14 (CHM–3) 301

2021

(Held in 2022)

CHEMISTRY

Paper : CH–301

(Biochemistry)

Full Marks : 60

Time : Three hours

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

1. Choose the correct option from the multiple choices : $1 \times 6 = 6$

   (i) FAD is reduced to $FADH_2$ during

   (a) Oxidative phosphorylation

   (b) Lactate fermentation

   (c) Kreb cycle

   (d) Glycolysis

(ii) Which of the following is **not** a feature of **oxidative** phosphorylation ?

(a) Direct transfer of phosphate from a substrate molecule to ADP

(b) An electrochemical gradient across the inner mitochondrial membrane

(c) A membrane bound ATP synthase

(d) A proton motive force

(iii) Which of the following is **not** a significant biological oxidizing agent ?

(a) FAD

(b) Fe^{3+}

(c) O_2

(d) NAD^+

(iv) Which of the following is **not** formed during Krebs cycle ?

(a) Lactate

(b) Isocitrate

(c) Succinate

(d) Both (a) and (b)

(v) NAD is a

(a) enzyme

(b) cofactor

(c) protein

(d) nucleoside

(vi) Identity the complementary strand of the DNA primary structure ATGCCGATC

(a) AUGCCGAUC

(b) TACGGCTAG

(c) UACGGCUAG

(d) GATCGGCAT

2. Draw the structure of mitochondria and discuss about its importance in living organism.   2

Or

What is the role of t-RNA and r-RNA in protein biosynthesis ?

3. Answer *any three* questions :   6×3=18

(a) Write down the various steps involved in glycolysis.   6

(b) Write down *two* major functions of fatty acid molecule in cells. Discuss about various steps involved in fatty acid biosynthesis. 2+4=6

(c) Discuss about protein biosynthesis considering the steps involved in it. 6

(d) Discuss about the structural differences between actin and myosin. Write down the steps involved in muscle contraction using a pictorial diagram. 2+4=6

(e) Discuss Boyer's three-state model for conformational coupling of ATP formation with a pictorial diagram. 6

4. Answer *any five* questions : 4×5=20

(a) Draw the structures of the purine nucleotides. What is Chargaff's rule ? 3+1=4

(b) Show the H-bonds involved in an A=A•T type of Hoogsteen base pairing. What is G-quadruplex ? 3+1=4

(c) What do you understand by melting of a double helical DNA ? How do you determine melting temperature (T_m) ? What are the factors on which the melting temperature of a DNA molecule depend ? 1+1+2=4

(d) Describe the roles of the enzymes DNA polymerases I-V in DNA replication. What does helicase do in a propagating replication fork ? 3+1=4

(e) Derive an expression for the velocity (V) of an enzyme-catalysed reaction in terms of Michaelis-Menten constant (K_m), velocity at maximum concentration of substrate (V_{max}) and substrate concentration ([S]). Show how a Lineweaver-Burk plot can be used to determine V_{max} and K_m ? 3+1=4

(f) Draw the structure of the tripeptide Ser-Gly-Tyr. Show the 1-fluoro-2, 4-dinitrobenzene adduct of the tripeptide when it is subjected to Sanger's method of peptide sequencing. 2+2=4

(g) What are α-helices and β-sheets ? Discuss the process of waving of straight hair at the molecular level. 2+2=4

(h) Give *one* example each of naturally occurring saturated and unsaturated fatty acids showing their molecular structures. How are soaps different from detergents ? Give examples. 2+2=4

5. Answer **any seven** questions : $2 \times 7 = 14$

(a) Write the *three* properties of iron for which it is extensively used in terrestrial biological reactions. 2

(b) Deoxyhemoglobin is paramagnetic, whereas oxyhemoglobin is diamagnetic. Give reasons for your answer. 2

(c) What conformational change is observed in the globin part of the hemoglobin when first dioxygen binding occurs ? What is the consequence of this conformational change in hemoglobin ? $1+1=2$

(d) Explain briefly the mechanism of CO_2 release from RBCs in our lungs. 2

(e) How does Bohr effect help in releasing more O_2 from oxyhemoglobin ? 2

(f) What causes inflammation around the tissues of joints of a person suffering from Rheumatoid Arthritis ? How is it treated ? $1+1=2$

(g) Write the molecular formula of the D-penicillamine copper complex formed during the treatment of Wilson's disease with D-penicillamine. Mention *one* drawback of chelation therapy. $1+1=2$

(h) Write the structure of one second-generation platinum anticancer drug. What is the advantage of $Pt(IV)$ anticancer drugs over their $Pt(II)$ analogues ? $1+1=2$

(i) Sketch the schematic diagram of molybdenum nitrogenase and label its various components. 2

(j) Briefly discuss about *one* catalytic reaction that involves vitamin B_{12} coenzyme. 2

(k) Write the geometry of rubredoxin. What is the origin of the intense red color of Fe^{3+}- rubredoxin ? $1+1=2$

(l) Why is the color of blue copper protein intensely blue ? What is its function ? $1+1=2$

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