1. Plasminogen domain resembles

a) Fibrinogen

b) LDL receptor

c) Apolipoprotein (a)

d) Prothrombin

Correct Answer - C
Apolipoprotein (a) REF:
http://onlinelibrary.wiley.com/doi/10.1002/pro.5560031222/pdf,http://ww
Phylogeny of the serine proteinase domains and analysis of intron-exon boundaries and Kringle sequences indicate that hepatocyte growth factor/scatter factor (HGF/SF), hepatocyte growth factor-like/macrophage stimulating protein (HGFVMSP), plasminogen, and apolipoprotein (a) have evolved from a common ancestral gene. The name Kringle comes from the Scandinavian pastry that these structures resemble.

2. Boiled cabbage or rancid butter smelling urine is seen in

a) Phenylketonuria

b) Tyrosinemia

c) Isovaleric Acidaemia

d) Multiple carboxylase deficiency

Correct Answer - B
Tyrosinemia
REF: Sapira's art & science of bedside diagnosis - Page 138, Textbook of Pediatric Emergency Medicine by Gary R. Fleisher, Stephen Ludwig Page 1566
Tyrosinaemia is an error of metabolism, inherited, in which the body cannot effectively break down the amino acid tyrosine, found in most animal and plant proteins. It is an autosomal recessive, which means two copies of an abnormal gene must be present in order for this to develop. There are three types of tyrosinemia, each with distinctive symptoms and caused by the deficiency of a different enzyme. One of the symptoms of Tyrodinaemia type 1 is an odor like cabbage or rancid butter.

3. True about G protein coupled receptors is:

a) G proteins bind to hormones on the cell surface

b) All the three subunits alpha, beta and gamma should bind to each other for G protein to act

c) G proteins act as inhibitory and excitatory because of difference in alpha subunit

d) G protein is bound to GTP in resting state

Correct Answer - C
G proteins act as inhibitory and excitatory because of difference in alpha subunit *[Ref: Harper 26/e p458; Lippincott Biochem 3/e p93; Ganong 22/e p41]*

- G-protein coupled receptors *(GPCR)* are the largest superfamily of cell surface receptors.
- They typically have *seven helices* that traverse the membrane.
- These receptors are *integral membrane proteins* characterized by an *extracellular ligand-binding region,* seven transmembrane helices, and an *intracellular domain that interacts with G-proteins.*
- The function of GPCR is to transduce signals that induce a cellular response to the environment.
- Mechanism:
- The ligand binds to a site on the extracellular portion of the receptor.
- Binding of the ligand to the receptor
  * activates a G protein associated with the cytoplasmic C-terminal.
- This initiates the production of a "second messenger". The most common of these are
  * cyclic AMP, (cAMP) which is produced by adenylyl cyclase from ATP and
  * inositol 1,4,5-trisphosphate (IP3)

- The second messenger, in turn, initiates a series of intracellular events such as
  * phosphorylation and activation of enzymes
  * release of Ca^{2+} into the cytosol from stores within the endoplasmic reticulum

  G proteins
- G proteins are so-called because they bind the guanine nucleotides GDP and GTP. They are heterotrimers (i.e., made of three different subunits)
- The three subunits are:
  * Ga, which carries the binding site for the nucleotide. At least 21 different kinds of Ga molecules are found in mammalian cells.
  * GP
  * Gy
- How They Work
- In the inactive state G protein has GDP bound to its Ga. subunit.
- When a hormone or other ligand binds to the associated GPCR the GDP is exchanged for GTP
- GTP activates Ga causing it to dissociate from GI3Gy (which remain linked as a dimer).
- Activated Ga in turn activates an effector molecule *(adenylyl cyclase- an enzyme in the inner ˙ s face of the plasma membrane which catalyzes the conversion of ATP into the "second messenger" cyclic AMP).*
- The beta and gamma subunit do not separate from each other, and Gi3Gy dimer also activates a variety of effectors.
- The actions of the Ga-GTP complex are short lived because the G-protein has an inherent GTPase activity, resulting in the rapid hydrolysis of GTP to GDP. This leads to reassociation of the Ga unit with the GI3Gy dimer. This inactivates the G protein.
- The ability of a ligand to stimulate or inhibit the second messenger depends on the type of G-protein that is linked to the receptor. One family of G-proteins, designated Gs, is specific for stimulation of adenylyl cyclase; another family, designated Gi, causes inhibition of the enzyme. These different actions of G proteins are attributed to different alpha subunits. Gs contains a, and Gi contains

  Some Types of Ga Subunits

- Ga_s_This type stimulates (s = "stimulatory") adenylyl cyclase. *Ga_s is the target of the toxin liberated by Vibrio cholerae, the bacterium that causes cholera. Binding of cholera toxin to Ga_s keeps it turned "on". The resulting continuous high levels of cAMP causes a massive loss of salts from the cells of the intestinal epithelium. Massive amounts of water follow by osmosis causing a diarrhea that can be fatal if the salts and water are not quickly replaced.*
- Ga;-This inhibits (i = "inhibitory") adenylyl cyclase lowering the level of cAMP in the cell.
- Ga_g_This activates phospholipase C (PLC) which generates the second messengers:
  * inositol trisphosphate (IP3)
  * diacylglycerol (DAG)
- Ga_t_The "t" is for *transducin,* the molecule responsible for generating a signal in the rods of the retina in response to light.

4. Respiratory quotient of carbohydrate is:

a) 0.5

b) 0.8

c) 0.75

d) 1

Correct Answer - D
Ans: D. 1

- The **respiratory quotient** (or **RQ** or **respiratory coefficient**), is a dimensionless number used in calculations of basal metabolic rate (BMR) when estimated from carbon dioxide production. It is calculated from the ratio of carbon dioxide produced by the body to oxygen consumed by the body. Such measurements, like measurements of oxygen uptake, are forms of indirect calorimetry. It is measured using a respirometer.
- The respiratory quotient (**RQ**) is the ratio:
RQ = $CO_{2\ \text{eliminated}}$ / $O_{2\ \text{consumed}}$

5. **Essential fatty acids are except:**

a) Arachidonic acid

b) Linoleic acid

c) Palmitic acid

d) Linolenic acid

Correct Answer - A
The essential fatty acids are polyunsaturated fatty acids, ***linoleic acid (18:26) and linolenic acid (18:33).***

Arachidonic acid (20:46) is derived from dietary linoleic acid and is present primarily in membrane phospholipids.

Important derivatives of linolenic acid are eicosapentaenoic acid (20:63) and docosahexaenoic acid (DHA, 22:63) found in human milk and brain lipids.Palmitic acid is a common saturated fatty acid. Arachidonic acid (20C: ro6) is not nutritionally essential because chain elongase system can convert linoleic acid (l8C: <o6) into Arachidonic acid (20C: o6). So arachidonic acid is considered as conditionally essential, because it has to be supplied
in the diet if linoleic acid is not supplemented.
Ref : Botham K.M., Mayes P.A. (2011). Chapter 23. Biosynthesis of Fatty Acids & Eicosanoids. In D.A. Bender, K.M. Botham, P.A. Weil, P.J. Kennelly, R.K. Murray, V.W. Rodwell (Eds), *Harper's Illustrated Biochemistry*, 29e.

6. **The predominant isozyme of LDH in Lung is:**

a) LD-1

b) LD-2

c) LD-3

d) LD-5

Correct Answer - C

Isoenzymes of Lactate Dehydrogenase: Lactate dehydrogenase is a tetrameric enzyme and consists of four subunits. These subunits can occurs in two isoforms i.e. H isoform (for heart), M isoform (for muscle).
LDH-1 (4H) - in the heart and RBCs
LDH-2 (3H1M) - in the reticuloendothelial system
LDH-3 (2H2M) - in the lungs
LDH-4 (1H3M) - in the kidneys, placenta, and pancreas
LDH-5 (4M) - in the liver and striated muscle
Normal value of LDH in serum is 100-200 U/L. LDH level is 100 times more inside the RBC than in plasma, and therefore minor amount of hemolysis will result in a false positive test.

Ref: Harper's Illustrated Biochemistry, 26th Edition, Page 57; Textbook of Biochemistry By Vasudevan, 5th Edition, Page 53

7. Substrate level phosphorylation occur in step catalysed by which of the following enzyme in TCA cycle?

a) Isocitrate dehydrogenase

b) Malate dehydrogenase

c) Aconitase

d) Succinate thiokinase

Correct Answer - D
Succinate thiokinase is the enzyme that generates ATP directly by substrate-level phosphorylation. In Krebs cycle succinate thiokinase catalyze the conversion of Succinyl CoA into succinate. In this step GDP is phosphorylated to GTP. GTP can then be converted to ATP by reacting with an ADP molecule.
Substrate-level phosphorylation is a type of metabolism that results in the formation and creation of adenosine triphosphate (ATP) or guanosine triphosphate (GTP) by the direct transfer and donation of a phosphoryl (P03) group to adenosine diphosphate (ADP) or guanosine diphosphate (GDP) from a phosphorylated reactive intermediate.
In glycolysis substrate level phosphorylation occur in two steps:
Conversion of 1,3 BPG to 3 Phosphoglycerate catalyzed by Phosphoglycerate kinase
Conversion of Phosphoenolpyruvate to pyruvate catalyzed by Pyruvate kinase
Ref: Textbook of Biochemistry By D M Vasudevan, 3rd Edition, Page 195

8. Phosphofructokinase-1 occupies a key position in regulating glycolysis and is also subjected to feedback control. Which among the following is the allosteric activators of phosphofructokinase-1?

a) Fructose 2, 3 bisphosphate

b) Fructose 2, 6 bisphosphate

c) Glucokinase

d) PEP

Correct Answer - B

The most potent positive allosteric activator of phosphofructokinase-1 and inhibitor of fructose 1,6-bisphosphatase in the liver is fructose 2,6-bisphosphate.

- It relieves inhibition of phosphofructokinase-1 by ATP and increases the affinity for fructose 6-phosphate.
- It inhibits fructose 1,6-bisphosphatase by increasing the Km for fructose 1,6-bisphosphate.
- Its concentration is under both substrate (allosteric) and hormonal control (covalent modification).

Phosphofructokinase-1 is **inhibited by citrate** and by **normal intracellular concentrations of ATP** and is **activated by 5' AMP.**

Ref: Bender D.A., Mayes P.A. (2011). Chapter 20. Gluconeogenesis & the Control of Blood Glucose. In D.A. Bender, K.M. Botham, P.A. Weil, P.J. Kennelly, R.K. Murray, V.W. Rodwell (Eds), Harper's Illustrated Biochemistry, 29e.

9. **Enzymes of glycolysis are found in:**

a) Cytosol

b) Cell membrane

c) Mitochondria

d) Ribososmes

Correct Answer - A
All of the enzymes of glycolysis are found in the cytosol.

Ref: Harper 28th edition, chapter 18.

10. **The Fenton reaction leads to free radical generation when:**

a) Radiant energy is absorbed by water

b) Ferrous ions are converted to ferric ions

c) Nitric oxide is converted to peroxynitrite anion

d) Hydrogen peroxide is formed by, myeloperoxidase

Correct Answer - B

Fenton reaction involves the ferrous iron catalyzed conversion of hydrogen peroxide into a hydroxide ion and a hydroxyl free radical with the concurrent oxidation of ferrous iron to ferric iron.

Fenton reaction: H.J.H Fenton discovered in 1894 that several metals have a special oxygen transfer properties which improve the use of hydrogen peroxide.
Actually, some metals have a strong catalytic power to generate highly reactive hydroxyl radicals (.OH).
Since this discovery, the iron catalyzed hydrogen peroxide has been called Fenton's reaction.
Hydrogen peroxide is converted to hydroxyl radicals in the Fenton reaction.

The iron can exist in a number of different oxdation states. Therefore the oxidation of fe2+ by h2o2 can proceed through a one electron transfer or a two electron transfer. **Fentons reaction is an inner sphere one electron transfer process.** The h2o2 forms a complex with fe2+ before electron transfer takes place. After addition of the iron and the hydrogen peroxide, they are going to react together to generate some hydroxyl radicals as it shows in the following equations:
Fe2+ + H2O2 ----> Fe3+ + .OH + OH-
Fe3+ + H2O2 ----> Fe2+ + .OOH + H+

Importance: Hydroxyl radicals are the most powerful of the reactive oxygen species.It is capable of destroying any organic molecule.

Uses: Used to treat a large variety of water pollution such as phenols, formaldehyde, BTEX, pesticides and rubber chemicals.

Ref: Free Radicals in Medicine, By Radu Olinescu, Dr. Terrance L. Smith, Page 28

11. **The mechanism of action of uncouplers of oxidative phosphorylation involves:**

a) Inhibition of ATP synthase

b) Stimulation of ATP synthase

c) Disruption of proton gradient across the inner membrane

d) Disruption of proton gradient across outer membrane

Correct Answer - C

Uncouplers are protein carriers that can freely pass through the inner mitochondrial membrane.
It allows translocation of the protons into the intermembranous space during the electron transport in the respiratory chain but blocks the formation of proton gradient across the inner mitochondrial membrane.

Thermogenin a protein present in the inner mitochondrial membrane of adipocytes is an example of physiologic uncouplers of oxidative phosphorylation.

Examples of uncouplers are: 2,4 dinitrophenol, pentachlorophenol, nigericin, thyroxin and thermogenin.

Ref: Jaypee's Review of Med. Biochemistry By S. M. Raju page 102.

12. **Which of the following is the rate limiting step in cholesterol synthesis?**

a) HMG CoA synthase

b) HMG CoA reductase

c) Thiokinase

d) Mevalonate kinase

Correct Answer - B

Initially in cholesterol synthesis, two molecules of acetyl-CoA condense to form acetoacetyl-CoA catalyzed by cytosolic **thiolase.**

Acetoacetyl-CoA condenses with a further molecule of acetyl-CoA catalyzed by ***HMG-CoA synthase*** *to form HMG-CoA, which is reduced to* ***mevalonate*** *by NADPH in a reaction catalyzed by* ***HMG-CoA reductase****.*

This last step is the principal regulatory step in the pathway of cholesterol synthesis and is the site of action of the most effective class of cholesterol-lowering drugs, the statins, which are HMG-CoA reductase inhibitors.

Ref: Botham K.M., Mayes P.A. (2011). Chapter 26. Cholesterol Synthesis, Transport, & Excretion. In D.A. Bender, K.M. Botham, P.A. Weil, P.J. Kennelly, R.K. Murray, V.W. Rodwell (Eds), *Harper's Illustrated Biochemistry*, 29e.

13. Which one of the following can be a homologous substitution for isoleucine in a protein sequence?

a) Methionine

b) Aspartic acid

c) Valine

d) Arginine

Correct Answer - C

Isoleucine is one of the aminoacid with an aliphatic side chain.
Other aminoacids with an aliphatic side chain is glycine, alanine, valine and leucine.
Among the options provided, valine is the only aminoacid with an aliphatic side chain and so it can be a homologous substitution for isoleucine in a protein sequence.
Ref: Harper's Illustrated Biochemistry, 26th Edition, Chapter 3, Page 15; Human Gene Evolution By David N. Cooper, 1999, Page 299.

14. **Albinism is due to deficiency of the following enzyme?**

a) Phenylalanine hydroxylase

b) Homogentisic acid oxidase

c) Tyrosinase

d) Decarboxylase

Correct Answer - C

The most common cause of albinism is a defect in tyrosinase, the enzyme most responsible for the synthesis of melanin. Albinism is an inborn error due to lack of synthesis of melanin. It is an autosomal recessive disorder with a frequency of 1 in 20,000.

Ref: Textbook of Biochemistry and Human Biology by G. P. Talwar, 3rd Ed, Page 452

15. **Which among the following glucose transporter present in beta cells ?**

a) GLUT1

b) GLUT2

c) GLUT3

d) GLUT4

Correct Answer - B
GLUT2 is the glucose transporter present in the betacells and liver cells.It has a high Km for glucose.Hence entry of glucose is directly proportional to the glucose level.It is an insul;in independent transport.

GLUT3 is present in brain and **GLUT4** medites insulin dependent transport of glucose into muscle and adipose tissue.

Ref: Murray R.K., Granner D.K. (2011). Chapter 40. Membranes: Structure & Function. In D.A. Bender, K.M. Botham, P.A. Weil, P.J. Kennelly, R.K. Murray, V.W. Rodwell (Eds), *Harper's Illustrated Biochemistry,* 29e.

16. **What is the role of catabolite activator protein (CAP) in LAC operon?**

a) Positive regulator

b) Negative regulator

c) Attenuation

d) Constitutive expression

Correct Answer - A
Catabolite activator protein, CAP is an activator required for high level transcription of the lac operon. CAP protein exerts positive control and lac repressor exerts negative control.
What is an Operon?

In prokaryotes, the genes coding for proteins involved in a particular metabolic pathway are often sequentially arranged- together on the chromosome along with a single promoter or regulatory region. This entire cluster is termed as an operon, for eg, the lac operon (coding proteins for metabolism of lactose) or trp operon (coding proteins needed for the synthesis of tryptophan).

Lac operon:

Lac operon contains lacZ, lacY and lacA genes encoding beta galactosidase, galactose permease and thiogalactoside transacetylase and is preced by an operator (O) site and promoter (P) site. The operon is transcribed by RNA polymerase to produce a single polycistronic mRNA that is translated to produce all three enzymes which are involved in lactose metabolism.

17. True about glutamate dehydrogenase is A/E

a) Liver mitochondrial enzyme

b) Use both NAD* or $NADP^+$ coenzyme

c) Inhibited by ADP & activated by GTP

d) Reversible oxidative deamination

Correct Answer - C
C i.e. Inhibited by ADP & activated by GTP
During first few days of fasting, there is *rapid breakdown of muscle protein, providing aminoacids (alanine & glutamine mainly) that are used by liver for gluconeognesisQ.*
In the fasting state, the output of alanine from skeleton muscle is in far excess of its concentration in the muscle proteins that are being catabolized. Because it is also formed by transamination of pyruvate produced by glycolysis of muscle glycogen. Alanine is exported to the liver, where it is transaminated *back to pyruvate, which serves as a substrate for gluconeogenesisQ.*

18. Among the following, the maximum redox potential is for:

a) NADH/NAD

b) Succinate/Fumarate

c) Ubiquinone

d) $Fe+^{3}/ Fe^{+2}$

Correct Answer - D
Ans. D i.e. $Fe+^{3}/ Fe^{+2}$
Because electrons tend to flow spontaneously from carries of lower redox potential (E°) to carries of higher redox potential. The order (sequence) of electron carriers in ETC of mitochondria (and so the *increasing order of redox potential)* is
Substrate --> $NADP^{+}$ /NADPH —> NADVNADH —› NADH dehydrogenase (FMN) / NADH dehydrogenase (FMNH2) —> $FAD/FADH_2$ —> Ubiquinone or Coenzyme Q —> Fe^{3+} / Fe^{e*} in cytochromes b —> C —> a -+ a_3 —> 02

19. (β-oxidation of palmitic acid yields

a) 3 acetyl CoA

b) 129 ATP net

c) 131 ATP net

d) 16 Acetyl CoA

Correct Answer - B
B i.e. 129 ATP net

20. Refsum's disease is due to deficiency of which of the following enzyme?

a) Malonate dehydrogease

b) Thiophorase

c) Succinate thiokinase

d) Phytanic alpha oxidase

Correct Answer - D
D i.e. Phytanic alpha oxidase
Refsum's disease is a rare autosomal recessive disorder caused by deficiency of phytanic a oxides (Nelson) / a?hydroxylase (Lippincot) / Phytanoyl CoA hydroxylase (Lehninger) results in accumulation of phytanic acid due to its *decreased a - oxidation (i.e. hydroxnlation at a carbon* by fatty acid a hydroxylase)

21. Energy source used by brain in later days of Starvation is

a) Glucose

b) Ketone bodies

c) Glycogen

d) Fatty acids

Correct Answer - B
B i.e. Ketone bodies

22. In starvation, nitrogen is carried from muscle to liver and kidney by:

a) Alanine

b) Aspartic acid and Serine

c) Glycine

d) Asparagines

Correct Answer - A
A i.e. Alanine
In starvation , alanine and glutamine are quantitatively the most important gluconeogenic aminoacidsQ. So alanine carries nitrogen from muscle to liver & kidney for further metabolism & energy production during starvation.

23. The gaps between segments of DNA on the lagging strand produced by restriction enzymes are rejoined sealed by:

a) DNA Ligases

b) DNA Helicase

c) DNA topoisomerase

d) DNA phosphorylase

Correct Answer - A
A i.e. DNA Ligases

24. Replication and transcription are similar processes in mechanistic terms because both :

a) Use RNA primers for initiation.

b) Use deoxyribonucleotides as precursors.

c) Are semi conserved events

d) Involve phosphodiester bond formation with elongation occurring in the 5' - 3' direction

Correct Answer - D
D i.e. Involve phosphodiester bond formation with elongation occurring in the 5'- 3' direction.
In both DNA and RNA synthesis, the general steps of *initiation, elongation and termination occur in* 5'- 3' *direction with the formation of phosphodiester bondsQ.*

25.

The anticodon region is an *important* part of the

a) r-RNA

b) m-RNa

c) t-RNa

d) hn-RNa

Correct Answer - C
C i.e. t - RNA

26. Km value is defined as:

a) Substrate concentration at Vmax/2

b) Substrate concentration of twice Vmax

c) Substrate concentration of thrice Vmax

d) Substrate concentration of one third Vmax

Correct Answer - A
Ans. A. Substrate concentration at Vmax/2

27. Enzyme activity is expressed as:

a) Millimoles /lit?

b) Milli gm/lit?

c) Mg/ dl

d) Micromoles/min

Correct Answer - D
Ans. is. D. Micromoles/min

28. Which of the following is a serine protease

a) Chymotrypsin

b) Pepsin

c) Carboxypeptidase

d) Caspases

Correct Answer - A
Ans. is'a'i.e., Chymotrypsin lRef: Chatterjee 7h/e p. 4j5-361
* The term Protease is used to represent the group of enzymes that catalyze the cleavage ofpeptide bonds in proteins and peptide molecules with the participation of water as co-reactant. In simple words, proteases catalyze the cleavage of peptide bonds by hydrolysis (addition of water
Serine proteases:-
* These posses a critical serine residue at the active site.
- Example of serine proteases are trypsin, chymotrypsin, elastase, and thrombin.
* Serine proteases are inhibited by disopropylphosphofluridate which binds covalently to serine residue.
- The active site of serine proteases contain three critical amino acids serine, histidine and aspartate. These residues are often referred to as catalytic triad

29. Creatinine is formed from :

a) Arginine

b) Lysine

c) Leucine

d) Histamine

Correct Answer - A
Glycine, arginine and methionine all participate in creatine biosynthesis

30. Acidic amino acids are -

a) Asparagine

b) Arginine

c) None

d) Lysine

Correct Answer - A
Proline is a *unique* amino acid and has an *immino group* (=NH) instead of an amino (NH_2) group found in other amino acid.
Methionine & Cysteine are sulfur containing aminoacids.
The property of photochromicity (i.e. absorbance of ultraviolet light at 250-290nm esp 280nm) is seen with aromatic amino acid (tryptophan > tyrosine > phenylalanine).
Hydrophobic (non polar) aminoacids have no charge on their R group or side chain. Aliphatic (eg methyl, methylene, thioether & imino) side chains and aromatic side chains are nonpolar. So methyl (CH_3) side chain of alanine; propyl (C3H7) side chain of valine; butyl (C_4H_9) side chain of leucine & isoleucine; thioether side chain of methionine; and *imino group/ pyrrolidine containing side chain of proline* are nonpolar.
Methyl (CH3) side chain of *alanine is nonpolar.* Serine, threonine, tyrosine containing hydroxyl group and cysteine containing sulfhydryl group, are polar aminoacids with neutral/uncharged/nonionic side chain. Positively charged basic amino (NH_3^+)group side chain of *histidine, arginine* and lysine ; and negatively acidic carboxyl (COO-) side chain of *aspartic acid and glutamic acid* is polar.

31. Non-Essential amino acid is -

a) Tyrosine

b) Phenylalanine

c) Lysine

d) Threonine

Correct Answer - A
Ans. A. Tyrosine

32. Detergent action of bile salts is due to:

a) Hydropathic

b) Acts as a zwitter ion

c) Amphipathic

d) All

Correct Answer - C
Ans. C. Amphipathic

33. Heme synthesis requires

a) Ferrous iron

b) Glycine

c) Succhyl CoA

d) All

Correct Answer - D

34. Tumor suppressor gene is not involved in ?

a) Breast cancers

b) Neurofibromatosis

c) Multiple endocrine neoplasia

d) Retinoblastoma

Correct Answer - C

o Multiple endocrine neoplasia involves RET protooncogene (not tumor suppressor gene).

35. In Endometrial carcinoma, which of the following tumor suppressor gene occurs?

a) P53

b) Rb

c) PTEN

d) APC

Correct Answer - C
PTEN is a tumor suppressor gene which is implicated in the causation of endometrial and prostate carcinoma.

36. Telomerase -

a) RNA polymerase

b) Causes carcinogenesis

c) Present in somatic cells

d) Absent in germ cells

Correct Answer - B
Telomerase is a DNA polymerase (RNA dependent DNA polymerase) which is present in germ cells and is absent from most somatic cells.
Thus telomerase activity and maintenance of telomere length are essential for the replicative potential in cancer cells.

37. E cadherin gene deficiency is seen in -

a) Gastric ca

b) Intestinal ca

c) Thyroid ca

d) Pancreatic ca

Correct Answer - A
The majority of gastric cancers are not hereditary, the mutations identified in familial gastric cancer have provided important insights into mechanism of carcinogenesis in sporadic cancers.
Germline mutations in CDHI, which encodes E cadherin, a protein that contributes to epithelial intercellular adhesion are associated with familial gastric cancers, which are usually of diffuse type.
Mutations in CDH 1 are present in about 50% of sporadic cases of diffuse gastric cancers, while E cadherin expression is drastically decreased in the rest, often by methylation of the CDH I promotor.
Lobular carcinoma of breast which also tends to infilterate as single cells, & individuals with BRCA2 mutations are at increased risk of developing diffuse gastric cancers.

38. Li–Fraumeni syndrome is due to mutation of which gene -

a) P 21

b) P 53

c) *P* 41

d) P 43

Correct Answer - B

Cancer arises through a series of somatic alterations in DNA that result in uncontrolled cell division.

Human cancers have following important etiological factors ?

- Genetic predisposition to cancer
- Non-hereditary predisposing conditions
- Geographic and environmental factors

Genetic (Hereditary or inherited) predisposition to cancer

- A large number of cancers have hereditary predispositions.
- Genetic predisposition may be of three types.
- Autosomal dominant Inherited cancer syndromes
- This is the most common type of genetic predisposition.

The mechanism involves uncontrolled cell division due to germline mutation of cancer suppressor gene.

Gene	Inherited predisposition
RB	Retinoblastoma
p53	Li-fraumeni syndrome
pl6INK4A	Melanoma
APC	Familial adenomatous polyposis/colon cancer
NF-1, NF-2	Neurofibromatosis 1 and 2
BRAC 1, BRAC 2	Neurofibromatosis 1 and 2

BRAC-1, BRAC-2	Neurofibromatosis 1 and 2
MEN 1, RET	Multiple endocrine neoplasia
MSN 2, MLH 1, MSH 6	Heriditary nonpolyposis colon cancer
PATCH	Nevoid basal cell carcinoma syndrome

2. Defective DNA repair syndrome

- Beside the dominantly inherited precancerous conditions, a group of cancer predisposing conditions is collectively characterized by defects in DNA repair.
- Normally, if the DNA damage is present it is repaired at cell-cycle checkpoints.
- If DNA repair mechanism is defective, cells replicate with defective DNA and mutations or chromosomal breaks are transfered in the progeny of cells that can lead to uncontrolled replication.
- Most of these conditions are inherited as autosomal recessive, e.g ?

1. Xeroderma pigmentosa
2. Fanconi syndrome
3. Bloom syndrome
4. Ataxia telangectasia

One condition in this group i
s autosomal dominant heriditory nonpolypid colon cancer (HNPCC).

3. Familial cancers

- Besides the inherited syndromes of cancer susceptibility, some cancers occur at higher frequency in certain families without a clearly defined pattern of transmission.
- That means, there is familial clustering of cases, but role of inherited predisposition is not clear for each individual.
- Example - Breast, ovarian, and pancreatic cancers.

39. Which element is required by phosphofructokinase?

a) Magnesium

b) Inorganic phosphate

c) Manganese

d) Copper

Correct Answer - A

Phosphofructokinase (PFK) is —300 amino acids in length, and structural studies of the bacterial enzyme have shown it comprises two similar (alpha/beta) lobes: one involved in ATP binding and the other housing both the substrate-binding site and the allosteric site (a regulatory binding site distinct from the active site, but that affects enzyme activity). The identical tetramer subunits adopt 2 different conformations: in a 'closed' state, the bound magnesium ion bridges the phosphoryl groups of the enzyme products (ADP and fructose-1,6- bisphosphate); and in an 'open' state, the magnesium ion binds only the ADP, as the 2 products are now further apart

40. Carbamoyl phosphate synthetase I is:

a) Lysosolic enzyme

b) Cytosolic enzyme

c) Mitochondrial enzyme

d) All of the above

Correct Answer - C
Mitochondrial carbamoyl phosphate synthetase I is an enzyme that catalyzes a reaction that produces carbamoyl phosphate.
This enzyme catalyzes the reaction of ATP and bicarbonate to produce carbonyl phosphate and ADP. Carbonyl phosphate reacts with ammonia to give carbamate
Cytosolic carbamoyl phosphate synthetase II uses glutamine rather than ammonia as the nitrogen donor and functions in pyrimidine synthesis.

41. Which of the following is required for proper effects of Insulin?

a) Selenium

b) Iron

c) Copper

d) Chromium

Correct Answer - D

In association with insulin, chromium promotes the utilization of glucose
Chromium is a component of a protein namely chromodulin which facilitates the binding of insulin to cell receptor sites
Chromium

- It is an essential nutrient for the maintenance of normal glucose tolerance
- Its deficiency causes insulin resistance.
- Chromium administration has also been shown in several studies to lower glucose and insulin levels in patients with type 2 diabetes.
- It has been classified as not essential for mammals. (Cr (III) or Cr3+).
- Chromium deficiency is controversial or is at least extremely rare.
- It has been attributed to only three people on parenteral nutrition, which is when a patient is fed a liquid diet through intravenous drips.
- In contrast, hexavalent chromium (Cr (VI) or Cr6+) is very toxic and mutagenic when inhaled.
- Cr (VI) has not been established as a carcinogen when in solution, although it may cause allergic contact dermatitis (ACD).

Dietary supplements for chromium include chromium (III) picolinate,

chromium (III) polynicotinate, and related materials.

- Glutathione peroxidase requires selenium
- Copper is an important constituent of catalse, cytochrome oxidase and tyrosinase.
- Zinc is also necessary for the storage and secretion of insulin

42. Glycemic index is defined as:

a) Glucose control in last 3 months

b) Measure of the change in the blood glucose following ingestion of proteins

c) Measure of the change in the blood glucose following ingestion of carbohydrate

d) Measure of the change in the blood glucose following ingestion of fats.

Correct Answer - C
The Glycemic index (GI) of a carbohydrate containing food is a measure of the change in the blood glucose following its ingestion

43. Which of the following is known as suicidal enzyme?

a) Lipoxygenase

b) Cyclooxygenase

c) Thromboxane synthatase

d) 5' nucleotidase

Correct Answer - B

Suicidal enzyme is one, which undergoes self-destruction in order to terminate its own acitivity, e.g. Cyclooxygenase.
Suicidal Inhibition is conversion of a substrate by the enzyme into a metabolite, which is a potent inhibitor of the enzyme; example: Xanthine oxidase converts allopurinol to alloxanthine (oxypurinol), which is a more potent inhibitor of allopurinol.
Cycloorygenase is known as suicide enzyme because it catalyzes its own destruction.

44. Which of the following enzyme is not a component of fatty acid synthase complex?

a) Acetyl Co-A carboxylase

b) Ketoacyl synthase

c) Enoyl reductase

d) Acetoacetyl

Correct Answer - A

The Fatty Acid Synthase Complex Is a Homodimer of Two Polypeptide Chains Containing Six Enzyme Activities and the Acyl Carrier Protein.

The 6 enzymes are-

- *Ketoacyl synthase*
- *Ketoacyl reductase*
- *Malonyl transacylase*
- *Dehydratase*
- *Enoyl reductase*
- *Thioesterase*

Acetyl Co-A carboxylase is the rate-limiting enzyme of fatty acid synthesis and is an enzyme, which is not a component of fatty acid synthase complex.

45. Umami taste is evoked by ?

a) Glucose

b) Glutamic acid

c) Quinine

d) Sodium chloride

Correct Answer - B

Ans. is 'b' i.e., Glutamic acid

There are four basic tastes namely *Sweet, bitter Salty and Sour.*

There mechanisms of sensory transduction are :

1) *Sweet receptor* is a *G protein coupled receptor* and leads to an increase in cAMP concentration in the sensory cells *which results in closure of* K^+ channels and depolarization.

2) Bitter receptors are also G protein coupled receptors and causes rise in *intracellular Ca'* by IP3-DAG system. Rise in intracellular Ca^{+2} triggers neurotransmitter release.

3) Salty-tasting substances depolarize taste cells by activating *amiloride-sensitive* Na^+ *channels.*

4) Sour-tasting substances depolarize taste cells by *raising the intracellular H + ion* concentration, which *causes closure of* K^+ *channels.*

The umami taste is the fifth taste which is unique. The proposed mechanism of umami taste is through **glutamate taste sensors (glutamate receptors)** with release of neuronal **glutamic acid.**

In nature, there are three umami substances :-

i) Monosodium glutamate (MSG)

ii) Disodium 5^1*-guanosine mosphosphate (GMP)*

iii) Disodium 5^1*-ionsine monophosphate (IMP)*

46. Sirtuins are associated with ?

a) Memory

b) Metabolism

c) Vision

d) Olfaction

Correct Answer - B

Ans. is 'b' i.e., Metabolism

- Sirtuins are a family of highly conserved *NAD^+ dependent deacetylase 5* that act as cellular sensors to detect energy availability and modulate metabolic process.
- Two mammalian sirtuins are involved in controling metabolic process : SIRT-1 (in nucleus) and SIRT-2 (in mitochondria).
- They are activated by high $NAD^{\pm}$ levels (low cellular energy status). They, then, deacetylate a variety of proteins causing *induction of catabolic processes and inhibition of anabolic processes.*
- SIRT-1 and SIRT-3 coordinately increase cellular energy stores and ultimately maintain cellular energy homeostasis.
- *Genetic variant in SIRT-1 gene is associated lower risk of cardiovascular mortality and with better cognitive functioning.*
- SIRT-1 variants are associated with decreased basal energy expenditure and a lower lipid peroxidation rate. Therefore, it has been proposed that genetic variation in SIRT-1 may determine the response rates of individuales undergoing *caloric restriction and increased physical activity.*
- Genetic variants of SIRT-3 may be associated with increased longevity (increased lifespan), but there is no evidence of such an association.

47. Normal uric acid level is ?

a) 1-2 mg/dl

b) 2-3 mg/dl

c) 3-6 mg/dl

d) 10-15

Correct Answer - C
Ans. is 'c' i.e., 3-6 mg/dl

48. All are true about phosphorus except ?

a) Comprises 1 % of the total body weight

b) 85% remains in the bones

c) Diet is not a common source

d) Parathormone acts on NaPiIIc receptors

Correct Answer - D
Ans. is 'd' i.e., Parathormone acts on NaPilic receptors

49. Carbohydrate in ABO blood group antigens is ?

a) Glucose

b) Fructose

c) Inulin

d) Maltose

Correct Answer - B
Ans.'b' Fructose
ABO antigens are glycoproteins, i.e. saccharides (carbohydrates) linked with polypeptides.
There are four main groups :
Blood group A: Containing A antigen
Blood group B : Containing B antigen
Blood group AB : Containing both 'A' and 'EV antigen
Blood group 0 : No ABO antigen
'A' and 'EV antigens are derived from H-antigen. H-antigen is formed by adding fucose to terminal galactose of backbone strucuture. The addition of N-acetyl-D-galactosamine or D-galactose to the galactose residue of H-antigen confers 'A' or 'B' antigen, respectively.

50. In argininosuccinase deficiency, what should be supplemented to continue the urea cycle ?

a) Aspartate

b) Arginine

c) Citrullin

d) Argininosuccinate

Correct Answer - B
Argininosuccinase (argininosuccinate lyase) catalyzes the cleavage of argininosuccinate into arginine and fumarate. Thus, in argininosuccinase deficiency, *arginine cannot be produced.* Supplementation with arginine base helps replenish this amino acid.

51. Tay-Sach disease is due to deficiency of

a) Hexosaminidase A

b) Hexosaminidase B

c) Sphingomyelinase

d) α-galactosidase

Correct Answer - A
Ans. is. A. Hexosaminidase A

52. Maximum energy is liberated by hydrolysis of ?

a) Creatine phosphate

b) ATP

c) Phosphoenol pyruvate

d) Glucose-6-phosphate

Correct Answer - C

Ans . C. Phosphoenol pyruvate

- A compound that liberates 7 Kcal/n:ol or more on hydrolysis is called high energy compound, or a compound that on hydrolysis undergoes a large (. 7 kcal/mol) decrease in free energy (AG) under standard condition is called high energy compound, i.e., AG - 7 Kcal/mol.

53. Which of the following is an aldose sugar?

a) Ribulose

b) Fructose

c) Glyceraldehyde

d) All of the above

Correct Answer - C

Ans. C. Glyceraldehyde

Sugar	Number of carbon Atoms	Aldoses	Ketoses
Trioses	3	Glyceraldehyde	Dihydroxyacetone
Tetroses	4	Erythrose	Erythrulose
Pentoses	5	Ribose,Xylose	Ribulose,Xylulose
Hexoses	6	Glucose,Galactose,Mannose	Fructose
Heptoses	7	Glucoheptose	Sdoheptulose

54. Bond involved in formation of primary structure of protein/polypeptide ?

a) Hydrogen

b) Peptide

c) Disulfide

d) a and b both

Correct Answer - D
Ans: D. a and b both
The primary structure is stabilized by a peptide bond, which is a type of covalent bond
Bonds responsible for protein structure
Two types of bonds stabilize protein structure : -
Covalent (strong):- Peptide bonds, Disulfide bond.
Non-covalent (weak):- Hydrogen bond, hydrophobic interactions, electrostatic (or ionic or salt) bond, Van der Waals interactions.

55. Main source of energy in 1 min is ?

a) Glycogen

b) FFA

c) Phosphates

d) Glucose

Correct Answer - A

Source of energy for muscular activity

The immediate source of energy for all muscle contractions is ATP, followed immediately by creatine phosphate.

In strenuous exercise, the ATP store is sufficient only for 1-2 seconds and creatine phosphate for another 5-7 seconds.

Thus, energy-rich phosphagen stores (ATP and creatine phosphate) permit severe muscle contraction for 8-10 seconds only.

After this, energy is obtained from the metabolism of stored glycogen or from circulating glucose and free fatty acids, depending upon the availability of oxygen.

Energy source during in exercise can be summarized by : -

i) The short burst of intense activity (e.g., 100-meter sprint or weight lifting) : - All energy comes from ATP and creatine phosphate. The breakdown of these compounds is anaerobic processes.

ii) Little longer intense exercise (e.g., 200-meter sprint or 100-meter swim):- Besides ATP and creatine phosphate, glycogen is metabolized by anaerobic glycolytic pathways to provide a ready source of energy. So, muscle work is anaerobic.

iii) Longer duration exercise (e.g., jogging, marathon run): - The muscle work is aerobic and energy comes from aerobic utilization of glucose *and free fatty acids.* More glucose is utilized at the initial stage, but as the exercise is prolonged, free fatty acids become the

predominant fuel.

56. Quarternary ammonium compound disinfectants are ?

a) Anionic

b) Cationic

c) Neutral

d) Gases

Correct Answer - B

Quaternary ammonium compounds are cationic detergents.
They have microcidal and viricidal activities.
They can be used for instrument disinfection and skin antisepsis.

57. Not a component of PCR ?

a) Primer

b) Taq polymerase

c) DNA Polymerase

d) Restriction enzyme

Correct Answer - D

Steps in PCR

PCR uses DNA polymerase to repetitively amlify targeted portion of DNA. Each cycle doubles the amout of DNA in the sample, leading to exponential increase with repeated cycles of amplification. Thus amplification after 'n' number of cycle in (2)". Twenty cycles provide an amplification of 10^6 (million) and 30 cycles of 109 (billion).

PCR occurs in following steps -

i) Isolation of target DNA sequence :-

ii) Primers construction:-

iii) Denaturation of DNA :-

iv) Annealing of primers to single stranded DNA :-

v) Chain extension:-

Thus following are required in PCR :- Target double stranded DNA, two specific primers, a thermostable DNA polymerase (Taq polymerase), deoxyribonucleotides (dNTP).

58. Which of the following is increased in lipoprotein lipase deficiency?

a) VLDL

b) LDL

c) HDL

d) Chylomicrons

Correct Answer - D
Type 1 hyperlipoproteinemias

- Lipoprotein fraction elevated- Chylomicrons
- Metabolic defect- Lipoprotein lipase or Apo CII deficiency.
- Features- Eruptive xanthoma, hepatomegaly, Pain abdomen.
- Management- Restriction of fat intake, supplementation with MCT

59. NADH CoQ reductase is inhibited by ?

a) Rotenone

b) Carbonmonoxide

c) Antimycin

d) Atractyloside

Correct Answer - A

Rotenone inhibits complex I (NADH-CoQ reductase).
Inhibitors of electron transport chain?
Inhibitors of respiratory chain may be divided into three groups : ?
1) Inhibitors of electron transport chain proper
These inhibitors inhibit the flow of electrons through the respiratory chain. This occurs at following sites.
i) Complex I (NADH to CoQ) is inhibited by : - Barbiturates (amobarbital), Piericidin A (an antibiotic), rotenone (an insectiside), chlorpromazine (a tranquilizer), and guanethidine (an antihypertensive). These inhibitors block the transfer of reducing equivalents from FeS protein to Coe.
ii) Complex II is inhibited by : - Carboxin and *TTFA* inhibit transfer of electon from FADH2 to CoQ, whereas *malanate* competitively inhibit from succinate to complex II.
iii) Complex III (Cytochrome b to cytochrome C1) is inhibited by : - Dimercaprol, antimycin A, BAL (British antilewisite), Naphthyloquinone. These inhibitors block the transfer of electrons from cytochrome b to cytochrome CI.
iv) Complex IV (cytochrome C oxidase) is inhibited by : - Carbon monoxide, CN^-, H_2S and azide (N_3). These inhibitors block the transfer of electrons from cytochrome aa3 to molecular oxygen and

therefore can totally arrest cellular respiration.

2) Inhibitors of oxidative phosphorylation

These compounds directly inhibit phosphorylation of ADP to ATP. Oligomycin inhibits Fo component of Fo F_1 ATPase. Atractiloside inhibits translocase, a transport protein that transports ADP into mitochondria for phosphorylation into ATP.

3) Uncouples

As the name suggests, these componds block the coupeling of oxidation with phosphorylation. These compounds allow the transfer of reducing equivalents in respiratory chain but prevent the phosphorylation of ADP to ATP by uncoupling the linkage between ETC and phosphorylation. Thus the energy instead of being trapped by phosphorylation is dissipated as heat. Uncouplers may be :-

i) Natural :- Thermogenin, thyroxine

ii) Synthetic :- 2, 4-dinitrophenol (2, 4-DNP), 2, 4-dinitrocresol (2, 4-DNC), and CCCP (chlorocarbonylcyanidephenyl hydrazone).

60. Rate limiting step in urea cycle is catalyzed by ?

a) Arginase

b) Argininosuccinase

c) Carbamoyl-phosphate synthase

d) Ornithine transcarbamylase

Correct Answer - C

Ans. is 'c' i.e., Carbamoyl-phosphate synthase

Biosynthesis of urea occurs in five steps.

1) Carbamoyl phosphate synthase-I (CPS-I), a *mitochondria!* enzyme, catalyzes the formation of carbamoyl phosphate by condensation of CO, and ammonia. Two molecules of ATP are required for the reaction. *CPS-I is the rate limiting enzyme of urea cycle.* It is an allosteric enzyme and allosterically activated by N-acetyl glutamate.

There is one cytosolic carbamyl phosphate synthase-II (CPS-II) which uses glutamine rather than ammonia as the nitrogen donor and functions in pyrimidine synthesis.

2) Ornithine transcarbamoylase catalyzes the formation of citrulline from carbamoyl phosphate and ornithine.

3) Arginosuccinate synthase catalyzes the formation of arginosuccinate from citrulline and aspartate. This reaction requires *I ATP, but 2 high energy phosphate* bonds are consumed as ATP is converted to AMP + PPi. The amino group of aspartate provides one of the two nitrogen atoms that appear in urea (The other one is provided by ammonia NH4).

4) Arginosuccinate lyase (arginosuccinase) catalyses the cleavage of arginosuccinate into arginine and fumarate. Fumarate enters in

TCA cycle.
5) Arginase catalyses the formation of urea from arginine by hydrolytic cleavage of arginine to yield urea and ornithine. Ornithine is thus regenerated and can enter mitochondria to initiate another round of the urea cycle.

61. Citrullinemia is due to deficiency of ?

a) Argininosuccinate lyase

b) Argininosuccinate synthase

c) Arginase

d) Ornithine transcarbamylase

Correct Answer - B
Ans. is. B. Argininosuccinate synthase

62. Urease is a/an ?

a) Oxidoreductase

b) Lyase

c) Ligase

d) Hydrolase

Correct Answer - D
functionally, belong to the superfamily of amidohydrolases and phosphotriesterases
Hydrolases --> All digestive enzymes (Pepsin,trypsin', Lipases, esterases), lysosomal enzymes'urease'and phosphatase.

63. Vitamin involved in decarboxylation ?

a) Biotin

b) Pyridoxine

c) Niacin

d) Thiamine

Correct Answer - B
Ans. is. B. Pyridoxine
Pyridoxal phosphate is a coenzyme for many enzymes involved in amino 1309 acid metabolism, especially transamination and decarboxylation.
It is also the cofactor of glycogen phosphorylase, where the phosphate group is catalytically important. In addition, it is important in steroid hormone action.
Pyridoxal phosphate removes the hormone-receptor complex from DNA binding, terminating the action of the hormones.

64. Nitrogen-9 of purine ring is provided by ?

a) Glycine

b) Aspartate

c) Glutamine

d) CO_2

Correct Answer - C

In de novo synthesis, purine ring is formed from variety of precursors is assembled on ribose-5-phosphate. Precursors for de novo synthesis are -

i) Glycine provides C_4, C_5 and N_7

ii) Aspartate provides N_1

iii) Glutamine provides N_3 and N_9

iv) Tetrahydrofolate derivatives furnish C_2 and C_8

v) Carbon dioxide provides C_6

65. Rate limiting step in fatty acid synthesis is ?

a) Production of acetyl CoA

b) Production of oxaloacetate

c) Production of malonyl-CoA

d) Production of citrate

Correct Answer - C
Production of malonyl-CoA is the initial and *rate-limiting step* in the fatty acid synthesis.
Acetyl-CoA needs to be converted to the activated form, which will serve as the donor of carbon units to the growing fatty acid chain.
Malonyl-CoA, a 3-carbon compound is such an activated form. It is produced by carboxylation of acetyl-CoA, a reaction catalyzed by acetyl-CoA carboxylase.
Acetyl-CoA carboxylase requires biotin as a cofactor. The reaction *also requires* HCO_3^- *and ATP*
The reaction takes place in two steps:
(i) Carboxylation of biotin involving HCO_3 and ATP.
(ii) transfer of the carboxyl group to acetyl-CoA to form malonyl-CoA.

66. Which is not a common enzyme for glycolysis and gluconeogenesis?

a) Aldolase

b) Glucose-6-phosphatase

c) Phosphoglycerate mutase

d) Phosphoglycerate kinase

Correct Answer - B

Seven of the reactions of glycolysis are reversible and are used in the synthesis of glucose by gluconeogenesis.

Thus, seven enzymes are common to both glycolysis and gluconeogenesis :

1. Phosphohexose isomerase;
2. Aldolase;
3. Phosphotriose isomerase,
4. Glyceraldehyde 3-phosphate dehydrogenase;
5. Phosphoglycerate kinase;
6. Phosphoglycerate mutase;
7. Enolase.

Three reactions of glycolysis are irreversible which are circumvented in gluconeogenesis by four reactions. So, enzymes at these steps are different in glycolysis and gluconeogenesis.

67. Which is not a step of gluconeogenesis?

a) Conversion of glucose-6-phosphate to glucose

b) Carboxylation of pyruvate

c) Conversion of oxaloacetate to phosphoenolpyruvate

d) Conversion of phosphoenolpyruvate to pyruvate

Correct Answer - D

Ans.' D' Conversion of phosphoenolpyruvate to pyruvate

Conversion of phosphoenolpyruvate to pyruvate is a step of glycolysis (not of gluconeogenesis).

Reaction in gluconeogenesis

Seven reactions of glycolysis are reversible and therefore are used with the same enzyme in the synthesis of glucose by gluconeogenesis. However, three of the reactions of glycolysis are irreversible and must be circumvented by four special reactions that are unique to gluconeogenesis and catalyzed by (I) Pyruvate carboxylase, (ii) Phosphoenolpyruvate carboxykinase, iii) fructose-I,6-bisphosphatase, (iv) Glucose-6-phosphatase.

All three irreversible steps of glycolysis should be bypassed for gluconeogenesis to occur. These three bypass steps are circumvented by four special reactions.

A) First bypass (conversion of pyruvate into phosphoenolpyruvate):- Conversion of pyruvate into phosphoenolpyruvate takes place through two reactions:?

i) Carboxylation of pyruvate: - First, pyruvate enters the mitochondria and is converted into oxaloacetate by pyruvate carboxylase. Pyruvate carboxylase is a mitochondrial enzyme, therefore this reaction occurs in mitochondria only.

ii) Conversion of oxaloacetate to phosphoenolpyruvate:

- Oxaloacetate produced in the mitochondria cannot cross the membrane. It is first reduced to malate, which then moves across the mitochondrial membrane into the cytosol. Malate is, then, reoxidized to oxaloacetate in the cytosol. Oxaloacetate is converted to phosphoenolpyruvate by phosphoenolpyruvate (PEP) carboxykinase.

B) Second bypass: - Conversion of fructose-1,6-bisphosphate into fructose-6-phosphate is catalyzed by fructose-1,6-bisphosphatase. Its presence determines whether tissue is capable of synthesizing glucose (gluconeogenesis) or glycogen (gluconeogenesis) not only from pyruvate but also from triose phosphate. It is present in the liver, kidney, and skeletal muscle, but is probably absent from heart and smooth muscle.

C) Third bypass: - Conversion of glucose-6-phosphate to glucose is catalyzed by glucose-6-phosphatase.

68. Vitamin C is required for ?

a) Posttranslational modification

b) Synthesis of epinephrine

c) Tyrosine metabolism

d) All of the above

Correct Answer - D

Vitamin C (ascorbic acid)
Ascorbic acid (Vitamin C) is also called antiscorbutic factor.
It is very *heat labile,* especially in basic medium.
Ascorbic acid itself is an active form.
Maximum amount of vitamin C is found in adrenal cortex.
Ascorbic acid functions as a reducing agent and scavanger of free radicals (antioxidant). Its major functions are :-
i) In collagen synthesis :- Vitamin C is required for post-translational modification by hydroxylation of proline and lysine residues converting them into hydroxyproline and hydroxylysine. Thus vitamin C is essential for the conversion of procollagen to collagen, which is rich in hydroxyproline and hydroxylysine. Through collagen synthesis, it plays a role in formation of matrix of bone, cartilage, dentine and connective tissue.
ii) Synthesis of norepinephrine from dopamine by dopamine-(3-monoxygenase (dopamine-13-hydroxylase) requires Vitamin C.
iii) Carnitine synthesis
iv) Bile acid synthesis :- 7-a-hydroxylase requires vitamin C.
v) Absorption of iron is stimulated by ascorbic acid by conversion of ferric to ferrous ions.
vi) During *adrenal steroid synthesis,* ascorbic acid is required during

hydroxylation reactions.
vii) Tyrosine metabolism - Oxidation of P-hydroxy-phenylpyruvate to homogentisate.
viii) Folate metabolism - Folic acid is converted to its active form tetrahydrofolate by help of Vitamin C.

69. First product of purine metabolism

a) Uric acid

b) Xanthine

c) P-alanine

d) CO_2

Correct Answer - B

- Humans catabolize purines to uric acid.
- But, first purines are catabolized to xanthine, which is further catabolized to purine.

70. Which of the following metabolic pathway in carbohydrate metabolism is required for synthesis of nucleic acids?

a) Gluconeogenesis

b) Glycolysis

c) HMP shunt

d) Glycogenesis

Correct Answer - C
Ans. 'C' HMP Shunt.
HMP is an alternative route for the oxidation of glucose (beside glycolysis). It is also called a *"pentose phosphate pathway", "Dickens - Horecker pathway", "Shunt pathway"* or *"phosphogluconate oxidative pathway"*
Metabolic Role of NADPH formed by HMP Shunt Pathway
1. Required for reductive biosyntheses, such as fatty acid, cholesterol, and steroids.
2. Free radical scavenging
3. RBC membrane integrity
4. Prevention of formation of meth-hemoglobin
5. Detoxification
6. Preserving transparency of the lens of the eye
7. Bactericidal activity of macrophages
8. Production of ribose and deoxyribose for DNA and RNA synthesis.

71. Mineral required for cholesterol biosynthesis ?

a) Fe

b) Mn

c) Mg

d) Cu

Correct Answer - C

Mg is required in stage 2 of cholesterol synthesis.

Biosynthesis (De Novo Synthesis) of cholesterol

- The liver *is the major site for cholesterol biosynthesis.* Some cholesterol is also synthesized in the intestine adrenal cortex, gonads and skin. The *microsomal (smooth endoplasmic reticulum) and cytosol fraction of cell are responsible for fir cholesterol synthesis; However, most of the reactions in synthesis occur in the cytosol.*
- Cholesterol is a C-27 compound. *All 27-carbon atoms of cholesterol are derived from a single precursor, i.e. acetyl-CoA (activated acetate).*
- The first two molecules of acetyl-CoA condense to form acetoacetyl-CoA. Next, the third molecule of acetyl- CoA condenses with acetoacetyl-CoA to form 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA). Then HMG-CoA is converted to mevalonate by HMG-CoA reductase, the key regulatory enzyme of cholesterol synthesis.

72. Source of energy in Kreb's cycle is -

a) NAD

b) NADP

c) NADPH

d) NADH

Correct Answer - D
Ans.'D' NADH
Energetics of TCA cycles (Kreb's cycle)

- Alpha-ketoglutarate is oxidatively decarboxylated to form succinyl CoA by the enzyme alpha-ketoglutarate dehydrogenase.
- The NADH thus generated enters into ETC to generate ATPs.
- Another molecule of CO_2 is removed in this step.
- This is the irreversible step in the whole reaction cycle.

73. Coenzyme used in Kreb's cycle ?

a) NAD

b) NADP

c) NADPH

d) NADH

Correct Answer - A

Niacin is used as coenzyme nicotinamide adenine dinucleotide (NAD') for transfer of hydrogen.

