Respiration In Plants

Question1

Match List I with List II

	List-I		List-II
A.	Citric acid cycle	I.	Cytoplasm
B.	Glycolysis	II.	Mitochondrial matrix
C.	Electron transport system	III.	Intermembrane space of mitochondria
D.	Proton gradient	IV.	Inner mitochondrial membrane

Choose the correct answer from the options given below:

[NEET 2024]

Options:

A.

A-I, B-II, C-III, D-IV

B.

A-II, B-I, C-IV, D-III

C.

A-III, B-IV, C-I, D-II

D.

A-IV, B-III, C-II, D-I

Answer: B

Solution:

Citric acid cycle occurs in mitochondrial matrix.

Glycolysis occurs in cytosol in most of the organism.

Electron transport system is present in the inner mitochondrial membrane.

Proton gradient isformed across the intermembrane space of mitochondria.

Question2

Identify the step in tricarboxylic acid cycle, which does not involve oxidation of substrate.

[NEET 2024]

Options:

A.

Malic acid ⟶ Oxaloacetic acid

B.

Succinic acid ⟶ Malic acid

C.

Succinyl-CoA ⟶ Succinic acid

D.

Isocitrate ⟶ α-ketoglutaric acid

Answer: C

Solution:

Oxidation involves the loss of electrons (often as part of hydrogen) from a molecule, leaving to an increase in its oxidation state. This process is typically associated with the transfer of electrons to an electron acceptor which is reduced in the process.

The conversion of succinyl CoA to succinic acid does not involve oxidation of substrate.

Question3

Given below are two statements : One is labelled as Assertion A and the other is labelled as Reason R :
Assertion A : ATP is used at two steps in glycolysis.
Reason R : First ATP is used in converting glucose into glucose-6-phosphate and second ATP is used in conversion of fructose-6-phosphate into fructose-1, 6-diphosphate.
In the light of the above statements, choose the correct answer from the options given below :

[NEET 2023]

Options:

A.

Both A and R are true but R is NOT the correct explanation of A.

B.

A is true but R is false.

C.

A is false but R is true.

D.

Both A and R are true and R is the correct explanation of A.

Answer: D

Solution:

ATP in glycolysis is used at two steps of conversion that are
Glucose → Glucose-6-phosphate
Fructose-6-phosphate → Fructose-1, 6-bisphosphate
The reason of the utilisation of ATP is for phosphorylation the substrates.

Question4

Match List I with List II :

List I	List II
A. Oxidative decarboxylation	I. Citrate synthase
B. Glycolysis	II. Pyruvate dehydrogenase
C. Oxidative phosphorylation	III. Electron transport system
D. Tricarboxylic acid cycle	IV. EMP pathway

Choose the correct answer from the options given below :

[NEET 2023]

Options:

A.

A – II, B – IV, C – I, D – III

B.

A – III, B – I, C – II, D – IV

C.

A – II, B – IV, C – III, D – I

D.

A – III, B – IV, C – II, D – I

Answer: C

Solution:

Solution:

Pyruvate, which is formed by the glycolytic catabolism of carbohydrates in the cytosol, after it enters mitochondrial matrix undergoes oxidative decarboxylation by a complex set of reactions catalyzed by pyruvate dehydrogenase.

The scheme of glycolysis was given by Gustav Embden, Otto Meyrhof and J. Parnas, and is often referred to as the EMP pathway.

In electron transport system, the energy of oxidation-reduction is utilized for the production of proton gradient required for phosphorylation, thus, this process is also called oxidative phosphorylation.

The TCA (tricarboxylic acid cycle) starts with the condensation of acetyl group with oxaloacetic acid (OAA) and water to yield citric acid. The reaction is catalysed by the enzyme citrate synthase. Thus, option (3) is correct.

Question5

How many times decarboxylation occurs during each TCA cycle?

[NEET 2023 mpr]

Options:

A.

Thrice

B.

Many

C.

Once

D.

Twice

Answer: D

Solution:

The tricarboxylic acid (TCA) cycle, also known as the citric acid cycle or Krebs cycle, involves the oxidative decarboxylation of malate to oxaloacetate and of isocitrate to alpha-ketoglutarate. However, the latter reaction is followed by another decarboxylation when alpha-ketoglutarate is converted to succinyl-CoA. So in total, there are two decarboxylation reactions per TCA cycle.

Question6

Fatty acids are connected with the respiratory pathway through :

[NEET 2023 mpr]

Options:

A.

Acetyl CoA

B.

α-Ketoglutaric acid

C.

Dihydroxy acetone phosphate

D.

Pyruvic acid

Answer: A

Solution:

Yes, that's correct. Fatty acids are broken down through a process called beta-oxidation, which occurs in the mitochondria. During beta-oxidation, fatty acids are broken down two carbon atoms at a time, resulting in the formation of acetyl CoA. This acetyl CoA can then enter the Krebs cycle (also known as the citric acid cycle or TCA cycle) to be further oxidized, producing NADH and FADH2, which can be used in the electron transport chain to produce ATP, the cell's main form of energy.

Question7

The 5-C compound formed during TCA cycle is:
[NEET Re-2022]

Options:

A. Fumaric acid

B. α-ketoglutaric acid

C. Oxalo succinic acid

D. Succinic acid

Answer: B

Solution:

Solution:

α-ketoglutaric acid is 5 carbon containing compound, fumaric acid is 4 carbon,

Oxalosuccinic acid is 6 carbon and

Succinic acid is 4 carbon.

Question8

The number of time(s) decarboxylation of isocitrate occurs during single TCA cycle is:
[NEET Re-2022]

Options:

A. Four

B. One

C. Two

D. Three

Answer: B

Solution:

In single kreb's cycle, decarboxylation takes place at following two steps:
(1) At 4^{th} step, where isocitrate gives off a pair of H-atoms (oxidation) and a molecule of CO_2 (decarboxylation) and becomes 5−C α-Ketoglutarate.
(2) 5^{th} step-where coenzyme-A reacts with α Ketoglutarate forming 4-C SuccinylCoenzyme A and releasing CO_2 and a pair hydrogen atoms.
The question is specifically asking for isocitrate

Question9

What is the net gain of ATP when each molecule of glucose is converted to two molecules of pyruvic acid? [NEET-2022]

Options:

A. Four

B. Six

C. Two

D. Eight

Answer: C

Solution:

During glycolysis, total 4 ATPs are produced from one glucose molecule with a net gain of 2 ATPs.

Question10

What amount of energy is released from glucose during lactic acid fermentation? [NEET-2022]

Options:

A. Approximately 15%

B. More than 18%

C. About 10%

D. Less than 7%

Answer: D

Solution:

Less than seven percent of the energy in glucose is released during lactic acid fermentation and not all of it is trapped as high energy bonds of ATP.

Question11

Which of the following statements of incorrect?
[NEET 2021]

Options:

A. During aerobic respiration, role of oxygen is limited to the terminal stage

B. In ETC (Electron Transport Chain), one molecule of NADH + H^+ gives rise to 2 ATP molecules, and one $FADH_2$ gives rise to 3 ATP molecules

C. ATP is synthesized through complex V

D. Oxidation-reducation reactions produce proton gradient in respiration

Answer: B

Solution:

Solution:
• During respiration, process of ATP synthesis is explained by chemiosmotic model. It says that a proton gradient is required for ATP synthesis that is established by oxidation-reduction reactions.
• In ETC, one NADH + H^+ produces 3 ATP while one $FADH_2$ produces 2 ATP molecules.
• ATP is synthesised via complex V.
• In ETS, oxygen acts as terminal electron acceptor.

