2.5.4 (1)

Retest for improvement

SANTHIRAM MEDICAL COLLEGE, NANDYAL (A.P)

Improvement EXAMINATION – BIOCHEMISTRY PAPER –II

II. THEORY QUESTION – 80M

ESSAY QUESTION **2X15=30**

1. Describe in detail the process of transcription in Prokaryotes. Add a note on post transcriptional modifications and inhibitors of transcription. (8+4+3= 15 Marks)
2. Explain the role of plasma buffers and respiratory mechanism in maintenance of acid base balance in the body. Add a note on Metabolic Acidosis. (5+5+5= 15 Marks)

Write short notes on: **10X5=50**

3. A 15yr old girl presented to OPD with abdominal distension and Jaundice. On examination bilateral Kayser-Fleischer ring noted in both eyes. LFT-Normal.
    1. What is the likely diagnosis? (1 M)
    2. What is the biochemical basis? (2M)
    3. What biochemical investigations has to done ? (1M)
    4. What is the treatment ? (1M)
4. Mechanism of action of Group I hormones.
5. Structure & Metabolic pathways in Mitochondria.
6. Immune responses.
7. Proto oncogenes.
8. Structure of collagen.
9. Acute phase proteins.
10. Steps of Ureacycle and regulation.
11. a) Derivatives of glycine
    b) Any 4 SAM involved reactions
12. A 55yr old man complained severe pain in the joints.He is a non-vegetarian and consumed alcohol occasionally. His laboratory findings are as follows.

1. S.Uricacid -12mg/dl 2. Bl.urea -25 mg/dl 3. Urinary uric acid -2.5g/day 4. Urine PH -4.5

1. Write the diagnosis. (1M)
2. Which metabolic pathway is affected ? (1M)
3. Describe the types and treatment of the disease. (2M)
4. What are the normal reference ranges for the above parameters.(1M)

SANTHIRAM MEDICAL COLLEGE
NANDYAL

Santhiram Medical College and General Hospital NANDYAL

1st Year UG

I/II/III Internal Assesment Examination I II III

Subject Biochemistry Paper I/II

Roll No. 21M1020170211

No. of Additional Sheets: 5

Dr. B. Indumathi
Signature of Invigilator

B. Dheeraj Reddy
Signature of Student

(To be filled by the Examiner)

Max Marks :

Marks Question Wise

Q.No.	Page No.	Marks
1		9.5
2		9.5
3		3.5
4		3
5		2
6		3.5
7		3
8		3
9		3.5
10		2.5
11		2
12		3
13		
14		
15		

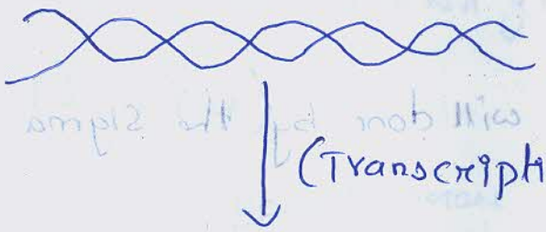
$\frac{48}{80} + \frac{10}{20} = \frac{58}{100}$

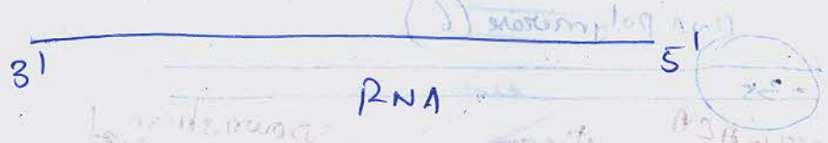
Signature of Examiner

⇒ ESSAY'S

1) Transcription in Prokaryotes →

* The Synthesis of RNA from the DNA is known as transcription





* Transcription in prokaryotes occur in 3 process and they are:

i) Initiation

ii) Elongation

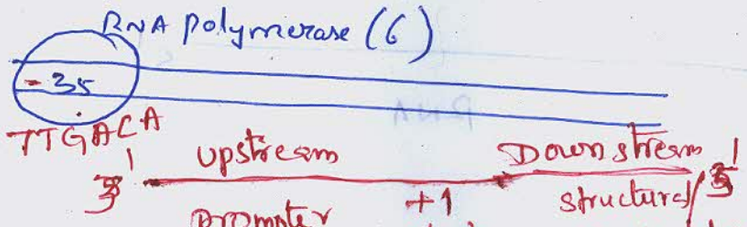
iii) Termination.

* Transcription depends upon the following factors → template strand, Codon strand etc (3→5' RNA strand)

i) Initiation → write few lines about RNA polymerase enzyme

* Formation of closed Complex

- Attachment of RNA polymerase to the promoter region
- Scaning of DNA will done by the sigma factor (6)