74. Mousy odor of urine is seen in ?

a) Alkaptunuria

b) Phenylketonuria

c) Hartnup disease

d) Albinism

Correct Answer - B

75. Cabbage-like odour is seen in ?

a) Alkaptonuria

b) Phenylketonuria

c) Hartnup disease

d) Tyrosinemia

Correct Answer - D
Ans. is. D. Tyrosinemia

76. Immediate energy supply for muscle contraction ?

a) GTP

b) ATP

c) Creatine phosphate

d) Fatty acid

Correct Answer - C

The immediate source of energy for all muscle contraction *is* ATP, followed immediately by creatine phosphate.

- The immediate source of energy for **all** muscle contraction is ATP, followed immediately by creatine phosphate.
- In sternous exercise ATP store is sufficient only for 1-2 seconds and creatine phosphate for another 5-7 seconds.
- Thus, energy rich phosphagen stores (ATP and creatine phosphate) permit severe muscle contraction for 8-10 seconds only.
- After this, energy is obtained from the metabolism of stored glycogen or from circulating glucose and free fatty acids, depending upon the availability of oxygen.

Energy source during in exercise can be summarized by :-
i) Short burst of intense activity (e.g., 100 meter sprint or weight lifting) :- All energy comes from ATP and creatine phosphate. Breakdown of these compound is an anaerobic processes.
ii) Little longer intense exercise (e.g., 200 meter sprint or *100 meter swim) :-* Besides ATP and creatine phosphate, glycogen is metabolised by anerobic glycolytic pathways to provide a ready source of energy. So, muscle work is anaerobic.
iii) Longer duration exercise (e.g., jogging, marathan run) : - The

muscle work is aerobic and energy comes from aerobic utilization of *glucose and free fatty acids.* More glucose is utilized at the initial stage, but as the exercise *is* prolonged, free fatty acids become the predominant fuel.

77. Cofactor for dopamine hydroxylase ?

a) Fe

b) Mg

c) Mn

d) Cu

Correct Answer - D
Dopamine 8-hydroxylase is a 'copper' containing monooxygenase that requires ascorbic acid and molecular oxygen.
It catalyzes the formation of norepinephrine.

78. Lipoprotein involved in reverse cholesterol transport?

a) LDL

b) VLDL

c) IDL

d) HDL

Correct Answer - D
The HDL particles are referred to as *scavengers* because their primary role is to remove free (unesterified) cholesterol from the extrahepatic tissues.
HDL particles transport cholesterol from extrahepatic tissues to the liver (i.e. *reverse cholesterol transport)* which is then excreted through bile.
Reverse cholesterol transport
All nucleated cells in different tissues synthesize cholesterol, but the excretion of cholesterol is mainly by the liver in the bile or by enterocytes in the gut lumen. *So, cholesterol must be transported from peripheral tissue to the liver for excretion.* This is *facilitated by HDL* and is called *reverse cholesterol transport* because it transports the cholesterol in reverse direction to that is transported from the liver to peripheral tissues through the VLDL → LDL cycle.
Process
HDL is synthesized in the liver and small intestine. Nascent HDL contains phospholipids and unesterified cholesterol and Apo-A, C, E. This nascent HDL is secreted into circulation where it acquires additional unesterified cholesterol from peripheral tissues. Within the HDL particle, the cholesterol is esterified by *lecithin - cholesterol acetyltransferase (LCAT) to* form cholesteryl ester and additional

lipid is transported to HDL from VLDL and chylomicrons. Apo-A_1 activates LCAT.

79. Allantoin is the end product of metabolism of ?

a) Glycogen

b) Purine

c) Pyrimidine

d) Histidine

Correct Answer - B

In non-primate mammals, end product of purine metabolism is allantoin due to presence of enzyme uricase. Uricase convertes uric acid to allantoin.
Humans lack the enzyme uricase. Therefore, end product of purine catabolism in humans is uric acid.

80. Pyruvate dehydrogenase contains all, except -

a) NAD

b) FAD

c) Biotin

d) CoA

Correct Answer - C

PDH complex is made up of three enzymes and requires five coenzymes.

The enzymes are :

i) E_1 : Pyruvate dehydrogenase or pyruvate decarboxylase

ii) E_2 : Dihydrolipoyl transacetylase

iii) E_3 : Dihydrolipoyl dehydrogenase.

The coenzyme required are thiamine pyrophosphate (APP), lipoic acid, FAD, NAD, and CoA.

81. Northern blot is used to detect ?

a) Protein

b) Immunoglobulin

c) RNA

d) DNA

Correct Answer - C
Ans: C. RNA

- Visualization of a specific DNA or RNA fragment among the many thousand of contaminating molecules requires the convergence of number of techniques collectively termed the blot transfer.
- Southern blot → Detects DNA
- Northern blot → Detects RNA
- Western blot → Detects proteins (proteins are separated by electrophoresis, renatured and analysed for an interaction by hybridization with a specific labelled DNA probe).

82. Not an essential amino acid ?

a) Arginine

b) Histidine

c) Glutamate

d) Lysine

Correct Answer - C
Ans 'C' Glutamate
Essential or Indispensable
The amino acids may further be classified according to their essentiality for growth. They are

- Isoleucine
- Leucine
- Threonine
- Lysine
- Methionine
- Phenylalanine
- Tryptophan
- Valine

83. Enzyme deficient in gangliosidoses ?

a) β-glucuronidase

b) Iduronidase

c) β-galactosidase

d) Hyaluronidase

Correct Answer - C

Ans. 'C' β-galactosidase

Generalized gangliosidoses is a lipid storage disorder.

- Enzyme defect- β-galactosidase
- Lipid accumulates- Ganglioside (GM1)
- Clinical features- Mental retardation, hepatomegaly, skeletal deformities. Foam cells in the bone marrow. Cherry red spot in the retina.

84. Defect in type II hyperlipidemia

a) Apo-E

b) Lipoprotein lipase

c) LDL receptor

d) None

Correct Answer - C
Also called Familial hypercholesterolemia.
Type II A
(Primary familial hypercholesterolemia)
There is an elevation of LDL. Patients seldom survive in the second decade of life due to ischemic heart disease. The cause is the LDL receptor defect.
Receptor deficiency in the liver and peripheral tissues will result in the elevation of LDL levels in plasma, leading to hypercholesterolemia. The LDL receptor defect may be due to the following reasons:
1. LDL receptor deficiency.
2. Defective binding of B-100 to the receptor.
3. The receptor-LDL complex is not internalized.

Secondary type II hyperlipoproteinemia is seen in hypothyroidism, diabetes mellitus, nephrotic syndrome, and cholestasis.

85. Major source of energy for brain in fasting/ starvation ?

a) Glucose

b) Glycogen

c) Fatty acids

d) Ketone bodies

Correct Answer - D
There is no stored fuel in the brain, but it utilized 60% of total energy under resting conditions.
Glucose is virtually the sole fuel for the brain, except in prolonged starving when ketone bodies are the major source.
Fatty acids do not serve as fuel for the brain, because they are bound to albumin in plasma; hence cannot cross the blood-brain barrier.

86. Nicotinic acid is derived from ?

a) Glutamine

b) Tryptophan

c) Glutathione

d) Phenylalanine

Correct Answer - B

Ans. 'B' Tryptophan.

Nicotinic Acid Pathway of Tryptophan-

- About 97% of molecules of tryptophan are metabolized in the major pathway. About 3% of molecules are diverted at the level of 3-hydroxy anthranilic acid, to form NAD^+.
- The enzyme, QPRT (quinolinate phosphoribosyltransferase) is the rate-limiting step.
- About 60 mg of tryptophan will be equivalent to 1 mg of nicotinic acid. The development of pellagra like symptoms in the maize eating population is due to tryptophan deficiency in maize.
- Hydroxy anthranilate production is dependent on pyridoxal phosphate. Hence in vitamin B6 deficiency, nicotinamide deficiency is also manifested.

87. Sex determining region is located on ?

a) Long arm of Y chromosome

b) Short arm of Y chromosome

c) Long arm of X chromosome

d) Short arm of X chromosome

Correct Answer - B
Product of SRY gene is sex-determining region Y protein.
This protein is involved in *male* sexual development.

88. Transferases are classified as ?

a) EC-1

b) EC-2

c) EC-3

d) EC-4

Correct Answer - B
Ans. B. EC-2

89. True about acid phosphatase is ?

a) Acts at pH 8-9

b) Prostate isoform is tartarate resistant

c) Erythrocyte isoform is inhibited by cupric ions

d) All of the above

Correct Answer - C

Acid phosphatase

Acid phosphatase (ACP) hydrolyzes phosphoric acid esters at pH 5-6.

It is found in different isoforms in *prostate, spleen, liver, erythrocytes, platelets and bones.*

Prostatic and erythrocyte isoform can be differentiated by *?*

i) Prostatic isoform is inhibited by tartarate (tartarate sensitive), whereas erythrocyte isoform is not.

ii) Erythrocyte isoform is inhibited by formaldehyde and cupric ions, whereas prostatic isoform is not.

Acid phosphatase, particularly prostatic enzyme, is unstable at room temperature above 37°C and at pH above 7·0 and more than 50% of the acid phosphatase activity may be lost in 1 hour at room temperature.

90. Alcohol is metabolized by ?

a) Alcohol dehydrogenase

b) MEOS

c) Catalase

d) All of the above

Correct Answer - D

Ethyl alcohol (ethanol) is readily absorbed from GIT and degraded by oxidation (oxidative process).
Liver is the major site for ethanol oxidation.
At least three enzyme systems are capable of ethanol oxidation :-
i) Alcohol dehydrogenase (ADH) → Major pathway
ii) Microsomal ethanol oxidising system (MEOS) : It involves cytochrome P450.
iii) Catalase of peroxisomes.
The product of all three oxidation pathways is acetaldehyde, which is rapidly oxidized to acetate by aldehyde dehydrogenase (ALDH).

91. Amino acid which is optically inert ?

a) Valine

b) Alanine

c) Glycine

d) Threonine

Correct Answer - C

Ans. 'C' Glycine

The a-carbon of amino acids has four different groups attached to it and so is a chiral or asymmetric carbon.

Hence, there are two possible enantiomers, L and D, i.e., mirror image with reference to α-carbon.

The chiral carbon is also responsible for optical activity and stereoisomerism.

The only exception is glycine, which is the *simplest amino acid.*

Glycine has no chiral carbon (chirality) because a-carbon of glycine does not have four different groups attached to it.

Therefore glycine does not have optical activity *or D and L forms (enantiomers).*

92. First purine nucleotide, which is synthesized in purine biosynthesis ?

a) AMP

b) GMP

c) IMP

d) UMP

Correct Answer - C

The biosynthesis of purine begins with ribose-5-phosphate, derived from pentose phosphate pathway (PPP).
First intermediate formed in this pathway, 5-phosphoribosyl-pyrophosphate (PRPP), is also an intermediate in purine salvage pathway.

93. Rate limiting step in heme synthesis is catalyzed by ?

a) ALA dehydratase

b) ALA synthase

c) UPG decarboxylase

d) Ferrochelatase

Correct Answer - B

Ans. B. ALA synthase

Synthesis of heme

- Heme synthesis takes place in all cells, but occurs to greatest extent in bone marrow and liver.
- The first step in the synthesis of heme is the condensation of glycine and succinyl Co-A to form &-aminolevulinic acid (Delta-ALA), which occurs in mitochondria.
- This reaction is catalyzed by Delta-ALA synthase which requires pyridoxal phosphate (PLP) as cofactor.
- This is the rate limiting step in heme synthesis.

94. Rate limiting step in porphyrine synthesis -

a) ALA dehydratase

b) ALA synthase

c) UPG decarboxylase

d) Ferrochelatase

Correct Answer - B
Ans. is. B. ALA synthase

95. Oxidation of very long chain fatty acids takes place in ?

a) Cytosol

b) Mitochondria

c) Ribosomes

d) Peroxisomes

Correct Answer - D

- A modified form of β-oxidation is found in peroxisomes and leads to the breakdown of very-long-chain fatty acids (eg, C20, C22) with the formation of acetyl-CoA and H_2O_2, which is broken down by catalase.
- This system is not linked directly to phosphorylation and the generation of ATP, and also does not attack shorter-chain fatty acids.
- The peroxisomal enzymes are induced by high-fat diets and in some species by hypolipidemic drugs such as clofibrate.
- Another role of peroxisomal β-oxidation is to shorten the side chain of cholesterol in bile acid formation

96. Salvage pathway of purine biosynthesis is important for ?

a) Liver

b) RBCs

c) Kidney

d) Lung

Correct Answer - B

Purine nucleotide synthesis occurs by two pathways :
1.De novo synthesis
2.Salvage pathway
Liver is the major site of purine nucleotide biosynthesis (de novo). Certain tissues cannot synthesize purine nucleotides by de novo patyway, e g. *brain, erythrocytes and polymorphonuclear leukocytes.* These are dependent on salvage pathway for synthesis of purine nucleotides by using exogenous purines, which are formed by degradation of purine nucleotides synthesized in liver.

97. Lipoprotein associated with carrying cholesterol from peripheral tissues to liver is ?

a) HDL

b) LDL

c) VLDL

d) IDL

Correct Answer - A
The total body cholesterol content varies from 130-150 grams.
LDL (low-density lipoprotein) transports cholesterol from the liver to the peripheral tissues and HDL (high-density lipoprotein) transports cholesterol from tissues to the liver.
Cells of extrahepatic tissues take up cholesterol from LDL.

98. Which of the following is a nucleoside?

a) Adenine

b) Uridine

c) Thymine

d) Guanine

Correct Answer - B
Ans. is. B. Uridine

99. Amino acids with extra NH_2 (amino group) in structure-

a) Aspartate

b) Glutamate

c) Histidine

d) Alanine

Correct Answer - C
Ans. is. C. Histidine
The amino acids will undergo alpha decarboxylation to form the corresponding amine.
Some important amines are produced from amino acids. For example,

- Histidine → Histamine + CO2
- Tyrosine → Tyramine + CO2
- Tryptophan → Tryptamine + CO2
- Lysine → Cadaverine + CO2
- Glutamic acid → Gamma-aminobutyric acid (GABA) + CO2

100. Number of ATP produced by RBC when Glycolysis occurs through Rapoport Leubering pathway-

a) 2

b) 6

c) 8

d) 0

Correct Answer - D
Ans. 'D' 0
Net number of ATPs produced from 1 mol of Glucose by

- Anaerobic Glycolysis- 2 ATPs
- Aerobic Glycolysis - 7 ATPs
- Aerobic oxidation- 32 ATPs
- Rapaport-LeuberingCycle- Zero

101. Most important vitamin, which promotes wound healing ?

a) Vitamin C

b) Vitamin D

c) Vitamin A

d) Niacin

Correct Answer - A

- Vitamin C is required for collagen synthesis.
- Due to its important role in collagen synthesis, vitamin C is required for adequate wound healing.

102. Which of the following is not a glycerosphingolipid?

a) Lecithin

b) Cardiolipin

c) Plasmalogens

d) Sphingomyelin

Correct Answer - D

Phospholipids are :

i. Glycerophospholipids (glycerol containing) :- *Phosphatidylcholine (lecithin),* phosphatidylethanolamine (cephaline), phosphatidylserine, phosphatidylinositol, *plasmalogens*, lysophospholipids, *cardiolipin.*

i. Sphingophospholipids (sphingosine containing) :- *Sphingomyelin*

103. Immediate precursor of creatine

a) Carbamoyl phosphate

b) Arginosuccinate

c) Guanidoacetate

d) Citrulline

Correct Answer - C
Ans. 'C' Guanidoacetate
Creatine and creatinine are not amino acids, but specialized products of amino acids.
Creatine is synthesized from glycine, arginine, and methionine.
The synthesis starts with the formation of guanidinoacetate from glycine and arginine in the kidney.
Further reactions take place in the liver and muscle.

104. Tyrosine enters gluconeogenesis by forming which substrate

a) Succinyl CoA

b) Alpha-ketoglutarate

c) Fumarate

d) Citrate

Correct Answer - C
Ans. 'C' Fumarate
TCA cycle intermediates are the substrate for gluconeogenesis. Gluconeogenic amino acids enter the TCA cycle after their transamination into various intermediates of the TCA cycle:?
Histidine, proline, glutamine and arginine are converted to glutamate which is then transaminated to α-ketoglutarate.
Isoleucine, methionine and valine enter by conversion into succinyl CoA. Propionate (a short chain fatty acid) also enter at this level.
Tyrosine, and phenylalanine enter by conversion into fumarate.
Tryptophan is converted to alanine which is then transaminated to pyruvate.
Hydroxyproline, serine, cysteine, threonine and glycine enter by conversion into pyruvate.

105. Fumarate of TCA is derived from transmination of which amino acid

a) Phenylalanine

b) Methionine

c) Valine

d) Glutamine

Correct Answer - A
Ans. is. A. Phenylalanine

106. Alpha helix and Beta pleated sheet are examples of?

a) Primary

b) Secondary structure

c) Tertiary

d) Quaternary structure

Correct Answer - B

Ans. 'B' Secondary structure

Structural organization of proteins

Every protein has a unique three -dimensional structure, which is referred to as its *native conformation* and made up of only 20 different amino acids. Protein structure can be classified into four levels of the organization.

1) Primary structures

- **The linear sequence of amino acid residues and the location of disulfide bridges, if any, in a polypeptide chain constitute its primary structure.** In simple words, the *primary structure of proteins refers to the specific sequence of amino acids. The primary* structure is maintained by the **covalent 'peptide' bond.**

2) Secondary structure

- For stability of the primary structure, hydrogen bonding between the hydrogen of NH and oxygen of C = 0 groups of the polypeptide chain occurs, which gives rise to twisting, folding or bending of the primary structure. Thus, **regular folding and twisting of the polypeptide chain brought about by hydrogen bonding is called secondary structure.** Important types of secondary structures are **a-helix, beta-pleated sheet,** and beta**-bends.**

3) Tertiary structure

- The peptide chain, with its secondary structure, maybe further folded and twisted about itself forming **three-dimensional arrangement** of the polypeptide chain, i.e., *tertiary structure refers to the overall folding pattern of a polypeptide which forms the three-dimensional shape. The tertiary* **structure (three-dimensional shape) is maintained by weak non-covalent interactions** which include *hydrogen bonds, hydrophobic interactions, ionic bond (electrostatic bonds or salt bridges)* and Van-der wall forces. *Covalent linkage (disulfide bond)* also plays some (but minor) role.

4) Quaternary structure

- Many proteins are made up of *more than one polypeptide chain (polymers).* Each polypeptide chain is known as *protomer (or subunit).* The subunit is linked with each other by *non-covalent bonds.* The structure formed by the union of subunits is known as quaternary structure, i.e., the *spatial relation of subunits (peptide chains) with one another is called the quaternary structure.* Mainly three *non-covalent bonds* stabilize quaternary structure: *Hydrophobic, hydrogen* and *ionic (electrostatic).*
- Dimeric proteins contain two polypeptide chains. Homodimers contain two copies of the same polypeptide chain, while in a heterodimer the polypeptides differ.

107. RNA polymerase has which activity

a) Primase

b) Helicase

c) Ligase

d) Topoisomerase

Correct Answer - A

DNA synthesis cannot commence with deoxyribonucleotides because DNA polymerase cannot add a mononucleotide to another mononucleotide.

- Thus, DNA polymerase cannot initiate synthesis of complementary DNA synthesis strand of DNA on a totally single stranded template.
- For this, they require RNA primer, which is a short piece of RNA formed by enzyme primase (RNA polymerase) using DNA as a template.
- RNA primer is then extended by addition of deoxyribonucleotides.
- Later on, the ribonucleotides of the primer are replaced by deoxyribonucleotides.
- Primase is actually a DNA primase which has RNA polymerase activity. This DNA primase is also called DNA polymerase.

108. which of the following occurs only in mitochondria

a) ECT

b) Ketogenesis

c) Urea cycle

d) Steroid synthesis

Correct Answer - C

Ans. D. Urea Cycle

- **Ketogenesis occurs primarily in the mitochondria of liver cells. Fatty acids are brought into the mitochondria via carnitine palmitoyltransferase (CPT-1) and then broken down into acetyl CoA via beta-oxidation**
- **In eukaryotes, an important electron transport chain is found in the inner mitochondrial membrane where it serves as the site of oxidative phosphorylation through the action of ATP synthase.**
- **Mitochondria are essential sites for steroid hormone biosynthesis. Mitochondria in the steroidogenic cells of the adrenal, gonad, placenta and brain contain the cholesterol side-chain cleavage enzyme, P450scc, and its two electron-transfer partners, ferredoxin reductase and ferredoxin. This enzyme system converts cholesterol to pregnenolone and determines net steroidogenic capacity, so that it serves as the chronic regulator of steroidogenesis.**
- **urea is produced through a series of reactions occurring in the *cytosol and mitochondrial matrix of liver cells both***

109. Number of structural gene in Lac operon

a) 3

b) 4

c) 5

d) 6

Correct Answer - A

Lactose operone or Lac operon

The lac operon is a region of DNA in the genome of E. coli that contains following genetic elements ?

i) Three structural genes :- These code for 3 proteins that are involved in catabolism of lactose. These genes are 'Z' gene (codes for P-galactosidase), 'Y' gene (codes for galactoside permease), and 'A' gene (codes for thiogalactoside transacetylase).

ii) Regulatory gene (lac i) It produces repressor protein.

iii) A promotor site (P) :- It is the binding site for RNA polymerase. It contains two specific regions ?

a) CAP site (Catabolite activator protein binding site).

b) RNA polymerase binding site

iv) An operator site (0) :- Repressor binds to this site and blocks transcription.

3 Structural genes are expressed only when '0' site is empty (repressor is not bound) and the CAP site is bound by a complex of cAMP and CAP (catabolite gene activator protein).

110. The enzyme involved in initiation of peptide chain synthesis-

a) Topoisomerase

b) Transformylase

c) RNA polymerase

d) Peptidyl transferase

Correct Answer - B

Ans. 'B' Transformylase

Steps in eukaryotic translation (protein synthesis)

There are three major steps, in protein synthesis (translation):- (i) Initiation, (ii) Elongation; and (iii) Termination.

- In prokaryotes and in mitochondria, the first amino acid methionine is modified by formylation, i.e. the initiator tRNA carries an N-formylated methionine. The formyl group is added by the enzyme transformylase (formyl-transferase).
- In Eukaryotes, the initiator tRNA carries a methionine that is not formylated.

111. Strongest interactions among the following

a) Covalent

b) Hydrogen

c) Electrostatic

d) Van der Waals

Correct Answer - A
Ans. A. Covalent
Strongest bond → Covalent
Weakest bond → Van der wals forces
Moleucular interactions
There are two types of interactions between molecules that stabilize molecular structures :-
1. Covalent bonds, e.g. peptide bonds and disulphide bonds.
2. Non-covalent bonds.

112. Highest mobility on electrophoresis

a) HDL

b) VLDL

c) LDL

d) Chylomicrons

Correct Answer - A
As in lipoprotein **electrophoresis**, **HDL** shows the **highest mobility** followed by VLDL, IDL, and LDL.
Chylomicrons migrate according to their net-charge between **HDL** and VLDL because isotachophoresis has negligible molecular sieve effects.

113. Regulating enzymes in Gluconeogenesis are all, except

a) Pyruvate carboxylase

b) PEP carboxykinase

c) PFK-1

d) Glucose-6-phosphatase

Correct Answer - C
Ans. is. C. PFK-1

114. Glucagon stimulates

a) Gluconeogenesis

b) Glycogenesis

c) Fatty acid synthesis

d) Glycolysis

Correct Answer - A

Ans. 'A' Gluconeogenesis.

Glucagon is a polypeptide hormone that is secreted by the A cells of the islets of Langerhans of the pancreas. It acts by increasing cAMP.

1) Glucagon stimulates glycogenolysis in the liver but not in muscle. Breakdown of glycogen yields glucose.

2) Glucagon stimulates the production of glucose from amino acids (gluconeogenesis). Both glycogenolysis and gluconeogenesis tend to raise plasma glucose levels.

3) Glucagon stimulates lipolysis. Breakdown of lipids yields free fatty acids, which may be oxidized completely to carbon dioxide, or incompletely to form ketone bodies.

115. Which of the following amino acids is purely ketogenic?

a) Phenylalanine

b) Leucine

c) Proline

d) Tyrosine

Correct Answer - B
Ans:B.)Leucine
Amino acids:
Ketogenic :

- Leucine, Lysine

Glucogenic:

- Valine, Cysteine, Serine,Alanine, Histidine,Threonine, Arginine, Glycine, Glutamate, Proline/Hydroxy proline

Both Glucogenic & Ketogenic :

- Isoleucine, Tyrosine , Tryptophan , Phenylalanine

116. Cystathionine lyase requires which cofactor ?

a) Thiamine

b) Riboflavin

c) Pyridoxine

d) Niacin

Correct Answer - C
Ans. 'C' Pyridoxine
Hydrolytic cleavage (hydrolysis) of cystathionine forms Homoserine plus cysteine.
This reaction is catalyzed by the enzyme cystathionine lyase (cystathionase), which requires cofactor pyridoxal phosphate (the active form of pyridoxine).

117. Most common physiological form of DNA

a) A-form

b) B-form

c) Z-form

d) C-form

Correct Answer - B
DNA can exist in at least six forms, i.e. A, B, C, D, E and Z.
The B-form of DNA is the most common form of DNA and is right-handed helix.
It is the strandard DNA structure with 10 base pairs per turn.
Watson and Crick model describes the B-form of DNA.
Other forms of DNA are A-form (contains 11 base pairs per turn and is *right handed helix)* and Z-form (contains 12 base pairs per turn and is *left handed helix).*
Z-form is favored by alternating G-C sequences in alcohol and high salt solution; and is inhibited by alternating A-T sequnces (Note-B form has minimum base pairs per turn, i.e. 10).

118. CO acts by inhibiting which component of respiratory chain ?

a) Cytochrome b

b) Cytochrome C oxidase

c) NADH CoQ reductase

d) Oxidative phosphorylation

Correct Answer - B

Ans. 'B' Cytochrome C oxidase

Inhibitors of Electron transport chain (Respiratory chain)

- *Complex I:-* Barbiturates *(amobarbital)*, piericidin A, *rotenone,* chlorpromazine, guanethidine.
- *Complex II:-* Carboxin, TTFA, malonate.
- *Complex* III**:-** Dimercaprol, BAL, actinomycin A, Naphthyloquinone.
- *Complex IV (cytochrome c oxidase) :- Carbon monoxide (CO), cyanide (CN),* H_2S**,** azide (N3-)

119. Specific inhibitor of succinate dehydrogenase?

a) Fluoroacetate

b) Arsenite

c) Malonate

d) Fluoride

Correct Answer - C
Ans. C. Malonate
Inhibition of the enzyme succinate dehydrogenase by malonate illustrates competitive inhibition by a substrate analog.
Succinate dehydrogenase catalyzes the removal of one hydrogen atom from each of the two methylene carbons of succinate.

120. In citric acid cycle, NADH is produced by-

a) Succinate thiokinase

b) Succinate dehydrogenase

c) Isocitrate dehydrogenase

d) Fumarase

Correct Answer - C

Ans 'C' Fumarase

NADH is produced and CO_2 is liberated at 3 steps :

i) Conversion of isocitrate to a-ketoglutarate by isocitrate dehydrogenase

ii) Conversion of alpha-ketoglutarate to succinyl CoA by alpha-ketoglutarate dehydrogenase

iii) Conversion of L-malate to oxaloacetate by malate dehydrogenase.

121. Urea is synthesized in all except

a) Liver

b) Brain

c) Kidney

d) Spleen

Correct Answer - D
Urea is synthesized in liver but small quantities (not significant) may be formed in brain and kidney also.
Ammonia is ultimately disposed of by formation of urea by "Kreb's Henseleit urea cycle" in the liver.
Urea cycle takes place *both in mitochondria and cytosol.*
First two reactions of urea cycle occur in the mitochondria, and remaining reactions occurs in cytosol

122. Which of the following step is specific for gluconeogenesis

a) Pyrovate to acetyl CoA

b) Oxaloacetate to citrate

c) Oxaloacetate to PEP

d) Oxaloacetate to PEP

Correct Answer - C
Ans. is 'c' i.e., Oxaloacetate to PEP

123. Pyruvate can be a substrate for

a) Fatty acid synthesis

b) TCA cycle

c) Cholesterol synthesis

d) All of the above

Correct Answer - D
Ans. is 'd' i.e., All of the above
Pyruvate
a It is a degradation product of glucose (glycolysis) and glycogenic aminoacids. It can be converted to glucose (gluconeogenesis through oxaloacetate) and acetyl CoA (therefore all biosynthetic products which arise from acetyl CoA)

124. In oxidative pathway, NADPH is produced in ?

a) Cytosol

b) Mitochondria

c) Ribosome

d) Peroxisomes

Correct Answer - A

Ans. is 'a' i.e., Cytosol

- NADPH is produced mainly in HMP shunt, which occurs cytosol.
- HMP is an alternative route for the oxidation of glucose (beside glycolysis).
- It is also called as *"pentose phosphate pathway", "Dickens - Horecker pathway", "Shunt pathway"* or *"phosphogluconate oxidative pathway".*
- HMP shunt is required for provision of reduced NADPH and fiver-carbon sugars e.g. ribose (Pentose phosphates) for nucleic acid synthesis.
- *Normally, 90% of glucose is oxidized by glycolysis and 10% is oxidized by HMP shunt.*
- However, in liver and RBCs HMP shunt accounts for oxidation of 30% glucose.
- HMP shunt occurs in the cytosol.
- It is highly active in *liver,* adipose tissue, *adrenal cortex, lens, cornea, lactating (but not the nonlactating) mammary gland. Gonads (testis, ovary) and erythrocytes.*
- Activity of this pathway is minimal in muscle and brain, where almost all of the glucose is degraded by glycolysis.

125. Glucose is converted to sorbitol by ?

a) Aldolase B

b) Aldose reductase

c) Sorbitol dehydrogenase

d) All of these

Correct Answer - B
Ans. is 'b' i.e., Aldose reductase

126. Lactose intolerance is due to ?

a) Deficiency of Galactokinase

b) Deficiency of Uridyl transferase

c) Deficiency of Lactase

d) Deficiency of Enteropeptidase

Correct Answer - C

Ans. is 'c' i.e., Deficiency of Lactase

Lactose intolerance

- It occurs due to deficiency of lactase, the most important member of β-galactosidase enzymatic class.
- Lactase hydrolyses lactose into glucose and galactose in the small intestine.
- Lactose is present in milk.
- Therefore, deficiency of lactase, (β-galactosidase) results in intolerance to milk and other dairy products.
- Clinical features are bloating, diarrhea, failure to thrive, abdominal distension and abdominal cramp.

127. Deficiency of which vitamin causes excretion of xantheurenic acid in urine ?

a) Folic acid

b) Pyridoxin

c) Niacin

d) Vitamin B12

Correct Answer - B
Ans. is 'b' i.e., Pyridoxin

128. Total number of dehydrogenases Krebs cycle ?

a) 3

b) 2

c) 4

d) 5

Correct Answer - C
Ans. is 'c' i.e., **4**

129. Number of ATP generated in one TCA cycle ?

a) 2

b) 8

c) 10

d) 11

Correct Answer - C
Ans. is 'c' i.e., 10

- In a single TCA cycle 10 molecules of ATP are produced (12 molecules according to older calculations).
- One turn of the TCA cycle, starting with acetyl CoA produces 10 ATPs. When the starting molecule is pyruvate, the oxidative decarboxylation of pyruvate, the oxidative decarboxylation of pyruvate yields 2.5 ATPs and therefore, 12.5 ATPs are produced when starting compound is pyruvate. Since, two molecules of pyruvate enter the TCA cycle when glucose is metabolized (glycolysis produces 2 molecules of pyruvate), the number of ATPs is doubled. Therefore, 25 ATP molecules, per glucose molecule, are produced when pyruvate enters the TCA cycle.
- Note : Previously calculations were made assuming that NADH produces 3 ATPs and FADH generates 2 ATPs. This will amount a net generation of 30 ATP molecules in TCA per molecule glucose and total 38 molecules from starting. Recent experiments show that these values are overestimates and NADH produces 2.5 ATPs and FADH produces 1.5 ATPs. Therefore, net generation during TCA is 25 ATPs and complete oxidation of glucose through glycolysis plus citric acid cycle yield a net 32 ATPs.
- Energy yield (number of ATP generated) per molecule of glucose

when it is completely oxidized through glycolysis plus citric acid cycle, under aerobic conditions, is as follows :-

130. If urine sample darkens on standing: the most likely conditions is ?

a) Phenylketonuria

b) Alkaptonuria

c) Maple syrup disease

d) Tyrosinemia

Correct Answer - B
Ans. is 'b' i.e., Alkaptonuria
Alkaptonuria
It is due to deficiency of homogentisate oxidase. As a result homogentisic acid (homogentisate) is excreted execessively in urine. There arc three important characteristic features in alkaptonuria?
i) Urine becomes dark after being exposed to air. It is due spontaneous oxidation of homogentisate into *benzoquinone acetate,* which polymerse to form *black-brown pigment alkapton* which imparts a characteristic black-brown colour to urine.
ii) Alkapton deposition occurs in sclera, ear, nose, cheeks and intervertebral disc space. A condition called ochronosis. There may be calcification of intervertebral discs.
iii) Onchronosis arthritis affecting shoulder, hips, knee.
Benedict's test is strongly positive in urine and so is the ferric chloride *(FeC1 $_3$)test. Benedict's reagent* gives a greenish brown precipitate with brownish black supernatent. *Fehling's reagent (FeC1$_3$)* gives blue green colour.

131. Which of the following enzyme does not catalyzes irreversible step in glycolysis ?

a) Hexokinase

b) Phosphoglycerate kinase

c) Pyruvate kinase

d) Phosphofructokinase

Correct Answer - B
Ans. is 'b' i.e., Phosphoglycorate kinase
Glycolysis is regulated at 3 steps which are irreversible.
These reactions are catalyzed by following key enzymes :?
1) Hexokinase and glucokinase
2) Phosphofructokinase - I
3) Pyruvate kinase.

132. Taurine is made from ?

a) Glycine

b) Tyrosine

c) Cysteine

d) Phenylalanine

Correct Answer - C
Ans. is 'c' i.e., Cysteine
Taurine is synthesized from cysteine.

133. Amino acid carrying ammonia from muscle to liver?

a) Alanine

b) Glutamine

c) Arginine

d) Lysine

Correct Answer - A

Ans. is 'a' i.e., Alanine.

DISPOSAL/DETOXIFICATION OF AMMONIA

1. First line of Defense (Trapping of ammonia)

- Being highly toxic, ammonia should be eliminated or detoxified, as and when it is formed. Even very minute quantity of ammonia may produce toxicity in central nervous system.
- But, ammonia is always produced by almost all cells, including neurons.
- The intracellular ammonia is immediately trapped by glutamic acid to form glutamine, especially in brain cells .
- The glutamine is then transported to liver, where the reaction is reversed by the enzyme glutaminase .
- The ammonia thus generated is immediately detoxified into urea.
- Aspartic acid may also undergo similar reaction to form asparagine .

2. Transportation of Ammonia

- Inside the cells of almost all tissues, the transamination of amino acids produce glutamic acid.
- However, glutamate dehydrogenase is available only in the liver.
- Therefore, the final deamination and production of ammonia is taking place in the liver .
- Thus, glutamic acid acts as the link between amino groups of amino

acids and ammonia.

- The concentration of glutamic acid in blood is 10 times more than other amino acids.
- Glutamine is the transport forms of ammonia from brain and intestine to liver; while alanine is the transport form from muscle.

3. Final disposal

- The ammonia from all over the body thus reaches liver. It is then detoxified to urea by liver cells, and then excreted through kidneys.
- Urea is the end product of protein metabolism.

Transport of alanine from muscle to liver (glucose-alanine cycle) has two functions :?

- i) Providing substrate for gluconeogenesis
- ii) Transport of ammonia (NH_4-) to liver for urea synthesis.

134. FIGLU excretion test is used for assessment of deficiency of ?

a) Vitamin B_{12}

b) Niacin

c) Folic acid

d) Pyridoxin

Correct Answer - C
Ans. is 'c' i.e., Folic acid
Assessment of folate deficiency
Following tests arc used for assessment of folate deficiency.
i) Blood level :- Normal level in serum is about 2-20 nanogram/ml and about 200 micorgram/ml of packed cells.
ii) Histidine load test or FIGLU excretion test :- Histidine is normally metabolized to formimino glutamic acid (FIGLU) from which formimino group is removed by THF. Therefore in folate deficiency, FIGLU excretion is increased in urine.

135. Role of molecular oxygen in ETC ?

a) Transfer of reducing equivalent to CoQ

b) Transfer of reducing equivalent from cytosol to mitochondria

c) To act as last electron acceptor

d) Generation of ATP

Correct Answer - C

Ans. is 'c' i.e., To act as last electron acceptor

Structural organizations of components of ETC

3 Components of respiratory chain do not function as discrete carriers of reducing equivalent but are organized *into four complexes* each of which acts as a specific oxidoreductase. Coenzyme Q and cytochrome C are not parts of any complex and are not fixed in the inner mitochondria! membrane. The other components are fixed in the membrane. These components are arranged in order of increasing redox potential. Therefore, reducing equivalents (electrons) flow in one direction, I ---> II --> III --> IV, only because redox couple with low redox potential is better electron donor where as the one with high redox potential is electron acceptor. Thus, reducing equivalents (electrons) flow through the chain from the components of more negative redox potential to the components of more positive redox potential.

i) Complex I (NADH - CoQ reductase) catalyzes the transfer of electron from NADH to coenzyme Q (CoQ).

ii) Complex II (Succinate - CoQ reductase or succinate dehydrogenase) transfers electrons from succinate to coenzyme Q.

iii) Complex III (CoQ - cytochrome C reductase), transfers electron from CoQ to cytochrome C.

iv) Complex IV (cytochrome C oxidase) transfers electrons from cytochrome C to 02

cytochrome C to O2.

136. Which of the following is a homopolysaccharide?

a) Heparin

b) Chitin

c) Hyaluronic acid

d) Chondroitin sulfate

Correct Answer - B
Ans. is 'b' i.e., Chitin
Polysaccharides are classified into ?
a) Homopolysaccharides (Homoglycans) :- This type of polysaccharide is made up of several units of same monosaccharide unit only. Examples are *starch* (multiple units of glucose), *glycogen* (multiple units of glucose), *cellulose* (multiple units of glucose), *Inulin* (multiple unit of fructose), *Dextrin, Dextran* (multiple units of glucose), and *chitin.*
b) Heteropolysaccharides (Heteroglycans) :- This type of polysaccharide contains two or more different types of monosacharide units. Examples are *heparin, heparan sulfate, chondroitin sulfate, dermatan sulfate, hyaluronic acid, keratan sulfate and blood group polysaccharides.*

137. If tyrosine level in blood is normal without external supplementation, deficiency of which of the following is ruled out ?

a) Tryptophan

b) Phenylalanine

c) Histidine

d) Isoleucine

Correct Answer - B
Ans. is 'b' i.e., Phenylalanine
Tyrosine is synthesized from phenylalanine.
In phenylalanine deficiency or in disorders in which phenylalanine cannot be converted into tyrosine (phenylketonuria), tyrosine becomes an essential amino acid and should be supplemented from outside.

138. End product of porphyrin metabolism ?

a) Albumin

b) CO_2 & NH_2

c) Bilirubin

d) None

Correct Answer - C
Ans. is 'c' i.e., Bilirubin

- Heme is the most important porphyrin.
- It is degraded into bilirubin.

139. Hunter syndrome is due to deficiency of

a) Beta galactosidase

b) Sphingomyelinase

c) Iduronate Sulfatase

d) Hyaluronidase

Correct Answer - C
Ans. is 'c' i.e., Iduronate Sulfatase

140. UDP glucose is not used in ?

a) Uronic acid pathway

b) Glycogen synthesis

c) Galactose metabolism

d) HMP shunt

Correct Answer - D
Ans. is 'd' i.e., HMP shunt
UDP-glucose is derived from glucose-6-phosphate via glucose-l-phosphate.
The major fate of UDP-glucose is the synthesis of glycogen.
Other uses of UDP-glucose are -
1. In uronic acid (glucoronic acid) cycle to generate UDP glucuronate.
2. Galactose metabolism
3. Glycosylation of proteins, lipids and proteoglycans.

141. Number of ATP molecules and NADH formed in each cycle of glycolysis ?

a) 4 ATP, 2 NADH

b) 2 ATP, 2 NADH

c) 4 ATP, 4 NADH

d) 2 ATP, 4 NADH

Correct Answer - A

Ans. is 'a' i.e., 4 ATP, 2 NADH

Enegetics of glvcolysis

During glycolysis 2 ATP are utilized and 4 ATP are produced at substrate level. 2 reducing equalents NADH' are produced and reoxidized by electron transport chain, to generata 5 ATP molecules (2.5 ATP per NADH' molecule). Thus total 9 ATP molecules are produced and 2 are utilized, i.e., There is net gain of 7 ATP molecules in aerobic glycolysis.

In anaerobic conditions, the reoxidation of NADH by electron transport chain is prevented and NADH gets reoxidized by conversion of pyruvate to lactate by lactate dehydrogenase. Thus, in anaerobic glycolysis only 4 ATP are produced at substrate level. Therefore, there is net gain of 2 ATP molecules in anaerobic glycolysis.

Note : - Previous calculations were made assuming that NADH produces 3 ATPs and FADH2 generates 2 ATPs. This will amount to a net generation of 8ATPs per glucose molecule during glycolysis. Recent experiments show that these old values are overestimates and NADH produces 2.5 ATPs and FADH2 produces 1.5 ATPs. Thus, net generation is only 7ATPs during glycolysis.

142. Which of the following is not true regarding ETC?

a) Occurs in mitochondria

b) Generates ATP

c) No role of inorganic phosphate

d) Involves transport of reducing equivalent

Correct Answer - C
Ans. is 'c' i.e., No role of inorganic phosphate

- Inorganic phosphate (Pi) is required in ETC to generate ATP.
  ADP+pi --> ATP
- ETC occurs in mitochondria and involves transfer of reducing equivalent to generate ATP

143. Proteins are separated on the basis of charge in ?

a) SDS-PAGE

b) Ultracentrifugation

c) Affinity chromatography

d) HPLC

Correct Answer - D
Ans. is 'd' i.e., HPLC

144. Isoform of LDH in skeletal muscles ?

a) LDH-1

b) LDH-2

c) LDH-3

d) LDH-4

Correct Answer - D
Ans. is 'd' i.e., LDH-4

- Skeletal muscles contain LDH-4 and LDH-5

145. Following is true regarding sulhydryl groups except?

a) They are present in coenzyme A and lipoic acid

b) They are present in Captopril and penicillamine

c) They are not involved in reduction of peroxides

d) They are present in cysteine

Correct Answer - C

Ans. is 'c' i.e., They are not involved in reduction of peroxides

- Sulfhydryl Group (or thiol group)
- It is an SH group of organic compounds.
- Sulfhydryl groups have great and varied reactivity. They oxidize easily, with the formation of disulfides and
- sulfenic, sulfinic, or sulfonic acids, and they readily undergo alkylation, acylation, and thiol-disulfide exchange.
- They form mercaptides upon reacting with the ions of heavy metals, and they form mercaptals and mercaptols upon reacting with aldehydes and ketones, respectively.
- Sulfhydryl groups play an important role in biochemical processes.
- The sulfhydryl groups of coenzyme A, lipoic acid, and 4'-phosphopantotheine participate in enzymatic reactions for the formation and transfer of acyl residues that are related to lipid and carbohydrate metabolism.
- The sulfhydryl groups of glutathione play an important role in the neutralization of foreign organic compounds and the reduction of peroxides; they are also of major importance in the fulfillment by glutathione of its function as a coenzyme.
- In proteins, residues of the amino acid cysteine have sulfhydryl groups.

- As components of the active centers of a number of enzymes, sulfhydryl groups participate in the catalytic effect of the enzymes and in the binding of substrates, coenzymes, and metal ions.
- Drugs containing sulfhydryl groups are: captopril, zofenopril and penicillamine.

146. Cause of Herpes Zoster ?

a) Primary infection with VZV

b) Recurrent infection with VZV

c) Reactivation of latent infection of VZV

d) Multiple infection with VZV

Correct Answer - C

Ans. is 'c' i.e., Reactivation of latent infection of VZV

Varicella zoster virus infection

- Varicella (Chicken pox) and Herpes zoster are different manifestations of the same virus infection. The virus is therefore called varicella zoster virus (VZA)
- Primary infection with VZV causes chicken pox.
- Reactivation of latent VZV, when immunity has fallen to ineffective levels causes-Herpes zoster
- The virus remains dormant in sensory ganglion of trigeminal nerve and reaches the eye along one or more branches of the opthalmic division of the 5th nerve

Herpes Zoster (Shingles)

Occurs in old age 60 years or above

As a consequence of *reactivation of latent infection from the dorsal root ganglion.* o Unilateral vesicular eruptions within a dermatomal distribution

Dermatomes from T3 to L3 and trigeminal nerve (especially ophthalmic branch) are involved. o Zoster ophthalmicus - due to reactivation in ophthalmic branch of trigeminal (gasserian) ganglia o Ramsay Hunt Syndrome - due to reactivation in geniculate ganglion of facial nerve. o Complications Post herpetic neuralgia - most debilitating complication

1. Meningeal irritation
2. Transverse myelitis
3. Cutaneous dissemination
4. Patient's with *hodgkin's disease* and *non hodgkin's lymphoma* are at greatest risk for progressive hespes zoster.
5. Bacterial superinfection

147. Bile acids are synthesized from ?

a) Heme

b) Cholesterol

c) Ribulose

d) Arachidonic acid

Correct Answer - B

Ans. is 'b' i.e., Cholesterol

- Primary bile acids are *cholic acid* and *chenodeoxycholic acid,* which are synthesized from cholesterol in liver.
- In the intestine some of the primary bile acids are converted into secondary bile acids, i.e., *deoxycholic acid* (formed from cholic acid) and *lithocholic acid* (derived from chenodexoxycholic acid).
- Glycine and taurine conjugates of these bile acids are called as bile salts.
- For example, cholic acid is a bile acid, and its glycine conjugate (glycocholic acid) is a bile salt.
- Bile salts help in digestion and absorption of fat by emulsification and micelles formation.
- Bile salts act as detergents, i.e., they have surface tension lowering action.
- Detergent action is due to amphipathic nature of bile salts (Note : Amphipathic molecules are molecules that contain both hydrophobic non-polar as well as hydrophilic-polar ends).

148. Not a substrate for gluconeogenesis -

a) Glycerol

b) Leucine

c) Lactate

d) Propionate

Correct Answer - B
Ans. is 'b' i.e., Leucine
Substrates for gluconeognesis ?
1. Lactate
2. All amino acids except leucine and lysine
3. Pyruvate
4. Propionate
5. Glycerol
6. Intermediates of citric acid cycle

Alanine is the most important gluconeogenic amino acid.

149. Rate limiting enzyme in bile acid synthesis ?

a) Desmolase

b) 21 α-hydroxylase

c) 7α-hydroxylase

d) 12α-hydroxylase

Correct Answer - C
Ans. is 'c' i.e., 7α-hydroxylase
About half of the cholesterol in the body is ultimately metabolized to bile acids.
The primary bile acids are synthesized from cholesterol in liver.
These are cholic acid and chenodeoxycholic acid.
Rate limiting enzyme in primary bile acids synthesis is 7α - hydroxylase (cholesterol 7α - hydroxylase).
This enzyme is inhibited by bile acids and induced by cholesterol.
Thyroid hormones induce transcription of 7a-hydroxylase, thus in patients with hypothyroidism plasma cholesterol tends to rise (because of inhibition of 7α-hydroxylase which in turn inhibits conversion of cholesterol to bile acids).

150. Rate limiting enzyme in catecholamine synthesis?

a) Dopa decarboxylase

b) N-methyltransferase

c) Dopamine hydroxylase

d) Tyrosine hydroxylase

Correct Answer - D
Ans. is 'd' i.e., Tyrosine hydroxylase

151. NAD^+ Acts as a coenzyme for ?

a) Xanthine oxidase

b) L-amino acid oxidase

c) Succinate dehydrogenase

d) Malate dehydrogenase

Correct Answer - D
Ans. 'D' Malate dehydrogenase
NAD -linked dehydrogenases Pyruvate dehydrogenase, isocitrate dehydrogenase, malate dehydrogenase, a-ketoglutarate dehydrogenase, glutamate dehydrogenase, glyceraldehyde-3-P dehydrogenase, lactate dehydrogenase, 13-hydroxy acyl CoA dehydrogenase, glycerol 3-P dehydrogenase (cytoplasmic).
NADP*-linked dehydrogenases Glucose-6-P dehydrogenase, 6-Phosphogluconate dehydrogenase, 3-ketoacyl reductase, Enoyl reductase, gulonate dehydrogenase.
FAD-linked dehydrogenases Succinate dehydrogenase, fatty acyl CoA dehydrogenase, glycerol-3P dehydrogenase (mitochondrial).

152. True about tRNA ?

a) 80% of total RNA

b) Contains 50-60 nucleotides

c) CCA sequence is transcribed

d) Longest RNA

Correct Answer - C
"The CCA tail is a CCA sequence at 3' end of the tRNA molecule. In prokaryotes, CCA sequence is transcribed. In eukaryotes, the CCA sequence is added during processing".
"tRNA is the smallest of three major species of RNAs" — Dinesh puri
tRNA comprises 15% of total RNA in the cell. It contains 73-93 nucleotide residue.

153. Selenocysteine is associated with ?

a) Carbonic anhydrase

b) Catalase

c) Deiodinase

d) Transferase

Correct Answer - C
Ans. C. Deiodinase
Selenocysteine is considered as 21 standard amino acid.

- It is present at the active site of some enzymes that catalyze redox reactions, e.g. thioredoxin reductase, glutathione peroxidase, and the deiodinase (converts thyroxin to triiodothyronine).
- Biosynthesis of selenocysteine requires cysteine, serine, ATP and a specific t-RNA.
- Serine provides the carbon skeleton of selenocysteine.
- Selenocysteine has a structure similar to cysteine, but containing the trace element selenium in place of sulfur atom of cysteine.

154. Which vitamin is required for transfer of 1-carbon unit?

a) Vitamin A

b) Folic acid

c) Vitamin B_{12}

d) Niacin

Correct Answer - B

Folic acid [Ref *Harper 29^{m}/e p. 537-539, Vasudevan ele* p. *400-402]*

- Goups, containing a single carbon atom are called one carbon groups. One carbon groups are formed from following amino acids during their metabolism:- *Serine, glycine, histidine and tryptophan.* One carbon groups formed during metabolism are: **methyl ($C11_3$), methylene (CH,), methenyl (C H), formyl (CHO) and formimino (CH=NH)**
These one carbon groups are transferred by way of tetrahydrofolate (THF), which is derivative of folic acid°. One carbon groups carried by THF are attached either to nitrogen N^5 or $M^{c'}$ or to both N^5 and N"). Different one corbon derivatives of THF **are- N^5- methyl THF, N^5, N'°-methylene THF, N^5, N"-methenyl THF, N^5-formyl THF and N^5-formimino THE** These derivatives are interconvertable.

155. Heme is synthesized from ?

a) Lysine + succinyl CoA

b) Glycine + succinyl CoA

c) Arginine + Malonyl CoA

d) Glycine + Malonyl CoA

Correct Answer - B
Ans. B. Glycine + succinyl CoA
Organelle: Partly cytoplasmic and partly mitochondrial
Starting materials: Succinyl CoA and Glycine

156. Splicing is a process of ?

a) Activation of protein

b) Removal of introns

c) Synthesis of protein

d) Replication of DNA

Correct Answer - B
In molecular biology and genetics, splicing is a modification of an RNA after transcription, in which introns are removed and exons are joined.
This is needed for the typical eukaryotic messenger RNA before it can be used to produce a correct protein through translation.
For many eukaryotic introns, splicing is done in a series of reactions which are catalyzed by the spliceosome a complex of small nuclear ribonucleoproteins (snRNAs), but there are also self-splicing introns.

157. Creatinine is formed from -

a) Glycine

b) Lysine

c) Leucine

d) Histamine

Correct Answer - A
Ans. A. Glycine
Creatinine and creatine are synthesized from glycine, arginine, and methionine.
Synthesis of creatine and creatinine

- Creatine and creatinine are not amino acids, but specialized products of amino acids. Creatine is synthesized from glycine, arginine, and methionine. The synthesis starts with the formation of guanidinoacetate from glycine and arginine in the kidney. Further reactions take place in the liver and muscle.

158. Most commonly used vector for DNA cloning ?

a) Plasmid

b) Virus

c) Cosmid

d) Phage

Correct Answer - A
Ans: A. Plasmid
A cloning vector is a carrier DNA molecule to which human DNA fragment is attached. Normally, foreign DNA fragments cannot self-replicate within host cell. Therefore, they are joined to a vector DNA, that can replicate within host cell.
The five major types of cloning vectors used are -
* Plasmids
* Viral vectors/Bacteriophages
* Cosmids
* Bacterial Artificial Chromosomes (BACs)
* Yeast artificial chromosomes (YACs)

159. Richest source of vitamin B12 ?

a) Meat

b) Green leafy vegetables

c) Corn oil

d) Sunflower oil

Correct Answer - A
Ans. is 'a' i.e., Meat

- Vitamin B12 is naturally found in animal products, including fish, meat, poultry, eggs, milk, and milk products.
- Vitamin B12 is generally not present in plant foods, but fortified breakfast cereals are a readily available source of vitamin B12 with high bioavailability for vegetarians.

Rich source of vitamin B12→

- Beef, liver, and chicken.
- Fish and shellfish such as trout, salmon, tuna fish, and clams.
- Fortified breakfast cereal.
- Low-fat milk, yogurt, and cheese.
- Eggs.

160. Keshan disease in due to deficiency of

a) Selenium

b) Copper

c) Zinc

d) Iron

Correct Answer - A
Ans. 'a' Selenium
Selenium is required for the synthesis of the amino acid selenocysteine. Selenocysteine is present at the active site of several human enzymes that catalyze redox reactions. Impairments in human selenoproteins have been implicated in tumorigenesis and atherosclerosis, and are associated with selenium deficiency cardiomyopathy (Keshan disease)

161. PFK-I inhibitor ?

a) AMP

b) Citrate

c) Glucose 6 phosphate

d) Insulin

Correct Answer - B
Ans. is 'b' i.e., Citrate

162. All are used in gluconeogenesis except ?

a) Oleate

b) Succinate

c) Glutamate

d) Aspartate

Correct Answer - A

Ans. *is* 'a' i.e., Oleate

Substrate of gluconeogenesis are :

- Lactate (lactic acid)
- Pyruvate
- All amino acids (except leucine and lysine)
- Propionate
- Intermediates of citric acid cycle
- Fatty acids are not substrates for gluconeogenesis.

Coming to the question

- Fatty acids (oleate in the question) is not a substrate for gluconeogenesis.
- Succinate is an intermediate of TCA cycle, and is a substrate for gluconeogenesis.
- All amino acids (in the question glutamate and aspartate), except leucine and lysine are substrates for gluconeogenesis.

