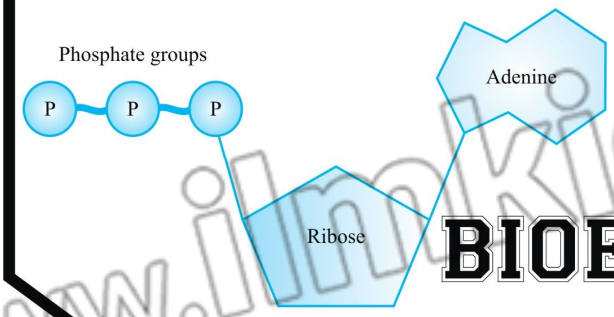


CH# 7

BIOENERGETICS

7.1 BIOENERGETICS AND THE ROLE OF ATP

LONG QUESTIONS

Q.1 Define bioenergetics and discuss energy transformations in living organisms.

(Knowledge Based) **(Ex Q. No 1)**

Ans:

BIOENERGETICS

Definition:

"It is the **study of energy relationships** and **energy transformations** in **living organisms**."

Energy Gain:

Organisms obtain energy by **metabolizing** the **food** they **eat** or **prepare**. Food **contains potential energy** in its **bonds**.

Release of Energy:

When these **bonds** are **broken down**, a **large amount of kinetic energy** is usually **released**. Some of this **energy** is stored in the **form of potential energy** in the **bonds of ATP molecules** while **the rest escapes as heat.**

Energy Transformations:

The **potential energy stored** in **ATP** is **again transformed** into **kinetic energy** to **carry out life activities.**

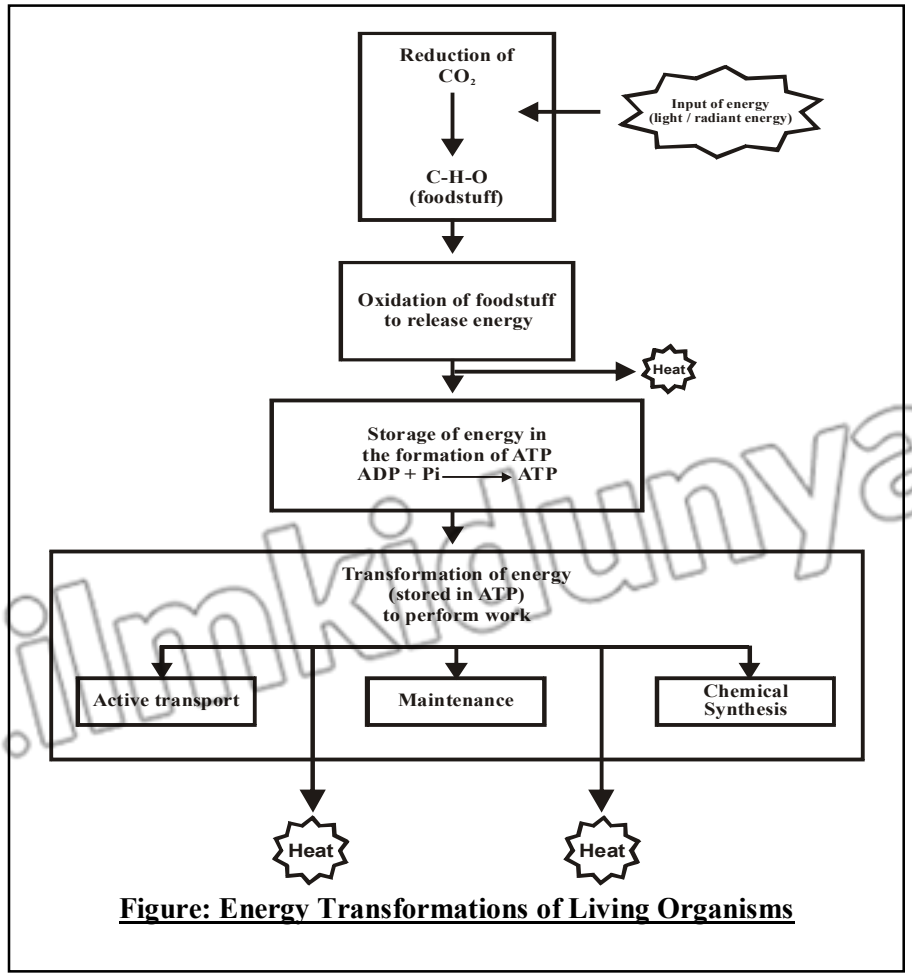


Figure: Energy Transformations of Living Organisms

Q.2 Write a note on oxidation reduction reactions. ***(Understanding Based)***
(MTN 2014, BWP 2014) (Ex Q. No 1)

Ans: **OXIDATION REDUCTION REACTIONS**

Life Processes:

Various life processes in **organisms** involve **constant flow of energy**. This **energy flow comprises** the **acquisition, transformation of energy** and **use of energy** for various life processes like:

- **Growth**
- **Movement**
- **Reproduction**

Direct Energy Source:

For all life processes, **oxidation-reductions reactions** (redox reactions) are the **direct source of energy**.

Redox Reactions:

Redox reactions involve **exchange of electrons between atoms**.

Oxidation:

The **loss of electrons** is called oxidation.

Reduction:

The **gain of electrons** is called reduction.

Electrons as Source of Energy:

Electrons **can be an energy source**. It **depends upon their location** and **arrangement in atoms**. They can form two types of associations:

- **Stable association**
- **Unstable association**

Stable Association:

When **electrons** are **present in oxygen**, they **make stable association** with **oxygen atom** and are **not good energy source.**

Unstable Association:

If electrons are dragged away from oxygen and attached to some other atom e.g. carbon or hydrogen, they make unstable association. The try to move back to oxygen and when this happens, energy is released.

Redox Reactions in Living Organisms:

In living organisms, **redox reactions** involve the loss and **gain of hydrogen atoms**. A **hydrogen atom contains one proton** and **one electron**. It **means** that when a **molecule loses a hydrogen atom,** it actually **loses an electron** (oxidation). Similarly, when a **molecule gains a hydrogen atom**, it actually **gains an electron** (reduction).

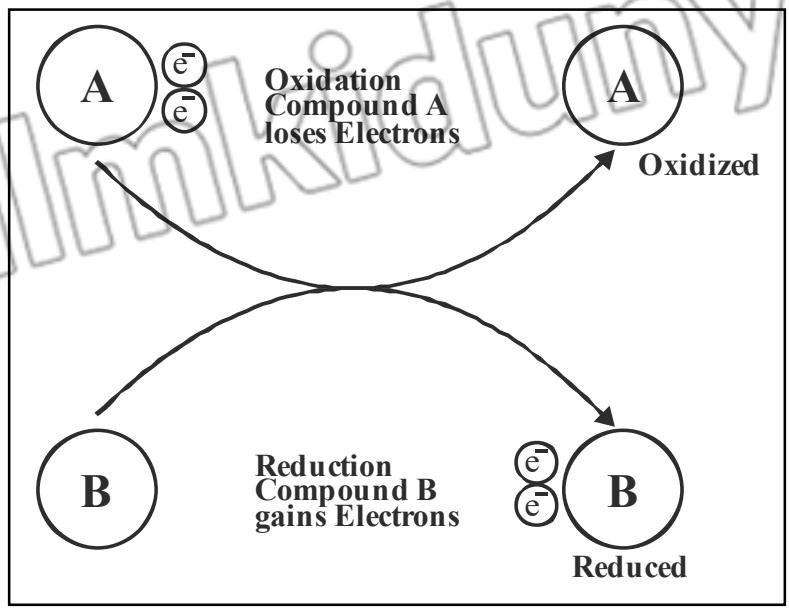


Figure: Redox Reactions

Q.3 Write a note on ATP. ***(Knowledge Based)*** **(SGD 2015) (Ex Q. No 2)**

Ans:

ATP: THE CELL'S ENERGY CURRENCY

Introduction:

The **major energy currency** of all **cells is a nucleotide** called adenosine triphosphate (ATP).

Discovery:

ATP was discovered in **1929 by Karl Lohmann**.

Work of Fritz Lipmann:

In **1941, Fritz Lipmann** proposed **ATP** to be the **main energy-transfer molecule** in the cell. He was **awarded Nobel Prize.**

Significance:

ATP is the main energy source for majority of the cellular functions like:

- **Synthesis of macromolecules** (DNA, RNA, proteins)
- **Movement**
- **Transmission of nerve impulses**
- **Active transport**
- **Exocytosis**
- **Endocytosis**

Appearance of ATP:

ATP plays a **central role as energy currency** in all organisms, it must **have appeared in the early history of life**.

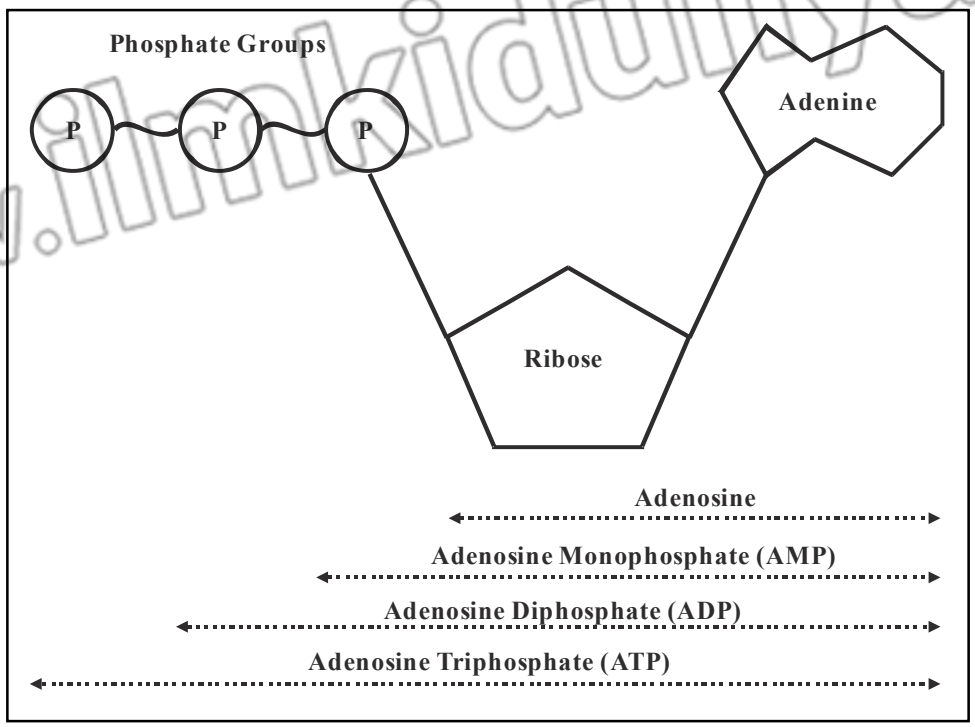


Figure: Molecular Structure of ATP

Molecular Structure of ATP:

The ability of ATP to **store** and **release energy** is **due to its molecular structure**. Each **ATP molecule has three subunits**:

- **Adenine** (a double-ringed nitrogenous base)
- **Ribose** (a five-carbon sugar)
- **Three phosphate groups in a linear chain**

Tilde Bond:

The **covalent bond connecting two phosphates** is indicated by **'tilde'** (~) and is **a high energy bond**.