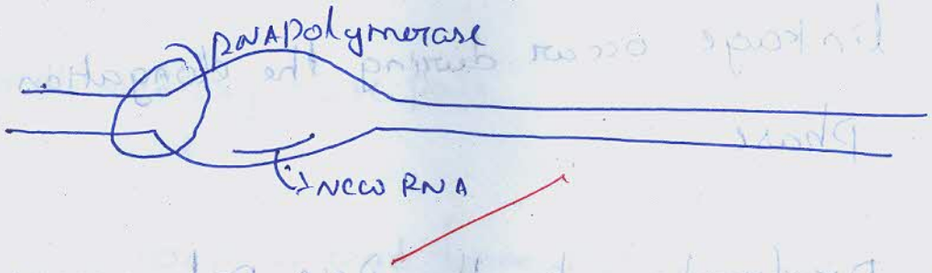
* Formation of open complex

- local binding of DNA at the region of TATA-box

* Initiation of RNA Synthesis

- Synthesis of RNA from the template strand

- Complementary to RNA polymerase by the template strand
- During this phase there is no need of the primer
- Short stretch of RNA get synthesized (5-10 RNA)

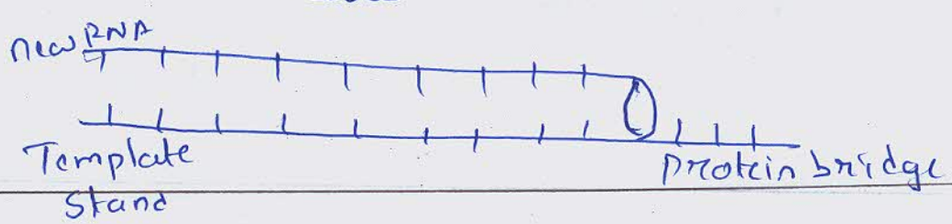


* Promoter clearance

- The RNA get shifted to the transcription site and get moved away from the promoter region

ii) Elongation →

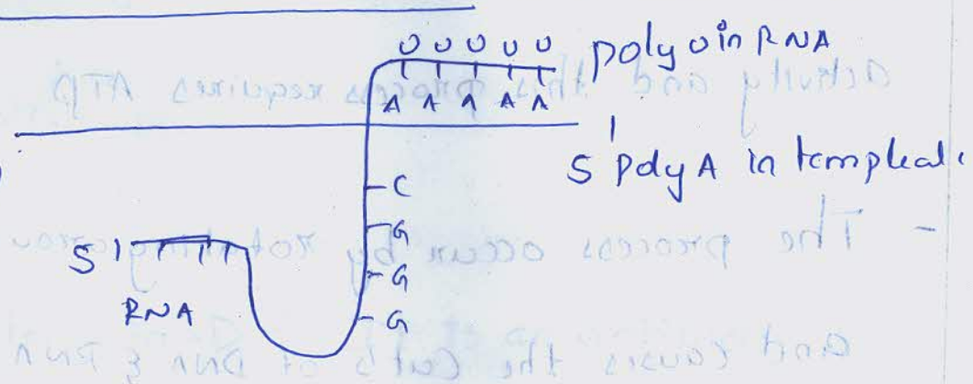
* At this phase the ribonucleotides are added to the chain and the chain increases continously
* formation of 3'–5' phosphodiester linkage occur during the elongation phase
* Proofreading by the RNA polymerase does not occurs
* Protein bridge provide the nucleotide to the template strand for the RNA Synthesis
* Nucleotides are added to 3' end of molecule



iii) Termination →

Rho (ρ) independent termination.

* Intrinsic termination



Complementary base pair

↓

Hair loop / strand formation

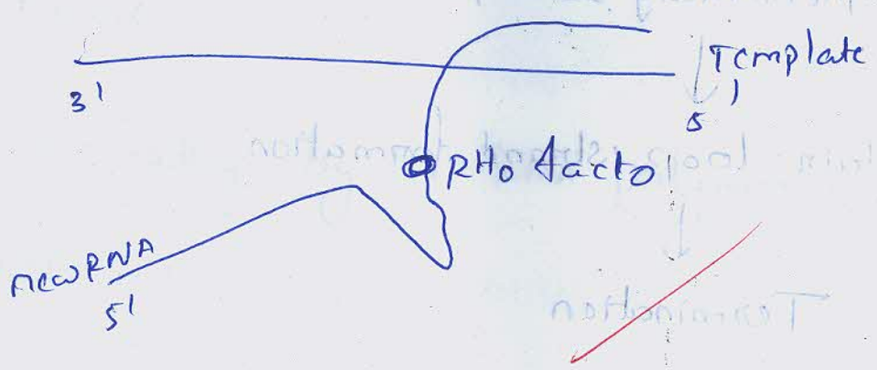
↓

Termination

* The occurence of poly U in the RNA is due to rich signals cause the termination in the transcription

* Rho protein dependent transcription

- The activated RNA activate the Helicase activity and this process requires ATP
- The process occur by rotating around and causes the cut's of DNA & RNA



⇒ Inhibitors

i) Acitomycin-D

ii) Rifampicin.

* Acitomycin-D → It is an antibiotic and it intercalated into Double Strand DNA & blocks the RNA polymerase

* Rifampicin → It is antitaborcular drug

It bind with β-subunit of RNA polymerase and prevents the transcription

⇒ Post transcriptional modifications

- Post transcriptional modifications occcurs in 2 categories →

i) Proteolytic cleavage

ii) Covalent modifications

2) Acid-base balance (buffers) ⇒

* The body has of three lines of defence mechanisms for the regulation of blood pH & acid base balance.

