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[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2180

IC

2019

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) Define the following :

- (i) Homeostasis
- (ii) End diastolic Volume
- (iii) Transpulmonary Pressure



P.T.O.

(iv) Regurgitation

(v) Receptor desensitization

(vi) Osteoclast

(vii) Implantation

(1×7)

(b) Justify/Give Reasons :

(i) Hemoglobin functions as “tissue oxygen buffer”

(ii) The left ventricle of the heart shows physiological hypertrophy

(iii) Osteoblasts help to build up the bone.

(iv) Gastric mucosa is resistant to autodigestion

(v) RBC count is less in females

(vi) Action potentials are all-or-none events.

(2×6)

2. Differentiate between the following :

(a) REM and NREM

- (b) Heterometric and homometric regulation of cardiac output
 - (c) Gastric and Intestinal phase of gastrointestinal regulation
 - (d) Peripheral and Central chemoreceptors (3.5×4)
3. (a) What is CSF? Explain how the chemical composition of the CSF is different from that of blood.
- (b) What will happen if :
- (i) PCT of tubular segment is removed
 - (ii) Thin segment of loop of Henle is removed
- (c) Describe sequence of events that occur during swallowing. (3,6,5)
4. (a) Give the physiological basis of following : (any 4)
- (i) Anemia
 - (ii) Peptic ulcer

(iii) Renal alkalosis

(iv) Emphysema

(v) Atherosclerosis

(3/4)

(b) Explain how plasticity of neurons helps in learning?

(2)

5. (a) Give one word for the following :

(i) Receptors for the pain stimulus

(ii) Supporting cells of peripheral nervous system

(iii) Sensation from the skin, muscles, bone, tendons and joints

(iv) The ability to recall past events at the conscious or unconscious level

(b) A person's cardiac output (CO) is 7 litre/minute and Mean Arterial Pressure (MAP) is 140 mmHg. What is person's total peripheral resistance?

(c) What are the various components of Countercurrent multiplier system? Why it is called so?

(d) Why a testis is considered to be immunologically privileged site? (4,3,5,2)

6. Explain the following with the help of diagram and flow chart :

(a) Tracheo-bronchial tree

(b) Different layers of GI tract

(c) Ovarian and uterine changes during menstrual cycle (4,5,5)

7. Write short notes on the following :

(a) Role of vitamin K in coagulation

(b) Blood flow into the liver

(c) Regulation of arterial pressure

(d) Transport of carbon-dioxide in the blood

(3,3,4,4)

8. Explain the following mechanisms :

(a) Voluntary control of micturition

(b) Capacitation and transport of sperm

(c) Ionic channels and their role in initiating action potential in skeletal muscle

(5,5,4)

(14)

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Your Roll No.....

2019

Sr. No. of Question Paper : 2181

IC

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.



1. (a) Comment on the following :

(i) Transposition causes rearrangement of segments of DNA.

P.T.O.

- (ii) Deamination of 5 methyl cytosine leads to hot spots for spontaneous mutations more than deamination of cytosine in DNA.
- (iii) The A form of DNA is wider and flatter than B form DNA.
- (iv) The melting curve of DNA is affected by changes in ionic strength.
- (v) Nucleosome remodeling complexes facilitate nucleosome movement.
- (vi) Linking number is composed of twist and writhe.
- (vii) Ames test is called reversal of mutation.
- (viii) The DNA polymerase is released at the end of DNA synthesis and joins again at new replication fork in the lagging strand.

(b) Explain the following terms in brief.

- (i) Chi sites

(ii) Holiday junction

(iii) Primase

(2×8,3)

2. (a) Compare and contrast the various types of DNA polymerase in prokaryotes and mention the function of RNA type III holoenzyme various subunits.

(b) Differentiate between point mutation and frameshift mutation.

(c) How does *E. coli* identify the mismatch strand for repair during replication? (6,5,3)

3. (a) Provide reason for the following to act as anticancer agent.

