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CHAPTER

RESPIRATION IN PLANTS

"Biochemistry has an important bearing on the progress of medicine. But because of this, it must itself remain a pure science, whose initiates are inspired by a craving for understanding and by nothing else."

"OTTO FRITZ MEYERHOF (1884-1951)"

INTRODUCTION

hy is breathing so essential for life? What happens when we breathe? When it comes to life, respiration is considered as one of the basic freatures which helps the organism to survive. Respiration provides energy for carrying out daily life activities, be it absorption, transport, movement, reproduction or even breathing.

The process of breathing is very much connected to the process of release of energy from food. All the enrggy required for 'life process' is obtained by oxidation of some macromolecules that w call as 'food'. The gaseous exchange i..e., intake of oxygen and release of carbon dioxide is calld breathing while respiration includes biological oxidation of organic molecules i.e. breaking of C-C bonds by using enzymes and results in the release of energy in the form of ATP. The oxidation of macromolecules that takes place inside the body us called as "**FOOD**". Only green plants prepare their own food through photosynthesis but only those cells which conain chloroplast show photosynthesis. In eukarytoes, photosynthesis takes place in chloroplast and respiration in cytoplasm and mitochondria. The compounds subjected to biologiccal oxidation is called **Respiratory substrate**. These may be carbohydrates, fats, protiens or organic acids.

ENZYME

Enzymes are proteinaceous, biocatalysts.

Term enzyme was given by Kuhne.

First of all isolated & discovered by Buchner

Zymase (from yeast) was the first discovered enzyme. (Buchner)

The first purified and crystalized enzyme was urease (by J.B.Sumner) from Canavalia/Jack Bean (Lobia plant).

Proteinaceous nature of enzyme was suggested by Northrop and Sumner.

DEFINITION

Enzymes are biocatalysts made up of proteins (except ribozyme), which increases the rate of bio-chemical reactions by lowering down the activation energy.

First discovered ribozyme was L19 RNAase by T.Cech from rRNA of a protozoan Tetrahymena thermophila and

RNAase P or Ribonuclease P by Altman in prokaryotic cell (Nobel prize).

CHARACTERISTICS OF ENZYMES

- 1. All enzymes are proteins, but all proteins are not enzymes.
- 2. Enzymes accelerate the rate of reaction, without undergoing any change in themselves.
- 3. Molecular weight of enzymes ranges from 6000 (bacterial fd) to 46 lakh (Pyruvate dehydrogenase comp.)
- Enzymes are colloidal substances, which are very sensitive to pH & temperature. Optimum temperature for enzymes is 20-35°C.
- 5. Most of enzymes are active at neutral pH, hydrolytic enzymes of lysosomes are active on acidic pH (5).
- 6. All enzymes are tertiary & globular proteins (Isoenzymes quarternary protein)
- 7. Enzymes lower down the activation energy of substrate or reactions.
- 8. Enzymes are required in very minute amount for bio-chemical reactions. Their catalytic power is represented by Michaelis Menten constant or Km constant and turn over number.

"The number of substrate molecules converted into products per unit time by one molecule of the enzyme in favourable conditions is called **turn over number**." The maximum turn over number is of **Carbonic anhydrase**, is 360 lakh, for **Catalase** is 50 lakh, for **flavoprotein** is 50 & for **lysozyme** is 30 per minute.

- 9. Enzymes are very specific to their substrate or reactions.
- 10. Enzymes are macromolecules of amino acids, which are synthesized on ribosomes under the control of genes.



Concept of activation energy

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- → In cellular respiration, carbohydrates are primary respiratory substrates. Others are Fats, organic acids and proteins. Organic acids are used in CAM plants.
- → Cellular respiration is an multistep process so that energy released in some steps can be used for ATP synthesis. If it occurs in single step, all the energy may released as heat.
- \rightarrow ATP energy currency of the cell .
- \rightarrow Reasons behind absence of specialised respiratory organs in plants -
 - \rightarrow Very little transport of gases required as each plant part takes care of its own gas exchange needs.
 - \rightarrow Plants have slow respiration rate.
 - \rightarrow In plants, most of the living cells located quite close to the surface of the plants.
- 1. Glycolysis Greek words Glycos = Sugar, Lysis = Splitting.
 - \rightarrow Also called EMP pathway (E = Embden, M = Meyerhof, P = Parnas)
 - \rightarrow Common in both aerobic and anaerobic respiration.
 - → Occurs in cytoplasm and it is the partial oxidation of hexose (glucose or fructose) into two molecules of pyruvic acid.
 - \rightarrow No use of O₂ and no release of CO₂.
 - \rightarrow Net or total ATP gain 6 ATP or 8 ATP (2 NADH, = 4 or 6 ATP + 2 ATP by SLP = Substrate level
 - \rightarrow Direct gain of ATP = 2 ATP (by SLP) [Not count the ATP from NADH,]
 - \rightarrow In glycolysis during anaerobic respiration, net or total or direct gain of ATP= 2 ATP [as NADH₂ not enter into the ETS]