* The mechanisms are ⟶

  i) Blood buffer (plasma)

  ii) Renal mechanism

  iii) Respiratory mechanism

i) Blood buffer ⟶

* The solution of the weak acid and the Strong base is known as buffer

* Blood buffers are of 3 types

  - Protein buffer
  - phosphate buffer
  - Bicarbonate buffer

- Bicarbonate buffer

* It is most predominant buffer system of the extra cellular fluid
* It depend on the sodium bicarbonate and carbonic acid

$$H_2CO_3 \rightleftharpoons H^+ + CO_3^-$$

* It's ratio is 20:1
- It's pka value is 6.1

- Phosphate buffer

It depend on the dihydrogen phosphate and dihydrogen sodium phosphate

It is defined as intracellular buffer due to low conc of plasma

It's ratio is 4:1

It's pka value is around 6.8

- Protein buffer

* Plasma protein and the hemoglobin both together constitute the protein buffer

* It's pKa value is 6.7

- It is mainly due to present of imidazole group.

ii) Respiratory mechanism →

* The Respiratory mechanism provide a rapid action mechanism to the acid base balance

* It is activated by regulating of the carbonic acid

$$H_2CO_3 \longleftrightarrow CO_2 + H_2O$$

* As this mechanism has rapid action, but it for the short regulatory Period.

⇒ Lungs

i) Alkalosis →

- Decrease in the conc of pCO_2
- Increase in conc of H_2CO_3 & pCO_2
- It causes hypoventilation

ii) Acidosis →

- Decrease in the conc of H_2CO_3 & pCO_2
- Increase in conc of pCO_2

→ Hemoglobin

- It binds to H^+ ions and helps in the transport of CO_2 & HCO_3^-
- Tissues causes decrease in O_2 and increase in CO_2

$\downarrow O_2 \rightarrow$ $CO_2 + H_2O \rightarrow H_2CO_3$

$\downarrow$

$H^+ + HCO_3^-$

$Hb \quad HHb$

$\uparrow O_2 \rightarrow$ $HHb + O_2 \rightarrow HbO_2$

$+$

$HCO_3 \quad H_2CO_3$

$\downarrow$

$CO_2 + H_2O$

$\downarrow$

release of CO_2

iii) Renal mechanism →

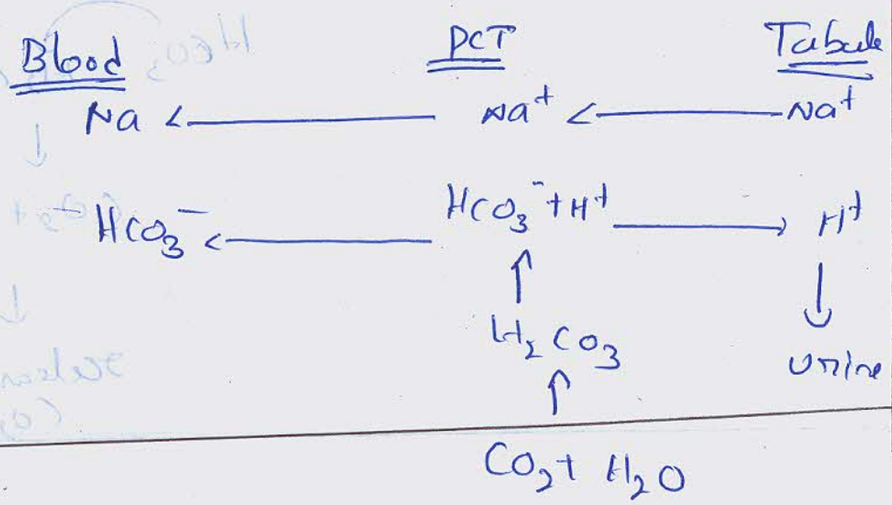
* Renal mechanism plays a major role in acid base balance

* As this mechanism provide a permanent solution to the acid-base disorders

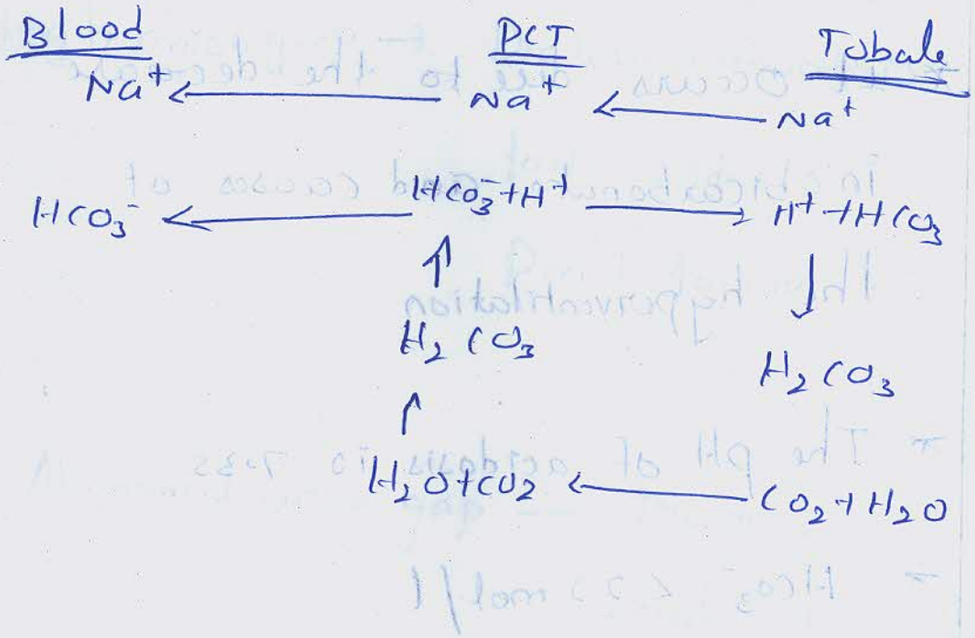
* It occurs in 4 process:

  - Excretion of H^+ ions
  - Reabsorption
  - Removal of titrable acid
  - Formation of NH_4^+

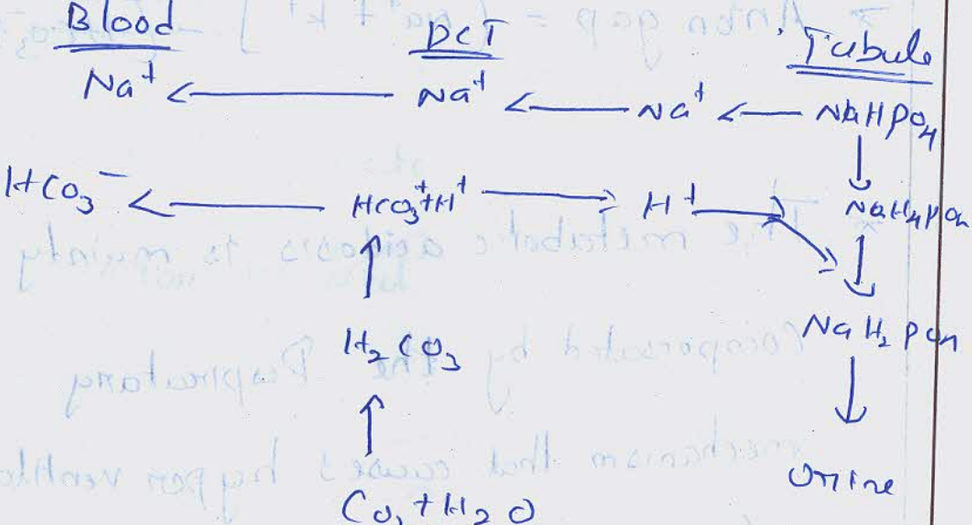
- Excretion of H^+ ions



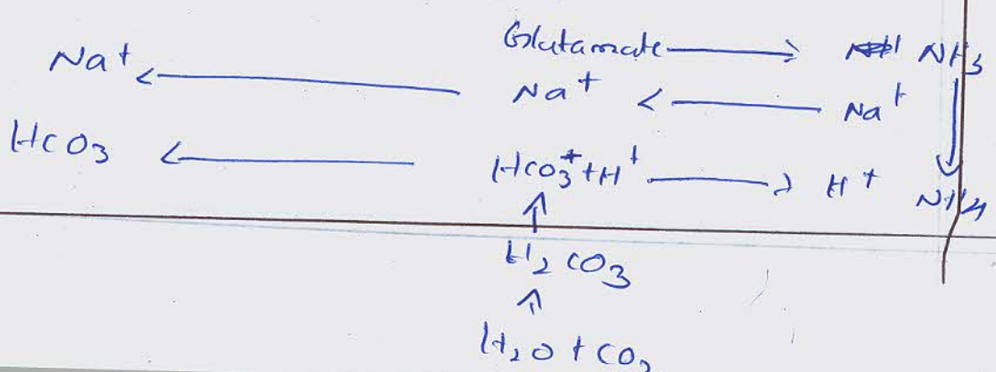
- Reabsorption



- Removale of titrable acid.



- Formation of NH_4



⇒ Metabolic Acidosis

* It occurs due to the decrease in bicarbonate and causes of the hyperventilation
* The pH of acidosis is 7.35
* HCO_3^- < 22 mol/l
* Anion gap = $[Na^+ + K^+] - [HCO_3^- + Cl^-]$
* The metabolic acidosis is mainly compensated by the Respiratory mechanism that causes hyperventilation ($\downarrow pCO_2$, $\downarrow H_2O$)

⇒ Causes

- High anion gap → Diabetic ketoacidosis
  lactic acidosis
  Renal failure

- Abnormal anion gap → Diarrhea
  Renal failure

3

→ Treatment

→ Sodium bicarbonate

→ monitor k+ level

⇒ Shorts:

3)

i) The patient is suffering from the wilson's disease

ii) Biochemical basis:

- Hepato lenticular degeneration
- Copper binding ATpase mutation

iii) Biochemical investigations:

- Accumulation of copper in liver
- Damages lenticular nucleus of brain

IV) Treatment

* Less intake of copper in diet

4) Group-1 hormones →

* Hormones →

- It is defined as the organic substances that produced in small amounts by Specific tissue

