


Name:			
Enrolment No:			
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, December 2022			
Course: Biochemistry Program: MSc Microbiology Course Code: HSMB7008		Semester : 1st Duration : 3 Hours Max. Marks: 100	
Instructions: All questions are compulsory			
S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	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 about cytochrome C is incorrect? A. They are hemoproteins that take part in oxidation-reduction reactions B. They are all dehydrogenase enzyme C. They act as electron carriers in the respiratory chain in mitochondria d. They contain iron which oscillates between Fe^{3+} and Fe^{2+} during the reaction they participate in	1.5	CO1
Q3	If the values of enthalpy change and entropy change is positive, which of the following will be true? A. Process will be spontaneous at any given temperature B. Process will be spontaneous at high temperature only C. Process will never be spontaneous D. Process will be spontaneous at low temperature only	1.5	CO1
Q4	Which of the following molecules produces highest energy on breakdown of its high energy bond? A. ATP B. Acetyl CoA	1.5	CO1

	C. PEP D. ADP		
Q5	Which of the following statements is correct about glucose metabolism? A. The main product of glycolysis in red blood cells is pyruvate B. Glycolysis requires NADP ⁺ C. In glycolysis, glucose is cleaved into two 3-carbon compounds D. Glucagon increases the rate of hydrolysis	1.5	CO2
Q6	Which of the following is not a pentose? A. Ribose B. Xylose C. Fructose D. Ribulose	1.5	CO2
Q7	The enzyme aconitase is responsible for A. polymerization B. degradation C. assembly D. isomerization	1.5	CO2
Q8	Fructose 1, 6-biophosphate upon undergoing cleavage yields: A. Two aldoses B. Two ketoses C. An aldose and a ketose D. Only a ketose	1.5	CO2
Q9	α -Linolenic acid is considered to be nutritionally essential in humans BECAUSE: A. It is an ω 3 fatty acid. B. It contains three double bonds. C. In humans double bonds cannot be introduced into fatty acids beyond the Δ 9 position. D. In humans double bonds cannot be introduced into fatty acids beyond the Δ 12 position.	1.5	CO3
Q10	Which one of the following is the major product of fatty acid synthase? A. Acetyl-CoA B. Palmitate C. Palmitoyl-CoA D. Acetoacetate	1.5	CO3

<p>Q11</p>	<p>Which of the following statements about fatty acids is true?</p> <p>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.</p>	<p>1.5</p>	<p>CO3</p>
<p>Q12</p>	<p>Which characteristic does this lipid share with a wax?</p> <p>A. Both contain a polar head. B. Both contain three fatty acids. C. Both contain one or more ester bonds. D. Both contain one or more carboxyl groups.</p>	<p>1.5</p>	<p>CO3</p>
<p>Q13</p>	<p>Identify the metabolite that does NOT serve as a precursor of a dietarily essential amino acid:</p> <p>A. α-Ketoglutarate B. 3-Phosphoglycerate C. Histamine D. Aspartate</p>	<p>1.5</p>	<p>CO4</p>
<p>Q14</p>	<p>Select the one of the following statements that is NOT CORRECT:</p> <p>A. Selenocysteine is present at the active sites of certain human enzymes. B. Selenocysteine is inserted into proteins by a posttranslational process. C. Transamination of dietary α-keto acids can replace the dietary essential amino acids leucine, isoleucine, and valine. D. Conversion of peptidyl proline to peptidyl-4-hydroxyproline is accompanied by the incorporation of oxygen into succinate.</p>	<p>1.5</p>	<p>CO4</p>
<p>Q15</p>	<p>Identify the amino acid that is the major contributor to the transport of nitrogen destined for excretion as urea:</p> <p>A. Alanine B. Glutamine C. Glycine D. Lysine</p>	<p>1.5</p>	<p>CO4</p>
<p>Q16</p>	<p>Which of the following are sulfur containing amino acids?</p> <p>A. Cysteine and methionine B. Methionine and threonine</p>	<p>1.5</p>	<p>CO4</p>

	<p>C. Cysteine and threonine D. Cysteine and serine</p>		
Q17	<p>Which of the following substrates has highest affinity for hexokinase?</p> <p>A. D-Glucose B. D-Fructose C. D-Galactose D. ATP</p>	1.5	CO5
Q18	<p>Michaelis and Menten assumed that the overall reaction for an enzyme-catalyzed reaction could be written as</p> $E + S \xrightleftharpoons[k_{-1}]{k_1} ES \xrightarrow{k_2} P$ <p>Using this reaction, the rate of breakdown of the enzyme-substrate complex can be described by the expression:</p> <p>A) $k_1 ([E_t] - [ES])[S]$ B) $k_{-1} [ES] + k_2 [ES]$ C) $k_2 [ES]$ D) $k_{-1} [ES]$</p>	1.5	CO5
Q19	<p>Enzymatic activity can be activated or inhibited through non-covalent interaction of the enzyme with metabolites other than the substrate.</p> <p>This form of control of enzyme activity is termed as:</p> <p>A. Allosteric regulation B. Covalent regulation C. Proteolysis D. Compartmentalization</p>	1.5	CO5
Q20	<p>The rate determining step of Michaelis-Menten kinetics is:</p> <p>A. The complex dissociation step to produce products B. The complex formation step C. The product formation step D. None of the mentioned</p>	1.5	CO5
<p>Section B (4Qx5M=20 Marks)</p>			
Q 1	A. Define high energy compounds. (2 marks)	5	CO1

	B. Why is ATP hydrolysis accompanied by high free energy changes? (3 marks)		
Q2	A. Explain Glucose-6-Phosphate dehydrogenase deficiency. (2 marks) B. State three important outcomes of hexose monophosphate pathway. (3 marks)	5	CO2
Q3	A. Write the difference in melting points of vegetable oils vs. animal fats. (2 marks) B. Write the three stages in fatty acid synthesis. (3 marks)	5	CO3
Q4	A. How will pKa value of Glutamic acid vary at the surface and bulk of a protein? (2.5 marks) B. Which properties of amino acids affect the structure of proteins? (2.5 marks)	5	CO4
Section C (2Qx15M=30 Marks)			
Q1	A. Explain the role of pentose phosphate pathway in glutathione peroxidase reaction. (4 marks) B. What is the importance of gluconeogenesis? (4 marks) C. Describe glycolysis. (7 marks)	15	CO2
Q2	A. What is steady state approximation. (3 marks) B. Using above derive Michaelis Menten equation. (5 marks) C. Giving examples, justify enzymes are specific. (7 marks)	15	CO5
Section D (2Qx10M=20 Marks)			
Q 1	A. How do REDOX potential help in determining the electron affinity of a system? (2 marks) B. Calculate the free energy change for the following reaction: (5 marks) $\text{O}_2 + \text{NADH} + \text{H}^+ \rightarrow \text{H}_2\text{O} + \text{NAD}^+$ Given is: $\text{O}_2 + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2\text{O} \quad E^0 = +0.815 \text{ V}$ $\text{NAD}^+ + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{NADH} + \text{H}^+ \quad E^0 = -0.315 \text{ V}$ C. What is phosphorylation potential? (3 marks)	10	CO1
Q2	A. What is ketogenesis and ketosis? (4 marks) B. How is ketogenesis regulated? (6 marks)	10	CO3