21 Respiration

Word understanding and Scientific contribution

If we distinguish the difference between respiration and respiratory system then,

Respiration = Cell respiration (in which cell organell like mitochondria and cytoplasm take part) where as in respiratory system different organs, tissue and cell participates in it.

- In another words, respiration is a complete biochemical process, where as respiratory system process can be physical as well as chemical process.
- Respiration is attached with ATP process of synthesis.
- Respiratory system is attached with transportation of O_2 and (CO_2 + H_2O) that is respiration.
- Respiration is of two types aerobic (with oxygen) anerobic (without oxygen).
- In respiratory system this type of system are not possible.
- Most importantly respiration is an essential process for both plant kingdom and animal kingdom.
- Where as respiratory system is associated with metabolism process in animal kingdom. Phisiological process = Biochemical process.

Metabolism (Physiological process biochemical process)

- In various organisms different Biologial processes occurs that is known as metabolism.

Endergonic process : Energy storing process

Example : Photosynthesis

Exergonic process : Energy releasing process

Example : Cell respiration

Respiratory substrates : The substances which are oxidized during respiration with in a cell are known as respiratory substrates.

(1) What things occur during respiration ?

(A) Energy stored in form of ADP

(B) Free energy stored in form of ATP

(C) Energy released

(D) Energy used

(2) During which process in a cell, the breakdown of C-C bonds of complex compounds, release considerable amount of energy.

(A) Redox (B) Oxidation

(C) Hydrogenation (D) Reduction

(3) What is the respiration rate in animals as compare to plants parts ?

(A) More (B) less

(C) Speedy (D) Very slow

(4) Plants don't have particular respiratory organ because

(A) As compare to animals, in plants respiration rate and exchange of gases is more.

(B) Each plant part is directly involved in exchange of gases.

(C) Availability of CO_2 is not a problem because CO_2 is released during photosynthesis.

(D) A and B both.

(5) Which of the following process is not related to respiration.

(A) Respiration is a catabolic process.

(B) Respiration is a exergonic process.

(C) The breakdown of C-C bonds of complex compounds through oxidation within the cells releases considerable amount of energy.

(D) Energy released during this process is utilized for the synthesis of ATP.

(6) Which of the following reaction is an aerobic respiration ?

(A) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6CO_2$

(B) $C_6H_{12}O_6 \rightarrow 6O_2 + 6\ CO_2 + 6H_2O$ + Energy

(C) $C_6H_{12}O_6 + 6O_2 \rightarrow 2C_2\ H_5OH + 6O_2$ + Energy

(D) None of these

(7) What is respiration ?

(A) Catabolic process, in which CO_2 is, used O_2 is released and free energy is converted into ATP.

(B) Anabolism process in which O_2 and CO_2 are used to form ATP.

(C) Anabolism process in which O_2 is used, CO_2 is released and free energy is converted into ATP.

(D) Catabolism process in which O_2 is used, CO_2 is released and free energy is converted into ATP.

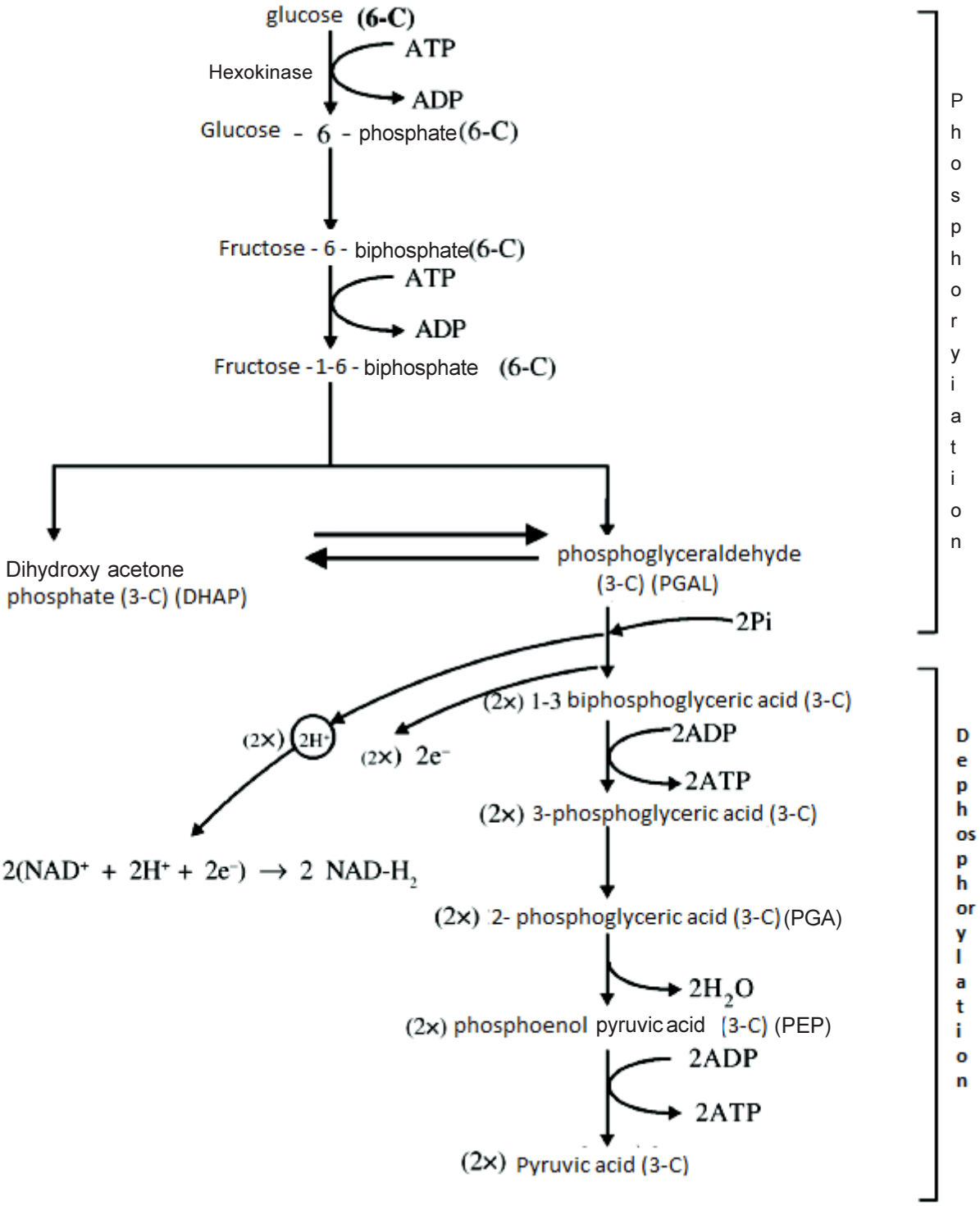
Answers : (1-B), (2-B), (3-D), (4-C), (5-B), (6-B), (7-D)

Glycolysis - EMP - Path

- It is the first step of respiration.
- It is the first step of aerobic and anerobic respiration.
- It is an anerobic phase of aerobic respiration (during glycolysis, presence of O_2 is not required).
- All enzymes are present in cytoplasm which are required during cellular respiration.
- In the end of glycolysis 2 pyruvic acid are formed.
- 2 molecules of ATP are consumed and 4 molecules of ATP are formed. Thus there is a net gain of 2 ATP. (4 ATP - 2ATP = 2ATP)

Formula :

- $C_6H_{12}O_6 + 2NAD^+ + H_3PO_4\ (P_i) + 2\ ATP \rightarrow 2CH_3CO{\cdot}COOH + 2NADH_2 + 4ATP$



Glocolysis

Glycolysis

Sr.	Process	Substrate	Enzyme	Product
1.	Phosphorylation	Glucose + ATP	Hexokinase + Cofactor Mg^{+2}	Glucose-6-phosphate (6 C) + ADP
2.	Isomerization	Glucose 6 phosphate	phosphogluco isomerase	Fructose-phosphate (6 C)
3.	Phosphorylation	Fructose-6-phosphate + ATP	phospho Fructo kinase + Mg^{+2}	Fructose 1, 6 biphosphate + ADP (6 C)
4.	Division	Fructose l, 6, biphosphate phosphoglycera-	Aldolase ⟶	3- phosphoglyceraldehyle + Dihydroxyacetone phosphate (DHAP)

According to above reaction there are 2 molecules of PGAL are fromed. This molecules are used in further reactions.

5.	Phosphorylation	3-PGAL + H_3PO_4 (Pi)	Phosphoglycerokinase	1,3 biphosphoglyce-raldehyde (1,3-PGAL) (3C)
6.	Dihydroginase	1,3 BPGAL+ NAD+	Glyceraldehyde phos-phateDehydrogenase	1,3 disphosphoglycerate (3C) + $NADH_2$
7.	Dephosphorylation	1,3 BPGA + ADP	Dephosphoglyce rodinase	3- PGA + ATP 3- Phosphoglycerate (3C)
8.	Isomerization	3-PGA	Phosphoglycerate Mutase (3-PGA)	2-PGA - (3C) 2- Phosphoglycerate (3C) (3-PGA) - 8
9.	Dehydration (H_2O Remove)	2PGA	Co-factor Enolase+ Mg^{+2}	2 Phosphoenol pyruvate + H_2O
10	Dephosphorylation	2 PEP + ADP	Pyruvat kinase + Mg^{+2}, K^+	Pyruvate + ATP (3C)

- Difference between aerobic and anerobic respiration

	Aerobic Respiration`	Amerobic Respiration
1.	Complete Breakdown of Glucose	– Incomplete breakdown of Glucose
2.	Process in presence of oxygen	– Process in absence of oxygen
3.	Large Amount of energy in form of ATP is released	– Small amount of energy ATP is released
4.	End product CO_2, H_2O and ATP	– End product ethylalcohol, CO_2, lactic acid
5.	This process occurs in higher organisms	– This process occurs in parasite and lower organism
6.	This process occurs in Cytoplasm and mitochondria	– This process occurs in Cytoplasm
7.	Economic value of product is high	– Economic value of product is low
8.	In this process glycolysis and krebs cycle and Oxidative phosphorylation phases are occurs.	– In this process only glycolysis and fermentation occurs

(8) Which bio-chemical reaction is seen in cytoplasm matrix ?

(A) Calvin cycle (B) Amphibolic cycle (C) Glycolysis (D) Krebs cycle

(9) Which enzyme is responsible for the glucose phosphorylation ?

(A) Isomarease (B) Hexokinase (C) Transferase (D) lyasis

(10) In which process of glycolysis the ATP is used ?

(A) Phosphoryslation in cytoplasm matrix (B) Oxidative phosphorylation

(C) Phosphorylation (D) Dephosphorylation

(11) Which enzyme convert sucrose into glucose and froctose ?

(A) Isomerase (B) Invertase (C) Hexokinase (D) Dehydrogenase

(12) Which bio chemial reaction of glycolysis the CO_2 is released ?