Question12

The number of substrate level phosphorylations in one turn of citric acid cycle is
[2020]

Options:

A. One

B. Two

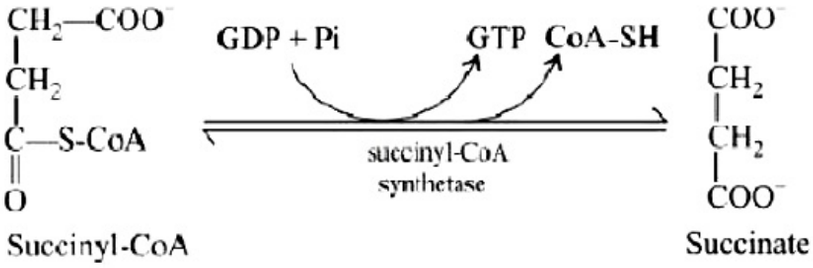
C. Three

D. Zero

Answer: A

Solution:

One substrate level phosphorylation in one turn of citric acid cycle as per following reaction:



Another example of substrate level phosphorylation are as follows:
1,3-bisphosphoglycerate + ADP →3-phosphoglycerate + ATP
Phosphoenolpyruvate + ADP → pyruvate + ATP
Acetyl phosphate + ADP → acetate + ATP
(same mechanism for other alkanoic acids)

Question13

Conversion of glucose to glucose-6-phosphate, the first irreversible reaction of glycolysis, is catalysed by: [2019]

Options:

A. Aldolase

B. Hexokinase

C. Enolase

D. Phosphofructokinase

Answer: B

Solution:

Solution:
(b) Glycolysis is the anaerobic enzymatic conversion of glucose to lactate or pyruvate, resulting in energy stored in the form of ATP, as occurs in muscle.
The two irreversible steps in Glycolysis are:
(i) Conversion of glucose to glucose 6-phosphate, catalysed by hexokinase. It is the first step of activation phase of glycolysis.
(ii) Conversion of fructose 6-phosphate to fructose 1,6 biphosphate catalysed by phosphofructokinase-1.

Question14

Where is the respiratory electron transport system (ETS) located in plants ?

[2019]

Options:

A. Intermembrane space

B. Mitochondrial matrix

C. Outer mitochondrial membrane

D. Inner mitochondrial membrane

Answer: D

Solution:

Solution:
Electron transport system is located in inner mitochondrial membrane, where it serves as the site of oxidative phosphorylation through the action of ATP synthase

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Question15

Respiratory Quotient (RQ) value of tripalmitin is:
[2019]

Options:

A. 0.9

B. 0.7

C. 0.07

D. 0.09

Answer: B

Solution:

Respiratory quotient may be defined as a ratio indicating the relation of the volume of carbon dioxide given off in respiration to that of the oxygen consumed.
Respiratory Quotient

$$(RQ) = \frac{\text{Amount of } CO_2 \text{ released}}{\text{Amount of } CO_2 \text{ consumed}}$$

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

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

Question16

Which of these statements is incorrect? [2018]

Options:

A. Enzymes of TCA cycle are present inmitochondrial matrix

B. Glycolysis occurs in cytosol

C. Oxidative phosphorylation takes place inouter mitochondrial membrane

D. Glycolysis operates as long as it is suppliedwith NAD that can pick up hydrogenatoms

Answer: C

Solution:

Oxidative phosphorylation takes place in inner mitochondrial membrane

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Question17

What is the role of NAD+ in cellular respiration? [2018]

Options:

A. It functions as an enzyme.

B. It functions as an electron carrier.

C. It is the final electron acceptor for anaerobic respiration.

D. It is a nucleotide source for ATP synthesis.

Answer: B

Solution:

Solution:
In cellular respiration, NAD^+ act as an electron carrier.

Question18

Which statement is wrong for Krebs' cycle? (NEET 2017)

Options:

A. There is one point in the cycle where FAD^+ is reduced to $FADH_2$

B. During conversion of succinyl CoA to succinic acid, a molecule of GTP is synthesised.

C. The cycle starts with condensation of acetyl group (acetyl CoA) with pyruvic acid to yield citric acid.

D. There are three points in the cycle where NAD^+ is reduced to $NADH + H^+$

Answer: C

Solution:

(c) : Krebs' cycle starts with condensation of acetyl group (acetyl CoA) with oxaloacetate to form a tricarboxylic, 6 -carbon compound called citric acid.

Question19

Which of the following biomolecules is common to respiration-mediated breakdown of fats, carbohydrates and proteins? (NEET II 2016)

Options:

A. Glucose- 6 -phosphate

B. Fructose 1,6 -bisphosphate

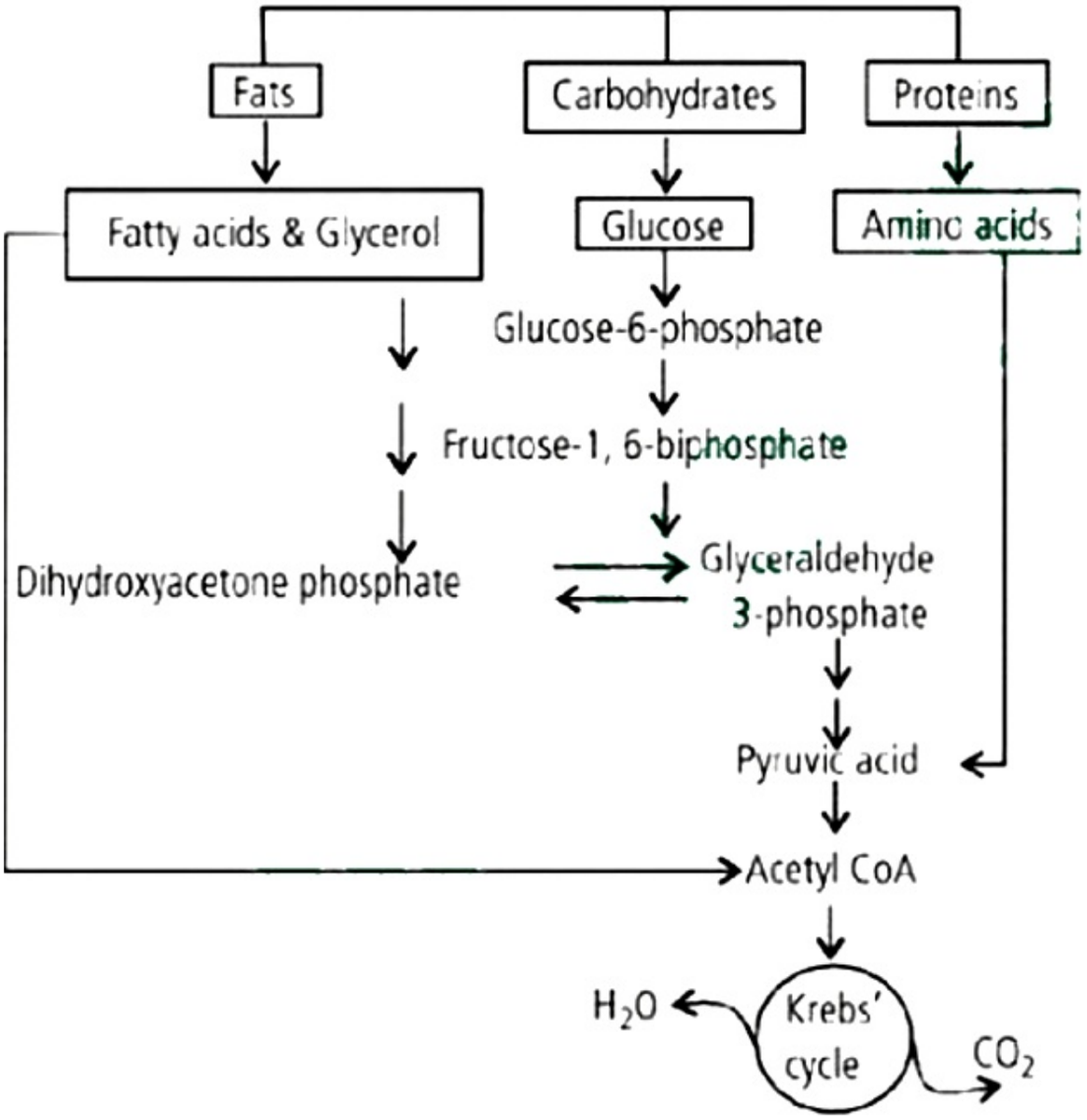
C. Pyruvic acid

D. Acetyl CoA

Answer: D

Solution:

Solution:
(d) : Carbohydrates are usually first converted into glucose before they are used for respiration. Fats are broken down into glycerol and fatty acids first. If fatty acids were to be respired they would first be degraded to acetyl CoA and enter the pathway. Glycerol would enter the pathway after being converted to 3 -phosphoglyceraldehyde (PGAL). The proteins are degraded by proteases to individual amino acids (after deamination) and depending on their structure enter the pathway within the Krebs' cycle or as pyruvate or acetyl CoA. Thus, acetyl CoA is the common metabolite of all the three (carbohydrates, proteins and fats). The given flowchart shows these interrelationships:



Question20

Oxidative phosphorylation is
(NEET II 2016)

Options:

A. formation of ATP by transfer of phosphate group from a sabstrate to ADP

B. oxidation of phosphate group in ATP

C. addition of phosphate group to ATP

D. formation of ATP by energy released from electrons removed during substrate oxidation.

Answer: D

Solution:

Solution:
(d) : Oxidative phosphorylation is the synthesis of energy rich ATP molecules with the help of energy liberated during oxidation of reduced co-enzymes (NADH, $FADH_2$) produced in respiration. The enzyme required for this synthesis is called ATP synthase. It is located in F_1 or head piece of $F_0 - F_1$ or elementary particles present in the inner mitochondrial membrane. F_1 particle is capable of ATP synthesis. ATP synthase becomes active in ATP formation only when there is a proton gradient having higher concentration of H^+ or protons on the F_0 side as compared to F_1 side. This higher concentration creates an electric potential across the mitochondrial membrane. The proton gradient and membrane electric potential together form proton motive force (PMF). The flow of protons through the F_0 channel which induces F_1 particle to function as ATP synthase. The energy of the proton gradient is used in attaching a phosphate radicle to ADP by high-energy bond. This produces ATP.

Question21

Cytochromes are found in (2015 Cancelled)

Options:

A. cristae of mitochondria

B. lysosomes

C. matrix of mitochondria

D. outer wall of mitochondria.

Answer: A

Solution:

Solution:
(a) : Cytochrome is a group of proteins, each with an iron containing haeme group. They are a part of electron transport chain in mitochondria (present in cristae) and chloroplasts (in thylakoids).

Question22

In which one of the following processes CO_2 is not released? (2014)

Options:

A. Aerobic respiration in plants

B. Aerobic respiration in animals

C. Alcoholic fermentation

D. Lactate fermentation

Answer: D

Solution:

Solution:
(d) : Anaerobic respifation or fermentation can be of two types, i.e., lactate fermentation and ethanol fermentation. Lactate fermentation produces lactic acid only as pyruvic acid produced in glycolysis is directly reduced by NADH to form lactic acid and no CO_2 is produced. Alcoholic (ethanol) fermentation involves conversion of pyruvate to acetaldehyde, hence, CO_2 is released.

Question23

Which of the metabolites is common to respiration-mediated breakdown of fats, carbohydrates and proteins? (NEET 2013)

Options:

A. Pyruvic acid

B. Acetyl CoA

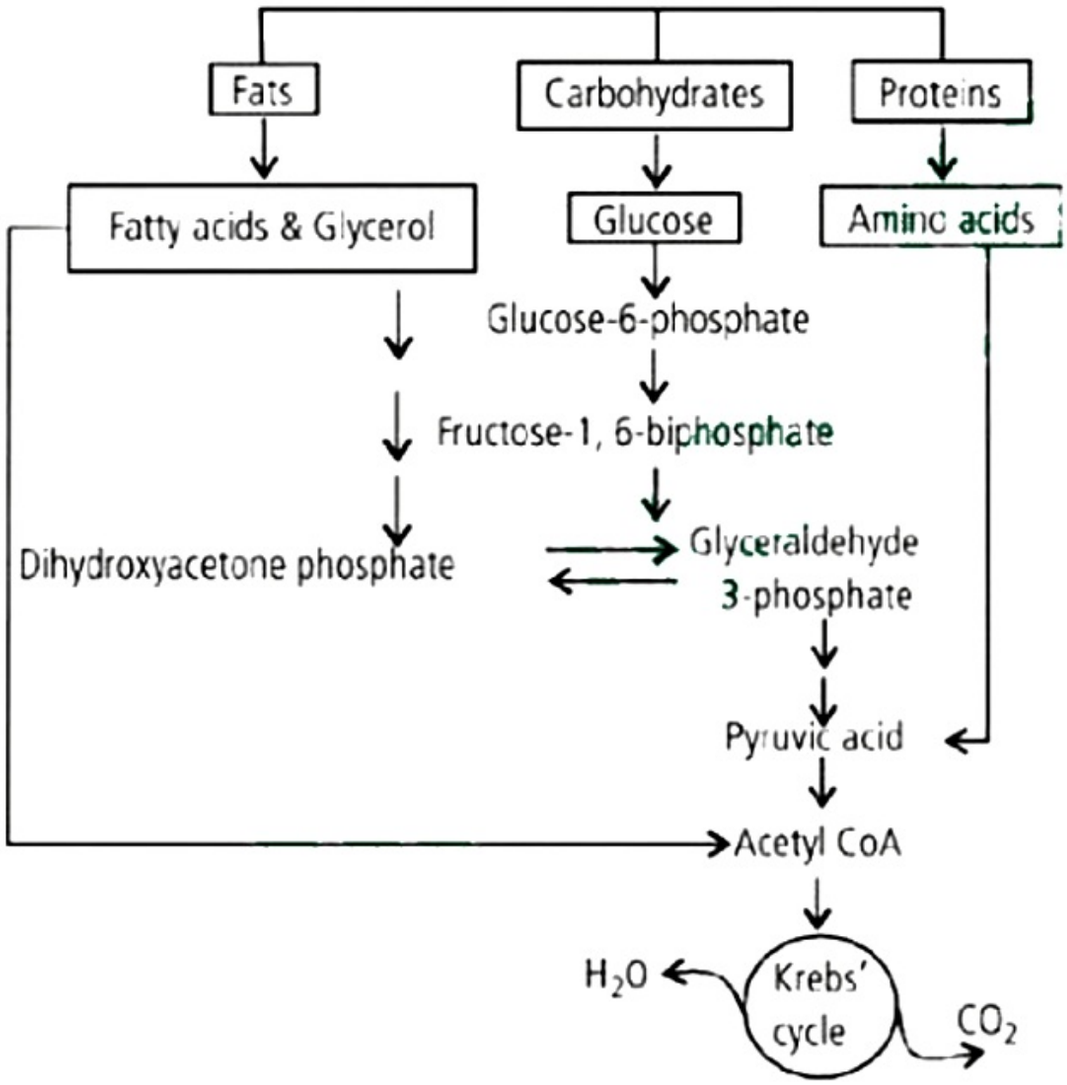
C. Glucose -6 - phosphate

D. Fructose 1,6 - bisphosphate

Answer: B

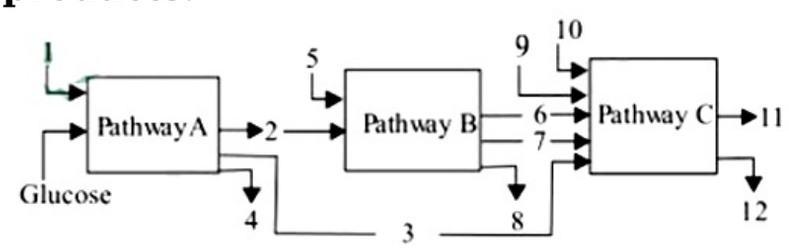
Solution:

Solution:
(b) : Carbohydrates are usually first converted into glucose before they are used for respiration. Fats are broken down into glycerol and fatty acids first. If fatty acids were to be respired they would first be degraded to acetyl CoA and enter the pathway. Glycerol would enter the pathway after being converted to 3 -phosphoglyceraldehyde (PGAL). The proteins are degraded by proteases to individual amino acids (after deamination) and depending on their structure enter the pathway within the Krebs' cycle or as pyruvate or acetyl CoA. Thus, acetyl CoA is the common metabolite of all the three (carbohydrates, proteins and fats). The given flowchart shows these interrelationships:



Question24

The three boxes in this diagram represent the three major biosynthetic pathways in aerobic respiration. Arrows represent net reactants or products.



Arrows numbered 4,8 and 12 can all be

(NEET 2013)

Options:

A. H_2O

B. FAD^+ or $FADH_2$

C. NADH

D. ATP

Answer: D

Solution:

Solution:
(d) : In the given diagram, pathway A represents glycolysis, pathway B represents Krebs' cycle and pathway C represents oxidative phosphorylation. Arrows numbered 4,8 and 12 can all be ATP.

Question25

In mitochondria, protons accumulate in the (Mains 2011)

Options:

A. outer membrane

B. inner membrane

C. intermembrane space

D. matrix

Answer: C

Solution:

Solution:
(c) : In respiration, protons accumulate in the inter membrane space of the mitochondria when electrons move through the ETS.

Question26

The energy-releasing metabolic process in which substrate is oxidised without an external electron acceptor is called (2010,2008)

Options:

A. glycolysis

B. fermentation

C. aerobic respiration

D. photorespiration

Answer: B

Solution:

(b) : Fermentation is the process of deriving energy from the oxidation of organic compounds such as carbohydrates and using an endogenous electron acceptor not external or exogenous, which is usually an organic compound, as opposed to respiration where electrons are donated to an exogenous electron acceptor, such as oxygen via an electron transport chain.

Question27

Aerobic respiratory pathway is appropriately termed (2009)

Options:

A. parabolic

B. amphibolic

C. anabolic

D. catabolic

Answer: B

Solution:

Solution:
(b) : A biochemical pathway that serves both anabolic and catabolic process is known as amphibolic pathway. The aerobic respiration involves both catabolism of carbohydrates and fatty acids and the synthesis of anabolic precursors for amino acid synthesis, various intermediatory metabolic products and secondary metabolites. Thus it is called as amphibolic pathway rather than a catabolic pathway.

Question28

The chemiosmotic coupling hypothesis of oxidative phosphorylation proposes that adenosine triphosphate (ATP) is formed because (2008)

Options:

A. a proton gradient forms across the inner membrane

B. there is a change in the permeability of the inner mitochondrial membrane toward adenosine diphosphate (ADP)

C. high energy bonds are formed in mitochondrial proteins

D. ADP is pumped out of the matrix into the intermembrane space

Answer: A

Solution:

(a) : The chemiosmotic coupling hypothesis of oxidative phosphorylation proposed by Mitchell, explains the process of ATP formation and states that it is linked to development of a proton gradient across a membrane. ATP synthase, required for ATP synthesis is located in F_1 particles present in the inner mitochondrial membrane and becomes active only when there is high concentration of proton on F_0 side as compared to F_1 side. The flow of proton through F_0 channel induces F_1 particle to function as ATP synthase and the energy of proton gradient produces ATP by attaching a phosphate radical to ADP.

Question29

The overall goal of glycolysis, Krebs' cycle and the electron transport system is the formation of (2007)

Options:

A. ATP in one large oxidation reaction

B. sugars

C. nucleic acids

D. ATP in small stepwise units

Answer: D

Solution:

Solution:
(d) : Respiration is an energy liberating enzymatically controlled multistep catabolic process of step wise breakdown of organic substances (hexose sugar) inside the living cells. Aerobic respiration includes the 3 major process, glycolysis, Krebs' cycle and electrons transport chain. The substrate is completely broken down to form CO_2 and water. A large amount of energy is released stepwise in the form of ATP.

Question30

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
(2007)

Options:

A. isocitrate dehydrogenase

B. malate dehydrogenase

C. succinate dehydrogenase

D. lactate dehydrogenase

Answer: C

Solution:

Solution:
(c) : Mitochondrion is the organelle which bears various enzymes participating in Krebs' cycle. Each mitochondrion is covered by double membrane. The inner membrane is selectively permeable and forms foldings called cristae. The inner membrane bears oxysomes, enzymes of fatty acids, succinate dehydrogenase (of Krebs' cycle) and electron transport system. All other enzymes of Krebs' cycle are present in the mitochondrial matrix.

Question31

How many ATP molecules could maximally be generated from one molecule of glucose, if the complete oxidation of one mole of glucose to CO_2 and H_2O yields 686 kcal and the useful chemical energy available in the high energy phosphate bond of one mole of ATP is 12 kcal?
(2006)

Options:

A. 1

B. 2

C. 30

D. 57

Answer: D

Solution:

Solution:
(d) : One mole of ATP liberates 12 kcal of energy. So 686 kcal will be liberated by 686 / 12 = 57.1 ATP molecules.

Question32

During which stage in the complete oxidation of glucose are the greatest number of ATP molecules formed from ADP? (2005)

Options:

A. Glycolysis

B. Krebs' cycle

C. Conversion of pyruvic acid to acetyl CoA

D. Electron transport chain

Answer: D

Solution:

Solution:
(d) : The last step of aerobic respiration is the oxidation of reduced coenzymes, i.e., $NADH_2$ and FADH $_2$ by molecular oxygen through FAD, ubiquinone, Cytb, Cytc, $Cytc_1$, Cyta and $Cyta_3$ By oxidation of 1 molecule of $NADH_2$, 3 ATP molecules are produced and by oxidation of 1 molecule of FADH $_2$,2 ATP molecules are produced. In glycolysis 2 ATP molecules are produced from ADP. Further $2NADH_2$ produced, give $2 \times 3 = 6$ ATP, on oxidative phosphorylation. Similarly in Krebs' cycle 2 ATP molecules are produced. So the greatest number of ATP molecules are produced in the electron transport chain.