163. Main enzyme for glycogen metabolism ?

a) Glucose-6-phosphatase

b) Glycogen synthase

c) PFK - 1

d) None of the above

Correct Answer - B
Ans. is 'b' i.e., Glycogen synthase

164. Action of metalloproteinase ?

a) Degradation of collagen

b) Polymerization of collagen

c) Oxidation of collagen

d) Stimulation of collagen

Correct Answer - A

Ans. is 'a' i.e., Degradation of collagen

- Degradation of collagen and other ECM (extracellular matrix) proteins is achieved by matrix metalloproteinases (MMPs).
- MMPs is a family of enzymes that have in common a 180-residue zinc protease domain.

Matrix metalloproteinases include :-

- Interstitial collagenase (MMP-1, 2, and 3) : Cleave the fibrillar collagen types I, II and III.
- Gelatinases (MMP-2 and 9) : Degrade amorphous collagen and fibronectin.
- Stromelysins (MMP-3, 10 and 11) : Act on proteoglycans, laminin, fibronectin and amorphous collagen.
- Membrane-bound MMPs (ADAMs) : Cleave membrane-bound precursor forms of TNF and TGF-a, releasing the active molecule.

165. Protein catabolism is increased in ?

a) Starvation

b) Burns

c) Surgery

d) All of the above

Correct Answer - D
Ans. is 'd' i.e., All of the above
Conditions causing increased protein catabolism

- Multiple trauma
- Infection and sepsis
- Burns
- Fever
- Surgery
- Long bone fracture
- Prolonged starvation
- Prolonged corticosteroid therapy

166. TATA box is seen in ?

a) Promoter region

b) Palindromic region

c) Enhancer region

d) Silencer region

Correct Answer - A
Ans. is 'a' i.e., Promoter region

167. Frame shift mutation does not effect complete amino acid sequence if it occurs in multiple of ?

a) I

b) 2

c) 3

d) None

Correct Answer - C
Ans. is 'c' i.e., 3

Frame-shift mutation

- Frameshift mutations^{Q} occur due to insertion or deletion^{Q} of one or two bases which causes change in the reading frame distal to the mutation.
- If I or 2 base pair change, whole reading frame is changed distal to the mutation, resulting into entirely different protein molecule.
- If 3 base pairs change, single amino acid is incorporated or deleted. The rest of amino acid sequence is same.
- This is because the genetic code is read in form of triplets of nucleotides (i.e. codons).
- If one or two base pairs from the code are removed or inserted, the genetic code will be misread from that change onwards because genetic code is not punctate. Therefore the amino acid sequence translated from the change onwards will be completely changed.
- However if the removal/insertion happens in multiple of three, rest of the reading from does not change and hence the amino acid sequence will not change.

168. Coris disease is due to defect in

a) Branching enzyme

b) Debranching enzyme

c) Myophosphorylase

d) Hepatic phosphorylase

Correct Answer - B
Ans. is 'b' i.e., Debranching enzyme

Type		Enzyme deficiency	Organ (s) affected
I	von Gierke's disease	Glucose 6-phosphatase	Liver, kidney
II	Pompe's disease	a (1 –44) Glucosidase (acid maltase)	All organs
III	Cori's disease/Forbe's disease	Debranching enzyme	Muscle, liver
IV	Andersen's disease	Branching enzyme	Liver, myocardium
V	McArdle's disease	Phosphorylase	Muscle
VI	Hers' disease	Phosphorylase	Liver
VII	Tarui's disease	Phosphofructokinase	Muscle, RBCs
VIII		Phosphorylase kinase	Liver

- There is also on X-linked form of phosphorylase kinase deficiency. This is sole exception as all other glycogen storage diseases are inherited as autosomal recessive trait.

169. Oxidative deamination is catalyzed by ?

a) Glutaminase

b) Glutamine synthase

c) Glutamate dehydrogenase

d) None of the above

Correct Answer - C
Ans. is 'c' i.e., Glutamate dehydrogenase

170. Glucose is transported in pancreas through whichreceptor ?

a) GLUT 1

b) GLUT 2

c) GLUT 3

d) GLUT 4

Correct Answer - B
Ans. is 'b' i.e., GLUT 2

- Glucose enters the B cells of pancreatic islets via *GLUT2* transporter and this stimulate the release of insulin.

171. Immediate source of energy is ?

a) Cori's cycle

b) HMP

c) ATP

d) TCA cycle

Correct Answer - C
Ans. is 'c' i.e., ATP
There are three energy systems to provide energy for muscular activities.

- Immediate energy system : Energy is provided by stored ATP and creatine phosphate.
- Anaerobic glycolytic system (lactic acid system) : Energy is generated by utilization of glucose or glycogen by anaerobic glycolysis. This energy is also generated early.
- Aerobic or oxidative system : Energy is generated by utilization of glucose/glycogen, and fatty acids through oxidative pathways, e.g. TCA cycle.
- These three energy systems operate as a continuum; each system is always functioning, even at rest. o What varies is the relative contribution each system makes to total ATP production at any given time.

	Immediate energy system	An erobic glycolytic system	Oxidative (aerobic) system
Substrates	ATP, creatine phosphate	Glucose or glycogen	Glucose or glycogen, fatty acids
Energy production	Very fast	Fast	Slow

Peak at	0-30 sec.	20-180 sec.	>3 min
Limiting factor	Depletion of CrP, ATP	Lactic acid as_. vitiation	Glycogen depletion
Activity example	Powerlifting & weight lifting, *short sprints*	Longer sprints Middle distance team sports	Endurance events Team sports
	Jumping, throwing	Ball games (Soccer, rugby)	Ball games (Soccer, field hockey)

172. Which of the following vitamins does not participate in oxidative decarboxylation of pyruvate to acetyl CoA ?

a) Thiamine

b) Niacine

c) Riboflavin

d) Biotin

Correct Answer - D
Ans. is `d' i.e., Biotin

173. Salvage pathway of purine nucleotide synthesis are used by all except ?

a) Brain

b) Liver

c) RBC

d) Leukocytes

Correct Answer - B
Ans. is 'b' i.e., Liver

- Purine nucleotide synthesis occurs by two pathways :
- De novo synthesis
- Salvage pathway
- Liver is the major site of purine nucleotide biosynthesis (de novo).
- Certain tissues cannot synthesize purine nucleotides by de novo patyway, e g. brain, erythrocytes and polymorphonuclear leukocytes.
- These are dependent on salvage pathway for synthesis of purine nucleotides by using exogenous purines, which are formed by degradation of purine nucleotides synthesized in liver.

174. Carboxypeptidase contains which mineral ?

a) Copper

b) Zinc

c) Iron

d) None

Correct Answer - B
Ans. is 'b' i.e., Zinc

- Zinc containing enzymes are *carboxypeptidase,* carbonic anhydrase, alkaline phosphatase, lactate dehydrogenase, alcohol dehydrogenase, glutamate dehydrogenase, RNA polymerase and superoxide dismutase.

175. Krabbes disease is due to deficiency of ?

a) Sphingomyelinase

b) Beta galactocerebrosidase

c) Hexosaminidase

d) Arylsulfatase

Correct Answer - B
Ans. is 'b' i.e., Beta galactocerebrosidase

176. True about gluconeogenesis ?

a) Occurs mainly in muscle

b) It is reverse of glycolysis

c) Alanine & lactate both can serve as substrate

d) Glycerol is not a substrate

Correct Answer - C

Ans. is 'c' i.e., Alanine & lactate both can serve as substrate

- Synthesis of glucose from noncarbohydrate precursors is called gluconeogenesis i.e., synthesis of new glucose.
- The major noncarbohydrate precursors (substrate) for gluconeogenesis are lactate, pyruvate, glycerol, glucogenic amino acids, propionate and intermediates of the citric acid cycle.
- All aminoacids, except for leucine and lysine, are substrate for gluconeogenesis.
- Alanine is the most important gluconeogenic amino acid.
- Gluconeogenesis occurs mainly in the liver and to a lesser extent in renal cortex.
- Some gluconeogenesis can also occur in small intestine, but it is not significant.
- Some of the reactions of gluconeogenesis occurs in the mitochondria but most occur in cytosol.
- Gluconeogenesis involves glycolysis, the citric acid cycle plus some special reactions.
- Glycolysis and gluconeogenesis share the same pathway but in opposite direction.
- Seven reactions of glycolysis are reversible and therefore are used with same enzyme in the synthesis of glucose by gluconeogenesis.
- However, three of the reactions of glycolysis are irreversible and

must be circumvented by four special reactions which are unique to gluconeogenesis and catalyzed by : (1) Pyruvate carboxylase, (ii) Phosphoenolpyruvate carboxykinase, (iii) Fructose-1,6-bisphosphatase, (iv) Glucose-6-phosphatase.

- These four enzymes are the key enzymes of gluconeogenesis (or gluconeogenesis enzymes).
- Among these four, pyruvate carboxylase is a mitocondrial enzyme and other three are cytoplasmic enzymes.

177. Which enzyme polymerises okazaki fragments ?

a) DNA polymerase I

b) DNA polymerase II

c) DNA polymerase III

d) RNA polymerase

Correct Answer - C
Ans. is 'c' i.e., DNA polymerase **III**
Two DNA polymerases act on Okazaki fragments *:?*

- DNA polymerase :- Causes polymerization of okazaki fragments, i.e. synthesis of DNA on lagging strand. It also causes synthesis of leading strand.
- DNA polymerase I :- It fills the gap between okazaki fragments when their polymerization is completed, i.e. when the synthesis on lagging strand is completed, DNA polymerase I fills the gap between fully polymerized okazaki fragments.
- Thus, DNA polymerase **III** is involved during 'elongation' (polymerization of okazaki fragments) and DNA polymerase I is involved during 'termination' (filling the gaps between okazaki fragments).

178. Riboflavin deficiency is assessed by ?

a) Transketolase

b) Glutathione reductase

c) PDH

d) None

Correct Answer - B
Ans. is 'b' i.e., Glutathione reductase
Riboflavin (Vitamin B2)

- Riboflavin is also called Warburg yellow enzyme.
- Riboflavin provides the reactive moieties of the coenzymes flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD).
- Flavin coenzymes are involved *in oxidoreduction reactions as electron carriers.*
- These reactions include the mitochondrial respiratory chain, key enzymes in fatty acid and amino acid oxidation and the citric acid cycle.

Flavin dependent (flavoprotein) enzymes are :

- FMN dependent : **L-amino acid oxidase,** NADH dehydrogenase.
- FAD dependent : **Complex II of respiratory chain,** microsomal hydroxylase system, D-amino acid oxidase, xanthine oxidase, succinate dehydrogenase, acyl-CoA dehydrogenase, glycerol-3-phosphate dehydrognenase, pyruvate dehydrognenase, a-ketoglutarate dehydrogenase.
- Deficiency of riboflavin is charcterized by cheilosis, desquamation and inflammation of tongue, and a seborrheic dermatitis.
- Riboflavin nutritional status is assessed by measurement of activation ofglutathione reductase by FAD added in vitro.

179. Heme is which porphyrin ?

a) Type I

b) Type II

c) Type III

d) Type IV

Correct Answer - C
Ans. is 'c' i.e., Type III

180. Which of the following is a lyase ?

a) Decarboxylase

b) Synthetase

c) Kinase

d) Oxygenase

Correct Answer - A
Ans. is 'a' i.e., Decarboxylase

Enzyme class	Important enzymes
Oxidoreductase	Oxidases, Dehydrogenases, Hydroperoxidases, (catalase, peroxidase), oxygenases
Transferase	Amino transferase or transaminase, e.g., SGOT (AST) and SGPT (ALT), kinases (Hexokinase^{o} glucokinase, pyruvate kinase etc), Transketolases, transaldolases, transcarboxylase
Hydrolases	All digestive enzymes (Pepsin, trypsin, lipases, esterases), lysosomal enzymes, urease, and phosphatase
Lyases	DecarboxylasesQ, aldolases, hydratases, enolase, fumarase^{Q}, Arginosuccinase
Isomerases	Racemases, epimerases, cis- trans- isomerases, mutases
Ligases	SynthatasesQ, Carboxylases, DNA ligase

181. Not present in DNA ?

a) Uracil

b) Thymine

c) Cytosine

d) Adenine

Correct Answer - A
Ans. is 'a' i.e., Uracil
Two types of bases are found in nucleotides : (i) purines and (ii) pyrimidines.
Purines : Two major purine bases found both in DNAs as well as RNAs are (i) adenine (A) and (ii) guanine (G).
Pyrimidines : Three major pyrimidine bases are (i) cytosine (C), (ii) Uracil (U) and (iii) Thymine (T). Cytosine and uracil are found in RNAs and cytosine and thymine are found in DNAs. Uracil is not found in DNAs [e] and thymine is not found in RNAs.
Different major bases with their corresponding nucleosides and nucleotides

Base	**Ribonucleoside**	**Ribonucleotide**
Adenine (A)	Adenosine	Adenosine monophosphate (AMP)
Guanine (G)	Guanosine	Guanosine monophosphate (GMP)
Uracil (U)	Uridine	Uridine monophosphate (UMP)
Cytosine (C)	Cytidine	Cytidine (Monophosphate) (CMP)
Base	**Deoxyribonucleoside**	**Deoxyribonucleotide**
	Deoxyadenosine	Deoxyadenosine monophosphate

Adenine		(dAMP)
Guanine	Deoxyguanosine	Deoxyguanosine monphosphate (dGMP)
Cytosine	Deoxycytidine	Deoxycytidine monophosphate (dCMP)
Thymine	Deoxythymidine	Deoxythymidine monophosphate (dCMP)

182. Neutral amino acid is ?

a) Aspartate

b) Arginine

c) Glycine

d) Histidine

Correct Answer - C
Ans. is 'c' i.e., Glycine

- Neutral amino acids
- Alanine Asparging
- Cysteine *Glycine* Glutamine Isoleucine
- Leucine Methionine
- Proline Phenylalanine
- Serine
- Threonine
- Tyrosine Tryptophan
- Valine

183. All are true about ketone bodies except ?

a) Acetoacetate is primary ketone body

b) Synthesized in mitochondria

c) Synthesized in liver

d) HMG CoA reductase is the rate-limiting enzyme

Correct Answer - D
Ans. is 'd' i.e., HMG CoA reductase is the rate-limiting enzyme

184. The mineral having action like vitamin E ?

a) Calcium

b) Iron

c) Selenium

d) Magnesium

Correct Answer - C
Ans. is 'c' i.e., Selenium

- Selenium functions as an antioxidant along with vitamin E.
- Selenium is a constituent of glutathione peroxidase, an antioxidant enzyme which prevents against oxidative damage.
- Selenium also is a constituent of iodothyronine deiodinase, the enzyme that converts thyroxine triiodothyronine.

185. Which is an abnormal lipoprotein ?

a) VLDL

b) Chylomicron

c) Lp (a)

d) LDL

Correct Answer - C
Ans. is 'c' i.e., Lp (a)

- Some people have a special type of abnormal LDL called lipoprotein (a) or Lp (a), containing an additional protein, apoprotein-a.
- Elevated LPa levels are associated with an increased risk of CHD.

186. Okazaki fragments are formed during ?

a) Transcription

b) Translation

c) DNA replication

d) None

Correct Answer - C
Ans. is 'c' i.e., DNA replication

187. Hay's sulpher test is used to detect which of the following ?

a) Bile salts in urine

b) Reducing sugar in urine

c) Ketone bodies in urine

d) Urobilinogen in urine

Correct Answer - A
Ans. is 'a' i.e., Bile salts in urine

Tests	Used for
Rothera's test (nitroprusside test)	Ketone bodies in urine :- acetone and acetocetate
Gerhardt's test (ferric chloride test)	Ketone bodies in urine :- acetoacetate.
Benedict's test	Reducing sugars in urine
Fehling's test	Reducing sugars in urine
Hay's sulpher test	Bile salts in urine
Fouchet's (borium sulphate test)	Bile pigment : bilirubin
Gmelin's (nitric acid) test	Bile pigment : bilirubin
Vanden Bergh test	Bile pigment : bilirubin
Ehrlich's test	Bilinogens (stercobilinogen, urobilinogen)
Schlesinger's test	Bilins (stercobilin, urobilin).
Ehrlich's aldehyde test	Porphobilinogen and urobilinogen in urine

188. Which of the following accumulates in maple syrup urine disease

a) Leucine

b) Valine

c) Isoleucine

d) All

Correct Answer - D
Ans. is `d' i.e., All
Maple syrup urine disease (MSUD) or branched-chain ketoaciduria
* It is an inborn error of metabolism of branched-chain amino acids *valine, leucine* and *isoleucine.*
* It is due to deficiency of an enzyme that catalyzes the second reaction in these amino acids metabolism i.e. **branched chain-a keto** acid dehydrogenase which catalyzes the decarboxylation of branched-chain amino acids.
* As a result, the branched-chain amino acids, leucine, isoleucine and valine, and their a-keto acids accumulate in the blood, urine, and CSF.
* There is a characteristic maple syrup odour to the urine.
* In maple syrup urine disease there is the excretion of branched-chain amino acids (isoleucine, *leucine,* valine) and their keto acids (α-keto β-methyl valerate, α-ketoisocaproate, α-ketoisovalerate) in the urine.

189. Keratin is a ?

a) Globular protein

b) Cylindrical protein

c) Fibrous protein

d) None of the above

Correct Answer - C
Ans. is 'c' i.e., Fibrous protein
Based on their three-dimensional shape (i.e., conformation), the proteins are divided into two classes :
1. Fibrous proteins : - The polypeptide chains extend along a longitudinal axis without showing any sharp bends, giving them rod or needle like elongated shape. Most of the structural proteins are fibrous proteins, e.g., *collagen, elastin, and keratin.* Fibrous proteins centrifuge more rapidly because of their rod like shape.
2. Globular proteins : - The polypeptide chains are tightly folded and packed into compact structure giving spherical or oval shape. Most enzymes, tranport proteins (albumin, globulins), hemoglobin, *myoglobin, antibodies and hormones* are globular proteins.

190. Keratin contains ?

a) Arginine

b) Histidine

c) Lysine

d) All

Correct Answer - D
Ans. is 'd' i.e., All
Amino acids required for specialized products

Creatine	→	Glycine + Arginine + Methionine
Glutathione	→	Glycine + Cysteine + Glutamate
Cystine	→	Cysteine + Cysteine
Purine	→	Glycine + Aspartate + Glutamate + Serine
Pyrinidine	→	Asparatate + Glutamine
Carnosine	→	13-Alanine + histidine
Choline	→	Formed with the help of methionine, glycine, serine, B6
Nitric oxide	→	Arginine
Heme	→	Glycinc, Succinyl CoA
Carnitine	→	Methionine + lysine
Keratin	→	Histidine; arginine; lysine (1 : 12 : 4)
Glutamate	→	Gamma-amino butyric acid (GABA)

191. Which of the following is high energy compound?

a) ADP

b) Glucose-6-phosphate

c) Creatine phosphate

d) Fructose-6-phosphate

Correct Answer - C
Ans. is 'c' i.e., Creatine phosphate
High energy compounds

- The energy released during oxidation of monosaccharides, fatty acids and amino acids may not be required immediately. Therefore, there must be some way of storing energy. The energy released during catabolism is captured in the form of a group of compounds known as "high-energy phosphates". The most important member of this groupis ATP.
- A compound that liberates 7 Kcal/mol or more on hydrolysis is called high energy compound, or a compound that on hydrolysis undergoes a large (7 kcal/mol) decrease in free energy (AG) under standard condition is called high energy compound, i.e., AG ?- 7 Kcal/mol. For example, ATP liberates 7.3 Kcal/mol on hydrolysis. High energy compounds are : ?
- Phosphate compounds : Nucleotides (ATP ^{Q},GTP, UTP, UDP-glucose), Creatinine phosphate, arginine phosphate, 1,3-bisphosphoglycerate, Phosphoenol pyruvate, inorganic pyrophosphate, Carbamoyl phosphate^{e},amino acyl adenylate (amino acyl AMP).
- Sulfur compounds : - CoA derivatives (acetyl CoA^{e}, Succinyl CoA,

fatty acyl CoA, HMG CoA), S-adenosyl methionine (SAM), adenosine phosphosulfate.

- A compound which liberates < 7 Kcal/mol on hydrolysis is called low energy compound, i.e., a decrease in free energy is < 7 Kcal/mol, i.e., AG < -7 Kcal/mol. Low energy compounds are glucose- 1-phosphate, fructose-6phosphate, glucose-6-phosphate, glycerol-3-phosphate, AMP, ADPQ.

192. True statement about hemoglobin is ?

a) Each hemoglobin molecule is made of 4 polypep tides of each subunit

b) Two alpha and two beta subunits having a 02 attached to each subunit

c) Each hemoglobin molecule binds to only one 02 molecule

d) Each hemoglobin has one heme molecule

Correct Answer - A
Ans. is 'a' i.e., Each hemoglobin molecule is made of 4 polypeptides of each subunit

193. All are true about LDL except ?

a) More dense than chylomicron

b) Smaller than VLDL

c) Transports maximum amount of lipid

d) Contains maximum cholesterol

Correct Answer - C
Ans. is 'c' i.e., Transports maximum amount of lipid

194. Gluconeogenesis from lactate needs all except ?

a) Transport of lactate from muscle to liver

b) Conversion of lactate to pyruvate

c) Transamination of pyruvate to alanine

d) None of the above

Correct Answer - C
Ans. is 'c' i.e., Transamination of pyruvate to alanine

195. All are true about Vitamin B_{12},except ?

a) Active form is methylcobalamine

b) Requires for conversion of homocysteine to methionine

c) Requires in metabolism of methylmalonyl CoA

d) Requires for conversion of pyruvate to lactate

Correct Answer - D
Ans. is'd' i.e., Requires for conversion of pyruvate to lactate

196. Polar amino acids are all except ?

a) Glutamic acid

b) Histidine

c) Glutamine

d) Methionine

Correct Answer - D
Ans. is 'd' i.e., Methionine

197. Major form of folic acid to transfer one carbon is ?

a) Methylene THF

b) Formyl THF

c) Methyl THF

d) All

Correct Answer - A
Ans. is 'a' i.e., Methylene THF

Folic acid

- The active form of folic acid (pteroyl glutamate) is tetrahydrofolate (THF).
- THF serves as a carrier of one-carbon (C_1) unit^0 during several biosynthetic reactions like nucleic acid^Q and amino acid metabolism.
- Two other cofactors are also known to be involved in the addition of one carbon (C_1) unit to a metabolic precursor, biotin in carboxylation reaction and S-adenosylmethionine (SAM) as methylating agent.
- However, folic acid is more versatile than either of these two because it can transfer the C, units in several oxidation states.
- THF acts as a carrier of one carbon unit0.
- The one carbon units can be : Methyl (C.11$_3$), methylene (CH_2), methenyl (CH), formyl (CHO), orformimino (CH =NH).
- One carbon unit binds to THF through N^5 or $N^{1\circ}$ or both N^5, N'° position.
- For example, if formyl unit is attached to N-5, it is cal led N^5-formyl THF; if methylene unit is attached to both N^5 and 1\l'°, it is called N^5, N'° methylene THF.
- Carbon units attached to N5 are formyl, formimino, or methyl;

attached to N'° is formyl; and attached to both N^5-N^{10} are methylene or methenyl.

- So, various possible THF are : - N^5-Formyl THF, N^5-formimino THF, N^5-methyl THF, $N^{1°}$-formyl THF, N^5-N^{10}methylene THF and N^5-N'°-methenyl THF.
- THF receives the C, units from various donor molecules during catabolic reactions and can transfers them to specific acceptors for the synthesis of various compounds.
- The major point of entry for one-carbon unit into substituted folates is methylene THF, which is formed by the reaction of glycine, serine and choline. Serine is the most important source of substituted folates for biosynthetic reactions, and activity of serine hydroxymethyltransferase is regulated by the state of folate substitution and availability of folate.

198. During starvation, muscle uses ?

a) Fatty acids

b) Ketone bodies

c) Glucose

d) Proteins

Correct Answer - A
Ans. is 'a' i.e., Fatty acids

199. Serotonin is derived from -

a) Tyrosine

b) Tryptophan

c) Phenylalanine

d) Methionine

Correct Answer - B
Ans. is 'b' i.e., Tryptophan
[Ref Harper 29'/e p. 300]

- Tryptophan is a precursor for synthesis of niacin (nicotinic acid), serotonin and melatonin.

200. Major apolipoprotein of chylomicrons ?

a) B-100

b) D

c) B-48

d) None

Correct Answer - C
Ans. is 'c' i.e., B-48

201. True about Glutathione except ?

a) Tripeptide

b) Formed from glutamic acid, glycine, cysteine

c) Act as antioxidant in reduced state

d) All of the above

Correct Answer - D
Ans. is `d' i.e., All of the above

Glutathione

- Glutathione is a tripeptide of glutamie acid, cysteine, and glycine. The molecule has a sulfhydryl (-SH) or thiol group on the cysteine, which accounts for its strong electron-donating character.
- It exists in two forms : reduced glutathione or GSH. In the reduced state, the thiol group of cysteine is able to donate a reducing equivalent (H+ e-) to other unstable molecules, such as reactive oxygen species. In donating an electron, glutathione itself becomes reactive, but readily reacts with another reactive glutathione to form glutathione disulfide (GSSG) or oxidized glutathione. GSH can be regenerated from GSSG by the enzyme glutathione reductase.
- While all cells in the human body are capable of synthesizing glutathione, liver glutathione synthesis has been shown to be essential. The liver is the largest GSH reservoir.
- Because of its reducing property, reduced glutathione has potent antioxidant action.

Functions :

- GSH is an extremely important cell protectant. It directly reduces reactive hydroxyl free radicals, other oxygen centered free radicals, and radical centers on DNA and other biomolecules.
- GSH is the essential cofactor for many enzymes which require thiol-

reducing equivalents, and helps keep redox-sensitive active sites on enzymes in the necessary reduced state. GSH is used as a cofactor by ?

- Multiple peroxidase enzymes, to detoxify peroxides generated from oxygen radical attack on biological molecules;
- Transhydrogenases, to reduce oxidized centers on DNA, proteins, and other biomolecules; and
- Glutathione S-transferases (GST) to conjugate GSH with endogenous substances (e.g., estrogens) and to exogenous electrophiles (e.g., arene oxides, unsaturated carbonyls, organic halides), and diverse xenobiotics.
- GSH is a primary protectant of skin, lens, cornea, and retina against radiation damage, and the biochemical foundation of P450 detoxication in the liver, kidneys, lungs, intestinal epithelia, and other organs.
- GSH acts as a carrier in transport of certain amino acids across membranes in the kidney.
- Glutathione (GSH) participates in leukotriene synthesis.

202. Concentration of which is inversely related to the risk of coronary heart disease ?

a) VLDL

b) LDL

c) HDL

d) None

Correct Answer - C
Ans. is 'c' i.e., HDL

- The level of HDL in serum is inversely related to the incidence of MI.
- As it is "antiatherogenic" or "protective" in nature, HDL is known as "good cholesterol".
- HDL has its beneficial effect by reverse cholesterol transport.

203. Maximum cholesterol is seen in ?

a) VLDL

b) LDL

c) HDL

d) Chylomicrons

Correct Answer - B
Ans. is 'b' i.e., LDL

Maximum triglyceride content	→	Chylomicrons
Maximum exogenous triglyceride	→	Chylomicrons
Maximum endogenous triglyceride	→	VLDL
Maximum cholesterol content	→	LDL

204. In humans, end product of purine metabolism

a) Allantoin

b) Uric acid

c) CO_2

d) None

Correct Answer - B
Ans. is 'b' i.e., Uric acid

205. All are true about chaperones except ?

a) Cause folding of proteins

b) Are lipid in nature

c) May have ATPase activity

d) Include heat shock proteins

Correct Answer - B

Ans. is 'b' i.e., Are lipid in nature

- Chaperones are proteins (not lipid).

Chaperones

- Certain proteins play a role in the assembly or proper folding of other proteins without themselves being components of the latter.
- Such proteins are called molecular chaperones.
- Most chaperones exhibit ATPase activity and bind ADP and ATP.
- This activity is important for their effect on folding.

Some Properties of Chaperone Proteins

- Present in a wide range of species from bacteria to humans
- Many are so-called *heat shock proteins (Hsp)*
- Some are inducible by conditions that cause unfolding of newly synthesized proteins (eg, elevated temperature and various chemicals)
- They blind to predominantly hydrophobic regions of infolded proteins and prevent their aggregation
- They act in part as a quality control or editing mechanism for detecting misfolded or otherwise defective proteins
- Most chapersones show associated ATPase activity, with ATP or ADP being involved in the protein-chaperone interaction
- Found in various cellular compartments such as cytosol, mitochondria, and the lumen of the endoplasmic reticulum

206. Which Vitamin is involved in Redox reactions

a) Pyridoxin

b) Biotin

c) Folic acid

d) Riboflavin

Correct Answer - D
Ans. is 'd' i.e., Riboflavin

- Riboflavin and niacin are involved in redox (reduction and oxidation) reactions.

207. Ninhydrin test is used for ?

a) Bile salts

b) Amino acids

c) Nucleic acid

d) Lipids

Correct Answer - B
Ans. is 'b' i.e., Amino acids
Important chemical reactions of amino acids

- Following are some important chemical reactions.
A. Reaction used to determine amino acid sequence in polypeptide chain : - Generally, amino terminal (N-terminal) of amino acid is tagged with some reagent. It is split off by hydrolysis and tagged amino acid is identified. The reaction is, then, repeated with new N-terminal of subsequent amino acid and so on. The two reactions are used for identification of amino acid sequence : ?
- Sanger's reaction : - Uses Sanger's reagent (1 -fluoro-2,4-dinitrobenzene) to tag amino terminal.
- Edman's reaction : - Uses Edman's reagent (phenylisothiocyanate) to tag amino terminal.
B. Reaction used to identification of individual or group of amino acids : - These reactions are frequently used for qualitative detection and quantitative measurement of various amino acids.
- Ninhydrin tese : - All a-amino acids.
- Xanthophoretic reaction : - Aromatic amino acids^{e} (Tyrosine, tryptophan, phenylalanine).
- Millan's test^{e} (Millon-Nasse reaction) : - Tyrosine° (phenol group of tyrosine). Therefore millon's test is positive in tyrosinosis°.
- Aldehyde test : - Tryptophan (indole ring)

- Hopkins-tole reaction : - Tryptophan (indole ring)
- Sakaguch's reaction : - Arginine (guanidinium group of arginine).
- Sulphur test : - Cysteine (sulphydryl group)
- Nitroprusside test : - Cysteine (sulphydryl group)
- Pauly's test : - Histidine (imidazole group)
- Biuret reaction : - Peptide bond
- Diazo reaction Q (Pauli's) : - Histidine or tyrosine.

208. Which is not a dietary fiber ?

a) Lignin

b) Lactulose

c) Pectin

d) Cellulose

Correct Answer - B
Ans. is 'b' i.e., Lactulose
Dietary fibres (Review)

- Dietary fibre consists of unabsorbable cell wall and other consititutents of vegetable food like celluloseQ, lignin, hemicellulose[e], gums, pectins°, aliginates and other polysaccharides.
- In herbivorous animals, intestinal microoganism breakdown these polysaccharides into acetate, propionate and butyrate.
- These polysaccharides contain 13-glycosidic linkages.
- Therefore, they cannot be digested by a-amylase present in human saliva and pancreatic juice because a-amylase breaks a-glycosidic bond (especially 1-4 a linkage).
- So, dietary fibers are not digested or hydrolyzed but are fermented by colonic bacteria except for lignin, which is neither digested nor fermented by intestinal microorganisms°.
- Dietary fibre absorbes water in the intestine, swells, increase bulk of stool by increasing water content of faeces and soften it, decreases transit time by facilitating colonic tansit.
- "The presence of fibre shortens the transit times[e] and increases the stool bulk".

Dietary fibre is of two types : -

.. Soluble fibre[e] : - These are pectin, aliginates, and gums. These

absorb upto 15 times its weight in water as it moves through GIT, producing softer stools. Its good sources are oat, flaxseeds, peas, beans, apple, citrus fruits, carrots, bareley and psyllium.

2. Insoluble fibre° : - These are cellulose, hemicellulose and lignin. These promote movement of material through digestive system and increases stool bulk. Its good sources are wheat flour, wheat bran, nuts and vegetables.

209. ATP is generated in ETC by ?

a) Na' ATPase

b) Cl- ATPase

c) FoF, ATPase

d) ADP Kinase

Correct Answer - C
Ans. is `c' i.e., FoFi ATPase

210. Atractiloside act as ?

a) Uncoupler

b) Inhibitor of oxidative phosphorylation

c) Inhibitor of complex I of ETC

d) Inhibitor of complex III of ETC

Correct Answer - B

Ans. is 'b' i.e., Inhibitor of oxidative phosphorylation

Inhibitors of electron transport chain?

- Inhibitors of respiratory chain may be divided into three groups : ?

1. Inhibitors of electron transport chain proper

- These inhibitors inhibit the flow of electrons through the respiratory chain. This occurs at following sites.
- Complex I (NADH to CoQ) is inhibited by : - Barbiturates (amobarbital), Piericidin A (an antibiotic), rotenone (an insectiside), chlorpromazine (a tranquilizer), and guanethidine (an ntihypertensive). These inhibitors block the transfer of reducing equivalents from FeS protein to CoQ.
- Complex II is inhibited by : - Carboxin and TTFA inhibit transfer of electon from FADH2 to CoQ, whereas malanate competitively inhibit from succinate to complex II. Complex III (Cytochrome b to cytochrome CI) is inhibited by : - Dimercaprol, antimycin A, BAL
- (British antilewisite), Naphthyloquinone. These inhibitors block the transfer of electrons from cytochrome b to cytochrome
- Complex IV (cytochrome C oxidase) is inhibited by : - Carbon monoxide, CN-, H_2S and azide (N3-). These inhibitors block the transfer of electrons from cytochrome aa3 to molecular oxygen and therefore can totally arrest cellular respiration.

2. Inhibitors of oxidative phosphorylation

- These compounds directly inhibit phosphorylation of ADP to ATP. Oligomycin inhibits F_o component of F_0F, ATPase. Atractiloside inhibits translocase, a transport protein that transports ADP into mitochondria for phosphorylation into ATP.

3. Uncouples

- As the name suggests, these componds block the coupeling of oxidation with phosphorylation. These compounds allow the transfer of reducing equivalents in respiratory chain but prevent the phosphorylation of ADP to ATP by uncoupling the linkage between ETC and phosphorylation. Thus the energy instead of being trapped by phosphorylation is dissipated as heat. Uncouplers may be :-

.. Natural :- Thermogenin, thyroxine

2. Synthetic :- 2, 4-dinitrophenol (2, 4-DNP), 2, 4-dinitrocresol (2, 4-DNC), and CCCP (chlorocarbonylcyanidephenyl hydrazone).

211. Riboflavin is a constituent of ?

a) FMN

b) NAD

c) PLP

d) THF

Correct Answer - A
Ans. is 'a' i.e., FMN

- Riboflavin is also called Warburg yellow enzyme.
- Riboflavin provides the reactive moieties of the coenzymes flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD).
- Flavin coenzymes are involved *in oxidoreduction reactions as electron carriers.*
- These reactions include the mitochondrial respiratory chain, key enzymes in fatty acid and amino acid oxidation and the citric acid cycle.

212. Rate limiting step in pyrimidine synthesis ?

a) Dihydro-orotase

b) Ornithine transcarbomoylase

c) Aspartate transcarbomoylase

d) Carbamoyl phosphate synthase-I

Correct Answer - C
Ans. is 'c' i.e., Aspartate transcarbomoylase

213. All are characteristics of genetic code ?

a) Overlapping

b) Nonambiguous

c) Universal

d) Degeneracy

Correct Answer - A
Ans. is 'a' i.e., Overlapping

- Characteristic of genetic codes

Genetic codes have following characteristics ?

1. Universal :- Each codon specifically codes for same amino acid in *all species, e.g.* UCA codes for serine and CCA codes for proline in all organisms. That means specificity of codon has been conserved from very early stages of evolution. Exception to the universality of genetic coder are found in human mitochondria, where the code : -

- UGA codes for tryptophan instead of serving as a stop codon.
- AUA codes for methionine instead of isoleucine?
- CUA codes for threonine instead of leucine.
- AGA and AGG serve as stop codon instead of coding for arginine.

2. Unambiguous/Specific :- A particular codon always codes for the same amino acid. For example CCU always codes for proline and UGG always codes for tryptophan.
3. Degeneracy/Redundancy :- A given amino acid may have more than one codon. For example, CCU, CCC, CCA and CCG all four codons code for proline. Therefore, there are 61 codons for 20 amino acids.
4. Stop or termination or nonsense codons:- Three of the 64 possible nucleotide triplets UAA(amber), UAG (Ochre) and UGA (opal) do not code for any amino acid. They are called nonsense

codons that normally signal termination of polypeptide chains. Thus, though there are 64 possible triplet codons, only 61 codes for 20 amino acids (as remaining three are non-sense codons).

5. Non overlapping and nonpuntate (Comma less) :- During translation, the code is read sequentially, without spacer bases, from a fixed starting point, as a continuous sequence of bases, taken 3 at a time, e.g. AUGCUA GACUUU is read as AUG/CUA/GAC/UUU without "ponctation" (coma) between codons.

214. Which of the following is an example of Trinucleotide repeat mutation ?

a) Huntington's chorea

b) Fragile-X-syndrome

c) Friedreich ataxia

d) All of the above

Correct Answer - D
Ans. is 'd' i.e., All of the above
Trinucleotide repeat mutation

- In this type of mutation a codon (i.e. trinucleotide sequence) undergoes amplification and the same codon is repeated continuously so many times in the chain.
- Diseases associated with trinucleotide repeat mutation are Huntington's disease (CAG repeat), Spinocerebellar ataxia (CAG repeat), friedreich ataxia (GAA repeat), fragile-X-syndrome (GGG or GCC repeat), dystrophia myotonica (CTG/CUG repeat), X-linked spinobulbar muscular atrophy (CAG repeat) and dentorubral pallidolusian atrophy (CAG repeat).

215. Which of the following is the major proteoglycan of synovial fluid ?

a) Chondroitin sulfate

b) Dermatan sulfate

c) Heparan sulfate

d) Hyaluronic acid

Correct Answer - D
Ans. is 'd' i.e., Hyaluronic acid

	Distribution
Hyaluronic acid	Synovial fluid (provides viscosity), vitreous humor, loose connective tissue)
Chondroitin sulfate	Cartilage, bone, tendon, ligament, cornea
Dermatan sulfate	Pliability of skin, and heart valves, wide distribution
Keratan sulfate	Horny structures like hair, nails, claws, horn, hoofs Also present in cornea
Heparin Heparan sulfate	Mast cells Skin fibroblast, aortic wall

216. The main function of Vitamin C in the body is

a) Coenzyme for energy metabolism

b) Regulation of lipid synthesis

c) Involvement as antioxidant

d) Inhibition of cell growth

Correct Answer - C

Ans. *is* 'c' i.e., Involvement as antioxidant

Vitamin C (Ascorbic acid)

- Ascorbic acid (Vitamin C) is also called antiscorbutic factor. It is very *heat labile,* especially in basic medium.
- Ascorbic acid itself is an active form. Maximum amount of vitamin C is found in adrenal cortex.
- Ascorbic acid functions as a reducing agent and scavanger of free radicals (antioxidant). Its major functions are:-
- In collagen synthesis :- Vitamin C is required for post-translational modification by hydroxylation of proline and lysine residues converting them into hydroxyproline and hydroxylysine. Thus vitamin C is essential for the conversion of procollagen to collagen, which is rich in hydroxyproline and hydroxylysine. Through collagen synthesis, it plays a role in formation of matrix of bone, cartilage, dentine and connective tissue.

.. Synthesis of norepinephrine from dopamine by dopamine-(3-monoxygenase (dopamine-f3-hydroxylase) requires Vitamin C.

2. Carnitine synthesis

3. Bile acid synthesis :- 7-ct-hydroxylase requires vitamin C.

4. Absorption of iron is stimulated by ascorbic acid by conversion of ferric to ferrous ions.

5. During adrenal steroid synthesis, ascorbic acid is required during hydroxylation reactions.
6. Tyrosine metabolism : - Oxidation of P-hydroxy-phenylpyruvate to homogentisate.
7. Folate metabolism : - Folic acid is converted to its active form tetrahydrofolate by help of Vitamin C.

217. Enzyme specificity is given by ?

a) K_m

b) Vrm„

c) Both

d) None

Correct Answer - A
Ans. is 'a' i.e., Km.

- *T*he K_m of an enzyme is the concentration of the substrate that enables the enzyme to function at half maximum activity and is therefore a measure of the specificity of a substrate for the enzyme" Clinical biochemistry
- Actually enzyme specificity is not measured by K_m alone.
- It is measured by the ratio K_{cat}/K_m which is a second order rate constant for the reaction between substrate and free enzyme.
- This ratio is important, for it provides a direct measure of enzyme efficiency and specificity.
- Note : ^{K}cat is turnover number and measures the rate of the catalytic process.

218. Natural uncoupler is ?

a) Thermogonin

b) 2, 4 nitrophenol

c) 2, 4 Dinitrophenol

d) Oligomycin

Correct Answer - A
Ans. is 'a' i.e., Thermogenin
Amongst the given options, a, b and c are uncouplers.

- However, only thermogenin, among these three is a natural (physiological) uncoupler.
- Uncouples
- As the name suggests, these componds block the coupeling of oxidation with phosphorylation. These compounds allow the transfer of reducing equivalents in respiratory chain but prevent the phosphorylation of ADP to ATP° by uncoupling the linkage between ETC and phosphorylation. Thus the energy instead of being trapped by phosphorylation is dissipated as heat. Uncouplers may be :-
- Natural :- Thermogenin, thyroxine
- Synthetic :- *2, 4-dinitrophenol (2, 4-DNP), 2, 4-dinitrocresol (2, 4-D*NC), and CCCP (chlorocarbonylcyanidephenyl hydrazone).

219. Lipid with highest mobility is ?

a) HDL

b) LDL

c) VLDL

d) Chylomicrons

Correct Answer - A
Ans. is `a' i.e., HDL

- HDL :- Has maximum electrophoretic mobility, has maximum density, has minimum lipid content, has maximum protein (apoprotein) content, are smallest in size, has maximum phospholipid, has minimum triglycerides.
- Chylomicrons :- Have no electrophoretic mobility, have minimum density, have maximum lipid content, have minimum protein content, are largest in size, have minimum phospholipids, have maximum triglycerides.

220. Apolipoprotein E is rich in ?

a) Lysine

b) Arginine

c) Histidine

d) Methionine

Correct Answer - B
Ans. is 'b' i.e., Arginine

- Arginine rich apo-E is isolated from VLDL.
- It contains arginine to the extent of 10 per cent of the total amino acids and accounts for 5 to 10 per cent of total VLDL apoproteins in normal subjects.

221. Which energy molecule gives 10.5 kcal/ molecule?

a) ATP

b) GTP

c) Creatine phosphate

d) Glucose-6-phosphate

Correct Answer - C
Ans. is 'c' i.e., Creatine phosphate

- A compound that liberates 7 Kcal/mol or more on hydrolysis is called high energy compound, or a compound that on hydrolysis undergoes a large (7 kcal/mol) decrease in free energy (AG) under standard condition is called high energy compound, i.e.,
  AG 7 Kcal/mol.
- For example, ATP liberates 7.3 Kcal/mol on hydrolysis

Metabolite	**A G**	**Liberated energy in Kcallmole**
Phosphoenol pyruvate	-14.8	14.8
Carbamoyl phosphate	-12.3	12.3
1, 3-Bisphosphoglycerate	-11-8	11.8
Acid phosphate	-112	112
Creatine phosphate	-10.3	*10.3*
Arginine phosphate	-7.6	7.6
ATP to ADP + Pi	-7.3	7.3
ATP to AMP + PPi	-7-7	7.7
Glucose-1 -phosphate	-5.0	5.0
Glucose-6-phosphate	-3.3	3.3
Glycerol-l-phosphate	-2.2	2.2

222. Branching enzyme is found in ?

a) Glycogenesis

b) Glucogenesis

c) Glycogenolysis

d) Glycolysis

Correct Answer - A
Ans. is 'a' i.e., Glycogenesis

223. Which of the following is not a phospholipid ?

a) Lecithine

b) Plasmalogen

c) Cardiolipin

d) Ganglioside

Correct Answer - D
Ans. is 'd' i.e., Ganglioside
Phospholipids are :
1. Glycerophospholipids (glycerol containing) :- Phosphatidylcholine (lecithin), phosphatidylethanolamine (cephaline), phosphatidylserine, phosphatidylinositol, plasmalogens, lysophospholipids, cardiolipin.
2. Sphingophospholipids (sphingosine containing) :- Sphingomyeline

224. The mechanism by which mercury causes damage ?

a) Binds to -SH group of enzyme

b) Directly toxic

c) Inhibits ETC

d) Inhibits protein synthesis

Correct Answer - A
Ans. is 'a' i.e., Binds to -SH group of enzyme

- Heavy metal toxicity is caused by tight binding of a metal such as mercury (Hg), lead (Pb), aluminium (Al), or iron (Fe) to a functional group of enzyme.
- Mercury, for example, binds to reactive sulfhydryl groups (-SH) in the active site of so many enzymes, that it has been difficult to determine which of the inhibited enzyme is responsible for mercury toxicity.
- Lead also has high affinity for sulfhydryl group.

225. Q10 in enzyme matches with ?

a) 2

b) 4

c) 8

d) 10

Correct Answer - A
Ans. is 'a' i.e., 2

- Most enzyme show a 50-300% (average 200%) increase in reaction rate when the temperature is increased by 10°, and the ratio of rate constant at two temperatures 10° apart is usually between 1.5 to 4 (average 2) for most enzymes.
- This value is termed as Q10.
- "The rate of enzymatic reaction doubles with every 10° rise in temperature. "

226. Creatine is made up of all, except ?

a) Glycine

b) Alanine

c) Methionine

d) Arginine

Correct Answer - B
Ans. is 'b' i.e., Alanine

227. In urea cycle which defect is an X linkeddisease ?

a) Ornithine transcarbamylase

b) Aspartate transcarbamylase

c) Arginase

d) Argininosuccinate synthase

Correct Answer - A
Ans. is 'a' i.e., Ornithine transcarbamylase

228. True regarding collagen synthesis is all except ?

a) Synthesized in ribosomes as preprocollagen

b) Hydroxylation of proline occurs in Golgi apparatus

c) Hydroxylation of lysine occurs in ER

d) Triple helix assembly occurs in ER

Correct Answer - B
Ans. is 'b' i.e., Hydroxylation of proline occurs in Golgi apparatus

229. Type of collagen found in space of Disse in liver is -

a) Collagen I & II

b) Collagen III & IV

c) Collagen II &

d) Collagen II & V

Correct Answer - B
Ans. is 'b' i.e., Collagen III & IV

230. Which is predominant in normal healthyhuman ?

a) LDH 1

b) LDH2

c) LDH 3

d) LDH4

Correct Answer - B
Ans. is 'b' i.e., LDH2

Isoenzyme	Submit composition	Issue	Percentage in serrum
LDH I	HHHH	Myocardium, RBC	30
LDH2	HHHM	Myocardium, RBC	35
LDH3	HHMM	Brain, Kidney	20
LDH4	HMMM	Skeletal muscle, Liver	10
LDH 5	MMMM	Skeletal muscle, Liver	5

231. Physiological uncoupler is ?

a) Thyroxine

b) Free fatty acids

c) Thermogenin

d) All of the above

Correct Answer - D
Ans. is 'd' i.e., All of the above

232. Which of the following is Aldosugar ?

a) Fructose

b) Erythrulose

c) Glucose

d) None

Correct Answer - C
Ans. is `c' i.e., Glucose

Sugar	Number of carbon atoms	Aldoses (Aldosugars)	Ketoses (ketosugars)
Trioses	2	Glyceraldehyde	Dihydroxyacetone
Tetroses	4	Erythrose	Erythrulose
Pentoses	5	Ribose, Xylose	Ribulose, xylulose
Hexoses	6	Glucose, galactase, mannose	Fructose
Heptoses	7	Glucoheptose	Sedoheptulose

233. Key enzyme of gluconeogenesis are all except?

a) Pyruvate carboxylase

b) PEP carboxykinase

c) Pyruvate kinase

d) Glucose-6-phosphatase

Correct Answer - C
Ans. is 'c' i.e., Pyruvate kinase

- Mitochondrial pyruvate carboxylase catalyzes the carboxylation of Pyruvate to Oxaloacetate, It is an ATP-requiring reaction, Biotin is the coenzyme.
- Phosphoenolpyruvate Carboxykinase: Catalyzes the decarboxylation and phosphorylation of oxaloacetate to phosphoenolpyruvate(PEPCK) (Cytosol) using GTP as the phosphate donor.
- The conversion of glucose-6-phosphate to glucose is catalyzed by glucose 6-phosphatase

234. Fructose intolerance is due to deficiency of ?

a) Aldolase B

b) Fructokinas

c) Triokinas

d) Aldolase A

Correct Answer - A
Ans. is 'a' i.e., Aldolase B

Disease	**Dificient enzymes**
Essential fructosuria	Fructokinase
Hereditary fructose intolerance	Aldolase-B
Galactosemia	Galactose-l-phosphate uridyl transferase (most common), Galactokinase UDP-galactose-4-epimerase
Lactose intolerance	Lactase ((3-galactosidase)
Essential pentosuria (xylulose reductase)	L-xylulose dehydrogenase

235. What is essential for transfer of fatty acid across mitochondrial membrane -

a) Creatine

b) Creatinine

c) Carnitine

d) None

Correct Answer - C
Ans. is 'c' i.e., Carnitine

236. Hexokinase is ?

a) Ligase

b) Transferase

c) Oxidoreductase

d) Reductase

Correct Answer - B
Ans. is `b' i.e., Transferase

237. Ketone body formation without glycosuria is seen in ?

a) Diabetes mellitus

b) Diabetes insipidus

c) Starvation

d) Obesity

Correct Answer - C
Ans. is 'c' i.e., Starvation
Amongst the given options, DM and starvation are the causes of ketosis
1. Diabetes :- Ketosis with hyperglycemia and glycosuria
2. Prolonged starvation :- Ketosis with low or normal glucose and without glycosuria.

- In diabetic Ketoacidosis:- (i) Positive Rothera's test (due to ketone bodies) (ii) Positive Benedict's test (due to presence of reducing sugar in urine)
- In Starvation ketosis:- (i) Postive Rothera's test (due to ketone bodies), (ii) Negative Benedict's test (no sugar in urine)

238. Amino acid with double chiral is ?

a) Phenyalanine

b) Threonine

c) Tryptophane

d) Tyrosine

Correct Answer - B
Ans. *is* 'b' i.e., Threonine

239. At physiological pH DNA is ?

a) Acidic

b) Negatively charged

c) Amphipathic

d) All of the above

Correct Answer - D
Ans. is 'd' i.e., All of the above
DNA *is* amphipathic

- Amphipathic molecule is one which contains both *polar (hydrophilic)* and *nonpolar (hydrophobic)* regions in its structure, i.e. the part of molecule is water soluble and part is water insoluble.
- In DNA helix
- Hydrophilic (polar) deoxyribose-phosphate of each chain is on outside of molecule.
- Hydrophobic (nonpolar) bases are stacked in.
- Thus DNA is regarded as amphipathic in nature.

DNA is negatively charged and acidic

- Phosphate group lies on outside of molecule of DNA.
- Each phosphate group has a negative charge at physiological pH, making DNA a *negatively charge (anion)* at physilogical pH.
- "Histones are strongly cationic and can bind non-specifically to strongly aniomic DNA" Harper "At physiological pH DNA is negatively charged, and is associated with positively charged (basic) histones" Ronald Hofmann. o Anionic molecules are acidic in nature.

240. Source of ammonia in urine ?

a) Glutaminase

b) Urease

c) Glutamate dehydrogenase

d) Arginase

Correct Answer - A

Ans. is 'a' i.e., Glutaminase

- In many tissues like *liver, kidney and brain,* ammonia combines with glutamate to yield glutamine, by the action of glutamine synthase. The brain is a rich source of glutamine synthase and it predominantly detoxifies ammonia by this route.

ATP ADP+Pi
Glutamate + NH, 4 Glutamine
Glutamine synthetase

- Glutamine is a nontoxic major transport form of ammonia. The glutamine is transported by blood to liver where deamination (removal of amino group) of glutamine takes place. Glutaminase cleaves glutamine to yield glutamate and free ammonia (ammonium ion). The ammonia is converted by liver to urea.

0 H2
Glutamine _____ Glutamate + NH,
Glutaminase

- Formation and secretion ammonia by renal tubular cells maintain acid base balance. Ammonia is formed from glutamine by glutaminase. Excretion of ammonia increases in metabolic acidosis and decreases in metabolic alkalosis.

241. Albumin binds with all except ?

a) Steroid

b) Calcium

c) FFA

d) Thyroxine

Correct Answer - D

Ans. is ' d' i.e., Thyroxine

- Albumin is involved in transport of several substances because of its predominantly polar nature.
- Nearly 40% of plasma calcium is bound-up with albumin.
- Other substances which are Bound-up and/or tranported by albumin are :?

1. Free fatty acids
2. Bilirubin
3. Steroids
4. Many nonpolar drugs

Coming back to question

- Thyroxine also binds to albumin, but it is not the major transport protein for thyroxin. Most of the thyroxine is transported by globulin.
- Thyroxine binding plasma proteins are :-

1. Thyroxine binding globulin Major thyroid hormone binding protein
2. Thyroxine binding albumin
3. Thyroxine binding pre-albumin

- Thus, among the given options, thyroxine is the best answer.

242. Chemical process involved in conversion of progesterone to glucocorticoids is

a) Methylation

b) Hydroxylation

c) Carboxylation

d) None

Correct Answer - B
Ans. is `b' i.e., Hydroxylation

243. Gluconeogenesis occurs in all except ?

a) Liver

b) Kidney

c) Gut

d) Muscle

Correct Answer - D
Ans. is 'd' i.e., Muscle

- Gluconeogenesis occurs mainly in the liver and to a lesser extent in renal cortex.
- Some gluconeogenesis can also occur in small intestine, but it is not significant.
- Some of the reactions of gluconeogenesis occurs in the mitochondria but most occur in cytosol.
- Gluconeogenesis cannot occur in muscles.
- Glucose-6-phosphatase is absent in muscles therefore, glucose-6-phosphate cannot be degraded to free glucose in muscles. Moreover, glucose-6-phosphate cannot diffuse out of the muscles. Therefore, muscle cannot provide glucose to maintain blood glucose level. Rather, muscle glycogen acts as a source of energy; the glucose-6phosphate enters the glycolysis to produce energy.

244. GLUT 2 receptors ?

a) Insulin dependent

b) Insulin independent

c) Found in cardiac muscle

d) Found in brain

Correct Answer - B
Ans. is 'b' i.e., Insulin independent

- GLUT - 2 is insulin independent (insulin dependent GLUT is GLUT-4).
- It is found in B-cells of islets of pancreas, liver, epithelial cells of small intestine and kidney.
- Also see explanation-4 of session-2.