Conversion of pyruvic acid to Acetyl CoA (Link reaction) is an oxidative decarboxylation catalysed by pyruvic dehydrogenase. (Occurs in the matrix of the mitochondria)

- 2. Krebs Cycle -
 - \rightarrow Also called TCA (Tri Carboxylic Acid) Cycle or CA (Citric Acid) Cycle.
 - \rightarrow Occurs in the matrix of the mitochondria.
 - \rightarrow Involve 4 dehydrogenations (3 NADH, and 1 FADH,) and 2 decarboxylations (2 CO,).
 - → Net or total ATP gain 12 ATP (3 NADH₂ = 9 ATP+ 1 FADH₂ = 2 ATP+ 1 GTP = 1 ATP). [If Question is asked for 1 glucose or fructose - in above point no. - (iii) and (iv) calculation will be double as Krebs cycle occurs two times during complete oxidation of 1 molecule of glucose or fructose.]
 - \rightarrow Cycle has single 5 carbon compound oc-ketoglutaric acid.
- 3. Electron transport system (ETS) and oxidative phosphorylation -
 - \rightarrow ETS is present in the inner mitochondrial membrane.
 - → Five complexes NADH dehydrogenase (I), FADH₂ (II), Cytochrome bc1 (III), Cytochrome a, $a_3 \& 2 C$ centres (IV) and ATP synthase (V).
 - → In respiration the energy of oxidation reduction utilised in production of proton gradient t synthesis ATP (Oxidative phosp!iorylation).
 - \rightarrow Molecular Oxygen (O₂) act as the final/ultimate hydrogen (electron) acceptor and it get reduce, to water.
 - \rightarrow Mobile electron carrier Cytochrome C and ubiquinone (UQ) / CoQ.

In aerobic respiration, net or total gain of ATP from one glucose or fructose - 36 ATP or 38 ATP. In aerobic respiration in prokaryotes - 38 ATP.

Respolaration is an amphibolic pathway (involved in both anabolism and catabolism).

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RESPIRATION IN PLANTS

		SOLVED E	XAM	IPLE	
Ex.1	The energy releasing process in which the substrate is oxidised without an external electron acceptor is called			Which of the option is o (A) In chloroplast, glyc	correct for photorespiration erate forms glycine
	(A) Aerobic respiration	(B) Glycolysis		(C) In mitochondria gly	voine forms serine
	(C) Fermentation	(D) Photorespiration		(D) In bundle sheath, set	erine form glycine
Sol.	(C)		Sol.	(C) : Two molecules of serine CO and NH in it	glycine form a molecule of
Ex.2.	How many ATP molecules are obtained from fermentation of 1 molecule of glucose		Ex.9	The three boxes in this diagram represent the three	
	(A) 2	(B)4		Arrows represent net r	way in aerobic respiration.
	(C) 3	(D) 5		Allows represent net to	cactants of products.
Sol.	(A)		٤	l glucose→Pathway A 2 → Pathw	9 10 way B 7 Pathway C 11
Ex.3	During cellulose fermentation by anaerobic bacteria in remen and reticulum, cellulose is majority			Arrow numbered 4, 8 at	3 12 12 12 12
	(A) Lectic coid	(D) Ethyl alaahal		(A) FAD ⁺ or FADH	(B) Unused
	(A) Lactic acid	(B) Ethyl alconol		(C) ATP	(D) H.O
C - I	(C) volatile fatty acids	$(\mathbf{D}) \mathbf{CO}_2$	Sol.	(C)	() 2
501.	(C)		-		
Ex.4	Aerobic respiratory pathway is appropriately termed		Ex.10	How many ATP are form	ned from NADPH ⁺ to NAD ⁺
	(A) Catabolic	(B) Parabolic		$(\mathbf{A}) 2 \mathbf{A} \mathbf{P}$	(B) 3 AI P
	(C) Amphibolic	(D) Anabolic	Sal	$(\mathbf{C}) 6 \mathbf{A} \mathbf{P}$	(D) 4 AI P
Sol.	(C)		501.	(D)	
			Ex.11	The net gain of energy	from one gram molecule of
Ex.5	How many ATP molecules will be generated in a plant system during complete oxidation of 40 moles of glucose ?			glucose when oxidized	15
				$(\mathbf{A}) 2 \mathbf{A} \mathbf{P}$	(B) 36 ATP
	(A) 190	(B) 380	C al	(C) 38 AIP	(D) 15 AI P
	(C) 1520	(\mathbf{D}) 3040	501.	(C)	
Sol.	(C) 1520 (C)	(1) 50 10	Ex.12	Choose the correct con molecules involved in	mbination of labelling the the pathway of anaerobic
Ex.6	How much of the energy released during aerobic			respiration in yeast	
	respiration is approximately conserved in the form of ATP			Glycolysis Glucose	Fermentatior. Process
	(A) 20 %	(B) 40 %			
	(C) 60 %	(D) 100 %		Glyceraldehyd	de-3-P
Sol.	(B)				NAD+ NADH+H+
Ex.7	Chemiosmotic theory of chloroplasts and mitocho	of ATP synthesis in the ondria is based on		1, 3-bisphosphoglycerate _	→ Pyruvate
	(A) Proton gradient			(A) A - EthanolB - CO_2	C - Acetaldehyde
	(B) Accumulation of K ions			(\mathbf{B}) A - CO ₂ B - Ethanol	C - Acetaldehyde
	(C) Accumulation of Na ions			(\mathbb{C}) A - CO_2B - Acetalde	chyde C - Ethanol
	(D) Membrane potential			(D) A - AcetaldehydeB -	$-CO_2C$ - Ethanol
Sol.	(A)			(E) A - EthanolB - Aceta	aldehyde C - CO_2
			Sol.	(E)	

