

Solved Paper for Common Entrance Test for Admission to PG Courses under CSS, May 2007

BIOCHEMISTRY

Time: 2 Hours

Max. Marks: 100

Instructions: Answer all the multiple choice questions from Part A and any ten of the descriptive questions from Part B.

- In this paper I have answered Part A and supported the answers with relevant explanations.
- Descriptive questions from Part B have also been jotted down.

PART – A

Time: 1 Hour

(50x1=50 Marks)

Each question carries 1 mark. No negative marks.

Q.1. The pH - value of a mixture of 100 ml of 0.1 N-acetic acid (of pKa = 4.7) and 100 ml of 0.1 N sodium acetate is

- a) 4.7
- b) 5.0
- c) 5.7
- d) 7.0

Ans A

Exp: According to Handerson-Hasselbalch equation $\text{pH} = \text{pKa} + \log \frac{[\text{Salt}]}{[\text{Acid}]}$

$$\text{pH} = 4.7 + \log \frac{.1}{.1}$$

$$\text{pH} = 4.7 + 0 = 4.7$$

Q.2. Larger molecules are eluted out earlier than smaller molecules in

- a) adsorption chromatography
- b) reversed phase chromatography
- c) HPLC
- d) gel Filtration

Ans D

Exp: During gel filtration the support medium (gel) consists of porous beads whose pore size can be controlled. Macromolecules smaller than the pores get entrapped in the pores, while those bigger than the pores travel unhindered through the column and get eluted out first.

Q.3. During electrophoresis, if the pH is above the isoelectric pH of a protein, it will

- a) migrate to anode
- b) migrate to cathode
- c) remain stationary
- d) precipitate

Ans A

Exp: When the pH is above the isoelectric point the protein forms negatively charged anion. This migrates toward anode.

Q.4. The absorbance of a solution exhibiting 50% transmittance is

- a) 0.17
- b) 0.30
- c) 0.50
- d) 1.70

Ans C

Q.5. Alpha particles consist of

- a) electrons
- b) electromagnetic rays
- c) hydrogen nuclei
- d) helium nuclei

Ans D

Exp: Alpha particles consist of two protons and two neutrons bound together into a particle identical to a helium nucleus, The alpha particle can be written as He^{2+} .

Q.6. The "D" in D-fructose indicates

- a) radio-active label
- b) deoxy status
- c) configuration
- d) dextro rotation

Ans C

Exp: There are two prominent "handed" biologically important molecules. The D- sugars and L- amino acids. The designations of D- and L- refer to how the pair of enantiomers differ in their bonding configurations. D is a symbol used if an organic compound has a configuration about an asymmetric carbon atom (chiral center) analogous to that of D-glyceraldehyde (the arbitrarily chosen standard), in which the hydroxy (OH) functional group is on the right side of the asymmetric carbon atom.

Q.7. Which of the following is not used as a criterion for the identification of an osazone?

- a) time of formation
- b) crystalline shape
- c) colour
- d) melting point

Ans D

Exp: Osazones are crystals formed when the sugars react with a compound known as phenylhydrazine at boiling point. The study of crystals along with the time of formation helps us to distinguish between various sugars.

Q.8. Which one of the following amino acids does not have an aromatic group?

- a) Phenyl alanine
- b) Tyrosine
- c) Threonine
- d) Tryptophan

Ans C

Q.9. Similarity between Methionine and Lysine is that both are

- a) aromatic amino acids
- b) basic amino acids
- c) essential amino acids
- d) sulphur containing amino acids

Ans C

Exp: An essential amino acid or indispensable amino acid is an amino acid that cannot be synthesized de novo by humans and therefore must be supplied in the diet. The amino acids regarded as essential for humans are phenylalanine, valine, threonine, tryptophan, isoleucine, methionine, leucine, lysine, and histidine.

