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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
School of Health Sciences

End Semester Examination, December 2021

Programme Name: B.Sc - Food, Nutrition & Dietetics | **Semester : 1st**
Course Name : Biochemistry and metabolism | **Time : 3 hour**
Course Code : HSCC1012 | **Max. Marks : 100**
Nos. of page(s) : 5

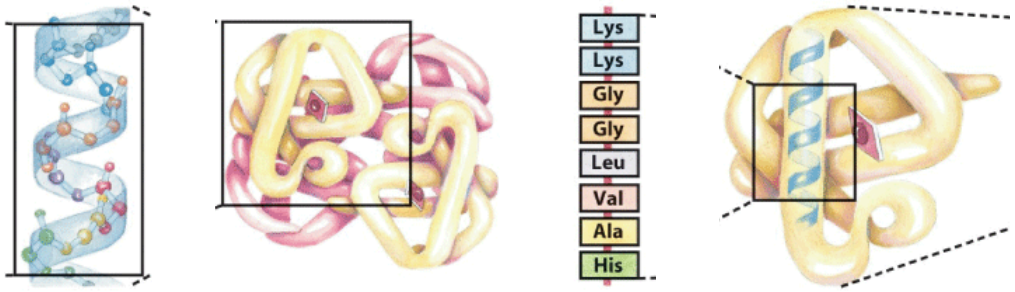
Instructions : All questions are compulsary

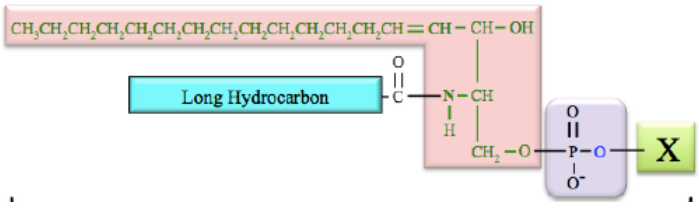
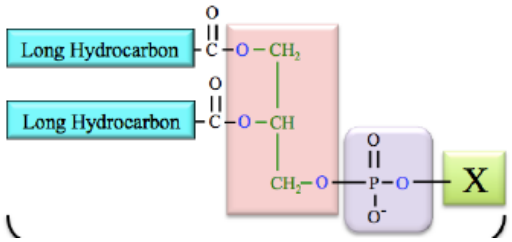
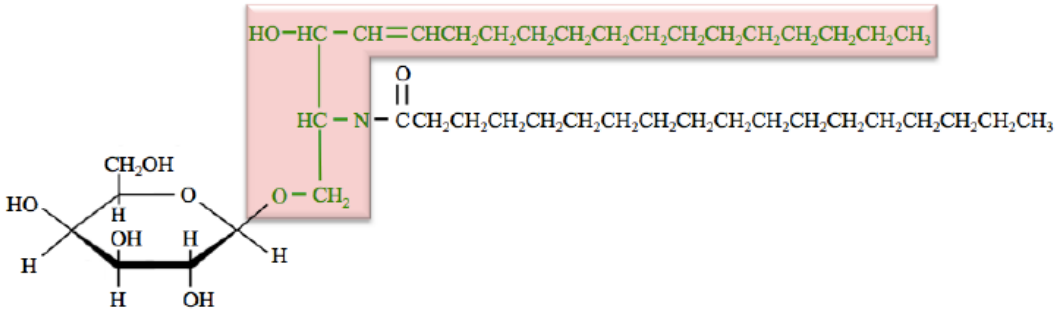
SECTION A (Scan & upload)

		Marks	CO
Q1	Which of the following statement about ATP is correct? A. It contains 3 high energy phosphate bonds B. It is needed in the body to drive exergonic reaction C. It functions in the body as a complex with Mg^{2+} D. It is used as energy store in the body	**1.5**	**CO1**
Q2	Which of the following is correct about free energy change? A. In an exergonic reaction, ΔG is positive B. In an endergonic reaction, there is loss of free energy C. If a reaction is essentially irreversible, it has a high positive ΔG D. If ΔG is negative, the reaction proceeds spontaneously with a loss of free energy	**1.5**	**CO1**
Q3	Which of the following has highest REDOX potential? A. NAD B. FAD C. O_2 D. Cytochrome C	**1.5**	**CO1**
Q4	Which of the following is incorrect? A. Upon reaching to equilibrium, the rates of forward and backward reaction both drop to zero B. ΔG is a function of the logarithm of K_{eq} C. ΔG° denotes the change in free energy that accompanies transition from the standard state to equilibrium D. As used in biochemistry, the standard state concentration for products and reactants other than protons is 1 molar	**1.5**	**CO1**