Energy Release:

The **energy in this bond is released** as it **breaks** and **inorganic phosphate** (Pi) **gets separated from ATP.**

Breakdown of ATP:

The breaking of one phosphate bond releases about 7.3 Kcal (7,300 calories) **per mole** of ATP as follows:

$$ATP + H_2O \longrightarrow ADP + P_i + \text{Energy (7.3 Kcal/mole)}$$

In common energy reactions, **only the outermost of the two high-energy bonds breaks. When this happens, ATP becomes ADP** (adenosine diphosphate) and one Pi is released.

Breakdown of ADP:

In some cases, **ADP is further broken down to AMP** (adenosine monophosphate) and **Pi as follows:**

$$ADP + H_2O \longrightarrow AMP + P_i + \text{Energy (7.3 Kcal/mole)}$$

Synthesis of ATP:

Cells constantly recycle ADP by recombining it with Pi to form ATP. The **synthesis** of **ATP** from **ADP** and **Pi requires** the **expenditure of 7.3 kcal** of **energy per mole**. This energy is obtained from **the oxidation of foodstuff**.

Conclusion:

ATP is **generated by energy-releasing processes** and is **broken down** by **energy-consuming processes**. In this way, **ATP transfers energy** between **metabolic reactions**.

Energy Storage:

When cells use energy to build **ATP** from **ADP,** or **ADP** from **AMP**, they are **storing energy** as we **put money in a bank.**

SHORT QUESTIONS (Topic 7.1)

Q.1 What are forms of energy in living organism? ***(U.B)***

OR

In how many forms does energy exist in living organisms? ***(U.B)***

Ans: **ENERGY FORMS IN LIVING ORGANISMS**

In living organisms, energy exists in two forms.

Kinetic energy:

It is involved in doing any work.

Potential energy:

It is stored energy for future use. Potential energy is stored in chemical bonds and is released as kinetic energy when these bonds break.

Q.2 Define bioenergetics. ***(K.B)*** **(GRW 2012, 2015)**

Ans: Page no 202.

Q.3 Discuss energy transformations in living organisms. ***(U.B)***

Ans: **TRANSFORMATIONS IN LIVING ORGANISMS**

Organisms obtain energy by metabolizing the food they eat or prepare. Food contains potential energy in its bonds. When these bonds are broken down, a large amount of kinetic energy is usually released. Some of this energy is stored in the form of potential energy in the bonds of ATP molecules while the rest escapes as heat. The potential energy stored in ATP is again transformed into kinetic energy to carry out life activities.

Q.4 Recall mode of nutrition of plants, microorganisms, fungi and animals. ***(K.B)***

Ans: **MODES OF NUTRITION**

Plants and Micro-organisms:

Plants and some micro-organisms (e.g. photosynthetic bacteria and algae) prepare their own food from carbon dioxide and water in the presence of light by a process called photosynthesis.

Animals and Fungi:

Animals, fungi and many micro-organisms (non-photosynthetic bacteria and protozoans) get the prepared food.

Q.5 What are redox reactions? ***(U.B)*** **(LHR 2013, 2014, FSD 2014, BWP 2015)**

Ans: Page no 203.

Q.6 Can electrons be an energy source? ***(U.B)***

Ans: Page no 203.

Q.7 What is the role of ATP in living organisms? *(A.B)*

Ans: Page no 204.

Q.8 What is the significance of Tilde (~) bond?

Ans: Tilde (~) bond is a high energy covalent bond connects phosphate present in ATP. The energy in "tilde" (~) bond is released as it breaks and inorganic phosphate (Pi) gets separated from ATP.

The breaking of one phosphate bond releases about 7.3 kcal (7300 calories) per mole of ATP as follows:

$$ATP + H_2O \rightarrow ADP + Pi + Energy(7.3\,kcal/mole)$$

Q.9 What is the Biochemical composition of ATP? Write down the structure of ATP? **(LHR-14)**

Ans: Page no 205.

Q.10 What is meant by cell's energy currency? *(K.B)* **(SWL 2014, MTN 2014, DGK 2015)**

Ans: Page no 205.

Q.11 How energy is recycled in a cell? *(U.B)*

Ans: Page no 206.

MULTIPLE CHOICE QUESTIONS (Topic 7.1)

1. All the process in cell are driven by: *(K.B)*

(A) Energy (B) Transportation
(C) Anabolic reactions (D) Catabolic reaction

2. Energy stored in chemical bonds is: *(K.B)*

(A) Potential energy (B) Kinetic energy
(C) Thermal energy (D) all of these

3. Food contains energy in its bonds in the form of: *(K.B)* **(LHR 2013)**

(A) Kinetic energy (B) Potential energy
(C) Mechanical energy (D) All of these

4. Conversion of food into CO2 and water, transforms energy into: *(U.B)*

(A) Chemical energy (ATP) (B) Thermal energy
(C) Kinetic energy (D) All of these

5. The loss of electrons is called: *(U.B)* **(GRW 2015, DGK 2014)**

(A) Oxidation (B) Reduction
(C) Redox (D) Both A and B

6. Direct source of energy in all life processes are: *(K.B)*

(A) Oxidation reactions (B) Reduction reactions
(C) Redox reaction (D) Catabolic reactions

7. Gain of electrons is called: *(U.B)*

(A) Oxidation (B) Reduction
(C) Redox (D) Both A and B

8. ATP was discovered by: *(K.B)* **(GRW 2012, BWP 2015)**

(A) Fritz Lipmann (B) Karl Lohmann
(C) Malvin Calvin (D) Sir Hans Krebs

9. ATP was discovered in: *(K.B)* **(GRW 2014, LHR 2012)**

(A) 1923 (B) 1925
(C) 1927 (D) 1929

10. ATP is an example of: *(K.B)* **(LHR 2016)**

(A) Amino acid (B) Fatty acid
(C) Nucleic acid (D) Nucleotide

11. The ATP was proposed to be the main energy transfer molecule in the cell by: *(K.B)*

(A) Fritz Lipmann (B) Karl Lohmann
(C) Rudolf Virchow (D) Sir Hans Krebs

12. Each ATP molecule has subunits: *(K.B)* **(GRW, 2012, LHR 2012, SGD 2014)**

(A) Two (B) Three
(C) Four (D) Five

13. Number of phosphate groups in ATP molecule: *(K.B)* **(SGD 2015)**

(A) One (B) Two
(C) Three (D) Four

14. From which bond of ATP molecule energy is taken? *(K.B)* **(GRW 2012)**

(A) C-N bond (B) C-O bond
(C) C-H bond (D) P-P bond

15. The covalent bond connected to two phosphate is: *(K.B)* **(LHR 2014)**

(A) Ratio (B) Proportion
(C) Colon (D) Tilde

16. How much energy is released by breaking of one phosphate bond of ATP? *(K.B)* **(LHR 2012, MTN 2014, FSD 2014)**

(A) 7100 calories (B) 7200 calories
(C) 7300 calories (D) 7400 calories

17. When one inorganic phosphate is detached from ATP, it is converted into: *(K.B)*

(A) ADP (B) AMP
(C) GMP (D) GTP

18. Transformed form of potential energy from food, inside body, is stored in bonds of: *(U.B)*

(A) Lipids (B) Proteins
(C) Carbohydrates (D) ATP

19. The high energy bond between adjacent phosphates in ATP is: *(U.B)*

(A) Tilde (B) Peptide
(C) Phosphor di-ester (D) Nucleotide

20. The amount of energy requires to convert ADP to ATP is: *(K.B)*

(A) 7300 calories (B)9000 calories
(C) 4000 calories (D) 7.3 calories

7.2 PHOTOSYNTHESIS

LONG QUESTIONS

Q.1 What is photosynthesis? Explain intake of water and carbon dioxide. ***(K.B)*** **(GWR 2015)**

Ans:

PHOTOSYNTHESIS

Definition:

"The process of **synthesis of glucose** from **carbon dioxide** and **water** in the **presence of sunlight** and **chlorophyll, with oxygen** as a **by-product** is called as photosynthesis."

Anabolic Process:

Photosynthesis is an **important anabolic** (building) **process**. It comprises **many coordinated biochemical reactions.**

Importance:

- It is an **important component of bioenergetics** in living systems.
- It is the **most important biochemical pathway** and **nearly all life depends on it**.