Q.10. The predominant form of Alanine at its isoelectric pH is

- a) anionic form

- b) zwitterionic form
- c) cationic form
- d) denatured form

Ans B

Q.11. Which of the following is a nucleoside?

- a) adenine
- b) adenosine
- c) cytosine
- d) AMP

Ans B

Exp: A nucleoside is a nitrogenous base linked to a ribose or deoxy-ribose sugar via a beta-glycosidic linkage.

Q.12. A molecule of DNA of 1000 base - pairs has guanine as 30% of its bases. The number of adenine bases in it is

- a) 600
- b) 400
- c) 300
- d) 200

Ans 200

Exp: Chargaff's rules state that DNA from any cell of all organisms should have a 1:1 ratio of pyrimidine and purine bases and, more specifically, that the amount of guanine is equal to cytosine and the amount of adenine is equal to thymine.

In this particular case guanine is 30% hence cytosine will be 30% making together 60%. The rest 40% is adenine (20%) and thymine (20%).
 $20\% \text{ of } 1000 = 200.$

Q.13. The two strands of DNA are interconnected by

- a) peptide bonds
- b) glycosidic bonds
- c) hydrogen bonds
- d) phospho diester bonds

Ans C

Exp: Double helical DNA is stabilized with the help of hydrogen bonds between purines and pyrimidines.

Q.14. Saponification of a triglyceride forms

- a) free fatty acid
- b) free glycerol
- e) solid fat
- d) phosphatidic acid

Ans B

Exp: Soap is produced by the saponification (hydrolysis) of a triglyceride (fat or oil). In this process the triglyceride is reacted with a strong base such as sodium or potassium hydroxide to produce glycerol and fatty acid salts. The salt of the fatty acid is called soap.

Q.15. The nitrogenous base found as a building block of lecithin is

- a) adenine
- b) thymine
- c) choline
- d) guanine

Ans C

Exp: Lecithin is composed of phospholipids like phosphatidylcholine. Choline is a quaternary saturated amine.

Q.16. The total number of carbon atoms in cholesterol is

- a) 25
- b) 27
- e) 28
- d) 30

Ans 27

Exp: Cholesterol has a molecular formula of $C_{27}H_{45}OH$.

Q.17. In the Lineweaver-Burk double reciprocal plot of an enzyme, the magnitude of maximal velocity is given by

- a) length of X-intercept
- b) length of Y- intercept
- c) reciprocal of length of X- intercept
- d) reciprocal of length of Y-intercept

Ans D

Exp: A double-reciprocal plot of enzyme kinetics is generated by plotting $1/V_0$ as a function $1/[S]$. The slope is the K_M/V_{max} , the intercept on the vertical axis is $1/V_{max}$, and the intercept on the horizontal axis is $-1/K_M$.

Q.18. In presence of a competitive inhibitor, the Michaelis constant (K_m) of an enzyme is

- a) reduced to half
- b) unaffected
- c) increased
- d) decreased slightly

Ans C

Exp: During competitive inhibitor the inhibitor has no effect on V_{max} but increases K_M .

Q.19. In presence of a non—competitive inhibitor, the maximal velocity (V_{max}) of an enzyme catalysed reaction is-

- a) unaffected
- b) reduced
- c) increased slightly
- d) doubled

Ans B

Exp: During noncompetitive inhibition the inhibitor has no effect on K_M but decreases the V_{max} .

Q.20. Inactive precursors of enzymes are called

- a) isoenzymes
- b) zymogens
- c) coenzymes
- d) ribozymes

Ans B

Exp: A zymogen (or proenzyme) is an inactive enzyme precursor.

Q.21. Coenzyme A is derived from

- a) vitamin A
- b) L-ascorbic acid
- c) pantothenic acid
- d) nicotinamide

Ans C

Exp: Coenzyme A is synthesized from Pantothenate (vitamin B_5) and cysteine in a five-step process.

