[This question paper contains 4 printed pages.]

11/5/17

Your Roll No.....

Sr. No. of Question Paper : 2784 **GC-4**

Unique Paper Code : 32491401

Name of the Paper : Human Physiology

Name of the Course : **B.Sc. (Hons.) Biochemistry**

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all including Q. No. **1** which is compulsory.

1. (a) Give the full form of the following :

   (i) JGA

   (ii) EDV

   (iii) IPSP

   (iv) ECG

   (v) ANF (1×5)

P.T.O.

(b) Comment on the following :

(i) Platelet plug does not dislodge from damaged endothelial site.

(ii) Some people cannot digest milk.

(iii) Left ventricular dysfunction can lead to pulmonary edema.

(iv) Lactation in women can act as temporary contraceptive.

(v) Acclimatization is required at high altitude

(vi) Enterohepatic circulation helps in lipid digestion.

(vii) Hypercapnea increases ventilation. (2×7)

2. (a) How does the kidney maintain the acid base balance of the blood ?

(b) Discuss the countercurrent mechanism of urine formation.

(c) Calculate Renal Clearance of substance X when its plasma concentration is 4 mg/ml, it urine concentration is 300 mg/ml and rate of urine formation is O.1L/hr.

(7,5,2)

3. (a) Explain how the gastric secretion of HCl and pepsin is regulated during the cephalic, gastric and intestinal phases ?

(b) How does liver act as detoxifying organ ?

(c) Describe how the pancreatic enzymes become activated in the lumen of the intestines. Why are these mechanisms needed ? (5,5,4)

4. Describe the causes and symptoms of the following diseases :

(i) ARDS

(ii) Hypertension

(iii) IBD

(iv) Renal failure

(v) Coma (3,3,3,3,2)

5. (a) Discuss the generation of action potential in heart muscle. Explain the ionic changes associated with it.

(b) What is pacemaker potential ? What is its inherent rate ? By what mechanism does the SA node function as pacemaker ?

(c) Describe the normal ECG pattern. (5,5,4)

6. (a) Describe sequence of events in ovarian follicular cycle.

(b) What is the role of oxytocin and prolactin in lactation ?

(c) Describe the sequence of events leading from spermatogonia to sperm. (5,4,5)

7. (a) Contrast the postsynaptic mechanisms of excitatory and inhibitory synapses.

(b) The chemical composition of the CSF is different from that of blood. Illustrate.

(c) Explain the functions of the major parts of the human brain. (5,4,5)

8. Differentiate between :

(i) Obstructive and Haemolytic jaundice

(ii) Respiratory and Metabolic acidosis

(iii) Parturition and Lactation

(iv) Blood Brain and Blood Testis barrier (3.5×4)

(2)

[This question paper contains 6 printed pages.] 15/5/17

Your Roll No.....

Sr. No. of Question Paper : 2785 **GC-4**

Unique Paper Code : 32491402

Name of the Paper : Gene Organization, Replication and Repair

Name of the Course : **B.Sc. (Hons) Biochemistry**

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question No. **1** is compulsory.
4. Use of scientific calculator / log tables may be allowed.

1. (a) State True or False and explain why :

   (i) 5'---3' Processivity of DNA polymerase necessitates the use of telomerase in eukaryotes.

(ii) Hoogstein base pairing is an unusual type of base pairing in which four adenine bases form hydrogen bonded quartet.

(iii) Bacterial transposable elements transpose by cut and paste mechanism.

(iv) Entropy and base stacking are the primary factors contributing to the stability of DNA.

(v) A supercoiled DNA molecule has lower energy than a relaxed DNA molecule.

(vi) The beads on the string model of eukaryotic DNA is enough to provide the compaction required to fit into the nucleus.

(vii) Viruses have high gene density. (2×7)

(b) Explain the following terms :

(i) Chi sequence

(ii) Topoisomers

(iii) Linker DNA

(iv) Hotspots

(v) Pseudogene (1×5)

2. Compare the following pairs :

(a) Heterochromatin and Euchromatin

(b) B DNA and Z DNA

(c) Serine recombinase and Tyrosine recombinase

(d) Base Excision and Nucleotide Excision Repair

(3,4,3,4)

3. (a) Mention the different types of topoisomerases and their role. Why aren't type I toposiomerases necessary for DNA replication ?

(b) Mention and discuss briefly the role of different proteins in homologous recombination in *E. coli.*

(c) What are Cot curves ? Explain their implications.