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	Exercise # 1	SINGLE OB.	JECTIV	/E	NEET LE	VEL
1.	The end products of respi $(A) CO_2, H_2O$ and energy (C) Sugar and oxygen	 ration in plants are (B) Starch and O₂ (D) H₂O and energy 	10.	Number of every transfer of 2e ⁻ in (A) 2 (B)	cytochrome m ETS : 4 (C) 1	olecule require for (D) 10
2.	The incomplete breakdow respiration results in the f (A) Fructose and water (B) Glucose and carbon d	yn of sugars in anaerobic formation of	11.	The respiration in ergy, which can b (A) water (C) Heat	n germinating s be deflected in t (B) ((D) (seeds produces enhe form of D_2 CO_2
2	(C) Alcohol and CO_2 (D) Water and CO_2	с · н.	12.	(A) Formed only (B) One of produ	when oxygen is ict of Krebs cyc	s available cle
3.	tivity is	ce of energy in cellular ac-		(D) a result of pro	otein break dow	$rac{1}{rac{1}{rac{0}{2}}}$
	(A) glucose (C) ATP	(B) aldohexose (D) NAD	13.	Most of the energy by oxidation whe	gy of the carboh	ydrates is released
4.	Different steps in respirat (A) Enzymes (C) Sugars	ion are controlled by (B) Auxins (D) Kinins		(A) Pyruvic acid(B) Pyruvic acid(C) Sugar is conv(D) Glucose is conv	is converted in is converted in verted into pyru onverted into al-	to CO_2 and H_2O to acetyl Co-A ivic acid cohol and CO_2
5.	A.T.P. is (A) A hormone (B) A protein		14.	Glycolysis takes (A) Cytoplasm (C) Ribosome	place in (B) ((D) N	Chloroplast Mitochondria
	(C) An enzyme which brin (D) A molecule which cor	ngs about oxidation atain high energy bond	15.	The end product used as raw mate	of fermentation	on when sugar are
6.	In anaerobic respiration s (A) In presence of O ₂	eeds respire (B) In presence of CO ₂		(A) Alcohol and (C) CO ₂	CO ₂ (B) A (D) A	Alcohol, Pyruvate Alcohol
7	(C) In absence of O_2 The following is require	(D) In absence of CO_2	16.	Fermentation is (A) All bacteria	conducted by	
1.	(A) Carbohydrates	(B) Sunlight (D) Cytochromes		(B) All fungi(C) Some fungi a(D) All microorga	nd some bacter nism	ia
8.	The net gain of ATP mole (A) Zero (C) Four	(b) Type I very second second	,17.	In the process of Respiration in plants 180 Glucose plus 192 gm of oxygen produce – (A) 132 gm of CO_2 , 54 gm of H_2O & 483 Cal .I (B) 264 gm of CO_2 , 216 gm of H_2O , & 686 K.Ca		1 plants 180 gm of produce – 9 & 483 Cal .E. 9, & 686 K.Cal E.
9.	Which one of the following is not true for iso en- zymes?			(C) 200 gm of C_2 H (D) None	I_{s} OH, 72 gm of H	$L_2O\&21$ K. Cal E.
	 (A) iso enzymes are quart (B) all forms synthesized (C) increase activation er (D) All the above 	enary proteins by different genes' hergy of substrate.	18.	Respiration is an (A) Exothermic p (B) Endothermic (C) Anabolic pro (D) None of thes	roces process icess e	