Photosynthetic Organisms:

It comprises many co-ordinated bio-chemical reactions that occur in:

- **Plants**
- **Some protists (algae)**
- **Some bacteria**

General Equation:

$$6CO_2 + 12H_2O + \text{Light energy} \xrightarrow{\text{Chlorophyll}} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

INTAKE OF WATER AND CARBONDIOXIDE

Raw Materials:

Water and **carbon dioxide** are the **raw materials** for **photosynthesis**. Plants **have mechanisms** for the **intake** and **transport of these raw materials.**

Intake of Water:

Water, present in soil, is **absorbed by root and root hairs through osmosis.** This water is eventually **transported** to the **leaves through xylem vessels.**

Intake of Carbon Dioxide:

The air that enters leaf through tiny pores (stomata) reaches into the air spaces present around mesophyll cells. This air carries CO_2, which gets absorbed in the thin layer of water surrounding mesophyll cells. From here, the carbon dioxide diffuses into mesophyll cells.

Role of Stomata:

Stomata cover only **1-2%** of the **leaf surface** but **they allow much air** to **pass through them.**

Q.2 Describe mechanism of photosynthesis in detail. ***(K.B)*** **(DGK 2014)**

Ans:

MECHANISM OF PHOTOSYNTHESIS

Photosynthesis occurs in two phases:

i. **Light reactions**
ii. **Dark reactions**

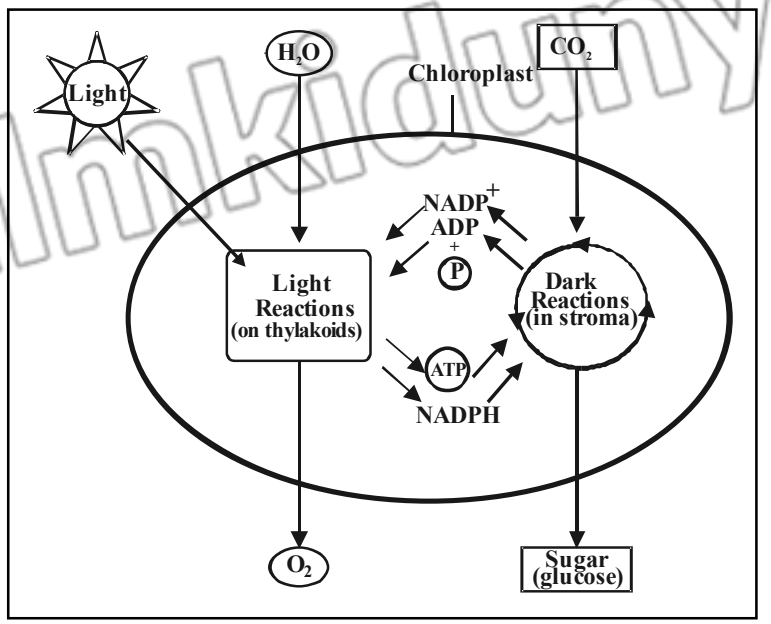


Figure: Summary of Photosynthesis

i. Light Reactions:

Definition:

"The reactions which **require light** are called light reactions. They are also called **'Z-scheme."**

Formation of High Energy Molecules:

During first phase, light energy is captured and is used to make high energy molecules:

- **ATP**
- **NADPH**

Occurrence:

These reactions, which **are known as light reactions**, take **place on the thylakoid membranes of chloroplasts.**

ii. Dark Reactions:

Definition:

"The reactions **which do not require light are called light reactions. They are also called 'Calvin cycle."**

Formation of Glucose:

During second phase, **carbon dioxide is reduced to make glucose**. In this phase, **the energy** from **high energy molecules** (ATP and NADPH) is **utilized**.

Occurrence:

The **dark reactions take place in the stroma of the chloroplasts.**

Q.3 Write a detailed note on light and dark reactions of photosynthesis. ***(Application Based)*** **(LHR 2013, 2014, 2016, GWR 2015, SWL 2015) (Ex Q. No 4)**

Ans:

LIGHT REACTIONS

Definition:

"The reactions **which require light** are called light reactions."

Formation of High Energy Molecules:

During first phase, **light energy** is **captured** and **is used to make high energy molecules** (ATP and NADPH).

Occurrence:

These reactions, **which are known as light reactions, take place** on the **thylakoid membranes of chloroplasts.**

Mechanism:

The **summary of events of light reactions is as follows:**

Emission of Electrons:

When **chlorophyll molecules absorb light**, their **energy level increases** and **their electrons** are **emitted**.

Synthesis of ATP:

Electrons are passed to electron transport chain to produce ATP.

Photolysis:

Light breaks water molecule (photolysis) and **oxygen is released**. **Hydrogen atoms of water** give **electrons** to **chlorophyll** and **become ions**.

Reduction of $NADP^+$:

The **electrons of chlorophyll,** after **the production of ATP**, and **hydrogen ions of water** are **used for** the **reduction of $NADP^+$ into NADPH**.

Z-scheme:

The **whole series of light reactions is called Z-scheme due to its Z-shaped flowchart.**

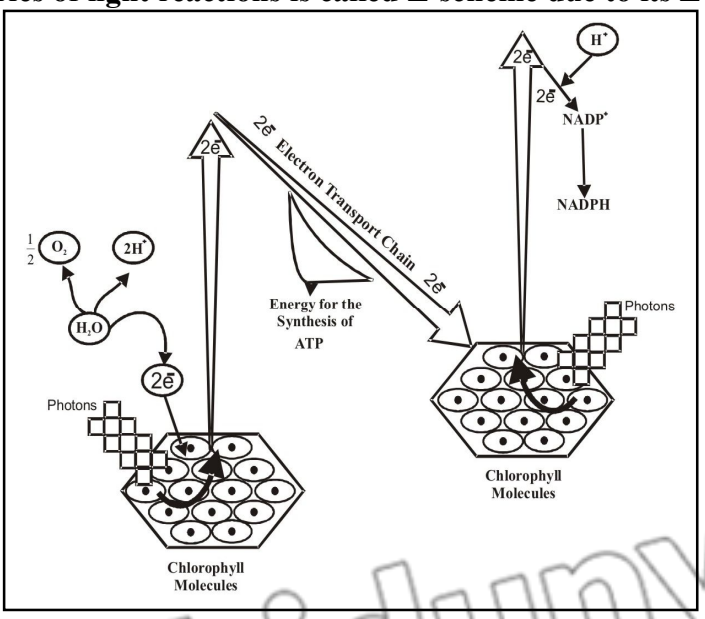


Figure: Light Reactions of Photosynthesis

DARK REACTIONS

(LHR 2013, GWR 2014, SWL 2014, DGK 2015, BWP 2015, FSD 2014, SGD 2015)

Definition:

"The reactions **which do not require light** are called **light reactions**. They are also **called 'Calvin cycle'."**

Discovery:

The details of dark reactions were discovered **by Malvin Calvin and his colleagues at The University** of **California**. Calvin was **awarded Nobel Prize in 1961** for his work on the **details of photosynthesis.**

Formation of Glucose:

During **second phase**, **carbon dioxide** is **reduced** to **make glucose**. In this phase, the **energy** from **high energy molecules** (ATP and NADPH) is **utilized.**

Occurrence:

The **dark reactions** take place in **the stroma of the chloroplasts**.

Mechanism:

The **summary of events** of **dark reactions** also **known as Calvin cycle** is as follows:

Formation of 3-C Compounds:

CO_2 molecules are **combined** with **5-carbon compounds** to **form temporary 6-carbon compounds**, each of **which splits into two 3-carbon compounds.**

Formation of 3-C Carbohydrates:

The **3-carbon compounds are reduced** to **3-carbon carbohydrates** by **using ATP** and **hydrogen** from **NADPH**. The **3-carbon carbohydrates** are used **to manufacture glucose**.

Formation of 5-C Compounds:

The **3-carbon carbohydrates** are also **used to generate** the **original 5-carbon compounds**. This step also **utilizes ATP**.

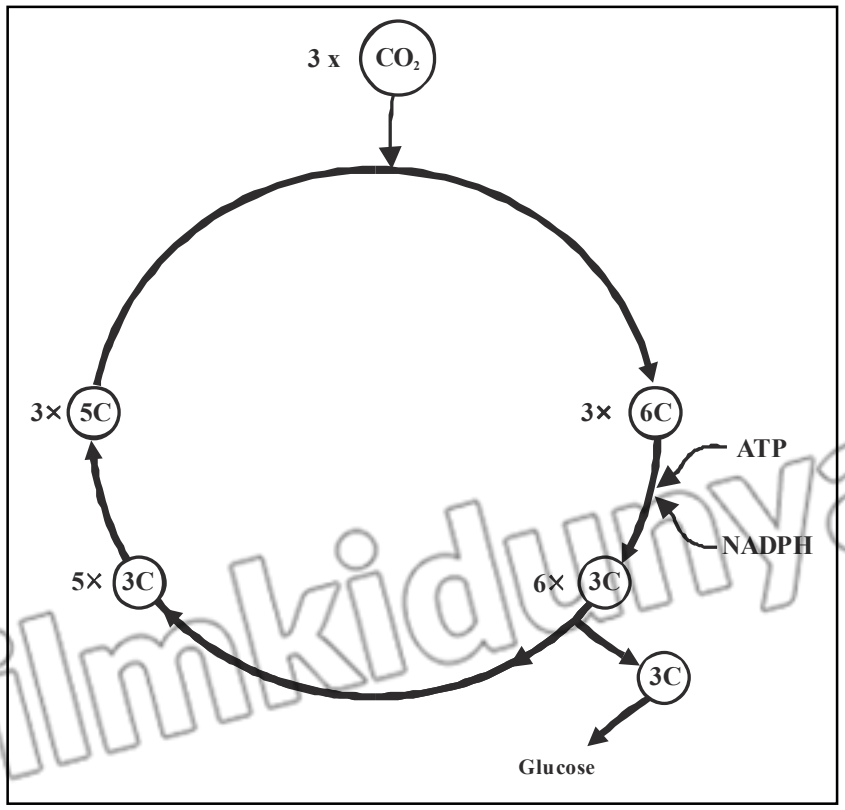


Figure: Dark Reactions of Photosynthesis (The Calvin Cycle)

Q.4 Discuss role of chlorophyll and light in photosynthesis. *(A.B)* **(SGD 2014) (Ex Q. No 3)**

Ans:

ROLE OF CHLOROPHYLL AND LIGHT

Absorption of Sunlight Energy:

Sunlight energy is **absorbed** by **chlorophyll**. It is then **converted** into **chemical energy**, which **drives the photosynthetic process**.