(5,5,4)

4. (a) What are suppressor mutations ? How do they suppress frameshift and nonsense mutations ? Explain how and what types of mutations are produced by the following compounds :

(i) 5-bromouracil

(ii) Nitrous acid

(b) What do you understand by the end replication problem ? How does telomerase solve this ?

(c) How histone proteins are inherited ? (6,5,3)

5. (a) What are transposable elements ? Mention the different classes of transposable elements ?

(b) How single stranded DNA binding proteins stabilizes ssDNA prior to replication ?

(c) A relaxed circular double stranded DNA molecule of 1600 bp is in the solution where conditions favor 10 bp per turn. What are the values of L_0 for this DNA molecule ? Suppose DNA gyrase introduces 12 negative supercoils into this molecule, what are the values of L, W and T now ? What is the superhelical density, σ ? (6,3,5)

6. (a) Explain why DNA synthesis is coupled to the hydrolysis of pyrophosphate.

(b) The *E. coli* chromosome contains 4,639,221 bp. How many turns of the double helix must be unwound during replication of the *E. coli* chromosome? How long would it take to replicate the *E. coli* chromosome at 37°C if

two replication forks proceeded from the origin ? Assume replication occurs at a rate of 1,000 bp/s. Under some conditions, *E. coli* cells can divide every 20 min. How might this be possible ?

(c) Discuss the structural organization of chromatin in terms of nucleosome model. (3,6,5)

7. Explain the following statements :

(a) The base composition of phage M13 DNA is A, 23%; T, 36%; G, 21% and C, 20%. What does this tell you about the DNA of phage M13 ?

(b) There are different modes of DNA replication in different organisms.

(c) Replicative movement of the growing fork induces supercoiling in the DNA.

(e) Resolving Holliday Junctions is a key step to finishing genetic exchange. (2,4,2,6)

8. Write short notes on :

(a) Retrotransposons

(b) Different modes of DNA replication

(c) Translesion repair

(d) Ames test (4,4,3,3)

(3)

[This question paper contains 6 printed pages.]

2017

Your Roll No.....

Sr. No. of Question Paper : 2786 **GC-4**

Unique Paper Code : 32491403

Name of the Paper : Metabolism of Amino Acids and Nucleotides

Name of the Course : **B.Sc. (Hons) Biochemistry**

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question No. **1** is compulsory.
4. Use of scientific calculator / log tables may be allowed.

1. (a) Fill in the blanks :

   (i) All α-keto acid decarboxylations are_____ dependent.

   (ii) The cofactor for tryptophan hydroxylase is _____ .

P.T.O.

(iii) _____ is a positive modulator of carbamoyl phosphate synthase I (CPS I).

(iv) In Phenylketonurics,_____ becomes an essential amino acid.

(v) Mammals other than primates do not suffer from gout because they possess the enzyme _____.

(vi) Plants synthesise δ-amino levulinic acid (δ-ALA) from _____.

(vii) _____ is a biologically active compound derived from tyrosine. (1×7)

(b) Indicate whether the following statements are true or false. Defend your choice.

(i) A phosphoribosyl transferase is needed for the de novo biosynthesis of both purines and pyrimidine nucleotides.

(ii) All inhibitors of tetrahydrofolate (THF) reductase are effective in treating human microbial infections.

(iii) In organisms that possess a functional glyoxylate cycle, there is strictly no ketogenic amino acid.

(iv) Nitrogen fixing organisms express very high levels of Nitrogenase.

(v) Allopurinol is generally administered along with 6- mercaptopurine (6-MP) in chemotherapeutic regimens.

(vi) Individuals with methyl malonic aciduria (MMA) often have hyperammonemia.

(vii) All amino acids are degraded in the liver.

(viii) Methionine is an essential amino acid in humans while cysteine is non-essential. (1.5×8)

2. (a) Give the primary cause and clinical symptoms associated with the following conditions :

(i) Lesch Nyhan syndrome.

(ii) Alkaptonuria.

(iii) Erythropoietic porphyria. (3×3)

(b) Lysine and tryptophan catabolic pathways converge at the same molecule. Write down the steps in the complete breakdown of this molecule. (5)

3. Write short notes on :

(i) Purine nucleotide cycle.

(ii) Biosynthesis of NAD^+

(iii) Glycine cleavage system.