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RESPIRATION IN PLANTS

I. What is the importance of respiration in organisms? (A) It provides exygen to plant 11. A reduction of NADP to NADPH, is associated with (B) It liberates energy (A) It provides exygen to plant (A) It provides exygen to plant (A) It provides exygen to plant (B) It liberates energy (A) It makes it dark (C) Calvin cycle (D) Glycolysis 2. An indispensible role in energy metabolism is played by (B) Criticates of fruits and vegetables often become dark because (A) Phosphorus (B) Lithium (C) Calvin cycle (D) Glycolysis 3. Which component of ETS is mobile, e= carrier? (A) Dug(CO-Q) (B) Cyto a (B) Cyto a is the source of respiration of the following is the source of respiration of an enzyme is the inhibition of an enzyme is the source of respiration of (B) Cyto a in succulent plants RQ, is less than one because of (A) Starch 13. A recodine simultaneously (D) Carbonic anhydrase by carbon - dioxide 6. In succulent plants RQ, is less than one because of (A) Complete reduction 14. (A) East of decline of respiration will be earlier than decline of respiration will be earlier than decline of respiration (B) Rate of decline of respiration will be earlier than d		Exercise # 2	SINGLE OB.	JECTI	VE	AIIMS LEVEL
(B) It liberates energy (A) EMP-pathway (B) HMP-shunt (C) It liberates CO ₂ (D) All the above 12. Cut surfaces of fruits and vegetables often become dark because (A) Phosphorus (B) Lithium (C) Calvin cycle (D) Glycolysis (A) Phosphorus (B) Lithium (C) Sodium (D) Calvin cycle (A) Dirty kinife makes it dark (A) VLO(CO-Q) (B) Cyto a (D) Cyto - f (D) None of the above (D) None of the above 4. Which of the following is the source of respiration? (A) Stored food (B) NRA (C) Fochrome oxidase by gamoloic acid (B) Cytop a (D) AIT (D) AIT (D) Cyto-rf (D) Stored food (D) ATP 5. R.Q. is less than one at the time of respiration? (A) Starch (B) Sugarcane (C) Glucose (D) Cround nut 6. In succulent plants R.Q. is less than one because of (A) Complete oxidation (D) Incomplete roxidation (D) Both do not show any fixed pattern 7. The link between Glycolysis and Krebs cycle is (A) Citric acid (B) Adia caid (C) More final singlycolysis 7. The link between Glycolysis and Krebs cycle is (A) Citric acid (B) Adia caid (C) More final singlycolysis 7. <td< td=""><td>1.</td><td>What is the importance of (A) It provides oxygen t</td><td>of respiration in organisms? o plant</td><td>11.</td><td>A reduction of N with</td><td>ADP to NADP.H₂ is associated</td></td<>	1.	What is the importance of (A) It provides oxygen t	of respiration in organisms? o plant	11.	A reduction of N with	ADP to NADP.H ₂ is associated
 (C) It liberates CO₂ (C) Calvin cycle (D) Glycolysis (D) All the above An indispensible role in energy metabolism is played by (A) Phosphorus (B) Lithium (C) Sodium (D) Calcium (B) Caddition of the air makes it dark (C) Sodium (D) Calcium (C) Sodium (D) Calcium (D) Cyto - b (D) Cyto a (A) UQ (CO-Q) (B) Cyto a (C) Cyto - b (D) Cyto - f (A) UQ (CO-Q) (B) Cyto a (C) DNA (D) ATP (D) NA (D) ATP (D) NA (D) ATP (D) Stored food (B) RNA (C) Garcone (C) Extra the time of respiration of (C) DNA (D) ATP (A) Stored food (B) Sugarcane (C) Glucose (D) Ground nut (B) Complete roduction (B) Complete roduction (B) Complete roduction (B) Complete roduction (C) Incomplete reduction (B) Complete roduction (B) Complete roduction (C) Incomplete reduction (C) Incomplete reduction (C) Incomplete reduction (C) Incomplete reduction (B) Complete roduction (B) Complete roduction (C) Incomplete reduction (C) Incomplete reduction (B) Complete roduction (B) Complete roduction (B) Complete roduction (B) Complete reduction (C) Incomplete reduction (C) Incomplete reduction (C) Incomplete reduction (B) Complete roduction (C) Incomplete reduction (B) Complete reduction (C) Incomplete reduction (C) I		(B) It liberates energy			(A) EMP-pathway	(B) HMP-shunt
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 (C) Sodium (D) Calcium (D) Calcium (D) Calcium (C) Sodium (D) Calcium (C) Dust of the air makes it dark (C) Dust of the above of the above		(A) Phosphorus	(B) Lithium		(B) Oxidation of ta	annic acid in the presence of trace
 (C) Dust of the air makes it dark (D) None of the above (A) UQ(CO-Q) (B) Cyto a (C) Cyto - b (D) Cyto - f An example of competitive inhibition of an enzyme is the inhibition of f (A) Stored food (B) RNA (C) DNA (D) ATP 5. R.Q. is less than one at the time of respiration of - (A) Starch (B) Sugarcane (C) Glucose (D) Ground nut 6. In succulent plants R.Q. is less than one because of (A) Complete oxidation (C) Incomplete reduction (C) Incomplete reduction (D) Incomplete oxidation 7. The link between Glycolysis and Krebs cycle is (A) G37 K.Cal (B) Galvin cycle (C) Giycolate cycle (D) According to chemiosmotic theory of P. Mitchell (1978), ATPs are synthesised on membranes due to the: (A) Proton gradient (B) Electron gradient (C) Osmosis (D) From H_sSQ₄ (C) Dust of the air makes it dark (C) Dust of the air makes it dark (D) None of the above (C) A is related to: (C) Giycolate cycle (D) Hardina (D) Catalase (C) Mathe air makes it dark (D) Catalase (D) Catalas		(C) Sodium	(D) Calcium		of iron from the kn	ife makes it dark