Question33

R.Q. is (2005)

Options:

A. C / N

B. N / C

C. CO_2 / O_2

D. O_2 / CO_2

Answer: C

Solution:

(c) : The ratio of the volume of CO_2, released to volume of O_2 absorbed in the respiratory process is termed as the respiratory ratio or Respiratory Quotient.

$$R.Q. = \frac{\text{Volume of } CO_2 \text{ evolved}}{\text{Volume of } O_2 \text{ absorbed}}$$

Value of R.Q. varies from one respiratory substrate to another, e.g., R.Q. of carbohydrates is equal to 1 , R.Q. of lipids and proteins are less than 1, that of organic acid is greater than 1 .

Question34

In glycolysis, during oxidation electrons are removed by (2004)

Options:

A. ATP

B. glyceraldehyde- 3 -phosphate

C. NAD^+

D. molecular oxygen.

Answer: C

Solution:

Solution:
(c) : During glycolysis, NAD (Nicotinamide adenine dinucleotide) removes electrons from 1 , 3-diphosphoglyceric acid using diphosphoglyceraldehyde dehydrogenase. NAD changes to $NADH_2$ and this is either utilized as such in anaerobic respiration or in the presence of oxygen.

Question35

In alcohol fermentation (2003)

Options:

A. triose phosphate is the electron donor while acetaldehyde is the electron acceptor

B. triose phosphate is the electron donor while pyruvic acid is the electron acceptor

C. there is no electron donor

D. oxygen is the electron acceptor.

Answer: A

Solution:

(a) : In alcohol fermentation triose phosphate is the electron donor while acetaldehyde is the electron acceptor.

(In alcoholic fermentation, the pyruvic acid from glycolysis loses one carbon in the form of carbon dioxide to form acetaldehyde, which is reduced to ethyl alcohol by NADH. When acetaldehyde is reduced to ethyl alcohol, NADH becomes NAD+ (is oxidized). This is the fermentation that commonly occurs in yeast.)

Question36

In which one of the following do the two names refer to one and the same thing?
(2003)

Options:

A. Krebs' cycle and Calvin cycle

B. Tricarboxylic acid cycle and citric acid cycle

C. Citric acid cycle and Calvin cycle

D. Tricarboxylic acid cycle and urea cycle

Answer: B

Solution:

Solution:
(b) : The reactions of Krebs' cycle were worked out by Sir Hans Kreb, hence the name Krebs' cycle. It involves many 3 -C compounds such as citric acid, cis-aconitic acid and iso-citric acid etc., so it is also called TCA cycle or tricarboxylic acid cycle. It involves formation of citric acid as its first product so it is called citric acid cycle. It involves production of 24 ATP molecules.

Question37

How many ATP molecules are produced by aerobic oxidation of one molecule of glucose?
(2002)

Options:

A. 2

B. 4

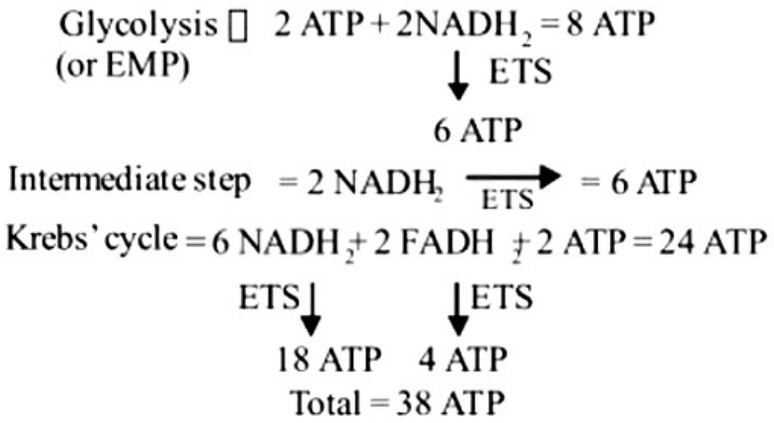
C. 38

D. 34

Answer: C

Solution:

(c) : Energy gain in one complete cycle of aerobic respiration is :



In aerobic respiration complete oxidation of one glucose molecule produces 38 ATP molecules. But the number of ATP molecules so produced may vary depending upon the mode of entry of $NADH_2$ in the mitochondria.
If the electrons of $NADH_2$ are accepted by malate then each molecule of $NADH_2$ yields 3 ATP molecules and the total would be 38 ATP molecules. But if the electrons of $NADH_2$ are accepted by FAD it yields only 2 ATP molecules making the total of 36 ATP molecules. This type of shuttle occurs in most of the eukaryotic cells.

Question38

Organisms which obtain energy by the oxidation of reduced inorganic compounds are called
(2002)

Options:

A. photoautotrophs

B. chemoautotrophs

C. saprozoic

D. coproheterotrophs

Answer: B

Solution:

Solution:
(b) : Chemoautotrophs are organisms that are capable of manufacturing their organic food utilizing chemical energy released in oxidation of some inorganic substances. The process of manufacture of food in such organisms is called chemosynthesis. It includes some aerobic bacteria. Photoautotroph obtain energy for their synthesis of food from light. Fungi living on dead or decaying plant or animal remains and also growing on dung of herbivores are saprophytes.

Question39

Cytochrome is
(2001)

Options:

A. metallo flavo protein

B. Fe containing porphyrin pigment

C. glycoprotein

D. lipid.

Answer: B

Solution:

Solution:
(b) : Cytochromes are electron transferring proteins often regarded as enzymes. They contain iron porphyrin or copper porphyrin as prosthetic groups. Cytochrome a, b and c are harmo-chromogens widely occurring in cells and acting as oxygen carriers during cellular respiration.

Question40

Net gain of ATP molecules, during aerobic respiration, is (1999)

Options:

A. 40 molecules

B. 48 molecules

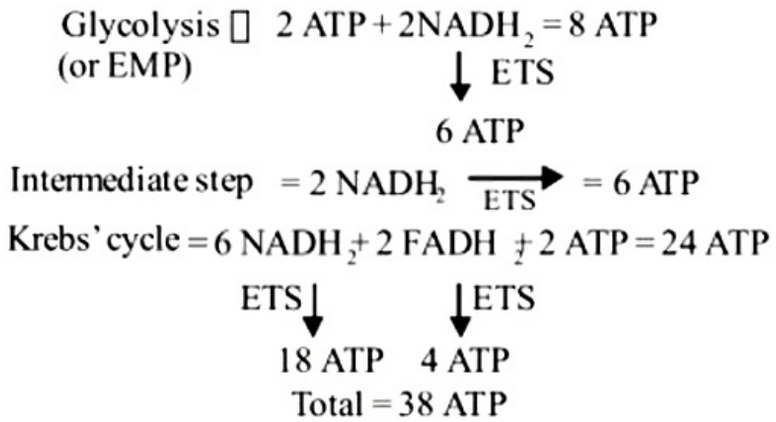
C. 36 molecules

D. 38 molecules

Answer: C

Solution:

(c) : Energy gain in one complete cycle of aerobic respiration is :



In aerobic respiration complete oxidation of one glucose molecule produces 38 ATP molecules. But the number of ATP molecules so produced may vary depending upon the mode of entry of NADH_2 in the mitochondria.
If the electrons of NADH_2 are accepted by malate then each molecule of NADH_2 yields 3 ATP molecules and the total would be 38 ATP molecules. But if the electrons of NADH_2 are accepted by FAD it yields only 2 ATP molecules making the total of 36 ATP molecules. This type of shuttle occurs in most of the eukaryotic cells.

(38 molecules of ATP are produced during aerobic respiration. Of these 2 ATP are used in link reaction. Hence net gain is of 36 ATP.)