245. Which of the following has antioxidant property?

a) Selenium

b) Copper

c) Zinc

d) All

Correct Answer - D

Ans. is 'd' i.e., All

- The activity of the antioxidant enzymes depends on supply of minerals :?
1. Manganese
2. Copper
3. Zinc
4. Selenium
- Manganese, copper and zinc are required for the activity of superoxide dismutase.
- Selenium is required for the activity of glutathione peroxidase.

246. The number of ATPs generated in krebs cycleare ?

a) 12

b) 24

c) 15

d) 30

Correct Answer - B
Ans. is 'b' > b' i.e., 24

- One turn of the TCA cycle, starting with acetyl CoA produces 10 ATPs. When the starting molecule is pyruvate, the oxidative decarboxylation of pyruvate, the oxidative decarboxylation of pyruvate yields 2.5 ATPs and therefore, 12.5 ATPs are produced when starting compound is pyruvate. Since, two molecules of pyruvate enter the TCA cycle when glucose is metabolized (glycolysis produces 2 molecules of pyruvate), the number of ATPs is doubled. Therefore, 25 ATP molecules, per glucose molecule, are produced when pyruvate enters the TCA cycle.
- Note : Previously calculations were made assuming that NADH produces 3 ATPs and FADH generates 2 ATPs. This will amount a net generation of 30 ATP molecules in TCA per molecule glucose and total 38 molecules from starting. Recent experiments show that these values are overestimates and NADH produces 2.5 ATPs and FADH produces 1.5 ATPs. Therefore, net generation during TCA is 25 ATPs and complete oxidation of glucose through glycolysis plus citric acid cycle yield a net 32 ATPs.
- Energy yield (number of ATP generated) per molecule of glucose when it is completely oxidized through glycolysis plus citric acid cycle, under aerobic conditions, is as follows :-

Pathway	Step	Enzyme	Method of ATP formation	No of ATPs gained perglucose (new calculation)	No of ATPs As per ol calculatio
Glycolysis	1	Hexokinase		Minus	Minus
Do	3	Phosphofructokinase		Minus	Minus
Do	5	Glyceraldehyde-3-p DH	NADH Respiratory chain	2.5 x 2 = 5	3 x 2 = 6
Do	6	1,3-BPGkinase ATP	Substrate level	1 x 2 -- 2	1 x 2 = 2
Do	9	Pyruvate kinase	ATP Substrate level	1 x 2 = 2	1 x 2 = 2
Pyruvate to Acetyl CoA	?	Pyruvate Dehydrogenase	NADH Respiratory chain	2.5^{x2}= 5	3x2= 6
TCA cycle	3	Isocitrate DH	NADH Respiratory chain	2.5x2= 5	3 x 2= 6
Do	4	Alpha keto glutarate DH	NADH Respiratory chain	$2.5^{x}2$= 5	3x2= 6
Do	5	Succinate thiokinase	GTP Substrate level	1 x 2 = 2	1 x 2 = 2
Do	6	Succicinate DHFADH2	Respiratory chain	1.5x2= 3	2 x 2= 4
Do	8	Malate DH	NADH Respiratory chain	$2.5^{x}2$= 5	3 x 2=
Net generation in glycolytic pathway				9 minus 2= 7	10

minus 2= 8		
Generation in pyruvate dehydrogenase reaction	5	• 6
Generation in citric acid cycle	20	• 24
Net generation of ATP from one glucose mole	32	• 38

247. One Krebs cycle generates how many ATP ?

a) 6

b) 12

c) 24

d) 36

Correct Answer - B
Ans. is 'b' i.e., 12

- This question is slightly different from previous one. Here the examiner is asking about the generaion of ATPs per TCA cycle.
- In a single TCA cycle 10 molecules of ATP are produced (12 molecules according to older calculations).

248. Glutathione requires which vitamin to act as antioxidant ?

a) Vitamin E

b) Niacin

c) Vitamin C

d) Vitamin A

Correct Answer - B
Ans. is 'b' i.e., Niacin

249. Metabolic change seen in starvation are all except?

a) Increased gluconeogenesis

b) Increased glycolysis

c) Ketogenesis

d) Protien degradation

Correct Answer - B
Ans. is 'b' i.e., Increased glycolysis

250. Catecholamines are synthesized from ?

a) Tryptophan

b) Tyrosine

c) Methionine

d) Histidine

Correct Answer - B
Ans. is 'b' i.e., Tyrosine

- Catecholamines (epinephrine, norepinephrine and dopamine) are synthesized from tyrosin.
- Has been explained in previous seesions.

251.

Which of the enzyme of glycolysis is a part ofgluconeogenesis ?

a) Pyruvate kinase

b) PFK

c) Hexokinase

d) Phosphoglycerate kinase

Correct Answer - D
Ans. is 'd' i.e., Phosphoglycerate kinase

- Seven of the reactions of glycolysis are reversible and are used in the synthesis of glucose by gluconeogenesis. Thus, seven enzymes are common to both glycolysis and gluconeogenesis: (i) Phosphohexose isomerase; (ii) Aldolase; (iii) Phosphotriose isomerase, (iv) Glyceraldehyde 3-phosphate dehydrogenase; (v) Phosphoglycerate kinase; (vi) Phosphoglycerate mutase; (vii) Enolase.
- Three reactions of glycolysis are irreversible which are circumvented in gluconeogenesis by four reactions. So, enzymes at these steps are different in glycolysis and gluconeogenesis.

Reactions	Enzyme in glycolysis	Enzyme in gluconeogenesis
Glucose – Glucose-6-P	Hexokinase/glucokinase	Glucose-6-phosphatase
Fructose-6-P – Fructose- I ,6-BP	Phosphofructokinase	Fructose-1-6-bisphosphatase
Phosphoenolpyruvate – Pyruvate	Pyruvate kinase	Pyruvate carboxylase PEP carboxykinase

252. Molecular interaction, found in the structure ofDNA -

a) Hydrogen bond

b) Glycosidic bond

c) Covalent interactions

d) All of the above

Correct Answer - D
Ans. is'd' i.e., All of the above

253. Pyridoxine is used in treatment of ?

a) Galactosemia

b) Phenylketonuria

c) Propionic acidemia

d) Homocystinuria

Correct Answer - D
Ans. is 'd' i.e., Homocystinuria

Inborn error of metabolism and Treatment

Alkaptonuria	Vitamin C, Folic acid
Homocystinuria	Pyridoxine + Folic acid
Cystinuria	Alkalization of urine + d-Penicillamine, Captopril
Hartnup disease	Nicotinamide
Multiple carboxylase eficiency	Biotin
Methyl malonic academia	Vitamin B 12
Hyperoxaluria	Pyridoxine
Tyrosinemia	NTBC, Liver Transplantation

254. Membrane proteins are synthesized in ?

a) Free ribosome

b) Bound ribosome

c) Nucleolus

d) Mitochondria

Correct Answer - B
Ans. is 'b' i.e., Bound ribosome

Ribosomes

- Ribosomes are the actual sites of protein synthesis[Q]. The ribosomes are small granules of RNAs. Ribosomes are usually occur in clusters called polyribosomes attached to one mRNA molecule, an arrangement that increases the rate of polypeptide synthesis. There are two types of polyribosomes : -

1. Free (cytosolic) : - Present free in cytosol.
2. Bound polyribosome : - Present on rough ER.

- Both types can synthesize protein : ?

Proteins synthesized by polyribosomes

Cytosolic (free) Polyribosomes	Bound (rough ER) Polyribosomes
Cytosolic proteins, e.g., Hemoglobin	Synthesize all membrane proteins
Cytoskeletal proteins	Mitochondria] membrane
Mitochondrial proteins	ER membrane
Nuclear proteins	Golgi apparatus membrane u Plasma membrane
Peroxisomal protein	Secretory proteins
	Lysosomal enzym

255. Transmination of Aspartate forms ?

a) Pyruvate

b) Acetly-CoA

c) Oxaloacetate

d) Alanine

Correct Answer - C
Ans. is 'c' i.e., Oxaloacetate
Transamination

- Transamination involves the reversible transfer of a-amino group of a-amino acid to an a-keto acid(' to form a new amino acid and a new keto acid. The enzyme catalyze the reaction is called aminotransferase (transaminase). Most transaminases use *a-ketoglutarate (a-keto acid)* as a common acceptor of a-amino group of a-amino acids. All transaminases require pyridoxal phosphate (Vitamin B_6) as a coenzymne^{Q}. Some of the most important transaminases are : -
- Alanine transaminase (ALT) also called glutamate pyruvate transaminase (GPT) : - It catalyzes the transfer of amino group of alanine to a-ketoglutarate resulting in formation of pyruvate and L-glutamate Q.
  ALT
  L-Alanine ^{Q}+ a-ketoglutarate ^{Q} —— Pyruvate ^{Q} + L-glutamate Q PLP
- Aspartate transaminase (AST) also called glutamate oxaloacetate transaminase (GOT) : It catalyzes the transfer of amino group of aspartate to a-ketoglutarate resulting in formation of oxaloacetate and L-glutamate.
  AST
  L-Aspartate + a-ketoglutarate Oxaloacetate + L-glutamate PLP

- Most amino acids undergo transamination reaction except lysine, threonine, proline and hydroxyproline.
- All the amino groups from amino acids that undergo transamination are collected into one common amino acid, i.e., glutamate. This is important because L-glutamate is the only amino acid that undergoes oxidative deamination at an appreciable rate in mammalian tissue. Thus, formation of ammonia from amino acids occurs mainly via the **a-**amino nitrogen of glutamate. Transamination is not restricted to a-amino groups. The 6-amino group of ornithine (but not the E-amino group of lysine) undergoes transmination.

256. Interaction involved in primary structure of protein ?

a) Hydrogen bond

b) Disulfide bond

c) Peptide bond

d) Electrostatic bond

Correct Answer - C
Ans. is `c' i.e., Peptide bond

257. All are true about vitamin E except ?

a) Act as antioxidant

b) Prevent lipid peroxidation of cell membrane

c) Water soluble vitamin

d) Chemically tocopheral

Correct Answer - C
Ans. is 'c' i.e., Water soluble vitamin

- Vitamin E is a fat soluble vitamin (not water soluble).
- All other options are correct.

258. Blood form of folic acid is -

a) Folinic acid

b) Pteroglutamate

c) Methyl THE

d) None

Correct Answer - C
Ans. is 'c' i.e., Methyl THE

- Folic acid is absorbed in the jejunum.
- Following absorption, folic acid is transported in blood by two (3-globulins.
- The major circulating form is methyltetrahydrofolate and the normal concentration range is 5-15 ng/ml.
- Once it arrives in the liver, the methyl derivates are taken up by hepatocytes where various coenzyme are produced. o Folic acid is not stored in the body.

Remembers

- Major circulating form of folic acid —0 methyl THE
- Major point of entery for 1 carbon transfer by substitued folate -4 methylene THE

259. Primary hypercholesterolemia is ?

a) Type I

b) Type Ha

c) Type IIb

d) Type III

Correct Answer - B
Ans. is 'b' i.e., Type Ha

260. Salvage purine synthesis refers to ?

a) Synthesis of purine from ribose-5-phosphate

b) Synthesis of purine from pyrimidine

c) Synthesis of purine nucleotides from purine bases

d) None of the above

Correct Answer - C

Ans. is 'c' i.e., Synthesis of purine nucleotides from purine bases

- Two important purine nucleotides are synthesized : (i) adenosine monophosphate (AMP) and (ii) guanosine monophosphate (GMP). Then AMP and GMP are converted to other purine nucleotides like ADP, ATP, GDP, GTP etc. Purine nucleotides can be synthesized by two pathways - (1) De novo synthesis and (2) Salvage pathway.

De novo pathway (De novo synthesis)

- In de novo pathway, the purine nucleotides are synthesized from amphibolic intermediates. Amphibolic intermediates are the intermediary metabolites of amphibolic pathways (eg. citric acid cycle) which have dual purposes, i e. they serve in catabolism as well as in anabolism.
- In de novo synthesis, purine ring is formed from variety of precursors is assembled on ribose-5-phosphate. Precursors for de novo synthesis are ?

1. Glycine provides Ca, C5 and N7
2. Aspartate provides N,
3. Glutamine provides N3 and N9
4. Tetrahydrofolate derivatives furnish C_2 and C8
5. Carbon dioxide provides Co

Salvage pathway of purine nucleotide synthesis

- Free purine bases (adenine, guanine and hypoxanthine) and purine

nucleosides are formed in cells during the metabolic degradation of nucleic acids and nucleotides.

- These free purine bases and purine nucleosides are reused in the formation of purine nucleotides.
- This is called salvage pathway (salvage means property saved from loss).
- *Salvage synthesis requires far less energy than de novo synthesis.*

261. RNA which contains codon for speicific amino acid ?

a) tRNA

b) rRNA

c) mRNA

d) None

Correct Answer - C
Ans. is 'c' i.e., m RNA
The m RNA carries genetic information in the form of codons.

- Codons are a group of three adjacent nucleotides that code for the amino acids of protein.
- Each mRNA molecule is a transcript of antisense or template strand of a particular gene.
- Its nucleotide sequence is complementary to that of antisense or template strand of the gene, i.e. adenine for thyamine, guanine for cytosine, uracil for adenine (as RNA does not contain thymine) and cytosine for guanine.
- For example, if antisense strand of DNA has a gene with sequence 5'-TTACGTAC-3', its complementary RNA transcript will be 5 '-GUACGUAA-3'.

262. Glycine is required in formation of all except ?

a) Heme

b) Purines

c) Glutathione

d) Thyroxine

Correct Answer - D
Ans. is 'd' i.e., Thyroxine
Glycine

- lycine is a nonessential amino acid which is *synthesized from serine.* Glycine is metabolized by following three pathways -
- It can be converted to serine, a reaction that require tetrahydrofolate (derivative of folic acid and pyridoxal phosphate as coenzyme. Further serine is metabolized by serine dehydratase into pyruvate and NH 4+.
- The major pathway of glycine degradation is oxidative cleavage into CO, and NH: by *glycine cleavage complex* of liver. H_4 folate is required which is converted to N^5, N^{10}-methylene H_4 folate. Thus folic acid is required for glycine metabolism.
- Glycine may be oxidatively deaminated by *glycine oxidase* to glyoxylic acid.
- Glycine is necessary for the formation of following products:- Heme, purine ring, bile acids conjugation (formation of glycocholic acid, and glyco-chenodeoxycholic acid), creatine, glutathione, glucose (by gluconeogenesis).

263. True about glycolysis are all except ?

a) Provide nutrition to cancer cells

b) Substrate level phosphorylation at pyruvate kinase

c) Two carbon end product is formed

d) NADPH is formed by glyceraldhyde-3-phosphate dehydrogenase

Correct Answer - C

Ans. is 'c' i.e., Two carbon end product is formed

Important facts about glycolysis

- An important biochemical significance is the ability of glycolysis to provide ATP in the absence of oxygen (anerobic glycolysis) and allows tissues to survive anoxic episodes.
- It occurs in cytosol
- 3 Carbon atoms end product (pyruvate or lactate) is produced.
- Irreversible steps are catalyzed by : - Glucokinase/Hexokinase, phosphofructohnase-I, and pyruvate kinase.
- Reversible steps are catalyzed by : - Phosphohexose isomerase, aldolase, phosphotriose isomerase, glyceraldehyde 3-phosphate dehydrogenase, Phosphoglycerate kinase, Phosphoglycerate mutase, Enolase.
- Energy (ATP) using steps are catalyzee by : - Hexokinase/glucokinase, phosphofurctokinase.
- Energy (ATP) production at substrate level are catalyzed by : Phosphoglycerate kinase, Pyruvate kinase.
- Reducing equivalent (NADH) production is catalyzed by : Glyceraldehyde 3-phosphate dehydrogenase.
- Cancer cells derive nutrition from glycolysis as they have lack of 02 supply because of lack of capillary network. Glycolysis (anaerobic

glycolysis) is the only metabolic pathway in the body which can provide energy by glucose metabolism in anerobic conditions.

264. Instant energy to muscle is provided by which pathway?

a) HMP shunt

b) Embden mayerhoff pathway

c) Cori cycle

d) TCA cycle

Correct Answer - B
Ans. is ' b' i.e., Embden mayerhoff pathway

- ATP and creatine phosphate provide immediate energy..
- Anaerobic glycolysis (EMP) provides early energy.

265. Which steroid is formed from cholesterol without hydroxylation ?

a) Progesterone

b) Glucocorticoid

c) Mineralocorticoid

d) Estradiol

Correct Answer - A
Ans. is 'a' i.e., Progesterone

- Progesterone is formed before hydroxylation step.

266. Not obtained from plant source ?

a) Cobalamine

b) Riboflavin

c) Thiamine

d) Vitamin A

Correct Answer - A
Ans. is 'a' i.e., Cobalamine

- Vitamin B12 (cobalamin or cynocobalmin) is present only in food of animal origin.
- Other three vitamins can be taken from plant source.

267. Pseudouridine found in?

a) DNA

b) rRNA

c) mRNA

d) tRNA

Correct Answer - D
Ans. is 'd' i.e., tRNA

- Modified bases found in tRNA are -

1. Dihydrouridine **(D)** in which one of the double bonds of the base is reduced.
2. Ribothymidine (T) in which methyl group is added to uracil to form thymine. Thus, tRNA is the only RNA that can contain thymine though only some times.
3. Pseudouridine (yr) in which uracil is attached to ribose by a carbon-carbon bond rather than a nitrogen bond.

268. Fatty acids used by all except ?

a) Liver

b) Muscle

c) Brain

d) Kidney

Correct Answer - C
Ans. is `c' i.e., Brain

- There is no stored fuel in brain, but it utilized 60% of total energy under resting conditions.
- Glucose is virtually the sole fuel for the brain, except in prolonged starving when ketone bodies are the major source.
- Fatty acids do not serve as fuel for the brain, because they are bound to albumin in plasma; hence cannot cross blood-brain barrier.

269. Vitamin not required in TCA cycle ?

a) Niacin

b) Riboflavin

c) Thiamine

d) Folic acid

Correct Answer - D

Ans. is 'd' i.e., Folic acid

- Four of the B vitamins are essential in the citric acid cycle :

1. Riboflavin, in the form of flavin adenine dinucleotide (FAD), a cofactor for succinate dehydrogenase.
2. Niacin, in the form of nicotinamide adenine dinucleotide (NAD) the electron acceptor for isocitrate dehydrogenase, a-ketoglutarate dehydrogenase, and malate dehydrogenase.
3. Thiamine (vitamin B_1), as thiamine diphosphate, the coenzyme for decarboxylation in a-ketoglutarate dehydrogenase reaction.
4. Pantothenic acid, as part of coenzyme A, the cofactor attached to "active" carboxylic acid residues such as acetyl-CoA and succinyl CoA.

270. Uric acid is formed by ?

a) Catabolism of proteins

b) Catabolism of ketones

c) Catabolism of purines

d) Catabolism fo pyrimidines

Correct Answer - C
Ans. is 'c' i.e., Catabolism of purines

271. Anaerobic glycolysis occurs in all places except

a) Muscles

b) RBCs

c) Brain

d) Kidney

Correct Answer - C
Ans. is 'c' i.e., Brain
There are two types of glycolysis : -
1. Aerobic glycolysis : - It occurs when oxygen is plentiful and the final product is pyruvate, i.e., final step is catalyzed by pyruvate kinase (see the cycle above). Which is later converted to acetyl CoA by oxidative decarboxylation. There is net gain of 7 ATPs. Acetyl CoA enters TCA cycle.
2. Anaerobic glycolysis : - It occurs in the absence of oxygen. The pyruvate is fermented (reduced) to lactate in single stage. The reoxidation of NADH (formed in the glyceraldehyde-3-phosphate dehydrogenase step) by respiratory chain is prevented as same NADH is utilized at lactate dehydrogenase step. So, there is no net production of NADH. Thus, there is net gain of 2 ATP only. Unlike pyruvate which is converted to acetyl CoA to enter into krebs cycle, lactate cannot be further utilized by further metabolic pathways. Thus, lactate can be regareded as dead end in glycolysis. Anaerobic glycolysis occurs in exercising skeletal muscle, RBCs, lens, some region of retina, renal medulla, testis and leucocytes.

272. Sweaty feet odor in urine is seen in ?

a) Phenylketonuria

b) Maple syrup urine

c) Isovaleric acidemia

d) Alkaptonuria

Correct Answer - C
Ans. is 'c' i.e., Isovaleric acidemia

- "Sweaty Feet" odour is seen in isovaleric acidemia & glutaric aciduria
- "Mousy or Musty Odour" of skin, hair and urine is seen in PKU.
- Burnt sugar like odour is seen in MSU disease (Branched chain ketonuria).
- Boiled cabbage like urinary odour is seen in - Tyrosinemia & hypermethioninemia.
- Swimming pool urine odour is seen in - Hawkinsinuria

273. Ketone bodies are not used by ?

a) Muscle

b) Brain

c) RBC

d) Renal cortex

Correct Answer - C
Ans. is 'c' i.e., RBC

- Only glucose is the sole fuel for RBCs.
- As RBCs have no mitochondria, they oxidize glucose anaerobically to lactate.
- Liver also cannot use ketone bodies because of lack of succinyl-CoA-acetoacetate-CoA transferase, which is required for activation of ketone bodies.

274. Which collagen produces sheets ?

a) I

b) II

c) IV

d) VI

Correct Answer - C
Ans. is 'c' i.e., IV

- Various structure produced by collagens

Fibrils	Sheets	Beaded filaments	Anchoring fibrils
Collagen I	Collagen IV	Collagen VI	Collagen VII
Collagen II	Collagen VIII		
Collagen III	Collagen X		
Collagen V			
Collagen XI			

275. The energy for glycogenesis is provided by -

a) GTP

b) GDP

c) UTP

d) AMP

Correct Answer - C
Ans. is 'c' i.e., UTP

276. The function of vitamin K largely depends on which mineral ?

a) Selenium

b) Calcium

c) Iron

d) Magnesium

Correct Answer - B
Ans. is 'b' i.e., Calcium

- Vitamin K plays an important role in blood coagulation for it is required for the post-translational processing of several clotting factors (factor II, VII, IX and X).
- Maturation of these clotting factors requires the conversion of glutamyl residues of precursor proteins into 'ycarboxyglutamate (Gla) residues by addition of carboxylate group. This carboxylation of glutamyl resdiue is vitamin K dependent.
- The y-carboxyglutamate (Gla) residues so formed serve as binding site for calcium ions. Each Gla contains two negative charges which chelate the positive calcium ion.
- After binding to Gla residue on activated clotting factor, calcium binds with negatively charged phospholipids present on the platelet cell membrane.
- In this way, bridging of the phospholipids the Gla residue of prothromin occurs via calcium ion.

277. Amino acid with aliphatic side chain is?

a) Serine

b) Leucine

c) Threonine

d) Aspartate

Correct Answer - B

Ans. 'B' Leucine

Based on the chemical structure of side chain, amino acids are classified into *?*

- Aliphatic amino acids:- Alanine, glycine, isoleucine, leucine, valine.
- Hydroxy amino acids:- serine, threonine, tyrosine.
- Sulfur-containing amino acids:- Cysteine, methionine.
- Dicarboxylic amino acids:- Aspartic acid (aspartate), glutamic acid (glutamate).
- Amide containing amino acids:- Glutamine, aspargine (these are amides of dicarboxylic amino acids. Glutamine is an amide of glutamic acid and aspargine is an amide of aspartic acid).
- Aromatic amino acids:- Phenylalanine, tyrosine, tryptophan.
- Imino acids or heterocyclic amino acids:- One of the 20 amino acids, proline is an imino (-NH) acid not an amino (-NH) acid, as are other 19.

278. According to IUB system, hydrolases belong to which class ?

a) EC-1

b) EC-2

c) EC-3

d) EC-4

Correct Answer - C
Ans. is 'c' i.e., EC-3

IUB classification

Enzyme code number (EC number)	Enzyme
EC-1	Oxidoreductase
EC-2	Transferase
EC-3	Hydrolases
EC-4	Lyases
EC-5	Isomerases
EC-6	Ligases

279. Which of the following is serine protease ?

a) Pepsin

b) Trypsin

c) Carboxypeptidase

d) None

Correct Answer - B
Ans. is 'b' i.e., Trypsin

280. Reducing equivalants produced in glycolysis are transported from cytosol to mitochondria by ?

a) Carnitine

b) Creatine

c) Malate shuttle

d) Glutamate shuttle

Correct Answer - C
Ans. is 'c' i.e., Malate shuttle

- Most of the NADH and FADH2, entering the mitochondrial electron transport chain arise from citric acid cycle and 13-oxidation of fatty acids, located in the mitochondria itself.
- However, NADH is also produced in the cytosol during glycolysis.
- To get oxidized, NADH has to be transported into the mitochondria as respiratory chain (ETC) is located inside the mitochondria.
- Since, the inner mitochondrial membrane is not permeable to cytoplasmic NADH, there are special shuttle systems which carry reducing equivalents from cytosolic NADH (rather than NADH itself) into the mitochondria by an indirect route.
- Two such shuttle systems that can lead to transport of reducing equivalent from the cytoplasm into mitochondria are : -

1. Malate shuttle (malate-aspartate shuttle system).
2. Glycerophosphate shuttle.

281. HMP shunt occurs in all organs except ?

a) Liver

b) Adipose tissue

c) RBC

d) Brain

Correct Answer - D
Ans. is 'd' i.e., Brain

- HMP is an alternative route for the oxidation of glucose (beside glycolysis).
- It is also called as *"pentose phosphate pathway", "Dickens - Horecker pathway", "Shunt pathway"* or *"phosphogluconate oxidative pathway".*
- HMP shunt is required for provision of reduced NADPH and fiver-carbon sugars (Pentose phosphates) for nucleic acid synthesis.
- *Normally, 90% of glucose is oxidized by glycolysis and 10% is oxidized by HMP shunt.*
- However, in liver and RBCs HMP shunt accounts for oxidation of 30% glucose.
- HMP shunt occurs in the cytosol.
- It is highly active in *liver,* adipose tissue, *adrenal cortex, lens, cornea, lactating (but not the nonlactating) mammag gland, Gonads* (testis, *ovary) and erythrocytes.*
- Activity of this pathway is minimal in muscle and brain, where almost all of the glucose is degraded by glycolysis.

282. Fastest acting enzyme ?

a) LDH

b) Trypsin

c) Catalase

d) None

Correct Answer - C
Ans. is 'c' i.e., Catalase
Measurement of enzyme activity

- The activity of enzyme is measured in terms of the following :
- Unit of enzyme activity : - By international agreement, *one unit enzyme activity is defined as* the amount causing transformation of 1.0 micro mole of substrate per minute at 25° C. It is usually expressed as *mole of substrate disappeared or mole of product formed per minute.*
- Specific activity : - It refers to the number of enzyme units per milligram of protein. It is a measure of enzyme purity; higher the enzyme purity, more is the specific activity.
- Turn over number : - This refers to the *number of substrate molecules transformed per unit time by a single enzyme molecule (or by a single catalytic site),* when the enzyme concentration alone is rate-limiting factor. *Catalase has the highest turnover number and hence is the fastest active enzyme. Carbonic anydrase has the 2" fastest turnover number; therefore, it is 2nd fastest active enzyme (after catalase).* Lysozyme has the lowest turnover number and therefore is slowest acting.

283. Inhibition of glycolysis by increased supply of 02 is called ?

a) Crabtree effect

b) Pasteur effect

c) Lewis effect

d) None

Correct Answer - B
Ans. is 'b' i.e., Pasteur effect
Pasteur effect

- It has been observed that under anaerobic condition a tissue or microorganism utilizes more glucose than it does under aerobic conditions.
- It reflects inhibition of glycolysis by oxygen and is called pasteure effect.
- The Pasteur effect is due to inhibition of the enzyme phosphofructokinase because of inhibitory effect caused by citrate and ATP, the compounds produced in presence of oxygen due to operation of TCA cycle. Crabtree effect
- This is opposite of Pasteur effect, which represents decreased respiration of cellular systems caused by high concentration of glucose.
- When *oxygen supply is kept constant* and glucose concentration is increased, the oxygen consumption by cells falls, i.e., relative anaerobiosis is produced when glucose concentration is increased in constant supply of oxygen.
- It is seen in cells that have a high rate of aerobic glycolysis.
- In such cells the glycolytic sequence consumes much of the available Pi and NAD^+, which limits their availability for oxidative

phosphorylation.

- As a result, rate of oxidative phosphorylation decreases, and oxygen consumption also shows a corresponding fall.

284. RNA is present in ?

a) Cytoplasm

b) Nucleus

c) Ribosome

d) All of the above

Correct Answer - D
Ans. is `d' i.e., All of the above

- mRNA is synthesized from DNA by the process of transcription in the nucleus.
- After formation mRNA transport out of the nucleus into cytoplasm.
- t-RNA is also synthesized in nucleus and is transported to cytoplasm.
- Protein synthesis (translation) occurs in ribosomes, and requires both mRNA and tRNA.
- rRNA is present in ribosomes.
- rRNA is synthesized in nucleolus

Thus, RNA can be found in -

1. Nucleus
2. Cytoplasm
3. Ribosome
4. Nucleolus

285. All are reducing sugars except-

a) Sucrose

b) Lactose

c) Glucose

d) Fructose

Correct Answer - A
Ans. A. Sucrose

Disaccharides	Sugar Units	Linkage
Trehalose (Sugar of insect hemolymph, yeast and fungi)	αDGlucose + αDGlucose	α1 ------- α1 linkage
Sucrose (Cane Sugar)	αDGlucose +β DFructose	α1 ------- β2 linkage

286. Reducing sugar in urine can be detected by-

a) a) Benedicts test

b) b) Fehling solution

c) c) Glucose-oxidase test

d) d) All of the above

Correct Answer - D
Explanation- Reducing sugar can be detected by- benedict's test, fehling's test, gluco-oxidase test.

287. Substrate level phosphorylation is by

a) Pyruvate kinase

b) Phosphofructokinase

c) Hexokinase

d) ATP synthase

Correct Answer - A
Ans. 'A' Pyruvate kinase
Substrate Level Phosphorylation-
In Glycolysis-

- Phosphoglycerate kinase
- Pyruvate kinase

In Citric Acid Cycle-

- Succinate thiokinase

288. Type VI glycogen storage disease is due to the deficiency of –

a) Muscle phosphorylase

b) Glucose-6-phosphatase

c) Liver phosphorylase

d) Branching enzyme

Correct Answer - C
Type VI glycogen is also called Her's disease and it is caused by enzyme defect liver phosphorylase.

Clinical features are hepatomegaly, accumulation of glycogen in the liver and mild hypoglycemia.

289. Xanthoproteic reaction involves-

a) Carbolic acid

b) H_2SO_4

c) HCL

d) Nitric acid

Correct Answer - D
Ans. 'D' Nitric acid
Xanthoproteic test: The ring systems in phenylalanine, tyrosine and tryptophan undergo nitration on treatment with concentrated nitric acid when heated. The end product is yellow in color which is intensified in strong alkaline medium. This reaction causes the yellow stain in the skin by nitric acid.

290. Coenzyme not required in formation of glutamate-

a) Thiamine pyrophosphate

b) Pyridoxial phosphate

c) Niacin

d) None of the above

Correct Answer - A
Ans. 'A' Thiamine pyrophosphate
NAD+ is derived from nicotinic acid, a member of the vitamin B complex, used in the synthesis of GABA.
During transamination reaction glutamate is formed. Pyridoxal Phosphate acts as a coenzyme.

291. Zewellger syndrone is due to absence of

a) Lysosomal

b) Mitochondria

c) Peroxisome

d) Nucleus

Correct Answer - C
Answer. C. Peroxisome

- Zellweger syndrome, also called cerebrohepatorenal syndrome, is a rare congenital disorder characterized by the reduction or absence of functional peroxisomes in the cells of an individual.
- Zellweger syndrome is associated with impaired neuronal migration, neuronal positioning, and brain development.
- In addition, individuals with Zellweger syndrome can show a reduction in central nervous system (CNS) myelin (particularly cerebral), which is referred to as hypomyelination.

292. Urea, creatinine, nitric oxide formed by which amino acid

a) Histidine

b) Glycine

c) Cysteine

d) Arginine

Correct Answer - D
Answer: D. Arginine

- Arginine, a semiessential or conditionally essential amino acid in humans, is one of the most metabolically versatile amino acids.
- It serves as a precursor for the synthesis of urea, nitric oxide, polyamines, proline, glutamate, creatine, and agmatine.

293. Which of the following is not the source of cytosolic NADPH ?

a) Isocitrate dehydrogenase

b) ATP citrate lyase

c) Malic enzyme

d) G6PD

Correct Answer - B
Answer. B. ATP citrate lyase
NADPH is a cofactor used in anabolic reactions, such as lipid and nucleic acid synthesis, which require NADPH as a reducing agent. The major source of NADPH in animals and other non-photosynthetic organisms is the pentose phosphate pathway. The key enzymes in these processes are: NADP-linked malic enzyme, NADP-linked isocitrate dehydrogenase, NADP-linked glutamate dehydrogenase and nicotinamide nucleotide transhydrogenase.

294. All are true regarding mitochondrial DNA, EXCEPT ?

a) Double stranded

b) Inherited from mother

c) High mutation rate

d) All respiratory proteins are synthesized within mitochondria itself

Correct Answer - D
Answer. D. All respiratory proteins are synthesized within mitochondria itself

- Mt DNA is organized as a circular, covalently closed, double-stranded DNA.
- In sexual reproduction, mitochondria are normally inherited exclusively from the mother; the mitochondria in mammalian sperm are usually destroyed by the egg cell after fertilization.
- Mutations of mitochondrial DNA can lead to a number of illnesses including exercise intolerance and Kearns–Sayre syndrome(KSS), which causes a person to lose full function of heart, eye, and muscle movements.

295. Which apolipoprotein is responsible for Alzeihmers disease

a) APOE4

b) APOE3

c) APOE2

d) APOE1

Correct Answer - A
ANSWER. A. APOE4
Three common polymorphisms in the APOE gene, e2, e3, and e4, result in single amino changes in the ApoE protein.
The e4 allele of apolipoprotein E (APOE) is the major genetic risk factor for Alzheimer's disease (AD).
the differential effects of apoE isoforms on Aß aggregation and clearance play the major role in AD pathogenesis.
In particular, APOE e4 is associated with increased risk for AD, whereas APOEe2 is associated with decreased risk.

296. Hyperammonaemia inhibit TCA cycle by depleting?

a) succinate

b) a keto glutarate

c) malate

d) fumarate

Correct Answer - B
Answer: B. a keto glutarate
The urea cycle and the citric acid cycle are independent cycles but are linked.
To detoxify ammonia in hyperammonemia, more glutamate is required. This glutamate is formed from c-ketoglutarate.
a-ketoglutarate ?Transamination ?glutamate + NH4+? glutamine.
Thus excessive a–ketoglutarate is consumed leading to decrease availability of a–ketoglutarate for TCA cycle

297. which amino acid is used to synthesise Nitric oxide ?

a) glycine

b) arginine

c) tyrosine

d) threonine

Correct Answer - B
ANSWER: B. Arginine
Nitric oxide is produced by a group of enzymes called nitric oxide synthases. These enzymes convert arginine into citrulline, producing NO in the process. Oxygen and NADPH are necessary co-factors. three distinct genes encode NOS isozymes: neuronal (nNOS or NOS-1), cytokine-inducible (iNOS or NOS-2) and endothelial(eNOS or NOS-3)

298. Menkes disease is associated with which enzyme deficiency.

a) lysyl oxidase

b) Methionine synthase

c) Glutamyl aminopeptidase

d) Lysyl hydroxylase

Correct Answer - A

Answers: A. lysyl oxidase

One of the enzymes, lysyl oxidase, requires copper for proper function. This enzyme cross-links tropocollagen into strong collagen fibrils.

Menkes disease (MNK), also known as Menkes syndrome, is an X-linked recessive disorder caused by mutations in genes coding for the copper-transport protein ATP7A, leading to copper deficiency. The decreased supply of copper can reduce the activity of numerous copper-containing enzymes.

These are necessary for the structure and function of bone, skin, hair, blood vessels and the nervous system such as lysyl oxidase.

299. LCAT deficiency increases the following

a) HDL

b) LDL

c) VLDL

d) Chylomicron

Correct Answer - A
Answer: A. HDL
Lecithin cholesterol acyltransferase deficiency (LCAT deficiency) is a disorder of lipoprotein metabolism.
A deficiency of LCAT causes accumulation of unesterified cholesterol in certain body tissues. Cholesterol effluxes from cells as free cholesterol and is transported in HDL as esterified cholesterol.
LCAT is the enzyme that esterifies the free cholesterol on HDL to cholesterol ester and allows the maturation of HDL.
LCAT is the enzyme that esterifies the free cholesterol on HDL to cholesterol ester and allows the maturation of HDL. LCAT deficiency does not allow for HDL maturation resulting in its rapid catabolism of circulating apoA-1 and apoA-2. The remaining form of HDL resembles nascent HDL.

300. A 25 year old alcoholic presented with edema,hypertension, ocular disturbance,and changes in mental state was observed, diagnosis of high output cardiac failure was made with Wet Beri Beri, this is due to deficiency of?

a) Vit B3

b) Vit B6

c) Vit B9

d) Vit B1

Correct Answer - D

Answer: D. Vit B1

Wet beriberi is the term used for thiamine deficiency with cardiovascular involvement.

In the first stage, peripheral vasodilation occurs, leading to a high cardiac output state. This leads to salt and water retention mediated through the renin-angiotensin-aldosterone system in the kidneys.

A more rapid form of wet beriberi is termed acute fulminant cardiovascular beriberi, or Shoshin beriberi.

The predominant injury is to the heart, and rapid deterioration follows the inability of the heart muscle to satisfy the body's demands because of its own injury.

In this case, edema may not be present. Instead, cyanosis of the hands and feet, tachycardia, distended neck veins, restlessness, and anxiety occur.

301. Glutamine is Increase in CSF, blood and urine, this is due to deficiency of

a) CPS-I

b) Arginase

c) OTC

d) Argininosuccinate synthetase

Correct Answer - A

Answer: A. CPS-I

CPS I deficiency is one of the proximal urea cycle defects and is due to a complete or partial deficiency of the mitochondrial enzyme carbamyl phosphate synthetase I (CPS I) which produces carbamyl phosphate from ammonia, ATP, and HCO3.

Carbamoyl phosphate synthetase I (CPS1 or CPSI) transfers an ammonia molecule from glutamine or glutamate to a molecule of bicarbonate that has been phosphorylated by a molecule of ATP. The resulting carbamate is then phosphorylated with another molecule of ATP. The resulting molecule of carbamoyl phosphate leaves the enzyme.

CPS-I is the rate limiting (pacemaker) enzyme this pathway.

CPS-I is active only in the presence of N-Acetyl Glutamate, an allosteric activator.

302. True about type 1 diabetes mellitus

a) Decreased protein catabolism

b) Decreased hepatic Glucose output

c) Increased lipolysis

d) Increase glucose uptake

Correct Answer - C
Answer: C. Increased lipolysis
Uncontrolled insulin-dependent diabetes mellitus (type I diabetes) involves decreased glucose utilization, with hyperglycemia, and increased fatty acid oxidation.
Increased fatty acid oxidation leads to excessive production of acetoacetic and 3-hydroxybutyric acids and of acetone, which are known as ketone bodies.
2. Acetoacetic and 3-hydroxybutyric acids dissociate at body pH and release H leading to a metabolic acidosis.
LCAT is the enzyme that esterifies the free cholesterol on HDL to cholesterol ester and allows the maturation of HDL.
LCAT deficiency does not allow for HDL maturation resulting in its rapid catabolism of circulating apoA-1 and apoA-2. The remaining form of HDL resembles nascent HDL.

303. Protein which is not synthesised In liver is

a) Phase protein

b) Immunoglobulins

c) Albumin

d) Plasma hormone

Correct Answer - B
Answer: B. Immunoglobulins
The liver serves several metabolic functions within the body including protein synthesis and metabolism. The liver is responsible for an array of proteins.
Immunoglobulins are synthesised in plasma cells which are believed to be end products of the differentiation of cells called B-lymphocytes.
The liver plays a crucial role in the production of nearly all plasma proteins (albumin, alpha-1-acid glycoprotein, majority of coagulation cascade, and fibrinolytic pathways).
Notable exceptions include: globulins, factor III, IV, VIII.
Proteins produced by the liver: protein S, protein C, protein Z, plasminogen activator inhibitor, antithrombin III. Vitamin K dependent proteins synthesized by the liver include: Factors II, VII, IX, and X, protein S and C.

304. type of cholesterol present in gallstones?

a) Amorphous cholesterol monohydrate.

b) Amorphous cholesterol dihydrate.

c) Crystalline Cholesterol dihydrate.

d) Crystalline cholesterol monohydrate.

Correct Answer - D
Answer: D. Crystalline cholesterol monohydrate.
Gallstones are hardened deposits of digestive fluid that can form in your gallbladder.
The most common type of gallstone, called a cholesterol gallstone, often appears yellow in color. These gallstones are composed mainly of undissolved cholesterol.
Precipitation of solid cholesterol crystals from supersaturated bile has an essential role in cholesterol gallstone formation.
Gallstones are composed principally of cholesterol monohydrate crystals (cholesterol stones) or the acid salt of calcium bilirubinate (pigment stones).
When bile is concentrated in the gallbladder, it can become supersaturated with these substances, which then precipitate from the solution as microscopic crystals. The crystals are trapped in gallbladder mucus, producing gallbladder sludge.

305. collagen present in skin is

a) Type II

b) Type I

c) Type III

d) Type IV

Correct Answer - B
Answer: B. Type I

- Collagen is a protein that is part of cartilage, bone, and other tissues in animals and humans.
- As the main component of connective tissue, it is the most abundant protein in mammals.
- Collagen consists of amino acids wound together to form triple-helices l of elongated fibrils.It is, mostly, found in fibrous tissues such as tendons, ligaments, and skin.
- So far, 28 types of collagen have been identified and described.

The five most common types are:

- Type I: skin, tendon, vasculature, organs, bone (main component of the organic part of bone)
- Type II: cartilage (main collagenous component of cartilage)
- Type III: reticulate (main component of reticular fibers), commonly found alongside type I.
- Type IV: forms basal lamina, the epithelium-secreted layer of the basement membrane.
- Type V: cell surfaces, hair, and placenta

306. which of the following is not Ribozyme?

a) Ploy A polymerase

b) Ribonuclease

c) Transpeptidase

d) Peptidyl Transferase

Correct Answer - A
Answer: A. Ploy A polymerase
Polyadenylation is the addition of a poly(A) tail to a messenger RNA. The poly(A) tail consists of multiple adenosine monophosphates; in other words, it is a stretch of RNA that has only adenine bases. polyadenylation is part of the process that produces mature messenger RNA (mRNA) for translation. It, therefore, forms part of the larger process of gene expression.

307. Type-I hyperlipoproteinemia is characterized by

a) Elevated LDL

b) Elevated HDL

c) Elevated chylomicrons

d) Elevated lipoprotein lipase

Correct Answer - C

Answer C. Elevated chylomicrons

Lipoprotein lipase deficiency (Type I hyperlipoproteinemia) results in increased level of chylomicrones.

Lipoprotein lipase deficiency is a genetic disorder in which a person has a defective gene for lipoprotein lipase, which leads to very high triglycerides, which in turn causes stomach pain and deposits of fat under the skin, and which can lead to problems with the pancreas and liver, which in turn can lead to diabetes.

The disorder only occurs if a child acquires the defective gene from both parents (it is autosomal recessive). It is managed by restricting fat in diet to less than 20 g/day.

The disease often presents in infancy with colicky pain, failure to thrive, and other symptoms and signs of the chylomicronemia syndrome.

The condition has also been called familial chylomicronemia syndrome, chylomicronemia, chylomicronemia syndrome. and hyperlipoproteinem type Ia.

308. In Kreb's cycle and Urea cycle the linking amino acid is

a) Fumarate

b) Alanine

c) Arginine

d) Aspartate

Correct Answer - D
Answer: D. Aspartate
Aspartate helps in condensation with citrulline to form argino succinic acid.
Arginosuccinic acid undergoes a lytic reaction to form Arginine and fumarate.
oxaloacetate , the keto acid obtained from aspartate is intermediate of TCA cycle.
Hence aspartate is a common intermediate of TCA cycle through oxaloacetate and urea cycle (directly)

309. The cofactor vitamin B12 is required for the following conversion:

a) Dopamine to Norepinephrine

b) Propionyl CoA to methyl malonyl CoA

c) Methyl malonyl CoA to succinyl CoA

d) Cysteine to homocysteine

Correct Answer - C
Ans: C. Methyl malonyl CoA to succinyl CoA
(Ref: Harper 30/e p550, 558, 28ie p346)
Vitamin B12 as Cofactor for:

- Methylmalonyl CoA mutase - Isomerization of methylmalonyl co-A to succinyl co-A.
- Methionine synthase - Methylation of pyrimidine ring to form thymine.
- Homocysteine methyl transferase - Methylation of homocysteine to methionine
- Metabolism of diol.
- In bacteria for interconversion of glutamate & beta-methyl aspartate°

310. Which of the following enzyme activity decreases in fasting?

a) Hormone sensitive lipase

b) Glycogen phosphorylase

c) Acetyl CoA Carboxylase

d) Phosphofructokinase I

Correct Answer - D
Ans: D. Phosphofructokinase I
Ans: D. Phosphofructokinase I

- Phosphofructokinase 1 (PFK1) provides the first enzymatic step at which a glucose molecule becomes committed to glycolysis and therefore is subject to regulation (Nelson & Cox, 2008). **PFK1 activity depends on the concentrations of AMP, ADP, and ATP with allosteric activation by AMP and ADP and allosteric inhibition by ATP.**
- In the fasting state, glucagon causes the liver to mobilize glucose from glycogen (glycogenolysis) and to synthesize glucose from oxaloacetate and glycerol (gluconeogenesis).
- Glucagon stimulates an increase in cAMP, leading to an increase in phosphorylation by protein kinase A.
- The wave of phosphorylation that spreads through the liver cell activates enzymes such as glycogen phosphorylase that are involved in glycogen degradation while simultaneously inhibiting glycogen synthesis.
- Inhibition of glycogen synthase prevents futile resynthesis of glycogen from glucose 1-phosphate (G1P) via UDP-Glc. Glucose-6-phosphatase (G6Pase), a gluconeogenic enzyme that is present in the liver but not in muscle, then converts G6P to glucose for release

into the blood.
Ref: Harper's illustrated biochemistry,3a,ed., pg. I88 and Lippincott's illustratet! reviewsr 6't' ed., pg. 107

311. Which micronutrient deficiency causes anemia?

a) Copper

b) Molybdenum

c) Selenium

d) Flurine

Correct Answer - A
Ans. is 'a' i.e., Copper
Copper containing protein ceruloplasmin is necessary for transport of iron in the Ferric form across membranes
Copper is an integral component of ALA synthase, which is necessary for heme synthesis
Copper helps in the uptake of iron across normoblasts

312. True about sigma factor?

a) Subunit of 50s ribosome

b) Subunit of DNA polymerase

c) Subunit of RNA polymerase

d) Initiates DNA replication

Correct Answer - C

Ans- 'C' Subunit of RNA polymerase

- The basic DNA-dependent RNA polymerase of the bacterium Escherichia coli exists as an approximately 400-kDa core complex consisting of two identical α subunits, two large β, and β′ subunits, and a ω subunit. The core RNA polymerase, ββ′α2ω, often termed E, associates with a specific protein factor (the sigma [σ] factor) to form holoenzyme, ββ′α2σ, or Eσ.
- Sigma factors have a dual role in the process of promoter recognition; σ association with core RNA polymerase decreases its affinity for non-promoter DNA, while simultaneously increasing holoenzyme affinity for promoter DNA.

313. In ETC, cyanide inhibits ?

a) Complex I

b) Cytochrome C oxidase

c) Complex IV

d) Complex III

Correct Answer - B:C

Ans. is 'b' i.e., Cytochrome C oxidase & 'c' i.e., Complex IV

[Ref Harper 29th/e p. 127, 28th/e p. 108, 109; Vasudevan 6th Ie p. 234]

* Complex I :- Barbiturates (amobarbital), piercidin A, rotenone, chlorpromazine, guanithidine.
* Complex II :- Carboxin, TTFA, malonate.
* Complex III:- Dimercaprol, BAL, actinomycin A, Naphthyloquinone.
* Complex IV (cytochrome c oxidase) :- Carbon monoxide (CO), cyanide (CN-), H_2S, azide (N')

314. HHH syndrome is due to defect in ?

a) Tryptophan metabolism

b) Histidine transporter

c) Branched chain AA metabolism

d) Ornithine transporter

Correct Answer - D

Ans. is 'd' i.e., Ornithine transporter *[Ref Textbook of clinical paediatrics* p. *496]*

- Hyperornithinaemia, hyperammonaemia, homocitrullinuria (HHH) syndrome is an autosomal recessive disorder of ornithine transport caused by mutations in gene SLC 25A15 encoding the ornithine transorter protein (ORNT1).
- There is defective activity of the ornithine transporter across the mitochondrial membrane, which causes a functional deficiency of two mitochondrial enzymes:
- Ornithine transcarbomylase : Which catalyses the condensation of ornithine and carbamoylphosphate to citrulline.
- Ornithine-8-aminotransferase (OAT) : Which metabolizes the ornithine to .'-pyrroline-5-carboxylate and ultimately glutamate and proline.
- Ornithine accumulates in the cytoplasm and its deficiency in mitochondria causes a secondary urea cycle disorder and hyperammonemia.

Carbamoylphosphate accumulates and undergoes allternate metabolism to form :

1. Homocitrulline - Excreted in urine
2. Orotic acid
3. Plasma

315. Earliest symptom of Tay sach disease

a) Exaggerated startle response

b) Bone deformation

c) Hepatomegaly

d) Excessive bleeding

Correct Answer - A

Ans. is 'a' i.e., Exaggerated startle response [Ref Illustrated medical biochemistry p. 330]

Tay-Sach disease

- Clinical symptoms are usually evident in the first year of life
- Initial signs are not dramatic and present as enfeeblement, spasticity and slow development.
- An exaggerated startle response to sound may be the most significant early sign of which a parent is aware.
- Other features are mental retardation, deterioration of vision and early death.
- "Affected infants usually develop normally until 4-5 months of age when decreased eye contact and an exaggerated startle response to noise (hyperacusis) are noted." ---Nelson.
- Patients with the infantile form of Tay-Sachs disease have clinical manifestations in infancy including loss of motor skills, increased startle reaction, and macular pallor and retinal cherry-red spots.

316. Most important tool used in genetic engineering

a) Halicase

b) Topoisomerase

c) DNA Ligase

d) Restriction endonuclease

Correct Answer - D

Ans. is 'd' i.e., Restriction endonuclease*[Ref Satyanarayan p. 579]*

- Genetic engineering simply means manipulation of genetic material to achieve the desired goal in a predetermined way.
- Most important molecular tools in genetic engineering are enzymes used in recombinant DNA technology. (also called genetic engineering).
- Most important of these enzymes is restriction endonuclease.
- At the heart of genetic engineering is the ability to cut DNA molecules at precisely defined sites.
- This is usually done with purified bacterial enzyme, the restrication endonuclease.

317. Chromosomal instability syndrome is

a) Fanconi syndrome

b) Ataxia Telangectasia

c) Bloom syndrome

d) All of the above

Correct Answer - D

Ans. is 'd' i.e., All of the above *[Ref Talwar G P p. 855]*

- Chromosomal instability syndromes are a group of disorders characterized by chromosomal instability and breakage.

There are :

1. Xeroderma pigmentosa
2. Bloom syndrome
3. Fanconi syndrome
4. Ataxia telangectasia

318. Vitamin B_1 is required for which reaction

a) Transamination

b) Oxidative decarboxylation

c) Carboxylation

d) All of the above

Correct Answer - B

Ans. is 'b' i.e.,Oxidative decarboxylation [Ref Harper 29th/e p. 534]

* Active form (coenzyme form) of thiamine is thiamine pyrophosphate (TPP), also called thiamine diphosphate (TDP).
* TPP acts as coenzyme for
- Oxidative decarboxylation:- Pyruvate dehydrogenase, a-ketoglutarate dehydrogenase, brached-chain keto acid dehydrogenase.
- Transketolase in PPP.

319. Hyperammonemia type-1 is due to deficiency of

a) Arginase

b) Arginosuccinate lyase

c) Arginosuccinate synthase

d) CPS-1

Correct Answer - D
Ans. is 'd' i.e., CPS-1 [Ref Dinesh Puri 3'/e p. 275]
Disorders caused by genetic defects of urea cycle enzymes

- Hyperammonemia type-I Hyperammonemia type-II Citrullinemia Argininosuccinic aciduria Argi ninemia

Defective enzyme

- Carbamoyl phosphate synthase-I Ornithine transcarbamoylase Argininosuccinate synthase Argininosuccinate lyase Arginase

Products accumulated

- Ammonia Ammonia Citrulline Argininosuccinate Arginine.

320. Major site of protein glycosylation is ?

a) ER and golgi body

b) Ribosome and golgi body

c) ER and ribosome

d) Ribosome and cytoplasm

Correct Answer - A

Ans. is 'a' i.e., ER and golgi body ***[Ref Harper 28^{a}Ve*** **p.** ***514, 515; Lippincotts 5thle p. 167,168]***

- N- Glycosylation occurs in ER and O-glycosylation occurs in golgi apparatus.

321. Which is not a step of PCR ?

a) Annealing

b) Extension

c) Transformation

d) Denaturation

Correct Answer - C

Ans. is 'c' i.e., Transformation *[Ref Lippincott' s* 5thle p. *479-83; Harper 28th/e p. 395]* Steps in PCR

- Isolation of target DNA sequence→ Primer **construction** → **Denaturation** of DNA→ Annealing of primers to single stranded DNA→ **Chain extension.**

322. Which does not play a role in protein synthesis?

a) Exon

b) Intron

c) m-RNA

d) ATP

Correct Answer - B

Ans. is 'b' i.e., Intron *[Ref Lippincott's 5tve p. 426]*

Primary transcript contains introns & exons. Splicing removes introns (segment of gene that is not represented in mature m-RNA) from primary transcript.

Synthesis of protein from mRNA is called translation. Translation is the process by which ribosomes convert the information (genetic code) carried by mRNA to the synthesis of new protein.

Translation occurs in ribosomes. Basic requirements for translation include mRNA, tRNAs, ribosomes, energy (ATP and GTP), enzymes, and specific protein factors like initiation factors, elongation factors etc.

323. Pyridoxine deficiency leads to altered metabolism of?

a) Phenylalanine

b) Tryptophan

c) Methionine

d) Tyrosine

Correct Answer - B

Ans. is 'b' i.e., Tryptophan [*Ref Dineshpuri 3rd le* p. *378]*

Tryptophan load test is used for pyridoxin.

In pyridoxin (vitamin B_6) deficiency, xanturenic acid excretion is increased after giving tryptophan load dose.

324. Kcat/km is a measure of -

a) Enzyme efficiency

b) Speed of enzymatic reaction

c) Concentration of substrate

d) Enzyme turn over

Correct Answer - D

Answer-D. Enzyme efficiency

- **"**The Km of an enzyme is the concentration of the substrate that enables the enzyme to
- Function at half maximum activity and is therefore a measure of the specificity of a substrate for the enzyme" .
- Actually enzyme specificity is not measured by alone.
- It is measured by the ratio Kcat /Km which is a second order rate constant for the reaction between substrate and free enzyme.
- This ratio is important, for it provides a direct measure of enzyme eficiency and specificity.