(iv) Creatine--Creatine phosphate energy shuttle. (3.5×4)

4. (a) Compare the following pairs :

(i) Kwashiorkor and Marasmus.

(ii) Conjugated and un-conjugated pterins.

(iii) *De novo* and salvage pathways of nucleotide synthesis.

(b) Indicate the mode of action of the following inhibitors :

(i) Fluoro uridine.

(ii) Hydroxyurea.

(iii) Allopurinol.

(iv) AZT (3′ azido 3′ deoxy thymidine)

(3,2,3;1.5×4)

5. (a) What are the major biosynthetic reactions that utilize PRPP ?

(b) What is deamination ? Indicate four ways by which amino acids are deaminated.

(c) Pyridoxal phosphate is a versatile coenzyme. Support your answer with suitable examples. (4,5,5)

6. (a) Provide an explanation for **any four** of the following observations :

(i) Slimming diets that recommend high protein intake frequently lead to polydipsia (increased thirst).

(ii) Birds excrete urate instead of urea.

(iii) *E. coli* lacking thioredoxin reductase are viable.

(iv) In vitamin B_{12} deficiency, conversion of methionine to glucose is impaired.

(v) Aspartate transaminase has the highest activity of all mammalian liver transaminases.

(vi) A defect in fumarase activity has a greater effect on the rate of urea synthesis than a defect in alanine amino transferase.

(b) Write the steps to bring about the following conversions :

(i) dUMP to dTMP

(ii) Cytidine to β alanine

(iii) Cysteine to Pyruvate (8,6)

7. (a) Describe the structure, function and regulation of ribonucleotide reductase.

(b) Give **one** significant contribution of each of the following :

(i) David Shemin

(ii) Archibald Garrod

(iii) A. Föiling

(iv) Mary Ellen Jones (10,4)

8. (a) Answer in **one** or **two** words :

(i) A high level of a non-protein amino acid is associated with an increased risk of cardiovascular disease.

(ii) A non-toxic carrier of ammonia in blood.

(iii) Number of high energy bonds hydrolysed in the synthesis of S-adenosyl methionine (SAM) starting from ATP and methionine.

(iv) A major reaction that replenishes one carbon units to the tetrahydrofolate (THF) pool.

(v) Transamination product of cysteine.

(vi) Regulated enzyme in polyamine biosynthesis on animals.

(b) Schematically depict the flow of nitrogen into the biosphere. Briefly explain how ammonia is assimilated. (6,8)

[This question paper contains 4 printed pages.]

MAY 2017

Your Roll No.....

Sr. No. of Question Paper : 675 G

Unique Paper Code : 107481

Name of the Paper : Cell Biology-II (CBHT-402)

Name of the Course : **B.Sc. (Hons.) (Botany/ Biochemistry/Microbiology/ Anthropology/Zoology)**

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates:

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Answer Five questions in all, including, Q. No. 1, which is compulsory. Illustrate your answers with appropriate diagrams wherever necessary.

1. (a) Expand the following terms (any **five**) (1×5=5)

   (i) JAK

   (ii) cdc

   (iii) GAG

P.T.O.

(iv) LDL

(v) GPl

(vi) NAM

(vii) ECM

(b) Match the followings : (1×5=5)

(i) Unit membrane	(a) SV40
(ii) BC1 - 2 family	(b) Robertson
(iii) Fibronectin	(c) Peptide Signal Molecule
(iv) Insulin	(d) Central regulator of apoptosis
(v) Tumour Virus	(e) Principal adhesion protein of connective tissue

(c) Fill in the blanks (1x5=5)

(i) Cancer of connective tissue is calld _____.

(ii) A zipper like protein structure called _____, is formed along the length of paired chromosomes during meiosis.

(iii) The normal cell genes from which the retroviral oncogenes originated are called _____.

(iv) _____ is a calcium binding protein affecting the Ca^{2+} concentration.

(v) _____ is the principal component of cell wall of algae and higher plants.

