MCQs

Life Sciences

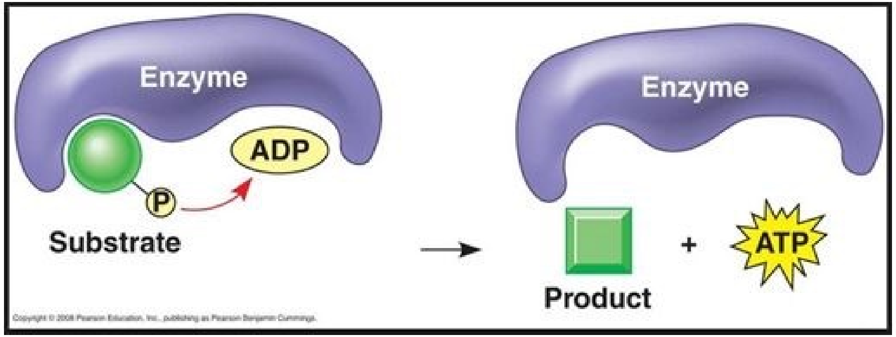
Question - Answers & Quick Notes

Useful for CSIR NET and other Life Science Examinations

Topic: Oxidative Phosphorylation

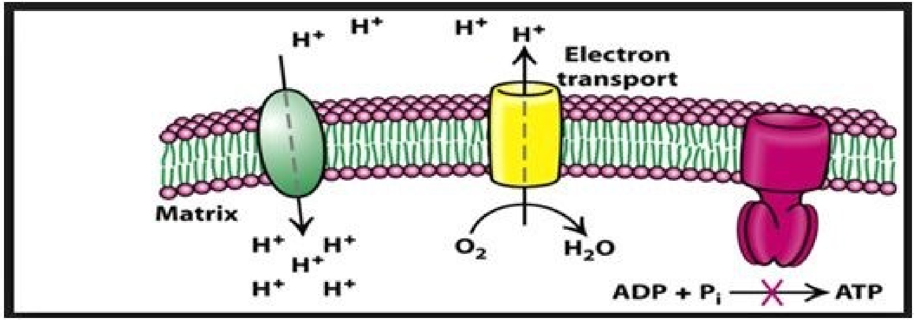
EXCEL SCIENCE

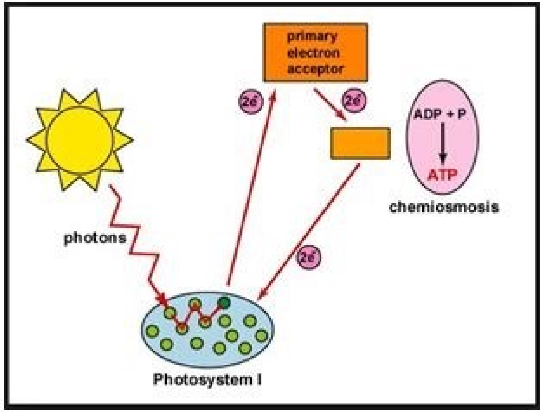
www.DiligentEdu.in



← SUBSTRATE LEVEL PHOSPHORYLATION

OXIDATIVE PHOSPHORYLATION →





← PHOTOPHOSPHORYLATION

EXCEL SCIENCE

MCQs

(JUNE 2017)

1. Three electron acceptors 'X', 'Y' and 'Z' have redox potential (E_0') of +0.15V, +0.06V and -0.1V, respectively. For a reaction

$$B + 2H + 2e^- \rightarrow BH_2 \quad E_0' = +0.05V$$

Which of these three electron acceptors are appropriate?

[useful equation: $\Delta G_0' = -nFE_0'$]

$\Delta G_0'$ = free energy change;

n = number of electron

F = Faraday constant

(1) X and Y
(2) Only X
(3) Y and Z
(4) Only Z

MCQs

(JUNE 2017)

1. Three electron acceptors 'X', 'Y' and 'Z' have redox potential (E_0') of +0.15V, +0.06V and -0.1V, respectively. For a reaction

$$B + 2H + 2e^- \rightarrow BH_2 \quad E_0' = +0.05V$$

Which of these three electron acceptors are appropriate?