(A) 3- Phosphoglyceric acid $\rightarrow$ 2 Phospho glycoric acid

(B) 3-Phosphoglyceraldihyde $\rightarrow$ 3 Phosphoglyceri acid

(C) 2-Phosphoglyceric acid $\rightarrow$ 2 Phosphoenol pyruvic acid

(D) 2-Phosphoenol pyruvic acid $\rightarrow$ Pyruvic acid

(13) How many ATP produce in dephosphorylation of glycolysis ?

(A) 3 ATP (B) 2 ATP (C) 4 ATP (D) 6 ATP

(14) Which is first phase of glucose splitting in eukaryotic organisam ?

(A) Oxidative phosphorylation (B) Krebs cycle

(C) Glycolysis (D) ETS

(15) Glycolysis is connect with

(A) Only in aerobic (B) only in anaerobic

(C) Mitochonotion matrix (D) Cytoplasm matrix

(16) Which type of sugar is formed when fructose 1-6 biphosphate splits in glycolysis ?

(A) Ketotroose (B) aldotriose (C) Pentose sugar (D) A and B both

(17) Which is common path of aerobic and anaerobic respiration.

(A) TCA-Cycle (B) Calvin cycle

(C) Glycolysis (D) Oxidative phosphorylation

(18) In glycolysis process ..... oxidation and ..... reduction process is seen.

(A) 2, 1 (B) 1, 0 (C) 1, 2 (D) 0, 1

(19) Which molecule is produce by phosphorylcation anaerobic phase of erobic respiration ?

(A) DHAP (B) 1,3 PGA

(C) PGAL (D) Fructose 1-6 biphosphate

(20) Released phosphate from ATP is connect with which glucose carbon of glucose ?

(A) 1 (B) 4 (C) 5 (D) 6

(21) How many times the phosphorylation and dephosphorylation occur in glycolysis ?

(A) 2 and 3 (B) 3 and 4 (C) 4 and 4 (D) 3 and 3

(22) What is phosphorylation ?

(A) Removal of H_3PO_4 (B) Change place of phosphate in glucose

(C) Remove phosphate from glucose (D) Joining of H_3PO_4

(23) What need to convert 3 phosphoglyceric acid into 2 phosphoenol pyruvic acid in glycolysis ?

(A) Use of H_3PO_4 (B) decarboxylation (C) dehydration (D) Formation of ATP

(24) How many oxygen are used in glycolysis ?

(A) 6 (B) 0 (C) 12 (D) 3

(25) End product of glycolysis

(A) $2CH_3CO\ COOH + 2NADH_2 + ATP$ (B) $2CH_3CO\ COOH + 2NADH_2 + 2\ ATP$

(C) $CH_3CO\ COOH + NADH + ATP$ (D) $CH_3CO\ COOH + 2H^+ + 2e^- + 4ATP$

(26) How many PGAL molecule produce from 3 molecule of glucose and how many ATP molecules produce from PGAL till CO_2 and H_2O produce during respiration.

(A) 6 PGAL – 160 ATP (B) 6 PGAL – 120 ATP

(C) 4 PGAL – 80 ATP (D) 4 PGAL – 40 ATP

(27) How many times isomerisation process seen during glycolysis ?

(A) 1 (B) 2 (C) 3 (D) 4

(28) Net profit of glycolysis ..... .

(A) 3 ATP and 1 NADH + H^+ (B) 2 ATP and 2 NADH + H^+

(C) 6 ATP and 4 NADH + H^+ (D) 10 ATP and 6 NADH + H^+

(29) Mean of dihydroxy acetone phosphate.

(A) 2C component (B) 3C component

(C) 4C component (D) 6C component

(30) When human muscles contracts ..... .

(A) Respiration not occur

(B) In less O_2 anaerobic respiration occur

(C) anaerobic never occur

(D) Always anaerobic respiration seen

(31) Which one is true sentence for 3 PGAL to 1,3 BPGA in glycolysis ?

(A) Use of H_3PO_4 (Pi) and produce of $NADH_2$

(B) Use of ATP and produce of $NADH_2$

(C) Synthesis of ATP and $NADH_2$

(D) Decompose of $NADH_2$ and formation of ATP

(32) How many ATP produce in dephosphorylation in glycolysis ?

(A) 2 ATP (B) 3 ATP (C) 4 ATP (D) 6 ATP

(33) Which sentence is true for glycolysis ?

(A) ATP used in dephosphorylation (B) Phosphorylation occur in matrix level

(C) $C_6H_{12}O_6 \rightarrow 3CO_2$ (D) ATP produce during phosphorylation

(34) What happened of released H^+ and e^- when oxidation of glyceraldehyde in glycolysis ?

(A) It released in form of CO_2 (B) It convert into pyruvic acid

(C) They oxidise by NAD (D) It reduce from NAD

(35) Identify me : "I am anaerobic phase of aerobic respiration."

(A) glycolysis (B) TCA cycle

(C) oxidative phoshphorylation (D) None of above

(36) Glucose + ATP $\xrightarrow{X}$ glucose : 6 - po_4 + ADP, (here x = Enzyme)

(A) X = carboxylase (B) X = Hexokinase

(C) X = decarboxylase (D) TPP

(37) Arrange in sequence of glycolysis process

(i) Glucose $\rightarrow$ glucose - 6-Po_4

(ii) 3PGA $\rightarrow$ 2PGA

(iii) Fructose 6-Po_4 $\rightarrow$ fructose 1-6 biphosphate

(iv) PGAL $\rightarrow$ PEP

(v) PGAL $\rightarrow$ PGAP

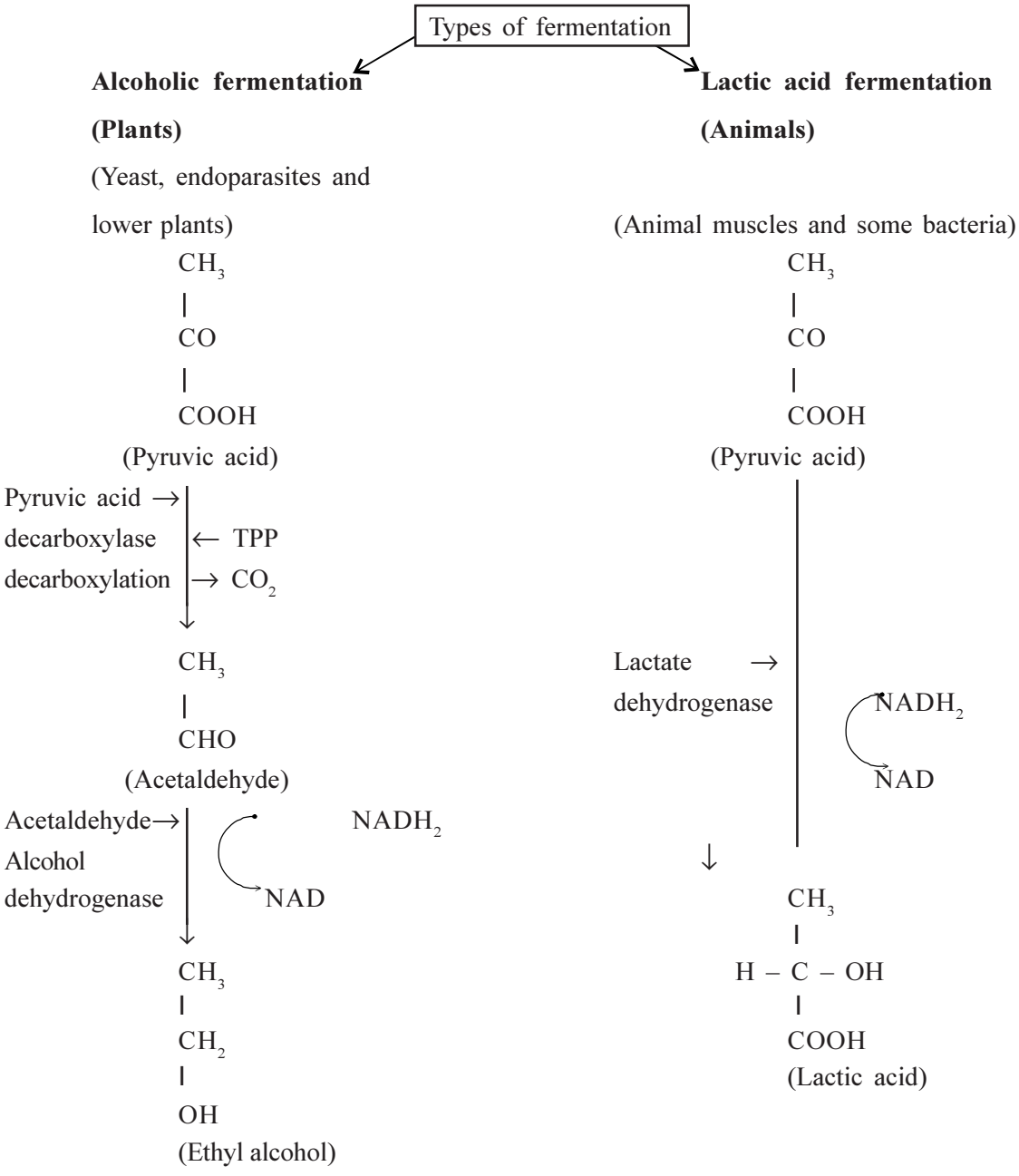
(A) (i), (ii), (iii), (v), (iv) (B) (i), (iii), (v), (ii), (iv)

(C) (i), (ii), (iv), (iii), (v) (D) (i), (iii), (v), (iv), (ii)

Answers : (8-C), (9-B), (10-C), (11-B), (12-C), (13-C), (14-C), (15-D), (16-D), (17-C), (18-B), (19-C), (20-D), (21-C), (22-D), (23-C), (24-B), (25-B), (26-B), (27-C), (28-B), (29-B), (30-B), (31-C), (32-C), (33-B), (34-D), (35-A), (36-B), (37-B)

Anaerobic cellular respiration (fermentation)

- **Takes place without O_2**
- **Glycolysis is the first stage of anaerobic respiration. Alcoholic fermentation is the second stage in plants, while in animals lactic acid fermentation takes place.**
- In this type of respiration comparatively less amount of energy is released.
- In this respiration incomplete breakdown of pyruvic acid occurs.
- During this process compounds like ethanol (ethyl alcohol C_2H_5OH) or lactic acid ($CH_3CHOHCOOH$) are produced from glucose.
- At the end of respiration 54 k cal energy releases.
- Anaerobic respiration occurs in the cytoplasm matrix of cytoplasm.
- Cytoplasm matrix of cytoplasm.



Summary of anaerobic respiration

- Respiration takes place in the absence of O_2.
- During this biochemical process It results in incomplete breakdown of glucose like organic molecule.
- In this type of respiration less amount (54 K cal) energy releases.
- The anaerobic respiration are of two types.

(1) **Alcoholic fermentation**

(yeast and lower class plants, endoparasites)

- equation :

$2CH_3CO\ COOH \xrightarrow[TPP]{decarboxylase} CH_3CHO + 2CO_2$

pyruvic acid — Acetaldehyde

$2CH_3CHO$

$Acetaldehyde + 2NADH_2 \xrightarrow[dehydrogenase]{Alcohol} 2(C_2H_5OH) + 2NAD$

(2) Lactic acid fermentation ethanol

(Some bacteria and animal muscle)

- equation :

$2CH_3CO\ COOH + 2NADH \xrightarrow[dehydrogenase]{lactate} 2CH_3\ CHOHCOOH + 2NAD$

pyruvic acid — lactic acid

38) Which process is neccessary to convert lactic acid from pyruvic acid ..... .