Q.22. The enzyme which catalyses a freely reversible reaction in glycolysis is

- a) hexokinase
- b) glucokinase
- c) phosphofructokinase
- d) phosphoglycerate kinase

Ans D

Q.23. Phosphofructokinase is allosterically inhibited by

- a) ATP
- b) ADP
- c) Insulin
- d) Fructose-6-phosphate

Ans A

Q.24. Which of the following metabolites cannot be formed from pyruvate in a single step?

- a) alanine
- b) lactate
- c) citrate
- d) oxaloacetate

Ans C

Q.25. Which of the following is not a coenzyme of pyruvate dehydrogenase complex?

- a) TPP
- b) Biotin
- c) FAD
- d) NAD^+

Ans B

Q.26. The vitamin whose coenzyme form is required for carboxylation reactions is –

- a) L-ascorbic acid
- b) biotin
- c) nicotinamide
- d) thiamine

Ans D

Exp: Thiamine derivate is a coenzyme for pyruvate dehydrogenase complex and is involved in the carboxylation reactions.

Q.27. An enzyme which participates in both glycogenesis and glycogenolysis is

- a) phosphoglucomutase
- b) hexokinase
- c) glucose-6-phosphatase
- d) branching enzyme

Ans A

Exp: During glycogenolysis phosphoglucomutase facilitates the conversion of glucose 1-phosphate to glucose 6-phosphate which later produces ATP or synthesizes ribose or NADPH. During glycogenesis it facilitates the conversion of G-6-P to G-1-P which later synthesizes glycogen.

Q.28. Glycogen phosphorylase acts on glycogen to form directly -

- a) free glucose
- b) glucose-6-phosphate
- c) glucose-1-phosphate
- d) maltose

Ans C

Exp: Glycogen phosphorylase catalyses the rate-limiting step in the degradation of glycogen in animals by releasing glucose-1-phosphate from the terminal alpha-1,4-glycosidic bond.

Q.29. Beta-oxidation of fatty acids yields all of the following except

- a) Acetyl coenzyme A
- b) NADH
- c) Malonyl coenzyme A
- d) FADH₂

Ans C

Exp Beta-oxidation of fatty acids is represented as fatty acid CoA + NAD⁺ + FAD ---> acetyl CoA + NADH + H⁺ + FADH₂

Q.30. Which of the following cannot be formed from acetyl CoA in a single step?

- a) aceto acetyl CoA
- b) Malonyl CoA
- c) citrate
- d) pyruvate

Ans C

Citrate synthase

Exp: acetyl-CoA + oxaloacetate + H₂O -----→ citrate + CoA-SH

Oxaloacetate is the first substrate to bind to the enzyme. This induces the enzyme to change its conformation, and creates a binding site for the acetyl-CoA.

Q.31. Coenzymes required for the biosynthesis of fatty acids include all of the following except

- a) ATP
- b) Biotin
- c) NADPH
- d) FAD

Ans D

Q.32. Cholic acid is

- a) a bile acid
- b) a bile pigment
- c) a precursor of cholesterol
- d) a vitamin

Ans A

Q.33. Transamination of alanine yields

- a) aspartate
- b) pyruvate
- c) phenyl alanine
- d) glutamate

Ans Both B and D

Exp: Alanine transaminase catalyzes the transfer of an amino group from alanine to α-ketoglutarate, the products of this reversible transamination reaction being pyruvate and glutamate.

Q.34. An amino acid which is not an intermediate in Krebs' urea cycle is

- a) arginine
- b) ornithine
- c) citrulline
- d) alanine

Ans D

Q.35. The average life-span of a human erythrocyte in circulation is

- a) 60 days

- b) 90 days
- c) 120 days
- d) 150 days

Ans C

Q.36. Fibrinogen is converted to fibrin by

- a) thrombin
- b) prothrombin
- c) plasmin
- d) heparin

Ans A

Q.37. Endemic goitre is caused by a dietary deficiency of

- a) vitamin -A
- b) iron
- c) iodine
- d) fluorine

Ans C

Q.38. Which of the following is a hypoglycemic hormone?