- Hormones are commonly regarded as Chemical messengers

- Hormones are classified into 2 categories:-

i) Chemical messengers →

- Peptide hormones
- Steroid hormones
- Amino acid hormones

ii) mechanism of action →

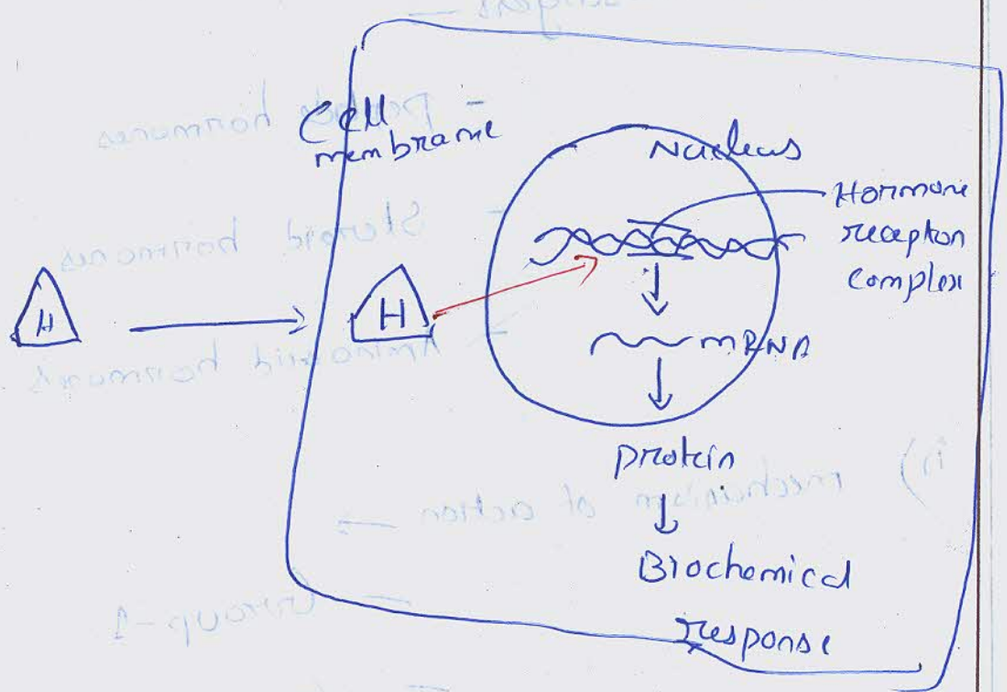
- Group-1
- Group-2

⇒ Group - 1 hormones

* These group of hormones bind with the intracellular receptors for the formation of hormonal complex
* These are lipophilic in nature and the derivatives of cholestrol

Eg: Estrogen, calcitriol, FSH, LH, Steroid hormones, progesterone, Estrogen.

* Mechanism



* when the Hormon (H) attach to the receptor then the negative effector get released

↳ positive effector gets attached to the DNA

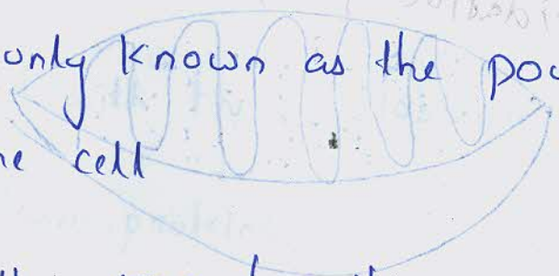
↳ transcription, translation of protein will occur

3'

5) Mitochondria →

* mitochondria is one of the important cell organelle

* It is commonly known as the powa house of the cell



* It provide the ATP for the energy to the cell

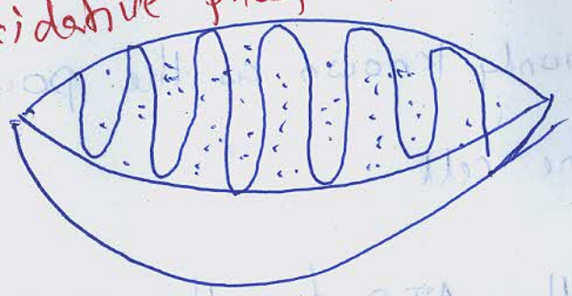
* The mitochondria consist of cristae, matrix, inner & outer mitochondrial membrane.

* The mitochondria play a major role (site) in the metabolic pathways.

⇒ metabolic pathways

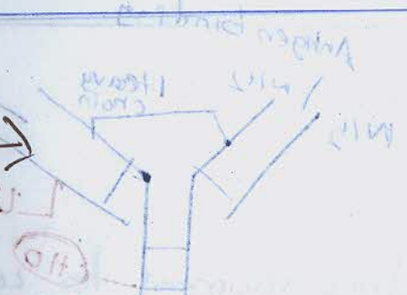
- In the electron transport chain the inner mitochondrial membrane act as site for synthesis

- Heme Synthesis
- Glucose metabolic pathways
  - TCA cycle
  - β-oxidation
  - oxidative phosphorylation