(A) Carboxylation (B) Reduction

(C) Oxidation (D) Decarboxylation

(39) Which type of respiration occur in human RBC ?

(A) Aerobic respiration (B) Lactic acid enzyme

(C) Alcoholic enzyme (D) None of above

(40) What produce when CO_2 and $2H^+$ Released from pyruvic acid ?

(A) citric acid (B) Lactate (C) Acetate (D) CO–A

(41) Which respiration process is only seen during anaerobic respiration in living organism ?

(A) TCA (B) ETS (C) CAM (D) EMP

(42) $2CH_3CO\ COOH \xrightarrow[TPP]{deccarboxylase}$ ..... + ...

(A) $2(C_2H_5OH) + NAD$ (B) $2CH_3CHO + O_2$

(C) $2CH_3CHO + 2\ CO_2$ (D) $CH_3CHOHCOOH + NAD$

(43) What is the end product of anaerobic respiration in animals ?

(A) $2CH_5CHOHCOOH.\ 2NAD^+$ (B) $2(C_2H_5OH),\ 2CO_2$

(C) $2CO_2,\ 2CH_3CHCOOH$ (D) $2CO_2,\ 2NADH_2$

(44) What is true when lactic acid formed during anaerobic respiration of two pyruvic acid ?

(A) loss of 3 ATP (B) loss of 6 ATP

(C) produce 3 ATP (D) produce 6 ATP

(45) How alcoholic and lactic acid fermentation is different from each other ?

(A) In alcoholic fermentation the end product possess 3 C.

(B) In production of lactic acid reduuction of pyruvic acid occurs.

(C) In alcoholic fermentation oxidation of pyruvic acid occurs.

(D) In alcoholic fermentation 4 ATP and in lactic acid 6 ATP are produced.

(46) During anaerobic respiration which one is first hydrogen receiver and last hydrogen donner ?

(A) PGAL (B) FAD (C) NAD (D) DHAP

(47) How much KJ energy is released when ethyl alcohol produce from glucose ?

(A) 225.93 (B) 686 (C) 2870.22 (D) 54

(Hint : 1 K.Cal = 4.184 KJ)

(48) How many glucose molecule is needed for formation of 38 ATP in anaerobic respiration ?

(A) 2 (B) 4 (C) 38 (D) 19

(49) What we get on reduction of acetaldehyde

(A) Methyl alcohol (B) Glycerol (C) Ethyl alcohol (D) Ethyl aster

(50) Which product is used in alcohol formentation of glycolysis ?

(A) CO_2 (B) $NADH_2$ (C) ATP (D) A and B both

(51) In alcoholic fermentation .....

(A) Triose phosphate is a electron donner when acetaldehyde is electron acceptor.

(B) Triose phosphate is a electron donner when pyruvic acid is electron acceptor.

(C) No electrone donner.

(D) O_2 is electron acceptor.

(52) If 15 CO_2 is produce instead of 18 by complete hydrolysis of 3 molecule of glucose in human muscles then how many CO_2 will produce in anaerobic respiration of glucose as a some living organism ?

(A) 03 (B) 02 (C) 00 (D) 04

(53) How many ATP is produce of oxidative phosphorylation of $NADH_2$ made by 5 molecule of glucose during glycolysis ?

(A) 28 (B) 20 (C) 15 (D) 30

(54) Which process is found in anaerobic respiration ?

(A) Dephosphorylation of PGA

(B) Oxidation of PGAL

(C) Oxidation of glucose

(D) Phosphorylation of PEP

(55) Which product is occur when fermentation of glucose by yeast ?

(A) Water and CO_2 (B) Methanol + O_2

(C) Ethanol + CO_2 (D) Ethanol and water

(56) In which process decarboxilation is seen ?

(A) Melic acid $\rightarrow$ oxalo acetic acid

(B) Pyruvic acid $\rightarrow$ acetaldehyde

(C) 2-phosphoglyceric acid $\rightarrow$ 2-Phospho enol pyruvic acid

(D) Citric acid $\rightarrow$ Isocitric acid

(57) In alcoholic fermentation ..... .

(A) Triose phosphate is electron donner and pyruvidc acid electron acceptors

(B) No electron donner

(C) Oxygen is electron acceptor

(D) Triose phosphate is electron donner and acetaldehyde is electron acceptors

(58) Which enzyme is useful in alcoholic fementation ?

(A) decarboxylase (B) Thimine pyrophosphate

(C) alcohol dehydrogenase (D) all above

(59) How many energy is released during fermentation ?

(A) < 7% (B) > 7% (C) 45% (D) 7%

(60) If 12(CO_2) is produce in alcoholic fermentation then substrate X and product Y

(A) X = 6 ($CH_3COCOOH$); Y = 6 (C_2H_5OH)

(B) X = 6 ($CH_6H_{12}O_2$); Y = 12 (C_2H_5OH)

(C) X = 12 ($CH_3COCOOH$); Y = 6 (C_2H_5OH)

(D) X = 12 ($CH_6CH_{12}O_6$); Y = 12 (C_2H_5OH)

(61) In yeast ..... and in animal muscle cells ..... are used in reduction during anaerobic respiration.

(A) CH_3CHO; $CH_3COCOOH$ (B) CH_3CHO; CH_3CHO

(C) $CH_3COCOOH$; Acetaldehyde (D) acetaldehyde, lactic acid

(62) Identify me " I am insidant of pyruvate reduction

(A) EMP - path (B) Fermentation

(C) TCA cycle (D) ETS

(63) End product of fermentation is ..... .

(A) O_2 and ethanol (B) O_2 and acetaldehyde

(C) CO_2 and ethanol (D) CO_2 and acetaldehyde

(64) Give the name of enzyme which convert pyruvic acid into acetaldehyde.

(A) Alcohol dehydrogenase (B) Pyruvid acid decarboxylase

(C) Hexokinase (D) oxidase

(65) Give the name of enzyme which convert pyruvic acid into lactic acid.

(A) Alcohol dehydrogenase (B) TPP

(C) Pyruvic acid decarboxylase (D) Lactate dehydrogenase

(66) It is a product of fermentation of alcohol ..... .

(A) O_2; CO_2 (B) 2(C_2H_5OH), $2CO_2$

(C) $2CO_2$, $2CH_2CHCOOH$ (D) $2CO_2$, $2NADH_2$

(67) What is true of lactic acid which produce from pyruvic acid during anaerobic respiration ?

(A) Loss of 3 ATP (B) Received 3 ATP

(C) Loss of 6 ATP (D) Received 6 ATP

Answers : (38-B), (39-B), (40-C), (41-D), (42-C), (43-A), (44-B), (45-B), (46-C), (47-A), (48-D), (49-C), (50-B), (51-A), (52-C), (53-D), (54-B), (55-C), (56-B), (57-B), (58-D), (59-A), (60-D), (61-D), (62-B), (63-C), (64-B), (65-C), (66-B), (67-D)

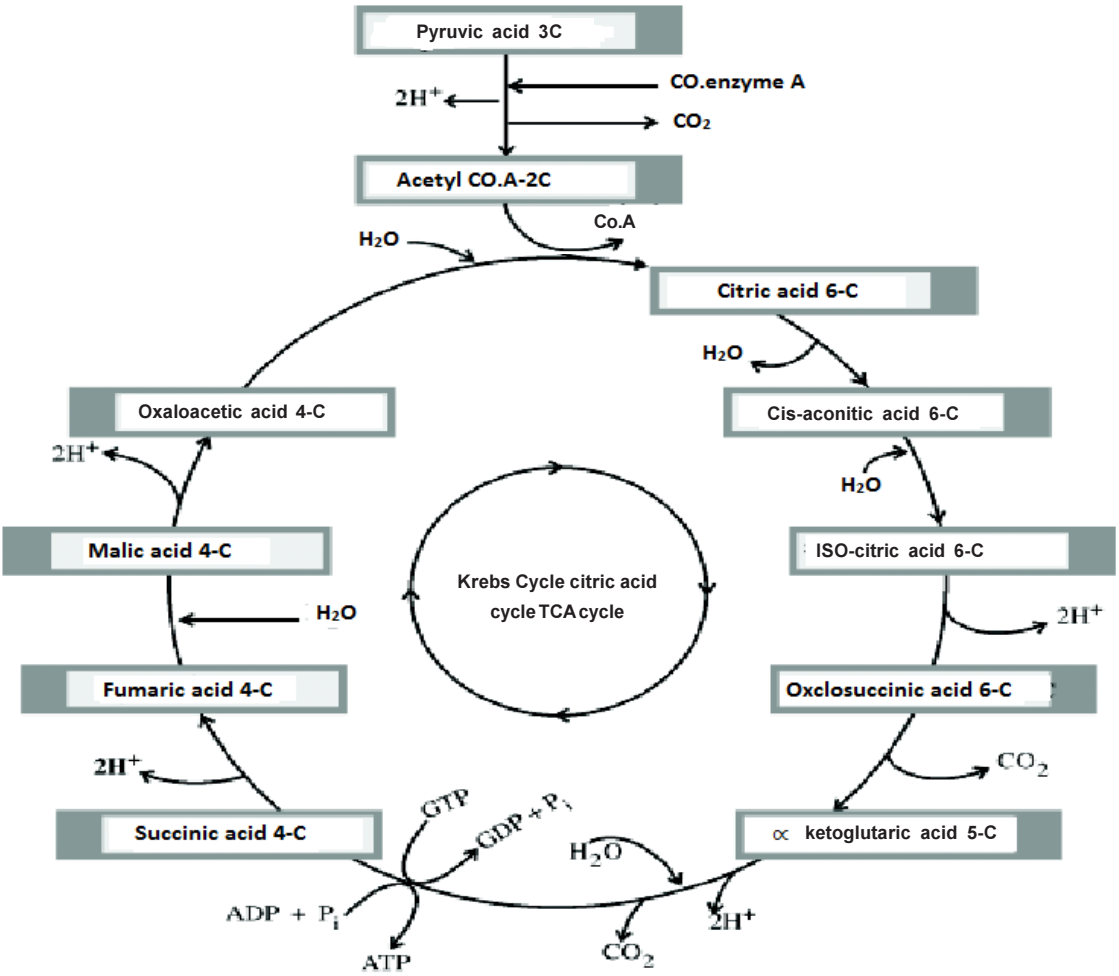
Krebs cycle (TCA cycle)

Discovered by - Hans krebs, Noble prize - 1953

- It is second stage of aerobic respiration followed by glycolysis.
- It provides a pathway for complete breakdown of glucose.
- This respiration is the process occurs in the presence of O_2.
- As the first substance formed is citric acid, this cycle is known as **citric acid cycle**.
- Citric acid possess three carboxylic groups, Hense, this cycle is also known as **TCA cycle** 3(-COOH).
- It provides the main pathway for synthesis of ATP.
- Two ATP are procuced during main pathway, but by the reduction of components of ETS 28 ATP are produced.
- Various carbon-complexes formed during this cycle provide necessary components for growth and maintenance of cell. These components are utilized in the synthesis of substances like amino acids, nucleotides, fats, chlorophyll and cytochromes.