- a) adrenaline
- b) insulin
- c) cortisol
- d) glucagon

Ans B

Q.39. Short oligonucleotide fragments containing RNA and DNA, formed during DNA- replication are known after

- a) Suzuki
- b) Nagasaki
- c) Kawasaki
- d) Okazaki

Ans D

Q.40. The minimum number of nucleotide—residues required on an m-RNA to code for a polypeptide of 90 amino acid residues is .

- a) 30
- b) 90
- c) 180
- d) 270

Ans D

Exp: Three nucleotides on mRNA code for an amino acid. Here we have 90 AA that is $90 \times 3 = 270$ bases.

Q.41 The property that one amino acid may have more than one codon is called

- a) non-overlapping nature
- b) universality .
- c) comma less nature
- d) degeneracy

Ans D

Q.42. The region on t-RNA which recognizes the codon on m-RNA is the

- a) anticodon
- b) amino acid acceptor arm .
- c) lump
- d) D-arm

Ans A

Q.43. During translation, peptide bond formation is catalyzed by

- a) initiation factors
- b) elongation factors
- c) translocation factors
- d) peptidyl transferase

Ans D

Q.44. Autonomous extrachromosomal circular DNA molecules are known as

- a) plasmids
- b) phages
- c) cistrons
- d) introns

Ans A

Q.45. Palindromic sequences in DNA serve as

- a) signals for attachment of RNA-primer
- b) sites for action of restriction endonucleases
- c) primers for DNA-replication
- d) sites for attachment of RNA polymerase

Ans B

Q.46. Reverse transcriptase synthesizes

- a) RNA from RNA
- b) RNA from DNA
- c) DNA from DNA
- d) DNA from RNA

Ans D

Q.47. Which of the following is classified as a high-energy compound?

- a) glucose-6-phosphate
- b) glyceraldehyde-3-phosphate
- c) 2-phospho glycerate
- d) 1, 3- bis-phospho glycerate

Ans D

Q.48. Complete aerobic oxidation of one molecule of acetyl coenzyme A produces

- a) 2 ATP
- b) 8 ATP
- c) 12 ATP
- d) 15 ATP

Ans D

Q.49. Source of oxygen evolved during photosynthesis is

- a) carbon dioxide
- b) water
- c) carbohydrates
- d) hydrogen peroxide

Ans B

Q.50. Non-cyclic photophosphorylation produces all of the following except

- a) ATP
- b) NADPH
- c) Oxygen
- d) Nitrogen

Ans D

PART — B

Time: 1 Hour

(10x5=50 Marks)

Answer any ten questions from Part B:

1. Discuss the role of hydrogen bonding in the structure of biomolecules.
2. Define the colloidal state. What are the properties and applications of colloids?
3. How are chromatographic methods classified on the basis of
 - a) principle of separation
 - b) technique of operation
4. Briefly outline any one method for the chromatographic separation of a mixture of three amino acids?
5. State the Beer-Lambert's law. What are its applications? Compare the features and applications of a photoelectric colorimeter and a spectrophotometer.
6. Discuss the different levels of structural organisation in proteins.
7. Outline the primary and secondary structure of DNA.
8. How are lipids classified? Give the structure of one member of each class.
9. Define the terms — K_m and V_{max} . How will you determine them?
10. Outline the reactions of anaerobic glycolysis. Calculate the yield of ATP from it.
11. Outline the steps in the citric acid cycle. Calculate the yield of ATP when one molecule of pyruvate is oxidised completely.
12. Outline the steps in the beta oxidation of a fatty acid.
13. Give one example for each of the following metabolic transformations of amino acids :
 - a) deamination
 - b) transamination and
 - c) decarboxylation.
14. What are the characteristics of the genetic code?
15. Outline the ribosomal events in translation.
16. Discuss the chemi osmotic theory of oxidative phosphorylation.