Note: Km, is turnover number and measures tJre rate of the catalytic process

325. Enzyme involved in the transfer of hydrogen ion is

a) Hydratase

b) Oxidase

c) Peroxidase

d) Dehydrogenase

Correct Answer - B:D

Ans. is 'b' i.e., Oxidase & 'd' i.e., Dehydrogenase [Ref Harper 30th/e p. 198; Vasudevan 5th/e p. 210]

- Enzyme involved in oxidation-reaction are :?
  Cause removal of hydrogen
- Dehydrogenases : Use NAD or FAD as acceptor
- Oxidases : Use oxgen as acceptor, Add oxygen
- Oxygenases

326. Which of the following is a constitutive enzyme?

a) Hexokinase

b) Glucokinase

c) p galactosidase

d) Cyclooxygenase-2

Correct Answer - A
Ans. is 'a' i.e.,Hexokinase

327. Sequence of complexes in the electron transport chain is -

a) NADH dehydrogenase → Q → Cytochrome bc1 → Cytochrome aa3 → O,

b) NADH dehydrogenase → Q → Cytochrome aa3 → Cytochrome bcl→ O,

c) NADH dehydrogenase → Cytochrome aa3 → Q → Cytochrome bcl→ O,

d) NADH dehydrogenase → Cytochrome bcl → Q → Cytochrome aa3 → O,

Correct Answer - A

Ans. is 'a' i.e., NADH dehydrogenase → Q → Cytochrome bcl → Cytochrome aa3→ 02

Electron transport chain is made up of 5 stationary complexes and 2 mobile complexes

328. Regarding energy production by the electron transport chain, which is true?

a) The complexes are arranged in a decreasing order of redox potential

b) The complexes are arranged in a decreasing order of ability to get reduced

c) The complexes are arranged in a decreasing order of state of oxidation

d) The complexes are arranged in a decreasing order of energy level

Correct Answer - D

Ans. is 'd' i.e., The complexes are arranged in a decreasing order of energy level *[Ref Essential of biochemistry p. 712]*

- ETC help in ATP generation
- It is explained by Mitchell's chemiosmotic theory. According to this theory, the complexes are arranged in an increasing order of redox potential. Redox potential is a measure of ability to get reduced. So the complexes are arranged in an increasing order of ability to get reduced. As more a substance is oxidised higher will be the ability to get reduced, the complexes are arranged in an increasing order of state of oxidation. As state of oxidation is inversely proportional to energy level, the complexes are arranged in a decreasing order of energy level.
- So, when electrons move from one complex to another, it means electrons move from a complex of high energy to a complex of low energy and that liberates energy. This energy is used for pumping hydrogen ions from the mitochondrial matrix to just outside the inner mitochondrial membrane. After hydrogen ions accumulate outside

the inner mitochondrial membrane, hydrogen ions go through FO Component of ATP synthase.

329. Electron transport chain all are true except

a) Complexes are arranged in an increasing order of redox potential;

b) Mitochondrial Glycerol phosphate dehydrogenase sends its electron directly to Q

c) l0 Hydrogen ions are translocated when NADH enters into an electron transport chain

d) 7 Hydrogen ions are translocated when FADH2 electrons get into electron transport chain.

Correct Answer - D

Ans. is 'd' i.e., 7 Hydrogen ions are translocated when FADH2 electrons get into electron transport chain

- NADH electrons get into electron transport chain through complex I. Energy difference between NADH and Q is in such a way that when electrons move from complex I to Q, 4 hydrogen ions get translocated.
- Similarly 4 ions get translocated when electrons move from Q to complex III and 2 1-1' ions get translocated when electrons move from complex III to IV. So totally 10 $1\text{-}1^{+}$ ions get translocated when electrons from NADH get into electron transport chain. Complex V or ATP synthase complex works in such a way that when 10 H* ions go through F_0 component, 1 ATP is generated. So when 10 Hydrogen ions are translocated, 2.5 ATPs can be generated.
- FADH, electrons get into electron transport chain through either complex II or they directly get into Q, in either case, no energy is liberated. No hydrogen ions are translocated. When electrons move

from Q to Complex III, 4 hydrogen ions and when electrons move from III to IV 2 hydrogen ions are translocated. So totally 6 hydrogen ions are translocated when FADH2 gets into electron transport chain. ATP synthase complex generates 1 ATP for every 4 hydrogen ions translocated through F, component. So for 6 hydrogen ions, it is 1.5 ATP

330. Which of the following is the respiratory centre of cell?

a) Mitochondria

b) Microsome

c) Lysosome

d) Nucleus

Correct Answer - A

Ans. is 'a' i.e., Mitochondria

- As mitochondria harbours the electron transport chain. In electron transport chain, the electrons from NADH and FADH2 are transferred through the various complexes to finally Oxygen.
- Oxygen is then converted to water. This way all fuels get oxidised to Carbondioxide. In other words in miotochondria, Oxygen is utilised and Carbon dioxide generation is supported. Hence it is called as the respiratory centre of the cell.

331. Cellulose is biochemically -

a) β (1,4) L glucose

b) ?, (14) D glucose

c) β(1,4) D glucose

d) ? (1,4) L glucose

Correct Answer - A

Ans. is 'a' i.e., β (1,4) L glucose

- Cellulose is a component of cell wall.
- Cellulose is a structural homopolysaccharide made up of glucose molecules linked by 13(1,4) linkages.
- Humans cannot digest cellulose because human digestive enzymes cannot break 43(1,4) linkages present in oligosaccharides and polysaccharides.
- This is why vegetarian diet is considered to provide fibre to the diet.

332. D and L isomerism is -

a) Optical isomerism

b) Functional isomerism

c) Epimerism

d) Enantiomerism

Correct Answer - D

Ans. is d.i.e., Enantiomerism

- Enantiomerism is a type of stereoisomerism in which two molecules have the same molecular formula and the same structural formula but they differ in spatial orientation with respect to all the carbon atoms and they are named based on the orientation in the penultimate carbon atom.
- In the penultimate carbon atom, if OH is on the right side, it is D form, if OH is on the left side, it is L form. The other name for enantiomerism is Racemism.

333. All of the following are converted to cr-ketoglutarate on catabolism except-

a) Glutamate

b) Histidine

c) Proline

d) Glycine

Correct Answer - D

Ans. is 'd' i.e., Glycine *[Ref Harper 30th/e* p. *162, 250/e p. 166, 167]*

334. Glucogenic aminoacids give rise to all of the following intermediates of citric acid cycle except-

a) Isocitrate

b) c ketoglutarate

c) Succinyl CoA

d) Fumarates

Correct Answer - A
Ans. is 'a' i.e., Isocitrate

335. What is the precursor of proline in Krebs cycle?

a) Oxaloacetate

b) c ketoglutarate

c) Succinyl CoA

d) Fumarates

Correct Answer - B

Ans. is 'b' i.e., c ketoglutarate ***[Ref Essentials of Biochemistry p. 232; Harper 29`'/e p.***

- Proline is an alpha aminoacid with a pyrrolidine ring
- It is a non polarimino acid with NH as one of its functional groups
- It disrupts a helix
- It is a nonessential amino acid and is synthesized from a non-essential aminoacid glutamate
- Glutamate in the presence of y glutamate kinase gets converted to glutamate 5 phosphate, which in the presence of y glutamate dehydrogenase gets converted to y glutamate semialdehyde. y glutamate semialdehyde spontaneously cyclises to form y pyrroline carboxylate which in the presence of reductase forms proline

336. used in citric acid cycle are all except-

a) NAD

b) FAD

c) NADP

d) GDP

Correct Answer - C

Ans. C. NADP

Enzyme	**Reducing equivalent**	**ATP**
Isocitrate dehydrogenase	1 NADH	2.5
alpha ketoglutarate dehydrogenase	1 NADH	2.5
Succinyl CoA	ATP/GTP	1
Succinate dehydrogenase	FADH2	1.5
Malate dehydrogenase	NADH	2.5
	total	10

337. All of the following steps act as sources of energy in citric acid cycle except -

a) Citrate synthase

b) Isocitrate dehydrogenase

c) Succinyl Thiokinase

d) Succinate Dehydrogenase

Correct Answer - A
Ans. is 'a' i.e.,Citrate synthase

338. True about glucokinase is -

a) It is present in all cells

b) It is a constitutive enzyme

c) It has a high km

d) It is inhibited by glucose 6 phosphate

Correct Answer - C

Ans. is 'c' i.e.,It has a high km

S. No.	Property	Hexokinase	Glucokinase
1	Location	All cells	Liver and Pancreatic (3 cells
2	Affinity	High	Low
3	Km	Low	High
4	Inhibition by glucose 6 phosphate	Yes	No
5	Induction by Insulin	No (Constitutive enzyme)	Yes (Inducible Enzyme)

339. All of the following are true about lactate utilisation in liver except -

a) Total net number of ATP formed because of cori's cycle is 6

b) Cori's cycle shifts the metabolic burden from muscle to liver

c) Cori's cycle can not be sustained indefinitely because it is energetically unfavourable

d) Cori's cycle is linked to glycogen synthesis in muscle

Correct Answer - A

Ans. is 'a' i.e., Total net number of ATP formed because of coil's cycle is 6

CORI'S CYCLE

- Muscle uses a molecule of glucose through anaerobic glycolysis and gets 2 ATPs. In this process, glucose becomes two molecules of lactate. The 2 lactate molecules through circulation reach liver. In liver, the two molecules of lactate are utilised through gluconeogenesis to form a glucose molecule at the expense of 6 ATPs. The glucose formed in liver reaches muscle and is utilised for again anaerobic glycolysis if the muscle is still exercising. In case muscle is done with exercising, the glucose which reaches the muscle from liver is used for glycogen synthesis.

340. Which of the following is true about effect of insulin and glucagon on gluconeogenesis?

a) Insulin favours the formation of fructose 2,6 bisphosphate

b) Fructose 2, 6 bisphosphate is an inhibitor of glycolysis

c) Insulin acts through a kinase

d) Glucagon stimulates PFK.2 activity of the tandem enzyme

Correct Answer - A

Ans. is 'a' i.e., Insulin favours the formation of fructose 2,6 bisphosphate

- Glycolysis and gluconeogenesis are reversal of each other. Hence the two pathways should be regulated in such a way that when one pathway is active, the other one has to be inactive. Otherwise they will end up in futile cycles.

341. In glycogen synthesis the active form of glucose used is-

a) Glucose 6 phosphate

b) Glucose I phosphate

c) UDP glucose

d) UTP glucose

Correct Answer - C

Ans. is 'c' i.e., UDP glucose

- Glycogen synthesis occurs in liver and Skeletal Muscle
- UDP glucose is the active form of glucose which gets added to the growing glycogen
- The number of high energy phosphates required for attaching a glucose molecule to growing glycogen is 3
- The rate limiting enzyme of glycogen synthesis is glycogen synthase
- Glycogen synthase gets activated by dephosphorylation
- Glycogen synthase attaches glucose residues one by one along a straight chain, linked by a(1,4) linkages. This continues until 11 to 13 residues are attached in a straight chain.
- At branch points in glycogen, a(1,6) linkages should be formed.

342. Neonatal hypoglycaemia which does not respond to counter regulatory hormone administration is diagnostic of -

a) Her's disease

b) Cori's disease

c) Anderson's disease

d) Von Gierke's disease

Correct Answer - D

Ans. is 'd' i.e.,Von Gierke's disease

- Glycogen storage disorders presenting with hypoglycaemia are Type I (Von Gierke's disease), Type III (Cori's disease or Forbe's disease), Type VI (Her's disease), Type IX (Fanconi Bickel syndrome)
- The only Glycogen storage disorder which presents as hypoglycaemia not responding to counter regulatory hormone administration is Von Gierke's disease
- Muscle involvement is not a feature of Type I(Von Gierke's disease), Type IV (Andersoen disease), Type VI (Her's disease), Type IX (Fanconi Bickel syndrome)
- Andersen disease or Type IV is the only glycogen storage disease which presents with neither hypoglycaemia nor with muscle involvement. It presents as hepatomegaly and cirrhosis

343. Which of the following is a transfatty acid?

a) Oleic acid

b) Elaidic acid

c) Stearic acid

d) Arachidonic acid

Correct Answer - B

Ans. is 'b' i.e., Elaidic acid ***[Ref Harper 30"/e p. 213]***

- There are two types of fatty acids :
- Saturated
- Unsaturated
- Cis - trans isomerism is for unsaturated fatty acids.
- Stearic acid is a saturated fatty acid (No cis-trans isomerism)
- Only important unsaturated trans-fatty acid is Elaidic acid (trans-9-octadecenoic)

344. Activators of Acetyl CoA carboxylase are all except

a) Acyl coA

b) Citrate

c) Glutamate

d) Dicarboxylic acid

Correct Answer - A

Ans. is 'a' i.e., Acyl CoA [Ref Harper 29th le p. 217, 220]

Allosteric modulation of acetyl CoA carboxylase

1. Activaters : Citrate (tricarboxylic acid), glutamate (dicarboxylic amino acid) & other dicarboxylic acids; ATP
2. Inhibitors : Acyl CoA

345. Arachidonic acid oxidation involves how many cycles of beta oxidation?

a) l0

b) 20

c) 9

d) 8

Correct Answer - C

Ans. is 'c' i.e., 9

- Number of acetyl CoA formed in (3-oxidation of fatty acids = Number of carbon atoms/2.
- Number of cycles of (beta-oxidation required -No of carbon / 2(-1)
- Hence arachidonic acid with 20 carbon atoms undergoes p oxidation to form 10 acetyl CoA by going through (20/2) - 1 cycles i.e., 9 cycles.

346. All are true about beta oxidation of fatty acids except -

a) Carnitine acyl transferase I is the rate limiting enzyme of fatty acid oxidation

b) Carnitine acyl transferase I is stimulated by Acyl CoA

c) Carnitine Acyl transferase I is stimulated by malonyl CoA

d) Carnitine Acyl transferase I defect causes a decrease in acylcarnitine levels

Correct Answer - C

Ans. is 'c' i.e., Carnitine Acyl transferase I is stimulated by malonyl CoA

- As CATI is the rate limiting enzyme of fatty acid oxidation, its substrate is acyl CoA. As we know that all enzymes get stimulated by their substrates, acyl CoA stimulates CATI.
- Malonyl CoA is a product of acetyl CoA carboxylase (ACC). ACC is the rate limiting enzyme of fatty acid synthesis, an anabolic pathway.
- So, malonyl CoA is an intermediate of anabolic pathway. Hence it is a signal of high energy (Anabolism happens only in high energy status). When the energy is already high, we do not want fatty acids to be further oxidised. We want fatty acids to be only stored. So, malonyl CoA, a signal of high energy inhibits CATI.
- In short, anything which signals low energy stimulates fatty acid oxidation (CATI). So, ADP, NAD, FAD, Glucagon , Acyl CoA stimulate fatty acid oxidation
- Anything which signal high energy inhibit fatty acid oxidation. So, ATP, NADH, FADH2, Insulin and malonyl CoA inhibit fatty acid oxidation.
- Fatty acid oxidation defects present as non ketotic hypoglycaemia,

hyperammonemia, dicarboxylic aciduria. And all fatty acid oxidation defects also present with increase in acyl carnitine levels. One exception is CATI defect. In CATI defect, as acyl CoA is not converted to acyl Carnitine, free carnitine levels are high and acyl carnitine levels are low.

347. All are true about beta oxidation of fats acids except -

a) Occurs in mitochondria

b) Occurs in peroxisome

c) Results in hydrogen peroxide generation

d) Fatty acid oxidation defects present with ketosis

Correct Answer - D

Ans. is 'd' i.e., Fatty acid oxidation defects present with ketosis

- Fatty acid oxidation defect causes non-ketotic hypoglycemia.
- Fatty acid oxidation happens in mitochondria and in peroxisomes.
- The difference between mitochondrial oxidation and peroxisomal oxidation is that in mitochondria, when the 13 carbon atom is oxidised, the hydrogen atoms are removed. Those hydrogen atoms are used for reducing NAD and FAD to form NADH and FADH2. NADH and FADH2 enter into electron transport chain to form ATP. In peroxisome, the hydrogen atom removed from (3 carbon atom is used to reduce 0_2 forming $F1_20_2$. Only because 11_20_2 is formed in peroxisome by (beta oxidation the organism is called so)

348. Which of the following is true about Beta oxidation of fatty acids?

a) Stearic acid on oxidation provides 106 ATPs

b) Odd chain fatty acid oxidation provides only propionyl coA

c) Fatty acid oxidation defects cause hypoglycemia

d) Ketone bodies are formed by incomplete oxidation of fatty acid during starvation to increase energy production

Correct Answer - C

Ans. is 'c' i.e., Fatty acid oxidation defects cause hypoglycaemia

Defect in fatty acid oxidation causes hypoglycemia.

About other options

- Stearic acid oxidation produces 122 ATPs.
- Even chain fatty acids are (3-oxidized to acetyl CoA. Odd chain fatty acids are also (3-oxidized normally but the last step produces a 3-carbon propionyl CoA along with an acetyl CoA (instead of 2 molecules acetyl CoA that occurs in even chain fatty acids).
- Ketone body formation (ketogenesis) occurs when there is a high rate of fatty acid oxidation in liver which provides excessive *acetyl* CoA, substrate for ketogenesis.
- When ketone bodies are formed, as we can't expect the 10 ATPs which *we* get from every acetyl CoA through citric acid cycle, the formula for energetics of incomplete oxidation of fatty acids is :

349. Which of the following is true about properties of VLDL/LDL-

a) In electrophoresis, VLDL migrates more cathodal than LDL

b) LDL is formed from liver

c) LDL is formed from Chylomicron

d) VLDL remnants reach extrahepatic tissues

Correct Answer - B

Ans. is 'b' i.e., LDL is formed from liver

- Lipoprotein electrophoresis of a fasting sample shows three bands - HDL, VLDL, LDL in that order from anode to cathode.
- VLDL is synthesized in liver that contains high triglyceride, ChE, cholesterol, phospholipid and Apo B-100. (VLDL particles resemble chylomicrones in composition except that VLDL contains Apo B-100 instead of Apo B-48).
- VLDL particles are secreted in the plasma and as with chylomicron, Apo E and Apo C are transferred from HDL to VLDL. Now VLDL contains Apo B-100, Apo E and Apo C.
- In plasma, triglycerides of VLDL are hydrolysed by same lipoprotein lipase (see above) and apo C is transferred to HDL and the remmants are called IDL.
- 40-60% of IDL is removed by liver via LDL receptor mediated endocytosis, this process require Apo E which acts as ligand for LDL receptors.
- Remaining IDL is remodeled by hepatic (liver) lipase which hydrolyzes more triglyceride to form LDL that contains maximum cholesterol.
- 70% of LDL is removed by liver via LDL receptor and 30% is utilized by peripheral tissues as a source of cholesterol.

350. Reverse cholesterol transport - all are true except-

a) Transport of cholesterol from extrahepatic tissues to liver

b) ATP Binding Cassette Transporter protein is involved in the conversion of HDL3 to HDL2

c) Lecithin Cholesterol Acyl Transferase helps in the conversion of Spheroidal HDL to Discoidal HDL

d) Cholesterol Ester Transfer Protein helps in increasing HDL level

Correct Answer - D

Ans. is 'd' i.e., Cholesterol Ester Transfer Protein helps in increasing HDL level

- Reverse Cholesterol Transport is the transport of Cholesterol ester and phospholipid from extrahepatic tissues to liver.
- HDL is released by both liver and intestinal cells.
- In both the cases, they are released as discoidal HDL
- Apo Al activates Lecithin Cholesterol Acyl Transferase and it converts discoidal HDL to Spheroidal HDL (HDL3)
- HDL3 activates ABC1 (ATP Binding Casette Transporter 1) to collect cholesterol and phospholipids from extra hepatic tissue membranes. This way HDL3 size increases and density decreases. Hence it forms HDL2.
- This HDL2 reaches liver to empty its contents into liver.
- On the way to liver, if HDL2 encounters IDL, Cholesterol Ester Transfer Protein (CETP) transfers Choelsterol ester from HDL2 to IDL, converting IDL to LDL. Hence CETP decreases HDL level and increases LDL level.

351. True about coproporphyrin I and coproporphyrin III is -

a) Coproporphyrin I is excreted in urine

b) Coproporphyrin III is excreted in bile

c) In Dubin Johnson Syndrome, Coproporphyrin I in urine is 80% of the total coproporphyrin

d) In Dubin Johnson Syndrome, total coproporphyrin levels is elevated

Correct Answer - C

Ans. is 'c' i.e., In Dubin Johnson Syndrome, Coproporphyrin I in urine is 80% of the total coproporphyrin

- Coproporphyrins are intermediates of heme synthesis
- Normally coproporphyrin I is excreted in bile and is lost in feces
- Coproporphyrin III is excreted in urine
- Hence in normal urine Coproporphyrin I is 25% of total coproporphyrin levels in urine
- Dubin Johson syndrome, is a form of conjugated hyperbilirubinemia and is caused by a defect of Multi Drug Resistant Protein 2 **(MRP-2),** which is responsible for secreting bile components (conjugated bile pigments) from hepatocytes into biliary canaliculi.
- In this disorder, the ratio of Coproporphyrin I : Coproporphyrin III is reversed and coproporhyrin I is more than 80% of the total Coproporphyrin levels. But the total coproporphyrin levels is normal. Possible mechanism is Coproporphyrin I is secreted into bile through MRP-2.

352. Synthetic oxygen carrier is ?

a) 2,4 dinitrophenol

b) Chloflurocarbon

c) Perflurocarbon

d) 1 fluro 2,4 dinitrophenol

Correct Answer - B

Ans. is 'b' i.e., Chloflurocarbon

- Blood doping is a form of fraudulent increase in the oxygen carrying capacity of a person, widely used to improve the aerobic capacity of athletes
- This is done by various methods
- Autologous blood transfusion
- Homologous blood transfusion
- Erythropoietin or Continuous Erythropoietin Receptor Activator

353. Abetalipoproteinemia affects ?

a) Retinal pigment epithelium

b) Optic nerve

c) Occipital cortex

d) Bipolar neurons

Correct Answer - A

Ans. is 'a' i.e., Retinal pigment epithelium

- Abetalipoproteinemia or Bassen-Kornzweig syndrome is caused by a defect of Microsomal Triglyceride Transfer Protein (MTTP).
- In abetalipoproteinemia, both chylomicron and VLDL formation get affected.
- As a result, fat absorption is affected and the affected child presents with steatorrhea in the first few months of life.
- All fat soluble vitamin absorption also get affected. Hence Vitamin A, D, E and K deficiency is expected, however Vitamin E deficiency is found to have profound effects.
- Vitamin E deficiency presents as retinitis pigmentosa and subacute combined degeneration.
- Other features of abetalipoproteinemia are acanthocytes (star shaped RBCs in peripheral smear caused because the lipid composition of RBC membrane gets affected), hypocholesterolemia.
- Treatment involves vitamin E administration.

354. Genetically mediated VLDL overproduction is a feature of all except ?

a) Familial combined hyperlipidemia

b) Hypoapobetalipoproteinemia

c) Familial dyslipidemic hypertension

d) LDL subclass B

Correct Answer - B

Ans. is 'b' i.e., Hypoapobetalipoproteinemia *[Ref Essentials of Biochemistry* p. *712]*

- Familial combined hyperlipidemia or Type lib Familial hyperlipoproteinemia is characterised by genetically determined overproduction of triglyceride rich VLDL (VLDL 1) and small dense LDL particles.
- It is the most commonly inherited disorder. Please remember Acquired combined hyperlipidemia with same features is caused by metabolic syndrome or insulin resistance.
- Hyperapobetalipoproteinemia is characterized by an increased number of small, dense LDL particles and an elevated LDL-B level with normal or borderline high LDL-C levels. Patients with Hyperapobetalipoproteinemia may have normal or high triglycerides.
- Hyperapobetalipoproteinemiahas been found to be the most common phenotype (34%) associated with premature CAD ;Hyperapobetalipoproteinemia with hypertriglyceridemiais found to be even more strongly associated with CAD than Hyperapobetalipoproteinemia with normal triglycerides.

355. Gerhardt's test is used to detect ?

a) Reducing sugar

b) Ketone body

c) Protein

d) Blood

Correct Answer - B

Ans. is 'b' i.e., Ketone body

- Gerhardt's test is a test used to detect acetoacetate in urine (acetone and (3 hydroxybutyrate do not answer this test).
- Reagents used for Gerhardt's test include Concentrated nitric acid and 10% Ferric chloride

356. Folds in collagen are due to-

a) Glycine

b) Proline

c) Hydroxyproline

d) Lysine

Correct Answer - A:B

Ans. is `b > a' i.e., Proline > Glycine *[Ref Essentials of biochemisty p. 868]*

- Two amino acids are involved in producing folds in collagen : proline and glycine.
- In order to form a triple-helix a polypeptide chain (a-chain) must contain glycine as every third residue in the sequence.
- This is because only the glycine is small enough to be accommodated in the limited space available down the central core of the triple helix. Each turn of polypeptide chain (a-chain) contains three amino acid residues, and glycine (Gly) is present at every third position.
- Thus glycine constitutes 33% of the total amino acid residues. The repeating amino acid residues, represented as (Gly-X-Y)n, is an absolute requirement for formation of triple helix. X and Y can be any amino acids, but most of the time Xis proline (10% of the total amino acid residues) and most of the time Y is hydroxyproline. Other important amino acids found in collagen are lysine and hydroxylysine.

357. Progesterone synthesis requires -

a) LDL

b) VLDL

c) HDL

d) Chylomicron

Correct Answer - C

Ans. is 'c' i.e.,HDL

- Granulosa cells use follicular fluid HDL as a source of cholesterol for the synthesis of progesterone.
- Under the influence of LH, corpus luteal cells take up cholesterol from follicular fluid HDL and convert cholesterol into progesterone.

358. The most abundant aminoacid of collagen is -

a) Glycine

b) Proline

c) Lysine

d) Tryptophan

Correct Answer - A
Ans. is 'a' i.e., Glycine

359. Site of small chain fatty acid absorption is -

a) Ileum

b) Duodenum

c) Ascending colon

d) Rectum

Correct Answer - C

Ans. is 'c' i.e., Ascending colon

- Short chain fatty acids (SCFA) are fatty acids with 2 to 6 carbon atoms. They are the major end-products of the microbial digestion of carbohydrates in the alimentary canal. These short chain fatty acids, butyrate particularly is important for colon health because it is the primary energy source for colonic cells and has anti-carcinogenic as well as anti-inflammatory properties that are important for keeping colon cells healthy. Butyrate inhibits the growth and proliferation of tumor cell lines in vitro, induces differentiation of tumor cells, producing a phenotype similar to that of the normal mature cell, and induces apoptosis or programmed cell death of human colorectal cancer cells
- The highest concentrations are observed in the large intestine (caecum and colon) of all the mammals.
- Human caecum and proximal colon have high luminal concentrations of organic nutrients (non-starch polysaccharides from plant cell walls, and proteins not absorbed by the small intestine) which maintain high bacterial growth rates. Against this fermentative background, antiperistalsis ensures retention and thorough mixing of faeces in the proximal colon, which is the site of maximal SCFA production. SCFA absorption is concentration dependent and occurs

most readily in the proximal colon (Includes cecum, ascending colon and transverse colon).

360. All of the following are true about collagen structure except -

a) Collagen is secreted by fibroblasts as procollagen

b) Lysyl oxidase is dependent on Vitamin C

c) Hydroxylysine undergoes glycosylation

d) Glycine is the most abundant aminoacid of collagen

Correct Answer - B

Ans. is 'b' i.e., Lysyl oxidase is dependent on Vitamin C

- Collagen is the most abundant protein in the body.
- Collagen is a triple helix. It is made up of 3 polypeptide chains - Each polypeptide chain has about 1000 amino acids. It is made up of repetitive units of (Gly- X - Y), where X and Y are most commonly proline and hydroxyproline. Hence 33% of aminoacid residues of collagen is glycine - the most abundant aminoacid of collagen.
- Collagen is synthesised as procollagen by fibroblasts intracellularly. After translation of mRNA of collagen in ribosomes, the polypeptide chains undergo posttranslational modifications in the form of hydroxylation and glycosylation.

361. HMG CoA is precursor of all except-

a) Ubiquinone

b) Dolichol

c) Bile pigments

d) Ketone body

Correct Answer - C
Ans. is 'c' i.e., Bile pigments

- 3 - Hydroxy 3 methyl glutaryl CoA or HMG CoA is formed from acetyl CoA.

362. Small RNAs are ?

a) Between 200 and 500 bps in length

b) Coded by small exons

c) A mode of regulation of gene expression

d) Always endogenously synthesised

Correct Answer - C

Ans. is 'c' i.e., A mode of regulation of gene expression

- Small RNAs are less than 200 nucleotides in length.
- They are coded by intronic sequences of genes.
- They help in regulation of gene expression through GENE SILENCING mechanism
- The miRNA gene sequences located within intronic sequences are transcribed by RNA polymerase III to form Pri-miRNA.
- Pri- miRNA is processed by microprocessor complex to form a stem loop structure, Pre-miRNA.

363. What is the parameter that is used to assess lipid peroxidation?

a) Malondialdehyde

b) CRP

c) hsCRP

d) Carboxymethyl lysine

Correct Answer - A

Ans. is 'a' i.e.,Malondialdehyde

- ROS can be produced by either breakage of covalent bond, addition of electrons to a molecule or removal of hydrogen by other radicals. They are generally highly reactive species and typically act as electrophilic species or oxidant agents. The most important radicals or pro-oxidant molecules involved in disease processes are superoxide (0_2-), hydroxyl radical (OH), hydrogen peroxide **(H_20_2)** and certain oxides of nitrogen, like nitric oxide (NO) and peroxynitrite (ONOO-)2
- Since it is complex measuring free radicals directly in vivo, it is necessary to carry out the quantification of cellular components which can react with these free radicals, such as proteins, DNA and mainly lipids. Once lipid peroxides are unstable compounds, they tend to degrade rapidly in a variety of sub products. *MDA (Malondialdehyde) is one of the most known secondary products of lipid peroxidation, and it can be used as a marker of cell membrane injury.*
- MDA is a three-carbon, low-molecular weight aldehyde formed by cyclization of aldehydes which have unsaturation in a or 13 positions
- Several methods have been developed to assess MDA, including

quantitative methods using spectrophotometry or fluorimetric detection, high performance liquid chromatography (HPLC), gas chromatography and immunological techniques

- Other markers of oxidative stress include conjugated dienes, ethane and pentane gases, isoprostanes and 4-HNE (4 - hydroxy 2-nonenal)

364. Ubiquitin Proteasome pathway is used for degradation of ?

a) Extracellular long lived proteins

b) Intracellular long lived proteins

c) Intracellular short lived proteins

d) Extracellular short lived proteins

Correct Answer - C

Ans. is 'c' i.e., Intracellular short lived proteins

- Extracellular proteins and intracellular long lived proteins get degraded in lysosomes with the help of cathepsin
- Intracellular short lived proteins get labelled with ubiquitin once their life span gets over.

365. Amino acid in synthesis of neurotransmitter

a) Glutamate

b) Proline

c) Cysteine

d) Alanine

Correct Answer - A

Ans. is 'a' i.e.,Glutamate

Aminoacid	Neurotransmitter
Glutamate	**Glutamate &** GABA
Glycine	Glycine
Phenylalanine & Tyrosine	Dopamine, Norepinephrine &Epinephrine
Tryptophan	Serotonin

366. Maximum buffering capacity of a buffer is maximum at pH

a) Less than pka

b) More than pka

c) Equal to pka

d) Has no relation with pka

Correct Answer - C

Ans. is 'c' i.e., Equal to pka ***[Ref Harper 30th/e*** **p.** ***21 & 29'11e p. 20, 21, 18; Vasudevan 6thie*** **p.** ***22, 23]***

- Maximal buffering capacity occurs at pH equal to pka of buffer.
- Therefore, to work as a best buffer at physiological pH amino acid should have pka value close to physiological pH (7.4).
- Amino acids can have buffering action due to three ionizable groups :-
- a-carboxyl group :- Different amino acids have pka value of a-carboxyl group between 3.5-4. So, carboxyl group of amino acids has maximum buffering capacity between pH 3.5-4.
- a-amino group :- Different amino acids have pka value of a-amino group between 8.0-9.0. Thus, a-amino group has maximum buffering capacity between pH 8.0-9.0.
- Special ionizable group (in some amino acids) :- Among special ionizable group of amino acids, imidazole group of histidine has pka value 6.5-7.4, which is closest to physiological pH. Hence, histidine (due to imidazole group) has maximum buffering capacity at physiologial pH.

367. LacY in Lac Operon codes for ?

a) B Galactosidase

b) Galactoside Permease

c) Thiogalactoside Transacetylase

d) Repressor

Correct Answer - B

Ans. is 'b' i.e., Galactoside Permease

- These code for 3 proteins that are involved in catabolism of lactose. These genes are 'Z' gene (codes for P-galactosidase), 'Y' gene (codes for galactoside permease), and 'A' gene (codes for thiogalactoside transacetylase).

368. Essential amino-acid deficiency affect nitrogen balance by

a) Increasing protein degradation

b) Decreasing protein degradation

c) Decreasing protein synthesis

d) Increasing protein synthesis

Correct Answer - C

Ans. is 'c' i.e., Decreasing protein synthesis *[Ref Principles of medical Biochemistry p. 464]*

- Nitrogen balance is the difference between ingested nitrogen and excreted nitrogen.
- Nitrogen balance = N ingested - N excreted
- Because dietary proteins are an important source of nitrogen, nitrogen balance is an important index of protein and amino acid metabolism.
- In healthy adults, nitrogen balance is zero, i.e. a state of nitrogen equlibrium exists, where nitrogen intake is equal to nitrogen excretion.
- Negative nitrogen balance (excretion exceeds intake) in dietary protein deficiency
- In adult, even of protein starved, at least 30-40 gm of amino acids are degraded each day; this amount defines the minimum dietary requirment. If dietary supply drops below this limit, a negative nitrogen balance occurs and the body protein is lost. Essential amino acid deficiency has the same effect because relative deficiency.

369. Function of tyrosinase is

a) Synthesis of norepinephrine

b) Synthesis of dopamine

c) Synthesis of melanin

d) All of the above

Correct Answer - C

Ans. is 'c' i.e., Synthesis of melanin *[Ref Harper 29th/e p. 288-290]*

Note- Tyrosine hydroxylase and tyrosinase catalyzes the conversion of tyrosine to Dopa, but both are defferent enzymes. Tyrosine hydroxylase is involved in catecholamines synthesis in adrenal medulla and sympathetic ganglia, whereas tyrosinase is involved in melanin synthesis in melanoblasts of skin.

370. Chimeric DNA true are all except ?

a) Formed by linking DNA fragments of unrelated genome

b) Sticky end producing restriction endonucleases favour formation of chimeric DNA

c) They don't require DNA ligases

d) The organism harbouring a chimeric DNA has features of themselves and the properties of the insert

Correct Answer - C

Ans. is 'c' i.e., They don't require DNA ligases

- Chimeric DNA or recombinant DNA is formed by linking DNA fragments of two unrelated genome.
- It is a step involved in recombinant DNA technology.
- It is done to introduce a favourable quality into an organism like ability to produce insulin by E.Coli (Done by linking insulin cDNA into a vector and introducing the recombinant vector or chimeric DNA into E.Coli) or insect resistance in crops (done my introducing the gene fragment capable of producing Bacillus thurengiensis) into Ti plasmid and introducing the chimeric DNA or recombinant DNA into growing plants).

371. Enzyme which acts on aspartate

a) Serum Glutamate Pyruvate Transaminase *(SGPT)*

b) Serum Glutamate Oxaloacetate Transaminase *(SGOT)*

c) Ornithine transcarbmaylase (OTC)

d) Argininosuccinate lyase *(ASL)*

Correct Answer - B

Ans. is 'b' i.e., Serum Glutamate Oxaloacetate Transaminase (SGOT)

- SGPT catalayses the transamination between Alanine and a Ketoglutarate.
- Alanine + a Ketoglutarate Pyruvate + Glutamate
- It is in no way related to aspartate.
- SGOT catalyses the transamination between Aspartate and a Ketoglutarate

372. Proteins are stored as ?

a) Structural proteins

b) Functional proteins

c) Fats

d) Lysosomal enzymes

Correct Answer - C

Ans. is 'c' i.e., Fats

- There is no storage form of protein
- Hence the aminoacids formed by breakdown of proteins undergo catabolism
- During catabolism, most of the aminoacids give off their amino groups and then the carbon skeleton undergoes catabolism
- On catabolism, the carbon skeleton of aminoacids give rise to glycolytic intermediate or citric acid cycle intermediates.

373. Allosteric stimulator of glutamate dehydrogenase is

a) ATP

b) GTP

c) Palmitoyl CoA

d) Leucine

Correct Answer - D

Ans. is 'd' i.e.,Leucine

- GLDH is allosterically stimulated by ADP, GDP, leucine, valine and isoleucine.
- It is inhibited by ATP, GTP, palmitoyl CoA and Zinc.

374. Aminoacyl tRNA gets attached to which site of ribosome?

a) P site of 40s ribosome

b) A site of 60s ribosome

c) A site of 40s ribosome

d) P site of 60s ribosome

Correct Answer - B

Ans. is 'b' i.e., A site of 60s ribosome

- Translation is a process by which nucleotide bases of mRNA get translated as aminoacid sequences of polypeptide chain. It takes part in free ribosome.
- Free ribosome reads the mRNA from 5' end to 3' end. It reads the codons of mRNA one by one. Depending upon the codon that is present in mRNA, ribosome is capable of attaching a complementary anticodon containing tRNA.
- This tRNA carries a corresponding aminoacid. This way the polypeptide chain grows from amino terminal end to carboxy terminal end.
- Eukaryotic ribosome is a 80s unit. It dissociates into 40s and 60s subunits. 60s subunit contains P site and A site.
- When ribosome enters into chain elongation, on the P site of 60s, is attached the AUG codon of mRNA, to which initiation methionine tRNA is attached and A site is free

375. Which of the following is a biologically important tripeptide?

a) Thyrotropin releasing hormone

b) Thyroid stimulating hormone

c) Gonadotropin releasing hormone

d) Follicle Stimulating hormone

Correct Answer - A

Ans. is 'a' i.e., Thyrotropin releasing hormone

- Tripeptide is a peptide with 3 aminoacids and 2 peptide linkages.
- Biologically important tripeptides include glutathione, TRH (Thyrotropin Releasing Hormone) and melanostatin.
- TSH is a glycoprotein not a peptide. It is made up of two subunits - a and (I a subunit is a polypeptide with about 92 aminoacids. It is a structural analogue of a subunit of FSH. LH and HCG. B subunit is a polypeptide made up of 118 aminoacids.
- GnRH (Gonadotropin releasing Hormone) is a decapeptide with 10 aminocids.
- FSH is a glycoprotein with two subunits - a and p. a subunit is a polypeptide with about 96 aminoacids. It is a structural analogue of a subunit of TSH. LH and HCG. p subunit is a polypeptide made up of 111 aminoacids.

376. Left handed helix is seen in -

a) B DNA

b) A DNA

c) Z DNA

d) F DNA

Correct Answer - C
Ans. is 'c' i.e., Z DNA
Based on quartenary structure of DNA many conformations are possible out of the common three forms are – B DNA, A DNA and Z DNA.
Z DNA

- It is found in those regions of chromosomes which are rich in GC sequences
- It is a left handed helix
- Every full turn has 12 base pairing.

377. DNA fragments are separated by ?

a) Ultracentrifugation

b) Agarose gel electrophoresis

c) Paper chromatography

d) High pressure liquid chromatography

Correct Answer - B
Ans. is 'b' i.e., Agarose gel electrophoresis *[Ref Essentials of biochemistry p.* 756]
DNA is cut into large fragments, using restriction enzymes. These fragments are then separated by gel electrophoresis (either agarose or polyacrylamide gel electrophoresis).

378. Carbamoyl Phosphate synthetase I [CPSI] true is

a) It is present in cytoplasm

b) It is involved in pyrimidine synthesis

c) N- Acetyl Glutamate is an allosteric stimulator of CPSI

d) Glutamine is the amino group donor for CPSI

Correct Answer - C

Ans. is 'c' i.e., N- Acetyl Glutamate is an allosteric stimulator of CPSI

PROPERTY	**CPS - I**	**CPS - II**
Pathway	**Urea cycle**	**Pyrimidine synthesis**
Subcellular location	Mitochondria	Cytoplasm
Amino Group donor	Ammonia	Glutamine
Allosteric regulation	Stimulated by N - Acetyl Glutamate(NAG)	Inhibited **by** the products - pyrimidine nucleotides,Uridine,Cyti & Thymidine

379. Molecular mimicry is established in the presence of ?

a) Cysteine

b) Alanine

c) Glycine

d) Tryptophan

Correct Answer - A

Ans. is 'a' i.e., Cysteine

- Molecular mimicry is caused by structural homology or similarity between foreign antigens and self-antigens.
- As a result of structural similarity a T cell or B cell activated against a foreign antigen cross reacts with self-antigen and causes autoimmunity.
- Molecular mimicry does not always expect a sequence similarity to get initiated. It is found to be induced even when the self antigens and exogenous antigens share the same binding motif with MHC (Major Histocompatibility Complex).
- This binding motif similarity is more often found in the presence of cysteine (forms disulphide bridges), arginine or lysine (form hydrogen bonds) in the binding site of antigens.

380. All of the following can determine protein structure except

a) Edman's Sequencing

b) X ray crystallography

c) Optical rotatory dispersion

d) Spectrophotometry

Correct Answer - D

Ans. is 'd' i.e., Spectrophotometry

Methods used for studying primary structure :

A) Sanger's sequencing

- Sanger's reagent is (1 fluro 2,4 Dinitrobenzene)

B) Edman's Sequencing

- Edman's reagent is Phenylisothiocyanate

C) Reverse Sequencing

- It has to be supplemented by Mass Spectrometry

Methods used for studying secondary structure:

1. Optical Rotatory Dispersion
2. Ocular Dichorism

Methods used for studying tertiary structure:

1. X-ray Crystallography
2. UV spectroscopy
3. NMR spectroscopy

381. Edman's reagent is used for

a) DNA sequencing

b) Protein sequencing

c) Protein Denaturation

d) DNA denaturation

Correct Answer - B

Ans. is 'b' i.e., Protein sequencing

- Edman's reagent is Phenyl isothiocyanate.
- Phenyl isothiocyanate is used for sequencing proteins
- Phenyl isothiocyanate binds to a aminogroups. In a protein, only aminoterminal aminoacid's a aminogroup will be free.
- Hence when Phenylisothiocyanate is added to a peptide which is adsorbed on to a glass fibre coated with a polymer, in the presence of 12% trimethylamine, it reacts with the amine group of N terminal aminoacid.
- By acid hydrolysis, the first aminoacid is cleaved from the polypeptide chain and the aminoacid is identified by chromatography.
- The cycle is continued. This way 50 aminoacids can be sequenced.

382. Most abundant aminoacid in brain is

a) Glutamate

b) Aspartate

c) Glutamine

d) Asparagine

Correct Answer - A

Ans. is 'a' i.e., Glutamate

- Glutamate is the most abundant free alpha aminoacid found in Brain.
- It is an acidic polar aminoacid.
- It is the predominant excitatory neurotransmitter of brain.
- It is synthesised in brain from glutamine and a Ketoglutarate.
- Glutamate is released from presynaptic excitatory neurons in a calcium dependent manner.
- Glutamate acts on both inotropic and metabotropic receptors.
- Inotropic receptors of glutamate include :
- Kainate receptors
- AMPA receptors
- NMDA receptors

383. Cystine has how many molecules of cysteine?

a) 1

b) 2

c) 3

d) 4

Correct Answer - B

Ans. is 'b' i.e., 2

- Cysteine is a sulphur containing aminoacid
- It is a polar but uncharged aminoacid
- Cysteine with a sulfhydryl group can get oxidised and forms a dimer (2) called as cystine.
- Cysteine acquires its polar nature only by virtue of its sulfhydryl group.

384. Jumping genes are ?

a) Moderately repetitive sequences

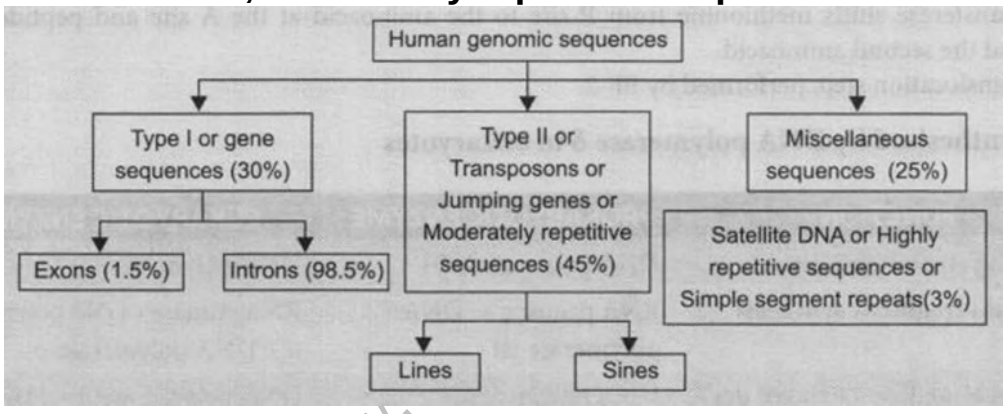
b) Highly repetitive sequences

c) Satellite sequences

d) Simple segment repeat sequences

Correct Answer - A

Ans. is 'a' i.e., Moderately repetitive sequences



385. Vitamin given in homocysteinuria are all except

a) Vitamin B6

b) Vitamin B12

c) Folate

d) Thiamine

Correct Answer - D

Ans. is 'd' i.e., Thiamine

- Major fate of homocysteine is that it gets converted into cysteine in the presence of cystathionine I synthase. Cystathionine p synthase is dependent on pyridoxal phosphate.
- Hence defect of cystathionine p synthase can result in homocysteinuria. This is called as classical homocysteinuria. This condition responds to *B6 administration,* as the enzyme cystathione p synthase is dependent on B6.
- Minor fate of homocysteine is that it gets converted into methionine in the presence of methionine synthase. Methionine synthase is dependent on *methyl cobalamine (coenzyme form of Vitamin B12).* Methyl group donor for methylcobalamine is *methyl THFA.*
- Homocysteinuria is also caused by defect of methionine synthase. As this enzyme is dependent on Vitamin B12 and THFA, homocysteinuria responds to B12 and THFA administration

386. Glutathione is used to detoxify which free radical?

a) Hydrogen peroxide

b) Superoxide

c) Peroxyl radical

d) Singlet Oxygen

Correct Answer - A

Ans. is 'a' i.e., Hydrogen peroxide

- Glutathione is a tripeptide.
- It is gamma glutamyl cysteinyl glycine
- It is denoted as GSH - because it has cysteine with a sulphydryl group
- It is used to detoxify hydrogen peroxide and lipid peroxides in the presence of glutathione peroxidase.
- Glutathione can also detoxify peroxyl radical. Peroxyl radical can not get reduced by enzymatic reactions. They get detoxified by antioxidants like vitamin E and Glutathione
- Singlet oxygen gets detoxified principally by polyphenol antioxidants
- Superoxide radicals are detoxified by Superoxide dismutase (SOD) using Zinc as electron acceptor or donor (Some classes of SODs use iron or Nickel as electron acceptor or donor)

387. Ataxia telangiectasia is caused by a defect of ?

a) Base Excision Repair

b) Nucleotide Excision repair

c) Mismatch repair

d) ds DNA break repair

Correct Answer - D

Ans. is 'd' i.e., ds DNA break repair

DNA repair	**Defect associated**
Mismatch repair	Hereditary Non polyposis Colon Cancer
Nucleotide Excision Repair	Xeroderma pigmentosa, Cockayne syndrome
Double Stranded DNA Break Repair	Ataxia Telangiectasia, Bloom's syndrome, Fanconi's anemia

388. Bond formation between ribose sugar and nitrogen is ?

a) Acidanhydride linkage

b) Phosphodiester linkage

c) Phosphoester linkage

d) Glycosidic linkage

Correct Answer - D
Ans. is 'd' i.e., Glycosidic linkage
Pentose sugar (ribose or deoxyribose) is linked to a nitrogenous base (purine or pyrimidine) via covalent N-glycosidic bond to form nucleoside

389. The linkage which links individual nucleotides in a polynucleotide chain is -

a) p N- Glycosidic linkage

b) a N - glycosidic linkage

c) 3'5' Phosphodiester linkage

d) 5'3' Phosphodiester linkages

Correct Answer - C

Ans. is 'c' i.e., 3'5' Phosphodiester linkage

Nucleoside	N-glycosidic bond between pentose sugar and nitrogenous base.
Nucleotide (monophasphate nucleatide)	Posphoester linkage (not phosphodiester) between nucleoside and phosphate grp.
Diphosphate & polyphosphate nucleotides	Acid anhydride linkage between monophosphate & other phosphate grp
Polynucleotide chain	3'5' phosphodiester linkage between 3' hydroxyl group nucleotide with 5' phosphate group of next nucleotide.

390. All of the following are true about Nucleic Acid Sequence Based Amplification except ?

a) It is a specific amplification of RNA

b) It is a replacement for reverse transcriptase PCR

c) Denaturation is carried out at 94°C

d) It requires Reverse transcriptase.

Correct Answer - C

Ans. is 'c' i.e., Denaturation is carried out at 94°C

- Nucleic Acid Sequence Based Amplification (NASBA) or Isothermal RNA amplification is a replacement for Reverse transcriptase PCR (RT-PCR).
- Both NASBA and RT-PCR are used for amplifying desired or specific RNA fragments.
- In RT-PCR, first the desired RNA is converted to dsDNA using reverse transcriptase and then the dsDNA is amplified using PCR technique

391. Regarding FISH all are true except ?

a) Used to detect copy number variations

b) Used to detect balanced translocations

c) Requires oligonucleotides

d) Requires DNA polymerase

Correct Answer - D

Ans. is 'd' i.e., Requires DNA polymerase

- **Fluoroscent in Situ Hybridisation** is a cytogenetic technique used to detect chromosomal abnormalities.
- This technique uses fluorescently labelled **oligonucleotides** or DNA probes. These probes bind to specific sequences of a chromosome. Attached to the probes are reporter fluorescent dyes which under fluorescence microscopy confirm the presence or absence of a particular chromosomal aberration.
- In FISH, the target is the nuclear DNA of either interphase cells or of metaphase **chromosomes** affixed to a microscope slide. When a specific probe is added, it anneals to its complementary sequence in the affixed DNA. As the probe is labelled with a reporter molecule it is visualized by fluorescence microscopy

392. True about pyrimidine catabolism is ?

a) It is a source of uric acid

b) β aminoisobutyrate is generated

c) Unlike other catabolic pathways, it does not generate intermediates of citric acid cycle

d) Increased pyrimidine catabolism causes decreased synthesis of carnosine

Correct Answer - B

Ans. is 'b' i.e., β aminoisobutyrate is generated

- In pyrimidine catabolism, first cytidine and thymidine are converted to uridine by deamination and demethylation respectively.
- Uridine in the presence of phosphorylase gets converted into uracil.
- Uracil undergoes hydrogenation in the presence of dihydrouracil dehydrogenase to form dihydrouracil
- Dihydrouracil hydratase opens the ring of dihydrouracil to form a linear structure

393. True about Purine synthesis ?

a) Glutamine is the amino group donor for N9

b) PRPP synthetase is the rate limiting enzyme of purine synthesis

c) THFA is necessary for forming C6 of purine ring

d) GMP is the first nucleotide to be formed during purine synthesis

Correct Answer - A

Ans. is 'a' i.e.,Glutamine is the amino group donor for N9

- In purine nucleotide synthesis, first Ribose 5 phosphate is activated by PRPP synthetase to form PRPP.
- This PRPP gets attached to N9 (source is glutamine) in the presence of PRPP glutamine amido transferase. This is the rate limiting enzyme of purine synthesis.
- PRPP synthetase is a common enzyme of pyrimidine nucleotide synthesis and of niacin adenine dinucleotide synthesis. As PRPP synthetase is not committed for Purine nucleotide synthesis, it can not be considered as the rate limiting enzyme of purine synthesis.
- In purine synthesis, Inosine monophosphate (IMP) is first formed
- IMP on amination with Aspartate gives rise to AMP in the presence of adenylosuccinate synthetase. This step needs GTP as a source of energy
- IMP on dehydrogenation by IMP dehydrogenase followed by amination with glutamine will give rise to GMP. This step used ATP as a source of energy

394. Antistress Vitamin is?

a) Vitamin B1

b) Vitamin B2

c) Vitamin B3

d) Vitamin B5

Correct Answer - D
Ans. is 'd' i.e., Vitamin B5
Vitamin B5 or pantothenic acid is called as an antistress vitamin as it is found to have an impact on cortisol release and is found to support our immune system.

395. Match enzyme with the disease caused due to its deficiency -

Enzyme	Disease
Fumarylacetoacetate	A. Tyrosinemia Type II
Tyrosine transaminase	hydroxylase
Tyrosinase	B. Homogentisate Oxidase
Alkaptonuria	C. Tyrosinemia Type I
	D- Albinism

a) I → D, 2 → C, 3 → A, 4 → B

b) I → A,2 → C,3 → D, 4 → B

c) 1 → C,2 → D,3 → A,4 → B

d) I → C, 2 → A, 3 → D, 4 → B

Correct Answer - D

Ans. is 'd' i.e., 1 -[p] C, 2 → A, 3 → D, 4 → B *[Ref Harper 29th/e* p. *289]*

396. Regarding NAD and NADP, true is ?

a) Precursor is tyrosine

b) Malic enzyme is an NAD dependent enzyme

c) High leucine causes niacin deficiency

d) Niacin deficiency causes cutaneous vasodilatation

Correct Answer - C

Ans. is 'c' i.e., High leucine causes niacin deficiency

- NAD and NADP are nicotinic acid derivatives which is synthesized from tryptophan (not tyrosin)
- Malic enzyme is NADP dependent enzyme (not NAD dependent)
- Excess of leucine inhibits the conversion of tryptophan into niacin and causes pellagra.
- Niacin deficiency causes Pellagra. Pellagra characterised by the three Ds - Diarrhoea, Dermatitis and Dementia is caused by niacin or vitamin B3 deficiency.

397. Which of the following has two amino groups-

a) Glycine

b) Arginine

c) Lysine

d) Asparagine

Correct Answer - B

- Histidine has two imino groups.
- Lysine has one amino group.
- Arginine has two amino groups

398. Deficiency of which vitamin during pregnancy predisposes to meningomyelocele?

a) Folic acid

b) Biotin

c) Pyridoxine

d) Thiamine

Correct Answer - A

Ans. is 'a' i.e.,Folic acid

Folic acid deficiency in pregnancy predisposed to NTD (e.g. myelomeningocele, meningocele, spina bifida).

399. Vitamin B12 deficiency causes all except ?

a) Homocysteinuria

b) Methylmalonic aciduria

c) Subacute combined degeneration

d) Epinephrine excess

Correct Answer - D

Ans. is 'd' i.e.,Epinephrine excess *[Ref Dinesh Puri 3rd le p. 381]*

- Deficiency of vitamin B12 causes Pernicious anemia, megaloblastic anemia (secondary to functional folate deficiency due to folate trap), methylmalonic aciduria due to accumulation of methylmalonyl-CoA, and neuropathy, like subacute combined degeneration (SACD) and demyelination.
- There may homocysteinuria as methionine synthase, a methylcobalamine dependent enzyme, is defective.