Amount of Light Absorbed:

Only about **1% of the light falling** on the **leaf surface** is **absorbed**, the rest is **transmitted** or **reflected**.

Variation in Absorption:

The **light rays** of **different wavelengths** are **not only differently absorbed** by **photosynthetic pigments**, but are also **differently effective in photosynthesis**. The **blue** and **red lights** carry **out more photosynthesis**.

Pigments:

Pigments are the **substances** that **absorb visible light**. **Different pigments** absorb **light of different wavelengths** (colours).

Photosystems:

Photosynthetic pigments are **organized in the form of clusters called** photosystems, in thylakoid membranes of chloroplasts.

Main Pigment:

Chlorophyll-a is the **main photosynthetic pigment.**

Accessory Pigments:

Chlorophyll-b and **carotenoids are the accessory pigments**.

Role of Chlorophyll:

Chlorophylls mainly **absorb red** and **blue lights**. Some **wavelengths not absorbed by Chlorophyll-a** are **very effectively absorbed** by **accessory pigments** and **vice versa**.

Q.5 Define limiting factor. Explain some of the limiting factors in photosynthesis. *(A.B)***(LHR 2015, MTN 20**

Ans:

LIMITING FACTOR

Definition:

"Any environmental factor the **absence** or **deficiency of which** can **decrease** the **rate of a metabolic reaction**, is called limiting factor for that reaction."

Important Limiting Factors:

Many factors act as limiting factors for photosynthesis like:

- **Light intensity**
- **Temperature**
- **Concentration of carbon dioxide**
- **Availability of water**

Effect of Light Intensity:

The **rate of photosynthesis** varies **with light intensity**. It **decreases** as the **light intensity decreases** and **increases as the light intensity increases**. However, at **much higher light intensity,** the **rate of photosynthesis becomes constant**.

Effect of Temperature:

The **rate of photosynthesis decreases** with **decrease in temperature**. It **increases** as **temperature** is **increased over a limited range**. But if **light intensity is low, increasing** the **temperature** has **little influence on the rate of photosynthesis.**

Effect of Carbon Dioxide Concentration:

As **carbon dioxide concentration rises**, the **rate of photosynthesis** goes **on increasing until limited** by **other factors**. **Increase** in **carbon dioxide concentration** beyond a **certain level** causes the **closure of stomata**, and it **decreases** the **rate of photosynthesis**.

SHORT QUESTIONS (Topic 7.2)

Q.1 Define photosynthesis. Write down its chemical equation. *(K.B)*
(GRW 2012, 13, 14, LHR 2013, 15, SWL 2014, MTN 2014, BWP 2015, SGD 2014, 15, RWP 2015)

Ans: Page no 209.

How CO_2 is taken into plants through leaves? *(U.B)*

Ans: Page no 209.

Q.2 Differentiate between dark and light reactions. *(K.B)* **(LHR 2012)**

Ans:

DIFFERENTIATION

The difference between dark and light reactions are as follows:

Light Reactions	Dark Reactions
Phase	
It is the first phase of photosynthesis.	It is the second phase of photosynthesis.
ATP and NADPH	
Light energy is captured and is used to make high-energy molecules (ATP and NADPH)	Carbon dioxide is reduced to make glucose and energy from high-energy molecules (ATP and NADPH) is utilized.
Occurrence	
It takes place on the thylakoid membranes of chloroplasts.	It takes place in the stroma of the chloroplasts.
Light	
These reactions require light.	These reactions do not use light directly.

Q.3 What is NAD^+? *(K.B)*

Ans:

NAD^+

Nicotinamide adenine dinucleotide (NAD^+) is a coenzyme that takes electrons and hydrogen ions and is thus reduced to NADH. One form of this coenzyme also carries phosphate with it, so called $NADP^+$.

Q.4 What is meant by photolysis? *(K.B)* **(LHR 2016)**

Ans: Page no 211.

Q.5 Who discovered dark reactions? *(K.B)*

Ans: Page no 211.

Q.6 What is the function of chlorophyll in photosynthesis? *(A.B)*

Ans: Page no 212.

Q.7 Define photosystems. *(K.B)* **(SWL 2015)**

Ans: Page no 212.

Q.8 What is meant by pigments? *(K.B)* **(RWP 2015)**

Ans: Page no 212.

Q.9 Define limiting factor. *(U.B)* **(MTN 2015, GRW 2015, DGK 2014, RWP 2014, 2015)**

Ans: Page no 212.

Q.10 What is effect of light intensity on photosynthesis? *(A.B)*

Ans: Page no 212.

Q.11 How the temperature affects rate of photosynthesis? *(A.B)* **(LHR 2012)**

Ans: Page no 212.

Q.12 What is the effect of carbon dioxide concentration on photosynthesis? *(A.B)*
(GRW 2014, RWP 2015)

Ans: Page no 212.

Q.13 There are more chloroplasts in the palisade mesophyll than spongy mesophyll, why? ***(U.B)***

Ans: **MORE CHLOROPLASTS IN PALISADE MESOPHYLL**

There are more chloroplasts in the palisade mesophyll than spongy mesophyll because the palisade cells are on the upper surface and receive more light, so they contain more chloroplasts to be able to absorb more light.

Q.14 What are photosynthetic pigments? Write down the types of photosynthetic pigments. ***(K.B)***

Ans: Pigments are the substances that absorb visible light. Different pigments absorb light of different wavelengths. There are two types of photosynthetic pigments. Main photosynthetic pigment --- Chlorophyll-a Accessory photosynthetic pigment --- Chlorophyll-b and Carotenoids. Some lights not ansorbed by chlorophyll „a" are very effectively absorbed by accessory pigments and vice versa.

Q.15 What is the significance sunlight in photosynthesis? ***(U.B)***

Ans: Sunlight energy is absorbed by chlorophyll. It is then converted into chemical energy, which drives the photosynthetic process. Only about 1% of the light falling on the leaf surface is absorbed, the rest is reflected or transmitted.

Q.16 How wavelength of light affects theprocess of photosynthesis? ***(K.B)***

Ans: The sunlight of different wavelengths are not only differently absorbed by photosynthetic pigments but are also differently effective in photosynthesis. The blue and red lights carry out more photosynthesis.

Q.17 There are more chloroplasts in the palisade mesophyll than in the spongy mesophyll. Why? ***(U.B)***

Ans: Because the palisade cells are on the upper surface and receive more light, so they should be able to absorb more light.

MULTIPLE CHOICE QUESTIONS (Topic 7.2)

1. Photosynthesis is: ***(K.B)***

(A) Anabolic process (B) Catabolic process
(C) Metabolic process (D) Physical process

2. In which process oxygen is released as a byproduct? ***(U.B)***

(DGK 2014, GRW 2015, BWP2014)

(A) Photosynthesis (B) Respiration
(C) Fermentation (D) Reproduction

3. Raw materials of photosynthesis are: ***(K.B)***

(A) CO_2 and O_2 (B) H_2O and CO_2
(C) H_2O and O_2 (D) $C_6H_{12}O_6$ and sunlight

4. How much surface area of leaf comprises of stomata? ***(K.B)***

(A) 10-20 % (B) 80-90 %
(C) 1-2 % (D) 3-4%

5. Water is transported to leaves through: ***(K.B)***

(A) Stomata (B) Phloem vessels
(C) Xylem vessels (D) Lenticels

6. Light reactions take place on: ***(K.B)*** **(LHR 2012, 2013)**

(A) Thylakoid membranes (B) Stroma of chloroplasts
(C) Mitochondria (D) All of these

7. Dark reactions take place in: *(K.B)*
(A) Stroma of chloroplasts (B) Thylakoid membranes
(C) Mitochondria (D) Cisternae

8. NADPH is formed during: *(U.B)*
(A) Light reactions (B) Dark reactions
(C) Krebs cycle (D) Glycolysis

9. High energy molecules like ATP, NADPH are synthesized in: *(U.B)*
(A) Dark reaction (B) Light reaction
(C) Calvin cycle (D) Kreb cycle

10. Light reaction occurs at/in: *(K.B)*
(A) Inter grana (B) Stroma
(C) Cytoplasm (D) Thylakoid membrane

11. The break down of water molecule during light reactions is called: *(K.B)*
(A) Glycolysis (B) Krebs cycle
(C) ETC (D) Photolysis

12. The details of dark reactions were discovered by: *(K.B)*
(A) Karl Lohmann (B) Fritz Lipmann
(C) Malvim Calvin (D) Louis Pasteur

13. When was Calvin awarded Nobel Prize? *(K.B)*
(A) 1960 (B) 1961
(C) 1962 (D) 1963

14. CO2 is reduced to form glucose during: *(U.B)*
(A) Light reaction (B) Z-scheme reaction
(C) Calvin cycle (D) Kreb cycle

15. Electrons passing through electron transport chain to produce: *(U.B)*
(A) NADH (B) O_2
(C) ATP (D) NADPH

16. Photosynthetic pigments are arranged in the form of clusters called: *(K.B)*
(A) Carotenoids (B) Chlorophyll-a
(C) Chlorophyll-b (D) Photosystems

17. Main photosynthetic pigment: *(K.B)* **(LHR 2016)**
(A) Carotenoids (B) Chlorophyll-a
(C) Chlorophyll-b (D) All of these

18. Sun light is absorbed by: *(U.B)* **(RWP 2015)**
(A) Flower (B) Stem
(C) Chlorophyll (D) Roots

19. Light energy is converted into chemical energy during: *(U.B)*
(A) Z-scheme reaction (B) Dark reaction
(C) Calvin cycle (D) Kreb cycle

20. Chlorophyll pigment absorbs maximum light in wavelengths of: *(K.B)*
(GRW 2013, SWL 2014, MTN 2015)
(A) Green and blue (B) Green and red
(C) Green (D) Red and blue

21. Which one factor does not affect the rate of photosynthesis? *(U.B)*
(A) Light (B) Temperature
(C) Humidity (D) Carbon dioxide

22. How much percentage of light falling on the leaf surface is absorbed? *(K.B)*
(A) 1% (B) 10 %
(C) 3% (D) 7%

7.3 RESPIRATION

LONG QUESTIONS

Q.1 Define respiration. Also discuss types of respiration. *(K.B)* **(Ex Q. No 7)**

Ans:

RESPIRATION

Definition:

"The **cellular energy-yielding process** in which **food is oxidized** by **breaking C-H bonds through oxidation-reduction reactions** to **produce carbon dioxide** and **water**, is called cellular respiration."