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 (C) Cyto - b (D) Cyto - f (A) Stored food (B) RNA (C) DNA (D) ATP (A) Starch (B) Sugarcane (C) Glucose (D) Ground nut (C) Glucose (D) Ground nut (A) Complete oxidation (C) Incomplete reduction (C) Incomplete reduction (D) Incomplete reduction (D) Incomplete reduction (C) Fumaric acid (D) Actryl Co-A is related to: (A) Krebs cycle (B) Calvin cycle (C) Glycolate cycle (A) Krebs cycle (A) Krebs cycle (B) Calvin cycle (C) Glycolate cycle (A) Proton gradient (B) Electron gradient (C) Osmosis (D) Form H₂SO₄ 		(A) UQ (CO-Q)	(B) Cyto a	13.	An example of cor	npetitive inhibition of an enzyme
 4. Which of the following is the source of respiration? (A) Stored food (B) RNA (C) DNA (D) ATP 5. R.Q. is less than one at the time of respiration of – (A) Starch (B) Sugarcane (C) Glucose (D) Ground nut 6. In succulent plants R.Q. is less than one because of (A) Complete oxidation (C) Incomplete reduction (D) Incomplete eduction (D) Incomplete eduction (D) Incomplete oxidation (C) Fumaric acid (D) Acetyl co-enzyme 8. Aerobic respiration of glucose produces energy (A) 637 K.Cal (B) 640 K.cal (C) Glycolate cycle (D) 693 K.cal 9. Succinyl Co-A is related to: (A) Krebs cycle (B) Calvin cycle (C) Glycolate cycle (D) HMP-cycle 10. According to chemiosmotic theory of P. Mitchell (1978), ATPs are synthesist on membranes ducto the : (A) Proton gradient (B) Electron gradient (C) Osmosis (D) From H₂SO₄ 		(C) Cyto - b	(D) Cyto - f		is the inhibition of	f:
 (A) Which of the following is the source of respiration? (A) Stored food (B) RNA (C) DNA (D) ATP (B) Cytochrome oxidase by cyanide (C) DNA (D) ATP (D) Carbonic anhydrase by carbon - dioxide (F the temperature is increased above 35°C (A) Starch (B) Sugarcane (C) Glucose (D) Ground nut (A) Complete oxidation (B) Complete oxidation (C) Incomplete oxidation (C) Incomplete reduction (D) Incomplete oxidation (C) Incomplete reduction (D) Incomplete oxidation (C) Fumaric acid (D) Acetyl co-enzyme (A) Citric acid (D) Acetyl co-enzyme (A) G37 K.Cal (B) 640 K.cal (D) Galvin cycle (C) Glycolate cycle (D) HMP-cycle (A) Krebs cycle (B) Calvin cycle (C) Glycolate cycle (D) HMP-cycle (A) Proton gradient (B) Electron gradient (C) Osmosis (D) From H₂SO₄ (C) Phaspination of Lector gradient (C) Osmosis (D) From H₂SO₄ 	4	Which of the following i	a the source of respiration?		(A) Succinic dehy	drogenase by malonic acid
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(C) Glucose(D) Ground nutdecline of photosynthesis6.In succulent plants R.Q. is less than one because of (A) Complete oxidation (B) Complete Reduction (C) Incomplete reduction 		(A) Starch	(B) Sugarcane		(A) Rate of decline	e of respiration will be earlier than
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(C) Fumaric acid(D) Acetyl co-enzyme(D) Much less than glycolysis8.Aerobic respiration of glucose produces energy (A) 637 K.Cal(B) 640 K.cal16.(C) 686 K.cal(D) 693 K.cal16.Conversion of pyruvic acid into ethyl alcohol is me- diated by $-$ 9.Succinyl Co-A is related to : (A) Krebs cycle (C) Glycolate cycle(B) Calvin cycle (D) HMP-cycle(A) Phosphatase10.According to chemiosmotic theory of P. Mitchell (1978), ATPs are synthesised on membranes due to the : (A) Proton gradient (C) Osmosis17.The formation of Acetyl Co-A from pyruvic acid is the result of its (A) Reduction(A) Proton gradient (C) Osmosis(B) Electron gradient (D) From H_2SO4(D) Oxidative decarboxylation		(A) Citric acid	(B) Malic acid		(C) More than gly	colysis
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 (A) Krebs cycle (B) Calvin cycle (C) Glycolate cycle (D) HMP-cycle (D) Catalase <l< td=""><td>9.</td><td>Succinyl Co-A is related</td><td>l to :</td><td></td><td>(C) Decarboxylas</td><td>e & dehydrogenase</td></l<>	9.	Succinyl Co-A is related	l to :		(C) Decarboxylas	e & dehydrogenase
 (C) Glycolate cycle (D) HMP-cycle 10. According to chemiosmotic theory of P. Mitchell (1978), ATPs are synthesised on membranes due to the : (A) Proton gradient (B) Electron gradient (C) Osmosis (D) From H₂SO₄ 17. The formation of Acetyl Co-A from pyruvic acid is the result of its (A) Reduction (B) Dehydration (C) Phosphorylation (D) From H₂SO₄ 		(A) Krebs cycle	(B) Calvin cycle		(D) Catalase	
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(C) Osmosis (D) From H_2SO_4 (D) Oxidative decarboxylation		(A) Proton gradient	(B) Electron gradient		(C) Phosphorylati	on
i = i		(C) Osmosis	(D) From H_2SO_4		(D) Oxidative deca	arboxylation