2

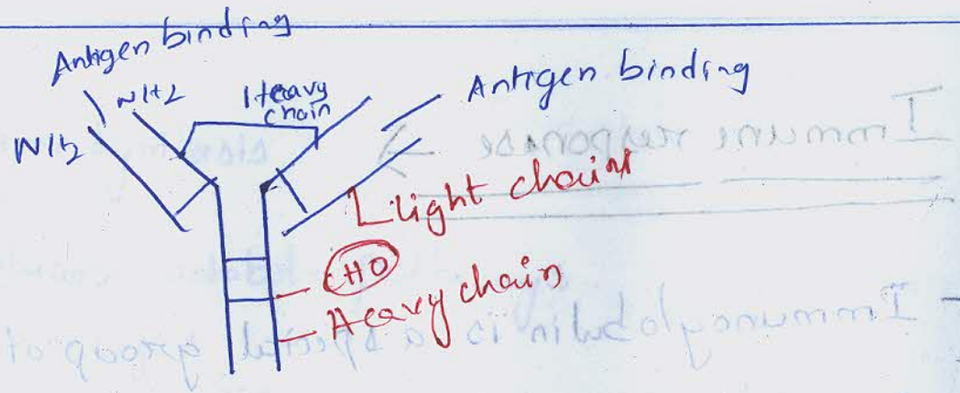
6) Immune response →



- Immunoglobulin is a special group of Proteins
- It is associated with the γ-globular fraction of plasma proteins
- It is a functional form

⇒ Structure

- Immunoglobulin consist of 2 heavy chains and 2 light chains
- The molecular weight of heavy chain is 50000 to 75000 and the light chain is around 25000
- It is a Y-shaped tetramer
- 450 amino acids present in heavy chain
- 200 amino acid in light chain



⇒ classification

- Immunoglobulins are classified into 5 classes:
  - Ig G
  - Ig A
  - Ig M
  - Ig D
  - Ig E
- It consist of 2 types of light chains
  - kappa
  - lamba

* IgG:

It is most abundant class of immunoglobulin

It composed of single y-shaped unit

It can traverse blood vessels

It is only the immunoglobulin that cross the placenta & transfer mother immunity to newborn & protects against the infection.

* IgA:

It occur as single (or) dimer unit

It held together by J chain

It is found in body secretions such as sweat, tears etc

It is most predominant antibody in the colostrum

* IgM:

- It is largest immunoglobulin
- It consist of 5-y shaped polypeptide bonds that held by J-chain
- It is most efficient against the invading mechanisms
first line defence

* IgD:

- It is composed of Single y-shaped unit
- It function as B-cell receptor and present in low concentration

32 * IgE:

- It is a single y-shaped monomer
- It is tightly bind with mast cells
- These are elevated in individuals with allergies

7) Proto oncogenes →

* The normal gene that present in cell is responsible for production of various factors and that proteins regulate the gene expression is known as proto oncogenes

→ mechanisms

The proto oncogenes formation occurs under 4 mechanisms and they are →

i) point mutation
ii) Chromosomal translocation
iii) Gene amplification
iv) Promoter insertion

