U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

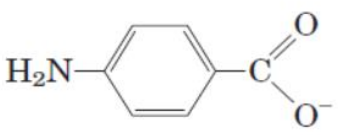
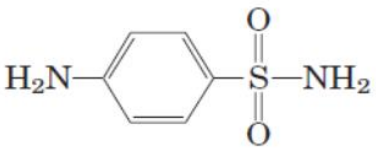
Programme: B.E. **Semester: IV**
Branch: Biotechnology **Duration: 3 hrs.**
Course Code: 22BT4PCBAB **Max Marks: 100**
Course: BIOCHEMISTRY AND BIOENERGETICS

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		What are high energy compounds Draw the structure of ATP and explain the factors responsible for high energy character of ATP.	*CO1*	*PO 1*	**8**
	b)		Calculate ΔG^{10} for the reaction and ΔG at 25^0C if acetaldehyde and NADH are present at 0.1M concentration but ethanol and NAD^+ are present at 1M concentration respectively. Acetaldehyde + NADH + $H^+ \rightarrow$Ethanol + NAD^+ $E^{10}_{NAD/NADH}$ = - 0.32V ; $E^{10}_{acetaldehyde/ethanol}$ = -0.197V	*CO1*	*PO1*	**8**
	c)		For the hydrolysis of ATP: ATP $\rightarrow$ADP + Pi, If the equilibrium concentrations of ATP = $1x10^{-7}$ M, ADP = 0.165 M and Pi = 0.1 M, what is the equilibrium constant and $\Delta G^{o'}$ for the hydrolysis of ATP at 37^o C?	*CO1*	*PO1*	**4**
			UNIT - II			
2	a)		The degree of reduction of each carrier in the respiratory chain is determined by conditions in the mitochondrion. For example, when NADH and O_2 are abundant, the steady-state degree of reduction of the carriers decreases as electrons pass from the substrate to O_2. When electron transfer is blocked, the carriers before the block become more reduced and those beyond the block become more oxidized. For each of the conditions below, predict and justify the state of oxidation of ubiquinone and cytochromes *b*, c_1, *c*, and *a* & a_3. i) Abundant NADH and O_2, but cyanide added ii) Abundant NADH, but O_2 exhausted iii) Abundant NADH and O_2	*CO2*	*PO 2*	**6**
	b)		In a laboratory experiment, a mitochondrial extract was prepared that contains all the soluble enzymes of the matrix but has lost all the low molecular weight cofactors.	*CO3*	*PO3*	**10**

			i) What cofactors must be added to the extract so that the preparation will oxidize acetyl CoA to $CO_{2?}$ ii) Explain the pathway involved in the conversion of acetyl CoA to CO_2, listing the enzymes involved in each step of the pathway.			
	c)	^{14}C-labeled glyceraldehyde3-phosphate was added to a yeast extract. After a short time, fructose 1,6-bisphosphate labeled with^{14}C at C-3 and C-4 was isolated. i) What was the location of the^{14}C label in the starting glyceraldehyde 3-phosphate? ii) Where did the second ^{14}C label in fructose 1,6-bisphosphate come from? Explain.	*CO2*	*PO2*	**4**
		OR			
3	a)	Explain the mechanism of rotational catalysis of ATP synthesis with neat labelled diagrams.	*CO2*	*P 2*	**8**
	b)	When the antibiotic valinomycin is added to actively respiring mitochondria, several things happen: the yield of ATP decreases, the rate of O_2 consumption increases, and the pH gradient across the inner mitochondrial membrane increases. Does valinomycin act as an uncoupler or an inhibitor of oxidative phosphorylation? Justify your answers.	*CO2*	*PO2*	**4**
	c)	Two of the steps in the oxidative decarboxylation of pyruvate do not involve any of the three carbons of pyruvate yet are essential to the operation of the PDH complex. i) Identify the reactions. ii) Explain the mechanism of action of PDH complex.	*CO*	*PO2*	**8**
		UNIT - III			
4	a)	Photorespiration is an expense paid by C3 plants during Photosynthesis. Justify.	*CO2*	*PO2*	**7**
	b)	When the [NADPH]/[$NADP^+$] ratio in chloroplasts is high, photophosphorylation is predominantly cyclic. Why? Explain illustrating the Z scheme. Is O_2 evolved during cyclic photophosphorylation? Is NADPH produced?	*CO2*	*PO2*	**8**
	c)	With a neat labelled diagram , explain the structure of a chloroplast	*CO2*	*PO2*	**5**
		UNIT - IV			
5	a)	When the acetyl-CoA produced during β oxidation in the liver exceeds the capacity of the TCA cycle, the excess acetyl CoA forms ketone bodies. This occurs in severe uncontrolled diabetes as the tissues oxidize large amounts of fatty acids. What are ketone bodies? Explain the mechanism of formation	*CO3*	*PO3*	**8**
	b)	Elucidate the pathway for the synthesis of cholesterol.	*CO2*	*PO2*	**8**

		c)	What changes in metabolic pattern would result from a mutation in the muscle carnitine acyltransferase I in which the mutant protein has lost its affinity for malonyl-CoA but not its catalytic activity?	*CO3*	*PO3*	**4**
			UNIT - V			
	6	a)	PRPP is essential for recycling of nucleotides by salvage pathway. Justify	*CO2*	*PO2*	**8**
		b)	Explain the role of PLP in transamination reactions.	*CO2*	*PO2*	**12**
			OR			
	7	a)	Why are Carbamoyl phosphate and aspartate required for the synthesis of urea? List the sequence of reactions involved in the synthesis of urea. Add a note on its energetics.	*CO2*	*PO2*	**10**
		b)	Some bacteria require p-aminobenzoate which is an important component of formyl tetrahydrofolate in the culture medium for normal growth.Their growth is severely inhibited by the addition of sulfanilamide, one of the earliest sulfa drugs. Moreover, in the presence of this drug, 5-aminoimidazole-4-carboxamideribonucleotide (AICAR) accumulates in the culture medium. These effects are reversed by addition of excess p-aminobenzoate. i) Identify the nucleotide pathway involved ii) Show the structure of the nucleotide marking the origin of its atoms. iii) Addition of which atom is being inhibited in the above situation? iv) Why does AICAR accumulate in the presence of sulfanilamide? v) identify the enzyme and the reaction involved leading to accumulation of AICAR  *p*-Aminobenzoate  Sulfanilamide	*CO2*	*PO2*	**10**

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