400. Alternate fuel for brain is

a) Glucose

b) Ketone bodies

c) Fatty acid

d) Aminoacid

Correct Answer - B

Ans. is 'b' i.e., Ketone bodies

- **There** is no stored fuel in brain, but it utilizes 60% of total energy under resting conditions.
- Glucose is virtually the sole fuel for the brain, except in prolonged starving when ketone bodies are the major source.
- Fatty acids do not serve as fuel for the brain, because they are bound to albumin in plasma; hence cannot cross the blood-brain barrier.

401. Pyruvate can be a substrate of all except

a) Lactate Dehydrogenase

b) Malic enzyme

c) Aspartate transaminase

d) Alanine transaminase

Correct Answer - C

Ans. is 'c' i.e., Aspartate transaminase

- There are several pathways into which pyruvate can enter. The pathway chosen in a given tissue depends on its state of oxygenation and prevailing metabolic conditions, as described below :
- Oxidative decarboxylation to acetyl CoA
- In tissues that are adequately perfused with oxygen (i.e., under aerobic conditions), pyruvate undergoes oxidative
- decarboxylation to form acetyl CoA, which is further catabolized to CO_2 and H_20 via citric acid cycle (Krebs cycle). This reaction serves as a bridge between glycolysis and Kreb's cycle. Thus, pyruvate serves as the source of substrate of first reaction of TCA (Citric acid cycle), i.e., acetyl CoA.

402. Which of the following elements is known to influence the body's ability to handle oxidative stress?

a) Fluride

b) Iron

c) Copper

d) Selenium

Correct Answer - D
Ans. is 'd' i.e., Selenium *[Ref: Pankaj Naik p. 382]*
The activity of the antioxidant enzymes depends on supply of minerals:?
* Manganese
* Zinc
* Copper
* Selenium
- Manganese, copper and zinc are required for the activity of superoxide dismutase.
- Selenium is required for the activity of glutathione peroxidase.

403. Gas released from oligosaccharide metabolism by intestinal bacteria is

a) Carbondioxide

b) Sulphur dioxide

c) Nitric oxide

d) Methane

Correct Answer - D

Ans. is 'd' i.e., Methane

- Some food items are high in indigestible oligosaccharides . Eg, transgalactooligosaccharides, fructooligosaccharides (Inulin)
- Since these oligosaccharides do not get digested in the small intestine, they reach the large intestine.
- Large intestinal microorganisms breakdown these oligosaccharides to form short chain fatty acids like propionate, butyrate. These short chain fatty acids are found to be trophic to intestinal mucosa. It has anti-inflammatory effects too. Hence these are found to protect intestinal malignancy. This is the basis of prebiotics being supplemented to people with intestinal inflammatory disorders and to maintain intestinal flora.
- But the downside of these indigestible oligosaccharides is that, when microorganisms act on these oligiosaccharides, they result in gas production. The gases produced includes the usual hydrogen, nitrogen and carbondioxide. Apart from that when oligosaccharides are acted upon by microorganisms, it results in methane production.
- This methane is found to have the bloating and flatulence effect.

404. Chain breaking antioxidants are all except -

a) Tocopherol

b) Ascorbic acid

c) Polyphenolic flavinols

d) Superoxide dismutase

Correct Answer - D

Ans. is 'd' i.e., Superoxide dismutase

- Chain breaking antioxidants are molecules which can donate an electron or accept electron from unstable intermediates of lipid peroxidation converting them into stable intermediates.

They are of two two types

- Lipid phase chain breaking antioxidant
- Aqueous phase chain breaking antioxidant
- Lipid phase chain breaking antioxidant
- The most important lipid phase chain breaking antioxidant is a tocopherol. a tocopherol reacts with peroxyl radical to form tocopheroxyl radical with excess charge associated with extra electron being distributed along the chromane ring.
- Aqueous phase chain breaking antioxidant
- The most important chain breaking antioxidant of this type is ascorbic acid or vitamin C. It can scavenge many superoxide radicals. Most importantly it helps by regenerating tocopherol after it is oxidised during the process of reducing peroxyl radicals.
- Apart from vitamin C we have a group of polyphenol flavinols like epitachin gallate which can reduce oxidant species in aqueous phase. These are present in green tea and some antioxidant supplements

- Superoxide dismutase is an antioxidant enzyme which helps in detoxifying superoxides to form molecular oxygen and hydrogen peroxide. It is not a chain breaking antioxidant

405. Which vitamin is required for conversion of serine to glycine?

a) Vit C

b) B12

c) Pyridoxine

d) Thiamine

Correct Answer - C

Ans. is 'c' i.e., Pyridoxine *[Ref Harper 29^{0}/e* p. *267-268]*

- Glycine is a non essential amino acid synthesized from another nonessential aminoacid serine
- Serine in the presence of Serine hydroxyl methyltransferase (SHMT) gets converted to glycine. SHMT is a pyridoxine dependent enzyme. This step uses tetrahydrofolate as coenzyme and it gets converted to N5, N10 methylene THFA, which then acts as 1 carbon donor and helps in the conversion of uridine to thymidine.

406. Which of the following vitamins is significantly synthesised in gut by intestinal flora?

a) Folate

b) B12

c) Biotin

d) B6

Correct Answer - A:B:C

Ans. is 'c > 'b' & 'a' i.e., Biotin > B12 & Folate

- Though vitamins are supposed to be essential micronutrients which are supposed to be supplied in the diet, some vitamins like Vitamin D and Niacin are endogenously synthesised.
- Vitamin D3 or cholecalciferol is synthesised in the skin epidermis when UV light acts on 7 dehydrocholesterol which is present in the malphigian layer. UV light opens up one of the rings of cholesterol, converting cholesterol into a secosteroid which is cholecalciferol.
- Cholecalciferol reaches liver. In liver it is hydroxylated at 25th position by 25 a hydroxylase to form 25 hydroxycholecalciferol
- 25 hydroxycholecalciferol reaches the kidney. It is hydroxylated at 1st position by 1 a hydroxylase to form 1,25 dihydroxycholecalciferol, the active form of vitamin D.
- Niacin's active coenzyme forms NAD and NADP are synthesised endogenously from aminoacid tryptophan
- Apart from these two vitamins synthesised by human metabolic pathways, there are vitamins like Biotin, Vitamin K which are synthesised to significant amount in large intestine by intestinal microorganisms. Research has identified synthesis of folate and B12

as well in large intestine.

- Though they are synthesised in large intestine, as all water soluble vitamins get absorbed in small intestine, only endogenously synthesised Biotin and Vitamin K are found to contribute significantly to metabolic pathways. That is why biotin and vitamin K deficiencies are relatively rare.

407. Headache and papilledema are features of toxicity of which vitamin?

a) Vitamin A

b) Vitamin D

c) Vitamin C

d) Vitamin E

Correct Answer - A
Ans. is 'a' i.e., Vitamin A
Hypervitaminosis A

- Caused by consumption of food rich in vitamin A like fish or liver (not by excessive intake of carotenoids as the conversion of carotene to vitamin A is regulated).

Mechanism of toxicity:

- Suppresses osteoblasts and stimulates osteoclasts.
- High retinol concentrations stimulate lysosomal enzyme release and cause local tissue damage.
- Features include anorexia, irritability, headache, skin peeling, vomiting. Headache, vomiting and papilledema are found to be caused by increase in intracranial tension. Hence this condition is called as pseudotumourcerebri. As vitamin A stimulates osteoclasts, hypercalcemia, bony projections, pathological fractures are also observed as features.

408. Vitamin B12 is required for all of the following except ?

a) Conversion of homocysteine to methionine

b) Conversion of homocysteine to cysteine

c) Conversion of propionyl coA to succinyl CoA

d) Conversion of methyl THFA to THFA

Correct Answer - B

Ans. is 'b' i.e., Conversion of homocysteine to cysteine

Active form of vitamin B12 are methylcobalamine and deoxyadenosylcobalamine. Following reactions require vitamin B12 coenzyme :

i) Isomerization of methylmalonyl CoA to succinyl CoA :

- In this reaction, active form of vitamin B12 is deoxyadenosyl cobalamine.
- Propionyl-CoA is produced as catabolic end product of some alipathic amino acids and (3-oxidation of odd chain fatty acids. Propionyl CoA is then converted to succinyl CoA through methylmalonyl-CoA.
- Thus methylmalonyl-CoA is accumulated and excreted in urine as methylmalonic acid (methylmalonate) in vitamin **B12** deficiency, i.e. methylmalonic aciduria.

ii) Conversion of homocystein to methionine

- In this reaction, active form is methylcobalamine.
- This is the only reaction which requires both vitamin 8_{12} (as methylcobalamine) and folic acid (as N5-methyl-114-folate).
- The reaction is catalyzed by the enzyme cobalamin-dependent methionine synthase also called 5- methyltetrahydrofolate -

homocysteine methyltransferase.

409. Alcoholism leads to deficiency of which vitamin ?

a) Vitamin A

b) Vitamin B1

c) Vitamin D

d) Vitamin B6

Correct Answer - B

Ans. is 'b' i.e.,Vitamin B1

Of all the micronutrients, thiamine **will** be the first micronutrient to become deficient. Reason is, apart from the person missing his mixed balanced diet, alcohol is also found to interfere with thiamine absorption. The third reason related to thiamine deficiency in a chronic alcoholic is that alcohol interferes with magnesium absorption. Magnesium is necessary for activation of thiamine to its coenzyme form thiamine pyrophosphate in the presence of thiamine kinase.

410. AST/ALT > 2 occurs in deficiency of

a) Glucose-6-phosphotase

b) Branching enzyme

c) Acid maltase

d) Liver phosphorylase

Correct Answer - C

Ans. is 'c' i.e., Acid maltase *[Ref Read below]*

- In liver diseases, ALT (alanine transaminase) is elevated more than AST (aspartate transaminase). So, in liver diseases ALT/ AST ratio is elevated.
- But, when AST is higher than ALT, a muscle, source of these enzymes should be considered.
- Among the given options, only acid maltase deficiency (Pompe's disease) is myopathic form of glycogen storage disease (muscular glycogenosis). Thus, AST/ALT ratio may be more than 2.
- Other three options are liver glycogenoses (AST/ALT < 1, as ALT is raised more than AST).

411. LDH has how many isoenzymes

a) 3, based on B and M polypeptide subunits

b) 5, based on B and M polypeptide subunits

c) 7, based on H and M polypeptide subunits

d) 5, based on H and M polypeptide subunits

Correct Answer - D

Ans. is 'd' i.e., 5, based on H and M polypeptide subunits

lRef: Dinesh puri 3'd/e p. 1221

- LDH is a tetramer with two types of polypeptide units : (H) (for heart) and M (for muscle).

It has five isoenzymes:

- LDH 1 (HHHH), LDH 2 (HHHM), LDH3 (HHMM), LDH 4 (HMMM), and LDH s (MMMM).
- LDH-I and LDH-2 are the predominant isozymes in myocardium, therefore these are raised in MI (LDHf > LDH2),
- LDH-f is more specific for myocardium (as it has 4H) than LDH-2.
- The predominent isoenzyme in liver is LDH5; Hence LDH5 is raised in liver diseases like viral hepatitis.
- Normal LDH pattern on electrophoresis is LDH2 > LDHI > LDH 3 > LDH 4 > LDH5.
- In MI LDHI is raised more thar LDHz, So, pattern becomes LDHI > LDH2 > LDH3 > LDH4 > LDH5.
- Increase in total LDH level is also seen in hemolytic anemia, hepatocellular damage, muscular dystrophies, leukemia,
- carcinomas, cerebrovascular accident, pancreatitis, kidney disease, intestinal and pulmonary infarction, megaloblastic anemia and infectious mononucleosis. Therefore study of specific

isozyme is more significant.

412. Example of allosteric inhibition

a) Inactivation of glycogen synthase by phosphorylation

b) Decreased synthesis of glucokinase by glucagon

c) Inhibition of PFK-1 by citrate

d) All of the above

Correct Answer - C
Answer-Ans. is 'c' i.e., Inhibition of PFK-l by citrate [lRef, Dinesh puri 3d/e p. 1161]
Enzyme:-Phosphofructokinase I
Pathway:- Glycolysis
Stimulator:- AMP, ADP, fructose-6-phosphaie, fuctose-2,6-bisphophate.
Inhibitor:- ATP, citrate, Ca2+, Mg+

413. Lysyl oxidase requires which cofactor -

a) Zn

b) Cu

c) Se

d) Fe

Correct Answer - B

Ans. is'b'i.e., Cu [Rel Harper 27t'/e p. 546]

metal	**metalloenzymes**
Calcium	Lipase, Lecithinase
Copper	Cytochrome oxidase, Tyrosinase, Lysyl oxidase, Superoxide dismutase, Ascorbic acid oxidase, Ferroxidase (ceruloplasmin)
iron	Cytochrome oxidase, Xanthine oxidase, Catalase, Peroxidase
Zinc	Carbonic anhydrase, alkaline phosphatase, RNA polymerase, alcohol dehydrogenase, Carboxypeptidase, Prophobilinogen synthase, glutamate dehydrogenase, lactate dehydrogenase, Superoxide dismutase
Magnesium	Hexokinase, phosphofructokinase, glucose-6-phosphatase, enolase, creatinine kinase, Phosphatases, kinase
Manganese	Arginase, Pyruvate carboxylase, phosphoglucomutase, Glycosyl transferase, Hexokinase, Enolase
Potassium	Pyruvate kinase
Selenium	Glutathione peroxidase
Nickel	Urease
molybdnum	Xanthine oxidase

molybdenumXanthine oxidase

414. Mechanism of conversion of trypsinogen to trypsin -

a) Hydrolysis

b) Phosphorylation

c) Removal of part of protein

d) Removal of Carboxyl group

Correct Answer - C

Ans. is'c'i.e., Removal of part of protein [Ref: Dinesh puri 3'd/e p- 1181

- All zymogens (including trypsinogen) are activated by removal of a small length of protein (few amino acids) from one end of the molecule.
- Trypsinogen → → Trypsin + peptide fragent
- Pepsinogen → → pepsin +peptide fragment

415. True about NADP -

a) Acts as coenzyme form of Niacin

b) Involved in HMP shunt

c) Not involved in glycolysis

d) All are true

Correct Answer - D

Ans. is'd'i.e., All are true

- Niacin, in the form of nicotinamide, is incorporated into the structure of two coenzymes: nicotinamide adenine dinucleotide
- (NAD+) and nicotinamide adenine dinucleotide phosphate (NADP+)
- NADP is involved in HMP shunt and NAPDH is produced.
- In glycolysis NAD is involved (not NADP).

416. In malate shuttle, NADH Produces how many ATPs

a) 1

b) 1-5

c) 2

d) 2.5

Correct Answer - D

Ans-is'd'i.e., 2.5 (Ref : Harp* 2*/e p. 129-130)

- In glycerophosphate shuttle, the mitochondrial ennlme is linked to respiratory chain (ETC) via a flavoprotein, So only l.5 mol of ATP are produced (According to older calculations,2 ATP mol of ATP are produced).
- In malate shuttle, the mitochondrial enzyme is linked to ETC via NAD, so 2.5 mol of ATP are produced (according to older calculations 3 mol of ATP are produced).

417. Pyruvate dehydrogenase requires all cofactors except

a) Thiamin

b) Riboflavin

c) Niacin

d) Pyridoxin

Correct Answer - D

Ans. is 'd' i.e., Pyridoxin [Ref Harper 29thle p. 176]

- Pyruvate dehydrogenase catalyses oxidative decarboxylation of pyruvate to acetyl CoA.

The coenzyme required by PDH are :-

1. Thiamine pyrophosphate
2. Riboflavin(FAD)
3. CoA
4. Niacin (NAD)
5. Lipoic acid

418. Lactate produced anaerobically is used by

a) Gluconeogenesis & Glycolysis

b) Cori cycle & gluconeogenesis

c) TCA cycle & Glycogenolysis

d) Cori cycle only

Correct Answer - B

Ans. is 'b'i.e., cori cycle & gluconeogenesis [Ref Lehninger 4h/e p. 523,53g-391

Cori cycle or lactic acid cycle

- Anaerobic glycolysis in muscles results in the production of lactate, which cannot be converted into glucose, as gluconeogenesis does not occur in muscles.
- Through blood, Lactate is transported to the liver where it is oxidized to pyruvate. pynrvate so produced, is converted to glucose by gluconeogenesis, which is then transported to the muscle.
- The glucose thus reformed from lactate again becomes available for energy purpose in skeletal muscle.

419. Citrate synthase is inhibited by -

a) ATP

b) ADP

c) Insulin

d) Glucagon

Correct Answer - A
Ans. is'a'i.e., ATP [Ref Chatterjee & Shinde Vh/e p. 171,166-180; Harper 28th/e p. 145-147

420. Fumarate is formed from which amino acid

a) Methionine

b) Valine

c) Histidine

d) Tyrosine

Correct Answer - D

Ans. is 'd' i.e., Tyrosine [Ref Harper 29th/e p. 166-67]

All major members of the citric acid cycle from citrate to oxaloacetate are glucogenic and therefore, are involved in gluconeogenesis. Some glucogenic amino acids enters the TCA cycle after transamination e.g.:

1. Histidine, proline, glutamine and arginine are converted to glutamate which is then transaminated to a-ketoglutarate.
2. Isoleucine, methionine and valine enter by conversion into succinyl CoA. Propionate (a short chain fatty acid) also enter at this level.
3. Tyrosine, and phenylalanine enter by conversion into fumarate.
4. Tryptophan is converted to alanine which is then transaminated to pyruvate.
5. Hydroxyproline, serine, cysteine, threonine and glycine enter by conversion into pyruvate.

421. The major role of 2, 3 bisphosphoglycerate in RBCs is -

a) Acid-base balance

b) Reversal of glycolysis

c) Release of oxygen

d) Binding of oxygen

Correct Answer - C

Ans. is 'c' i.e.,Release of Oxygen [Ref Lehninger ilthie p. 171]

Rapoport Luebering cycle (Bisphosphoglycerate shunt)

- This cycle occurs in erythrocytes (ABCs).
- In this production of ATP by substrate phosphorylation from 1,3-BPG is bypassed by taking diversion pathways, i.e., side reaction of glycolytic pathway.
- In this cycle, 1,3-BPG is converted to 2,3 BPG by an enzyme bisphosphoglycerate mutase. Then 2,3 BPG is converted to 3-phospholycerate by 2,3-bisphosphoglycerate phosphatase.

422. Enzyme deficient in Hers disease -

a) Muscle phosphorylase

b) Liver phosphorylase

c) Acid maltase

d) Debranching enzyme

Correct Answer - B

Ans. is B' i.e., Liver phosphorylase [Ref Harper 250/e p. 181]

Type		Enzyme deficiency	Organ (s) affected
I	von Gierke's disease	Glucose 6-phosphatase	Liver, kidney
II	Pompe's disease	alpha (1 → 4) Glucosidase (acid maltase)	All organs
III	Cori's disease/Forbe's disease	Debranching enzyme	Muscle, liver
IV	Andersen's disease	Branching enzyme	Liver, myocardium
V	McArdle's disease	Phosphorylase	Muscle
VI	Hers' disease	Phosphorylase	Liver
VII	Tarui's disease	Phosphofructokinase	Muscle, RBCs
VIII		Phosphorylase kinase	Liver

423. Immediate metabolic products during conversion of Fructus 1-6 bisphosphate to 2 molecules of pyruvate -

a) Glyceraldehyde-3-phosphate and 1,3-bisphosphoglycerate

b) Dihydroxyacetone phosphate and 1,3 bisphosphoglycerate

c) Glyceraldehyde-3-phosphate and dihydroxy-acetone phosphate

d) 3-phosphoglycerate and 1,3 bisphosglycerate

Correct Answer - C

Ans. is 'c' i.e., Glyceraldehyde-3-phosphate and dihydroxyacetone phosphate (Ref: Harper 29h/e p. 170-177).

424. In conversion of glucose to glucose-6-phosphate in glycolysis true is

a) Glucokinase has low km

b) Hexokinase is found only in liver

c) Glucokinase is induced by insulin

d) Hexokinase is not specific for glucose

Correct Answer - C:D

Ans. is 'c' i.e., Glucokinase is induced by insulin & 'd' i.e., Hexokinase is not specific for glucose (Ref: Harper 29h/e p. 170-177; Vasudevan #/e p. 98)

- Hexokinase is not specific for glucose metabolism. It is found in most tissues except glucose.
- Glucokinase has high KM. It is induced by insulin.

425. Major carbohydrate store in the body -

a) Blood glucose

b) Glycogen in adipose tissue

c) Hepatic glycogen

d) None of the above

Correct Answer - C

Ans. is 'c' i.e., Hepatic glycogen (Ref: Harper 29/e p. 161; Dinesh puri 3d/e p. 320)

- Major Carbohydrate source of body is hepatic glycogen.
- Humans carry supplies of fuel within their body. Calories are stored in the body as fat (triglycerides), glycogen and some protein.

426. Most abundant source of fuel in starvation -

a) Liver glycogen

b) Muscle glycogen

c) Adipose tissue

d) Blood glucose

Correct Answer - C

Ans. is 'c' i.e., Adipose tissue [Ref Harper 29th le p. 161 & 28th le p. 134, 140; Vasudevan 6th/e p. 84, 85]

- Fat (triglycerides) in the adipose tissue is the largest store of energy of the body.

427. Major metabolism of saturated fatty acids in the mitochondria is called as -

a) β-oxidation

b) α-oxidation

c) ω-oxidation

d) None of the above

Correct Answer - A

Ans. is 'a' i.e., β-oxidation [Ref Harper 29"'/e p. 208]

- β-oxidation is the principal pathway for catabolism of saturated fatty acids. P-oxidation mainly occurs in the mitochondrial matrix (whereas fatty acid synthesis occurs in cytosol).

428. Which method is used to separate a mixture of lipids -

a) Electrophoresis

b) Chromatography

c) Isoelectric focusing

d) PAGE

Correct Answer - B

Ans. is 'b' i.e., Chromatography [Ref Clinical biochemistry p. 719]

- Extracted lipids are separated into individual class by chromatography.
- Chromatography can separate a complex mixture of lipids into simpler group.

Various types of chromatography, used to separate, lipids are -

- Adsorption (solid-liquid) chromatography
- Partition (liquid-liquid) chromatography
- Thin layer chromatography (TLC)
- Gas chromatography (GC)
- High performance liquid chromatography (HPLC) -› method of choice if available.

429. Chylomicrons core is formed by ?

a) Triglyceride

b) Triglyceride and Cholesterol

c) Triglyceride, Cholesterol and Phospholipids

d) Free fatty acids

Correct Answer - B

Ans. is 'B' i.e., Triglyceride and Cholesterol [Ref Harper 27th/e p. 218; Lehninger 4th/e p. 633]

The surface is a layer of phospholipids, with head groups facing the aqueous phase. Triacylglycerols sequestered in the interior make up more than 80% of the mass.

Several apolipoproteins that protrude from the surface (B-48, C-III, C-II) act as signals in the uptake and metabolism of chylomicron contents.

The diameter of chylomicrons ranges from about 100 to 500 nm.

Core: It's made up of neutral lipids like triacylglycerols and cholesterol/cholesterol esters. Shell: composed of apolipoproteins, phospholipids.

430. All are true about Niemann- Pick disease except -

a) Due to deficiency of sphingomyelinase

b) CNS symptoms in type A

c) Histiocytes showing PAS positive inclusions and Type B is less severe

d) None

Correct Answer - D

Ans. is D. None [Ref Clinical biochemistry 4th/e p. 786]

- Niemann-Pick disease is an autosomal recessive `lysosomal storage disease due to deficiency of sphingomyelinase.
- Characteristic histopathological feature is histiocytes showing PAS positive diastase resistant inclusions which on microscopy shows concentric or parrallel lamellar arrangement.

Clinical cases are divided into -

1. Type A: These are more common with more severe deficiency of sphingomyelinase. There is visceral and CNS involvement. Symptoms may present since birth and death usually occurs before the age of 4 years.
2. Type B : There is less severe deficiency of sphingomyelinase. Patient's have only visceral involvement but no CNS involvement. Patients present by the age of 3-4 years with organomegaly and may remain reasonably healthy.

431. Acetyl CoA Carboxylase is stimulated by -

a) Starvation

b) Glucagon

c) Citrate

d) All of the above

Correct Answer - C

Ans. is 'c' i.e., Citrate [Ref Harper 29th/e p. 219]

	Activator	Inhibitor
Allosteric (palmitoyl CoA)	Citrate	Long chain acyl-CoA
Covalent	Insulin	Glucagon, epinephrine

432. Cholesterol is not a precursor for synthesis of -

a) Vitamin D

b) Progesterone

c) Bile acids

d) Lipocortin

Correct Answer - D
Ans. is 'd' i.e., Lipocortin
Cholesterol is an important precursor for the synthesis of :-
.. Steroid hormones:- Progesterone, estrogen„ androgens, glucocorticoids, mineralocorticoids
2. Vitamin D
3. Bile acids

433. HDL is called good cholesterol because -

a) Removes cholesterol from extrahepatic tissues

b) Causes transport of cholesterol to extrahepatic tissues

c) Stimulate hepatic TGs synthesis

d) Activates lipoprotein lipase

Correct Answer - A

Ans. is 'a' i.e., Removes cholesterol from extrahepatic tissues

- The HDL particles are referred to as scavengers because their primary role is to remove free (unesterified) cholesterol from extrahepatic tissues, which is then excreted through bile. This is a crucial mechanism that prevents the inappropriate accumulation of cholesterol in peripheral tissues. Because accumulation of cholesterol in tissues is strongly associated with the development of atherosclerosis, the level of HDL in serum is inversely related to the incidence of MI (myocardial infarction). Thus, HDL is cardioprotective and anti-atherogenic in nature, and is referred to as "good cholesterol".
- Therefore, HDL-Cholesterol appears to be the best independent predictor of coronary artery disease (inverse relationship) than any other known risk factor. That means low HDL is a much stronger predictor of coronary artery disease than increased LDL cholesterol or increased total cholesterol.

434.

Amide group is present in which part of protein -

a) Amino-terminal

b) Carboxy-terminal

c) Peptide bond

d) Disulfide bond

Correct Answer - C

Ans. is 'c' i.e., Peptide bond [Ref Text book of biochemistry by Talwar - p. 30]

- A peptide bond is a chemical bond that connects amino acids to each other.
- A peptide bond essentially results from a dehydration synthesis reaction.
- It is formed between two amino acids when the carboxyl group of one amino acid reacts with the amino group of the other, releasing a molecule of water (H20).
- Peptide bond is the resulting CO-NH bond and the resulting molecule is an amide.
- The four-atom functional group - C (=0) NH- is called an amide group or peptide group.
- Peptide bond is a partial double bond.
- Partial double bond nature renders the amide group planar and rigid, making all the atoms that are involved in the peptide bond lie in a flat plane.

435. Non- essential amino-acids are all except -

a) Basic amino acids

b) Acidic amino acids

c) Neutral amino acids

d) None of the above

Correct Answer - A

Ans. is 'a' i.e., Basic amino acids [Ref Harper 29th/e p. 266]

- There, are three basic amino acids (Arginine, Histidine and lysine), all of them are essential amino acids
- Essential amino acids (PVT. TIM. HALL) : Phenylalanine, valine, threonine, tryptophan, isoleucine, methionine, histidine, arginine, lysine, leucine.
- Among these, arginine and histidine are semiessential amino acids.
- Nonessential amino acids : alanine, aspartic acid, aspargine, cysteine, glutamine, glutamic acid, glycine, proline, tyrosine, serine.
- Neutral amino acids: Alanine , asparagine, cysteine, glycine, glutamine, isoleucine, leucine, methionine, proline, phenylalanine, serine, threonine, tyrosine, tryptophan, valine.
- Acidic amino acids (negatively charged or anion) : Aspartic acid (aspartate), glutamic acid (glutamate).
- Basic amino acids (positively charged or cation) : Arginine, histidine, lysine.

436. Amino acid which can be used in both gluconeogenesis and ketogenesis -

a) Threonine

b) Valine

c) Tyrosine

d) Arginine

Correct Answer - C
Ans. is 'c' i.e., Tyrosine [Ref Chatterjee 5''/e p. 448]
Amino acids which can be used both in gluconeogenesis and ketogenesis (Both glucogenic & ketogenic amino acids) are :-
1. Tyrosine
2. Phenylalanine
3. Tryptophan
4. Isoleucine.

437. In phenylketonuria, diet restriction is advised for -

a) Tyrosine

b) Phenylalanine

c) Maize

d) All

Correct Answer - B
Ans. is 'b' i.e., Phenylalanine, The main treatment is a phenylalanine restricted diet for life.

438. Guanidinium group is associated with -

a) Tyrosine

b) Arginine

c) Histidine

d) Lysine

Correct Answer - B

Some amino acids contain a special functional group in their side chain which provides some specific functions to that amino acids. These are

.. Hydroxyl group in serine and threonine
2. Indole ring in tryptophan
3. Amide group in aspargine and glutamine
4. 13-Carboxyl in glutamic acid
5. Thioether in methionine
6. Imidazole in histidine
7. Sulfhydryl in cysteine
8. Phenol in tyrosine
9. y-carboxyl in glutamic acid
0. Pyrrolidine in proline
.. Guanidinium in arginine
2. c-amino in lysine
3. Benzene in phenylalanine

439. Coenzyme for phenylalanine hydroxylase is -

a) Tetrahydrofolate

b) Pyridoxal phosphate

c) S-adenosyl methionine

d) Tetrahydrobiopterin

Correct Answer - D

Ans. is 'd' i.e., Tetrahydrobiopterin

- Phenylalanine metabolism is initiated by its oxidation to tyrosine which then undergoes oxidative degradation

440. Which of the following is required in the synthesis of acetylcholine -

a) Inositol

b) Carnitine

c) Glycine

d) Choline

Correct Answer - D
Ans. is 'd' i.e., Choline [Ref Principles of medical physiology p. 96]
Acetylcholine is synthesized in the cytosol of nerve terminal from acetyl-CoA and choline, in the presence of choline-0-acetyltransferase

441. Most important factor which causes lactic acidosis in alcoholics -

a) Prudiction of NADH

b) Formation of acetaldehyde

c) Production of acetate

d) None of the above

Correct Answer - A

Ans. is 'a' i.e., Production of NADH [Ref Pankaj Naik 3rd/e p. 351]

- Excess intake of alcohol leads to excessive production of NADH with a concomitant decrease in NAD..
- The increased availability of NADH favours the reduction of pyruvate to lactate and oxaloacetate to malate and decreasing its availability for gluconeogenesis and decrease synthesis of glucose. This results in Hypoglycemia.
- Excess of lactate production leads to lactic acidosis

442. Insulin dependant cells are -

a) Pituitocytes

b) Myocytes

c) Adipocytes

d) RBCs

Correct Answer - B:C

Ans. is 'b' i.e., Myocytes & 'c' i.e., Adipocytes [Ref Ganong 24th/e p. 435]

- Insulin stimulates the uptake of glucose by myocytes (skeletal muscle, cardiac muscle), adipocytes (adipose tissue) and hepatocytes. Tissues that do not depend on insulin for glucose uptake include brain, erythrocytes (RBC), the epithelial cells of kidney & intestine, Liver, and Cornea & lens of the eye.
- In the liver, insulin stimulates glucose entry into hepatocytes indirectly by induction of glucokinase so that the glucose entering the liver cells is promptly converted to glucose - 6 - phosphate (glucose trapping). This keeps the intracellular glucose concentration low and favours entry of glucose into the liver. Thus, though the liver do not depend on insulin for glucose uptake, insulin stimulates glucose entry into hepatocytes. That means glucose entry can occur in liver without the action of insulin, but this is facilitated by insulin. On the other hand, myocytes (skeletal and cardiac muscles) and adipocytes (adipose tissue) are dependent on insulin for glucose uptake.

443. Epinephrine increases free fatty acid level by causing -

a) Increased fatty acid synthesis

b) Increasing lipolysis

c) Increasing cholesterol catabolism

d) All of the above

Correct Answer - B

Ans. is 'b' i.e., Increasing lipolysis [Ref Pankaj Naik %tale p. 248]

Epinephrine and glucagon accelerate lipolysis in adipose tissue by activating hormone sensitive lipase. In starvation and diabetes, glucagon is high (and insulin is low), leading to enhanced lipolysis.

444. Vitamin formed in the body -

a) B 1

b) B 3

c) B 6

d) B 12

Correct Answer - A:B:D

Ans. is 'b > a & d' i.e., B3 > B1 & B12

- This question is confusing one (Read text below).
- Niacin (Vitamin B3) is synthesized from tryptophan inside the body(endogenous).
- Some vitamins are also formed by bacterial activity in colon :-

1. Vitamin K
2. Riboflavin (Vitamin B2)
3. Vitamin B12
4. Biotin (Vitamin B7)
5. Thiamin (Vitamin B1)

Thus, options a, b & d all are correct here. But the best answer among these is niacin as it is the only vitamin which is synthesized by proper anabolic metabolism.

445. Which of the following is not seen in 12 days of fasting -

a) Gluconeogenesis

b) Ketogenesis

c) Lipolysis

d) Glycolysis

Correct Answer - D

Ans. is i.d.e., Glycolysis [Ref Harper 28'Ve p. 140; Dinesh purl 3'/e p. 414]

Duration	Early stage	Intermediate stage (3-24 d)	Late state {> 24 d}
Pathways enhanced	Glycogenolysis Gluconeogenesis Lipolysis Ketogenesis↑ Protein degradation ↑	Gluconeogenesis Lipolysis↑ Ketogenesis ↑ Ketone body oxidation ↑↑	Ketone body oxidation By brain ↑↑ By other tissues↑↑↑ Fatty acid utilization↑↑ Gluconeogenesis ↑↑
Pathways slowed		Protein degradation Protein synthesis	Glycolysis TCA Protein synthesis and degradation Glycogen synthesis and degradation

446. Pyridoxine is required in -

a) Glycolysis

b) TCA cycle

c) Glycogenesis

d) Glycogenolysis

Correct Answer - D

Ans. is 'd' i.e., Glycogenolysis [Ref Dinesh puri p. 187; Harper 29th/e p. 180 & 27th/e p. 159-160]

- PLP is a cofactor for glycogen phosphorylase, hence it favors glycogenolysis.

447. Pruritis [Itching] is caused by deficiency of -

a) HMB synthase

b) 5-ALA dehydratase

c) Uroporphyrinogen - I synthase

d) Uroporphyrinogen - III synthase

Correct Answer - D

Ans. is 'd' i.e., Uroporphyrinogen - III synthase [Ref Rooks 7th/e p. 12.7, 12.8]

- Cutaneous (erythropoietic) porphyrias cause skin manifestations like photosensitivity, rash and pruritus.
- Among the given options, Uroporphyrinegen III synthase deficiency causes cutaneous porphyria (Congenital erythropoietic porphyria).

448. Vitamin acting on intranuclear receptors -

a) Vitamin K

b) Vitamin D

c) Vitamin E

d) Vitamin E

Correct Answer - B

Ans. is 'b' i.e.,Vitamin D [Ref Understandings medical physiology p. 408]

Two vitamins are considered as hormones which act on intranuclear receptors (steroid receptor family). There are :-

1. Vitamin A (retinoic acid)
2. Vitamin D

449. Niacin acts as coenzyme -

a) TPP

b) FAQ

c) NAD

d) NAD

Correct Answer - C
Ans. is 'c' i.e.,NAD
Niacin, in the form of nicotinamide, is incorporated into the structure of two coenzymes : nicotinamide adenine dinucleotide (NAD*) and nicotinamide adenine dinucleotide phosphate (NADI)*).

450. Not a metabolic product of urea cycle -

a) Citrulline

b) Ornithine

c) Alanine

d) Arginine

Correct Answer - C

Ans. is 'c' i.e., Alanine

- Metabolic products in urea cycle are carbamoyl phosphate, ornithine, citrulline, argininosuccinate, arginine and fumarate.
- Biosynthesis of urea occurs in five steps

1- Carbamoyl phosphate synthetase-I (CPS-I), a mitochondrial enzyme, catalyzes the formation of carbamoyl phosphate by condensation of CO, and ammonia.

2- Ornithine transcarbamoylase catalyzes the formation of citrulline from carbamoyl phosphate and ornithine.

3- Argininosuccinate synthase catalyzes the formation of argininosuccinate from citrulline and aspartate. This reaction requires !ATP,

4- Argininosuccinate lyase (arginosuccinase) catalyses the cleavage of argininosuccinate into arginine and fumarate. Fumarate enters TCA cycle.

5-) Arginase catalyses the formation of urea from arginine by hydrolytic cleavage of arginine to yield urea and ornithine. Ornithine is thus regenerated and can enter mitochondria to initiate another round of the urea cycle.

451. Which amino acid is not involved in transamination -

a) Alanine

b) Aspartate

c) Lysine

d) Histidine

Correct Answer - C

Ans. is 'c' i.e.,Lysine

- Most amino acids undergo transamination reaction except lysine, threonine, proline and hydroxyproline.

452. Apo B48 is synthesized in -

a) Liver

b) Kidney

c) Intestine

d) RBCs

Correct Answer - C
Ans. is 'c' i.e.,Intestine

- It mediate uptake of LDL by LDL receptors of liver,

453. What are okazzaki fragments -

a) Long pieces of DNA on lagging strand

b) Long pieces of DNA on leading strand

c) Short pieces of DNA on lagging strand

d) Short pieces of DNA on leading strand

Correct Answer - C

Ans. is 'c' i.e., Short pieces of DNA on lagging strand [Ref: Lippincott's 5thie p. 399, 401, 406]

- DNA polymerases responsible for copying the DNA templates are only able to "read" the parental nucleotide sequence in 3' - 5' direction, and they synthesize the new DNA strands only in 5' - 3'direction.
- Therefore, 2 newly synthesized chains must grow in opposite directions :?

.. The DNA chain which runs in the 3'45' direction towards replication fork as *continued strand* is called the leading strand. This requires only one RNA primer

?. The DNA chain which runs in the 5'43' direction away from the replication fork is called lagging strand. It is synthesized discontinously and requires numerous RNA primers. As the replication fork moves, RNA primers are synthesized at specific intervals. These RNA primers are extended by DNA polymerase III into short pieces of DNA called Okazaki fragments.

454. C4, C5, N7 in purine ring are derived from -

a) Aspartate

b) Glutamine

c) Glutamine

d) CO

Correct Answer - C

Ans. is 'c' i.e., Glycine [Ref Harper 29th/e p. 332]

- In de novo synthesis, purine ring is formed from a variety of precursors is assembled on ribose-5-phosphate. Precursors for de novo synthesis are ?

1. Glycine provides C4, C5 and N7
2. Aspartate provides NI
3. Glutamine provides N3 and N9
4. Tetrahydrofolate derivatives furnish C2 and G
5. Carbon dioxide provides C6

455. If content of A is 15%, what is the amount of G in DNA according to Chargaff s rule?

a) 15%

b) 85%

c) 35%

d) 70%

Correct Answer - C

Ans. is 'c' i.e., 35% [Ref Harper's Illustrated biochemistry 27th/e p. 311-313]

Chargaff's rule:

Amount of purine = Amount of pyrimidine (A + G = T + C) Also A+G+T+C= 100

Since A = T, Therefore 15 + G + 15 + C = 100

Since G = C, Therefore 30, + 2G = 100

2G = 70 4 G = 35

456. cDNA from RNA is synthesized by -

a) Helicase

b) DNA dependent DNA polymerase

c) Topoisomerase

d) Reverse transcriptase

Correct Answer - D

Ans. is 'd' i.e., Reverse transcriptase [Ref Satyanarayan 4th/e p. 550]

- The enzyme RNA dependent DNA polymerase (reverse transcriptase) is responsible for the formation of DNA from RNA.
- This DNA is complementary (c DNA) to viral RNA and can be transmitted into host DNA.

457. Which is not a chaperon protein -

a) Calnexin

b) Protein disulfide isomerase

c) Calreticulin

d) Calbindin

Correct Answer - D

Ans. is 'd' i.e., Calbindin [Ref Harper 29thle p. 598-599 & 28th/e p. 497]

Some Chaperones and Enzymes Involved in Folding that are Located in the Rough Endoplasmic Reticulum:-

- BiP (immunoglobulin heavy chain binding protein)
- GRP94 (glucose-regulated protein)
- Calnexin
- Calreticulin
- PDI (protein disulfide isomerase)
- PPI (peptidyl prolyl cis-trans isomerase)

458. All are functions of glycosaminglycans except -

a) Lubrication

b) Wound healing

c) Anticoagulant

d) Transport of lipids

Correct Answer - D
Ans. is 'd' i.e., Transport of lipids [Ref Pankaj Naik 4th/e p. 29]

459. Bile salts help in absorption of fat by -

a) Micelles formation

b) Activation of transporter protein

c) Creation of concentration gradient

d) All of the above

Correct Answer - A

Ans. is 'a' i.e., Micelles formation [RefGangong24th le p. 465]

- Emulsification is the process which breaks down ingested fats (mainly triglycerides) into smaller droplets so that they can be digested more efficiently. Thus emulsification mainly helps in digestion of ingested fats.
- Micelles formation is the process in which digested fats (FFAs and monoglycerides) are incorporated into much smaller droplets (micelles) so that they can be absorbed more efficiently. Thus, micelles formation helps in absorption of digested fats.
- Detergent action of bile salts is necessary for both emulsification and micelles formation.

460. a-aminolevulinic acid is a metabolic product in synthesis of -

a) Tryptophan

b) Collagen

c) Glycosaminoglycans

d) Heme

Correct Answer - D

Ans. is 'd' i.e., Heme

- Heme synthesis takes place in all cells, but occurs to greatest extent in bone marrow and liver. The first step in the synthesis of heme is the condensation of glycine and succinyl Co-A to form 6-aminolevulinic acid (6-ALA), which occurs in mitochondria. This reaction is catalyzed by 6-ALA synthase which requires pyridoxal phosphate (PLP) as cofactor. This is the rate limiting step in heme synthesis.

461. Which is an inhibitor of ferrochelatase ?

a) Lead

b) Mercury

c) Iron

d) Arsenic

Correct Answer - A

Ans. is 'a' i.e., Lead [Ref Essentials of biochemistry 4thie p. 919]

- Ferrochelatase, also called heme synthase, catalyses the last reaction in heme synthesis.
- Lead inhibits **ALA dehydratase.** Therefore, lead poisoning causes inhibition of heme synthesis and excessive amount of 6-ALA is excreted in urine. Lead can also inhibit **ferrochelatase (heme synthase).**

462. Bile acids consist of all except -

a) Lithocholic acid

b) Taurocholic acid

c) Deoxycholic acid

d) Chendeoxycholic acid

Correct Answer - B

Ans. is 'b' i.e., Taurocholic acid [Ref Ganong 22na le ch. 26]

- Taurocholic acid is bile salt (not bile acid).
- Bile acids are mainly presents as sodium or potassium salts which are conjugated with glycine or taurine to form bile salts.
- Primary bile acids are cholic acid and chenodeoxycholic acid, which are synthesized from cholesterol in liver. In the intestine some of the primary bile acids are converted into secondary bile acids, i.e., deoxycholic acid (formed from cholic acid) and lithocholic acid (derived from chenodexoxycholic acid).
- Glycine and taurine conjugates of these bile acids are called as bile salts. For example, cholic acid is a bile acid, and its glycine conjugate (glycocholic acid) is a bile salt.

463. True about cAMP and cGMP -

a) Second messengers

b) Act on membrane receptors

c) Act by post-translational modification

d) All of the above

Correct Answer - D

Ans. is 'd' i.e.,All of the above

Second messengers

- Second messengers are molecules that relay signals from the membrane receptors to target molecules inside the cells. In above described receptors second messengers are cAMP, cGMP, Phosphatidylinositol, diacylgleceral, IP3, Ca.
- Secondary messengers of membrane receptors act by posttranslation modification, i.e., modification of proteins (e.g., enzymes) after they have already formed (i.e., after translation).

464. Spectroscopy is used for interaction of -

a) Electromagnetic radiation

b) Protons

c) Alpha particles

d) Positrons

Correct Answer - A
Ans. is 'a' i.e.,Electromagnetic radiation
Spectroscopy is the study of the structure of atoms/molecules from studying their interaction with electromagnetic radiation.

465. Abnormal proteins which are bound to ubiquitin are degraded in -

a) Proteosomes

b) Golgi apparatus

c) Smooth ER

d) Lysosomes

Correct Answer - A

Ans. is 'a' i.e.,Proteosomes [Ref Harper 25^{0}/e p. 560-561 & 28th/e p. 498-99]

- Ubiquitin plays major role in degradation of proteins and is particularly associated with disposal of misfoldedproteins.
- It is small, highly conserved protein that plays a key role in marking various proteins for subsequent degradation in proteosomes

466. Enzyme degradation is caused by -

a) Ubiquitin

b) RNAse

c) Zymase

d) Chaperone

Correct Answer - A
Ans. is 'a' i.e., Ubiquitin [Ref Harper 29thie p. 560-561]
Degradation of defective (misfolded) proteins (including enzymes) is caused by ubiquitin

467. G1cNAc-P-P- oligosacharride is -

a) Proteoglycan

b) Glycoprotein

c) Collagen

d) Phospholipid

Correct Answer - B
Ans. is 'b' i.e., Glycoprotein [Ref Medical Biochemistry by Bhagvan p. 312]
Dolichol plays a role in post-translational modification of protein by glycosylation to form glycoproteins.
It acts in the form of Dolichol pyrophosphate (Dolichol PP) and transfer Oligosaccharide from dolichol to glycoproteins
N-acetylgalactosamine-P-P-Dolichol (GLc NAc-P-P-dol) compound formed in the bionsynthesis of lipid-linked oligosaccharides.
Dolichol -P-P acts as a carrier of oligosaccharide and transfer it to glycoprotein.

468. Prolyl hydroxylase require which cofactor -

a) Sc

b) Vitamin C

c) Mo

d) Vitamin K

Correct Answer - B
Ans. is 'b' i.e., Vitamin C [Ref Harper 29'Ve p. 590-593]
Hydroxylation of proline and lysine residue takes place during post-translational modification in rough ER. The enzyme catalyzing the reactions are prolyl hydroxylase (for proline) and lysyl hydroxylase (for lysine). Both these enzymes are dioxygenases using molecular oxygen (0_2) and cofactor for both these enzymes is vitamin C (ascorbic acid). a-Ketoglutatrate is a coreductant, which is oxidized to succinate.

469. Side chain linkage in proteoglycons -

a) Covalent

b) Hydrogen bond

c) Electrostatic bond

d) Van-der Waal's force

Correct Answer - A

Ans. is 'a' i.e.,Covalent [Ref Essentials of biochemistry p. 712]

Among the given options two bonds are involved in proteoglycan structure :

.. Covalent - In proteoglycon monomer, i.e. between central core protein and side chain of repeated disaccharides

?. Electrostatic → In proteoglycan aggregates between proteoglycan monomer and hyaluronic acid.

470. Which of following is not a free radical -

a) H202

b) (M?

c) Superoxide anion

d) HOC1-

Correct Answer - D

Ans. is 'd' i.e., $HOC1^{-}$ [Ref Principles in medical pathology p. 391]

Free radicals are chemical species that have a single unpaired electron in the outer orbit. Most of these are partially reduced reactive oxygen forms that are produced as an unavoidable byproduct of mitochondria! respiration - also known as reactive oxygen species.

The most important are hydrogen peroxide (11_20), Superoxide anion (02) and hydroxyl radical (OH).

471. In type la maple syrup urine disease, gene mutation seen is ?

a) Ela

b) Elb

c) E2

d) E3

Correct Answer - A

Ans. is 'a' i.e., Ela ***[Ref Harper 27"/e ch. 29; Nelson 18th/e ch. 85.6; Medical biochemistry by sheriff 1"/e p. 513]***

Metabolic disorders of branched-chain amino acid catabolism

- As the name implies, the odor of urine in maple syrup urine disease (branched-chain ketonuria) suggests maple syrup or burnt sugar. Decarboxylation of leucine, isoleucine, and valine is accomplished by a complex enzyme system (branched-chain a-ketoacid dehydrogenase) using thiamine pyrophosphate (vitamin 8_1) as a conzyme.
- This mitochondrial enzyme consists of four subunits: Ha, El (3, E2, and E3. Deficiency of this enzyme system causes MSUD. Based on clinical findings and response to thiamine administration, five phenotypes MSUD have been identified classical, intermediate, intermittent, thiamine responsive and E3 deficiency. All forms of MSUD are inherited as an autosomal recessive trait.

472. Hexokinase is inhibited by ?

a) Glucose-6-phosphate

b) Glucagon

c) Glucose

d) Insulin

Correct Answer - A
Ans. is 'a' i.e., Glucose-6-phosphate ***[Ref: Harper 29"/e p. 171, 190]***

473. All of the following are inhibited during fasting/ starvation, except ?

a) Hexokinase

b) Glucokinase

c) PDH

d) Pyruvate kinase

Correct Answer - A
Ans. is 'a' i.e.,Hexokinase *[Ref Harper 29th/e p. 190]*
Hexokinase (in contrast to glycokinase) is not affected by feeding/insulin or starvation.
Other three enzymes activity is decreased in starvation.

474. Hereditary orotic aciduria Type-I is due to deficiency of ?

a) Orotate phosphoribosyl transferase

b) Orotic acid decarboxylase

c) UMP synthase

d) All of the above

Correct Answer - D

Ans. is 'd' i.e., All of the above *[Ref Pankaj Naik p. 310]*

Orotic aciduria is a hereditary disorder which can result from a defective enzyme in pyrimidine synthesis.

There is a defect in the multifunctional enzyme UMP synthase which has two activities :?

.. Orotate phosphoribosyl transferase

2. Orotic acid decarboxylase (orotidylate decarboxylase)

- UMP synthase converts orotic acid to UMP. Thus, in defect of UMP synthase orotic acid can not be converted to UMP and is excreted in urine orotic aciduria.

There are two types of orotic aciduria.

.. Type I:- There is deficiency of both the components of UMP synthase, i.e. orotate phosphoribosyl transferase and oritidylate decarboxylase.

2. Type II:- There is deficiency of only orotidylate decarboxylase/

475. Replication of mitochondrial DNA is caused by which type of DNA polymerase ?

a) a

b) p

c) S

d) y

Correct Answer - D
Ans. is 'd' i.e., y *[Ref Pankaj Naik p. 314]*
DNA polymerase a :- It has primase activity (i.e. synthesizes RNA primer), and initiates DNA synthes
DNA polymerase :- It is a DNA repair enzyme ?
DNA polymerase y :- Replicates mitochondrial DNA
DNA polymerase 6 :- Helps DNA synthesis on lagging strand, i.e. elongation of okazaki fragments on lagging strand. It also has 5'3' exonuclease activity for proof reading.
DNA polymerase c :- Helps in DNA synthesis on leading strand. It also has 5'->3'exonuclease activity for proof reading.

476. Which isoform of LDH is raised in Anemia ?

a) LDH 5

b) LDH 4

c) LDH 3

d) LDH 2

Correct Answer - D

Ans. is 'd' i.e., LDH 2 *[Ref Chatterjea 7th/e* p. *600-605, Harper 28th/e* p. 59]

LDH-2 is found in RBCs and is increased in megaloblastic anemia.

477. Digestive enzymes are

a) Hydrolases

b) Oxidoreductases

c) Dehydrogenases

d) Ligases

Correct Answer - A
Ans. is 'a' i.e., Hydrolases *[Ref Harper's 29th le* p. *518-19]*
All digestive enzymes are hydrolases.

478. Enzymes that move a molecular group from one molecule to another are known as -

a) Ligases

b) Oxido-reductases

c) Transferases

d) Dipeptidases

Correct Answer - C

Ans. is C. i.e., Transferase [Ref Chatterjea 8th/e p. 123; Harper 28th/e p. 52]

Transferases Catalyze transfer of C-N-, or P-containing group from one substrate to another,

479. Glucose-6-phosphate dehydrogenase need -

a) NAD

b) NADP

c) FAD

d) FMN

Correct Answer - B

Ans. is 'b' i.e., NADP *[Ref : Harper 29th/e* p. *197]*

NAD* -linked dehydrogenases Pyruvate dehydrogenase, isocitrate dehydrogenase, malate dehydrogenase, a-ketoglutarate dehydrogenase, glutamate dehydrogenase, glyceraldehyde-3-P dehydrogenase, lactate dehydrogenase, p-hydroxy acyl CoA dehydrogenase, glycerol 3-P dehydrogenase (cytoplasmic).

NADP'-linked dehydrogenases Glucose-6-P dehydrogenase, 6-Phosphogluconate dehydrogenase, 3-ketoacyl reductase, Enoyl reductase, gulonate dehydrogenase.

FAD-linked dehydrogenases Succinate dehydrogenase, fatty acyl CoA dehydrogenase, glycerol-3P **et*** hydrogenase (mitochondrial).

480. Which of the following is NADP linked

a) G6PD

b) APDH

c) a-keto glutarate dehydrogenaes

d) None

Correct Answer - A
Ans. is 'a' i.e.,G6PD *[Ref Harper 28"le* p. 175]
Amongst the given options, only G6-PD (glucose-6-phosphate dehydrogenase) is NADP linked enzyme.

481. Oxidative deamination occurs in ?

a) Cytoplasm of all cells

b) Mitochondria of all cells

c) Cytoplasm of hepatocytes

d) Mitochondria of hepatocytes

Correct Answer - D
Ans. is 'd' i.e., Mitochondria of Hepatocytes *[Ref : Harper 29'/e p. 274]*
Deamination means removal of amino group of amino acid in the form of ammonia. Thus, an amino acid is converted to a keto acid.
Deamination coupled with oxidation is called *oxidative deamination.* It occurs in the mitochondria.
Oxidative deamination occurs primarily in the *liver (major organ) and kidney.*

482. Aldehyde dehydrogenase requires NAD as ?

a) Cofactor

b) Apoenzyme

c) Coenzyme

d) None

Correct Answer - C
Ans. is C. i.e., Coenzyme [Ref Read below]
The complete enzyme, i.e. protein part (apoenzyme) with its non-protein part is called Holoenzyme.
Alcohol dehydrogenase is the enzyme (protein) part of complete enzyme (Holoenzyme). Thus, alcohol dedydrogenase itself is apoenzyme.
It requires non-protein part NAD, which is an organic component.
So, NAD acts as coenzyme for alcohol dehydrogenase.

483. In FITC the color emitted after blue light absorption? \

a) Yellow green

b) Orange red

c) Apple green

d) Golden brown

Correct Answer - A
Ans. is 'a' i.e., Yellow green
Fluorescein isothiocyanate (FITC) is a derivative of fluorescein used in wide-ranging applications including flow cytometry. FITC is the original fluorescein molecule functionalized with an isothiocyanate reactive group (-N=C=S), replacing a hydrogen atom on the bottom ring of the structure. This derivative is reactive towards nucleophiles including amine and sulfhydryl groups on proteins.
FITC (fluorescein isothiocyanate) is a fluorochrome dye that absorbs ultraviolet or blue light causing molecules to become excited and emit a visible yellow green light. This emission ceases upon removal of the light causing the excitation.