Oxidation-Reduction Reaction:

In **cellular respiration food** is **oxidized** to **carbon dioxide** while **oxygen** is **reduced to water**.

TYPES OF RESPIRATION

There are two main types of respiration:

i. **Aerobic respiration**
ii. **Anaerobic respiration**

i. Aerobic Respiration:

Definition:

"The **cellular respiration occurring** in the **presence of oxygen** is called aerobic respiration."

Mechanism:

In the **presence of oxygen**, **complete oxidation** of **glucose** occurs with **maximum release of energy**. Mechanism of aerobic respiration is as follows:

First Phase:

In the **first phase of aerobic respiration**, a **molecule of glucose** (6-C) is **broken down** into **two molecules of pyruvic acid (3-C).**

Second Phase:

In the second phase, **molecules of pyruvic acid** are **completely oxidized** (all C-H bonds are broken) **to CO_2 and water**, and **all energy is released.**

Chemical Equation:

The overall reaction is as follows:

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{Energy}$$

ii. Anaerobic Respiration (Fermentation):

Definition:

"The cellular respiration **occurring** in **the absence of oxygen** is called anaerobic respiration."

Mechanism:

In the absence of oxygen, **glucose** is **incompletely oxidized** with **less amount of energy** released. The mechanism of anaerobic respiration is as follows:

First Phase:

The **first phase is exactly similar** to that of aerobic respiration. **A molecule of glucose is broken down** into **two molecules of pyruvic acid**.

Second Phase:

In the second phase, **pyruvic acid** is **not completely** oxidized **due** to the **absence of oxygen**. It is **transformed into ethyl alcohol** or **lactic acid**. In this way, many of the C-H bonds are left unbroken in the products.

TYPES OF FERMENTATION

Anaerobic respiration or fermentation is further classified into:

i. **Alcoholic fermentation**
ii. **Lactic acid fermentation**

i. Alcoholic Fermentation:

In this **type of anaerobic respiration, pyruvic acid** is **further broken down** into alcohol (C_2H_5OH) and **CO_2**.

Pyruvic acid ⟶ Ethyl alcohol + Carbon dioxide

Occurrence:

It occurs in:

- **Bacteria**
- **Yeast**

ii. Lactic Acid Fermentation:

In this type of anaerobic respiration, **each pyruvic acid molecule** is **converted into lactic acid** ($C_2H_6O_3$).

Pyruvic acid ⟶ Lactic Acid

Occurrence:

It occurs in:

- **Skeletal muscles of humans and other animals during extreme physical activities**
- **Bacteria present in milk**

Q.2 Discuss the importance of fermentation in detail. ***(A.B)*** **(GWR 2014, DGK 2015)**

Ans:

IMPORTANCE OF FERMENTATION

Evolution of Life:

When life evolved on Earth, the **early land** or **water habitats did not have any supply of free oxygen** (O_2). In these anaerobic conditions, **early organisms respired anaerobically and got energy for their life activities.**

Anaerobes:

Even today, when **free oxygen is available, some organisms including** some **bacteria** and some **fungi** get **energy** from **anaerobic respiration** and are called anaerobes.

Strenuous Exercise:

Humans can also provide energy to their skeletal muscle cells through anaerobic respiration. This happens when skeletal muscles have to work hard, (during exercise etc.) but oxygen supply cannot be increased to fulfill the demand.

Industrial Usage:

Scientists have used the fermenting abilities of fungi and bacteria for the benefit of mankind.

Examples:

- The fermenting powers of **bacteria** are used for **making cheese** and yogurt.
- Fermentation in yeasts is used in **brewing** and **baking industries**.
- Soy sauce is made by the **fermentation** of a **fungus *Aspergillus*.**

Q.3 Describe mechanism of respiration. *(K.B)* **(Ex Q. No 6) (LHR 2014, 2016, SWL 2014, 2015)**

Ans: **MECHANISM OF RESPIRATION**

Complexity:

The process of respiration involves a complex series of reactions.

Stages:

Aerobic respiration is a **continuous process** and is divided it into **three main stages**:

i. **Glycolysis**
ii. **Kreb's cycle**
iii. **Electron transport chain**

i. Glycolysis:

Definition:

The **breakdown of glucose** into **pyruvic acid** is called glycolysis."

Occurrence:

Glycolysis occurs in the **cytoplasm** and **oxygen** is not **involved** in this **stage**. That is why, it **occurs** in **both types** of **respiration** i.e. **aerobic** and **anaerobic**.

Formation of Pyruvic Acid:

In glycolysis, **glucose** (6-C) **molecule** is **broken** into **two molecules** of **Pyruvic acid** (3-C).

ii. Krebs Cycle:

Naming:

Krebs Cycle is **named** after **Sir Hans Krebs** who discovered this **series of reactions.**

Formation of Acetyl Co-A:

Before entering into Krebs Cycle, **pyruvic acid** is **changed into 2-C compound** called acetyl Co-A.

Oxidation of Pyruvic Acid:

In Krebs cycle, **pyruvic acids molecules** are **completely oxidized**.

Formation of New Compounds:

The following new compounds are formed:

- **ATP**
- **NADH**
- **$FADH_2$**

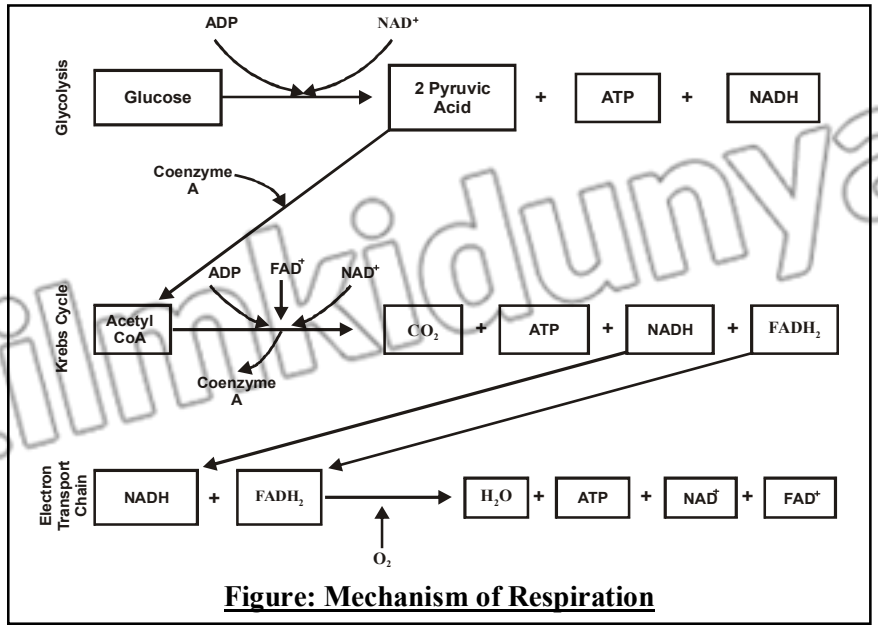


Figure: Mechanism of Respiration

iii. Electron Transport Chain:

Electron transport chain is **the final step of cellular respiration**. It is the **transfer of electron** on an **electron transport chain**.

Release of Electrons and H^+:

In this step, **NADH** and **$FADH_2$ release electrons** and **Hydrogen ions**.

Role of Electron Carriers:

These **electrons are taken up** by a **series of electron carriers.**

Synthesis of ATP:

When electrons **move through the series of electron** carriers, they **lose energy** which is **used to synthesize ATP.**

Formation of Water:

At the end of chain, electrons and hydrogen ions combine with molecular oxygen and form water.

Q.4 Write a note on the energy budget of respiration. ***(K.B)***

Ans: **THE ENERGY BUDGET OF RESPIRATION**

ATP by NADH:

Each NADH produces 3 ATP in electron transport chain. The NADH generated in glycolysis gives 2 ATP, because one ATP is spent to transport it across the mitochondrial membrane.