Ĩ	Exercise # 3	PART - 1 MATRIX MATCH COLUMN				
1.	Match Column - I with Column - II and select the correct option from the codes given below.					
	Column - I	Column - II				
	A. Wine	(i) Apples				
	B. Cider	(ii) Grapes				
	C. Beer	(iii) Molasses				
	D. Rum	(iv) Cereals				
	(A) A-(ii), B-(iv), C-(iii), D-(i)	(B) A-(ii), B-(i), C-(iv), D-(iii)				
	(C) A-(iv), B-(iii), C-(ii), D-(i)	(D) A-(iv), B-(ii), C-(iii), D-(i)				
2.	Match Column - I with Column - I	and select the correct option from the codes given below.				
	Column - I	Column - II				
	A. Fats made of three fatty-acid	(i) Glycogen chains attached to glycerol				
	B. Glycolysis metabolite made	(ii) Glyceraldehyde from glycerol				
	C. Storage form of glucose	(iii) Triglycerides				
	D. Result of running reactions $(A \cap A \cap B)$	(iv) Glucose of glycolysis in reverse $(1) + (1) + (2$				
	(A) A-(iv), B-(ii), C-(i), D-(iii) (C) A-(i), D-(iii), C-(i), D-(iii)	(B) A-(11), B-(11), C-(1), D-(1V)				
	(C) A-(1V), B-(111), C-(1), D-(11)	(D) A- (1) , B- (11) , C- (111) , D- $(1V)$				
3.	Match Column-I with Column-II a	nd select the correct option from the codes given below.				
	Column-I	Column - II				
	A. TCA cycle	(i) Inner mitochondrial membrane				
	B. $F_0 - F_1$ particles	(ii) Hans Krebs				
	C. End product of	(iii) Oxidative decarboxylation glycolysis				
	D. Pyruvate	(iv) Pyruvic acid dehydrogenase				
	(A) A-(ii), B-(i), C-(iv), D-(iii)	(B) A-(i), B-(ii), C-(iv), D-(iii)				
	(C) A-(ii), B-(iii), C-(iv), D-(i)	(D) A-(iii), B-(ii), C-(i), D-(iv)				
4.	Match Column - I with Column - I	and select the correct option from the codes given below.				
	Column - I	Column - II				
	A.R.Q	(i) Chemiosmotic ATP synthesis				
	B. Mitchel	(ii) Muscle fatigue				
	C. Cytochromes	(iii) Inner mitochondrial membrane				
	D. Lactic acid	(iv) Alcoholic fermentation				
	E. Yeast	(v) Respirometer				
	(A) A-(v), B-(i), C-(iii), D-(ii), E-(iv)	(B) A-(v), B-(i), C-(iii), D-(iv), E-(ii)				
	(C) A-(i), B-(v), C-(ii), D-(iii), E-(iv)	(D) A-(v), B-(ii), C-(iv), D-(iii), E-(i)				
5.	5. Match Column-I with Column-II and select the correct option from the codes given below.					
	Column-I	Column-II				
	A. Glycolysis	(i) Inner mitochondrial membrane				
	B. TCA cycle	(ii) Mitochondrial matrix				
	C.ETS	(iii) Cytoplasm				
	(A) A-(iii), B-(i), C-(ii)	(B) A-(iii), B-(ii), C-(i)				
	(C)A-(1), B-(ii), C-(iii)	(D) A-(11), B-(1), C-(iii)				
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RESPIRATION IN PLANTS