[useful equation: $\Delta G_0' = -nFE_0'$]

$\Delta G_0'$ = free energy change;

n = number of electron

F = Faraday constant

(1) X and Y (2) Only X

(3) Y and Z (4) Only Z

Correct Answer is (1)

B is donor. Reduction potential should be either equal or more. Electron cannot move from '+' to '–'

MCQs

Q2. The half reaction during reversible ***lactate dehydrogenase*** reaction and standard redox potential are

$$\text{Pyruvate} + 2H^{+} + 2e^{-} \rightarrow \text{lactate} \quad E^{o} = -0.185V$$

$$NADH + H^{+} \rightarrow NAD^{+} + 2H^{+} + 2e^{-} \quad E^{o} = -0.315V$$

On basis of above information the correct statement is

(1) The electron are readily picked up by NAD from pyruvate under standard conditions

(2) $NADH_2$ provide electrons to pyruvate for reduction to lactate under standard conditions

(3) Both reaction are independent

(4) Reaction occurs spontaneously in direction lactate to pyruvate under standard conditions

MCQs

Q2. The half reaction during reversible ***lactate dehydrogenase*** reaction and standard redox potential are

$$\text{Pyruvate} + 2H^+ + 2e^- \rightarrow \text{lactate} \quad E^o = -0.185V$$

$$NADH + H^+ \rightarrow NAD^+ + 2H^+ + 2e^- \quad E^o = -0.315V$$

On basis of above information the correct statement is

(1) The electron are readily picked up by NAD from pyruvate under standard conditions

(2) $NADH_2$ provide electrons to pyruvate for reduction to lactate under standard conditions

(3) Both reaction are independent

(4) Reaction occurs spontaneously in direction lactate to pyruvate under standard conditions

Correct Answer is (2) - Redox potential of NADH/NAD pair is more negative as compare to lactate/pyruvate pair. Electron will flow from low to high redox potential.

Half reactions: Reduction or oxidation?

Reduction potentials are useful because they indicate how likely a half reaction will take on the role of the "reduction" in a redox reaction. When two half reactions are paired in a redox reaction, the half reaction with the higher E°' will act as the reduction reaction, and the half reaction with the lower E°' will act as the oxidation reaction. Consider the words "reduction potential"—the higher the E°' value, the stronger the tendency for the compound to gain electrons.

In other words, electrons flow from the substance whose half reaction has the lower reduction potential to the substance whose half reaction has the higher reduction potential.

The higher the E°' value, the stronger the tendency for the compound to gain electrons.

The difference in the E°' values of different half reactions has very real consequences for life on our planet. For example, the half reaction for the reduction of oxygen to water has a very high E°' value, 0.816 V.

$$O_2 + 2\,H^+ + 2\,e^- \quad H_2O \quad E°' = 0.816\ V$$

It is no coincidence that oxygen has a very high E°' and that we require it for life. Oxygen's great affinity for electrons allows it to be used in living organisms as an electron "sink" or dumping ground for excess electrons generated by biochemical reactions needed for life. Without the presence of oxygen in our cells to sweep away these excess electrons, aerobic life would soon cease.

https://sceweb.sce.uhcl.edu/wang/biochem/redox/4_reduction_potential.html

MCQs

3. Consider the following coupled reaction

Acetaldehyde + $2H^+$ + 2 e^- → Ethanol $\Delta E^{0'} = -0.16$ V

NAD + $2H^+$ + 2 e^- → NADH + H^+ $\Delta E^{0'} = -0.32$ V

Under standard conditions the transfer of electron is from

(1) NAD to acetaldehyde

(2) NADH to ethanol

(3) NADH to acetaldehyde

(4) Ethanol to NADH

MCQs

3. Consider the following coupled reaction

Acetaldehyde + $2H^+$ + 2 e^- → Ethanol $\Delta E^{0'} = -0.16$ V

NAD + $2H^+$ + 2 e^- → NADH + H^+ $\Delta E^{0'} = -0.32$ V

Under standard conditions the transfer of electron is from

(1) NAD to acetaldehyde
(2) NADH to ethanol
(3) NADH to acetaldehyde ✓
(4) Ethanol to NADH

Reduction potential should be either equal or more.
The higher the $E^{o'}$ value, the stronger the tendency for the compound to gain electrons.

MCQs

4. The process of photosynthesis which leads to formation of glucose from CO_2 and H_2O is an example of

(1) Oxidation
(2) Reduction
(3) Condensation
(4) Fixation

MCQs

4. The process of photosynthesis which leads to formation of glucose from CO_2 and H_2O is an example of

(1) Oxidation
(2) Reduction ✓
(3) Condensation
(4) Fixation

The **reduction of carbon dioxide** into sugars and **oxidation of water** into molecular oxygen is involved in photosynthesis.