(i) Novabiocin

(ii) Compactothecin

(iii) Cisplatin

(iv) Azidothymidine

(v) 6 mercaptopurine

- (b) Explain the key steps of homologous recombination.
- (c) Differentiate between base excision repair and nucleotide excision repair. (6,4,4)
4. (a) Explain the mechanism of translesion synthesis during DNA damage.
- (b) Write down the steps of DNA processing by RecBCD enzymes.
- (c) Compare and contrast serine recombinases with tyrosine recombinases with their mechanism. (4,5,5)
5. (a) How does λ integrase promote integration and excision of a viral genome into host chromosome?
- (b) Explain the mechanism of mismatch repair in prokaryotes.
- (c) Explain the role of methyl transferases and acetyl transferases in nucleosome assembly and disassembly. (5,4,5)

6. (a) Name the various classes of transposition and explain cut and paste transposition.

(b) Eukaryotic DNA has higher Cot value than prokaryotic DNA. Explain.

(c) Discuss the roles of various types of topoisomerases. (6,4,4)

7. (a) Justify the following statements :

(i) The sliding DNA clamp makes DNA polymerase more processive.

(ii) D loop mode of replication is different from rolling circle model of replication.

(iii) Ethidium bromide affects the topology of closed circular DNA

(iv) The fidelity of replication is ensured.

(b) How does DNA renature? Briefly explain its correlation with DNA complexity.

(2.5×4,4)

8. Write short notes on the following :

(a) Replicon model of two components for replication initiation

(b) Telomerase enzyme in eukaryotes

(c) Replicative transposition

(4,5,5)

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Your Roll No.....

2019

Sr. No. of Question Paper : 2182

IC

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.



1. (a) Justify the following statements.

(i) Threonine is both glucogenic and ketogenic.

(ii) Serine is synthesized from glycolytic intermediates.

P.T.O.

- (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. (2×8)

(b) Identify the following :

- (i) This amino acid formed from serine is a key building block in the biosynthesis of heme.
- (ii) A multifunctional enzyme of pyridimine biosynthesis.

- (iii) This natural catecholamine is used as a drug to treat Parkinson's disease. (3)

2. (a) Discuss 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 (10)

(b) Provide one significant contribution of the following scientists :

(i) P. Reichard

(ii) John Buchanan

(iii) A. Foiling

(iv) Hans Krebs and Henseleit (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

(14)

4. Write down the steps to accomplish the following conversions (**any seven**) :

- (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
- (viii) dUMP to dTTP

(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 tetrahydofolate

(ii) Molybdopterin (5,5,4)

6. (a) 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 acute intermittent porphyria (6,8)

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

(b) Write the role of Pyridoxal phosphatase 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) Salvage pathways for nucleotide pathways
- (iv) Purine nucleotide cycle (14)

Sl. No. of Q.P.

Unique Paper Code	107485
Name of the Paper	Molecular Biology II (MBHT-402)
Name of the Course	B.Sc. (H) (Botany/Zoology/Biochemistry/Bio-Medical/Microbiology/Anthropology)
Semester	IV
Duration	3 hours
Maximum Marks	75

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Instructions for candidates:

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

Q1. (a) Define the following:

- (i) Transcription unit
- (ii) Allostery
- (iii) Polysome
- (iv) Intron
- (v) Insulator

5

(b) Expand the following:

- (i) DCE
- (ii) ORF
- (iii) STAT
- (iv) snRNP
- (v) RISC

5

(c) Write the contributions of the following:

- (i) Jacques Monod
- (ii) Thomas Cech
- (iii) Mary Lyon

3

(d) Distinguish between:

- (i) Positive and negative regulation of lac operon
- (ii) siRNA and miRNA
- (iii) Histone acetylation and histone methylation

6

Q2. (a) Describe the mechanisms by which transcription is terminated in prokaryotes. 8

(b) What are the different types of RNA molecules in eukaryotes. Discuss their functions. 6

Q3. (a) Explain transcription attenuation in *Trp* operon. 8

(b) Describe the role of aminoacyl tRNA synthetases in fidelity of translation. 6

Q4. Describe the various ways by which eukaryotic activators and repressors regulate the transcription. 14



- Q5. (a) Explain in detail the role of ribosomes in protein synthesis. 8
(b) Describe the mechanism of X-chromosome inactivation in mammals. 6

Q6. What is the role/significance of the following: $4 \times 3.5 = 14$

- (a) Kozak sequence
- (a) tmRNA
- (b) Alpha-amanitin
- (c) Zinc-finger domain

Q7. Write short notes on (any three): $4 \times 3.5 = 14$

- (a) Spliceosome machinery
- (b) Riboswitches
- (c) RNA editing
- (d) Exon shuffling
- (e) Gene silencing