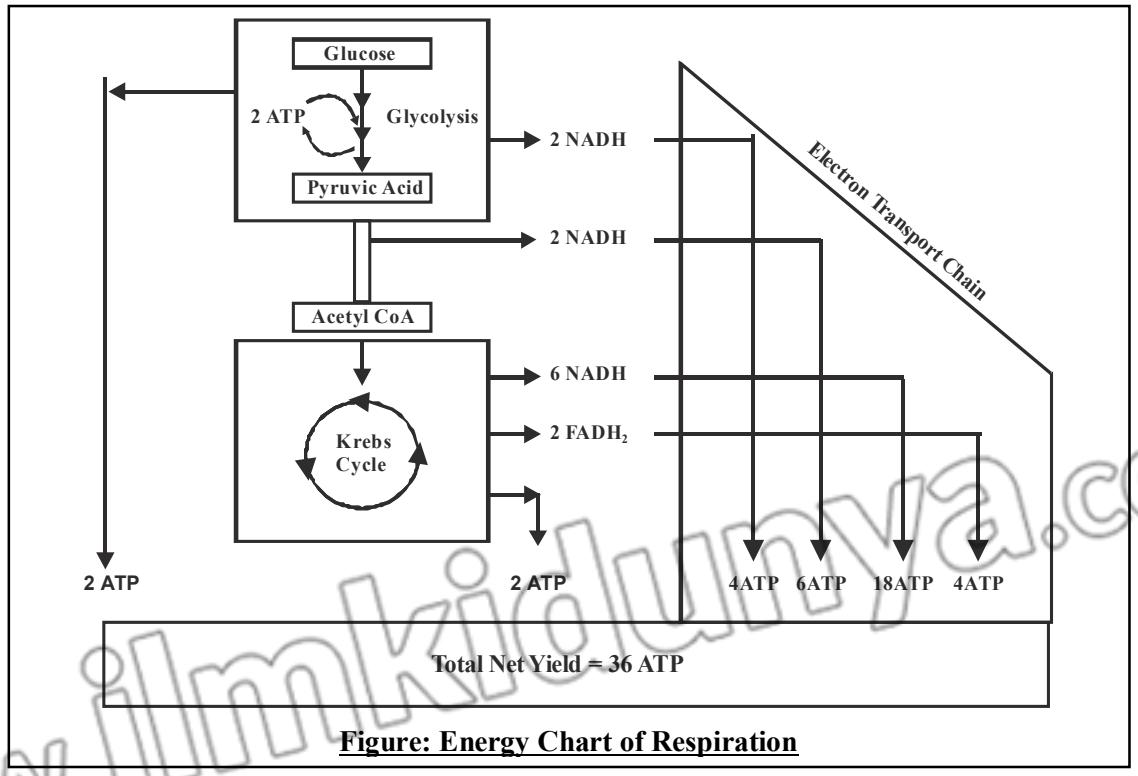


Figure: Energy Chart of Respiration

ATP by $FADH_2$:

Each **$FADH_2$** produces **2 ATP**.

Anaerobic Oxidation:

During **anaerobic oxidation of glucose** only **2 ATP molecules** are **gained** as a **net profit**. It is **because there is no Kreb's Cycle** and **electron transport chain in anaerobic respiration**.

Net Yield:

The **total net yield** of **ATP is 36 molecules**.

Q.5 Differentiate between photosynthesis and respiration. ***(K.B)*** **(Ex Q. No 8)**

Ans: **DIFFERENCES BETWEEN PHOTOSYNTHESIS AND RESPIRATION**

Characteristics	Photosynthesis	Respiration
Metabolism	Anabolism	Catabolism
Energy investment / Production	Investment of light energy to store it in the form of bond energy.	Bond energy transformed into chemical energy of ATP.
Organisms	Some bacteria, All algae, all plants	All organisms
Site of occurrence	Chloroplasts	Cytoplasm and mitochondria
Time of occurrence	Daytime only, in the presence of light	All the time

Q.6 Differentiate between aerobic and anaerobic respiration.

Ans: **DIFFERENCES BETWEEN AEROBIC AND ANAEROBIC RESPIRATION**

Properties	Aerobic Respiration	Anaerobic Respiration
Presence of Oxygen	Yes	No
Net profit of ATP	36	2
Final Products	CO_2, H_2O	Lactic Acid or Ethanol + CO_2
Site of occurrence	Glycolysis in cytoplasm Krebs cycle and electron transport chain in mitochondria	Cytoplasm
Importance	Major source of energy for all organisms	Source of energy for anaerobic organisms. Source of energy for aerobic organisms in short supply of Oxygen. Source of many products (ethanol, cheese, etc.)

SHORT QUESTIONS (Topic 7.3)

Q.1 Define cellular respiration. **(LHR 2014, 2016, BWP 2014, RWP 2014, FSD 2015)**

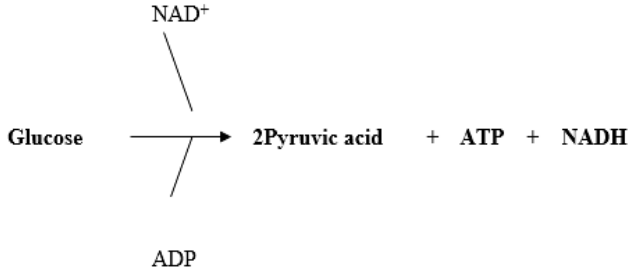
Ans: Page no 217.

Q.2 What is meant by Glycolysis? **(GRW-G-15)**

The breakdown of glucose into pyruvic acid is called glycolysis.

Occurrence:

Glycolysis occurs in the cytoplasm In glycolysis, glucose (6-C) molecule is broken into two molecules of Pyruvic acid (3-C).



Q.3 Define aerobic respiration. Write its equation. *(K.B)*
(GRW 2012, 2013, 2014, SWL 2014, MTN 2015)

Ans: Page no 217.

Q.4 What is anaerobic respiration? *(K.B)* **(SWL 2015)**

Ans: Page no 217.

Q.5 What is alcoholic fermentation? *(K.B)* **(DGK 2015)**

Ans: Page no 218.

Q.6 What is lactic acid fermentation? *(K.B)* **(LHR 2016)**

Ans: Page no 218.

Q.7 What is difference between aerobic and anaerobic respiration? *(K.B)*
(LHR 2012, 2015, 2016, BWP 2015, FSD 2014, SGD 2015)

Ans: **DIFFERENTIATION**

The difference between aerobic and anaerobic respiration are as follows:

Aerobic Respiration	Anaerobic Respiration
Definition	
The cellular respiration occurring in the presence of oxygen is called aerobic respiration.	The cellular respiration occurring in the absence of oxygen is called anaerobic respiration.
Amount of Energy	
In the presence of oxygen, complete oxidation of glucose occurs with maximum release of energy.	In the absence of oxygen, glucose is incompletely oxidized with less amount of energy released.
Number of ATP	
36 ATP are produced as a result of aerobic respiration.	2 ATP are produced as a result of anaerobic respiration.

Q.8 How fermentation is important to living organisms? *(A.B)*

Ans: Page no 218.

Q.9 What is the importance of fermentation in food industries?

Scientists have used the fermenting abilities of fungi and bacteria for the benefit of mankind. i.e.

α. The fermenting powers of bacteria are used for making cheese and yogurt.
β. Fermentation in yeast is used in brewing and baking industries.
χ. Soy sauce is made by fermentation of a fungus *Aspergillus*.

Q.10 Name the steps involved in aerobic respiration. *(K.B)*

Ans: Page no 219.

Q.11 Differentiate between photosynthesis and respiration. *(K.B)*

Ans: **DIFFERENTIATION**

The difference between photosynthesis and respiration are as follows:

Photosynthesis	Respiration
Type	
It is an anabolic reaction.	It is a catabolic reaction.
Energy	
Light energy is stored in the form of chemical energy.	C-H bonds in food are broken down by oxidation reduction reactions.
Occurrence	
It occurs in plants, algae and some photosynthetic bacteria.	It occurs in all organisms.
Function	
Energy is used to produced glucose.	Energy is released in the form of ATP.

Q.12 What do you know about FAD^+? *(K.B)* **(GRW 2015)**

Ans:

FAD^+

Flavin adenine dinucleotide (FAD^+) is a coenzyme like NAD^+. It gets two hydrogen and reduces to $FADH_2$.

Q.13 Why it is incorrect to say that energy releasing step of respiration is electron transport chain? *(U.B)*

Ans:

ENERGY RELEASING STEP OF RESPIRATION

It is incorrect to say that energy releasing step of respiration is electron transport chain because energy is released in glycolysis and Kreb's cycle in the form of NADH and $FADH_2$. Electron transport chain transforms the energy present in these compounds to ATP.

Q.14 How many energy molecules are produced in aerobic and anaerobic respiration? *(K.B)*

Ans:

ATP PRODUCTION

Aerobic Respiration:

36 ATP molecules are produced as a result of aerobic respiration.

Anaerobic Respiration:

2 ATP molecules are produced as a result of anaerobic respiration.

MULTIPLE CHOICE QUESTIONS (Topic 7.3)

1. From which bond of food energy is taken? *(K.B)*

(A) P-P bonds (B) C-H bonds
(C) C-N bonds (D) C-O bonds

2. The greatest fuel of energy of cellular respiration is: *(U.B)* **(RWP 2014)**

(A) Glucose (B) Proteins
(C) Amino acid (D) Lipids

3. Oxidation of glucose depends upon: *(U.B)*

(A) Availability of CO_2 (B) Availability of O_2
(C) Availability of H_2O (D) Availability of ATP

4. In cellular respiration, food is oxidized to: *(K.B)*

(A) Carbon dioxide (B) H_2O
(C) Both A and B (D) Glucose

5. The most common fuel used by cell to get energy from cellular respiration is: *(K.B)*

(A) Glucose (B) Oxygen
(C) Carbon dioxide (D) Food

6. Through which process organism gets energy? *(K.B)* **(SGD 2015)**

(A) Photosynthesis (B) Respiration
(C) Transpiration (D) Evaporation

7. Which of the following reaction is associated to aerobic respiration? *(U.B)*

(A) Glycolysis (B) Calvin cycle
(C) Electron transport chain (D) Alcoholic fermentation

8. Which of the following is common in both aerobic and anaerobic respiration? *(U.B)*

(A) Glycolysis (B) Kerb cycle
(C) Electron transport chain (D) Alcoholic fermentation

9. Alcoholic fermentation occurs in: *(K.B)*

(A) Bacteria (B) Yeasts
(C) Viruses (D) Humans

10. Whose fermenting powers are used for making cheese and yogurt? ***(A.B)*** **(SGD 2014)**
(A) Bacteria (B) Viruses
(C) Fungi (D) Algae

11. In which phase of respiration glucose molecule is broken into two molecules of pyruvic acid? ***(K.B)***
(A) Glycolysis (B) Krebs cycle
(C) Electron transport chain (D) Light reaction

12. Soy sauce is made through the fermentation by a fungus: ***(A.B)***
(A) *Rhizopus* (B) *Penicillium*
(C) *Aspergillus* (D) *Puccinia*

13. How many stages are present in aerobic respiration? ***(K.B)***
(A) 1 (B) 2
(C) 3 (D) 4

14. Yogurt and cheese is made by using the fermentative abilities of: ***(U.B)***
(a) Bacteria (b) Plants
(c) Fungi (d) Yeast