484. Apoenzyme is ?

a) Cofactor

b) Coenzyme

c) Protein moiety

d) None

Correct Answer - C

Ans. is 'c' i.e., Protein moiety [Ref Harper 28^{15}/e p. 52]

The complete enzyme (Holoenzyme) is made of protein portion (apoenzyme) and cofactor/coenzyme.

485. In xanthine oxidase co factor is ?

a) Selenium

b) Zn

c) Molybdenum

d) Mg

Correct Answer - C
Ans. is 'c' i.e., Molybdenum [Ref : Essential biochemistry p. 786]
Two important enzymes using molybdenum are xanthine oxidase and sulfite oxidase.

486. What are isoenzyme -

a) Physically same forms of different enzymes

b) Physically disinct forms of same enzyme

c) Forms of same enzyme that catalyze different reactions

d) Forms of different enzyme that catalyze same reactions

Correct Answer - B

Ans. is 'b' i.e., Physically disinct forms of same enzyme

Isoenzymes are the physically distince forms of the same enzyme. They catalyze the same chemical reaction or reactions but differ from each other structurally°, electrophoretically° and immunologically.

Isoenzymes possess quaternary structure, and are made up of two or three different subunit° (multimeric^{Q}).

The subunits have slightly different primary structures. Isoenzymes catalyze the same reaction and act on same substrate°, but with different Km° and Vmax values, i.e., isozymes have different kinetics°.

The isoenzymes can be separated from each other by electrophoretic, chromatographic or immunochemical techniques. Separation and quantitation of isoenzymes can give information of great diagnostic importance as the tissue distribution of isoenzymes is quite specific

487. Enzyme causing covalent bond cleavage without hydrolysis ?

a) Lyase

b) Ligase

c) Hydrolase

d) Transferase

Correct Answer - A
Ans. is 'a' i.e., Lyase [Ref Classification of enzymes from your notes]
Cleavage by hydrolysis (addition of water) Hydrolases
Cleavage without hydrolysis (without addition of water) → Lyases

488. Enzymes act by ?

a) Increase in activation energy

b) Decrease in activation energy

c) Shift equilbrium constant

d) None

Correct Answer - B

Ans. is 'b' i.e., Decrease in activation energy

In a chemical reaction, the substrate has to be converted to a higher energy form (called transition form) before it can form the reaction products.

The transition state is structurally an intermediate between the substrate and the product, and represents the highest energy arrangement of atoms.

Therefore, it is unstable; once formed, it decomposes almost immediately to form the reaction product.

So, this high energy intermediate acts as energy barrier, separating the substrates and the products.

This barrier, called the free energy of action, is the energy difference between the energy of the substrates and high energy intermediates.

In other words, initially some energy must be put into the substrate for conversion into transition state (high-energy intermediate); this is the free energy of activation.

The enzymes speed up the chemical reaction by lowering the magnitude of the activation energy barrier, i.e., free energy of activation.

489. Shortest peptide ?

a) Angiotensin II

b) Angiotensin III

c) Oxytocin

d) Vasopressin

Correct Answer - B
Ans. is 'b' i.e., Angiotensin III *[Ref Essentials of biochemistry* p. *627]*

490. The predominant isoenzyme of LDH occuring in liver injury is ?

a) LDH-1

b) LDH-2

c) LDH-4

d) LDH-5

Correct Answer - D
Ans. is 'd' i.e., LDH-5 [Ref: Essentials of biochemistry p. 756]
Predominant form in liver is LDH5.

491. Specific activity of enzyme is ?

a) limo' of enzyme per gram of substrate

b) Enzyme units per mg of protein

c) Conc. of substrate transformed per minute

d) None

Correct Answer - B

Ans. is 'b' i.e., Enzyme units per mg of protein [Ref Lippincott's 3"[1]/e p.

492. Type of inhibition of aconitase by Transaconitate is?

a) Non-competitive

b) Competitive

c) Allosteric

d) None

Correct Answer - B

Ans. is 'b' i.e., Competitive [Ref Essentials of Biochemistry p. 685]

	enzymes	**competitive inhibitors**
1	Lactate dehydrogenase	Oxamate
2	**Aconitase**	**Transaconitate**
3	**Succinate dehydrogenase**	**Malanate**[Q]
4	HMG-CoA reductase	HMG, Lovastatin
5	Dihydrofolate reductase	Amethopterin, Methotrexate
6	Xanthine oxidase	Allopurinol
7	Alcohol dehydrogenase	Ethanol
8	Carbonic anhydrase	Acetazolamide
9	Digoxin	Na-K ATPase
10	5 - Fluorouracil	Thymidylate synthase

493. Functional plasma enzyme is ?

a) Fibrinogen

b) LDH

c) SGOT

d) SGPT

Correct Answer - A
Ans. is 'a' i.e., Fibrinogen [Ref harper's 28th/e p. 59]
Cloting factors (including fibrinogen) are functional plasma enzymes.

494. NADPH via glycerophosphate shunt makes how many ATP?

a) 1

b) 2

c) 3

d) 4

Correct Answer - B
Ans. is > b' i.e., 2 [Ref : Harper 29"/e p. 129-130]
In glycerophosphate shuttle, the mitochondrial enzyme is linked to respiratory chain (ETC) via a flavoprotein, So only 1.5 mol of ATP are produced (According to older calculations, 2 ATP mol of ATP are produced).
In malate shuttle, the mitochondrial enzyme is linked to ETC via NAD, so 2.5 mol of ATP are produced (according to older calculations 3 mol of ATP are produced).

495. Which of the following tripeptide ?

a) Glutathione

b) Angiotensin

c) Glucagon

d) Oxytocin

Correct Answer - A

Ans. is 'a' i.e.,Glutathione *[Ref Harper 28th Ie p. 679-680]*

Angiotensin III	Heptapeptide (6 amino acids)
Angiotensin II	Octapeptide (8 amino acids)
Oxytocin	Nonapeptide (9 amino acids)
Bradykinin	Nonapeptide (9 amino acids)
Vasopressin	Nonapeptide (9 amino acids)
Glucagon	Decapeptide (10 amino acids)
Angiotensin I	Decapeptide (10 amino acids)

496. Enzyme involved in oxidative phosphorylation ?

a) Pyruvate kinase

b) Succinyl CoA thiokinase

c) NADH dehydrogenase

d) None

Correct Answer - C

Ans. is 'c' i.e., NADH dehydrogenase [Ref Harper 29'/e p. 126-128, Vasudevan 6th Ie p. 234]

Oxidative phosphorylation takes phase along the electron transport chain (respiratory chain), where the ATP is synthesized indirectly from creation of a protein gradient and movement of protiens across inner mitochondrial membrane helps in formation of ATP.

The protein gradient is created by large change in free energy due to transport of electron in ETC. Electrons enter the ETC via NAD' or FAD.

Complex I (NADH - CoQ reductase) catalyzes the transfer of electron from NADH to coenzyme Q (CoQ). {NADH-CoQ reductase is also called NADH dehydrogenase.}.

497. Protein segregation occurs in ?

a) Golgi appparatus

b) Peroxisomes

c) ER

d) Mitochondria

Correct Answer - A
Ans. is 'a' i.e.,Golgi appparatus *[Ref Harper 29th/e p.* 549]
Golgi apparatus plays a major role in sorting of proteins.

498. Weakest bond is ?

a) Covalent

b) Hydrogen

c) Electrostatic

d) Vander wall

Correct Answer - D

Ans. is 'd' i.e., Vander wall *[Ref: Harper 28th le* p. 9; *Basics of molecular biology p. 786]*

Strongest bond Covalent

Weakest bond -4 Van der walls forces

Covalent (strongest)° > Electrostatic^0 (ionic or salt linkage) > hydrogen> hydrophobic > Van der waal's (weakest)°

499. In ETC NADH generates -

a) 1 ATPs

b) 2 ATPs

c) 3 ATPs

d) 4 ATPs

Correct Answer - C

Ans. is '> c' i.e., 3 ATPs [Ref : Harper 28'"/e p. 106, Vasudevan 5thie p. 231]

The energy liberated of site **I** (complex I) is used to synthesize 1 ATP molecule, at site II (complex **III)** is used to synthesize 1 ATP molecule and at site **III** (Complex **IV)** is used to synthesize 1/2 ATP molecule.

Thus,**when 1 NADH molecule enters the respiratory chain, it produce 2.5 molecules of ATP°. When I molecule of FADH2 enters the respiratory chain only 1.5 molecules of ATP are produced°** as site I of energy liberation is bypassed.

Note : Previously it was assumed the NADH produces 3 ATPs and FAD generates 2 ATPs. Recent experiments show-that these old values are overestimates and **NADH produces 2.5 ATPs° and FADH2 produces 1.5 ATPs°.**

500. This attaches to protein before destruction ?

a) Ubiquitin

b) RNAseF

c) Zymase

d) Chaperone

Correct Answer - A

Ans. is 'a' i.e., Ubiquitin *[Ref Harper 29^{1}Ve p. 560-561]*

Ubiquitin Is a Key Molecule in Protein Degradation

There are two major pathways of protein degradation in eukaryotes. One involves lysosomal proteases and does not require ATP. The other pathway involves ubiquitin and is ATP-dependent.

It plays the major role in the degradation of proteins, and is particularly associated with disposal of misfolded proteins and regulatory enzymes that have short half-lives.

501. In glycolysis, inorganic phosphate is used reaction, catalyzed by ?

a) Enolase

b) Pyruvate kinase

c) Glyceraldehyde-3-p dehydrogenase

d) Aldolase

Correct Answer - C

Ans. is 'c' i.e.,Glyceraldehyde-3-p dehydrogenase [Ref Harper's 25^{0}/e p. 171]

502. Protein glycosylation occurs in ?

a) ER

b) Golgi bodies

c) Mitochondria

d) Peroxisomes

Correct Answer - A:B

Ans. is 'b > a' i.e., Golgi bodies > ER *[Ref Harper's 29th/e p. 549, 572]*

The endoplasmic reticulum and the Golgi apparatus are the major sites involved in glycosylation processes.

However, 0-glycosylation occurs only in the Golgi apparatus and so it is the organelle where all types of glycosylation reactions can take place

503. True about glycolysis?

a) Hexokinase produce ATP

b) 1 cycle produces 2 ATP

c) It produces directly 2 molecules of lactate

d) Aldolase produces irreversible polymerization

Correct Answer - C

Ans. is 'c' i.e.,It produces directly 2 molecules of lactate [Ref Harper 29th/e p. 170-177]

- Each cycle of anaerobic glycolysis produces 2 molecules of lactate (lactic acid) whereas in aerobic condition it produces 2 molecules of pyruvate.

Option b is tricky one. **Each glycolytic cycle produces 4 ATPs** (not 2 ATPs). But out of these 4 ATPs, 2 are used in the cycle itself. Therefore, there is net gain of 2 ATPs. So,:-

1. Each cycle of glycolysis produces - 4 ATPs.
2. Each cycle utilizes 2 ATPs
3. Net gain in each cycle - 2 ATPs

504. The rate limiting step in glycolysis is catalyzed by?

a) Pyruvate kinase

b) Enolase

c) Glucokinase

d) Phosphofructokinase

Correct Answer - A:C:D

Ans. is 'd> a & c' i.e., Phosphofructokinase > Pyruvate kinase & Glucokinase [Ref Lippincott's 5th Ie p. 99]

Phosphofructokinase, glucokinase and pyruvate kinase are rate limiting enzymes **of glycolysis. However, phosphofructokinase** is the most important one.

505. Rate limiting enzyme in heme synthesis ?

a) ALA synthase

b) Hmg coa reductase

c) ALA dehydratase

d) Uroporphyrinogen 1 synthase

Correct Answer - A

Ans. is 'a' i.e.,ALA synthase *[Ref Harper's 29' le p. 309]*

Heme synthesis takes place in all cells, but occurs to greatest extent in bone marrow and liver. The first step in the synthesis of heme is the condensation of glycine and succinyl Co-A to form 6-aminolevulinic acid (6-ALA), which occurs in mitochondria. This reaction is catalyzed by 6-ALA synthase which requires pyridoxal phosphate (PLP) as cofactor. This is the rate limiting step in heme synthesis.

506. Reverse folding of proteins is carried out by ?

a) Valine

b) Threonine

c) Chaperone

d) Aspartate

Correct Answer - C
Ans. is 'c' i.e.,Chaperone *[Ref Harper's 29th/e p. 558, 559]*
Certain proteins play a role in the assembly or proper folding of other proteins without themselves being components of the latter.
Such proteins are called molecular chaperones.
Most chaperones exhibit ATPase activity and bind ADP and ATP.
This activity is important for their effect on folding

507. Myoglobin contains ?

a) Iron

b) Copper

c) Zink

d) Selenium

Correct Answer - A
Ans. is 'a' i.e.,Iron *[Ref Harper 29th/e p. 308, Vasudevan 6th/e p. 242]*
Hemoproteins are proteins which have heme as prosthetic group.
Important hemoproteins are hemoglobie, myoglobinQ, cytochromesQ (cytochrome CQ, cytochrome $_{P450Q)}$, catalaseQ, peroxidase, tryptophan pyrrolase and nitric oxide synthase.
All hemoproteins contain iron as iron is the central component of heme

508. All are activated by insulin except ?

a) Lipoprotein lipase

b) Pyruvate kinase

c) Hormone sensitive lipase

d) Acetyl-CoA carboxylase

Correct Answer - C
Ans. is C. i.e., Hormone sensitive lipase
Enzymes /Pathways activated by insulin
Glycolysis : PFK-1, Pyruvate kinase, glucokinase, PDH.
Glycogenesis : Glycogen synthase.
Lipogenesis : Acetyl-Co-carboxylase, Fatty acid synthase.
Cholesterol synthesis : HMG - CoA reductase.
Triglyceride synthesis : Acyl - CoA glycerol-3-P transferase, glycerol kinase.
Lipoprotein degradation : Lipoprotein lipase

509. Acute intermittent porphyria is due to deficiency of?

a) Uroporphyrinogen I synthase

b) Uroporphyrinogen III synthase

c) Ferrochelatase

d) ALA synthase

Correct Answer - A

Ans. is 'a' i.e.,Uroporphyrinogen I synthase *[Ref Harper 29^{t}Ve p. 313]*

510. Nonsense codons bring about ?

a) Elongation of polypeptide chain

b) Pre-translational modificastion of protein

c) Initiation of protein synthesis

d) Termination of protein synthesis

Correct Answer - D

Ans. is D. i.e., Termination of protein synthesis [Ref Harper 28"le p. 353, 354]

Stop or termination or nonsense codons:- Three of the 64 possible nucleotide triplets UAA^{Q} (amber ^{0}),UAG^{Q} (Ochre) and UGA^{Q} (opal) do not code for any amino acid. They are called nonsense codons that normally signal termination of polypeptide chains^{0}. Thus, though there are 64 possible triplet codons, only 61 codes for 20 amino acids (as remaining three are non-sense codons).

511. Repeatitive chains of glucosamine with uronic acid are seen in ?

a) NANA

b) Heparan sulphate

c) Keratan sulphate

d) None of these

Correct Answer - B

Ans. is `b' i.e., Heparan sulphate *[Ref Dinesh puri Yale p. 31, 32]*

Proteoglycans are made up of core protein, core trisaccharide and glycosaminoglycans.

Proteoglycans = Glycosaminoglycans + Core trisaccharide + Core protein.

Glycosaminoglycans (mucopolysaccharides) are made up of repeating diasaccharide units. Each diasaccharide unit contains?

512. ATP is consumed at which step of glycolysis

a) Enolase

b) Hexokinase

c) Pyruvate kinase

d) Isomerase

Correct Answer - B
Ans. is 'b' i.e., Hexokinase
ATP is consumed at reactions catalysed by - hexokinase, phosphofructokinase I.
ATP is produced at reactions catalyzed by -> phosphoglycerate kinase, pyruvate kinase.

513. Which of the following GAG is not sulphated ?

a) Chondroitin

b) Dermatan

c) Keratan

d) Hyaluronic acid

Correct Answer - D

Ans. *is* 'd' i.e., Hyaluronic acid *[Ref: Harper's 29th Ie p. 596]*

A Glycosaminoglycan(GAG) is an unbranched polysaccharide made up of repeating disaccharides, one component of which is always an amino sugar (hence the name GAG), either D-glucosamine or D-galactosamine.

The other component of the repeating disaccharide (except in the case of keratan sulfate) is a uronic acid, either L-glucuronic acid (GlcUA) or its 5'-epimer, L-iduronic acid (IdUA).

Proteoglycans are proteins that contain covalently linked glycosaminoglycans.

The proteins bound covalently to glycosaminoglycans are called "core proteins".

With the exception of hyaluronic acid, all the GAGs contain sulfate groups, either as 0-esters or as N-sulfate (in heparin and heparan sulfate).

Hyaluronic acid affords another exception because there is no clear evidence that it is attached covalently to protein, as the definition of a proteoglycan given above specifies.

514. Methionine can entre the TCA cycle at which level?

a) Fumarate

b) Oxabacetate

c) Succinyl - CoA

d) Citrate

Correct Answer - C
Ans. is 'c' i.e., Succinyl - CoA

515. Rate limiting steps in TCA cycle ?

a) a–Ketoglutarate Succinyl CoA

b) Citrate - Isocitrate

c) Succinyl CoA 4 Succinate

d) Succinate - Fumarate

Correct Answer - A
Ans. is 'a' i.e., alpha-Ketoglutarade - Succinyl CoA [Ref Harper's 28th/e p. 147, 154]
Regulating steps in TCA Cycle are catalyzed by : a) Citrate Synthase : Catalyzes condensation of acetyl CoA & oxaloacetate to from citrate.
Isocitrate dehydrogenase : Catalyzes the conversion of isocitrate to a-ketoglutarate by decarboxylation.
a-ketoglutarate dehydrogenase : Catalyzes the conversion of a-ketoglutarate to succinyl CoA

516. The folds in collagen is due to ?

a) Glycine

b) Alanine

c) Arginine

d) Histidine

Correct Answer - A

Ans. is 'a' i.e., Glycine *[Ref Essentials of biochemisty* p. *868]*

In order to form a triple-helix a polypeptide chain (a-chain) must contain glycine as every third residue in the sequence.

This is because only the glycine is small enough to be accommodated in the limited space available down the central core of the triple helix.

Each turn of polypeptide chain (a-chain) contains three amino acid residues, and glycine (Gly) is present at every third positions.

Thus glycine constitutes 33% of the total amino acid residues.

The repeating amino acid residues, represented as (Gly-X-Y)n, is an absolute requirement for formation of triple helix.

X and Y can be any amino acids, but most of the time X is proline (10% of the total amino acid residues) and most of the time Y is hydroxyproline.

517. Rate limiting step in TCA cycle is catalyzed by -

a) a-ketoglotarate synthase

b) Fumarase

c) Aconitase

d) Thiokinase

Correct Answer - A

Ans. is 'a' i.e., a-ketoglotarate synthase [Ref Harper 28th/e p. 147, 154]

518. Which of the following statements regarding mature cytoplasmic messenger RNA is true ?

a) Transcribed from Nuclear DNA

b) Has Thiamine in place of Uracil

c) Sugar is Deoxy Ribose

d) Its molecular weight is more than hn-RNA

Correct Answer - A

Ans. is *'a' i.e.*, Transcribed from Nuclear DNA *[Ref: Lippincott's Biochemistry 5th p.428;Fundamentals of Cytogenetics & Genetics (2010)* p. *444]*

Mesenger RNA (mRNA) is formed by the process of 'transcription' from one of the strands of double stranded nuclear DNA and carries genetic information from the nuclear DNA to the cytosol where it is used as a template for protein synthesis.

mRNA comprises only 5-10% of total cellular RNA. It carries the information (massage) from the nucleus to the ribosome. mRNA is synthesized in the nucleus as lieterogenous RNA (hn RNA)', which is processed into functional m RNA.

519. Fluroacetate inhibits ?

a) Citrate synthetase

b) Aconitase

c) Succinate dehydrogenase

d) Alphaketoglutarate dehydrogenase

Correct Answer - B
Ans. is 'b' i.e., Aconitase [Ref Harper 28thIe p. 145]

520. Identification of individed by their DNA was invented by ?

a) Shapiro

b) Lewis

c) Jeffreys

d) Pasture

Correct Answer - C
Ans. is 'c' i.e.,Jeffreys *[Ref Lippicott's Sthie* p. *83, 474, Lehniger 5thie* p. *319-21]*
The DNA fingerprinting was first reported in 1984 by Sir Alec Jeffreys° at the university of leicester in England.

521. Inhibitors of glycolysis are all except ?

a) Fluoride

b) Fluoroacetate

c) Arsenite

d) Iodoacetate

Correct Answer - B
Ans. is 'b' i.e., Fluoroacetate [Ref Harper' s 28`"/e p 151]
Fluoroacetate is an inhibitor of TCA cycle.

522. Which of following is an analouge guanosine ?

a) Abacavir

b) Allopurinol

c) Bromodeoxyuridine

d) None

Correct Answer - A
Ans. is 'a' i.e., Abacavir *[Ref Essentials of biochemistry* p. *888]*

523. DNA microarrays allow detection of Gene mutations using?

a) Polymerase chain Reaction

b) Cloning

c) Southern Blotting

d) Hybridization

Correct Answer - D

Ans. is 'd' i.e.,Hybridization *[Ref Biology by Raven Tata* p. *331]*

DNA Microarray (DNA-Chips)

- DNA microarrays contain thusands (500-5000) of immobilized DNA probes/sequences (few dozen to hundreds of nucleotide long) from known genes organized in an area no longer than a microscope slide. DNA segments (from DNA libraries) are amplified by PCR and placed on small wells in a solid polystyrene plates, using robotic devices. Upto million such spots are deposited in a predesigned array on a surface area of just few cm'. An alternate way is to synthesize DNA directly on the solid surface using photolithography.
- C-DNA (obtained directly or from mRNA of patients particular cell type or stage) is added to each well, hybridize and fluorescence is assessed to assess genes being expressed in those cells/stage.
- This is based on principles of nucleic acid hybridization like southern or northern blot tests but allows simultaneous study of multiple genes or entire genome rather than single.
- Hybridization means binding of complementary strands of nucleic acid according to Watson-Crick rules (i.e. A = T and G =C binding).
- Southern blot for DNA and Northern blot for RNA allows the study/detection of single gene whereas microarray technique (for DNA & RNA) allows detection of multiple genes or entire genome.

So it can be considered as multiple Southern or Northern blot analysis running in parallel.

524. The biosynthesis of the enzyme pyruvate carboxylase is repressed by ?

a) Insulin

b) Glucagon

c) Cortisol

d) Epinephrine

Correct Answer - A

Ans. is 'a' i.e., Insulin [Ref : Harper 28th/e p. 168]

Gluconeogenesis is regulated by four key enzymes : (i) Pyruvate carboxylase; (ii) Phosphoenolpyruvate carboxykinase; (iii) Fructose-1, 6-bisphosphatase; and (iv) Glucose-6-phosphatase.

The hormone glucagon, epinephrine and glucocorticoids stimulate gluconeogenesis, by inducing these enzymes. Conversely, insulin inhibits gluconeogenesis by repressing their synthesis.

525. Termination codon is ?

a) AUG

b) UAA

c) AUA

d) AGG

Correct Answer - B
Ans. **is 'b' i.e., UAA**
Initiation codon ·4AUG
Stop codons (termination codons or nonsense codons) → UAA, UGA, UAG

526. Where can glucose 6 phosphate not be converted to glucose ?

a) Muscle

b) Liver

c) Adipose tissue

d) Kidney

Correct Answer - A

Ans. is 'a' i.e., Muscle [Ref : Harper 25^{0} le p. 178-179]

Glucose-6-phosphatase is absent in muscles therefore, glucose-6-phosphate cannot be degraded to free glucose in muscles. Moreover, glucose-6-phosphate cannot diffuse out of the muscles. Therefore, muscle cannot provide glucose to maintain blood glucose level. Rather, muscle glycogen acts as a source of energy; the glucose-6-phosphate enters the glycolysis to produce energy.

527. Common intermediate between gluconeogenesis and fatty acid synthesis ?

a) Glucose-6-phosphate

b) Acetyl-CoA

c) Citrate

d) Succinyl-CoA

Correct Answer - C

Ans. is 'c' i.e., Citrate [Ref Harper 29th le p. 188]

Citrate in Gluconeogenesis

- Gluconeogenesis involves glycolysis, the citric acid cycle and some special reactions.
- Citrate is an intermediary metabolism of gluconeogenesis (through TCA cycle).

528. Chromosomal study is best carried out in ?

a) Prophase

b) Metaphase

c) Telophase

d) Anaphase

Correct Answer - B

Ans. is `b' i.e., Metaphase *[Ref: Anderson 10th*ie p. *225, 226, Robbins 8th*ie p. *158]*

Method of karyotyping

- Karyotyping is the study of coromosone.
- Dividing cells are arrested in metaphase by addition of colchicine or colcemid (deacetylmethylcolchicine).
- Subsequently, cells are exposed to a hypotonic solution to induce swelling of the cell for enhancing spreading of the chromosomes.
- The metaphase cells are then fixed with methanol/glacial acetic acid mixture and stained by one of the several banding techniques.
- After staining chromosomes are analysed under a microscope and photographed.
- Finally, a karyotype is constructed by manual or automated pattern.
- Chromosomes are arranged in pairs and decreasing order of length

529. Glycogen synthase is activated by ?

a) Insulin

b) Glucagon

c) Epinophrine

d) AMP

Correct Answer - A
Ans. is 'a' i.e.,Insulin [Ref Harper 28th/e p. 159-161, Lehinger 5th/e p. 603, 604]

530. Which of the following usually require a RNA intermediate for cloning/replication?

a) Transposons

b) Plasmids

c) Phages

d) Cosmids

Correct Answer - A

Ans. is 'a' i.e., Transposons *[Ref : Lippincot 4th/e p. 461 & Harper 29tVe p. 436, 437]*

Transposons (Tn) are mobile segments of DNA that move in an essentially random manner from one site to another on the same or a different chromosome.

Movement is mediated by transposase, an enzyme encoded by Tn itself. Movement can be :- (i) direct, in which transposase cuts out and then inserts Tn at a new site, or (ii) replicative, in which the Tn is copied and the copy inserted else where while the origin remains in place.

In eukaryotes, including humans, replicative transposition frequently involves a RNA intermediate, in which case the transposon is called a retrotransposon i.e. tronsposons that involve a RNA intermediate are called retrotransposons

531. Glycogen storage disease which presents as lysosomal storage disease ?

a) Von gierke's disease

b) Pompes disease

c) Mcardle's disease

d) Andersen's disease

Correct Answer - B

Ans. is 'b' i.e., Pompes disease [Ref Lippincott's 4th/e p. 129-131]

Type II glycogen storage disease (Pompes disease) is the only glycogen storage disease that is a lysosomal storage disease

532. In sickle cell anemia, translocation on codon 6 is due to substitution of ?

a) Valine for glutamate

b) Glutamate for valine

c) Isoleucine for valine

d) Valine for isoleucine

Correct Answer - A

Ans. is 'a' i.e., Valine for glutamate *[Ref Harper's 29th/e* p. *444]*

Sickle cell disease, is caused by mutation of a single base out of the 3×10^9 in the genome, a T-to-A DNA substitution, which in turn results in an A-to-U change in the mRNA corresponding to the sixth codon of the 13-globin gene. The altered codon specifies a different amino acid (valine rather than glutamic acid), and this causes a structural abnormality of the p-globin molecule.

533. Aldolase-B is involved in metabolism of ?

a) Galactose

b) Fructose

c) Sucrose

d) None

Correct Answer - B
Ans. is 'b' i.e., Fructose [Ref Harper's 28th /e p. 179)

534. In humans, ascorbic acid cannot be synthesized because of ?

a) Deficiency of G6PD

b) Deficiency of xylulose kinase

c) Deficiency of L-gulonolactone oxidase

d) Deficiency of phosphoglucomutase

Correct Answer - C
Ans. is 'c' i.e., Deficiency of L-gulonolactone oxidase
In man, other primates and guinea pigs, ascorbic acid can be synthesized due to absence of L-glucanolactone oxidase, an enzyme used in lower animals to synthesise ascorbic acid as a byproduct of uronic acid pathway (glucuronic acid cycle).

535. Function of exonuclease -

a) Polymerization

b) Proof reading

c) Chain elongation

d) Termination

Correct Answer - B

Ans. is 'b' i.e., Proof reading *[Ref Dinesh puri 3rd /e* p. *455, 456]*

Nucleases refers to an enzyme that catalyzes hydrolysis of phosphodiester bond in a nucleic acid.

The nucleses are of two types :

* Endonucleases : Cleave the internal phosphodiester bonds.
* Exonucleases : Cleave bonds at ends. Some exonucleases cleave only at the 3' end (the 3'-exonuclease activity) while other cleave at the 5' end (the 5'-exonuclease activity).

- 3^1-exonuclease activity is responsible for proofreading. 3'-exonuclease activity is present in DNA polymerase I, II and III.
- 5^1-exonuclease activity is responsible for error correction in damaged DNA.

536. Glucose oxidase converts glucose to?

a) Gluconic acid

b) Glucuronic acid

c) Iduronic acid

d) Galactic acid

Correct Answer - A
Ans. is 'a' i.e., Gluconic acid [Ref : Internet]
Oxidase-peroxidase enzyme system is used to determine glucose in urine & blood.
Glucose oxidase enzyme produces hydrogen peroxide & gluconic acid from glucose.Peroxidase catalyses the reaction of H202 with colourless potassium iodide to brown iodide. This produces a colour change, the intensity of which may indicate glucose concentration in some tests(such as Boehringer, Diastix).

537. Glucose is converted to glucuronate by ?

a) Oxidation of aldehyde group

b) Oxidation of terminal alcohol

c) Oxidation of both

d) None

Correct Answer - B

Ans. is 'b' i.e., Oxidation of terminal alcohol [Ref Chatterjee 8th/e p. 29]

When aldose sugars are oxidized they may form three different sugar acid, depending upon oxidation of aldehyde group (at C-1) or terminal alcohol group (at C-6).

1. Aldonic acid :- Oxidation of an aldose with hypobromous acid (HOBr) oxidises only aldehyde group and convert it to carboxyl group to form aldonic acid. For example, glucose is oxidized to gluconic acid.
2. Saccharic acid :- Oxidation of aldoses with nitric acid convert both aldehyde and terminal primary alcohol groups to carboxyl group, formic saccharic acid. For example, glucose is oxidize to glucosaccharic acid.
3. Uronic acid :- When an aldose is oxidized in such a way that the terminal primary alcohol is converted is to carboxyl without oxidation of aldehyde group, a uronic acid is produce. For example, glucose is oxidized to glucuronic acid.

538. Enzyme require for cutting the strand DNA synthesis?

a) DNA polymerase

b) DNA ligase

c) Topoisomerase

d) Helicase

Correct Answer - C

Ans. is 'c' i.e., Topoisomerase *[Ref Lippincott's 5th ie p. 400, 401]*

As the two strands of DNA are separated a problem is encountered, i.e. appearance of positive supercoils (supertwists) in the region of DNA aheud of replication form.

The accumulation of positive supercoiling interferes with further unwinding of the double helix.

To solve this problem, there is a group of enzymes called DNA topoisomerases which are resonsible for removing supercoils in the helix.

DNA topoisomerases are nick and seal enzymes, i.e. they have both nuclease (strand-cutting) and ligase (strand-resealing) activities.

539. Increased uric acid levels are seen in which glycogen storage disease ?

a) Type I

b) Type II

c) Type III

d) Type IV

Correct Answer - A

Ans. is 'a' i.e., Type I [Ref Harper 29^{m}/e p. 339]

Purine overproduction and hyperuricemia in von Gierke disease (glucose-6-phosphatase deficiency) occurs secondary to enhanced generation of PRPP precursor, i.e. ribose-5-phosphate (a pentose). In glucose-6-phosphatase deficiency, glucose-6-phosphate cannot be converted to glucose. Accumulated glucose-6-phosphate is then metabolized via HMP shunt, which in turn generates large amounts of ribose-5-phosphate, a precursor of PRPP. The increased synthesis of PRPP then enhances de novo synthesis of purine nucleotides

540. Gulonate dehydrogenase requires ?

a) NADP

b) NAD

c) FAD

d) FMN

Correct Answer - A
Ans. is 'a' i.e., NADP [Rep Harper 29t5/e p. 201-204]
Gulonate dehydrogenase is an enzyme in glucuronic acid pathway (uronic acid pathway) that requires NADP+.

541. Reverse transcription involves ?

a) RNA dependent DNA synthesis

b) DNA dependent RNA synthesis

c) DNA dependent DNA synthesis

d) RNA dependent RNA synthesis

Correct Answer - A

Ans. is 'a' i.e., RNA dependent DNA synthesis *[Ref Harper 29th Ie p. 348]*

Synthesis of RNA from DNA is called transcription.

In transcription, RNA is synthesized by RNA polymerase. RNA polymerase is also called DNA dependent RNA polymerase because it is dependent on DNA (non-coding strand) for RNA synthesis.

Reverse transcription, as the name suggests, is the reverse of transcription i.e. synthesis of DNA form RNA.

In reverse transcription DNA is synthesized by reverse transcriptase. Reverse transcriptase is also called RNA dependent DNA polymerase because it is dependent on RNA for DNA synthesis.

542. Mutation in GLUT-2 causes ?

a) Dandy walker syndrome

b) Fanconi becker syndrome

c) Beckwith syndrome

d) Menke's disease

Correct Answer - B
Ans. is 'b' i.e., Fanconi becker syndrome [Ref Diagnostic of Endocrine function is children and adolescents p. 271]
GLUT 2 is expressed in pancreatic 13-cells, hepatocytes and in epithelial cells of kidney and intestine.
Fanconi-Bickel syndrome is caused by GLUT 2 mutation, a disease characterized by proximal renal tubulopathy, impaired glucose homeostasis and hepatomegaly.

543. Amino sugar are formed forms ?

a) Glucose- 1 -phosphate

b) Glucose-6-phosphate

c) Fructose- 1 -phosphate

d) Fructose-6-phosphate

Correct Answer - D

Ans. is 'd' i.e., Fructose-6-phosphate [Ref Dinesh puri 3rdle p. 170]

Amino sugars are dervatives of monosaccharides in which an amino group replaces the -OH residue on carbon-2 of hexose, such as glucose, galactose and mannose, The corresponding compounds are glucosamine, galactosamine and mannosamine, respectively.

The amino acid group is usually acetylated, e.g. N-acetylglucosamine or N-actylgalactosamine.

The amino sugars are required for the synthesis of glycolipids, glycoproteins and proteoglycans.

They are synthesized from fructose-6-phosphate

544. Difference between ganglioside & cerebroside, all except?

a) Charge

b) Presence of NANA

c) Presence of carbohydrate

d) Native tissue

Correct Answer - C

Ans. is 'c' i.e., Presence of carbohydrate [Ref Lippincott's 4th/e p. 208-210]

Both ganglioside and cerebroside contain carbohydrate as both are glycolipids.

NANA is present in ganglioside (not in cerebroside).

545. In glycolysis, NADH is produced at ?

a) Pyruvate kinase

b) Enolase

c) Glyceraledehyde-3-P-dehydrogenase

d) PFK-1

Correct Answer - C
Ans. is 'c' i.e., Glyceraledehyde-3-P-dehydrogenase *[Ref Harper 28th/e p. 151-152]*
Reducing equivalent (NADH) production is catalyzed by :
Glyceraldehyde 3-phosphate dehydrogenase

546. 1" acetyl group donor in fatty acid synthesis is ?

a) Malonyl CoA

b) Palmitate

c) Acetyl CoA

d) Citrate

Correct Answer - C

Ans. is 'c' i.e., Acetyl CoA [Ref : Harper 29"le p. 216-217]

Acetyl-CoA acts as a primer to donate 1st 2 carbon atoms (C-15 and C-16) of palmitate. The addition of all the subsequent C2 units is via malonyl-CoA.

Propionyl-CoA acts as primer (for donating first 3 carbon atoms) in the synthesis of odd-carbon number fatty acids.

547. Chargaff's rule states that ?

a) A=T, G=C

b) A=G, T=C

c) A=C, G=T

d) Any combination possible

Correct Answer - A
Ans. is 'a' i.e., A=T, G=C *[Ref : Harper 29th/e* p. *344 & 28th/e* p. *302; Essentials of biochemistry p. 915]*
Chargaffs rule states that in DNA of all species quantities of purines is the same as that of pyrimidines, i.e. A+G = T+C

548. Only vitamin that help in carbon fixation ?

a) Folic acid

b) Pantothenic acid

c) Niacin

d) Thiamine

Correct Answer - A
Ans. is 'a' i.e., Folic acid

549. Rate controlling enzyme of fatty acid synthesis -

a) Thioesterase

b) Transacetylase

c) Acetyl-CoA carboxylase

d) Ketacyl synthase

Correct Answer - C

Ans. is 'c' i.e., Acetyl-CoA carboxylase [Ref Harper 29th/e p. 217, 220]

Production of malonyl-CoA is the initial° and rate limiting step in fatty acid synthesis.

Acetyl-CoA needs to be converted to activated form, which will serve as the donor of carbon units to growing fatty acid chain.

Malonyl-CoA°) a 3- carbon compound is such activated form.

It is produced by carboxylation of acetyl-CoA, a reaction catalyzed by acetyl-CoA caroxylase°. Acetyl-CoA carboxylase requires biotin as a cofactor°.

550. Primer function is in ?

a) Transcription

b) Translation

c) Initiation of DNA replication

d) Termination of DNA replication

Correct Answer - C

Ans. is 'c' i.e., Initiation of DNA replication *[Ref Harper's 29th Ie p. 366, 367]*

DNA synthesis cannot commence with deoxyribonucleotides because DNA polymerase cannot add a mononucleotide to another mononucleotide.

Thus, DNA polymerase cannot initiate synthesis of complementary DNA synthesis strand of DNA on a totally single stranded template.

For this, they require RNA primer, which is a short piece of RNA formed by enzyme primase° (RNA polymerase°) using DNA as a template.

RNA primer is then extended by addition of deoxyribonucleotides.

Later on, the ribonucleotides of the primer are replaced by deoxyribo nucleotides.

551. Which of the following is a ribozyme?

a) Peptidyl transferase

b) Elongation factor 2

c) Primase

d) RNA polymerase

Correct Answer - A

Ans. is 'a' i.e., Peptidyl transferase *[Ref Harper 29thIe p. 405]*

- Some RNA molecules have intrinsic catalytic activity.
- The activity of these ribozymes often involves the cleavage of nucleic acid.

Two important RNA enzymes or ribozymes are : ?

- The *peptidyl transferase* that catalyzes peptide bond formation on the ribosome and Ribozymes involved in the RNA splicing.

552. Which RNA is used in RNA splicing ?

a) mRNA

b) Small nuclear RNA

c) Small cytosolic RNA

d) tRNA

Correct Answer - B

Ans. is 'B' i.e., Small nuclear RNA *[Ref Harper 29th/e p. 378, 390]*

Splicesome Splicesome is an assembly made up of small nuclear RNA (snRNA), some proteins and hnRNA. snRNA combines with proteins to form small nuclear ribnonucleoprotein particles (snRNPs or snurps) that mediate splicing. It is snRNA component of snurps that catalyzes splicing°. Snurps are U,,U,,U_3,U4, U_5 and U6

553. What is attatched to 3' end of mRNA after transcription?

a) Poly Atail

b) CCA

c) Intron

d) 7-methylguanosine

Correct Answer - A

Ans. is 'a' i.e.,Poly Atail *[Ref: Harper's 29`h/e p. 392]*

Mammalian mRNA molecules contain a 7-methylguanosine cap structure at their 5' terminal, and most have a poly (A) tail at the 3' terminal.

Prokaryotic mRNA is functional immediately upon synthesis, i.e. prokaryotic primary transcript of mRNA is functional.

Thus it does not require post-transcriptional modification.

In Eukaryotes the primary transcript of mRNA is the hn RNA (hetrogeneous nuclear RNA).

After transcription hnRNA is extensively modified to form functional mRNA.

554. Primase functions as ?

a) Joining DNA fragments

b) Synthesining small RNA fragments during DNA synthesis

c) Synthesising small RNA fragments during translation

d) Unwinding of DNA

Correct Answer - B
Ans. is 'b' i.e., Synthesining small RNA fragments during DNA synthesis *[Ref Harper's 29th/e p.* 366, 367]

555. What is the function of DNA ligase ?

a) Unwinding (denaturation) of dsDNA to provide an ssDNA template

b) Seals the single strand nick between the nascent chain and Okazaki fragments on lagging strand

c) Initiation of DNA synthesis and elongation

d) Initiates synthesis of RNA primers

Correct Answer - B
Ans. is 'b' i.e., Seals the single strand nick between the nascent chain and Okazaki fragments on lagging strand *[Ref Harper 25^{0}1e p. 367]*

556. Central Dogma of molecular biology indudes all except ?

a) Transcription

b) Translation

c) RNA replication

d) DNA replication

Correct Answer - C
Ans. is 'c' i.e., RNA replication
DNA stores genetic information :- Information about amino acid sequence of all the proteins is present in the form of genes in DNA. The entire genetic material present in the DNA of an organism is known as **genome.** The important role of DNA in transfer of information in living cells is called **central dogma of molecular biology.** According to the central dogma, information flows from DNA to RNA to protein.

557. Nucleotide consists of all except ?

a) Sugar

b) Phosphate

c) Fatty acid

d) Base

Correct Answer - C
Ans. is 'c' i.e., Fatty acid *[Ref Harper's 28"/e p. 286]*
Nucleotides are monomeric units of nucleic acids. They are required for synthesis of nucleic acid.
Each nucleotide is made up of : **(i) A nitrogenous base, (ii) A sugar (pentose sugar)** and **(iii) A phosphate group (phosphoric acid).** Nitrogenous base combines with a sugar to form **nucleosides.** The nucleoside combines with phosphoric acid to form a nucleotide.

558. Which of the following is required for fatty acid synthesis ?

a) NADPH

b) NADH

c) FADH

d) None

Correct Answer - A

Ans. is 'a' i.e.,NADPH [Ref Harper 29th/e p. 216-217]

Fatty acid synthesis takes place in cytosolQ.

Acetyl-CoA is the immediate substrate for lipogenesis and synthesis always ends in formation of plamitic acie.

In humans; liver and lactating mammary glands are the main organs for lipogenesisQ.

Although kidney, brain, lungs and adipose tissue are also involved, to a lesser extent.

Cofactor requirements for fatty acid synthesis are NADPH, ATP, $Mr1^{\cdot 2}$, biotin and HCO_3- (as a source of CO2).

Because most fatty acids have multiples of two carbons, they are synthesized from successive addition of two carbon units, the donor of which is acetyl-CoA.

So, the basic building block is acetyl-CoA° which is the source of all the carbon atoms of the fatty acid being synthesized.

559. Shine dalgarno sequence is related to ?

a) Transcription

b) Translation

c) DNA replication

d) None

Correct Answer - B
Ans. is 'b' i.e., Translation
Shine dalgarno sequence in prokaryotes and Kozak consensus sequences in eukaryotes helps in initiation of protein synthesis (Translation)
In **prokaryotes,** a sequence of nucleotide bases on mRNA known as **Shine-Dalgarno sequence (SD sequence)** facilitates the binding of mRNA to the preinitiation complex. SD sequence is a purine-rich sequence of nucleotide bases, which is **located -6 to -10 bp from AUG codon°.**
In **Eukaryotes, 'Kozak consensus' sequence** surrounds AUG (initiation codon) and determines the initiating codon of mRNA.

560. Citrate used in fatty acid synthesis uses which enzyme ?

a) Citrate Synthase

b) ATP citrate lyase

c) Aconitase

d) Malic enzyme

Correct Answer - B

Ans. is 'b' i.e., ATP citrate lyase [Ref Harper's 28th/e p. 193, 196]

Glucose is the primary substrate for lipogenesis and acetyl-CoA (immediate substrate for fatty acid synthesis) is formed from glucose via oxidation of pyruvate within the mitochondria.

However, acetyl-CoA can not penetrate inner mitochondrial membrane.

Therefore it is transferred in the form of citrate.

Citrate is formed in the mitochondrial matrix by the condensation of acetyl-CoA with oxaloacetate (first reaction in citric acid cycle).

Then citrate is transported into cytosol via the tricorboxylate transporter in exchange with malate.

In cytosol, citrate is cleaved by ATP-citrate lyase to oxaloacetate and acetyl-CoA.

561. Which of the following is w-6 fatty acid -

a) Cervonic acid

b) Linoleic acid

c) Alpha linolenic acid

d) Elaidic acid

Correct Answer - B
Ans. is 'b' i.e., Linoleic acid [Ref Harper 28th/e p. 123]
Alpha linolenic acid → Linoleic acid → Oleic acid
Clupandonic acid → Gama linolenic acid → Nervonic acid
Cervonic acid → Arachidonic acid → Elaidic acid

562. Linoleic acid is -

a) w-3 fatty acid

b) w-6 fatty acid

c) w-9 fatty acid

d) Saturated fatty acid

Correct Answer - B

Ans. is b' i.e., w-6 fatty acid [Ref Harper 28thle p. 123]

563. Watson crick model is for which DNA ?

a) B DNA

b) A DNA

c) C DNA

d) Z DNA

Correct Answer - A

Ans. is 'a' i.e., B DNA *[Ref : Harper 25^{0}/e p. 344]*

DNA is the repository of genetic information. DNA is located in nucleus. DNA is also present in mitochondria

564. Lipogenesis occurs in ?

a) Liver

b) Skeletal muscles

c) Myocardium

d) Lungs

Correct Answer - A:D
Ans. is 'a > d' i.e., Liver > Lungs
Fatty acid synthesis takes place in cytosol°.
Acetyl-CoA is the immediate substrate for lipogenesis and synthesis always ends in formation of palmitic acid.

565. Which of the following is monoenoic acid ?

a) Arachidonic acid

b) Linoleic acid

c) Oleic acid

d) Linolenic acid

Correct Answer - C
Ans. C. Oleic acid
In humans; liver and lactating mammary glands are the main organs for lipogenesisQ.
Although kidney, brain, lungs and adipose tissue are also involved, to a lesser extent.
Cofactor requirements for fatty acid synthesis are NADPH, ATP, $Mn^{\cdot 2}$, biotin and HCO_3- (as a source of CO).
Because most fatty acids have multiples of two carbons, they are synthesized from successive

566. Which of the following is not involved in synthesis of pyrimidines?

a) Glutamine

b) CO

c) Aspartic acid

d) Glycine

Correct Answer - D

Ans. is 'd' i.e., Glycine *[Ref Harper 29th/e p. 336-337]*

Amino acids involved in purine synthesis → *Glycine, aspartate, glutamine.*

Amino acids involved in pyrimidine synthesis → Glutamine, aspartic acid (aspartate)

567. Which of the following fatty acid has maximum number of carbon atoms ?

a) Oleic acid

b) Linolenic acid

c) Arachidonic acid

d) Cervonic acid

Correct Answer - D
Ans. is 'd' i.e., Cervonic acid
Cervonic acid has 22 carbon atoms, more than oleic acid (18C), linolenic acid (18C) and arachidonic acid (20C).
So, the basic building block is acetyl-CoA^{Q} which is the source of all the carbon atoms of the fatty acid being synthesized.

568. Chylomicron remnants are associated with ?

a) Apo-A

b) Apo-B100

c) Apo-E

d) Apo-C

Correct Answer - C
Ans. is 'c' i.e., Apo-E

569. Purine are formed by ?

a) Aspartic acid, glycine, uric acid

b) Aspartate, glycine,

c) Aspartate, glutamate

d) Aspartate, glycine, glutamine

Correct Answer - D

Ans. is 'd' i.e., Aspartate, Glycine, Glutamine *[Ref Harper 29thie p. 332]*

Amino acids involved in purine synthesis → *Glycine, aspartate, glutamine.*

Amino acids involved in pyrimidine synthesis → Glutamine, aspartic acid (aspartate).

570. Apoprotein - C ?

a) Activates lipoprotein lipase

b) Inactivates lipoprotein lipase

c) Facilitates triglyceride transport

d) All of the above

Correct Answer - D

Ans. is 'd' i.e., All of the above [Ref Harper 28th/e p. 213]

Apo C-II is an activator of LPL, wheras apo A-II and apo C-III act as inhibitors of LPL.

As apo-C is a component of chylomicrons and VLDL, it facilitates transport of TGs.

571. Which is not true of chylomicrons ?

a) Lowest desnsity

b) Max. content is TGs

c) Max. content is cholesterol

d) Largest size

Correct Answer - C

Ans. is 'c' i.e., Max.content is cholesterol [Ref: Harper 29th/e p. 238, Chatterjea 8th le p. 445, 446]

572. Beta-alanine is derived from ?

a) Adenosine

b) Guanosine

c) Thymine

d) Uracil

Correct Answer - D
Ans. is 'd' i.e., Uracil *[Ref: Harper 29^{il}le p. 339, 340]*

573. Oxidised LDL is more athreogenic because ?

a) Binds to Apo E

b) Binds to scavenger R

c) Binds to ATP binding

d) Accumulates in macrophages

Correct Answer - D

Ans. is 'd' i.e., Accumulates in macrophages [Ref Robbin's 8th Ie p. 837]

Macrophages engulf LDL cholesterol and form foam cells formation of earliest lesion, i.e. fatty streak.

Macrophages also form oxygen free radicals that cause oxidation of LDL to yield oxidized LDL (modified LDL).

574. Adenine phosphoribosyl transferase is involved ?

a) De novo purine synthesis

b) Purine degradation

c) Salvage synthesis of purine nucleotides

d) None

Correct Answer - C

Ans. is 'c' i.e., Salvage synthesis of purine nucleotides *[Ref Harper 29th ie* p. *334-335]*

Salvage pathway of purine nucleotide synthesis

- Free purine bases (adenine, guanine and hypoxanthine) and purine nucleosides are formed in cells during the metabolic degradation of nucleic acids and nucleotides. These free purine bases and purine nucleosides are reused in the formation of purine nucleotides. This is called salvage pathway (salvage means property saved from loss). Salvage synthesis requires far less energy than de novo synthesis.

575. Hormone sensitive lipase is inhibited by?

a) Thyroid homone

b) Insulin

c) GH

d) ACTH

Correct Answer - B
Ans. is `b' i.e.,Insulin [Ref Harper 29"Ve p. 246, 247]

576. Lecithine hydrolysis yeilds ?

a) Choline

b) Pyruvate

c) Glycine

d) None

Correct Answer - A
Ans. is 'a' i.e.,Choline [Ref Harper 29th/e p. 233]

577. Which of the following requires vitamin B_{12} ?

a) Serine to lysine

b) Homocysteine to methionine

c) Serine to glycine

d) Glutamine to glutamate

Correct Answer - B

Ans. is 'b' i.e., Homocysteine to methionine *[Ref: Harper 29^{6}7e p. 537-539]*

Conversion of homocystein to methionine In this reaction, active form is methylcobalamine. This is the only reaction which requires both vitamin $B_{,2}$ (as methylcobalamine) and folic acid (as N^{5}-methyl-Hdolate). The reaction is catalyzed by the enzyme cobalamin-dependent methionine synthase also called 5-methyltetrahydrofolate-homocysteine methyltransferase

578. The pyruvate utilization in tissues is decreased in ?

a) Pernicious anemia

b) Scurvy

c) Beriberi

d) Pellagra

Correct Answer - C

Ans. is 'c' i.e., Beriberi *[Ref Harper 29th/e p. 534]*

Pyruvate utilization is decreased in thiamine deficiency. Beriberi is due to thiamine deficiency.

In thiamine deficiency, pyruvate cannot be converted to acetyl-CoA as thiamine pyrophosphate is a coenzyme for pyruvate dehydrogenase which catalyzes the conversion of pyruvate to acetyl-CoA. Hence, excess of pyruvate is metabolized to lactate by lactate dehydrogenase

579. Coenzyme form of pyridoxine is ?

a) ADP

b) NAD

c) PLP

d) FAD

Correct Answer - C
Ans. is 'c' i.e.,PLP [Ref Guyton 12thie p. 854]

580. Omega oxidation of fathy acids occur?

a) ER

b) Mitochondria

c) Cytosol

d) None

Correct Answer - A
Ans. is 'a' i.e.,ER [Ref Harper's 28th/e p. 185, 195]
Beta (a) → Mitochondria
Alpha (a) → Endoplasmic reticulum, Mitochandria
Omega (w) → Microsomal system (smooth ER)
a-oxidation of very long chain FA → Peroxisomes

581. Most potent anti oxidant ?

a) Vit A

b) Vit K

c) Vit E

d) Vit C

Correct Answer - C

Ans. is 'c' i.e., Vit E *[Ref : Harper 29thie p. 532, 541, 543]*

Amongst given options, vitamin A, E and C are anti-oxidants. However, Vitamin E (tocopherol) is the most important antioxidant in the body, acting in the lipid phase of membranes protecting against the effects of free radicals.

582. What is true regarding medium chain fatty acids ?

a) Don't require pancreatic lipase

b) Not deposited in adipose tissue

c) Diffuse directly into portal circulation

d) All of the above

Correct Answer - D

Ans. is 'd' i.e.,All of the above [Ref Vasudevan 6" p. 160]

Metabolism of short chain fatty acids (SCFAs) and medium chain fatty acids (MCFAs) is drastically different from long chain fatty acids (LCFAs).

SCFAs and MCFAs do not require pancreatic lipase and bile salts for digestion, but required for LCFAs digestion.

SCFAs and MCFAs are directly absorbed from intestine into portal circulation, whereas LCFAs are taken by lymphatics, after incorporation into chylomicrons.

SCFAs and MCFAs are oxidized by peripheral cells and are not used for storage. LCFAs are esterified with glycerol to form triacylglycerol, storage form of lipid

583. What will you give to stop chyluria in diet?

a) Small chain FA

b) Medium chain FA

c) Long chain FA

d) Omega 3 unsaturated FA

Correct Answer - B
Ans. is 'b' i.e.,Medium Chain FA [Ref Harrison's 18thie p. 294]
Medium chain fatty acids directly enter the portal vein on absorption,bypassing the lymphatics.Hence,they are used in chyluria

584. Pantothenic acid is needed for donating the following moiety ?

a) Acetyl (or acyl) CoA

b) Carboxyl

c) Hydroxyl

d) Amino

Correct Answer - A

Ans. is 'a' i.e., Acetyl (or acyl) CoA *[Ref Harper 29th/e p. 540]*

Pantothenic acid functions as coenzyme by providing building block of coenzyme A and ACP

.. Coenzyme-A participates in reactions of citric acid cycle, fatty acid oxidation, acetylation, and cholesterol synthesis.

?. ACP takes part in fatty acid synthesis

585. Ascorbic acid is required for synthesis of ?

a) Phenylserine

b) Homoserine

c) Hydroxylysine

d) Selenocysteine

Correct Answer - C

Ans. is 'c' i.e., Hydroxylysine *[Ref Harper's 29th/e p. 540]*

Hydroxylation of proline and lysine residue takes place during post-translational modification in rough ER.

The enzyme catalyzing the reactions are prolyl hydroxylase (for proline) and lysyl hydroxylase (for lysine).