- Stages involved in krebs cycle

No.	Process	Final product
1.	Pyruvic acid (3C) + NAD^+ + Co-A (acetyl group)	acetyl Co-A (2C) + $NADH_2$ + CO_2
2.	Oxaloacetic acid (4C) + acetyl Co-A (2C) + H_2O	Citric acid (6C) + Co-A
3.	Citric acid	Cis-aconitic acid (6C) + H_2O
4.	Cis-aconitic acid (6C) + H_2O	Isocitric acid (6C)
5.	Isocitric acid (6C) + NAD^+	Oxalosuccinic acid (6C) + $NADH_2$
6.	Oxalosuccinic acid (6C)	∝-Ketoglutaric acid (5C) + CO_2
7.	∝-Ketoglutaric acid (5C) + H_2O + NAD^+ + Co-A	Succinyl Co-A (4C) + $NADH_2$ + CO_2
8.	Succinyl Co-A + GDP + H_3PO_4 (Pi) GTP + ADP	Succinic acid (4C) + Co-A + GTP GDP + ATP
9.	Succinic acid (4C) + FAD^+	Fumaric acid (4C) + $FADH_2$
10	Fumaric acid (4C)+ H_2O	Malic acid (4C)
11	malic acid (4C) + NAD^+	Oxaloacetic acid (4C) + $NADH_2$



Krebs cycle

Differentiate between : Glycolysis and krebs cycle.

	Glycolysis	Krebs cycle
1.	It is respiration process occur in cytoplasm.	It is respiration process occurs in mitochondria.
2.	Aerobic as well as anerobic respiration means, either presence or absence of O_2 it occurs.	It is aerobic respiration means presence of O_2 is necessary.
3.	Two molecules of pyruvic acid are formed from one molecule of glucose.	It is continue cyclic process.
4.	At the end of the process net gain of 2 ATP and 2 molecules of $NADH_2$ are formed.	During this process 2 ATP molecules from GTP are formed and 6 $NADH_2$ and are also $2FADH_2$ are also formed.
5.	During this process CO_2 does not release.	In One krebs cycle 3 molecules of CO_2 releases

(68) If two molecule of glucose enter into aerobic respiration and one molecule of glucose enter in anaerobic respiration then how many NAD molecule is formed ?

(A) 20 (B) 10 (C) 14 (D) 08

(69) Which carbonic acid is seen between two decarboxylation in krebs cycle ?

(A) $\propto$ - Ketoglutaric acid (B) Isocitric Acid

(C) Oxalo succinic acid (D) Succinic Acid

(70) Which product is made if we remove CO_2 and $2H^+$ from pyruvic acid ?

(A) Acetyle Co-A (B) Citric Acid

(C) Acetate (D) Co-A

(71) Which is known as tricarboxylic acid ?

(A) Fumeric acid (B) Pyruvic acid

(C) Citric acid (D) Melic acid

(72) How many carbon molecue is occur in oxalo acitic acid ?

(A) 2 (B) 4 (C) 5 (D) 6

(73) Which of the following process are related in both decarboxylation and dehydrogenation ?

(A) Melate - Oxaloacitate
Succinate - Fumarte

(B) Succinate - fumarate
Fumerate - Melate

(C) C Isocitrate $\rightarrow$ $\propto$-Ketoglutarate
$\propto$-Ketoglutarate $\rightarrow$ Succinate

(D) $\propto$-ketoglutaric acid $\rightarrow$ Succinate
Malate $\rightarrow$ Oxaloacetate

(74) Product of TCA Cycle ?

(A) 2 $FADH_2$, 2 $NADH_2$, 2 GTP (B) 1 $FADH_2$, 2$NADH_2$, 1 GTP

(C) 1 $FADH_2$, 3 $NADH_2$, 1 GTP (D) 1 $FADH_2$, 4 $NADH_2$, 1 GTP

(75) Which is isomer of citric acid ?

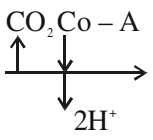
(A) Cis - aconitic acid (B) Malic acid

(C) iso-citric acid cycle (D) $\propto$ - Ketoglutaric acid

(76) How many ATP formed of two molecule of pyruvic acid in krebs cycle ?

(A) 28 (B) 30

(C) 36 (D) 38

(77) Pyruvic acid 

Acetyl-Co-A where this process occur ?

(A) In matrix of cell (B) In chloroplast

(C) In krebs cycle (D) In matrix of mitochondria

(78) How many carboxylic groups found in citric acid ?

(A) 2 (B) 4

(C) 3 (D) 6

(79) Which is true for dehydrogenation process ?

(A) Iso-citrate → ∝-ketoglutrate → succinyl Co-A → Fumaric acid

(B) Citrate → Iso citrate → succinate → fumaric acid

(C) Acetyle Co - A → citrate → Isocitrate → Malet

(D) Citrate - isocitrate - fumaric acid - Malet

(80) How many CO_2, $2H^+$ and $2e^-$ released when one molecule of pyruvic acid enter into krebs cycle ?

(A) 6, 10, 10 (B) 3, 5, 5 (C) 10, 10, 6 (D) 5, 5, 3

(81) How many ATP formed in one time through substrate in krebs cycle ?

(A) 1 (B) 3 (C) 2 (D) 4

(82) How many $NADH^+$ H^+ ion in one time kreb cycle ?

(A) 2 (B) 6 (C) 4 (D) 5

(83) Where is most less ATP produce in aerobic respiration ?

(A) Pyruvate - acetyl Co - A

(B) Succinyl - Co - A - Succinic acid

(C) Malic acid - oxaloacetic acid

(D) Isocitric acid - oxalosuccinic acid

(84) How many water molecule produce and used respectivly during aerobic respiration in mitochondria matrix ?

(A) 6 and 6 (B) 12 and 6 (C) 14 and 8 (D) 2 and 8

(85) What happened of malic acid in krebs cycle ?

(A) decarboxylation (B) Hydrolysis (C) Oxidation (D) Reduction

(86) By whom FAD as electro acceptor in Krebs cycle ?

(A) succinyl Co-A - Succinic acid (B) Fumaric acid - melic acid

(C) Succinic acid - Fumaric acid (D) Malic acid - Oxaloacetic acid

(87) Which molaule of primary and secondary in aerobic respiration ?

(A) Pyruvic acid (B) Co-A (Co. factor)

(C) Oxaloacetate (D) Acetyle Co-A

(88) If secondery phase is not occur then which product is found in glucose aerobic respiration ?

(A) 4 ATP, 10 $NADH_2$, 2 $FADH_2$ (B) 4 ATP, 6 $NADH_2$, 1 $FADH_2$

(C) 2 ATP, 8 $NADH_2$, 1 $FADH_2$ (D) 2 ATP, 8 $NADH_2$, 2 $FADH_2$

(89) Which primary process is seen of pyruvic acid during both aerobic and anaerobic respiration ?

(A) Decarboxylation (B) Caboxylation (C) dehydrogenation (D) A and C both

(90) Connecting link between glycolysis and krebs cycle.

(A) Oxalo acitate (B) PEP (C) Pyruvate (D) Acetylco-A

(91) How malic acid formed from fumaric acid ?

(A) H_2O (B) H_2O (C) by CO_2 removal (D) CO_2 addition

(92) Pyruvic acid co.A + NAD $\rightarrow$

(A) Acetyl Co-A + $NADH_2$

(B) Acetyl Co. A + $NADH_2$ + CO_2

(C) Acetyl Co-A + $NADPH_2$ + CO_2

(D) Acetyl Co-A + $NADH_2$ + CO_2

(93) In which process dehydrogenation occur but do not decarboxylation in krebs cycle ?

(A) Citric acid - isocitric acid

(B) Succinic acid - fumaric acid

(C) Fumaric acid - Malic acid

(D) Isocitric acid - Oxalo succinic acid

(94) How many CO_2, $2H^+$ $2e^-$ Released when one molecule of pyruvic acid pass on krebs cycle ?

(A) 6, 10, 10 (B) 10, 10, 6 (C) 3, 5, 5 (D) 5, 5, 3

(95) Product of krebs cycle.

(A) $4NAD^+ + FAD^+ + 2H_2O$

(B) $4NAD^+ + FAD^+ + 2H_2O$ + ADP + Pi

(C) $CH_3CO.COOH + 4NAD^+ + FAD^+ + 2H_2O$ + ADP + Pi

(D) $3CO_2$, $4NADH + 4H^+ + FADH_2$ + ATP

(96) Which molecue is contain 4C in krebs cycle ?

(A) Citric acid (B) 2-Kitoglutarate (c) (C) Isocitrate (D) Succinic acid

(97) Importance of krebs cycle.

(A) It provides a pathway for complete breakdown of glucose

(B) It provides the main pathway for synthesis of ATP

(C) Various carbon - complex formed during this cycle provide necessary components for growth and maintenance of cell

(D) All three - A, B, C are important

(98) In which process CO_2 is released during krebs cycle

(A) $\propto$- keto glutaric acid - succinic acid

(B) Citric acid - Iso citric acid

(C) Succinic acid - Fumaric acid

(D) Malic acid - oxalo acetic acid

(99) Matrix related phosphorylation occur when .....

(A) Succinic acid convert into fumaric acid

(B) Succinic acid co-A convert into, succinic acid

(C) Fumaric acid convert into melic acid

(D) Isocitric acid convert into α-keto glutaric acid

(100) Which is true sequence of carbonic acid in krebs cycle ?