2. Differentiate between (any **five**) : (3×5=15)

(i) Tight junctions and Gap junctions

(ii) Carrier proteins and Channel proteins

(iii) Programmed Cell Death and Necrosis

(iv) Malignant and Benign tumour

(v) Autocrine and Paracrine signalling

(vi) Anaphase of Mitosis and Anaphase I of Meiosis

3. (a) Describe the programmed cell death in *C. elegans*. (8)

(b) Discuss the different types of cancer. (7)

4. Describe G-protein coupled receptor and regulation of G-proteins with the help of well labelled diagrams. (15)

5. (a) Give a diagrammatic representation of the Fluid Mosaic Model. (6)

(b) Briefly discuss the various polysaccharides of the cell wall. (6)

(c) How does cholesterol affect membrane fluidity? (3)

6. Write short notes on any **three** of the following: (3×5=15)

(a) cGMP pathway in intracellular signaling.

(b) Properties of cancer cell

(c) Somatic cell nuclear transfer

(d) Facilitated diffusion

(e) Pachytene of Meiosis

This question paper contains 4 printed pages] May 2017

Roll No. | | | | | | | | | | |

S. No. of Question Paper : **676**

Unique Paper Code : **107485** **G**

Name of the Paper : **Molecular Biology-II**

Name of the Course : **B.Sc. (H) (Botany/Zoology/Biochemistry/ Bio-Medical/Microbiology/Anthropology)**

Semester : **IV**

Duration : **3 Hours** Maximum Marks : **75**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *five* questions in all, including

Question No. **1** which is compulsory.

Draw well-labelled diagrams wherever necessary.

1. (*a*) Define the following : 5

(*i*) Transcription bubble

(*ii*) Trans-esterification

(*iii*) ORF

(*iv*) Catabolite repression

(*v*) Ribozyme.

P.T.O.

(*b*) State true/false : 5

(*i*) RNA polymerase does not need a primer for transcription initiation.

(*ii*) Dicer and Drosha recognize and cleave RNAs on the basis of sequence of their substrates.

(*iii*) Each aminoacyl-*t*RNA synthetase attaches a single amino acid to one or more *t*RNAs.

(*iv*) Group I introns release a lariat rather than a linear intron.

(*v*) Apo-repressors can bind directly to the operator site of the gene.

(*c*) Expand the following : 5

(*i*) TAF

(*ii*) RBS

(*iii*) Xist

(*iv*) STAT

(*v*) CAP

2. (*a*) Explain transcription initiation by RNA polymerase II. Illustrate your answer. 7

(*b*) Explain, with the help of suitable diagrams, the working of the *lac* operon in the following conditions : 8

(*i*) When only lactose is present

(*ii*) When only glucose is present

(*iii*) When both lactose and glucose are present

(*iv*) When both lactose and glucose are absent

3. Differentiate between the following (any *three*) : 3×5=15

(*a*) Spliceosome and ribosome

(*b*) *m*RNA and *t*RNA

(*c*) Alternative splicing and exon shuffling

(*d*) Translation initiation in prokaryotes and eukaryotes.

4. What is the role/significance of the following ? 3×5=15

(*a*) RRF

(*b*) Sigma factor in transcription

(*c*) rut sites

(*d*) tmRNA

(*e*) Leucine zipper domain.

5. (*a*) How are mRNAs that are incomplete or have a premature stop codon targeted and destroyed in eukaryotes ? 8

(*b*) Explain the spliceosome-mediated splicing reaction with the help of a well-labelled diagram only. 7

6. (*a*) Explain the various ways by which transcription is terminated in prokaryotes. 7

(*b*) Discuss the various ways in which eukaryotic repressors regulate transcription. 8

7. Write short notes on the following (any *three*) : 3×5=15

(*a*) RNA editing

(*b*) Combinatorial control

(*c*) Riboswitches

(*d*) RNA interference

(*e*) Attenuation.

(E)

Sl. No. of Q.P : 928

09/5/17

Unique Paper code : 249401

Name of the Paper : BCHT – 406: BIOENERGETICS

Name of the Course : B.Sc. (Hons.) Bio-Chemistry

Semester : IV

Duration : 3 hours

Maximum Marks : 75 Marks

Instructions for Candidates

1. Attempt five questions in all, including Question No.1 which is compulsory.
2. Log tables and/ or scientific calculators may be provided.

1 a. Explain How?

(i) Energy charge of the cell is buffered.

(ii) Import of Pi into the mitochondria leads to decrease in PMF.

(iii) Plastoquinone is a two electron carrier.

(iv) Addition of succinate to rotenone blocked electron transport chain restores O_2 consumption.

(v) Uncoupling proteins increase metabolic rate.

(vi) Phosphocreatine reservoir in skeletal muscle is used to replenish ATP during exercise.

