UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
School of Health Sciences

End Semester Examination, December 2021

Programme Name: M.Sc. Microbiology | **Semester : 1st**
Course Name : Biochemistry | **Time : 3 hour**
Course Code : HSMB7008 | **Max. Marks : 100**
Nos. of page(s) : 5

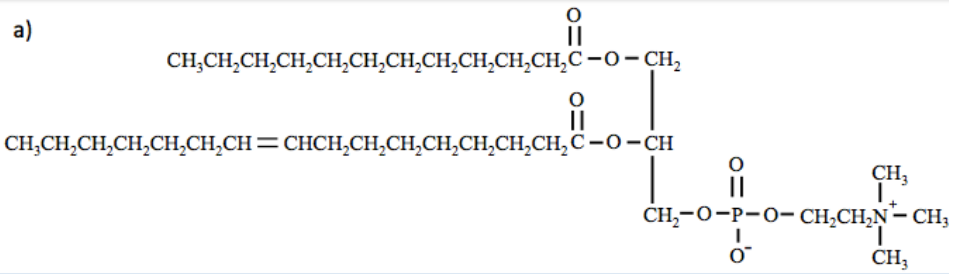
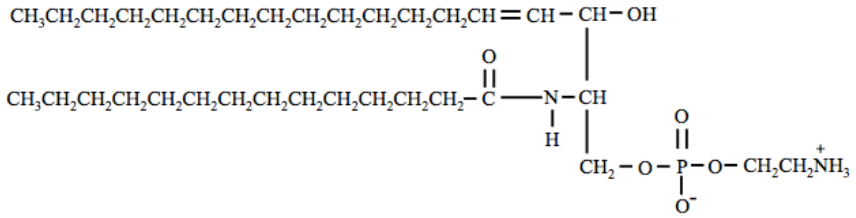
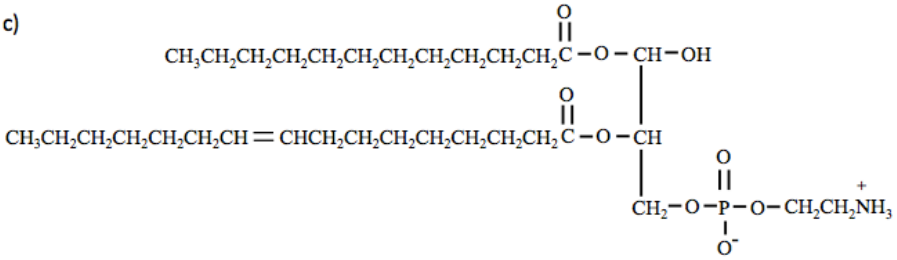
Instructions : All questions are compulsary

SECTION A (Scan and upload)

		Marks	CO
Q1	If ΔG of a reaction is zero: A) The reaction goes virtually to completion and is essentially irreversible B) The reaction proceeds only if free energy can be gained C) The reaction is exergonic D) The system is at equilibrium and no net change occurs	**1.5**	**CO1**
Q2	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**
Q3	ΔG is defined as the standard free energy change when: A) The reactants are present in concentration of 1 mmol/L at pH 7 B) The reactants are present in concentration of 1 mol/L at pH 7 C) The reactants are present in concentration of 1 mol/L at pH 7.4 D) The reactants are present in concentration of 1 mmol/L at pH 7.4	**1.5**	**CO1**
Q4	Which of the following is not a reducing sugar? A) Erythrose B) Sucrose C) Galactose D) Ribose	**1.5**	**CO3**
Q5	What is the general term used for the anaerobic degradation of glucose to obtain energy?	**1.5**	**CO3**