15. Process of glycolysis is found in: ***(K.B)*** **(GRW 2014, LHR 2015)**
(A) Ribosomes (B) Cytoplasm
(C) Golgi complex (D) Vacuole

16. In electron transport chain each NADH produces: ***(K.B)***
(A) 2 ATP (B) 3 ATP
(C) 4 ATP (D) 5 ATP

17. In which step of respiration CO_2 is produced? ***(K.B)*** **(GRW 2013)**
(A) Glycolysis (B) Krebs cycle
(C) Electron transport chain (D) All of these

18. How many molecules of CO_2 are produced when Krebs cycle operates once? ***(K.B)*** **(LHR 2015, MTN 2015)**
(A) 6 (B) 3
(C) 2 (D) 1

19. How many ATP molecules are generated in aerobic respiration? ***(K.B)*** **(GRW 2009, LHR 2014)**
(A) 2 (B) 24
(C) 34 (D) 36

20. In cell, aerobic respiration sites are: ***(K.B)*** **(SGD 2015)**
(A) Golgi bodies (B) Mitochondria
(C) Ribosomes (D) Chloroplast

21. Krebs cycle and electron transport chain occur in: ***(K.B)***
(A) Cytoplasm (B) Nucleus
(C) Mitochondria (D) Ribosomes

22. How many ATP molecules are utilized for passage of each Pyruvic acid inside mitochondria? ***(U.B)***
(A) 1 (B) 2
(C) 3 (D) 6

ANSWERS KEYS

MULTIPLE CHOICE QUESTIONS

7.1 BIOENERGETICS AND THE ROLE OF ATP

1	A	**6**	C	**11**	A	**16**	C
2	A	**7**	B	**12**	B	**17**	A
3	B	**8**	B	**13**	C	**18**	D
4	A	**9**	D	**14**	D	**19**	A
5	A	**10**	D	**15**	D	**20**	A

7.2 PHOTOSYNTHESIS

1	A	**6**	A	**11**	D	**16**	D	**21**	C
2	A	**7**	A	**12**	C	**17**	B	**22**	A
3	B	**8**	A	**13**	B	**18**	C		
4	C	**9**	B	**14**	C	**19**	A		
5	C	**10**	B	**15**	C	**20**	D		

7.3 RESPIRATION

1	B	**6**	B	**11**	A	**16**	B	**21**	C
2	A	**7**	A	**12**	C	**17**	B	**22**	B
3	B	**8**	A	**13**	C	**18**	C		
4	A	**9**	B	**14**	A	**19**	D		
5	A	**10**	A	**15**	B	**20**	B		

REVIEW QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. In which of the following steps of respiration, CO_2 produced? *(K.B)*
(a) Glycolysis (b) Krebs cycle
(c) Electron transport chain (d) All of these

2. Oxygen takes part in aerobic respiration in: *(K.B)*
(a) Glycolysis
(b) Link step between glycolysis and Krebs cycle
(c) Krebs cycle
(d) Electron transport chain

3. When a plant was kept in darkness for many days its leaves turned yellow, why? *(U.B)*
(a) Leaves could not get oxygen and so there was no photosynthesis
(b) Leaves could not get light and so there was no respiration
(c) Leaves could not get oxygen and so there was no respiration
(d) Leaves could not get light and so there was no photosynthesis

4. From which bonds of ATP molecule energy is taken? *(K.B)*
(a) P-P bonds (b) C-H bonds
(c) C-N bonds (d) C-O bonds

5. In which component of leaf cells chlorophyll is present? *(K.B)*
(a) Stroma (b) Thylakoids
(c) Plasma membrane (d) Cytoplasm

6. Which of these can enter Krebs cycle? *(K.B)*
(a) Glucose (b) Pyruvic acid
(c) Citric acid (d) Acetyl Co-A

7. When we work hard, we suffer from muscle fatigue because muscle cells: *(U.B)*
(a) Carry out aerobic respiration at a faster rate and so are tired
(b) Carry out anaerobic respiration and so accumulate more CO_2
(c) Carry out anaerobic respiration and so accumulate more lactic acid
(d) Carry out aerobic respiration and so accumulate more lactic acid

8. How many molecules of CO_2 are produced when Krebs cycle operates once? *(K.B)*
(a) 01 (b) 02
(c) 03 (d) 06

9. In which of the following metabolic processes, oxidation as well as reduction of molecules occur? *(U.B)*
(a) Photosynthesis (b) Respiration
(c) Both (d) None of these

10. Chlorophyll pigment absorbs maximum light in wavelengths of: *(K.B)*
(a) Green and blue (b) Green and red
(c) Green only (d) Red and blue

ANSWERS KEY

1	**b**	**4**	**a**	**7**	**c**	**10**	**d**
2	**d**	**5**	**b**	**8**	**b**		
3	**d**	**6**	**d**	**9**	**c**		

UNDERSTANDING THE CONCEPTS

1. How would you define bioenergetics while relating it to the oxidation-reduction reactions in living systems? ***(U.B)***

Ans: See the LQ.1 and 2 of **(Topic 7.1)**

2. Interpret that ATP is the chief energy currency of all cells. ***(U.B)***

Ans: See the LQ.3 of **(Topic 7.1)**

3. What is the role of chlorophyll and light in photosynthesis? ***(A.B)***

Ans: See the LQ.4 of **(Topic 7.2)**

4. Outline the processes involved in photosynthesis. ***(K.B)***

Ans: See the LQ.2 of **(Topic 7.3)**

5. State how the varying light intensity, carbon dioxide concentration and temperature affect the rate of photosynthesis? ***(A.B)***

Ans: See the LQ.5 of **(Topic 7.2)**

6. Outline the mechanism of respiration while defining glycolysis, Krebs cycle, and electron transport chain. ***(K.B)***

Ans: See the LQ.3 of **(Topic 7.3)**

7. Draw a comparison of aerobic and anaerobic respiration. ***(K.B)***

Ans: See the LQ.6 of **(Topic 7.3)**

8. How will you compare respiration and photosynthesis? ***(K.B)***

Ans: See the LQ.5 of **(Topic 7.3)**

SHORT QUESTIONS

1. Why is it said that all life forms are dependent on photosynthesis? ***(U.B)***

Ans: **ALL LIFE FORMS ARE DEPENDENT ON PHOTOSYNTHESIS**

All life forms on the earth ultimately depend on each other for their energy requirements.

Autotrophic Organisms:

Autotrophic organisms such as plants are capable of producing their own food by the process of photosynthesis. Autotrophic organisms lie at the base of food chain which implies that all life forms are dependent on the process of photosynthesis, directly or indirectly.

Heterotrophic Organisms:

All other organisms are heterotrophs, i.e. depend on other organisms for their food requirements. Food is manufactured by autotrophic organisms via photosynthesis, which is used by themselves and also animals that feed on them.

2. What structures and phenomena are involved in the intake of carbon dioxide and water by plants? ***(K.B)***

Ans: See the LQ.1 of **(Topic 7.2)**

3. In what ways the respiratory energy is used in the body of organisms? ***(K.B)***

Ans: See the SQ.7 of **(Topic 7.1)**

4. What is the importance of anaerobic respiration? ***(A.B)***

Ans: See the LQ.2 of **(Topic 7.3)**

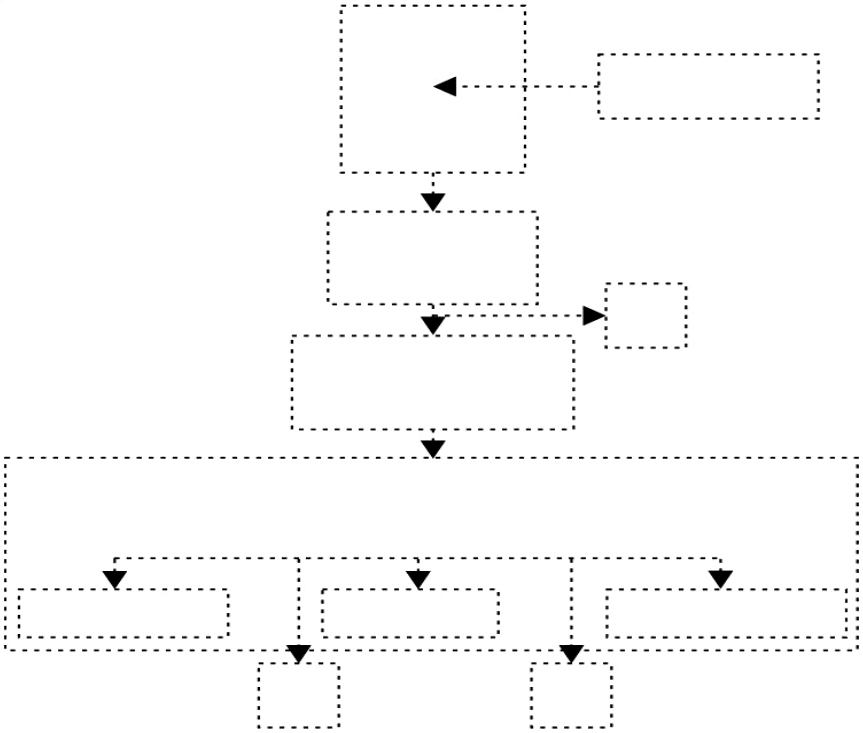
KIPS ASSIGNMENT

LET'S DRAW & LABEL

(A) Energy Transformations in Living Organisms

Instructions:

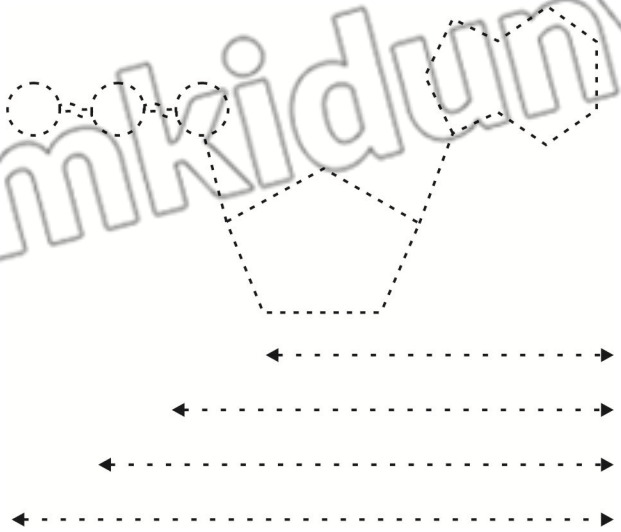
- Trace the patterns and mark the labels