(vii) Accessory pigments funnel light energy to the reaction center.

(viii) All nucleoside triphosphates; GTP, UTP, and CTP) are energetically equivalent to ATP.

b. Give the contribution of the following scientists:

(i) Albert Lehninger

(ii) Andre Jagerdorf

(iii) Louis Duysens

(16,3)

2.a Differentiate between the following:

(i) Isolated and closed system

(ii) Endergonic and exergonic reactions

b. Explain the significance of moderate free energy release from ATP hydrolysis to cellular energy metabolism.

c. Consider a cell with $[ATP] = 3.0mM, [ADP] = 0.8mM, and\ [Pi] = 4.0mM$. Determine the phosphorylation potential at 37°C.

(4,6,4)

3.a. State the chemiosmotic theory. Give experimental proof that oxidation is obligatory coupled to phosphorylation in mitochondria.

b. Give the mechanism of rotational catalysis of ATP synthesis catalyzed by FoF1ATP synthase.

c. Calculate the proton motive force generated across the inner mitochondrial membrane per pair of electrons transferred through the respiratory chain from NADH to O_2. Assume $\Delta\Psi$ is 0.15V and pH difference is 0.5 units.

(6,5,3)

4.a. Explain the role of the following in electron transport chain:

(i) Ubiquinone

(ii) Cytochrome C

(iii) a_3 - Cu_b center in Complex IV

b. Compare the action of Myxothiazol and Antimycin A on Complex III of mitochondria.

c. Calculate the free energy change, $\Delta G'^0$ for the reaction given below:

Succinate + O_2 → Fumarate + H_2O

When $\frac{1}{2}O_2 / H_2O$ $E'^0 = 0.816V$

Fumarate / Succinate $E'^0 = 0.031$

(6,4,4)

5.a. How does Green sulfur bacteria carry out anoxygenic photosynthesis?

b. Calculate the energy of one mole of photon of light of wavelength 680 nm. How many moles of ATP could theoretically be synthesized if 100% energy is conserved under standard conditions?

c. Show how four photons are required to split two water molecules by oxygen evolving complex in thylakoids releasing molecular oxygen.

(5,5,4)

6. Explain the mechanism of the following processes:

a. Transport of reducing equivalents by malate – aspartate shuttle.

b. Thermogenesis in skunk cabbage.

c. Bacteriorhodopsin as light harvesting protein.

d. Production of Reactive Oxygenic species in mitochondria.

(4,4,4,2)

7.a. Give the cyclic photophosphorylation pathway in plants. What is its significance?

b. Why do organisms show bioluminescence? Give the mechanism of Bioluminescence.

c. Give an account of light harvesting complexes in cyanobacteria.

(5,5,4)

8.a. Give the mechanism of ATP production in *Halobacterium salinarium,* when growing under O_2 limiting conditions in salt lakes.

b. Give the molecular architecture of Photosystem I, showing electron flow from P700 to $NADP^+$.

c. How do the following affect Photophosphorylation:

(i) Herbicides

(ii) Segregation of PSII and PSI in thylakoid membrane.

(5,5,4)

[R=8.314J/mol.K, F=96,480J/V.mol, h =6.626 x 10^{-34} J .s .]

(7)

Sl. No. of Q.P : 929

2017

Unique Paper Code	:	249403
Name of the Course	:	B.Sc. (Hons.) Biochemistry
Name of the Paper	:	Metabolism of Amino Acids and Nucleotides
Semester	:	IV
Duration	:	3 Hours
Maximum Marks	:	75

Instructions for candidates

1. Write your roll number on the top immediately on receipt of this question paper.
2. Attempt five questions in all, including Q.No. 1 which is compulsory

1(a) Justify the following statements

(i) Kwashiorkar leads to depigmentation of skin & hair.

(ii) dATP is toxic to mammalian cells.

(iii) Von Gierke's disease results in hyperuricemia.

(iv) Deficiency of folic acid leads to increased mutagenesis leading to susceptibility to cancer.

(v) L-Asparaginase is an effective chemotherapeutic agent.

(vi) Mature RBCs are unable to synthesize heme.

(vii) Polyamines are required for cell proliferation.

(viii) Serine is synthesized from glycolytic intermediates.

(b) Give one significant contribution of the following scientists.

