

OTHELLO

ENZYMES

classmate

Date 11 Oct 2018

Page

Mun.

100%

Enzymes are grouped into 6 classes:

Class I: OXIDOREDUCTASES: catalyze oxidⁿ & redⁿ of other molecules. Ex: **Alcohol dehydrogenase**.

Class II: TRANSFERASES: transfer one group (other than H₂) from 1 substrate to another.

Ex: Hexose + ATP $\xrightarrow{\text{Hexokinase}}$ Hexose-6-P⁺.

Class III: HYDROLASES: H₂O⁺ of ester, ether, peptide / glycosidic bonds by adding H₂O & then breaking the bond.
ACh + H₂O $\xrightarrow{\text{Acetylcholinesterase}}$ Choline + acetate.

Class IV: LYASES: can remove groups from substrates or break bonds by mechanisms other than hydrolysis.
Fructose-1,6-bisP⁺ $\xrightarrow{\text{Aldolase}}$ Glyceraldehyde-3-P⁺ + Dihydroxyacetone-P⁺.

Class V: ISOMERASES: produce optical, geometric / positional isomers of substrates.
Ex: **cis trans isomerase**.
Many other isomerases in trans isomerase.

Class VI: LIGASES: Link 2 substrates together with simultaneous splitting of ATP.
Acetyl CoA + Co₂ + ATP $\xrightarrow{\text{AcCoA CoA ligase}}$ Malonyl-CoA + ADP + P_i.

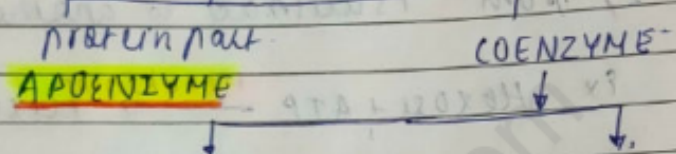
② DNA Ligase

- ⑧ - The protein part gives necessary 3D str. for chemical rxn.
 ⑨ - Group is transferred from / accepted by

COENZYMES

- ① - Enzymes may be simple proteins / complex enzymes containing non-protein part, called prosthetic group. The prosthetic group is called coenzyme.

- ② - ~~Protein~~ Enzyme (HOLOENZYME)

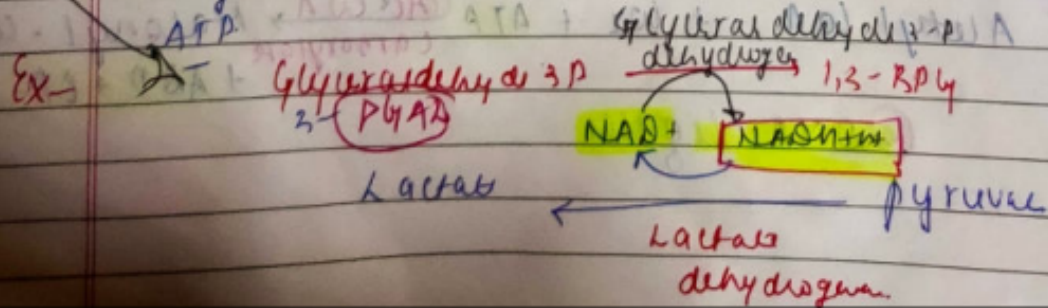


- ④ - taking part in rxn catalysed by oxidoreductases by donating / accepting H^+ or e^- .
 - enzyme - substrate / 2^o substrate.
 taking part in rxn transferring group other than H^+ .

- EX ① NADP - NADPH
 ② FAD - FADH₂
 ③ FMN - FMNH₂
 ① most belong to vit B complex
 ② CoA contains SH grp
 ③ PLP

- ⑤ - cof - essential for biological activity of enzyme
 ⑥ - coenzyme - $\downarrow$ no organic substrate
 - heat stable
 - combines loosely with enzyme molecules.

- ⑦ - molecule of coenzyme is able to convert a large no. of substrate molecules with the help of



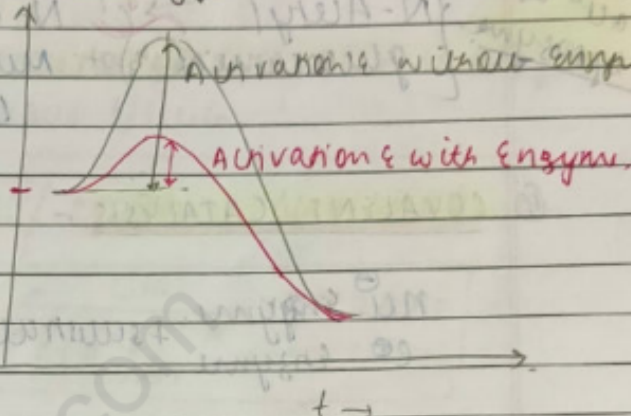
Ex 15
 # structure
 # steps
 # select distinct features
 # week

