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

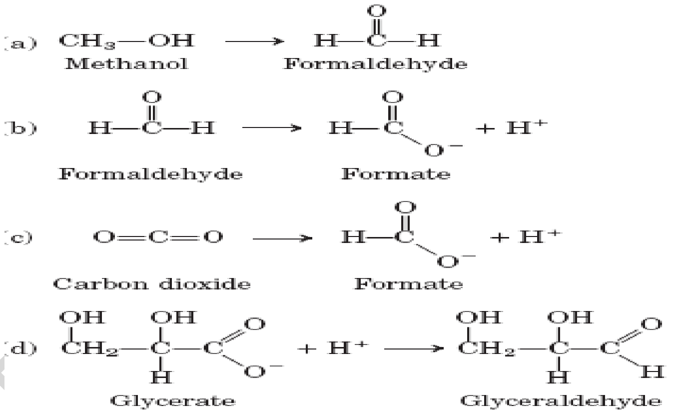
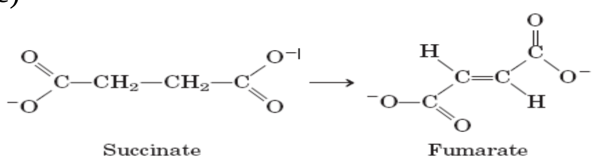
Autonomous Institute Affiliated to VTU

August 2024 Semester End Main Examinations

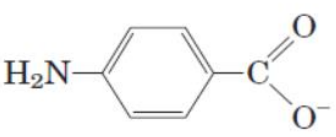
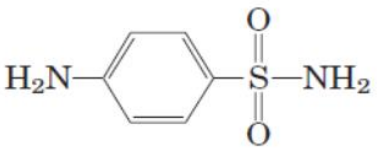
Programme: B.E. | **Semester: IV**
Branch: Biotechnology | **Duration: 3 hrs.**
Course Code: 22BT4PCBAB | **Max Marks: 100**
Course: BIOCHEMISTRY & BIOENERGETICS

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)	Calculate the ΔG^{10} and ΔG for the reaction at 25^0C if pyruvate and NADH are present in 0.5M concentration and lactate and NAD^+ are present in 5M concentration. Pyruvate + NADH + H^+ →Lactate+ NAD^+ . E^{10} NAD^+/NADH= - 0.32V. E^{10} Pyruvate/lactate = - 0. 185V	*1*	*1*	**10**
	b)	For each of the metabolic transformations in (a) through (e),determine whether oxidation or reduction has occurred  e) 	*2*	*1*	**5**
	c)	What are high energy compounds? Give any two examples.	*2*	*1*	**5**

			UNIT - II			
	2	a)	The citric acid cycle has eight enzymes: citrate synthase, aconitase,isocitrate dehydrogenase,α-ketoglutarate dehydrogenase,succinyl-CoA synthetase, succinate dehydrogenase, fumarase,and malate dehydrogenase. (a) Write a balanced equation for the reaction catalyzed by each enzyme. (b) For each enzyme determine which of the following describes the type of reaction(s) catalyzed: condensation (carbon–carbon bond formation); dehydration (loss of water);hydration (addition of water); decarboxylation (loss ofCO_2); oxidation-reduction; substrate-level phosphorylation; isomerization.	*4*	*2*	**8**
		b)	What is substrate Channeling? Illustrate the process of substrate channeling taking the example of PDH	*3*	*2*	**8**
		c)	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.	*3*	*2*	**4**
			OR			
	3	a)	Explain the mechanism of rotational catalysis of ATP synthesis with neat labelled diagrams.	*3*	*2*	**8**
		b)	What is the cost (in ATP equivalents) of transforming glucose to pyruvate via glycolysis and back again to glucose via gluconeogenesis? Justify your answer showing the steps involved in both the pathways.	*4*	*2*	**12**
			UNIT - III			
	4	a)	When the [NADPH]/[NADP_] ratio in chloroplasts is high, photophosphorylation is predominantly cyclic Why? Explain illustrating the Z scheme . Is O2 evolved during cyclic photophosphorylation? Is NADPH produced	*4*	*2*	**10**
		b)	Photorespiration is an expense paid by C3 plants during Photosynthesis. Justify	*4*	*2*	**10**
			UNIT - IV			
	5	a)	Elucidate the pathway for synthesis of cholesterol	*4*	*2*	**8**
		b)	Free palmitate is activated to its coenzyme A derivative (palmitoyl-CoA) in the cytosol before it can be oxidized in the mitochondrion. If palmitate and [14C]coenzyme A are added to a liver homogenate, palmitoyl-CoA isolated from the cytosolic fraction is radioactive, but that isolated from the mitochondrial fraction is not. Explain.	*4*	*2*	**4**

		c)	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	*5*	*2*	**8**
			UNIT - V			
	6	a)	Predict the locations of 14C in orotate isolated from cells grown on a small amount of uniformly labeled [14C] succinate. Justify your prediction giving the steps involved in the synthesis of orotate.	*4*	*2*	**10**
		b)	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 Bioenergetics	4	*2*	**10**
			OR			
	7	a)	PRPP is essential for recycling of nucleotides by salvage pathway .Justify	*5*	*2*	**6**
		b)	Name and draw the structure of the *α* keto acid resulting when each of the following amino acids undergoes transamination with *α*-ketoglutarate: (a) aspartate, (b) alanine	*1*	-	**4**
		c)	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 what 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	*5*	*2*	**10**

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