(i) Irwin Rose and Schweigert

(ii) John Buchanan and G. Robert Greenberg

(iii) David Shemin

(16, 3)

2.(a) Differentiate between the following pairs:

(i) *De novo* synthesis of purine and pyrimidine nucleotides

(ii) Glucogenic and ketogenic amino acids

(iii) Carbamoyl phosphate synthetase I and II

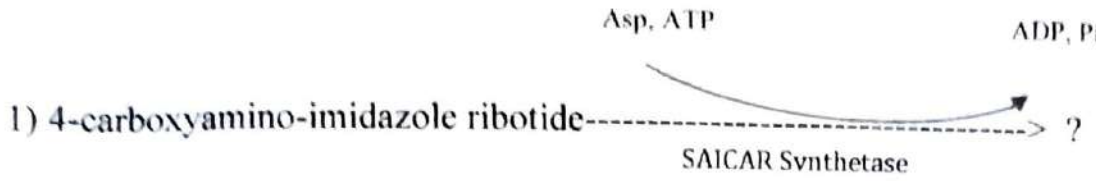
(iv) Positive and negative nitrogen balance.

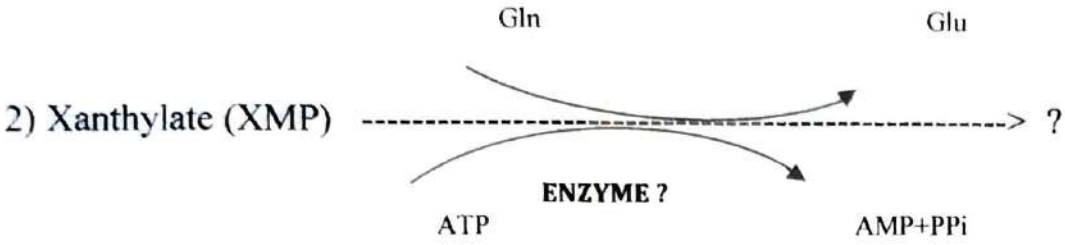
(b) Phenylketonuria resulting from dihydropteridine reductase deficiency is a more serious disorder than phenylketonuria resulting from phenylalanine hydroxylase deficiency.

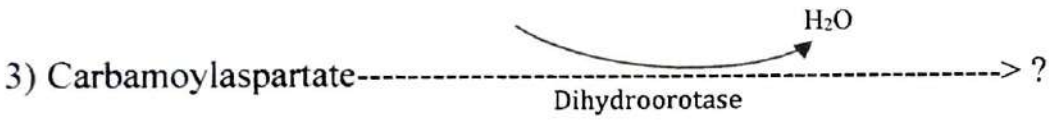
(c) Write briefly on transmethylation and its significance in metabolic processes.

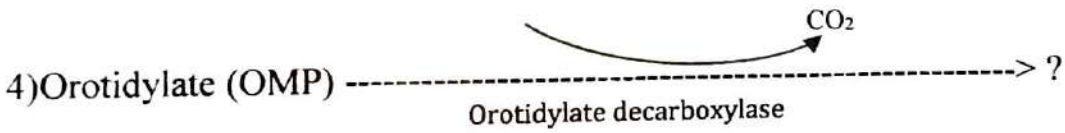
(8, 2, 4)

3.(a) Complete the following reactions against the question mark.









(b) What are the common enzymes that catalyze the breakdown of branched chain amino acids?

(c) Pyridoxal phosphate is a versatile cofactor. Give its role in amino acid metabolism.

(4, 5, 5)

4. Write the action of following inhibitors

i. Azaserine

ii. Allopurinol

iii. Mycophenolic acid

iv. Leflunomide

v. Hadacidin

vi. Methotrexate

vii. Hydroxyurea

viii. 5-fluorouracil

ix. 8-hyroxyquinoline

(b) Give a brief account of regulation of activity of bacterial glutamine synthetase.

(9, 5)

5.(a) Name the chief excretory product of purine nucleotide catabolism in the following:

(i) Teleost fishes

(ii) Birds and reptiles

(iii) Marine invertebrates

(iv) Spider

(v) Man

(b) Give the regulatory mechanism for the deoxyribonucleotide biosynthesis.

(c) Write down the steps to accomplish the given conversions

(i) Ornithine to spermine

(ii) Tryptophan to nicotinamide adenine dinucleotide

(iii) Tyrosine to epinephrine

(iv) Methionine to homocysteine.

(5, 3, 6)

6.(a) Explain urea cycle and also discuss its physiological importance.