(A) Citric acid - oxalo succinic - isocitric acid

(B) Citri acid - isocitric acid - Oxalo succinic acid

(C) Isocitric acid - oxalo succinic acid - citric acid

(D) Oxalo succinic acid - isocitric acid - citric acid

Answers : (68-A), (69-A), (70-A), (71-B), (72-B), (73-C), (74-D), (75-C), (76-A), (77-D), (78-C), (79-A), (80-C), (81-A), (82-C), (83-B), (84-D), (85-C), (86-C), (87-D), (88-A), (89-A), (90-D), (91-B), (92-B), (93-B), (94-C), (95-D), (96-D), (97-D), (98-A), (99-B), (100-B)

Electron transport chain (ETC)

Or

Oxidative Phosphorylation

Or

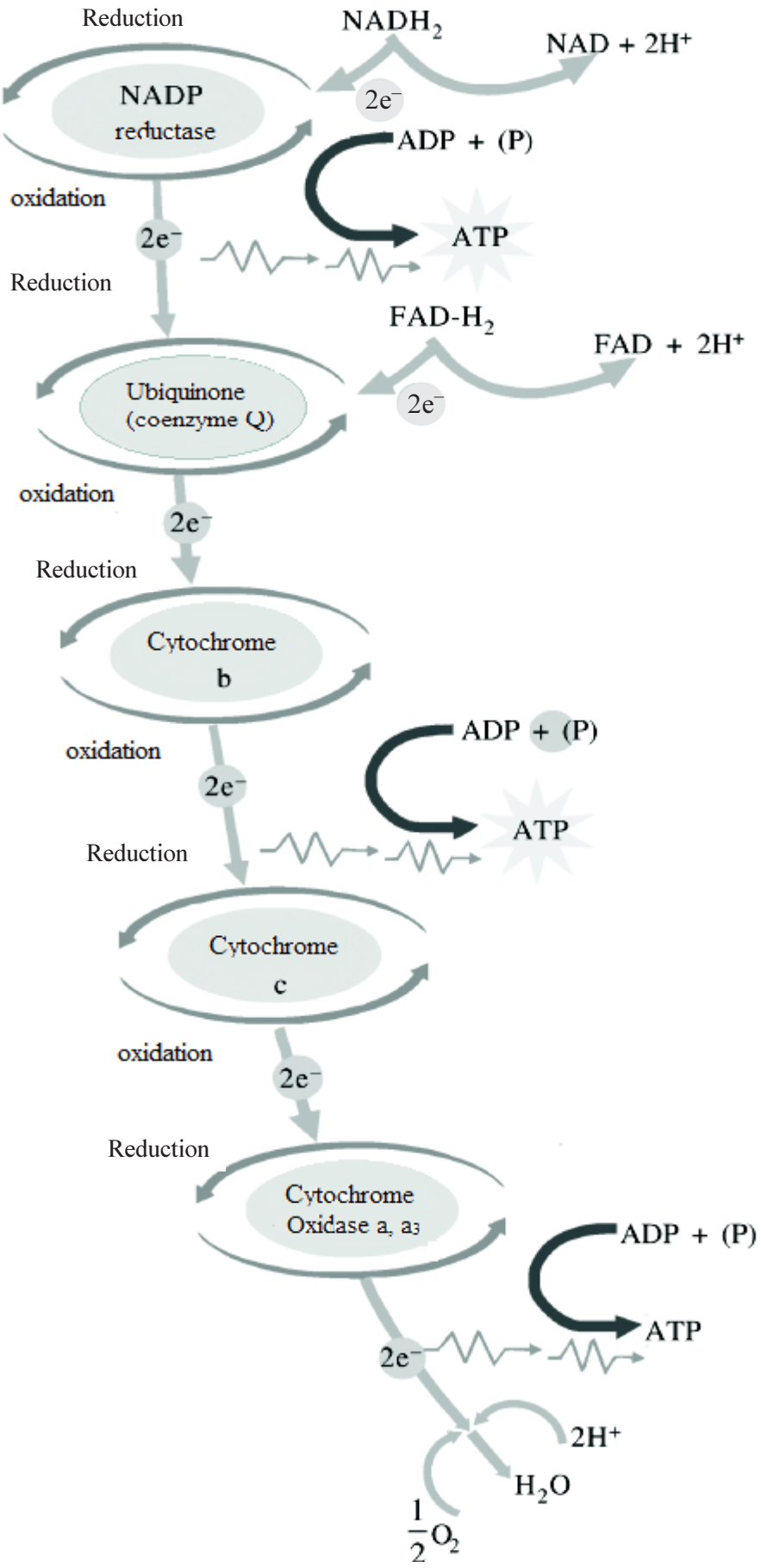
Last (third) stage of cellular respiration

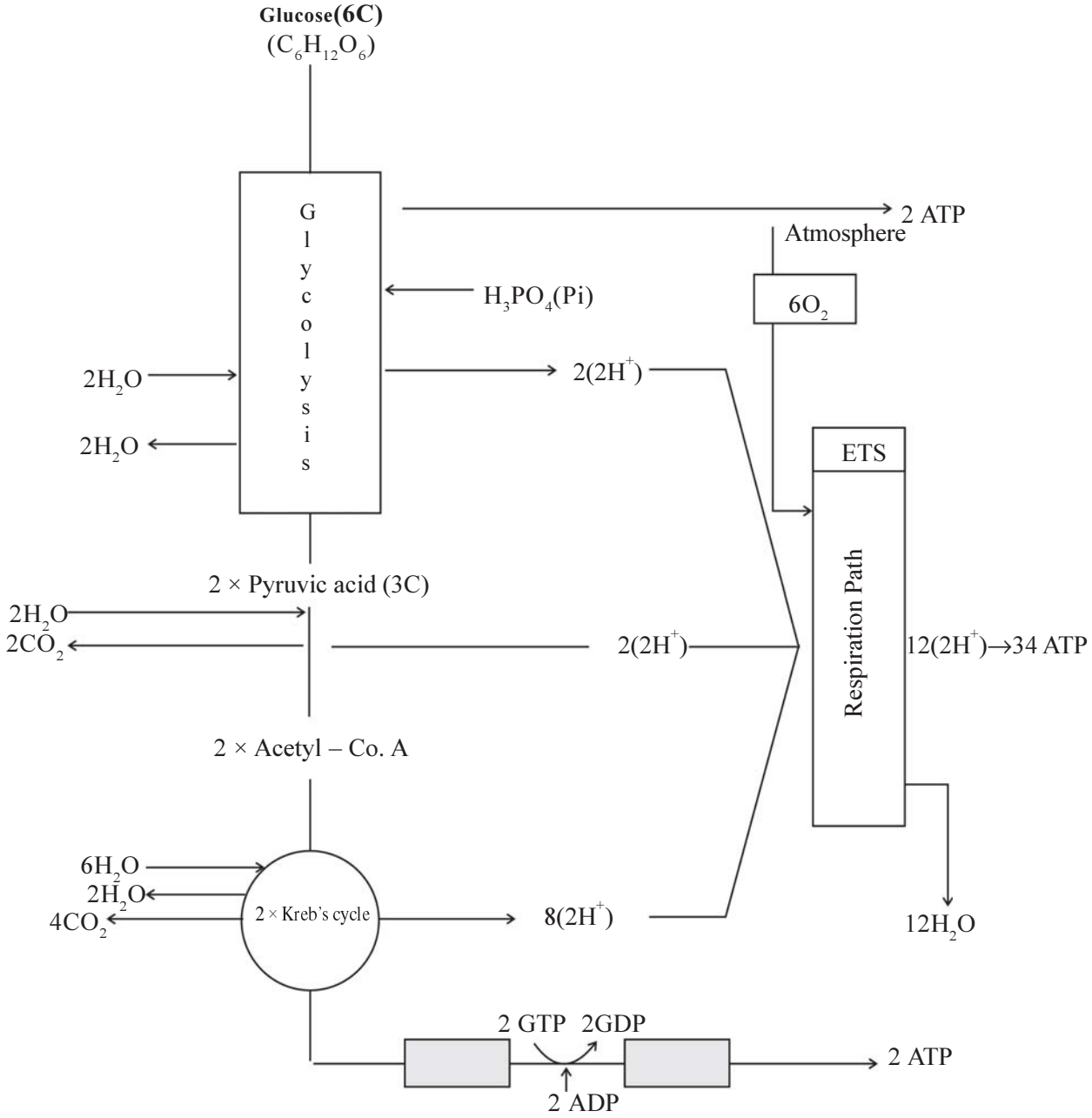
- $NADH_2$ and $FADH_2$ formed by dehydrogenation of $2H^+$ during glycolysis and krebs cycle do not react directly with oxygen (O_2).
- Hydrogen acceptors like NAD and FAD reduce them and they convert into $NADH_2$ and $FADH_2$.
- NAD and FAD work as coenzyme, it reduced in mitochondrial matrix and transports electrons in mitochondrial respiration pathway. So this pathway is known as electron transport system (ETS).
- Where $NADH_2$ and $FADH_2$ formed during this process are transported to atmospheric O_2 and oxidized, ATP is released.
- Transportation of $2H^+$ and $2e^-$ towards O_2 is essential.
- The metabolic pathway through which the electron passes from one carrier to another is called the Electron Transport System (ETS).
- This system is performed of inner membrane of mitochondria.
- By oxidation of one $NADH_2$ and on $FADH_2$ 3 ATP and 2 ATP are formed respectively . Which is as following :

(1) $NAD^+ + H \xrightarrow[\text{Reduction}]{} NADH_2 + \frac{1}{2} O_2 \xrightarrow[\text{oxidation}]{} NAD^+ + 3ATP + H_2O$

(2) $FAD^+ + H \xrightarrow{\text{Reduction}} FADH_2 + \frac{1}{2} O_2 \xrightarrow{\text{oxidation}} FAD^+ + 2ATP + H_2O$

- Mechanism of chemiosmotic generation of ATP.
- Since mitochondrial membrane is impermeable to protons. These can not be diffused back into the matrix across the membrane.


Reduction
NADH2
NAD + 2H+
NADP
reductase
2e−
ADP + (P)
oxidation
2e−
ATP
Reduction
FAD-H2
FAD + 2H+
Ubiquinone
(coenzyme Q)
2e−
oxidation
2e−
Reduction
Cytochrome
b
oxidation
ADP + (P)
2e−
ATP
Reduction
Cytochrome
c
oxidation
2e−
Reduction
Cytochrome
Oxidase a, a3
ADP + (P)
ATP
2e−
2H+
H2O
1/2 O2



Whole equation for aerobic respiration

$$C_6H_{12}O_6 + 6H_2O + 6O_2 \rightarrow 12H_2O + 6CO_2 + 38 \text{ ATP}$$

(101) How many ATP are formed during complete breakdown of glucose from $NADH_2$ and $FADH_2$ oxidation ?

(A) 3 ATP (B) 2 ATP (C) 34 ATP (D) 36 ATP

(102) In which of the following process O_2 is used directly ?

(A) glycolysis (B) ETS (C) Citric acid cycle (D) Alcoholic fermentation

(103) How many ATP are formed during complete breakdown of 3 glucose molecule from $NADH_2$ oxidation ?

(A) 60 (B) 90 (C) 180 (D) 38

(104) Which is true sentence for aerobic respiration ?

(A) NPD is first respiratory substance which accepts hydrogen.

(B) NAD is a last hydrogen donner.

(C) Cy + C_3 is a last electron donner.

(D) Oxygen is a last component for receiving eletron.

(105) How many protons (H^+) are released from $12H_2O$?

(A) $6H^+$ (B) $12H^+$ (C) $24H^+$ (D) $18H^+$

(106) Which process is found during last phase of aerobic respiration ?

(A) Oxidative phosphorylation (B) Electron circulation

(C) A and B both (D) Electron excretion

(107) What is another name of ubiquinone ?

(A) cyt – b (B) NADP Reductase

(C) COA – Q (D) Cyctocrome oxidase

(108) Which is not respiration related enzyme ?

(A) Cytocrome oxidase (B) TPP

(C) Pyruvate dehydrogenase (D) RubisCO

(109) In which process energy released by hydrogen acceptor during respiration ?

(A) Glycolysis (B) ETS (C) TCA-cycle (D) Fermentation

(110) In last process of aerobic respiration, which process is seen after $FADH_2$ oxidation ?

(A) $\frac{1}{2}$ O_2 received $2e^-$ and $2H^+$ during ETS.

(B) $2e^-$ is released in ETS when $2H^+$ remain in the Matrix.