Question41

Which one of the following statements about cytochrome P_{450} is wrong? (1998)

Options:

A. It is a coloured cell.

B. It is an enzyme involved in oxidation reactions.

C. It has an important role in metabolism.

D. It contains iron

Answer: A

Solution:

Solution:
Cytochromes P_{450} are proteins of the superfamily containing heme as a cofactor and, therefore, are hemeproteins. CYPs use a variety of small and large molecules as substrates in enzymatic reactions. They are, in general, the terminal oxidase enzymes in electron transfer chains, broadly categorized as P450-containing systems. The term "P_{450}" is derived from the spectrophotometric peak at the wavelength of the absorption maximum of the enzyme (450 nm) when it is in the reduced state and complexed with carbon monoxide. Most CYPs require a protein partner to deliver one or more electrons to reduce the iron (and eventually molecular oxygen). Depending on the substrate and enzyme involved, P_{450} enzymes can catalyze any of a wide variety of reactions. A hypothetical hydroxylation is shown in this illustration. After the product has been released from the active site, the enzyme returns to its original state, with a water molecule returning to occupy the distal coordination position of the iron nucleus. So the correct option is 'it is a coloured cell.

Question42

Which of the following is the key intermediate compound linking glycolysis to the Krebs' cycle? (1997)

Options:

A. Malic acid

B. Acetyl CoA

C. NADH

D. ATP

Answer: B

Solution:

(b) : During glycolysis pyruvic acid is produced from glucose and is oxidatively decarboxylated to form acetyl CoA. This formation of acetyl CoA from pyruvic acid needs a multienzyme complex and 5 essential cofactors, i.e., lipoic acid, CoA, Mg^{2+}, NAD and TPP (thiamine pyrophosphate). It results in production of 2 molecules of CO_2 and 2 molecules of $NADH_2$. This acetyl CoA enters mitochondria and is completely oxidised during Krebs' cycle. Thus acetyl CoA acts as the linker of glycolysis and Krebs' cycle.

Question43

In Krebs' cycle, the FAD precipitates as electron acceptor during the conversion of
(1997)

Options:

A. fumaric acid to malic acid

B. succinic acid to fumaric acid

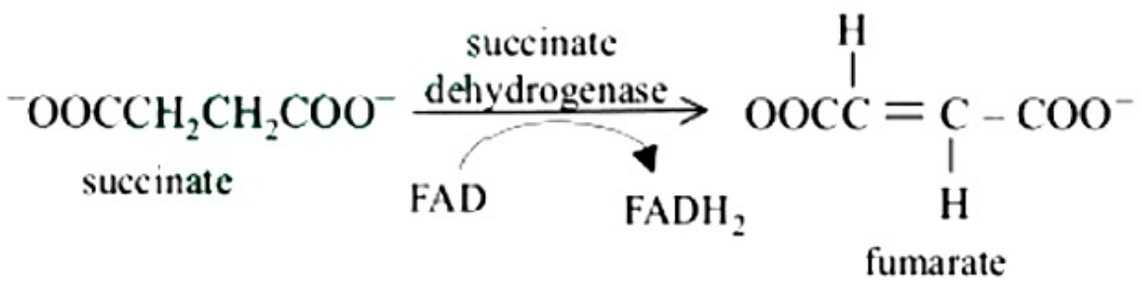
C. succinyl CoA to succinic acid

D. α -ketoglutarate to succinyl CoA.

Answer: B

Solution:

(b) : During Krebs' cycle when succinic acid is oxidised to fumaric acid then the precipitation of FAD as electron acceptor occurs. It is the only Krebs' cycle oxidation that does not employ a pyridine nucleotide. In this, succinate is dehydrogenated by succinate dehydrogenase. This enzyme removes two hydrogen ions and two electrons from succinate and these are then used to reduce FAD to $FADH_2$.



Question44

The end product of fermentation are
(1997)

Options:

A. O_2 and C_2H_5OH

B. CO_2 and acetaldehyde

C. CO_2 and O_2

D. CO_2 and C_2H_5OH

Answer: D

Solution:

Fermentation is the process of partial breakdown of glucose into ethyl alcohol or lactate. It is an anaerobic process. Fermentation takes place through the two types - lactic acid fermentation and alcohol fermentation.

Name of process	End products
Lactic acid fermentation	Lactate
Alcohol fermentation	Ethyl alcohol + CO_2

So, the correct answer is ' CO2 and ethyl alcohol '(C_2H_5OH)

Question45

The correct sequence of electron acceptor in ATP synthesis is (1997)

Options:

A. Cyt. b, c, a_3, a

B. Cyt. c, b, a, a_3

C. Cyt. a, a, b, c

D. Cyt. b, c, a, a_3

Answer: D

Solution:

Solution:
(d) : Last step of aerobic respiration is oxidation of reduced co-enzymes, i.e., $NADH_2$ and $FADH_2$ by molecular oxygen through FAD, CoQ (ubiquinone), Cyt. b, Cyt. c_1, Cyt. c, Cyt. a and $Cyta_3$. Two hydrogen atoms or electrons move from $NADH_2$ and travel through this ETS chain and finally combine with half molecule of O_2 to form water. During this electron transport FAD and Fe of different cytochromes are successively reduced and oxidised and at certain points, enough energy is released which is used to bind ADP with Pi to form ATP.

Question46

Which of the following products are obtained by anaerobic respiration from yeast?
(1996)

Options:

A. Beer and wine

B. Alcohols

C. CO_2

D. All of these

Answer: D

Solution:

Solution:
(d) : In the absence of O_2, fermentation or anaerobic respiration occurs. In this process pyruvic acid forms ethyl alcohol and CO_2.

Question47

At the end of glycolysis, six carbon compound ultimately changes into
(1996)

Options:

A. ethyl alcohol

B. acetyl Co − A

C. pyruvic acid

D. ATP.

Answer: C

Solution:

Solution:
(c) : Glycolysis or EMP pathway is the breakdown of glucose to two molecules of pyruvic acid through a series of enzyme mediated reaction releasing energy. Pyruvic acid is a 3 -carbon compound. In glycolysis net gain of 2AT P and 2 NADH $_2$ molecules occurs. It can be represented in equation form as -
$C_6H_{12}O_6 + 2\,ADP + 2\,Pi + 2\,NAD \rightarrow 2CH_3COCOOH + 2\,ATP + 2NADH_2$

Question48

When one molecule of ATP is disintegrated, what amount of energy is liberated?
(1996)

Options:

A. 8 kcal

B. 38 kcal

C. 7 kcal

D. 4.5 kcal

Answer: C

Solution:

Solution:
(c) : ATP is adenosine triphosphate. It was discovered by Lohmann in 1929 . It consists of a purine, adenine, a pentose sugar (ribose) and a row of three phosphates out of which the last two are attached by high energy bonds. The last phosphate bond yields an energy equivalent of 7 kcal.

Question49

Poisons like cyanide inhibit Na^+ efflux and K^+ influx during cellular transport. This inhibitory effect is reversed by an injection of ATP. This demonstrates that
(1994)

Options:

A. ATP is the carrier protein in the transport system

B. energy for $Na^+ - K^+$ exchange pump comes from ATP

C. ATP is hydrolysed by ATPase to release energy

D. $Na^+ - K$ - exchange pump operates in the cell.

Answer: B

Solution:

(b) : Active transport is uphill movement of materials across the membrane where the solute particles move against their chemical concentration or electrochemical gradient. Hence the transport requires energy in the form of ATP. Metabolic inhibitors like cyanide inhibit absorption of solutes by lowering the rate of respiration. Consequently less ATP are formed. However, by adding ATP, active transport is facilitated.

