14 (CHM–3) 301

2020

(Held in March 2021)

CHEMISTRY

Paper : CH–301

(Biochemistry)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer ***any five*** of the following questions : 2×5=10

   (a) "Mitochondria are also known as the powerhouses of the cell." Explain the statement.

   (b) Who identified the TCA cycle ? Why is it also known as *citric acid cycle* ?

   (c) What are *NADH* and $FADH_2$? Discuss their role in biological process.

(d) How many ATP molecules are consumed and generated in glycolysis ? Describe the steps involved in it based on chemical reaction.

(e) What is ribosome ? Discuss its role in protein synthesis.

(f) What is the function of actin in muscle contraction ? Explain.

(g) Why is ATP known as the 'energy currency of the cell' ? Why do ATP hydrolysis yield more energy than ADP or AMP ? Explain.

2. Answer ***any four*** of the following questions : 4×4=16

(a) Explain the statement — "Fatty acids are considered as better source of energy for storage in the body compared to carbohydrates or protein." Discuss the steps involved in fatty acid degradation.

(b) Write down the steps involved in citric acid cycle using chemical reaction.

(c) Why are the genetic codes degenerate in nature ? Write down the initiation and non-sense codon and the corresponding amino acids that are coded by them.

(d) Explain the statement—"Electron transport and ATP formation are coupled process." What do you mean by inhibitor and uncoupler ? Discuss with examples.

(e) Discuss the secondary structure of t-RNA. What is the role m-RNA in protein synthesis ?

3. Answer ***any two*** questions : 3×2=6

(a) What are nucleotides ? Draw the structures of deoxyadenosine monophosphate (dAMP) and deoxycytidine monophosphate (dCMP).

(b) Discuss briefly what 'sugar pucker' and 'glycosyl bond conformation' are in DNA.

(c) What are unusual DNA structures ? Show the H-bonds in a T=A•T Hoogsteen type base pairing.

(d) Describe the roles of the enzymes DNA polymerase I and III in the lagging and leading strands during DNA replication.

4. Answer ***any two*** questions : 3×2=6

(a) Give *one* example each of an amino acid with non-polar aliphatic, aromatic, positively charged and negatively charged R groups. Give *one* example of an uncommon amino acid.

(b) What is peptide sequencing? Illustrate the reactions involved in Sanger's and Edman's methods of peptide sequencing.

(c) What is an α-helix? Discuss how interactions between amino acid side chains can stabilize *or* destabilize a α-helix.

(d) What are tertiary and quaternary structures of proteins? What are fibrous and globular proteins? Give examples.

5. Answer ***any two*** questions : 3×2=6

(a) Name *six* different classes of enzymes as per international classification and the reactions they catalyze.

(b) Discuss induced fit model of enzyme activity. Give example. What are different types of interactions through which a substrate binds at the active site of an enzyme?

(c) What are enzyme inhibitors? Discuss competitive and non-competitive inhibition processes using suitable examples.

(d) What are enzyme models? Discuss a functional mimic of an enzyme illustrating the reaction it catalyzes.

6. Answer ***any one*** question : 3

(a) What are lipids? Give *one* example each of a vitamin, hormone, terpene and fat that are soluble in organic solvents.

(b) What are phospholipids? Illustrate how sphingolipids are structurally different from phosphoglycerides.

(c) What are prostaglandins? Give examples. Discuss a general biosynthetic pathway for prostaglandins.

7. Answer ***any two*** *from the following* questions : *3×2=6*

(a) Explain how paramagnetic deoxy-hemoglobin becomes diamagnetic upon O_2 binding. How does the initial O_2 binding to the first heme unit of hemoglobin tetramer affect the subsequent O_2 binding to the remaining heme units?

(b) What are the benefits of cooperative dioxygen binding observed in the case of hemoglobin ?

(c) Illustrate Bohr effect observed in hemoglobin dioxygen binding with the help of a diagram. What is the benefit of Bohr effect ?

(d) Illustrate the Hill plots of binding curves for both non-cooperative (myoglobin) and cooperative (hemoglobin) dioxygen binding.

8. Answer ***any two*** from the following questions : 2×2=4

(a) How does British anti-Lewisite (BAL) detoxify lewisite ?

(b) What is Wilson's disease ? How can *D-penicillamine* be used for the treatment of Wilson's disease ?

(c) Draw the structure of Satraplatin. How is it superior to *cis*-platin ?

(d) Why are gold compounds good drug agents for the treatment of rheumatoid arthritis ? Write the function of the triethyl phosphine ligand present in auranofin.

9. How is iron transported by a transferrin into the cell ? Lactoferrin is a component of the innate immune system. Write the immune function of a lactoferrin. 3

OR

Why is iron needed to be stored ? How is iron core of ferritin formed ?

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