Q5	Which of the following is true about Michaelis-Menten kinetics? a) K_m, the Michaelis constant, is defined as that concentration of substrate at which enzyme is working at maximum velocity b) It describes single substrate enzymes c) K_m, the Michaelis constant is defined as the dissociation constant of the enzyme-substrate complex d) It assumes covalent binding occurs between enzyme and substrate	**1.5**	**CO2**
Q6	The concept of "induced fit" refers to the fact that: a) when a substrate binds to an enzyme, the enzyme induces a loss of water (desolvation) from the substrate. b) substrate binding may induce a conformational change in the enzyme, which then brings catalytic groups into proper orientation. c) enzyme-substrate binding induces an increase in the reaction entropy, thereby catalyzing the reaction. d) enzyme specificity is induced by enzyme-substrate binding.	**1.5**	**CO2**
Q7	In glycolysis, the conversion of 1 mol of fructose 1,6-bisphosphate to 2 mol of pyruvate results in the formation of: A. 1 mol NAD+ and 2 mol of ATP B. 1 mol NADH and 1 mol of ATP C. 2 mol NAD+ and 4 mol of ATP D. 2 mol NADH and 4 mol of ATP	**1.5**	**CO3**
Q8	Which one of following statements about carbohydrate metabolism is correct? A. A key step in the biosynthesis of glycogen is the formation of UDP-glucose. B. Glycogen can be broken down to glucose-6-phosphate in muscle, which then releases free glucose by the action of the enzyme glucose-6-phosphatase. C. Glycogen is stored mainly in the liver and brain. D. Insulin inhibits the biosynthesis of glycogen.	**1.5**	**CO3**
Q9	Which of the following will provide the main fuel for muscle contraction during short-term maximum exertion? A. Muscle glycogen B. Muscle reserves of triacylglycerol C. Plasma glucose D. Plasma nonesterified fatty acids E. Triacylglycerol in plasma very low density lipoprotein	**1.5**	**CO3**
Q10	Which would be a property of all the major types of lipids in this membrane? A) They would be saponifiable in base and hydrolyzed in acid. B) They would have polar heads and non-polar tails. C) They would be composed of five-carbon units. D) They would be joined to each other through covalent bonds.	**1.5**	**CO5**
Q11	Which component is found in all sphingolipids?	**1.5**	**CO5**

	A) a carbohydrate B) a negative charge C) a phosphate group D) an amino alcohol		
Q12	Which of the following is a characteristic of both triacylglycerols and glycerophospholipids? A) Both contain carboxyl groups and are amphipathic B) Both contain fatty acids and are saponifiable. C) Both contain glycerol and ether bonds. D) Both can be negatively charged at cellular pH.	**1.5**	**CO5**
Q13	Select the one of the following statements that is NOT CORRECT. A) The side-chains of the amino acids cysteine and methionine absorb light at 280 nm. B) Glycine is often present in regions where a polypeptide forms a sharp bend, reversing the direction of a polypeptide. C) Polypeptides are named as derivatives of the C-terminal aminoacyl residue. D) The C, N, O, and H atoms of a peptide bond are coplanar.	**1.5**	**CO4**
Q14	Which of the following are positively charged basic amino acids? A) Lysine and arginine B) Lysine and asparagine C) Glutamine and arginine D) Lysine and glutamine	**1.5**	**CO4**
Q15	Out of these, which one is the non-essential amino acid? A) Lysine B) Threonine C) Serine D) Histidine	**1.5**	**CO4**
Q16	Storage form of glucose is _____	**1.5**	**CO3**
Q17	The defective enzyme associated with the glycogen storage disease, "Pompe" is _____	**1.5**	**CO2**
Q18	Zymogens are inactive precursors of _____	**1.5**	**CO2**
Q19	High triglyceride levels in the blood are a risk indicator for _____	**1.5**	**CO5**
Q20	The first protein whose amino acid sequence was determined is _____	**1.5**	**CO4**
SECTION B (Scan and upload)			
Q1	Given are the standard reduction potentials for the following reaction: a. $O_2 + 2H^+ + 2e^- \rightarrow H_2O$ $E° = +0.815$ V b. $NAD^+ + 2H^+ + 2e^- \rightarrow NADH + H^+$ $E° = -0.315$ V	**5**	**CO1**

	Using above given information, calculate the Free-Energy Change for the following reaction: $O_2 + NADH + H^+ \rightarrow H_2O + NAD^+$ Faraday's constant is 96,485 C/Mole		
Q2	Write 3 differences between enzyme and catalyst. (2.5 marks) Name any five functional classes of enzymes classified by the International Union of Biochemists (I.U.B.) on the basis of types of reactions that they catalyze. (2.5 marks)	**5**	**CO2**
Q3	Explain energetics of glycolysis pathway. (3 marks) Name the 3 regulatory enzymes of glycolysis (2 marks)	**5**	**CO3**
Q4	Explain the structure of different classes of lipids. (5 marks)	**5**	**CO5**
SECTION C (Scan and upload)			
Q1	A. Name the different conformational states of protein. (4 marks) i. ii. iii. iv.  B. Describe Edman degradation of amino acid sequence determination. (3 marks) C. Explain the principle forces associated with protein folding. (5 marks) D. How does amino acid sequence impact stability of α-helical structure of proteins? (3 marks)	**15**	**CO4**
Q2	A. Arrange the following four lipids in order of their decreasing melting point and explain. (6 marks) i) $CH_3(CH_2)_7CH=CH(CH_2)_7COOH$ ii) $CH_3CH_2(CH=CHCH_2)_3(CH_2)_6COOH$ iii) $CH_3(CH_2)_{16}COOH$ iv) $CH_3(CH_2)_4(CH=CHCH_2)_2(CH_2)_6COOH$ B. Identify the following lipids (6 marks) i)	**15**	**CO5**

	 ii)  iii)  C) Explain hydrogenation and oxidation of triglycerides. (3 marks)		
SECTION D (Scan and upload)			
Q1	A) What is crabtree effect? (2 marks) B) Explain the role of pentose phosphate pathway in glutathione peroxidase reaction. (4 marks) C) Why glutathione-6-phosphate dehydrogenase has more effect on RBSs? (3 marks) D) In which part of the cell does glucose metabolism occur through pentose phosphate pathway? (1 marks)	**10**	**CO3**
Q2	A) What are enzyme inhibitors? (2 marks) B) Name 3 classifications of enzyme inhibitors. (2 marks) C) Explain each classification of reversible inhibitor with example. (3 marks) D) Using Michaelis Menten plot, graphically represent how K_m and V_{max} for each of these reversible inhibitors will vary. (3 marks)	**10**	**CO2**