(b) Discuss the regulation of heme biosynthesis.

(c) Discuss four different types of porphyrias.

(6, 4, 4)

7.(a) Explain briefly the catabolism of thymine.

(b) Indicate the role of creatine in energy shuttle.

(c) Give the salvage pathway of nucleotide biosynthesis.

(4, 6, 4)

8. Write short notes on (*any four*):

(i) Purine nucleotide cycle

(ii) Parkinsons disease

(iii) Hartnup's disease

(iv) SCID

(v) ADA deficiency

(vi) Maple syrup disease

(3.5 x 4)

(8)

~~SEM-A~~ 2017

Sl. No. 09 QP 1536

Unique Paper Code	:	2491403
Name of the Course	:	B.Sc. (Hons)/ Biochemistry
Name of the Paper	:	Metabolism of amino acids and nucleotides
Semester	:	IV
Duration	:	3 Hours
Maximum Marks	:	75

Instructions for Candidates

Write your Roll No. on the top immediately on receipt of this question paper.
*Attempt **five** questions in all; Question No. 1 is compulsory.*

1(A) Justify the following statements:

i. Threonine is both glucogenic and ketogenic.
ii. Serine is synthesized from glycolytic intermediates.
iii. Kwashiorkar leads to depigmentation of skin and hair.
iv. S-adenosyl methionine is involved in a number of biologically important transmethylation except for the synthesis of methionine itself.
v. Individuals undergoing chemotherapy with FdUMP or methotrexate temporarily go bald.
vi. Sulfonamide drugs do not interfere with human purine synthesis.
vii. Branched chain amino acid metabolism is affected by vitamin B12 and biotin deficiency.
viii. L-asparaginase is an effective chemotherapeutic agent.

(B) Name the following:

i. This amino acid formed from serine is a key building block in the biosynthesis of heme.
ii. A multifunctional enzyme of pyrimidine biosynthesis.
iii. This natural catecholamine is used as a drug to treat Parkinson's disease.

(16,3)

2(A) Give the mode of action of the following inhibitors and their roles as medicine:

i. Allopurinol
ii. Hydroxyurea
iii. Methotrexate
iv. 5-fluorouracil
v. 6-mercaptopurine

(B) Give one significant contribution of the following scientists:

i. P. Reichard
ii. John Buchanan
iii. A. Folling
iv. Hans Krebs and Henseleit

(10, 4)

3. Name the defective enzyme(s), biochemical basis and symptoms of the following disorders ***(any four)***:

i. Alkaptonuria
ii. Severe combined Immunodeficiency
iii. Maple syrup urine disease
iv. Hartnup's disease
v. Lesch Nyhan Syndrome
vi. Orotic aciduria

(14)

4. Write down the steps to accomplish the following conversions:

i. Tyrosine to epinephrine
ii. Methionine to homocysteine
iii. Arginine to creatine
iv. Xanthine to uric acid
v. IMP to AMP
vi. Proline to α-ketoglutarate
vii. Succinyl coA to porphobilinogen

(14)

5(A) Describe the structure and regulation of the ribonucleotide reductase.

(B) Indicate the role of creatine in energy shuttle.

(C) Give an example each of a reaction requiring the following coenzyme/cofactor:

(i) N^5N^{10} methylene tetrahyrdofolate
(ii) Molybdopterin

(5, 5, 4)

6(A) What is nitrogen fixation? Explain how atmospheric inorganic nitrogen from the biosphere is assimilated into biomolecules.

(B) Differentiate between the following:

i. Carbamoyl phosphate synthetase I and II
ii. Positive and negative nitrogen balance
iii. Oxidative deamination and transamination
iv. Erythropoietic porphyria and intermittent porphyria

(6, 8)

7(A) Explain the regulation of Glutamine synthetase (GS) in *E. coli*.

(B) Write the role of Pyridoxal phosphate in amino acid metabolism.

(C) Describe the key steps of urea cycle along with their subcellular localization.

(5, 4, 5)

8. Write short notes on:

i. Glucose alanine cycle
ii. Glycine cleavage system
iii. Gamma glutamyl cycle
iv. Salvage pathways for nucleotide pathways

(14)

Sl. No. of QP: 1610 (9)

2017

Unique Paper Code: 2172501

Name of Paper: Paper-2, Thermodynamics, Equilibrium and Electrochemistry

Name of the Course: ~~B.Sc. (H)~~ Biochemistry Allied Course

Semester: IV

Duration: 3 Hours

Maximum Marks: 75

Attempt *six* questions in all including Question No.1 which is compulsory.
Scientific Calculators are allowed.

