I : BIOCHEMISTRY

Q. 1 – Q. 10 carry one mark each.

Q.1 Which one of the following small molecules is a prerequisite for fatty acid oxidation?

(A) Inositol (B) Choline (C) Carnitine (D) Glycerol

Q.2 Which one of the following bases is **NOT** found in the T-arm of an aminoacyl t-RNA?

(A) Dihydrouridine
(B) Pseudouridine
(C) Uracil
(D) Guanine

Q.3 Oxidation of one molecule of glucose via the glycerol-phosphate shuttle produces

(A) 32 molecules of ATP (B) 32 molecules of NADPH
(C) 30 molecules of ATP (D) 30 molecules of NADPH

Q.4 Ribulose-5-phosphate epimerase is involved in which one of the following processes?

(A) Glycolysis
(B) TCA cycle
(C) Glycosylation
(D) Pentose phosphate pathway

Q.5 Proteolytic enzymes are usually biosynthesized as large, inactive precursors known as

(A) holoenzymes (B) ribozyme
(C) zymogens (D) apoenzymes

Q.6 The formation of a carbocation, also called an oxonium ion, occurs during the reaction catalyzed by

(A) aldolase (B) lysozyme (C) ribonuclease A (D)) carboxypeptidase

Q.7 Which one of the following amino acid substitutions is likely to cause the largest change in protein conformation?

(A) Phe $\longrightarrow$ Ile (B) Ser $\longrightarrow$ Thr (C) Gln $\longrightarrow$ Tyr (D) Glu $\longrightarrow$ Val

Q.8 Which one of the following does **NOT** constitute the lipid moiety in lipid-linked membrane proteins?

(A) Palmitic acid (B) Stearic acid
(C) Farnesyl groups (D) Myristic acid

Q.9 A closed circular B-DNA of 4000 base pairs is negatively supercoiled by introduction of 4 writhes. The super helical density of the resultant DNA molecule will be _________

Q.10 Which one of the following is **NOT** a receptor tyrosine kinase?

(A) Platelet derived growth factor receptor
(B) Insulin like growth factor - 1 receptor
(C) Macrophage colony stimulating factor receptor
(D) Transforming growth factor β receptor

Q. 11 – Q. 20 carry two marks each.

Q.11 Match the entries in Column-1 with those in Column-2

Column-1	**Column-2**
P. Vitamin B1	1. Thiamine pyrophosphate
Q. Carboxypeptidase	2. Aconitase
R. TCA cycle	3. Sucrose
S. Reducing sugar	4. Zn^{2+}
	5. Riboflavin
	6. Lactose

(A) P-1; Q-4; R-2; S-6
(B) P-5; Q-1; R-2; S-3
(C) P-1; Q-4; R-5; S-6
(D) P-5; Q-2; R-1; S-6

Q.12 The following table provides information about four proteins.

Protein	Native mol. wt. (Da)	pI	Type
P	32000	6.4	monomer
Q	40000	8.5	homodimer
R	25000	4.9	monomer
S	45000	8.5	homotrimer

Which one of the following options correctly identifies the order of elution in size exclusion chromatography and the increasing order of mobility in SDS polyacrylamide gel?

(A) Chromatrography: **SQPR**; Electrophoresis: **RPQS**
(B) Chromatrography: **RPQS**; Electrophoresis: **SQPR**
(C) Chromatrography: **PRQS**; Electrophoresis: **PRQS**
(D) Chromatrography: **SQPR**; Electrophoresis: **PRQS**

Q.13 The predicted molar extinction coefficient at 280 nm for the peptide **GEEFHISFLLIMFGAWSTHMYRTYWFIHEMISTRY** is _______ $M^{-1}cm^{-1}$.

[Molar extinction coefficients for phenylalanine, tryptophan and tyrosine at 280 nm are 200, 5600 and 1400 $M^{-1}cm^{-1}$, respectively]

Q.14 Match the contents of Column I with the most appropriate options in Column II

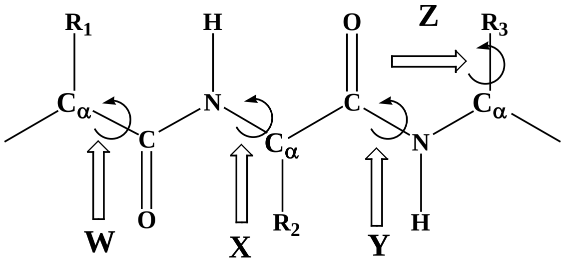
Column I	**Column II**
P. Complement C1q	i. CD34
Q. L-Selectin	ii. Complement C5b
R. Membrane Attack Complex	iii. Fc region of antibody
S. T-Helper cells	iv. Complement C5a
	v. CD40L

(A) P-iii ; Q-v ; R-iv ; S-i
(B) P-i ; Q-ii ; R-iv ; S-v
(C) P-iii ; Q-i ; R-ii ; S-v
(D) P-iv ; Q-v ; R-ii ; S-i

Q.15 The value of ΔG at 37 °C for the movement of Ca^{2+} ions from the endoplasmic reticulum where $[Ca^{2+}]$ is 1 mM to the cytosol where $[Ca^{2+}]$ is 0.1 μM at –50 mV membrane potential is _______________ kJ mol^{-1}.

[R = 8.314 $JK^{-1}mol^{-1}$ and 1 Faraday = 96500 Coulombs]

Q.16



Column I	Column II
W	i. ψ
X	ii. χ
Y	iii. ϕ
Z	iv. ω

Which of the following identifies the correctly matched pairs?