(B) Molecular Structure of ATP

Instructions:

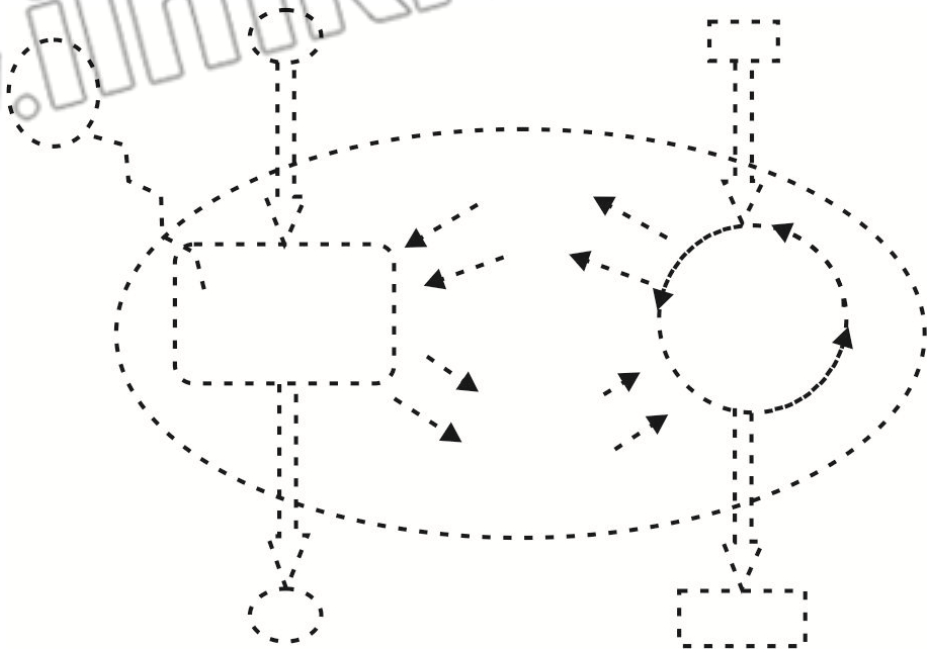
- Trace the patterns and mark the labels



(C) Summary of Photosynthesis

Instructions:

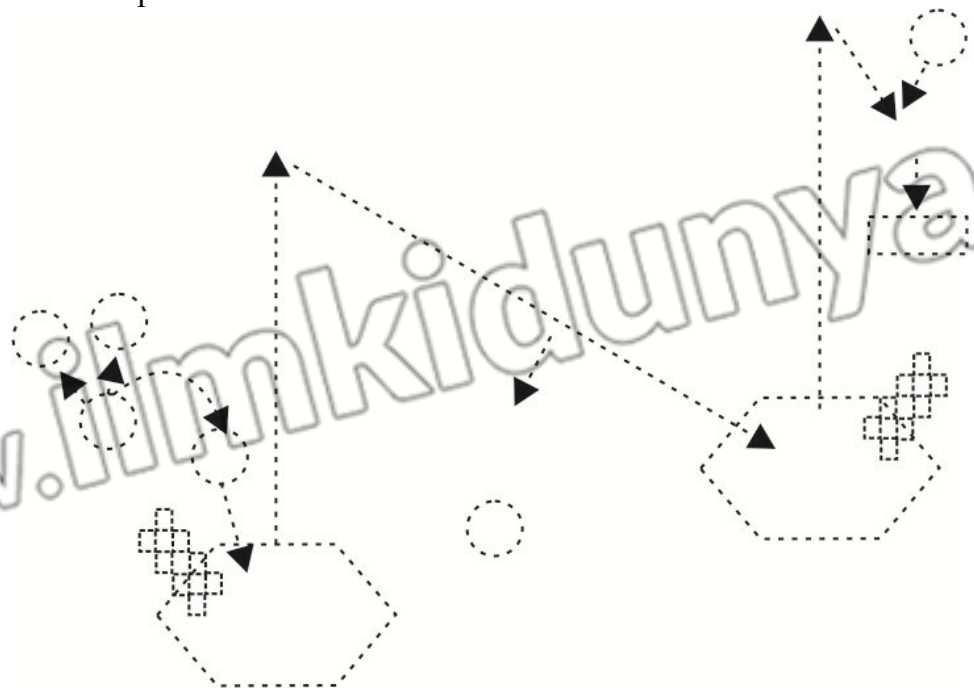
- Trace the patterns and mark the labels



(D) Light Reactions of Photosynthesis

Instructions:

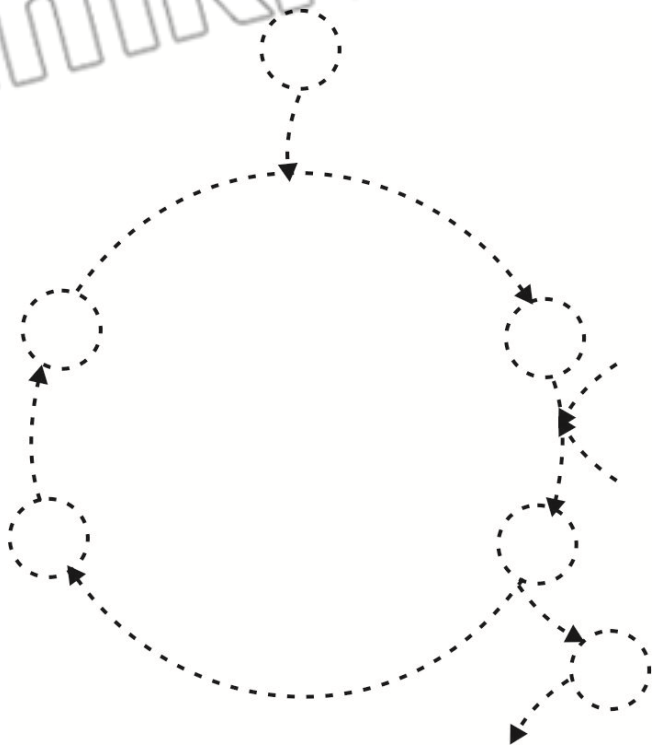
- Trace the patterns and marks the labels



(E) Dark Reactions of Photosynthesis

Instructions:

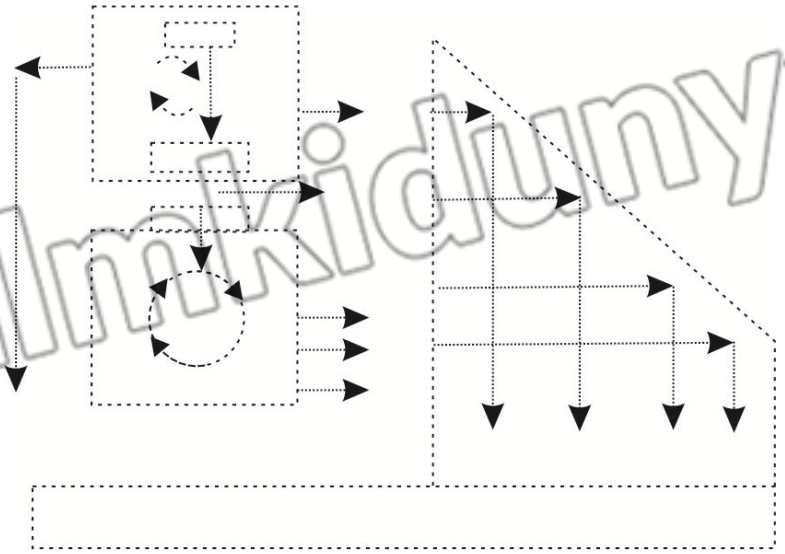
- Trace the patterns and mark the labels



(F) Energy Chart of Respiration

Instructions:

- Trace the patterns and mark the labels



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SELF TEST

Time: 40 min **Marks: 25**

Q.1 Four possible answers A, B, C and D to each question are given, mark the correct answer. **(6×1=6)**

1. Food contains energy in its bonds in the form of: ***(K.B)***

(A) Kinetic energy **(B)** Potential energy

(C) Mechanical energy **(D)** All of these

2. ATP is an example of: ***(K.B)***

(A) Amino acid **(B)** Fatty acid

(C) Nucleic acid **(D)** Nucleotide

3. When one inorganic phosphate is detached from ATP, it is converted into: ***(K.B)***

(A) ADP **(B)** AMP

(C) CMP **(D)** GMP

4. Light reactions take place on: ***(K.B)***

(A) Thylakoid membranes **(B)** Stroma of chloroplasts

(C) Mitochondria **(D)** Inner mitochondrial membrane

5. Which one factor does not affect the rate of photosynthesis? ***(U.B)***

(A) Light **(B)** Temperature

(C) Humidity **(D)** Carbon dioxide concentration

6. How many stages are present in aerobic respiration? ***(K.B)***

(A) 1 **(B)** 2

(C) 3 **(D)** 4

Q.2 Give short answers to following questions. **(5×2=10)**

1. Define bioenergetics. *(K.B)*

2. Draw structure of ATP. *(K.B)*

3. How carbon dioxide is taken into plants through leaves? *(A.B)*

4. What is meant by photolysis? *(K.B)*

5. What is effect of light intensity on photosynthesis? *(U.B)*

Q.3 Answer the following Questions in detail. **(5+4=9)**

(a) Write a note on light reactions. *(K.B)* **(5)**

(b) Describe mechanism of respiration. *(K.B)* **(4)**

Note:

Parents or guardians can conduct this test in their supervision in order to check the skill of students.