It occurs in plants as in climacteric fruits and under cold stress. ATP synthesis does not occur. Reducing power present in reduced coenzymes is oxidised to produce heat energy. Therefore, the heat liberation pathway of terminal oxidation is cyanide resistant. In normal aerobic respiration, the effect of cyanide poisoning can be minimised by immediate supply of ATP.

Question50

The ultimate respiratory substrate, yielding maximum number of ATP molecules, is
(1994)

Options:

A. glycogen

B. ketogenic amino acid

C. glucose

D. amylose

Answer: C

Solution:

Solution:
(c) : Glucose is the chief respiratory substrate which fields maximum number of ATP molecules. Glucose is the most common substate in glycolysis. Any other carbohydrate is first converted into glucose. During glycolysis it changes to pyruvic acid and net gain is of 2 ATP and 2 NADH, molecules. And later on during Krebs cycle 30 molecules of ATP are produced. So a total of 38 ATP molecules are produced from 1 mol of glucose during aerobic respiration.

Question51

When yeast ferments glucose, the products obtained are
(1994)

Options:

A. ethanol and CO_2

B. methanol and CO_2

C. ethanol and water

D. water and CO_2

Answer: A

Solution:

Solution:
(a) : When oxygen is not available (anaerobic condition) yeast and some microbes convert pyruvic acid into ethyl

alcohol. It is a two step process. In the first step pyruvic acid is decarboxylated to yield acetaldehyde and CO_2.
Pyruvic acid is a 3 -C compound and acts as electron donor while acetaldehyde is the electron acceptor.
$CH_3COCOO^- + H^+ \rightarrow CH_3CHO + CO_2$ (pyruvic carboxylase)
In the second step acetaldehyde is reduced to ethyl alcohol by NADH $_2$ formed in the glycolysis.
$CH_3CHO + NADH + H^+ \rightarrow C_2H_5OH + NAD^+$ (alcohol dehydrogenase)

Question52

The 1992 Nobel Prize for medicine was awarded to Edmond H. Fischer and Edwin J. Krebs for their work concerning (1994)

Options:

A. reversible protein phosphorylation as a biological regulation mechanism

B. isolation of the gene for a human disease

C. human genome project

D. drug designing involving inhibition of DNA synthesis of the pathogen

Answer: A

Solution:

Solution:
(a) : The 1992 Nobel prize for medicine was awarded to Edmond H. Fischer and Edwin J. Krebs for their work concerning reversible protein phosphorylation as biological regulation mechanism. The winners of 1992 Noble prize in Physiology and Medicine discovered a 'life switch" that turns on and off a variety of biological functions of the cell, including the breakdown of fats and the generation of chemical energy. The prize - winning discovery is known as "reversible protein phosphorylation".

Question53

The first phase in the breakdown of glucose, in animal cell, is (1994)

Options:

A. fermentation

B. Krebs' cycle

C. glycolysis

D. E.T.S.

Answer: C

Solution:

(c) : Glycolysis is the first step of glucose breakdown in both animals and plants. During glycolysis 6-carbon glucose molecule is converted into 2 molecules of 2 carbon pyruvic acid. In this process net gain of 2 ATP and 2 $NADH_2$ occurs. It is a common pathway for both aerobic and anaerobic modes of respiration.

Question54

Plants, but not animals, can convert fatty acids to sugars by a series of reactions called
(1994)

Options:

A. photosynthesis

B. Kreb's cycle

C. glycolysis

D. glyoxylate cycle

Answer: D

Solution:

Solution:
(d) : Kornberg and Krebs (1957) gave glyoxylate cycle in Pseudomonas bacteria. It involves conversion of insoluble fats into soluble sugars. This occurs in germinating fatty seeds because plants are not able to transport fats from the endosperm to the root and shoot tissues of the germinating seedling, so they must convert stored lipids to a more mobile form of carbon, generally sucrose.

Question55

Life without air would be
(1993)

Options:

A. reductional

B. free from oxidative damage

C. impossible

D. anaerobic

Answer: D

Solution:

(d) : Anaerobic respiration (absence of oxygen) takes place in anaerobic bacteria and in plant seeds Anaerobic respiration occurs in the organism which can live without oxygen. In this respiration, only glycolysis takes place due to the absence of oxygen.

Question56

Out of 38 ATP molecules produced per glucose, 32 ATP molecules are formed from NADH F ADH_2 in
(1993)

Options:

A. respiratory chain

B. Krebs' cycle

C. oxidative decarboxylation

D. EMP

Answer: A

Solution:

Solution:
(a) : During respiratory chain, complete degradation of one glucose molecule produced 38 ATP molecules. NAD and FAD is reduced to NADH/FADH.

Question57

End product of citric acid cycle/Krebs' cycle is
(1993)

Options:

A. citric acid

B. lactic acid

C. pyruvic acid

D. $CO_2 + H_2O$

Answer: D

Solution:

(d) : The end product of glycolysis is pyruvic acid whereas acetyl CoA is the connecting link between glycolysis and Krebs' cycle. The TCA cycle was first described by Krebs, 1937 as a cyclic process in which acetyl coA is oxidised to CO_2 and water. Acetyl CoA combines with oxalo acetic acid to form citric acid. After a series of cyclic reactions OAA is recycled back.

Question58

Apparatus to measure rate of respiration and R.Q. is (1992)

Options:

A. auxanometer

B. potometer

C. respirometer

D. manometer.

Answer: C

Solution:

Solution:
(c) : Respirometer is an instrument used for measuring R . Q. and rate of respiration. The apparatus consists of a graduated tube attached at right angles to a bulbous respiratory chamber in its upper end. Desired plant material whose R . Q. is to be determined is placed in the respiratory chamber.

Question59

When one glucose molecule is completely oxidised, it changes (1992)

Options:

A. 36 ADP molecules into 36 ATP molecules

B. 38 ADP molecules into 38 ATP molecules

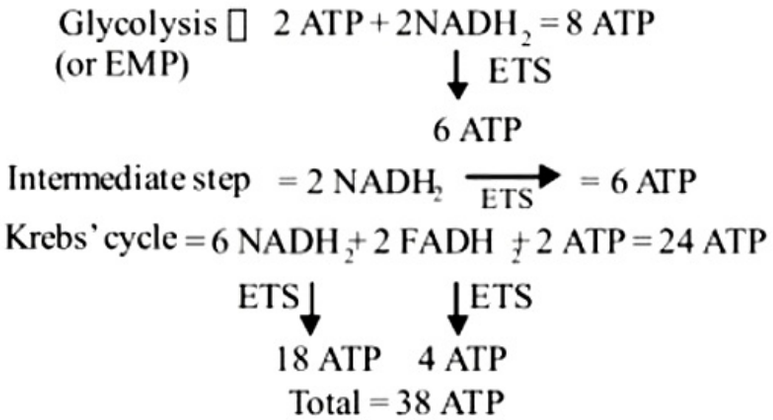
C. 30 ADP molecules into 30 ATP molecules

D. 32 ADP molecules into 32 ATP molecules

Answer: B

Solution:

(b) : Energy gain in one complete cycle of aerobic respiration is :



In aerobic respiration complete oxidation of one glucose molecule produces 38 ATP molecules. But the number of ATP molecules so produced may vary depending upon the mode of entry of $NADH_2$ in the mitochondria.

If the electrons of $NADH_2$ are accepted by malate then each molecule of $NADH_2$ yields 3 ATP molecules and the total would be 38 ATP molecules. But if the electrons of $NADH_2$ are accepted by FAD it yields only 2 ATP molecules making the total of 36 ATP molecules. This type of shuttle occurs in most of the eukaryotic cells.