Protooncogenes

i) point mutation
ii) Chromosomal translocation
iii) Gene amplification

↓

Mutation

↓

Oncogenes

↓

Mutated proteins

↑ cell growth
↑ cell division

↓

Cancer

need to add few points

Eg: protooncogens

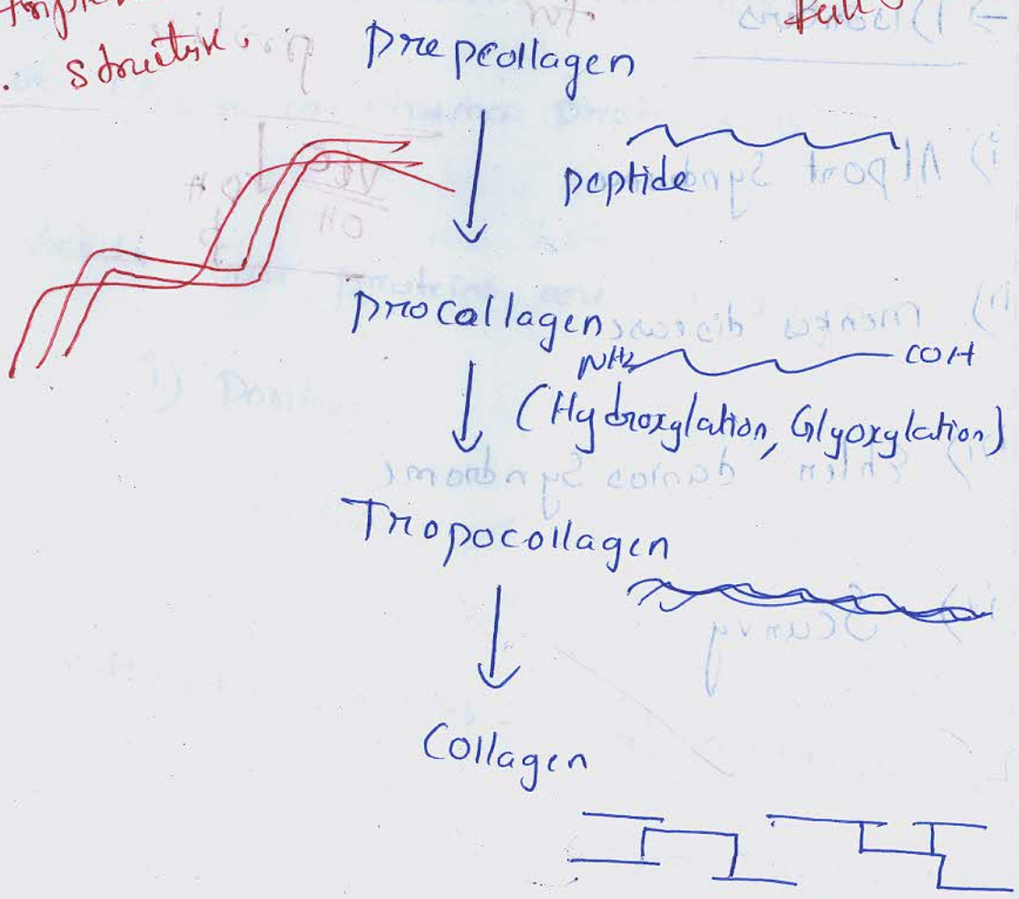
8) Collagen →

* collagen is a type of structural fibrous proteins

* Collagen Synthesis occurs at PPTC

triple helical structure

Pull from



* It is most abundant protein found in animals

* It is a triple helical structure & stabilised by covalent linking
* Vitamine C — Causes hydroxylation of proline.
* Collagen fibres are of 14 types
→ proline & Glycine
→ proline converted to hydroxy proline
→ Disorders for proline

i) Alport Syndrome

ii) Menkes disease

iii) Ehlen danios Syndrome

iv) Scurvy

3

9) Acute phase Proteins →

- It refers to non specific response to stimulus of infection, injury.
- It is associated with characteristic portion of change in plasma proteins p.
- Acute phase proteins are of 2 types
  - i) Positive
  - ii) negative

* Positive phase proteins → α_1 - antitrypsin
  α_2 - macroglobulin
  Ceruloplasmin
  C - reactive protein
* negative phase proteins → Albumin
  Transferrin

⇒ Ceruloplasmin

* It is blue coloured Copper Containing α_2-globulin
* It's plasma Concentration is around 30 mg/dl
* It posses oxidase activity
* It is associated with wilson disease

⇒ α_1-antitrypsin

* It is a glycoprotein that contain of 394 amino acids
* It's molecular weight is around 54,000
* It is a Serine protease inhibitor

⇒ C-reactive protein

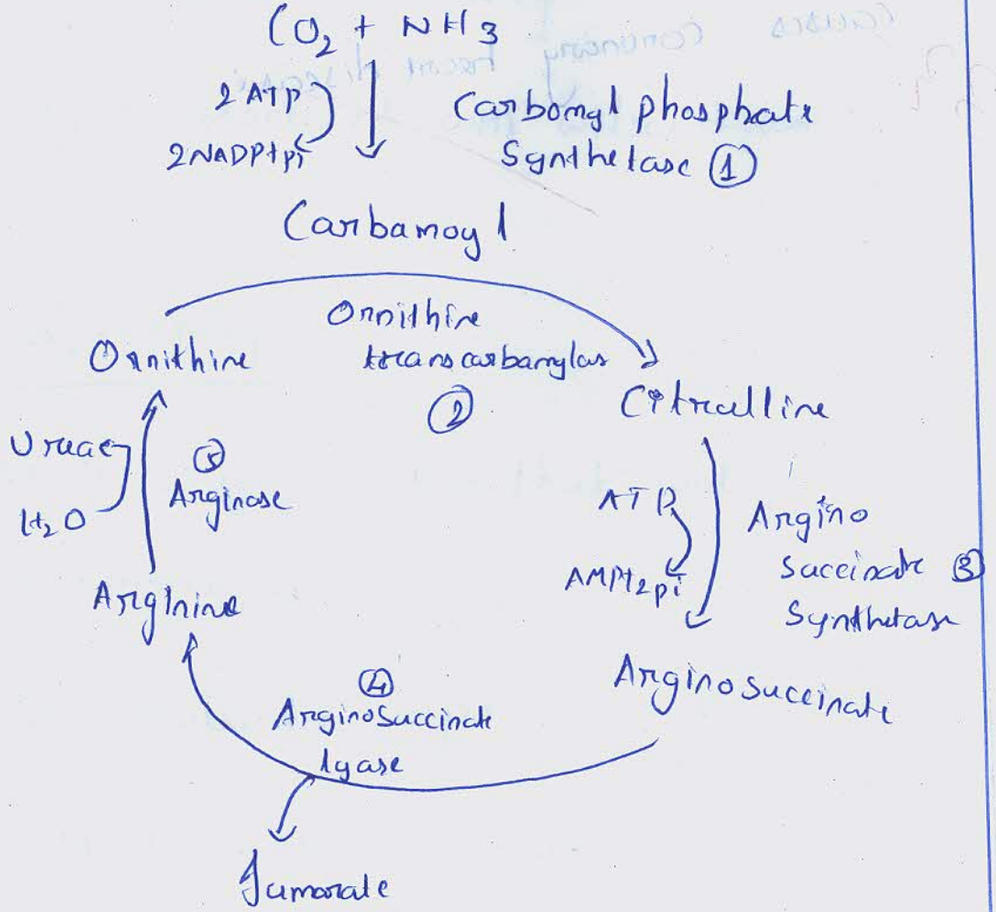
* It is a major component of acute phase protein
* It is produced in liver
* Increase in the C-reactive protein causes coronary heart disease