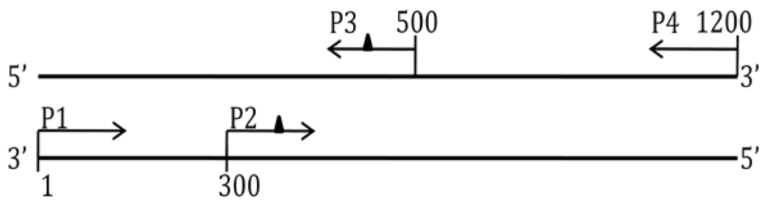
(A) W-iii ; X-i ; Y-iv ; Z-ii
(B) W-i ; X-iii ; Y-iv ; Z-ii
(C) W-i ; X-iii ; Y-ii ; Z-iv
(D) W-iii ; X-i ; Y-ii ; Z-iv

Q.17 Which of the following statements is/are **INCORRECT** about hemoglobin (Hb)?

I. Hb demonstrates higher oxygen carrying capacity compared to myoglobin
II. There is covalent bonding between the four subunits of Hb
III. During deoxygenation the loss of the first oxygen molecule from oxygenated Hb promotes the dissociation of oxygen from the other subunits

(A) II (B) II & III (C) I & III (D) III

Q.18 A 1.2 kb DNA fragment was used as a template for PCR amplification using primers P1, P2, P3 and P4 as shown in the scheme below. The annealing positions of primers on the template are indicated by numbers. Primers P2 and P3 contain single base mismatches as indicated by filled triangles.



PCR was performed using primer pair P1 and P3 in one vial and P2 and P4 in another vial. The purified PCR products from the two vials were mixed and subjected to another round of PCR with primers P1 and P4. The final PCR product will correspond to a

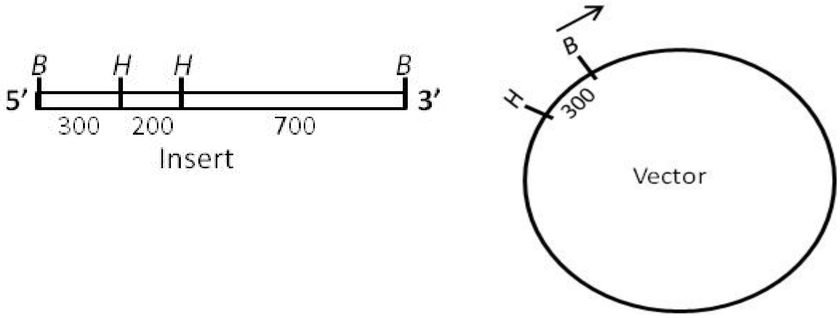
(A) 1.2 kb wild type DNA
(B) 1.2 kb DNA with two point mutations
(C) 0.9 kb DNA with one point mutation
(D) 0.5 kb DNA with one point mutation

Q.19 A cell suspension was subjected to membrane disruption followed by differential centrifugation to fractionate the cellular components.
Match the centrifugal conditions in Column I to the appropriate subcellular components in Column II.

Column I	Column II
P. 1000 g, 10 min	i. Microsomes and small vesicles
Q. 20000 g, 30 min	ii. Ribosomes
R. 80000 g, 1 hour	iii. Nuclei
S. 150000 g, 3 hours	iv. Lysosomes and peroxisomes

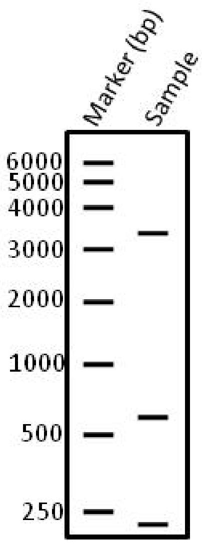
(A) P-iii ; Q-iv ; R-i ; S-ii
(B) P-i ; Q-iv ; R-iii ; S-ii
(C) P-iii ; Q-iv ; R-ii ; S-i
(D) P-ii ; Q-i ; R-iv ; S-iii

Q.20 Given below are the maps of a 1200 base pairs (bp) long DNA insert and a 3000 bp expression vector. The *Bam*HI (*B*) and *Hin*dIII (*H*) restriction sites and DNA length between them are indicated in base pairs.

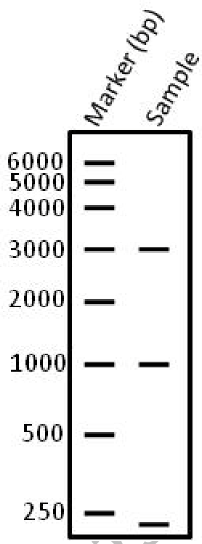


The insert is cloned into the vector at the *Bam*HI site and the desired orientation is shown by the arrow. After cloning, the orientation of the insert in the recombinant plasmid is tested by complete *Hin*dIII digestion followed by agarose gel electrophoresis. Which one of the following band patterns reveals the correct orientation of the insert in the construct?

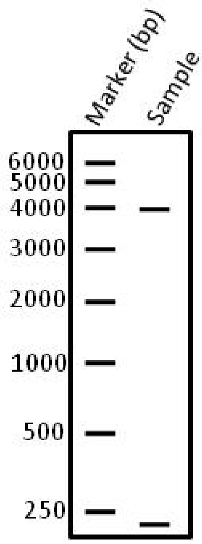
(A)



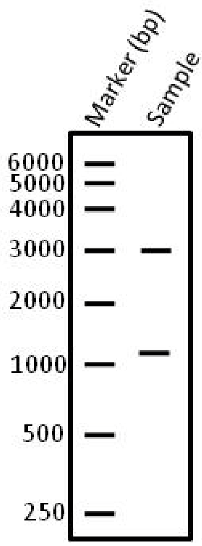
(B)



(C)



(D)



END OF THE QUESTION PAPER