(C) $2e^-$ NADP reductase enter into ETS when $2H^+$ remain in the matrix.

(D) None of the above.

(111) Which is true related to ETS ?

(A) CO. A–Q - $\xrightarrow{2e^-}$ cyt – b + ATP (B) cyt – C $\xrightarrow{2e^-}$ cyt – a, a_3 + ATP

(C) cyt – b - $\xrightarrow{2e^-}$ cyt – c + ATP (D) A and C Both

(112) If aerobic respiration occur in PEP = X how many ETS take place = X.

How many ATP formed in matrix = Y X

How many ATP formed in oxidative phosphorylation = 2 Y

(A) X = 4; Y = 3; Z = 15 (B) X = 5; Y = 2, Z = 14

(C) X = 6; Y = 1; Z = 17 (D) X = 1; Y = 4; Z = None of All

(113) Maltose X $\rightarrow$ Y = NAD reduction

(A) X = glucose Y = 10 NAD (B) X = $C_6H_{12}O_6$; Y = 5 NAD

(C) X = 2($C_6H_{12}O_6$); Y = 10 NAD (D) X = 2($C_6H_{12}O_6$); Y = 20 NAD

(114) Which is true sequence during ATP synthesis of electron receptor ?

(A) Cyt (a_1, a, b, c) (B) Cyt (b, c, a, a_3)

(C) Cyt (b, c, a, a) (D) Cyt (c, b, a, a_3)

(115) In which process energy is released from ETS ?

(A) Ubiquinone $\xrightarrow{2e^-}$ Cytocrome b (B) Cytocrome $\xrightarrow{2e^-}$ Cytocrome c

(C) Cytocrome $\xrightarrow{2e^-}$ Cytocrome a, a_3 (D) above three

(116) All process of krebs cycle : occur in mitochonria matrix : : all process of ETS : ..... .

(A) Matrix of mitochondria (B) Matrix of cell

(C) Cristymembrane of mitochondria (D) Matrix of peroxisome

(117) Which one is first receptor of $2H^+$ and $_{2e^-}$ from $NADH_2$?

(A) NAD Reductase (B) alcolage

(C) Hexokinase (D) None of above

(118) Give the name of enzyme which take place in oxidative phosphorylation.

(A) Aldolase (B) NAD Reductase (C) Hexokinase (D) None of above

(119) How many ETS take place during the one molecule of pyruvic acid breakdown ?

(A) 14 ETS (B) 5 ETS (C) 6 ETS (D) 1 ETS

(120) How many ATP produce during bio-oxidation of $NADH_2$?

(A) 2 ATP (B) 6 ATP (C) 3 ATP (D) 1 ATP

(121) Which is end product of oxidative phosphorylation ?

(A) ATP (B) $FADH_2$ (C) $NADH_2$ (D) Electron

(122) How many ATP produce during oxidative phosphorylation of pyruvic acid ?

(A) 12 (B) 14 (C) 13 (D) 15

Answers : (101-C), (102-B), (103-B), (104-C), (105-C), (106-B), (107-C), (108-D), (109-B), (110-A), (111-D), (112-B), (113-D), (114-B), (115-B), (116-C), (117-A), (118-B), (119-B), (120-C), (121-A), (122-B)

ATP

- However, these can enter the membrane via a proton channel.
- Which is established by the membrane bound adenosine triphosphatase (ATPase).
- ATPase is multienzyne complex containing two parts F_0 and F_1
- F_1 headpiece is a peripheral membrane protein complex.
- This is the site for the synthesis of ATP from ADP.
- For each ATP produced, $2H^+$ passes through F_0 from the intermembrane space to the matrix down the electrochemical proton gradient.
- Thus for each pair of protons flowing back into matrix, one molecule of ATP is synthesized.
- So for three pairs of protons, three molecules of ATP are generated.

  (Note : 3 Molecules of ATP are formed from $NADH_2$ when 2 molecules of ATP are formed from $FADH_2$ because they have only 2 pairs of protons.)

Energy capacity available to glucose by aerobic respiration

- From slow oxidation of 1 mole glucose 180 grams CO_2, H_2O and only

2870 KJ mol^{-1} (686000 cal 686 K cal) energy produce which is stored in form of 38 ATP.

- When ATP is hydrolised then produced energy is useful for biological activity.

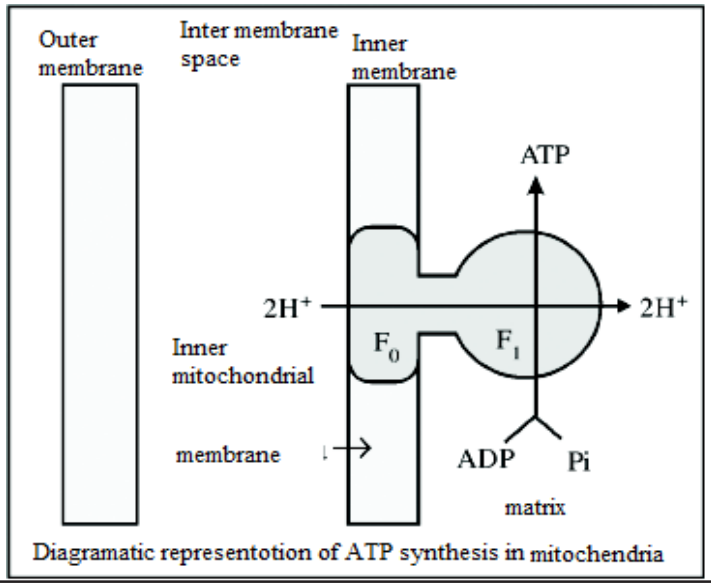
Which is 1 ATP = 34 KJ. (7.3 K cal)

Energy capacity of glucose = $38 \times \frac{34}{2870}$

= 1292 KJ

= 45 %

- Thus, the efficiency of the process of transformation of potential chemical energy in glucose into the energy in ATP is about 45%. The remaining 55% energy is dissipated as heat.



Diagramatic representotion of ATP synthesis in mitochendria

(123) Where ATPase F, component is seen in mitochondria ?

(A) Proton channel (B) middle membrane of mitochondria

(C) Peripheral mambrane of mitochondria (D) Matrix of mitochondria

(124) How many pair of protons needed for formation of 3 ATP ?

(A) 3 (B) 6 (C) 9 (D) 12

(125) Chemiosomotic theory is related with ..... .

(A) K^+ ion theory (B) H^+ ion theory

(C) membrane capacity (D) Protongradient

(126) Which characteristic is found in mitochondrial membrane for entry proton ?

(A) Permeable (B) Semi permeable (C) impermeable (D) None of above

(127) By whom proton channel produce ?

(A) ATPase (B) Multi enzyme complex

(C) Adenosine triphosphate (D) above all

(128) How many ATP molecule produce with the help of one pair of proton ?

(A) 1 (B) 2 (C) 3 (D) 4

(129) In which complex ATP format formed ADP ?

(A) F_0 (B) F_1

(C) F_2 (D) F_3

(130) How many protons tranfered by $FADH_2$ towards F_0 and F_1 complex ?

(A) 2 (B) 6

(C) 4 (D) 8

(131) In mitochondria related of chemiosomotic ..... .

(A) On the basis of proton gradient there is movement of $2H^+$ from inter-membrane space to matrix.

(B) ATP produce by passing every pair of protons towards matrix.

(C) $2H^+$ passes from ATPase ATP F_0 to F_1 by proton rediant

(D) above all

Answers : (123-C), (124-B), (125-D), (126-C), (127-D), (128-A), (129-B), (130-C), (131-D)

Respiration balance sheet

	Step of reaction	**Consumed ATP**	**Released ATP**	**Net gain ATP**
●	Glycolysis			
1.	Glucose → glucose 6-P	1 ATP		1 ATP
2.	Fructose 6-p → Fructose 1,6 biphosphate	1 ATP		
3.	3-phosphoglyraldehyde ↓ 1,3-biphosphate glyciric acid		3 ATP	3 × 2 = 6 ATP
4.	1,3-biphosphate glyciric acid ↓ 3-phosphoglyciric acid		1 ATP	1 × 2 = 2 ATP
5.	2-phosphoenol pyruvic acid ↓ Pyruvic acid		1 ATP	1 × 2 = 2 ATP
6.	Pyruvic acid → Acetyl coA.		3 ATP	3 × 2 = 6 ATP
●	Krebs cycle			
7.	Isocitric acid - Oxalo succinic acid		3 ATP	3 × 2 = 6 ATP
8.	α -Ketoglutaric acid → Succnyl co A		3 ATP	3 × 2 = 6 ATP
9.	Succnyl Co A → Succinic acid		1 ATP	1 × 2 = 2 ATP
10.	Succinic acid → Fumaric acid		2 ATP	2 × 2 = 4 ATP
11.	Malic acid → Oxalo acetic acid		3 ATP	3 × 2 = 6 ATP
			Total	**38 ATP**

(132) How many ATP are produce in aerobic respiration without phosphorylation ?

(A) 2 (B) 4 (C) 6 (D) 8

(133) How many ATP are produce after glycolysis and before krebs cycle ?

(A) 1 (B) 3 (C) 12 (D) 8

(134) How many ATP are used when pyruvic acid enter into mitochondria ?

(A) 2 (B) 4 (C) 0 (D) 8

(135) If 162 ATP are phosphorylated during aerobic respiraltion of complet breakdown of glucose then how many NAD reduced in same process ?

(A) 45 (B) 38 (C) 10 (D) 36

(136) Which product is formed during respiration of 360 gm glucose and 384 gm oxygen ?

(A) 528 gm CO_2 + 432 gm H_2O + energy (B) 180 gm CO_2 + 2.64 gm H_2O + energy

(C) 528 gm CO_2 + 180 gm H_2O + energy (D) 264 gm CO_2 + 264 gm H_2O + energy

(137) By complete oxidation of one molecule of glucose, among 38 ATP produce by

(A) 2 ATP in EMP path : 36 ATP in ETS

(B) 2 ATP outside mitochondria : 36 ATP in mitochondria

(C) 8 ATP outside mitochondria : 30 ATP in mitochondria

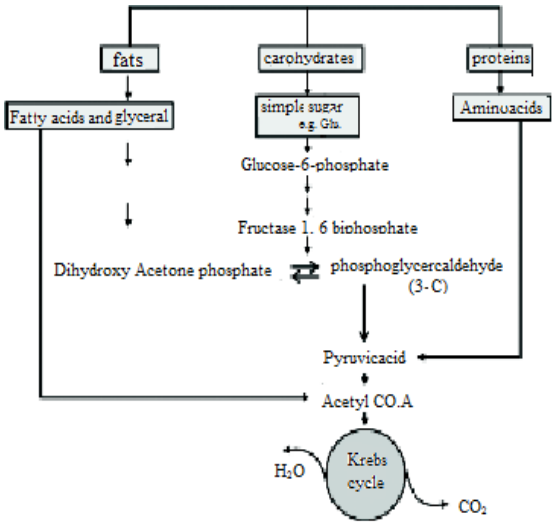
(D) 6 ATP in EMP : 32 ATP in ETS

Answers : (132-A), (133-B), (134-A), (135-A), (136-A), (137-B)

Amphybolic pathway
(bidirectional metabolism pathway)

- Carbohydrate (glucose) oxidation is main respiration pathway.
- Other important organic components or substrates like lipid or protein also can be respired.
- Fats need to be broken down into glycerol and fatty acids first. Now fatty acids degraded into acetyl Co A and glycerol to DHAP → PGAL and then enter into respiratory pathway.
- In case of protein they first broken down into their monomers amino acids after that enter respiratory pathway.
- Both oxidation and reduction process can be seen in respiration pathway.
- It is involved in both anabolic and catabolic processes and hence it is known as an amphibolic pathway.