Both these enzymes are dioxygenases° using molecular oxygen (0_2) and cofactor for both these enzymes is vitamin C (ascorbic acid)°. a-Ketoglutatrate is a coreductant, which is oxidized to succinate.

586. In a person fasting overnight with carnitine deficiency, following chemicals increase in quantity in blood ?

a) Glucose

b) Fatty acids

c) Amino acids

d) Ketone bodies

Correct Answer - B

Ans. is 'b' i.e., Fatty acids [Ref : Harper 29th/e p. 208-209, 214]

In starvation, there is increased hydrolysis of TGs (of adipose tissues) into glycerol and fatty acids. Fatty acids are further oxidized by [3-oxidation in the mitochondria.

Carnitine is required for transported of activated fatty acid into mitochondria for 3-oxidation.

If carnitine is deficient, fatty acids cannot be transferred into the mitochondria, but they are continuously produced due to hydrolysis of TGs (in starvation there is decreased insulin to glucagon ratio, which stimulates hydrolysis of TGs).

Thus free fatty acid level is increased as there is increased production but no utilization (p-oxidation).

587. Which of the following is a Fat Soluble vitamin ?

a) Thiamine

b) Niacine

c) Vitamin A

d) Ribaflavin

Correct Answer - C
Ans. is 'c' i.e., Vitamin A *[Ref Harper's 29^{6}/e p. 335]*

588. Serum appeary milky white in ?

a) Increased LDL

b) Increased HDL

c) Increased VLDL

d) Increased Chylomicrons

Correct Answer - D

Ans. is 'd' i.e., Increased Chylomicrons [Ref Harrison 18thle p. 3151]

"The fasting plasma is turbid, and if left at 4°C (39.2°F) for a few hours, the chylomicrons float to the top and form a creamy supernatant".

Chylomicrons are the largest lipoprotein molecule with maximum lipid contents. Therefore, they have least density and float on the top giving a creamy (milky) supernatant.

589. Overnight fasting what occurs ?

a) Glucose decreases

b) FFA increases

c) Increased gluconeogenesis

d) Increased beta-hydroxybutyrate

Correct Answer - C

Ans. is 'c' i.e., Increased gluconeogenesis *[Ref Vasudevan &hie p. 85, 86, Harper 28th/e p. 240, 241]*

In overnight fasting glucose level is maintained due to glycogenolysis and gluconeogenesis.

FFA and ketone bodies (p-hydroxybutyrate) starts rising after 2-3 days, i.e. in later part of initial stage of prolonged starving

590. Adipose tissue fat metabolism is done by ?

a) Lipoprotein lipase

b) Hormone sensitive lipase

c) Acid lipase

d) Acid maltase

Correct Answer - B

Ans. is 'b i.e., Hormone sensitive lipase [Ref : Harper 29th/e chap. 16]

Adipose tissue fat (TGs) metabolism → Hormone sensitive lipase

Lipoproteins (VLDL & chylomicrons) TGs metabolism - Lipoprotein lipase

591. RQ is least in ?

a) Brain

b) RBC

c) Adipose

d) Heart

Correct Answer - D
Ans. is 'd' i.e., Heart *[Ref Read below]*
Respiratory qnotient (RQ) of :
1. Carbohydrate is 1
2. Fat is 0.70
3. Protein is 0.82

Under normal condition the major fuel of heart is fatty acids, while other three organs (given in options) utilize glucose.
Thus RQ value is minimum for heart.

592. Enzyme deficient in Type I Hyperlipidemia is ?

a) HMG CoA reductase

b) Lipoprotein lipase

c) Cholesterol acyl transferase

d) Peroxidase

Correct Answer - B
Ans. is 'b' i.e.,Lipoprotein lipase [Ref : Harper 2e/e p. 232 table (26.1)]

593. Apo-E dificiency is seen in

a) Tpye I hypolipoproteinemia

b) Tpye II hypolipoproteinemia

c) Tpye III hypolipoproteinemia

d) Tpye IV hypolipoproteinemia

Correct Answer - C
Ans. is 'c' i.e., Tpye III hypolipoproteinemis [Ref Harison p. 3149, 3150, Chatterjea 8th/e p. 45]

594. Substance with highest thermogenic effect ?

a) Fat

b) Proteins

c) Carbohydrate

d) All are the same

Correct Answer - B
Ans. is `b' i.e., Proteins *[Ref Progress in obesity research-397]*
Thermogenic effect (thermic effect) of food refers to the increase in metabolic rate that occurs after ingestion of particular food.
This results in an increase in the amount of heat generated by the body.
Protein is at the top of the hierarely of macronutrients, as for as the thermogenic effect in concerned. About 25-30% of energy is consumed to digest the protein.
Carbohydrates come in the middle and lipids (fats) are in third place.

595. Anaplerotic reaction is catalyzed by ?

a) Pyruvate carboxylse

b) Enolase

c) Pyruvate kinase

d) G6PD

Correct Answer - A

Ans. is 'a' i.e., Pyruvate carboxylse *[Ref Dinesh Puri 3`die p. 177]*

Conversion of pyruvate to malate by the cytoplasmic malic-enzyme. Malate can then enter the mitochondrion as a substrate for the TCA cycle.

Pyruvate may react with aspartate or glutamate in transaminase reactions, producing the TCA cycle intermediates oxalocetate and a-ketogluarate, respectively.

Several glycogenic amino acids may serve as source of TCA intermediates

596. Which of the following is not affected in Abetalipoproteinemia ?

a) LDL

b) VLDL

c) HDL

d) IDL

Correct Answer - C

Ans. is 'c' i.e., HDL [Ref Chatterjea 8th le p. 462, 463 & Dinesh Puri 3rd le p. 248]

Hypolipoproteinemia

- In this group of disorders concentration of one or more lipoproteins in plasma is decreased. The commonest of these disorders are **abetalipoproteinemia, hypobetalipoproteinemia** and **hypoalphalipoproteinemia.**
- Abetalipoproteinemia:- There is defective synthesis or secretion of apoprotein-B (apo-B) in intestine and liver. So, there is deficiency **of apo-B containing lipoproteins i.e. chylomicrons°, VLDL°, IDL° and LDL°. As a result extremely low** plasma levels of cholesterol and triacylglycerols° **occurs. HDL levels are normal°** as HDL does not contain apo-B.
- Hypobetalipoproteinemia:- There is decreased synthesis of apo-B due to apo-B gene mutations. So, apo-B containing lipoproteins are synthesized at lower rate. There is slight decrease in VLDL, IDL and LDL levels. HDL is normal. Plasma cholesterol and triglycerides are decreased.
- **Hypoalphalipoproteinemia (Tangier disease):-** There is **marked deficiency of major lipoprotein HDL** (apo-A-I and apo-A-II),

probably because of accelerated catabolism.

597. In Zellweger syndrome,there is ?

a) Accumulation of long fatty acids

b) Accumulation of short chain fatty acids

c) Accumulation of very long chain fatty acids

d) Accumulation of medium chain fatty acids

Correct Answer - C
Ans. is 'c' i.e., **Accumulation of very long chain fatty acids** [Ref Harper 29^{m}/e p. **554;** Chatterjea 6th le p. 412]
Zellweger Syndrome **is** a rare inborn error **of peroxisomal fatty acid oxidation°** due to absence of functional peroxisomes in all tissues.
As a result, the long chain fatty acids are not oxidized in peroxisomes and accumulate in tissues particularly in brain, liver, kidney and muscle and usually result in death by age six.

598. Autooxidation is seen in ?

a) Cholesterol

b) Arachidonic acid

c) Stearic acid

d) Palmitic acid

Correct Answer - B
Ans. is 'b' i.e., Arachidonic acid [Ref Essential of biochemistry p. 736]
Polyunsaturated fatty acids (PUFAs) undergo peroxidation (auto-oxidation).
Amongst the given options, only arachidonic acid is PUFA.

599. Which of the following is a lipotropic factor : ?

a) Sphingomyelin

b) Histidine

c) Methionine

d) Bilirubin

Correct Answer - C
Ans. is 'c' i.e., Methionine [Ref Essentials of biochemistry/p. 761]
Lipotropic factors are substances which prevent accumulation of fat (TGs) in liver.
Primary lipotropic factors choline, betaine, methionine, lecithine, inositol.
Other factors with some lipotropic action :- Vitamin-$13_{,2}$, folic acid, casein, glycine, essential fatty acids, selenium, vitamin E and serine.

600. Lipogenesis is stimulated by ?

a) Insulin

b) Glucagon

c) Epinephrine

d) Corticosteroids

Correct Answer - A
Ans. is 'a' i.e., Insulin *[Ref Dinesh Puri 3rdie p. 318]*

601. Indole ring is present in ?

a) Tryptophan

b) Tyrosine

c) Phenylalanine

d) Threonine

Correct Answer - A

Ans. is 'a' i.e.,Tryptophan [Ref: Lehninger 4th Ie p. 80]

Some amino acids contain a special functional group in their side chain which provide some specific functions to that amino acids. These are : -

Hydroxyl group in serine and threonine	Guanidinium in arginineQ	Imidazole in histidine
Amide group in aspargine and glutamine	Benzene in phenylalanine	Phenol in tyrosine
Thioether in methionine	**Indole ring in tryptophanQ**	Pyrrolidine in proline
Sulphydryl in cysteine	13-Carboxyl in glutamic acid	E-amino in lysine
y-carboxyl in glutamic acid		

602. Taurine is biosynthesized by ?

a) Arginine

b) Leucine

c) Valine

d) Cysteine

Correct Answer - D

Ans. is 'd' i.e., Cysteine [Ref Harper 25^0/e p. 298-99]

Taurine is synthesized from cysteine by 3 enzyme-catalyzed reactions :

1. Cysteine is oxidized to cysteine sulfinate.
2. Cysteine sulfinate is decarboxylated to form hypotaurine.
3. Hypotaurine is oxidized to form taurine

603. Which of the following is true ?

a) Glucokinase has high affinity for glucose

b) Hexokinase has low affinity for glucose

c) Glucokinase has low affinity for glucose

d) Hexokinase is induced by insulin

Correct Answer - C

Ans. is 'c' i.e., Glucokinase has low effinity for glucose *[Ref Harper 28`"/e p. 151-152]*

Glucokinase, is specific for glucose. It has high Kin^{Q} (i.e., low affinity for glucose), high Vmax and unlike hexokinase, it is not inhibited by glucose-6-phosphate^{Q}. As it has low affinity for glucose (high km), it comes into play only when intracellular glucose concentration is high. It is induced by feeding and insulin. Glucagon inhibits glucokinase.

Function of hexokinase is to provide glucose-6-phosphate at a constant rate, according the needs of cells, i.e., function of hexokinase is to provide constant glucose utilization by all tissues of body even when blood sugar is low. Function of glucokinase in the liver is to remove glucose from blood after a meal, providing glucose-6-phosphate in excess of requirement for glycolysis so that it can be used for glycogen synthesis and lipogenesis.

604. Methylmalonyl aciduria is seen in deficiency of ?

a) Vit B12

b) Vit B6

c) Vit C

d) Folic acid

Correct Answer - A

Ans. is 'a' i.e., Vit B12 [Ref Harper 29"Ve p. 537]

Isomerization of methylmalonyl CoA to succinyl CoA :

- In this reaction, active form of vitamin B I 2is deoxyadenosyl cobalamine.
- Propionyl-CoA is produced as catabolic end product of some alipathic amino acids and n-oxidation of odd chain fatty acids.
- Propionyl CoA is then converted to succinyl CoA through methylmalonyl-CoA.
- Thus methylmalonyl-CoA is accumulated and excreted in urine as methylmalonic acid (methylmalonate) in vitamin B12 deficiency0, i.e. methylmalonic acidurie

605. Carnitine is synthesised from -

a) Lysine

b) Agrinine

c) Histidine

d) Choline

Correct Answer - A
Trimethyllysine and γ-butyrobetaine hydroxylases are required for the synthesis of carnitine

606. Chemiosmotic coupling of oxidation phosphorylation is related to ?

a) Formation of ATP at substrate level

b) ATP generation of pumping of proton

c) ATP generation of pumping of neutron

d) ATP formation by transport of 0,

Correct Answer - B

Ans. is 'b' i.e., ATP generation of pumping of proton *[Ref Harper 29rdie p. 125-127]*

Chemoiosmotic theory

- It states that "free energy of electron transport" is conserved by pumping protons from mitochondrial matrix to the intermembrane space, so as to create an electrochemical proton gradient across the inner mitochondrial membrane, with outer side of membrane is positively charged as compared to inside. Electrochemical potential of this gradient is used to synthesize ATP by ATP synthase

607. Which one of the following statements concerning gluconeogenesis is correct ?

a) It occurs in muscle

b) It is stimulated by fructose 2, 6-bisphosphate

c) It is inhibited by elevated levels of acetyl CoA

d) It is important in maintaining blood glucose during the normal overnight fast.

Correct Answer - D

Ans. is 'd' i.e., It is important in maintaining blood glucose during the normal overnight fast *[Ref Mark's Basic medical biochemistry* p. 566]

During fasting, many of the reactions of glycolysis are reversed as the liver produces glucose to maintain blood glucose levels. This process of glucose production is called gluconeogenesis.

During overnight fast, blood glucose levels are maintained by both gluconeogenesis and glycogenolysis. However, after approximately 30 hours of fasting, liver glycogen stores are mostly depleted. Subsequently, gluconeogenesis is the only source of blood glucose.

608. Fatty acid metabolism gives ?

a) Acetyl CoA

b) Malonyl CoA

c) Ketone bodies

d) Cholesterol

Correct Answer - A

Ans. is 'a' i.e., Acetyl CoA *[Ref Harper 25^{0}/e* p. *208-210]*

Acetyl-CoA has a special central role. Acetyl-CoA is the common degradation product of glucose (by glycolysis^{Q} and PDH complex), fatty acids and ketogenic amino acids.

Its acetyl group can be utilized in synthesis *of fatty acids*^{Q}, cholesterol^{Q} and other steroids^{Q}, ketone bodies^{Q}; or can be oxidized via TCA (citric acid cycle).

In fed state acetyl-CoA is oxidised via TCA cycle and used for synthesis of fatty acids and cholesterol^{Q}, whereas in starvation it is used to synthesize ketone bodiesQ

609. Tyrsoine is the precursor of all except ?

a) Thyroxine

b) Melanin

c) Dopmine

d) Nicotinic acid

Correct Answer - D

Ans. is 'd' i.e., Nicotinic acid [Ref: **Harper's 28th /e** p. 266, 268, 254]

Tyrosine is a precursor of many important compounds such as catecholamines (epinephrine Q, **norepinephrine Q),dopamine), thyroxine Q, triiodothryonine, melanin0.**

610. Organ which can utilize glucose, FA and ketone bodies is -

a) Liver

b) Brain

c) Skeletal muscle

d) RBC

Correct Answer - C

Ans. is 'c' i.e., Skeletal muscle *[Ref Harper 28th/e* p. *141]*

Skeletal muscles can utilize glucose, glycogen, fatty acids and ketone bodies.

Liver cannot utilize ketone bodies.

Brain and erythrocytes are exclusively dependent on glucose except in prolonged starvation where brain utilizes ketone bodies predominantly

611. Which of the following enzyme is not used by liver in urea cycle ?

a) CPS-I

b) CPS-II

c) Arginase

d) Arginosuccinate

Correct Answer - B
Ans. is 'b' i.e., CPS-II [Ref **Harper 29th / e** p. 277-278]
Carbmoyl phosphate synthase II (CPS II) is involved in pyrimidine synthesis (not in urea cycle).

612. HMG-CoA in liver mitochondria is inhibited by ?

a) Insulin

b) Glucagon

c) Glucocorticoid

d) Epinephrine

Correct Answer - A

Ans. is 'a' i.e., Insulin

This question is a little tricky.

<u>Effect of insulin on ketogenesis</u>

- Ketogenesis is usually associated with excessive fatty acid oxidation (lipolysis) which provides the substrate (acetyl-CoA) for ketogenesis.
- Thus, factors which inhibit lipolysis will inhibit ketogenesis (and also production of HMG-CoA).
- Insulin is an antilipolytic hormone. It inhibits lypolysis and therefore ketogenesis. Thus it decreases the synthesis of HMGCoA in ketogenesis.
- So, insulin inhibits as well as stimulates production of HMG-CoA. Then why is insulin the answer of this question ?
- Here comes the tricky part of this question. Read the question carefully examiner has asked about HMG-CoA production in liver mitochondria.
- Ketogenesis occurs in mitochondria.
- Cholesterol synthesis occurs in cytosol and smooth ER.
- Thus insulin inhibits HMG-CoA production in mitochondria but stimulates it in cytosol.

613. Amino acid used by liver in urea cycle ?

a) Glutamine

b) Glutamate

c) Aspartate

d) Fumarate

Correct Answer - C
Ans. is 'c' i.e., Aspartate [Ref Harper 29`"/e p. 276-278]
The source of two nitrogen atoms of urea -› one from ammonia° and one from amino group of aspartate°. Source of carbon is CO_2.
Thus out of all amino acids involved in urea cycle aspartate is consumed, while there is no net loss or gain of ornithine, citrulline, arginosuccinate or arginine. There is production of fumarate as by product°.
3 molecules of ATP are consumed (2 in first reaction and 1 in third reaction). However, 4 high energy phosphate bonds are utilized as 3rd ATP is converted to AMP+PPi.

614. Hydrolysis occurs at which step of urea cycle ?

a) Cleavage of arginine

b) Formation of Arginosuccinate

c) Formation of citrulline

d) Formation of ornithine

Correct Answer - A

Ans.'A', Cleavage of arginine

Urea synthesis is a 5 step cyclic process, with 5 distinct enzymes. The first 2 enzymes are present in mitochondria while the rest are localized in the cytosol

- Step 1. Formation of Carbamoyl Phosphate- One molecule of ammonia condenses with CO_2 in the presence of two molecules of ATP to form carbamoyl phosphate. It is catalyzed by carbamoyl phosphate synthetase-I (CPS-I).
- Step 2. Formation of Citrulline- The carbamoyl group is transferred to the NH2 group of ornithine by ornithine transcarbamoylase.
- Step 3. Formation of Argininosuccinate- One molecule of aspartic acid adds to citrulline forming a carbon to nitrogen bond which provides the 2nd nitrogen atom of urea. Argininosuccinate synthetase catalyzes the reaction.
- Step 4. Formation of Arginine- Argininosuccinate is cleaved by argininosuccinate lyase (argininosuccinase) to arginine and fumarate. The enzyme is inhibited by fumarate. The fumarate formed may be funneled into the TCA cycle to be converted to malate and then to oxaloacetate to be transaminated to aspartate. Thus the urea cycle is linked to the TCA cycle through fumarate.

- Step 5. Formation of Urea- The final reaction of the cycle is the hydrolysis of arginine to urea and ornithine by arginase.

615. Why citric acid cycle called amphibolic pathway ?

a) Both exergonic and endergonic reactions takes place

b) Metabolites are utilized in other pathways

c) It can proceed both in forward and backward direction

d) Same enzymes can be used in reverse directions

Correct Answer - A

Ans. is 'a' i.e., Both exergonic and endergonic reactions takes place *[Ref : Harper 29th/e* p. *151, 166]*

Citric acid cycle is called amphibolic pathway because it acts as a link between anabolic (endothermic) and catabolic (exothermic) pathways.

616. Urea & Kreb's cycle are linked at ?

a) Arginine

b) Ornithine

c) Oxaloacetate

d) Fumarate

Correct Answer - D

Ans. is 'd' i.e., Fumarate [Ref **Harper 25^{0}/e** p. 276-277]

Fumarate is released during urea cycle, which is an intermediate of Kreb's cycle, thus linking the two.

617. Which of the following metabolites is involved in glycogenolysis, glycolysis and gluconeogenesis ?

a) Galactose-l-phosphate

b) Glucose-6-phosphate

c) Uridine diphosphoglucose

d) Fructose-6-phosphate

Correct Answer - B

Ans. is 'b' i.e., Glucose-6-phosphate *[Ref Harper 28th Ie* p. *166, 158]*

→ **Glucose-6-phosphate is the metabolite which :?**

1. Joins glycolysis with glycogenesis and glycogenolysis
2. Joins glycogenolysis to pentose phosphate pathway (PPP)
3. Is involved in glycolysis, glycogenesis and gluconeogenesis, glycogenolysis, gluconeogenesis, PPP

618. Which will activate carbomoyl phosphate synthase I?

a) Alanine

b) N-acetyl glutamate

c) Ornithine

d) None

Correct Answer - B

Ans. is 'b' i.e., N-acetyl glutamate

Carbamoyl phosphate synthase-I (CPS-I), a mitochondrial enzyme, catalyzes the formation of carbamoyl phosphate° by condensation of CO_2 and ammonia. Two molecules of ATP are required for the reaction. CPS-I is the rate limiting enzyme of urea cycle^{Q}. It is an allosteric enzyme and allosterically activated by N-acetyl glutamate

619. Enzyme deficient in Isovaleric acidemia

a) Isovaleryl CoA dehydrogenase

b) Phenylalanine hydroxylase

c) Arginase

d) None

Correct Answer - A
Ans. is 'a' i.e.Isolvaleryl CoA dehydrogenase
- Isovaleric acidemia is due to the defect in the metabolism of leucine.
-The enzyme defective is isovaleryl Co-A dehydrogenase.
-A characteristic odor of sweaty feet is present.
-Vomiting, acidosis, and coma follow the ingestion of excess protein. Accumulated isovaleryl-CoA is hydrolyzed to isovalerate and excreted.

620. Transamination of Alanine results in formation of ?

a) Oxaloacetate

b) Pyruvate

c) Aspartate

d) Arginine

Correct Answer - B
Ans. is 'b' i.e., Pyruvate

621. True about alkaptonuria ?

a) Deficiency of Tyrosinase

b) Urine is black

c) Banedict test is not useful

d) Fecl, test gives red colour

Correct Answer - B
Ans. is 'b' i.e., Urine is black *[Ref Nelson 18thie p. 1812]*

622. Cofactors for glutamate dehydrogenase?

a) NAD^+

b) FAD

c) FMN

d) FADH2

Correct Answer - A

Ans. 'A' NAD^+

Anaerobic Dehydrogenases are the enzymes that catalyze the removal of hydrogen from a substrate but oxygen cannot act as the hydrogen acceptor. They, therefore, require coenzymes as acceptors of the hydrogen atoms.

When the substrate is oxidized, the coenzyme is reduced.

NAD+ is derived from nicotinic acid, a member of the vitamin B complex. The NAD+ linked dehydrogenases are-

- Glyceraldehyde-3-phosphate dehydrogenase
- Isocitrate dehydrogenase
- Malate dehydrogenase
- Glutamate dehydrogenase
- Beta hydroxy acyl CoA dehydrogenase
- Pyruvate dehydrogenase
- Alpha-ketoglutarate dehydrogenase

623. Ochronosis is due to accumulation of ?

a) Homogentisic acid

b) Phenylpyruvate

c) Xanthurenate

d) Glyoxylate

Correct Answer - A

Ans. is 'a' i.e., Homogentisic acid *[Ref: Harper 29th/e p. 287-289]*

Alkaptonuria

It is due to **deficiency of homogentisate oxidase.** As a result **homogentisic acid (homogentisate) is excreted execessively in urine.** There are three important characteristic features in alkaptonuria?

1. **Urine becomes dark after being exposed to air**Q**.** It is due spontaneous **oxidation of** homogentisate into benzoquinone acetate, which polymerse to form black-brown pigment alkapton which imparts a characteristic **black-brown colour to urine.**
2. Alkapton deposition occurs in sclera, ear, nose, cheeks and intervertebral disc space. A condition called **ochronosis. There may be calcification of intervertebral discs** Q.
3. **Onchronosis arthritis** affecting shoulder, hips, knee.
4. **Benedict's test is strongly positive** in urine and so is the ferric chloride (Pea) testQ. Benedict's reagent gives a greenish brown precipitate with brownish black supernatent. Fehling's reagent ($FeC1_3$) gives blue green colour.

624. Neonatal tyrosenemia is due to deficiency of ?

a) Tyrosinase

b) Fumarylacetoacetate hyroxyase

c) Hydroxyphenyl pyruvate hydroxylase

d) Tyrosine transminase

Correct Answer - C

Ans. is 'c' i.e., Hydroxyphenyl pyruvate hydroxylase [Ref **Harper's 28th/e** p. 266, 268]

Tyrosinemia

It is a defect in metabolism of tyrosine. It may be of following types.

1. Tyrosinemia type-I (tyrosinosis/hepatorenal syndrome) : - It is due to defect infumarylacetoacetate hydroxylase deficiency. Patients with chronic tyrosinosis are prone to develop cirrhosis and hepatic carcinoma°. There is cabbage like odor in acute tyrosinosis.
2. Tyrosinemia type - II (Richer-Hanhart syndrome) : - It is due to deficiency of tyrosine transaminase^{Q} (tyrosine aminotransferase).
3. Neonatal tyrosinemia : - It is due to deficiency of hydroxyphenyl **pyruvate hydroxylase.**

625. Separation of proteins by their mass ?

a) Electrophoresis

b) Salting out

c) SDS-PAGE

d) Ion exchange chromatography

Correct Answer - C
Ans. is 'c' i.e., SDS-PAGE [Ref **Vasudevan** 6"die p. 600]

626. About Denaturation of protein,which is true ?

a) Biological property persists

b) Primary structure lost

c) Always irreversible

d) Mostly renders protein insoluble

Correct Answer - D
Ans. is 'd' i.e., Mostly renders protein insoluble *[Ref Lippincott's 4th Ie p.* 57]
The term denaturation refers to disruption of higher order (secondary, tertiary and quaternary) structure of protein.
All non-covalent bonds that maintain higher order structure are disrupted, but **peptide bond (covalent bond) remains intact.**
Thus, the primary structure is not altered during denaturation, i.e., amino acid sequence is not altered, but denaturation **may completely disrupt secondary, tertiary and quaternary structure, e.g.,** denaturated oligomeric proteins dissociated into subunits, each with a **randam coil formation.**
Denaturation is always accompanied by a loss of biological function, e.g., enzymes are inactivated and antibodies fail to act with antigens.
Denaturation is generally irreversible, e.g., boiled egg does **not regain its original form when kept in** cold.
Denatured proteins are less soluble and in many cases they **precipitate.**

627. Two same charged proteins can be separated by all except -

a) Agarose

b) DEAE Cellulose

c) Sephadex

d) None of these

Correct Answer - B
Ans. is 'b' i.e., DEAE Cellulose [Ref Essentials of Biochemistry p. 670, 795]
DEAE cellulose chromatography (anion exchange) separates molecules based on molecular charge. Therefore, it cannot separate two proteins with same charge.
Agarose (sepharose) and dextran **(sephadex)** are used in gel filtration chromatography, which is based on molecular size. Thus, they can separate proteins of same charge.

628. In glycolysis, inorganic phosphate is used reaction, catalyzed by ?

a) Enolase

b) Pyruvate kinase

c) Glyceraldehyde-3-p dehydrogenase

d) Aldolase

Correct Answer - C
Ans. is 'c' i.e., Glyceraldehyde-3-p dehydrogenase

629. 250 nm light is absorbed by ?

a) Arginine

b) Alanine

c) Tyrosine

d) Histidine

Correct Answer - C
Ans. is 'c' i.e.,Tyrosine
Amino acids do not absorb visible light and thus are colourless. However, **aromatic amino acids^{Q} (tryptophan, tyrosine, phenylalanine) absorb** high-wavelength (250-290 nm) UV light. **Trypytophan has the greatest absorption maxima** in this region than other two aromatic amino acids.
Thus, **aromatic amino acids are responsible for UV absorption of most proteins^{0},** maximum absorption being at 280 rim.

630. Tyrosinosis is caused due to deficiency of which enzyme?

a) Fumarylacetoacetate hydrolase.

b) p-hydroxy phenylpyruvate dehydrogenase.

c) Tyrosine transaminase.

d) Tyrosine ligase.

Correct Answer - A

Answer: A. Fumarylacetoacetate hydrolase

- Several metabolic disorders are associated with the tyrosine catabolic pathway. The probable metabolic defect in type I tyrosinemia (tyrosinosis) is at fumarylacetoacetate hydrolase.
- It is characterized by buildup of too much of the amino acid tyrosine in the blood and tissues due to an inability to metabolize it
- The therapy employs a diet low in tyrosine and phenylalanine. Untreated acute and chronic tyrosinosis leads to death from liver failure.

631. Lesch–Nyhan syndrome is caused by deficiency of which enzyme?

a) Orotate Phosphoribosyltransferase

b) Uracil phosphoribosyltransferase

c) Quinolinate Phosphoribosyltransferase

d) Hypoxanthine-guanine phosphoribosyltransferase (HGPRT)

Correct Answer - D

Answer: D. Hypoxanthine-guanine phosphoribosyltransferase (HGPRT)

- The condition is called ksch-Nyhan slmdrome, in which there is complete deficiency of HGPRT.
- HGPRT deficiency causes decreased utilization of PRPP in salvage pathway.
- This results in increased production of purine nucleotide from PRPP via de-novo pathway.
- The disease is characterized by hyperuricemia, gouty arthritis, urinary stones, neurological symptoms.

632. Fish odor syndrome is caused by deficiency of which enzyme?

a) Fumarylacetoacetate hydrolase

b) Methane monooxygenase

c) Monooxygenase 3 (FMO3)

d) D-amino acid oxidase

Correct Answer - C

Answer: C. Monooxygenase 3 (FMO3)

Trimethylaminuria, or fish odor syndrome (FOS), is a condition characterized by the presence of trimethylamine (TMA)—a tertiary amine whose odor is described as resembling that of rotting fish—in the urine, sweat, and expired air. The cause of the syndrome is rooted in the dysfunctional metabolism of TMA, which is normally oxidized by flavin monooxygenase 3 (FMO3) into non-odorous trimethylamine-N-oxide (TMAO).

Most patients with FOS are eventually diagnosed with primary trimethylaminuria, which is caused by a deficiency in FMO3 that is inherited in an autosomal recessive fashion.

The diagnosis is made on the basis of the clinical presentation and urinalysis. Urine can be analyzed for the concentration of both TMA and TMAO, and the results may be given as an oxidizing ratio based on the formula- TMAO/(TMAO+TMA) x 100%.

Short courses of oral neomycin, metronidazole, and amoxicillin have been reported to be useful in some cases.

633. Galactosemia is due to deficiency of which enzymes

a) Galactose-1-phosphate uridyltransferase

b) HGPRT

c) Galactokinase

d) Epimerase

Correct Answer - A
Answer: A. Galactose-1-phosphate uridyltransferase
Galactosaemia (British galactosaemia) is a rare genetic metabolic disorder that affects an individual's ability to metabolize the sugar galactose properly. Galactosemia follows an autosomal recessive mode of inheritance that confers a deficiency in an enzyme responsible for adequate galactose degradation.

634. Which of the following is most abundant end product of fatty acid synthesis -

a) Oleic acid

b) Palmitic acid

c) Arachidonic acid

d) Glucose

Correct Answer - B
Answer: B. Palmitic acid
Fatty acid are synthesized by extramitochondrial system.
This system is present in many tissues including liver kidney brain lung mammary gland and adipose tissues.
Acetyl CoA is immediate substrate.
The end products of this synthesis are usually the saturated fatty acidspalmitate and stearate with the latter predominating.

635. About DNA polymerase I which one is correct?

a) Not required in bacteria

b) Repair any damage with DNA

c) Involved in okazaki fragment

d) Participate in DNA replication

Correct Answer - A
Answer: A. Not required in bacteria
DNA polymerase I participates in the DNA replication of prokaryotes. Function of Pol I is mainly to repair any damage with DNA, but it also serves to connect okazaki fragments deleting RNA primers and replacing the strand with DNA.

636. What does chaperones assist in?

a) Protein Cleavage

b) Protein Folding

c) Protein Degradation

d) Protein Modification

Correct Answer - B
Answer: B. Protein Folding
Folding of Proteins in Vivo Is Promoted by Chaperones

637. Fishy odour occurs due to deficiency of this vitamin from diet -

a) Biotin

b) Thiamine

c) Riboflavin

d) Vit. A

Correct Answer - C
Answer: C. Riboflavin
Vitamin B2 or riboflavin **deficiency** can bring about a **fishy odor** in the body.
* Fish-odor syndrome, also called **trimethylaminuria,** is a rare metabolic disorder caused by the absence of enzyne n-oxidase (A Flavin containing monooxygenase, 3(FMO3). Gene for trimethylamine o has been mapped on chromosome I(Iq23-q25).
* Trimethylamine is normally produced in the intestine from the breakdown of dietary choline and trimethylamine oxide by bacteria.
* Egg yolk and liver are the main sources of choline, and fish is the major source of **trimethylamine oxide.**
* Trimethylamine is absorbed and oxidized in the liver by trimethylamine oxidase (flavin-containing monooxygenases) to trimethylamine oxide, which is odorless and excreted in the urine. Deficiency of the enzyme results in massive excretion of trimethylamine in urine.
* Consequently, to these patients such foods may taste like rotten fish and import a fishy odor to their salvia, sweat and urine.
Treatment
* Restriction of fish, eggs, liver and other sources of choline

(such as nuts and grains) in the diet significantly reduce the odor.
- Treatment with short course of oral metronidamle, neomycin or lactulose causes temporary reduction in the body odor.
* Riboflavin supplement can be given to enhance residual FMO3 activity.

638. VMA is excreted in urine in which condition -

a) Alkaptonuria

b) Phenylketonuria

c) Pheochromocytoma

d) Diabetic ketoacidosis

Correct Answer - C
Answer: C. Pheochromocytoma
VMA is the end product of catabolism of catecholamines.
In pheochromocytoma and neuroblastoma there is excessive synthesis of catecholamines which causes enhanced synthesis of VMA and its excretion in the urine.
VMA is the urinary product of both epinephrine and norepinephrine.
It is a good screening test for pheochromocytoma, and is also used to diagnose and follow up neuroblastoma and ganglioneuroma.

639. In Cystinuria all of the following amino-acids reabsorption defect is present, except

a) Lysine

b) Citrulline

c) Arginine

d) Ornithine

Correct Answer - B

Ans. is 'B' i.e., Citrulline

Types of cystinuria

* Type-I: It is homozygous with a fully recessive form. The patient excretes a large quantity of cystine, ornithine, lysine, and arginine. Gene involved is rBAT on chromosome-2.
* Type-II & III: These are heterozygous variants of incompletely recessive forms. They excrete cystine, ornithine, lysine, and arginine more than normal but less than the homozygous state (Type-I). Gene involved is SLC7A9 on chromosome 79.

Cystinuria

*** Biochemical Defect**: An autosomal recessive disorder that results in the formation of a defective amino acid transporter in the renal tubule and intestinal epithelial cells.

*** Pathophysiology**: The amino acid transporter is responsible for transporting cystine, ornithine, lysine, and arginine. Defective tubular reabsorption of these amino acids in the kidneys results in increased cystine in the urine, which can precipitate and cause kidney stones.

*** Clinical Manifestations**: Cystine kidney stones presenting with

severe, intermittent flank pain and hematuria.
* **Lab findings**: Increased urinary excretion of cystine, ornithine, arginine, and lysine on urine amino acid chromatography; hematuria and cystine crystals (hexagonal) on the cooling of acidified urine sediment.
* **Imaging**: Radiopaque kidney stones on CT scan. The most specific test is the cyanide–nitroprusside test
* **Treatment**: Low-methionine diet; increased fluid intake; acetazolamide to alkalinize the urine. If this fails then patients are usually started on chelating therapy with penicillamine.

640. Fibrinopeptide A and fibrinopeptide B are acidic due to the presence of which amino acids in its structure -

a) Serine and threonine

b) Glutamate and aspartate

c) Histidine and lysine

d) Glutamine and valine

Correct Answer - B

Answer: B. Glutamate and aspartate

The N-terminal A and B portions of the Aα and Bβ chains are termed fibrinopeptide A (FPA) and fibrinopeptide B (FPB), respectively. These domains are highly negatively charged as a result of an abundance of aspartate and glutamate residues.

The negative charges contribute to the solubility of fibrinogen in plasma and importantly also serve to prevent aggregation by causing electrostatic repulsion between fibrinogen molecules.

641. HIAA in urine present in?

a) Alkaptonuria

b) Albinism

c) Carcinoid

d) Phenylketonuria

Correct Answer - C
Answer: C. Carcinoid
Carcinoid syndrome develops in some people with carcinoid tumors and is characterized by cutaneous flushing, abdominal cramps, and diarrhea.
Carcinoid tumour occur throughout the gastrointestinal tract, most commonly in the appendix, ileum and rectum in decreasing order of frequency.
Right-sided valvular heart disease may develop after several years.
The syndrome results from vasoactive substances (including serotonin, bradykinin, histamine, prostaglandins, polypeptide hormones) secreted by the tumor, which is typically a metastatic intestinal carcinoid.
Diagnosis is clinical and by demonstrating increased urinary 5-hydroxyindoleacetic acid(HIAA).
Tumor localization may require a radionuclide scan or laparotomy.
Treatment of symptoms is with somatostatin or octreotide, but surgical removal is performed where possible; chemotherapy may be used for malignant tumors.

642. Nitric oxide acts by increasing ?

a) BRCA 1

b) BRCA 2

c) Interleukin

d) cGMP

Correct Answer - D
Answer: D> cGMP
Nitric oxide diffuses to the surrounding smooth muscle cells, **increasing cGMP .**
Cyclic guanosine monophosphate (cGMP)
Cyclic nucleotide derived from guanosine triphosphate (GTP).
Function:

- cGMP acts as a second messenger much like cyclic AMP.

Mechanism of action:

- Activation of intracellular protein kinases in response to the binding of membrane-impermeable peptide hormones.

643. Phenylketonuria is due to deficiency of:

a) Phenylalanine

b) Phenylalanine hydroxylase (PAH)

c) Phenylene

d) All of these

Correct Answer - B
Answer B. Phenylalanine hydroxylase (PAH)
A birth defect that causes an amino acid called phenylalanine to build up in the body.
PKU is an autosomal recessive metabolic genetic disorder.
PKU is characterized by homozygous or compound heterozygousmutations in the gene for the hepatic enzyme **phenylalanine hydroxylase (PAH), r**endering it nonfunctional.
This enzyme is necessary to metabolize the amino acid phenylalanine (Phe) to the amino acid tyrosine (Tyr). When PAH activity is reduced, phenylalanine accumulates and is converted into phenylpyruvate (also known as phenylketone), which can be detected in the urine.
The PAH gene is located on chromosome 12 in the bands 12q22-q24.1. More than 400 disease-causing mutations have been found in the PAH gene.

644. By which method foreign DNA is introduced into a cell by a virus or viral vector?

a) Transduction

b) Transcription

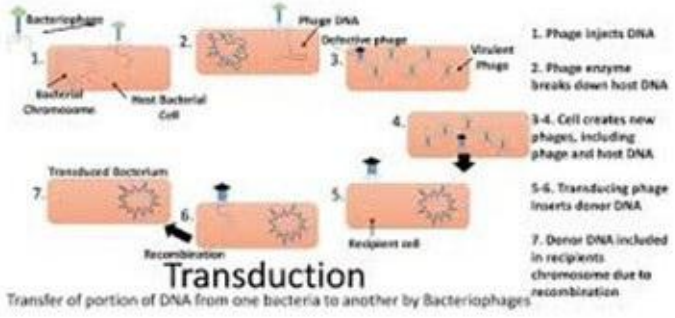
c) Lysogenic conversion

d) Transformation

Correct Answer - A

Ans. A. Transduction

Transduction is the process by which foreign DNA is introduced into a cell by a virus or viral vector. An example is the viral transfer of DNA from one bacterium to another.



645. Which one of the following shows allosteric inhibition?

a) Malonic acid & succinate

b) 2,3 BPG

c) Amino acid alanine & pyruvate kinase

d) Citrate

Correct Answer - B
Answer: B. 2,3 BPG
Negative **allosteric** modulation (also known as **allosteric inhibition**) occurs when the binding of one ligand decreases the affinity for substrate at other active sites. For **example**, when 2,3-BPG binds to an **allosteric** site on hemoglobin, the affinity for oxygen of all subunits decreases.

646. A 4-year-old boy of a first-degree consanguineous couple was noted by the parents to have darkening of the urine to an almost black color when it was left standing. He has a normal sibling, and there are no other medical problems. Growth and development to date are normal. Which of the following is most likely to be elevated in this patient?

a) Methylmalonate

b) Homogentisate

c) Phenylpyruvate

d) α-Ketoisovalerate

Correct Answer - B

Ans: B. Homogentisate.

* Alkaptonuria is a rare metabolic disease involving a deficiency in homogentisic acid oxidase, and the subsequent accumulation of homogentisic acid in the urine, which turns dark upon standing.
* The elevation of
→ methylmalonate (due to methylmalonyl CoA mutase deficiency),
→ Phenylpyruvate (due to phenylalanine hydroxylase deficiency),
→ α-ketoisovalerate (due to branched-chain α-keto acid dehydrogenase deficiency),
→ Homocysteine (due to cystathionine β-synthase deficiency)

* All of these are inconsistent with a healthy child with a darkening of the urine.
* Ref lippincott's Illustrated reviews,5th edition, Amino Acid Degradation and Synthesis,Pg 276.

647. Which of the following is true about different structures of protein?

a) Secondary structure is the three-dimensional structure of protein

b) Secondary structure is stabilized by disulfide bonds

c) Primary, secondary and tertiary structures destroyed during denaturation

d) Secondary and tertiary structure depends on the sequence of amino acids

Correct Answer - D
Ans: D. Secondary and tertiary structure depends on the sequence of amino acids
Explanation
Proteins are arranged in any of the following four structures viz:
* Primary
The sequence of amino acids in a protein is called the primary structure of the protein.chain
* Secondary
- The polypeptide backbone does not assume a random three-dimensional structure, but instead generally forms regular arrangements of amino acids that are located near to each other in the linear sequence. The α-helix, β-sheet, and β-bend (β-turn) are examples of secondary structures frequently encountered in proteins.
* Tertiary
- It refers to the three-dimensional arrangement of a polypeptide chain that has assumed its secondary structure. Disulfide bonds

between cysteine residues may stabilize the tertiary structure. Protein denaturation results in the unfolding and disorganization of the protein's secondary and tertiary structures, which are not accompanied by hydrolysis of peptide bonds

* Quaternary

- The quaternary structure requires more than one polypeptide chain. These chains associate through noncovalent interactions.

Ref lippincott's Illustrated reviews,5th edition, Structure of Protein,Pg 13

648. The insulin glucagon ratio decreased. The enzyme is active at this time?

a) Glucokinase

b) Hexokinase

c) Phosphofructokinase

d) Glucose 6 phosphatase

Correct Answer - D
Ans. D.Glucose 6 phosphatase
Explanation
Low insulin:glucagon ratio (IGR) stimulates mobilization of stored nutrients, increases glycogenolysis and gluconeogenesis, and promotes the breakdown of adipose tissue into free fatty acids and glycerol.
Decreases Insulin/glucagon ratio shows the fasting stage.
Glucokinase, Hexokinase, and phosphofructokinase are glycolytic.
Only gluconeogenic is glucose 6 phosphatase.
Ref- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4801814

649. Ochronosis is due to the accumulation of?

a) Homogentisic acid

b) Homogentisic acid

c) Xanthurenate

d) Glyoxylate

Correct Answer - A
Ans: A. Homogentisic acid
Alkaptonuria is an autosomal recessive condition due to the deficiency of homogentisate 1,2 dioxidase. This results in the excretion of homogentisic acid in urine.is compatible with a fairly normal life.
The only abnormality is the blackening of urine on standing. Homogentisic acid is oxidized by polyphenol oxidase to benzoquinone acetate. It is then polymerized to black colored alkapton bodies.
By the 3rd or 4th decade of life, the patient may develop ochronosis (deposition of alkapton bodies in intervertebral discs, cartilages of nose, pinna of the ear). Black pigments are deposited over the connective tissues including joint cavities to produce arthritis.
No specific treatment is required. But minimal protein intake with phenylalanine less than 500 mg/day is recommended.
Ref- DM Vasudevan- Textbook of biochemistry for medical students, 6th edn, Aromatic Amino Acids, and Amino Acidurias, pg 208.

650. Bilirubin in serum can be measured by

a) Van den Bergh reaction

b) Ehrlich's Reaction

c) Schlesinger's Reaction

d) Fouchet's Reaction

Correct Answer - A
Ans: A. Van den Bergh reaction
Bilirubin is most commonly determined by the van den Bergh reaction, in which diazotized sulfanilic acid reacts with bilirubin to form red azodi pyrroles
These are measured colorimetrically. In aqueous solution, the water-soluble, conjugated bilirubin reacts rapidly with the reagent (within one minute), and is said to be "direct-reacting." The unconjugated bilirubin, which is much less soluble in aqueous solution, reacts more slowly.
However, when the reaction is carried out in methanol, both conjugated and unconjugated bilirubin are soluble and react with the reagent, providing the total bilirubin value. The "indirect-reacting" bilirubin, which corresponds to the unconjugated bilirubin, is obtained by subtracting the direct-reacting bilirubin from the total bilirubin
Note: In normal plasma, only about 4% of the total bilirubin is conjugated or direct-reacting, because most are secreted into bile.
Ref- Lippincott's Illustrated reviews,5th edition, Conversion of amino acids in specialized products,Pg 285.

651. If a sample of DNA if adenine is 28% what will be the amount of Cytosine present

a) 23%

b) 25%

c) 46%

d) 22%

Correct Answer - D

Ans: D. 22%

The bases of one strand of DNA are paired with the bases of the second strand so that adenine is always paired with thymine and cytosine is always paired with guanine. Therefore, one polynucleotide chain of the DNA double helix is always the complement of the other. Given the sequence of bases on one chain, the sequence of bases on the complementary chain can be determined.

Note: The specific base pairing in DNA leads to the Chargaff Rule: In any sample of dsDNA, the amount of adenine equals the amount of thymine, the amount of guanine equals the amount of cytosine, and the total amount of purines equals the total amount of pyrimidines.

The base pairs are held together by hydrogen bonds: two between A and T and three between G and C (Figure 29.5). These hydrogen bonds, plus the hydrophobic interactions between the stacked bases, stabilize the structure of the double helix.

Ref- lippincott's Illustrated reviews,5th edition, the structure of DNA, pg 397

652. Which of the following vitamin at higher doses causes cystoid macular edema-

a) Vit A

b) Vit D

c) Vit E

d) Niacin

Correct Answer - D
Ans: D. Niacin
Cystoid macular edema (CME) is a condition that involves the macula, causing painless vision loss.
Niacin (nicotinic acid, vitamin B3, vitamin PP), one component of the dietary supplement taken by the patient, is a vitamin preparation usually used for the treatment of lipid disorders
Fraunfelder et al. reported that 3 g or more per day of nicotinic acid could cause many ocular side effects such as blurred vision, eyelid edema, toxic amblyopia, proptosis, loss of eyelashes or eyebrow, superficial punctate keratitis, and cystoid macular edema, which represents the most serious ocular complications. All these adverse effects are reversible with discontinuation of niacin therapy
Ref- Case Reports in Ophthalmological Medicine, Volume 2013, Article ID 713061, 5 page

653. True statement regarding Huntington's chorea is

a) There is a loss of function type of mutation

b) It is an autosomal recessive

c) It is a trinucleotide repeat expansion type of disorder

d) Increased number of CAA repeats

Correct Answer - C
Ans: C. It is a trinucleotide repeat expansion type of disorder
Huntington's chorea is an autosomal dominant disorder with an increased number of CAG repeats. Clinically manifested as involuntary jerky movements, mood disturbances and finally severe dementia.
Ref- Lange biochemistry and genetics flash cards, Huntington's disease, pg 161

654. Addition of which Amino Acid will increase UV absorption

a) Tryptophan

b) Leucine

c) Proline

d) Arginine

Correct Answer - A

Ans: A. Tryptophan

Amino Acid Absorb UV Light

- Amino Acids that absorb 250-290 nm (Maximum at 280 nm) UV light are tryptophan, phenylalanine, tyrosine.
- The maximum absorption of UV light is by tryptophan.
- As it absorbs ultraviolet light about ten times more efficiently than phenylalanine or tyrosine, tryptophan makes the major contribution to the ability of most proteins to absorb light in the region of 280 nm.
- Tryptophan and tyrosine absorb UV at approximately 280 nrn.
- UV absorption spectroscopy is utilized to measure protein concentration. The absorption spectrum of a protein in the UV wavelength range is the result of absorption of light by the aromatic amino acids (250-320 nm), the disulfide bonds (250-300 nm) and the carbonyl group of the peptide bond (190-210).

Remember

- Aromatic Amino Acids absorb UV Lights
- Amino acids are colourless because they do not absorb visible light.

Ref-Rebecca james-self assessment and review of biochemistry, 3rd edn, Chemistry, and Metabolism of Amino Acids, Pg 7

655. V- Richest source of vitamin B12 ?

a) Meat

b) Green leafy vegetables

c) Corn oil

d) Sunflower oil

Correct Answer - A
Ans: A. Meat
* Vitamin B12 is naturally found in animal products, including fish, meat, poultry, eggs, milk, and milk products.
* Synonyms are cobalamin, extrinsic factor (EF) of Castle and anti pernicious anemia factor. Vitamin B12 is water-soluble, heat stable and red in color. It is satisfied by any of the following groups: cyanide, hydroxyl, adenosyl or methyl.
* Cyanocobalamin- Oral preparations are in this form.
* Hydroxy cobalamin- Injectable preparations are in this form.
* Adenosylcobalamin- This is the major storage form, seen in the liver.
* Methylcobalamin-This is the major form seen in blood circulation as well as in the cytoplasm of cells.
* Vitamin B12 is generally not present in plant foods, but fortified breakfast cereals are a readily available source of vitamin B12 with high bioavailability for vegetarians.
* Rich source of vitamin B12→
  - Beef, liver, and chicken.
  - Fish and shellfish such as trout, salmon, tuna fish, and clams.
  - Fortified breakfast cereal.
  - Low-fat milk, yogurt, and cheese.
  - Eggs.

Ref- DM Vasudevan- Textbook of biochemistry for medical students, 6th edn,Nutrition, pg 404.

656. Which amino acid is used to synthesize Nitric oxide?

a) Glycine

b) Arginine

c) Tyrosine

d) Threonine

Correct Answer - B
Ans: B. Arginine
Nitric oxide is formed from arginine by the enzyme nitric oxide synthase (NOS). It contains heme, FAD, FMN, NADPH, and tetrahydrobiopterin.
Nitric oxide has a very short half-life (3-4 seconds). NO combines with oxygen to form NO2. These nitrites are excreted through urine. Reacting with hemoglobin, NO is converted to NO3; and nitrates are also excreted in the urine. The very low quantity of NO is expelled through the lung.
Arginine is a highly basic, semi-essential amino acid. It is glucogenic in nature.

657. True About Noncompetitive antagonist -

a) Km remains same, Vmax decreases

b) Km remains same, Vmax decreases

c) Km decreases, Vmax increases

d) Km increases, Vmax increases

Correct Answer - A

Ans: A. Km remains same, Vmax decreases

Noncompetitive inhibition occurs when the inhibitor and substrate bind at different sites on the enzyme. The noncompetitive inhibitor can bind either the free enzyme or the ES complex, thereby preventing the reaction from occurring.

Effect on Vmax: Noncompetitive inhibition cannot be overcome by increasing the concentration of the substrate. Thus, noncompetitive inhibitors decrease the apparent Vmax of the reaction.

Effect on Km: Noncompetitive inhibitors do not interfere with the binding of substrate to enzyme. Thus, the enzyme shows the same Km in the presence or absence of the non-competitive inhibitor.

Effect on Lineweaver-Burk plot: Noncompetitive inhibition is readily differentiated from competitive inhibition by plotting 1/vo versus 1/[S] and noting that the apparent Vmax decreases in the presence of a non-competitive inhibitor, whereas Km is unchanged

Ref- lippincott's Illustrated reviews,5th edition,Inhibition of Enzyme Activity, pg 61.

658. Werner syndrome associated with premature aging is caused due to a defect in which of the following?

a) Telomerase

b) Caspase

c) DNA topoisomerase

d) DNA helicase

Correct Answer - D

Ans: D. DNA helicase

Werner syndrome is a human autosomal recessive disorder that displays symptoms of premature aging, including early graying and thinning of hair, wrinkling and ulceration of skin, atherosclerosis, osteoporosis, and cataracts.

In addition, Werner syndrome patients exhibit an increased incidence of diabetes mellitus type 2, hypertension, and are highly disposed to the emergence of benign and malignant neoplasms.

Werner syndrome caused by mutation of the *WRN* gene, a member of the RecQ DNA helicase family.

Ref- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3237395/

659. Which of the following dietary fiber is insoluble in water?

a) Pectin

b) Lignin

c) Hemicellulose

d) Cellulose

Correct Answer - B

Ans: B. Lignin

The unavailable or indigestible carbohydrates in the diet are called dietary fiber.

Dietary fiber is necessary to maintain the normal motility of the gastrointestinal tract. They are chiefly-

- Cellulose- Retains water in feces, promotes peristalsis, increases bowel action
- Lignin- Antioxidant, increases bile acid excretion, hypocholesterolemic.
- Pectins- Partially Absorb water, slows esterified gastric emptying, binds bile acids, increases their excretion
- Hemi-cellulose- Retains water in feces, cellulose, increases bile acid and uronic acid excretion.

Ref- DM Vasudevan- Textbook of biochemistry for medical students, 6th edn , Energy Metabolism and Nutrition. Pg 435.

660. According to NCEP-ATP III, which among the following have not been included in metabolic syndrome?

a) High LDL

b) Hypertriglyceridemia

c) Central Obesity

d) Hypertension

Correct Answer - A

Answer- A. High LDL

Metabolic syndrome refers to the co-occurrence of several known cardiovascular risk factors, including insulin resistance, obesity, atherogenic dyslipidemia, and hypertension. These conditions are interrelated and share underlying mediators, mechanisms, and pathways.

Criteria for the Diagnosis of Metabolic Syndrome

- Elevated waist circumference: (For men >90 cm and for women, >80 cm).
- Elevated triglycerides: >150 mg/dL
- Reduced HDL (“good”) cholesterol: For men, <40 mg/dL; for women, < 50 mg/dL
- Elevated blood pressure: >130/85 mm Hg
- Elevated fasting glucose: >100 mg/dL
- Insulin resistance (hyperinsulinemia)
- Additional parameters include: coagulation abnormalities, hyperuricemia, microalbuminuria non-alcoholic steatohepatitis (NASH) and increased CRP.
- Diagnosis is made, if any 3 out of the 5 criteria given above.

Ref- DM Vasudevan- Textbook of biochemistry for medical students, 6th edn, Clinical, and Applied Biochemistry, pg 286

661. Which of the following is the basis for the intestine-specific expression of apoprotein B-48?

a) DNA rearrangement and loss

b) DNA rearrangement and loss

c) RNA alternative splicing

d) RNA editing

Correct Answer - D
Ans: D. RNA editing.
The production of apoB-48 in the intestine and apoB-100 in liver is the result of RNA editing in the intestine, where a sense codon is changed to a nonsense codon by post-transcriptional deamination of C to U.DNA rearrangement and transposition, as well as RNA interference and alternate splicing, do alter gene expression, but are not the basis of apoB-48 tissue-specific production.
Reference- Lippincott's Illustrated Reviews: Biochemistry, 5th edition, Regulation of Gene Expression, Pg 464.