	Exercise # 4 PART - 1	7[PREVIOUS YEAR (NEET/AIPMT)
1.	How many ATP molecules produced by Aerobic oxidation of one molecule of glucose : - [CBSE AIPMT 2002] (A) 2 (B) 4 (C) 38 (D) 34	7.	 During which stage in the complete oxidation of glucose are the greatest number of ATP molecules formed from ADP - [CBSE AIPMT 2005] (A) Glycolysis (B) Krebs cycle (C) Conversion of pyruvic acid to acetyl Co - A
2.	In which one of the following do the two names refer to one and the same thing : - [CBSE AIPMT 2003] (A) Tricarboxylic acid cycle and urea cycle (B) Kreb's cycle and Calvin cycle (C) Tricarboxylic acid cycle and citric acid cycle (D) Citric acid cycle and Calvin cycle	8.	 (D) Electron transport chain How many ATP molecules could maximally be generated from one molecule of glucose, if the complete oxidation of one mole of glucose to CO₂ and H₂O yields 686 kcal and the useful chemical energy available in the high energy phosphate bond of one mole of ATP is 12 kcal? [CBSE AIPMT 2006] (A) 30 (B) 57
3.	Which one of the following concerns photophos- phorylation : - [CBSE AIPMT 2003] (A) AMP + Inorganic PO ₄ $\xrightarrow{\text{Light energy}}$ ATP (B) ADP + AMP $\xrightarrow{\text{Light energy}}$ ATP (C) ADP + Inorganic PO ₄ $\xrightarrow{\text{Light energy}}$ ATP (D) ADP + Inorganic PO ₄ $\xrightarrow{\text{Light energy}}$ ATP	9.	 (C) 1 (D) 2 All enzymes of TCA cycle are located in the mitochondrial matrix except one which is located in inner mitochondrial membranes in eukaryotes and in cytosol in prokaryotes. This enzyme is: [CBSE AIPMT 2007] (A) lactate dehydrogenase (B) isocitrate dehydrogenase
4.	 In alcoholic fermentation : - [CBSE AIPMT 2003] (A) Oxygen is the electron acceptor (B) Triose phosphate is the electron donor while acetaldehyde is the electron acceptor (C) Triose phosphate is the electron donor while pyruvic acid is the electron acceptor (D) There is no electron donor 	10.	 (D) isociriate dehydrogenase (C) malate dehydrogenase (D) succinate dehydrogenase The overall goal of glycolysis, Krebs cycle and the electron transport system is the formation of: [CBSE AIPMT 2007] (A) ATP is small stepwise units (B) ATP in one large oxidation reaction
5.	In glycolysis, during oxidation electrons are re- moved by - [CBSE AIPMT 2004] (A) ATP (B) Glyceraldehyde-3-phosphate (C) NAD ⁺ (D) Molecular oxygen	11.	 (C) Sugars (D) Nucleic acids The chemiosmotic coupling hypothesis of oxidative phosphorylation proposes that Adenosine Tri-Phosphate (ATP) is formed because: [CBSE AIPMT 2008] (A) Lick ensure the rade set formed time its denoted and the set of the set
6.	Chemiosmotic theory of ATP synthesis in the chlo- roplasts and mitochondria is based on [CBSE AIPMT 2005] (A) Membrane potential (B) Accumulation of Na ⁺ ions (C) Accumulation of K ⁺ ions (D) Proton gradient		 (A) High energy bonds are formed in mitochondrial proteins (B) ADP is pumped out of the matrix into the intermembrane space (C) A proton gradient forms across the inner membrane (D) There is a change in the permeability of the inner mitochondrial membrane toward Adenos-

(D) Proton gradient

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ine Di-Phosphate (ADP)

BIOLOGY FOR NEET & AIIMS

		MC	OCK TEST		
1.	Which enzyme helps in (A) Phosphatase	transfer of phosphate (B) ATPase	group from ATP to a carbohyd (C) Phosphorylase	drate? (D) Catalase	
2.	During glycolysis, fruc (A) dihydroxyacetone p (B) dihydroxyacetone p (C) dihydroxyacetone p (D) dihydroxyacetone p	tose 1, 6-bisphosphate phosphate and 2-phosp phosphate and 1-phosp phosphate and 2-phosp phosphate and 3-phosp	is split into hoglyceraldehyde hoglyceraldehyde hoglycerate hoglyceraldehyde		
3.	Select the correct order A. Conversion of 3-ph B. Conversion of 3-ph C.Conversion of BPGA D. Splitting of fructose (A) D, C, A, B (E) D, A, C, B	of reactions in glycoly osphoglyceraldehyde to sphoglyceric acid to 2- to 3-phosphoglyceric a 1,6-bisphosphate into (B) B, C, A, B	sis. o 1,3-bisphos-phoglycerate phospho-glycerate cid dihydroxy acetone phosphate (C) B, D, A, C	e and 3-phosphoglyceraldehyde (D) A, D, C, B	
4.	 In glycolytic pathway which of the following steps shows reduction of co-enzyme? (A) 1, 3-diphosphoglycerate to 3-phosphoglycerate (B) Glucose 6-phosphate to fructose 6-phosphate (C) Glyceraldehyde 3-phosphate to 1, 3-diphospho-Glycerate (D) 3-phosphoglycerate to 2-phosphoglycerate 				
5.	Conversion of pyruvic a (A) carboxylase (C) dehydrogenase	acid into ethyl alcohol i	s facilitated by the enzymes (B) phosphatase (D) decarboxylase an	d dehydrogenase	
6.	Choose the correct con Yeast.	Glucose Glyceraldehyde-3 Glyceraldehyde-3 NAD 1, 3, biphosphogly	he molecules involved in the -phosphate A H ycerate \rightarrow Pyruvate C	pathway of anaerobic respiration in	