Respiratory Substrates



(138) Which componant take place in respiration path ?

(A) Fatty acid (B) glycerol

(C) Lipid (D) Acetyl Co-A

(139) Which 2 carbon organic containing substance is elegible to enter into kreb cycle ?

(A) Oxalo acitic acid (B) Acetyle co-A

(C) pyruvic acid (D) glycerol

(140) Which form of glycerol is enter in glycolysis ?

(A) Fructose - 6-phosphate

(B) PGAL

(C) glucose-6-phosphate

(D) Fructose 1-6-biphosphtate

(141) Give the name of 3-c cotaining substance which produce in amphibolic path and enter into respiration path.

(A) Pyruvic acid (B) PGAL

(C) glycerol (D) Acetaldehyde

(142) Which of the following process is occur in both anabolic and catabolic ?

(A) Krebs cycle (B) glycolysis

(C) Amphibolic path (D) Electron transfer system

(143) ..... enter into respiration path by fatty acid breakdown.

(A) Citric acid (B) OAA

(C) PGAL (D) Acetyl Co - A

(144) During the lipid respiration glycerol enter into respiratory path in which sequance ?

(A) Glycerol $\rightarrow$ acetyl co A $\rightarrow$ TCA cycle

(B) Glycerol $\rightarrow$ DHAP $\rightarrow$ PGAL $\rightarrow$ EMP

(C) Glycerol $\rightarrow$ Pyruvic acid $\rightarrow$ Krebs cycle

(D) Glycerol $\rightarrow$ PGAL $\rightarrow$ Krebs cycle

(145) Catabolic path is also called as amphibolic pathway because ..... .

(A) only include anabolic process

(B) it include only respiratory process

(C) it include both anabolic and catabolic process

(D) None of above

(146) Energy released from 1 gram of total breakdown is ..... .

(A) high, when, wheat starch as a reagent

(B) high when potato starch as a reagent

(C) high, when rice starch as a reagent

(D) Energy produce equally in all above

Answers : (138-D), (139-B), (140-C), (141-A), (142-C), (143-D), (144-B), (145-C), (146-D)

Respiratory quatient

Definition : At specific temperature and pressure the ratio of released CO_2 to the O_2 consumed during respiration is called (RQ) respiratory quatient.

Equation

$$RQ = \frac{CO_2 \text{ released during respiration}}{O_2 \text{ consumed during respiration}} = \frac{CO_2}{O_2}$$

- Burning capacity (ignition capacity) of respiratory substance of tissue can be known by RQ.

RQ of Carbohydrates

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy}$

$$RQ = \frac{6CO_2}{6O_2} = 1$$

- RQ of fats

$2(C_{51}H_{98}O_6) + 145\ O_2 \rightarrow 102\ CO_2 + 98H_2O + \text{energy}$

$$RQ = \frac{102\ CO_2}{145\ O_2} = 0.7$$

- RQ for protein is 0.9
- As O_2 is not consumed during anerobic respiration RQ is infinitive (α).
- When respiratory substances are more than one pure protein or fats never use as respiratory mollecules.

---

(147) How much RQ of carbohydrate ?

(A) 1 (B) less than 1 (C) more than 1 (D) α

(148) What is value of RQ in lipid ?

(A) 1 (B) less than 1 (C) more than 1 (D) α

(149) How much RQ of 2 $(C_{51}H_{98}O_6)$?

(A) 0.8 (B) 0.7 (C) 0.9 (D) 1

(150) $2\ (COOH) + O_2 \rightarrow 4CO_2 + 2H_2O$ + Heat How much RQ of given equation ?

(A) 4 (B) 1 (C) Less then 1 (D) α

(151) If RQ = 0.7 for one respiratory substance. What is indicates ?

(A) For breakdown more O_2 needed (B) For breakdown less O_2 needed

(C) O_2 is not used (D) it contain O_2

(152) $CH_3COCOOH + NADH_2 \rightarrow CH_3CHOHCOOH + NAD$ How much RQ of given equation ?

(A) 0 (B) Not to be conted

(C) 1 (D) α

(153) What will be the RQ for ethenol producing during alcoholic fermentation ?

(A) 0 (B) 1 (C) More than one (D) Infinite

(154) It RQ is α what it indicate ?

(A) more CO_2 produce (B) O_2 is produce (C) Not use of O_2 (D) it contain more O_2

(155) If RQ is maximum then which molecule occur ?

(A) Fat (B) Glucose (C) Proteine (D) carbonic acid

(156) How much RQ of hexosemonosaccharides ?

(A) 4 (B) 3 (C) 2 (D) 1

(157) For which more CO_2 releases than O_2 consumption during respiration ?

(A) Glucose (B) Fat (C) Protein (D) Sucrose

(158) RQ = ...

(A) $\frac{O_2 consumed}{released\ CO_2}$ (B) $\frac{released\ CO_2}{consumed\ O_2}$ (C) $\frac{released\ O_2}{consumed\ CO_2}$ (D) $\frac{released\ CO_2}{released\ O_2}$

(159) ..... change RQ will change.

(A) Light (B) Product (C) Substence (D) Type of respiration

(160) $2(C_{51}H_{98}O_6) + (X) \rightarrow (Y) + 98H_2O$ + Energy ?

(A) X = 145 O_2; Y = 102 CO_2 (B) X = 145 CO_2; Y = 102 O_2

(C) X = 102 O_2; Y = 145 CO_2 (D) X = 102 CO_2; Y = 145 O_2

(161) $2C_6H_{12}O_6 + 3O_2 \rightarrow 3C_4H_6O_5 + 3H_2O$ + 386 K.Cal What is RQ of given equation ?

(A) 0 (B) α (C) 3 (D) 0.3

(162) If RQ is - 0.7 what it indicate ?

(A) More O_2 is needed for respiration (B) less O_2 is needed for respiration

(C) No O_2 is used for respiration (D) it contain more O_2

(163) If RQ is less than one then material will be ..... .

(A) lipid (B) Carbonic Acid

(C) Protein (D) Glucose

(164) What indicates given figure ?

(A) Diagramatic representation of ATP synthesis in mitochondria.

(B) Diagramatic representation of ATP Release in mitochondria.

(C) Diagramatic representation of ATP synthesis in Cytoplasma

(D) Diagramatic representation of ATP release in cytoplasma

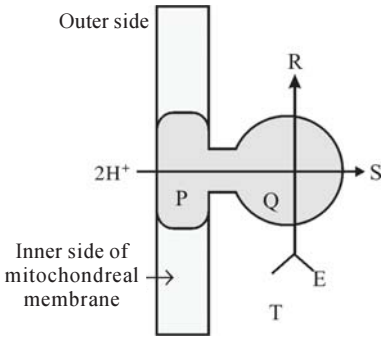


Figure 1

(165) Give the name of P and Q in figure 1.

(A) P–F_1 Q-F_2 (B) P–F_0, Q–F_1 (C) P–F_1 Q–F_0 (D) P–ADP- Q –ATP

(166) What indicate R in given figure 1 ?

(A) F_1 (B) Matrix (C) $2H^+$ (D) ATP

(167) What indicate T in given figure 1 ?

(A) F_1 (B) Matrix (C) $2H^+$ (D) ATP

(168) What indicates in given figure 1 ?

(A) F_1 (B) Matrix (C) $2H^+$ (D) ATP

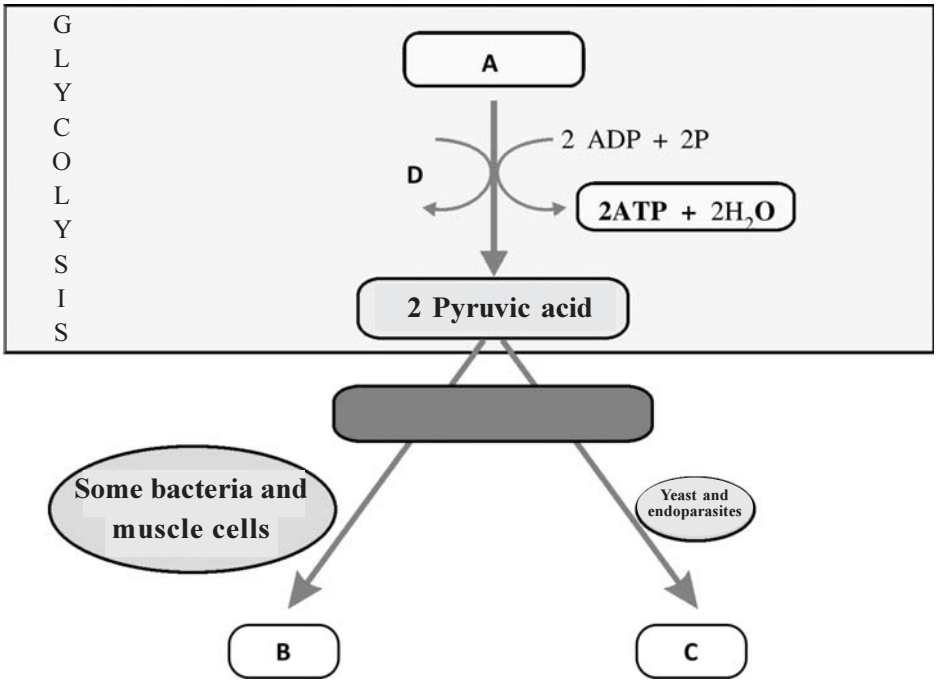


Figure 2

(169) Which biochemical process indicates given figure - 2 ?

(A) Glycolysis (B) Krebs cycle

(C) Fermentation (D) Amphibolic pathway

(170) What indicate P in given figure 2 ?

(A) Lactic Acid (B) Ethanol

(C) Hexose sugar (D) $NADH_2 \rightarrow NAD$

(171) What indicate S in given figure 2 ?

(A) $FADH_2 \rightarrow FAD$ (B) $NADH_2 \rightarrow NAD$

(C) $ADP \rightarrow ATP$ (D) Ethyl alcohol

(172) What indicate Q in given figure 2 ?

(A) Ethyl alcohol (B) Methyl alcohol

(C) Lactate (D) Phospho enol pyruvic acid

(173) What indicate R in given figure 2 ?

(A) Ethyl alcohol (B) Phosphoenol pyruvic

(C) Lactic acid (D) Hexose sugar

Select appropriate answer given below

(A) A and R both are true, R is explanation of A.

(B) A and R both are true, R is not explanation of A.

(C) A is true, R is flase.