	A) Anabolism B) Oxidation C) Fermentation D) Metabolism		
Q6	Which of the following will provide the main fuel for muscle contraction during short term maximum exertion? A) Plasma glucose B) Muscle glycogen C) Plasma nonesterified fatty acid D) Muscle reserves of triacylglycerol	**1.5**	**CO3**
Q7	In competitive inhibition, an inhibitor: A) binds at several different sites on an enzyme. B) binds reversibly at the active site. C) binds covalently to the enzyme. D) lowers the characteristic V_{max} of the enzyme.	**1.5**	**CO2**
Q8	Michaelis and Menten assumed that the overall reaction for an enzyme-catalyzed reaction could be written as $E + S \underset{k_{-1}}{\overset{k_1}{\leftrightarrow}} ES \xrightarrow{k_2} P$ Using this reaction, the rate of breakdown of the enzyme-substrate complex can be described by the expression: A) k_1 ([E_t] - [ES])[S] B) k_{-1} [ES] + k_2 [ES] C) k_2 [ES] D) k_{-1} [ES]	**1.5**	**CO2**
Q9	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**
Q10	Which of the following statements about fatty acids is true? A) Fatty acids with longer chain lengths have a higher melting point than fatty acids with shorter chain lengths. B) Saturated fatty acids have a lower melting point than unsaturated fatty acids. C) Cis double bonds of unsaturated fatty acids cause tighter packing of hydrophobic tails. D) Double bonds in polyunsaturated fatty acids are almost always conjugated.	**1.5**	**CO5**

Q11	Which membrane lipid contains an amide bond? A) cholesterol B) phosphatidylserine C) phosphatidic acid D) sphingomyelin	**1.5**	**CO5**
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	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**
Q14	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**
Q15	The 21st amino acid is A) Hydroxy lysine B) Hydroxyproline C) Selenocysteine D) Citrulline	**1.5**	**CO4**
Q16	A thermodynamically unfavorable reaction (endergonic) can be driven in the forward direction by coupling it to an _____	**1.5**	**CO1**
Q17	The defective enzyme associated with the glycogen storage disease, "Von Gierke" is _____	**1.5**	**CO3**
Q18	_____ are inactive precursors of enzymes.	**1.5**	**CO2**
Q19	The process of migration of charged molecules in response to an electric field is called _____	**1.5**	**CO4**
Q20	The salts of fatty acids are also called _____	**1.5**	**CO5**

SECTION B (Scan and upload)			
Q1	Describe any two high energy compounds with examples. (5 marks)	**5**	**CO1**
Q2	Write the difference in melting points of vegetable oils vs. animal fats. (2 marks) Categorize each of the following compounds as being either a glycerophospholipid or a sphingophospholipid. (3 marks) a)  b)  c) 	**5** **5**	**CO5**
Q3	Define the secondary, tertiary and quaternary structure of proteins. (5 marks)	**5**	**CO4**
Q4	Describe the amphibolic nature of TCA cycle. (5 marks)	**5**	**CO3**
SECTION C (Scan and upload)			
Q1	A. Oxaloacetate + Acetyl-CoA + H_2O ➛ citrate + CoA + H^+ At pH 7 and 25°C in rat heart mitochondria - oxaloacetate = 1µM; acetyl-CoA = 1µM; citrate = 220 µM; CoA = 65 µM; $\Delta G°$= -32.2 kJ/mol ; RT = 2.48 kJ/mol. What is direction of metabolite flow? (5 marks) B. Protein folding happens spontaneously in living cells. Justify the comment in relation with enthalpy, entropy and Gibbs free energy. (4 marks) C. Why is ATP hydrolysis accompanied by high free energy change? (4 marks) D. What is phosphorylation potential? (2 marks)	**15**	**CO1**

Q2	A. How do pH impact enzyme catalysed reaction? (5 marks) B. Plot graphs between rate of reaction vs pH for enzymes that has i) one; ii) Two; iii) Multiple ionizable amino acid residue at the active site of the enzyme. (5 marks) C. Hydrolysis of p-nitrophenylacetate to p-nitrophenol is catalysed by α-chymotrypsin enzyme. The proposed mechanism is: $E + S \overset{\text{Fast}}{\rightleftharpoons} ES \overset{K_1}{\rightarrow} ES' + P_1 \overset{K_2}{\rightarrow} E + P_2$ Where, ES, P_1 and P_2 are acetal enzymes, nitrophenol and acetate ion, respectively. If K_1 is much smaller than K_2, draw a qualitative plot of potential energy vs reaction coordinate for above reaction. (5 marks)	**15**	**CO2**
SECTION D (Scan and upload)			
Q1	A. Describe the following: i) electron transport chain. (4 marks) ii) glycogenesis; (3 marks) iii) gluconeogenesis (3 marks)	**10**	**CO3**
Q2	A. Explain with an example, role of protein structure as a causative agent for diseases. (4 marks) B. Briefly describe the following: (6 marks) i) Fibrous protein ii) Globular protein iii) Membrane	**10**	**CO4**