To produce carbon dioxide and water, the reverse reaction, respiration, oxidizes sugars.

EXCEL SCIENCE

MCQs

5. In bacteria site of respiration is-

(1) Mesosome only
(2) Plasma membrane
(3) Endoplasmic reticulum
(4) Microsomes

MCQs

5. In bacteria site of respiration is-

(1) Mesosome only
(2) Plasma membrane ✓
(3) Endoplasmic reticulum
(4) Microsomes

Cellular respiration takes place in the entire plasma membrane of bacteria. **Mesosomes** are folded invaginations in the cell membrane of bacteria. Their function is to form septum and allow bacteria to divide by binary fission.

MCQs

6. The site for oxidative phosphorylation in eukaryotes is

(1) Inner membrane of mitochondria

(2) Vacuole membrane

(3) Plasma membrane

(4) Thylakoid membrane of chloroplast

MCQs

6. The site for oxidative phosphorylation in eukaryotes is

(1) Inner membrane of mitochondria ✓

(2) Vacuole membrane

(3) Plasma membrane

(4) Thylakoid membrane of chloroplast

The site for oxidative phosphorylation in eukaryotes is inner membrane of mitochondria as it contains all enzymes for electron transport.

MCQs

7. In mitochondria the enzymes of electron transport chain are located at

(1) Outer membrane

(2) Inter membrane space

(3) Inner membrane

(4) Matrix

MCQs

7. In mitochondria the enzymes of electron transport chain are located at

(1) Outer membrane

(2) Inter membrane space

(3) Inner membrane ✓

(4) Matrix

The site for oxidative phosphorylation in eukaryotes is inner membrane of mitochondria as it contains all enzymes for electron transport.

MCQs

8. NADH donates its electron to electron transport chain through primary acceptor

(1) CoQ (2) FMN

(2) FAD (4) Cytochrome oxidase

MCQs

8. NADH donates its electron to electron transport chain through primary acceptor

(1) CoQ
(2) FMN ✓
(2) FAD
(4) Cytochrome oxidase

NADH initially binds to **complex - I** and transfers two electrons to the flavin mononucleotide (FMN) prosthetic group of the enzyme, creating $FMNH_2$. The electrons are then transferred through the FMN via a series of iron-sulfur (Fe-s) clusters, and finally to CoenzymeQ (ubiquinone).

MCQs

9. Iron-sulphur clusters (Fe-S] are the key prosthetic groups that carry electrons in all of the below EXCEPT:

(1) NADH - CoQ reductase

(2) Succinate - CoQ reductase

(3) Cytochrome c oxidase

(4) COQH2 -Cytochrome C reductase

MCQs

9. Iron-sulphur clusters (Fe-S] are the key prosthetic groups that carry electrons in all of the below EXCEPT:

(1) NADH - CoQ reductase

(2) Succinate - CoQ reductase

(3) Cytochrome c oxidase ✓

(4) COQH2 -Cytochrome C reductase

MCQs

The enzyme **Cytochrome c oxidase** or **Complex IV** is a large transmembrane protein complex found in bacteria, archaea, and mitochondria of eukaryotes. The complex is a large integral membrane protein composed of several metal prosthetic sites and 14 protein subunits in mammals.

The complex contains two hemes, a **cytochrome a** and **cytochrome a_3**, and two **copper** centers, the **Cu_A** and **Cu_B** centers.

MCQs

10. In prokaryotes, the terminal electron acceptor in anaerobic conditions are generally

(1) Glucose, fructose, maltose

(2) Fatty acids

(3) SO_4^{2-}, NO_3^{2-}, S

(4) Antioxidants such as Vitamin K

MCQs

10. In prokaryotes, the terminal electron acceptor in anaerobic conditions are generally

(1) Glucose, fructose, maltose

(2) Fatty acids

(3) SO_4^{2-}, NO_3^{2-}, S ✓

(4) Antioxidants such as Vitamin K

MCQs

Anaerobic respiration is the formation of ATP *without oxygen*.

This method still incorporates the respiratory electron transport chain, but without using oxygen as the terminal electron acceptor. Instead, molecules such as sulfate (SO_4^{2-}), nitrate (NO_3^-), sulfur (S), nitrite, ferric iron, carbon dioxide, and small organic molecules such as fumarate are used as electron acceptors. These molecules have a lower reduction potential than oxygen; thus, less energy is formed per molecule of glucose in anaerobic versus aerobic conditions.

Thank you!

EXCEL
SCIENCE

www.YouTube.com/@EXCEL_SCIENCE