MODE OF ENZYME ACTION

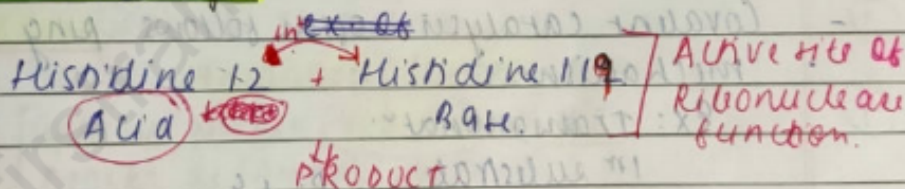
① Lowering of Activation Energy:

① Enzymes lower the energy of activation.

② Activation E_a is the E required to convert substrate molecule to transition state.



② Acid-Base Catalysis: Ex- The action of Ribonuclease



→ The ionisable pH of prosthetic grp. act as acid/base.

③ SUBSTRATE STRAIN:

① Binding of substrate to preformed site on enzyme can induce strain in substrate. The E level of substrate is raised, like transition state intermediate.

The resulting strain stretches/distorts the targeted bond, weakening it & making it more vulnerable to cleavage.

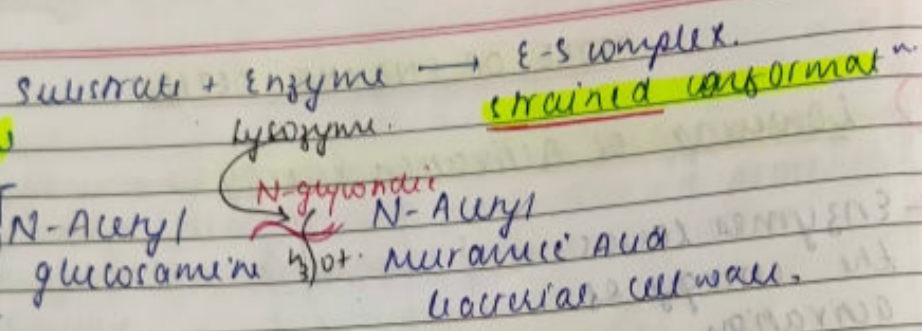
Ex: Lysosyme [acid base catalysis] substrate strain.

Ex: E & S
 # strain
 # stress
 # stretch
 # weaken
 # cleavage

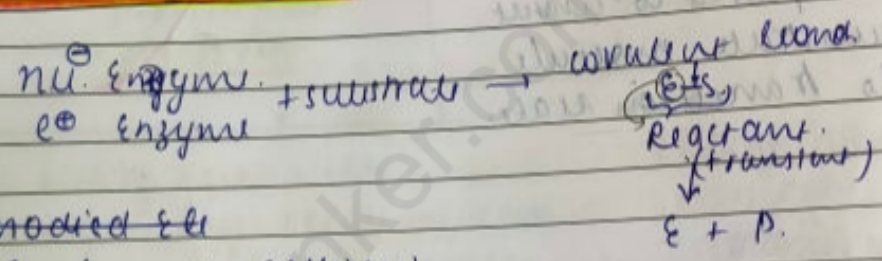
classmate

Date _____
Page _____

Backward
action of
lysozyme



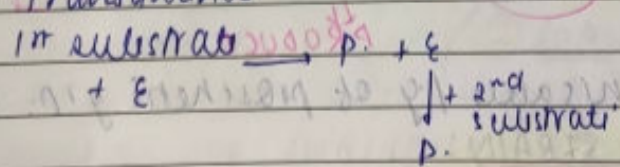
COVALENT CATALYSIS:-



-modified E_i

- ① - $\downarrow$ E_a (new rxn pathway).
- ② - faster rxn.
- ③ - Covalent catalysis often follows ping pong mechanism.

④ Ex: Transaminase.

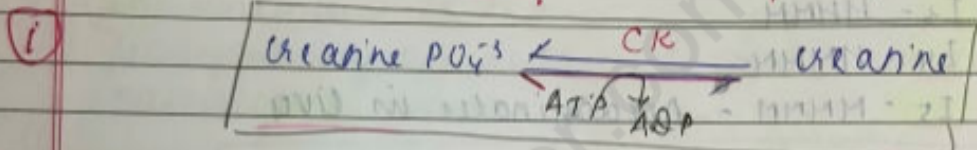


⑤ Responds to diff inhibitors

- properties
- (i) coded by diff gene
 - (ii) located in diff organ / diff compartment of same cell
 - (iii) may have diff specificity
 - (iv) diff mobility in electrophoresis
- ISOENZYMES** → different physical & chemical properties

- (1) Isoenzymes are distinct enzyme forms that catalyze the same rxn.
- ↳ These are diff molecular forms of same enzyme synthesized from various tissues.