Q1. Explain the following (any *five*):

(a) Variation of molar conductivity of a weak electrolyte.

(b) Will lead react with $AgNO_3$ solution? $E^0_{Ag+|Ag} = 0.799$ V and $E^0_{Pb+|Pb} = -0.126$ V.

(c) How ΔG of a chemical is related with ΔS and ΔH? Explain the significance of positive, negative and zero ΔG values.

(d) The pH of a solution of HCl is 2.0. Find out the amount of acid present in a litre of the solution?

(e) Why work done is zero in case of free expansion of an ideal gas?

(f) Why isothermal reversible work of expansion is greater than irreversible expansion of an ideal gas?

(3 x 5 = 15)

Q2. (a) At 298 K, molar conductivities at infinite dilution for $AgNO_3$, KCl and KNO_3 are 133.5, 149.9 and 144.9 Ω^{-1} cm^2 mol^{-1}, respectively. What is the molar conductivity of AgCl at infinite dilution?

(b) For the reaction:

$$Ag\ (s) + Cu^{2+}(aq.) \leftrightarrows Ag^{+}(aq.) + Cu\ (s)$$

Write the cell and the two half-cell reactions. Calculate its standard Emf. Indicate whether the cell reaction represented is spontaneous or not. $E^0_{Ag+|Ag} = 0.799$ V and $E^0_{Cu^{2}+|Cu} = 0.337$ V.

(c) Define ionic mobility. Derive the relation of ionic mobility in terms of molar conductivity.

(4, 4, 4)

Q3. (a) State the Le-Chatelier's principle and predict the effect of temperature and pressure on the following:

(i) $N_2(g) + 3H_2(g) \leftrightarrows 2NH_3(g)$; $\Delta H = -22.0$ kcal mol^{-1}

(ii) $N_2(g) + O_2(g) \leftrightarrows 2NO(g)$; $\Delta H = -22.0$ kcal mol^{-1}

(b) Write down the expression for the equilibrium constant, K_c for the reaction and give its unit?

$$4NH_3(g) + 5O_2(g) \leftrightarrows 4NO_2(g) + 6H_2O$$

(c) Drive the Kirchhoff's equation showing the variation of ΔH with temperature.

(4, 4, 4)

Q4. (a) What is meant by the term 'degree of hydrolysis' and 'hydrolysis constant'? Describe the relation between hydrolysis constant and the dissociation constant of the base for the hydrolysis of a salt of strong acid and a weak base.

(b) What is common-ion effect? Discuss its application in qualitative analysis.

(c) Show that pH of solution of a salt of weak acid and strong base is given by:

$$pH = \tfrac{1}{2}(pk_w + pk_a + \log_{10}C)$$

(4, 4, 4)

Q5. (a) Prove:

(i) $PV^{\gamma} = \text{Constant}$

(ii) $(\partial S/\partial V)_T = (\partial P/\partial T)_V$

(b) 1 mole of an ideal gas at 298K expanded isothermally and reversibly from a volume of 2.28 m^3 to 4.56 m^3. Calculate q, w, ΔE and ΔH.

(2x4=8, 4)

Q6. (a) Illustrate with suitable examples, the difference between reversible and irreversible cells. What are the conditions for a thermodynamically reversible cell?

(b) Calculate the bond energy of C-H bond in methane from the given data:

(i) $C(\text{graphite}) \rightarrow C(g)$ $\quad \Delta H^{\circ} = 716.68$ kJ

(ii) $1/2H_2(g) \rightarrow H(g)$ $\quad \Delta H^{\circ} = 217.97$ kJ

(iii) $C(\text{graphite}) + 2H_2 \rightarrow CH_4(g)$ $\quad \Delta H^{\circ} = -74.75$ kJ

(c) At a certain temperature, degree of dissociation of pure water is 1.81×10^{-9}. Calculate the ionic product of water at this temperature.

(4, 4, 4)

(a) Conductometric (acid-base) titration curves.

(b) Nernst equation and its importance.

(c) Buffer Capacity and Buffer Range.

(d) Free energy change in a chemical reaction.

(e) Integral heat of solution and integral heat of dilution.

(3, 3, 3, 3)