- **(B)** A Ethanol, B-CO₂, C-Acetaldehyde
- (C) A Ethanol, B-Acetaldehyde, C CO_2
- (\mathbf{D}) A CO₂, B Ethanol, C Acetaldehyde
- 7. During alcoholic fermentation by yeast two molecules of glucose produce
 - (A) 2 molecules of ethanol + 2 molecules of CO_2
- **(B)** 4 molecules of ethanol + 4 molecules of CO_2
- (C) 6 molecules of ethanol + 6 molecules of CO_2
- (D) 3 molecules of ethanol + 3 molecules of CO_2 (D) 3 molecules of ethanol + 3 molecules of CO_2
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11th Class Modules Chapter Details



PHYSICS

CHEMISTRY

Module-1

- 1. Physical World & Measurements
- 2. Basic Maths & Vector
- 3. Kinematics

Module-2

- 1. Law of Motion & Friction
- 2. Work, Energy & Power

Module-3

- **1.** Motion of system of
- particles & Rigid Body
- 2. Gravitation

Module-4

- 1. Mechanical Properties of Matter
- 2. Thermal Properties of Matter

Module-5

- 1. Oscillations
- 2. Waves

Module-1(PC)

- 1. Some Basic Conceps of Chemistry
- 2. Atomic Structure
- 3. Chemical Equilibrium
- **4.** Ionic Equilibrium

Module-2(PC)

- 1. Thermodynamics & Thermochemistry
- 2. Redox Reaction
- **3.** States Of Matter (Gaseous & Liquid)

Module-3(IC)

- 1. Periodic Table
- 2. Chemical Bonding
- 3. Hydrogen & Its Compounds
- 4. S-Block

Module-4(OC)

- 1. Nomenclature of
- Organic Compounds
- 2. Isomerism
- 3. General Organic Chemistry

Module-5(OC)

- 1. Reaction Mechanism
- 2. Hydrocarbon
- **3.** Aromatic Hydrocarbon
- 4. Environmental Chemistry & Analysis Of Organic Compounds

BIOLOGY

Module-1

- 1. Diversity in the Living World
- 2. Plant Kingdom
- 3. Animal Kingdom

Module-2

- 1. Morphology in Flowering Plants
- **2.** Anatomy of Flowering Plants
- **3.** Structural Organization in Animals

Module-3

- 1. Cell: The Unit of Life
- 2. Biomolecules
- 3. Cell Cycle & Cell Division
- 4. Transport in Plants
- 5. Mineral Nutrition

Module-4

- 1. Photosynthesis in Higher Plants
- 2. Respiration in Plants
- 3. Plant Growth and Development
- 4. Digestion & Absorption
- 5. Breathing & Exchange of Gases

Module-5

- Body Fluids & Its Circulation
 Excretory Products & Their Elimination
- **3.** Locomotion & Its Movement
- 4. Neural Control & Coordination
- **5.** Chemical Coordination and Integration

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12th Class Modules Chapter Details



PHYSICS

Module-1

- 1. Electrostatics
- 2. Capacitance

Module-2

- 1. Current Electricity
- 2. Magnetic Effect of Current and Magnetism

Module-3

- 1. Electromagnetic Induction
- 2. Alternating Current

Module-4

- 1. Geometrical Optics
- 2. Wave Optics

Module-5

- 1. Modern Physics
- 2. Nuclear Physics
- 3. Solids & Semiconductor Devices
- 4. Electromagnetic Waves

CHEMISTRY

Module-1(PC)

- 1. Solid State
- 2. Chemical Kinetics
- **3.** Solutions and Colligative Properties

Module-2(PC)

- 1. Electrochemistry
- 2. Surface Chemistry

Module-3(IC)

- 1. P-Block Elements
- 2. Transition Elements (d & f block)
- 3. Co-ordination Compound
- 4. Metallurgy

Module-4(OC)

- 1. HaloAlkanes & HaloArenes
- Alcohol, Phenol & Ether
 Aldehyde, Ketone &
- Carboxylic Acid

Module-5(OC)

- 1. Nitrogen & Its Derivatives
- 2. Biomolecules & Polymers
- 3. Chemistry in Everyday Life

BIOLOGY

Module-1

- 1. Reproduction in Organisms
- 2. Sexual Reproduction in
- Flowering Plants
- 3. Human Reproduction
- 4. Reproductive Health

Module-2

- **1.** Principles of Inheritance and Variation
- 2. Molecular Basis of Inheritance
- **3.** Evolution

Module-3

- 1. Human Health and Disease
- 2. Strategies for Enhancement in
- Food Production
- 3. Microbes in Human Welfare

Module-4

- **1.** Biotechnology: Principles and Processes
- 2. Biotechnology and Its
- Applications
- 3. Organisms and Populations

Module-5

- 1. Ecosystem
- 2. Biodiversity and Conservation
- 3. Environmental Issues

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