(1) **Creatine Kinase (CK) / creatine phosphokinase**



(2) CK has 3 isoenzymes:

- (i) CK-MM - skeletal muscle - max in blood
- (ii) CK-BB - brain - min % in blood
- (iii) CK-MB - brain & skeletal muscle

↳ useful diagnostic / marker

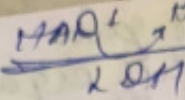
- (3) marker for cardiac diseases.
 - appears within 4-6 hrs of MI
 - peaks at 24 hrs (1 day)
 - returns to baseline by 48-72 hrs (2-3 days)

- (4) individual CK isoenzymes - separated by electrophoresis, ∴ facilitating detection

- (5) Today in most clinical lab, CK is supplemented by troponin for diagnosis of MI.

• Isoenzymes have diff ζ _{mm}
∴ separated by electrophoresis

Lactate



pyruvate

classmate

Date _____
Page _____

LACTATE DEHYDROGENASE

(2)

① - tetrameric enzyme - 2 monomer types.
H (for heart)
M (for muscle)

② - H & M monomers combines to yield 5 isoenzymes

- 1) I₁ - HHHH - predominates in heart tissue
- 2) I₂ - HHHM
- 3) I₃ - HMMM
- 4) I₄ - MMMM
- 5) I₅ - MMMM - predominates in liver

③

Tissue specific expression of H & M genes determines relative proportion H & M subunits in diff. tissues.

④

Tissue injury
↓
release

sp. LDH isoenzyme

↓
separated

electrophoresis

↓ detected
coupled assay

⑤

marker of MI

(3)

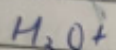
ALKALINE PHOSPHATASE (ALP)

Leucocyte (not in PM)

(1)

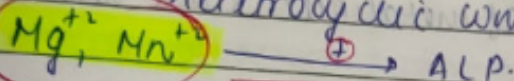
studied for diagnosis of liver disease

(2)



aliphatic
aromatic/
heterocyclic compounds

(3)



(4)

Zn constituent of ALP.

(5)

produced by osteoblasts of bone, associated with calcification process.

(6)

Moderate ↑
2-3 times

v. ↑ level of ALP.

(10-12 times of upper limit)

Dramatically high

level of ALP

(10-25 times)

• hepatic disease

(1) infective hepatitis

(2) infective mononucleosis, hepatitis.

• extrahepatic

obstruction

obstructive jaundice

• caused by gall

stones / P in bile

duct by carcinoma

of head of

Pancreas.

• bone disease.

osteoblastic

activity ↑

(1) Rickets

(2) Osteomalacia

(3) metastatic

carcinoma of bones

(4) hyperthyroidism.

(7)

6 isoenzymes of ALP.

(8)

major fractions

liver isoenzymes.

bone

intestinal

(9)

α-2 isoenzymes - metastatic.

↑ PAA

intestinal / placental origin

anger wait

...the available for kids by the start of next school year," said Dr Evan Anderson, a paediatrician at Children's Healthcare of Atlanta and a professor at the Emory University School of Medicine. "Any vaccine for measles — including the one designed for polio and measles — should be given to children with cases of inflammation. These vaccines typically in adults to achieve significant safe protection."

Date
Page

- (10) - Heart stable placental enzyme
- (11) - Bone Alkaline phosphatase (BAP):
 - ↳ used of normal pregnancy
 - ↳ identical heart stable fraction
 - ↳ marker of metabolic bone disease

Catalytic site/ACTIVE SITE/ACTIVE CENTER OF ENZYME

- (1) Catalysis occurs at active site of enzyme.
- (2) The region of the enzyme where substrate binding and catalysis occurs is called substrate active site or active centre of the enzyme.
- (3) Although all parts are required for maintaining the exact 3D-structure of the enzyme, the rxn is taking place at the active site. The active site occupies only a small portion in the whole E-mol.
- (4) Generally, active site is situated in a cave/ cleft in the enzyme molecule.
- (5) To the active site, the sp. substrate is bound. The binding of substrate to the active site depends on the alignment of atoms / specific groups at the active site.
- (6) ~~PTB~~ ★ The active site contains substrate binding site & catalytic site, sometimes these 2 may be diff.
- (7) Proteolytic enzymes having serine residue at the active site are called serine proteases.
Ex- Pancreatic Proteases & Coagulation Factor.
- (8) The substrate binds to A.S. by non covalent bond. These forces are hydrophobic in nature.