22

10) **Urea Cycle** ⟶

* It is also known as ornithine cycle

* 1st two reactions occur in mitochondria and remaining in the Cytosol



⇒ Regulation

NAG - N acetyl Glutamate act as a allosteric inhibiton of (carbomoy) synthetase

Acetyl coA + Glutamate $\xrightarrow[\text{Arginine}]{}$ N-acetyl Glutamate

Mention: Disorders

Enzy

- Hyper ammonemia Type I — CPS I
  Type II — ornithine transcarbomylase

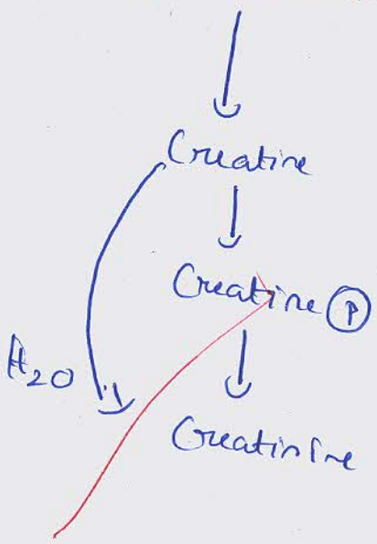
11)

a) Derivatives of glycine →

- Glycine is a non essential amino acid and it is optically inactive

Glycine + Succinyl CoA → γ ALA → Heme

Glycine + Arginine → Guanidoacetate



5) SAM reactions →

12)

i) Diagnois →

* on the basis of clinical characebristics we conclude that ~~person~~ pateint is Suffering from "Gout"

ii) The affected metabolic pathway :-

"Purine nucleotide metabolism"

mention symptoms
pptating factors

purine ⟶ xanthine ⟶ uric acid

xanthine Oxidase.

excess conversion of purine — Gout.

iii) Types & treatment :

* Types → 2 types

i) primary → Inborn error Enzymes :

ii) Secondary → Increase of uric acid

* Treatment → Allopurinol
Colchicine

iv) normal ranges →

males — 3–6mg/dl
female — 4–7mg/dl

IMPROVEMENT EXAMINATION – BIOCHEMISTRY

PAPER -II

Name: **Roll No:**

10/20

Answer all the MCQs **1x20=20 Marks**

1.Which amino acid is required for both purine and pyrimidine synthesis (A) (B)

A) Glycine B) Aspartate C) Alanine D) Glutamate

2. In wich aminoaciduria benedict's test is positive. (A) (C)

A) phenyl ketonuria B) Histidinemia

C) Alkaptonuria D) Nonketotic hyperglycinemia

3. Southern blotting is used to detect (A)

A) DNA B) RNA

C) Proteins D) Aminoacids

4. Frameshift mutation mutation results from (A) (B)

A) Substitution of a single base B) Deletion of a single base

C) Addition of a codon D) Deletion of a codon

5. Dystrophin is abnormal in: (D)

A) Menke's kinky hair syndrome B) Osteogenesis C) Dermatosparaxis D) Muscular dystrophy

6. The Amino acid which has maximum buffering capacity at physiology PH is: (C)

A) Arginine B) Alanine C) Histidine D) Glutamic acid

7. Fluidity of membranes depends on: (A)

A) Nature of fatty acids B) Concentration of Proteins

C) Membrane pumps D) Glycolation of proteins

8. Which of the following alpha globulins is a tumor marker? (A)

A) Alpha fetoprotein B) Thyroxin binding globulin

C) Transcortin D) High density lipoprotein

9.When pH falls by I unit, the hydrogen ion concentration: (A) (D)

A) Decreases 10times B) Increases two fold

C) Changes by 7times D) Increases 10times

10. Which Amino acid will give rise to an inhibitory neurotransmitter (B)

A) Histidine B) Glutamic acid C) Ornithine D) Tyrosine

11. The extacellular cation present in maximum concentration is: (C)

A) Potassium B) Magnesium C) Sodium D) Calcium

12. All the following Hormones have membrane receptors,except: (D)

A) Insulin B) Epinephrine C) Glucagon D) Thyroxine

13.Orotic aciduria is a feature of deficiency of all the following enzymes,except: (A) (B)

A) OMP decarboxylase B) Ornithine transcarbamoylase

C)OPRTase D) Aspartate transcarbamoylase

14.Zinc is present in all enzymes, except: (A) (B)

A) Alkaline phosphatase B) Amylase C) Carbonic anhydrase D) Carboxypeptidase

15.Hemopexin carries: (B)

A) Free hemoglobin B) Free heme C) Free bilirubin D) Free iron

16. Human insulin differs from bovine insulin in: (B) (D)

A) Biological B) Number of amino acids

C) Position of disulfide bonds D) Sequence of amino acids

17. Normal range of HCO_3 (C)

A) 3.5-5.5 mmol/L B) 136-145 mmol/L C) 22-26 mmol/L D) 96-106 mmol/L

18. Which is not true regarding the genetic code: (A) (B)

A) Degenerate B) Ambiguous C) Nonoverlapping D) Universal

19. All the following are channel formers, except: (C) (D)

A) Gramicidin B) Amelogenin C) Valinomycin D) Glutamate

20. Synthesis of recombinant DNA (r DNA) requires all the following, except: (C)

A) Restriction endonuclease B) RNA primer

C) Plasmid vector D) DNA ligase (B)