Question60

Oxidative phosphorylation is production of (1992)

Options:

A. ATP in photosynthesis

B. NADPH in photosynthesis

C. ATP in respiration

D. NADH in respiration.

Answer: C

Solution:

Solution:

(c) : In electron transport system the hydrogen donated by succinate is accepted by FAD which is reduced to $FADH_2$. This hydrogen dissociate into electrons and protons and then passes through a series of carriers involving the phenomenon of oxidation and reduction. During this flow, ATP synthesis occurs at different steps and the phenomenon is called as oxidative phosphorylation.

Question61

At a temperature above 35°C (1992)

Options:

A. rate of photosynthesis will decline earlier than that of respiration

B. rate of respiration will decline earlier than that of photosynthesis

C. there is no fixed pattern

D. both decline simultaneously.

Answer: A

Solution:

(a) : The plants can perform photosynthesis on a range of temperature, while some cryophytes can do photosynthesis at $35^{\circ}C$. Usually the plants can perform photosynthesis between $10^{\circ}C - 40^{\circ}C$. The optimum temperature ranges between $25^{\circ}C - 30^{\circ}C$. At high temperature the enzymes are denatured and hence the photosynthetic rate declines.

Question62

End products of aerobic respiration are (1992)

Options:

A. sugar and oxygen

B. water and energy

C. carbon dioxide, water and energy

D. carbon dioxide and energy

Answer: C

Solution:

Solution:
(c) : Respiration is an energy liberating enzymatically controlled multistep catabolic process of step wise breakdown of organic substances (hexose sugar) inside the living cells. Aerobic respiration includes the 3 major process, glycolysis, Krebs' cycle and electrons transport chain. The substrate is completely broken down to form CO_2 and water. A large amount of energy is released stepwise in the form of ATP.

Question63

Link between glycolysis, Krebs' cycle and β-oxidation of fatty acid or carbohydrate and fat metabolism is (1992)

Options:

A. oxaloacetic acid

B. succinic acid

C. citric acid

D. acetyl CoA

Answer: D

Solution:

Solution:
(d) : Krebs' cycle is intimately related with fat metabolism. Dihydroxy acetone phosphate produced in glycolysis may be converted into glycerol via glycerol - 3 - phosphate and vice-versa. Glycerol is important constituents of fats. After β - oxidation, fatty acids give rise to active 2 -C units, the acetyl-CoA which may enter the Krebs' cycle. Thus, Acetyl-CoA is a link between glycolysis, Krebs' cycle and β -oxidation of fatty acid or carbohydrate and fat metabolism.

Question64

Out of 36 ATP molecules produced per glucose molecule during respiration
(1992)

Options:

A. 2 are produced outside glycolysis and 34 during respiratory chain

B. 2 are produced outside mitochondria and 34 inside mitochondria

C. 2 during glycolysis and 34 during Krebs cycle

D. all are formed inside mitochondria

Answer: B

Solution:

Solution:
(b) : During respiration, 36 ATP molecules are produced per glucose molecule. 2 molecules of ATP are produced outside mitochondria i.e., during glycolysis and other 34 molecules of ATP are produced inside mitochondria from Krebs' cycle.

Question65

Terminal cytochrome of respiratory chain which donates electrons to oxygen is
(1992)

Options:

A. Cytb

B. Cyt c

C. Cyt a_1

D. Cyt a_3

Answer: D

Solution:

Solution:
(d) : Cytochrome a_3, helps in transfer of electron to oxygen. The oxygen has great affinity to accept the electrons and in presence of protons a water molecule is formed.

Question66

Connecting link between glycolysis and Krebs' cycle before pyruvate entering Krebs' cycle is changed to
(1990)

Options:

A. oxaloacetate

B. PEP

C. pyruvate

D. acetyl CoA.

Answer: D

Solution:

Solution:
(d) : The end product of glycolysis is pyruvic acid whereas acetyl CoA is the connecting link between glycolysis and Krebs' cycle. The TCA cycle was first described by Krebs, 1937 as a cyclic process in which acetyl coA is oxidised to CO_2 and water. Acetyl CoA combines with oxalo acetic acid to form citric acid. After a series of cyclic reactions OAA is recycled back.

Question67

EMP can produce a total of
(1990)

Options:

A. 6AT P

B. 8AT P

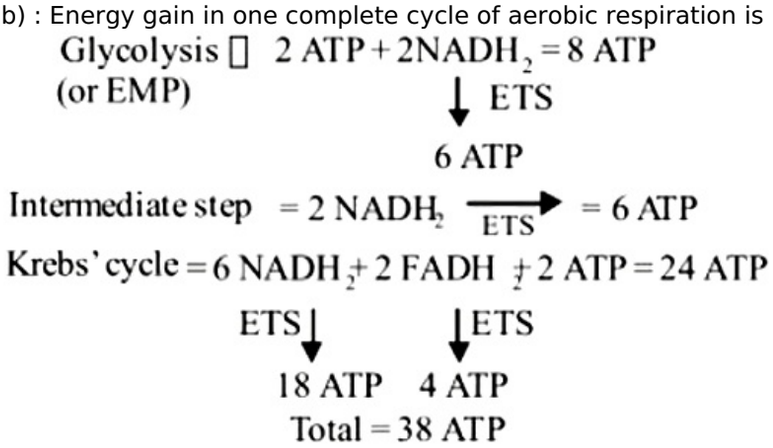
C. 24 ATP

D. 38 ATP

Answer: B

Solution:

Solution:
(b) : Energy gain in one complete cycle of aerobic respiration is :



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Question68

R.Q. is ratio of (1990)

Options:

A. CO_2, produced to substrate consumed

B. CO_2, produced to O_2 consumed

C. oxygen consumed to water produced

D. oxygen consumed to CO_2 produced

Answer: B

Solution:

(b) : The ratio of the volume of CO_2, released to volume of O_2 absorbed in the respiratory process is termed as the respiratory ratio or Respiratory Quotient.

$$R.Q. = \frac{\text{Volume of } CO_2 \text{ evolved}}{\text{Volume of } O_2 \text{ absorbed}}$$

Value of R.Q. varies from one respiratory substrate to another, e.g., R.Q. of carbohydrates is equal to 1 , R.Q. of lipids and proteins are less than 1, that of organic acid is greater than 1 .

Question69

End product of glycolysis is (1988)

Options:

A. acetyl CoA

B. pyruvic acid

C. glucose 1 -phosphate

D. fructose 1 -phosphate.

Answer: B

Solution:

Solution:
(b) : Glycolysis or EMP pathway is the breakdown of glucose to two molecules of pyruvic acid through a series of enzyme mediated reaction releasing energy. Pyruvic acid is a 3 -carbon compound. In glycolysis net gain of 2AT P and 2 NADH $_2$ molecules occurs. It can be represented in equation form as -
$C_6H_{12}O_6 + 2\,ADP + 2\,Pi + 2\,NAD \rightarrow 2CH_3COCOOH + 2\,ATP + 2NADH_2$

Question70

$NADP^+$ is reduced to NADPH in (1988)

Options:

A. HMP

B. Calvin Cycle

C. glycolysis

D. EMP.

Answer: A

Solution:

(a) : HMP pathway generates NADPH molecules which are used as reductants in biosynthetic process under conditions when NADPH molecules are not generated by photosynthesis. It is, therefore, important in non-photosynthetic tissues such as in differentiating tissues, generating seeds and during periods of darkness. Production of NADPH is not linked to ATP generation in pentose phosphate pathway.