Don't wait for kids

Vaccine developers are slowly aware that children are not simply miniature adults. Their biology is different in ways that may affect the way vaccines work. Because their airways are smaller for example, they can be vulnerable to low levels of inflammation that might be harmful to low-weight children. These trials allow vaccine developers to adjust the protection the vaccine provides for children.

classmate

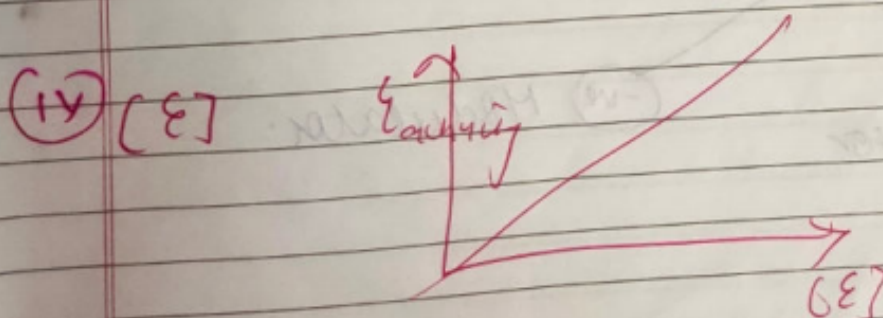
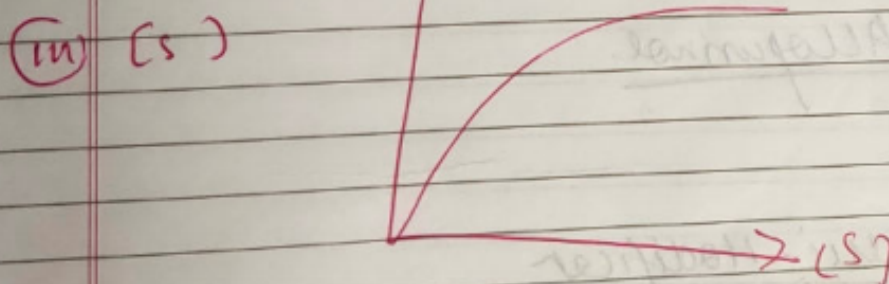
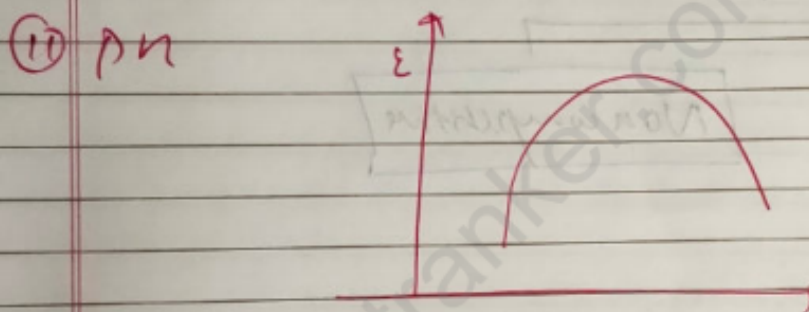
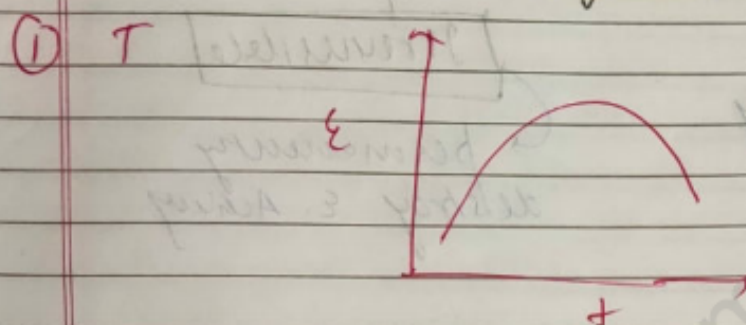
Date

Page

⑥ - During the binding, the sp. groups on active site may realign themselves to provide unique confirmational orientation so as to promote exact fitting of substrate to the active site.

⑦ - The AA/groups that directly participate in making/breaking of bonds at the active site are called CATALYTIC RESIDUE / GROUPS.

Factors Affecting the Rate of Enzyme Catalysed Rxn.



classmate

Date _____
Page _____

Inhibition

Reversible

↳ temporary

Irreversible

↳ permanently destroy E. Activity

Competitive

Non competitive

↳ Suicide Inhibitor / Mechanism based Inhibition -

Ex - Allopurinol.

→ Allosteric Modifier

+ve Modulator

(-ve) Modulator.