Sl-No. 7 Q.P. 3974
Unique Paper Code: 2172501

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

Name of 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) Aqueous solution of NaCl is neutral but NH_4Cl is acidic.
- (b) In alkali metal increasing order of conductivity is $\text{Na}^+ < \text{K}^+ < \text{Rb}^+ < \text{Cs}^+$ and not the reverse.
- (c) Differentiate between exothermic and endothermic reactions.
- (d) If pOH of a solution is 9, calculate its H^+ ion concentration at 25 °C.
- (e) Differentiate between ΔG and ΔG° .
- (f) Explain the role of salt bridge in electrochemical cell.

(3 X 5 = 15)

Q2. (a) Write the statement of first law of thermodynamics and illustrate its usefulness and limitations.

(b) Write expression for q , W , ΔE , ΔH for reversible expansion of an ideal gas under isothermal condition.

(c) Enthalpy of neutralization of strong acid with strong base is always equals to $-57.36 \text{ kJmol}^{-1}$. Comment.

(4, 4, 4)

Q3. (a) Calculate enthalpy of formation of sucrose from the following data

(i) Enthalpy of formation of water $\Delta H = -285.77 \text{ kJ}$

(ii) Enthalpy of formation of $\text{CO}_2(\text{g})$ $\Delta H = -393.71 \text{ kJ}$

(iii) Enthalpy of combustion of sucrose $\Delta H = -5665.0 \text{ kJ}$

(b) Explain Hess's law of constant heat summation with suitable example.

(c) Calculate the bond energy for C=C bond, from the following reaction:



The bond energy of C-C, C-H and H-H bonds are $347.3 \text{ kJ mol}^{-1}$, $414.2 \text{ kJ mol}^{-1}$ and $435.1 \text{ kJ mol}^{-1}$ respectively.

(4, 4, 4)

Q4. (a) How does buffer resist any change in pH of a given solution? Explain with the help of suitable example.

(b) Define solubility product and calculate the solubility product of following compounds:

(i). AgCl (solubility = $1.0 \times 10^{-5} \text{ mol/L}$)

(ii). BaSO₄ (solubility = 0.0023 g/L)

(c) Derive the following expression for the pH of a solution of a salt formed from strong acid and weak base:

$$\text{pH} = 1/2\text{pK}_w - 1/2\log(c) - 1/2\text{pK}_b$$

(4, 4, 4)

Q5. (a) Derive the relation between the equilibrium constants between K_p , K_c , K_x . Under what conditions $K_p = K_x = K_c$ where p, c, x stands for partial pressure, molar concentration & mole fraction?

(b) The reaction between gaseous sulphur dioxide and oxygen is



A mixture of SO₂ and O₂ was maintained at 800 K until the system reached equilibrium. The equilibrium mixture contained $5.0 \times 10^{-2} \text{ M SO}_3$, $3.5 \times 10^{-3} \text{ M O}_2$ and $3.0 \times 10^{-3} \text{ M SO}_2$.

Calculate (i) K_c and (ii) K_p at 800 K.

(c) Explain how Le Chatelier principle helps in understanding the effect of change of concentration, pressure and temperature on chemical equilibrium.

(4, 4, 4)

Q.6 (a) Write short note on standard hydrogen electrode.

(b) What is e.m.f. of a cell? Describe the method of measuring the e.m.f. of an electrochemical cell using a potentiometer.

(c) Given the E° value for the electrodes $\text{Cu}^{2+}(\text{aq})|\text{Cu}(\text{s})$ and $\text{Cu}^+(\text{aq})|\text{Cu}(\text{s})$ as $+0.340 \text{ V}$ and $+0.522 \text{ V}$ respectively, calculate the E° for the electrode $\text{Cu}^{2+}(\text{aq})|\text{Cu}^+(\text{aq})$.

(4, 4, 4)

Q7. (a) Define extensive and intensive properties and classify the following into intensive and extensive properties. Justify your choice.

Heat capacity, concentration, colour and temperature

(b) State and derive integrated form of Kirchhoff's equation.

(c) Gibbs free energy is the deciding factor in predicting the spontaneity of the given reaction. Comment.

(4, 4, 4)