(D) A is flase, R is true.

(174) A = ETS performed in cristy

R = Mitochondria matrix - TCA performed

(A) (B) (C) (D)

(175) A : RQ of Fat is less then one.

R : Fat has more oxygen then carbohydrate.

(A) (B) (C) (D)

(176) A : Aerobic and aenaerobic respiration start with glycolycis.

R : Aenaeroblec respiration occur in glycolysis only.

(A) (B) (C) (D)

(177) A : The ratio of released CO_2 to the O_2 consumed during respiration is called RQ

R : Burning capacity of respiratory substance can be known by RQ.

(A) (B) (C) (D)

(178) A : Ethanol produces by reduction of acetaldehyde

R : For that alcohol dehydrogenase enzyme is responsible.

(A) (B) (C) (D)

(179) A : 6 ATP produce during 2 $NADH_2$ oxidative phosphorylation.

R : 6 ATP produce during 3 $NADH_2$ oxidative phosphorylation.

(A) (B) (C) (D)

(180) A : Glycolysis is a first step of animal and plantcell respiration.

R : Other name of glycolysis is EMP.

(A) (B) (C) (D)

(181) A : Citric acid has 4 molecule of carbon.

R : Oxalosuccinic acid has 6 molecule of carbon.

(A) (B) (C) (D)

(182) Choose the correct option from column I and II:

	Coulmn - I	**Coulmn - II**	
a.	Phosphorylation phase of Glycolysis	p. 4 ATP	(A) (a–p), (b–q), (c–r), (d-s)
b.	Dephosphorylation phase of Glycolysis	q. 2ATP	(B) (a–r), (b–s), (c–q), (d–p)
c.	Fermentation of pyruvic acid	r. 30ATP	(C) (a–s), (b–r), (c–q), (d–p)
d.	Oxidation of pyruvic acid	s. 6ATP	(D) (a-s), (b–p), (c-q), (d-r)

(183)

	Coulmn - I		**Coulmn - II**	
(i)	Reduction of NAD	p.	Last stage of aerobic respiration	(A) r, a, s, p
(ii)	Reduction of FAD	q.	Succinate - Fumarate	(B) r, q, t, p
(iii)	Phosporylation of ADP	r.	Pyruvic $\rightarrow$ Acetyl Co. A	(C) a, r, p, s
(iv)	Oxidation of $NADH_2$	s.	2 – PGA $\rightarrow$ PEP	(D) p, t, q, s
		t.	PGAP $\rightarrow$ 3–PGA	

(184)

Coulmn - I	Coulmn - II
(a) Glycolysis	(i) mitochondrial matrix
(b) Krebs cycle	(ii) Cytoplasm
(c) Electron Transpart System (ETS)	(iii) inner membrane of mitochondria
(d) Ps-I and Ps-II	(iv) Thylakoids

	a	b	c	d
(A)	iii	iv	ii	i
(B)	ii	i	iii	iv
(C)	i	ii	iii	iv
(D)	iv	iii	ii	i

(185)

Coulmn - I	Coulmn - II
(a) H^+, OH^-	(i) glycolysis
(b) Pyruvic acid	(ii) Alcoholic fermentation
(c) $C_2H_5OH–CO_2$	(iii) Chemical synthesis
	(iv) Photolysis of water

	a	b	c
(A)	iv	i	iii
(B)	iv	i	ii
(C)	i	iv	ii
(D)	i	ii	iv

(186)

Coulmn - I	Coulmn - II
(a) Citric acid → Cisaconitic acid	(i) Dehydrogenation
(b) Succinic acid → fumaric acid	(ii) hydrolysis
(c) Oxalosuccinic acid → Ketoglutaric acid	(iii) dehydration
(d) cis aconitic acid → citric acid	(iv) decarboxylation

	a	b	c	d
(A)	ii	iv	iii	i
(B)	i	iii	iv	ii
(C)	iii	i	iv	ii
(D)	iv	ii	iii	i

Answers : (147-A), (148-B), (149-B), (150-A), (151-A), (152-A), (153-D), (154-C), (155-D), (156-D), (157-C), (158-B), (159-C), (160-A), (161-B), (162-A), (163-A), (164-A), (165-B), (166-D), (167-B), (168-C), (169-C), (170-C), (171-B), (172-C), (173-A), (174-B), (175-C), (176-C), (177-A), (178-A), (179-B), (180-B), (181-D), (182-D), (183-B), (184-B), (185-B), (186-C)

True - False type questions

(187) (1) The terminal transporter in cytochrome chain are cytochromes a and a_3 in oxidative phosphorylation.

(2) The terminal electron acceptor in last stage of oxidative phosphorylation is $\frac{1}{2}O_2$.

(3) Oxidative phosphorylation is performed on cristae membrane of mitochondria.

(4) Krebs cycle takes place in the matrix of chloroplast.

(5) Glycolysis is also known as bidirectional pathway of metabolism.

(A) T T F T T (B) T F F T F (C) T T F F T (D) T T T F F

(188) (1) Succinic acid is dehydrogenated to form fumaric acid.

(2) Krebs cycle is the second stage of aerobic respiration.

(3) Oxalo acetic acid reacts with acetyl Co-A; this is the first step of krebs cycle. Krebs cycle begins with this.

(4) For fats, respiratory quotient is 0.7.

(A) T T F T (B) T T T F (C) F T T F (D) T T T T

(189) (1) When fats are respiratory substrate, the ratio would be more than 1.

(2) By complete oxidation of one molecule of glucose 34 ATP are produced through oxidative phosphorylation.

(3) EMP pathway means glycolysis.

(4) Lactic acid is formed by the anaerohic respiration takes place in trhe muscles of animals.

(A) F T T F (B) F T T T (C) F T F T (D) T F F F

Answers : (187-D), (188-D), (189-B)

Questions for NEET

(190) Proton is released by proton, but how many protons are required to release 12 H_2O ?

(A) $24H^+$ (B) $48H^+$ (C) $12H^+$ (D) $6H^+$

(191) PGAL is produced from PGA. This process is known as ..... .

(A) Reduction (B) Oxidation (C) Hhydroxilation (D) Isomerisation

(192) What will be R.Q. of stored oil seeds ?

(A) More than one (B) Zero (C) Less than one (D) Equal to one

(193) Injury to plant leads to ..... .

(A) increases in respiration (B) decreases in respiration

(C) no change in respiration (D) first increase and then decrease in respiration

(194) What happens when succinate is converted to fumarate during TCA cycle ?

(A) Hydrogen is liberated (B) Oxygen is added

(C) Proton is removed (D) Electrons is added

(195) Who combinely discovered the scheme of glycolysis ?

(A) Embden, merisan, uts (B) Embden, meyerhof and parnas

(C) immersion, haufman and patterson (D) Avery, macleod mccarty

(196) What is the end product of ETS in mitochondria ?

(A) H_2O (B) H^+ (C) Electrons (D) All of these

(197) Arrange the enzymes increasing order of carbon numbers according their reaction on substrate

(P) Hexokinase (Q) Alcohol dehydrogenase

(R) Pyruvate dehydrogenase (S) Fumarase

(A) Q R S T (B) Q S R P (C) P S R Q (D) S P R Q

(198) Which is the place for ATP Synthesis ?

(A) ion channels (B) Plasma membrane (C) F_0- part (D) F_1- part

(199) Succinate + FAD = ...

(A) Fumarate + $FADH_2$ (B) Malate + $NADH_2$

(C) ISO citrate + $NADH_2$ (D) Citrate + H_2O

(200) During fast exercise glucose is converted into ..... .

(A) starch (B) glycogen (C) lactic acid (D) pyruvic acid

(201) Complete the reaction in a way that RQ = 4 (Choose the correct option)

16 $(COOH)_2$ + 80 = ... + ... + energy

(A) $CO_2 + 2H_2O$ (B) $8CO_2 + 4H_2O$ (C) $CO_2 + 8H_2O$ (D) $32CO_2 + 46H_2O$

(202) In all type of respiration, which important intermediate molecule is produced ?

(A) Acetyl Co. A (B) Oxaloacetate

(C) Pyruvic acid (D) Tricarboxylic acid

(203) What is phosphorylation ?

(A) Replace P in glucose

(B) Combination of some chemical with phosphoric acid

(C) Release of phosphoric acid from any chemical

(D) Removal of P from PGA

(204) Which of the following equation ?

(A) DHAP $\rightarrow$ PGAL (B) PGAL $\rightarrow$ PGAP

(C) Glucose $\rightarrow$ Glucose 6 - phosphate (D) Glucose - 6- phosphate $\rightarrow$ fructose - 6-phosphate

(205) Which of the following equation is true for glycolysis ?

(A) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 38$ ATP

(B) $C_6H_{12}O_6 \rightarrow 2CH_3CH_2OH + 2CO_2 + 2$ ATP

(C) $C_6H_{12}O_6 \rightarrow 2CH_3COCOOH + 2$ ATP + 2 $NADH_2$

(D) $C_6H_{12}O_6 \rightarrow 2CH_3COCOOH + 2$ ATP

Answers : (190-A), (191-B), (192-A), (193-A), (194-C), (195-B), (196-A), (197-A), (198-D), (199-A), (200-C), (201-D), (202-C), (203-B), (204-B), (205-C)

Respiration

Liberation of energy from food by chemical breakdown

Respiratory Quotient

Ratio of value of CO_2 evolved to the volume of O_2 consumed in respiration per unit time per unit weight at standard temperature and pressure

Gaseous Exchange

It occurs between enviroment and organism according to organism's needs through body surface or special respiratory organs. It does not involve any chemical reaction

Cellulor Respiration

Chemical breadown of food substrate mediated by several enzymes to release energy stored in chemical bonds

Anaerobic Respiration

Respiration that occurs in absence of oxygen It is common in microorganism

Aerobic Respiration

It is more efficient in terms of ATP production than anaerobic respiration. It occurs in mitochondria

Glycolysis

Series of biochemical reactions in which glucose is broken down to pyruvate with the release of usable energy in the form of ATP

Fermentation

Conversion of pyruvate to alcohol and organic acids in the absence of oxygen

Depending upon its products

Alcoholic Fermentation

Eathanol and CO_2 are produced

Lactic acid Fermentation

Only lactic acid is produced

Mixed Fermention

Produces lactic acid ethanol, formic acid and succinic acid

Glycolysis

It is same as that in anaerobic respiration and occurs in cytoplasm

Pyruvate Oxidation

It involves conversion of rlycolysis product pyruvate into acetyle coA that enters next step krebs' cycle. It is also a link reaction as it links glycolysis with krebs' cycle.

Kreb's Cycle

Acetyle CoA is converted to oxaloaccetate by enzymes and can be regained by intermediates. Thus, this the stage of cyclic processes

Terminal oxidation

Culminating step in which the energy of oxidation drives the synthesis of ATP

Electron Transport chain

Sequential arrangement of electron carriers in inner mitochondrial membrane that carry electrons to final electron acceptor i.e., oxygen

Oxidative Phosphorylation

Synthesis of energy rich ATP molecules with the help of energy liberated during oxidation of reduced coenzymes (NADH, FADH) produced in respiration.