

Life Processes in Living Organisms Part-1

Exercise

Q. 1. Fill in the blanks and explain the statements.

- a. After complete oxidation of a glucose molecules, ---- --- --- number of ATP molecules are formed.
- b. At the end of glycolysis, ---- --- -- molecules are obtained.
- c. Genetic recombination occurs in -- -- -- phase of prophase of meiosis-I.
- d. All chromosomes are arranged parallel to equatorial plane of cell in -- -- -- phase of mitosis.
- e. For formation of plasma membrane, --- --- --- molecules are necessary.
- f. Our muscle cells perform -- -- -- type of respiration during exercise.

Answer : a. After complete oxidation of a glucose molecules, 38 number of ATP molecules are formed.

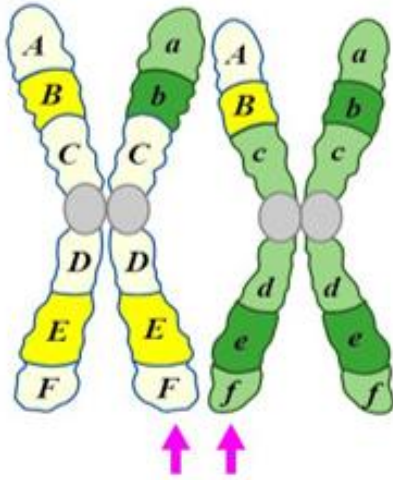
Explanation: We need energy to work through the day, similarly each cell of our body needs energy to survive. Cellular respiration is the process by which cell fulfill its energy need in the form of ATP. ATP is energy currency in the cell. In cellular respiration glucose molecules break down (oxidation) in presence of oxygen. On complete breakdown, each glucose releases 38 ATP molecules

b. At the end of glycolysis, 2 pyruvic acid, 2 ATP and 2 NAPH₂ molecules are obtained.

Explanation: Glycolysis is the first step in cellular respiration. It takes place in the cytoplasm of a cell. In this process 1 molecule of glucose is converted into 2 molecules of pyruvic acid or pyruvate are obtained.

c. Genetic recombination occurs in 3rd phase of prophase of meiosis-I.

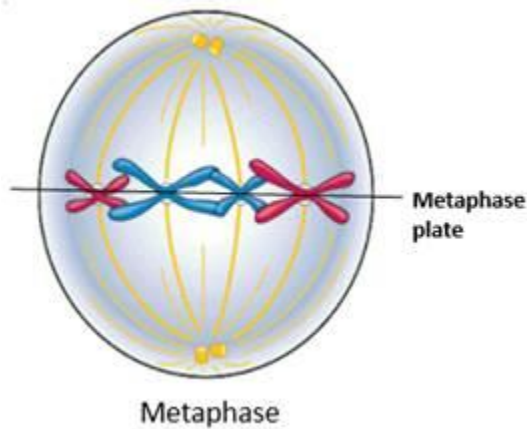
Explanation: In this phase of meiosis-I, there is exchange of a segment of chromosome between two non-sister chromatids of homologous chromosomes. This is called crossing over which leads to recombination. See diagram



Recombination creates chromosome with new combinations

d. All chromosomes are arranged parallel to equatorial plane of cell in metaphase of mitosis.

Explanation: The chromosomes arranged themselves in the middle of the cell along an “imaginary line” called the metaphase plate with the help of the spindle fibers.



e. For formation of plasma membrane, lipids molecules are necessary.

Explanation:

Lipids are made of fatty acids and alcohol. Actually plasma membrane is living boundary of the cell is made of lipid + protein (lipoprotein).

f. Our muscle cells perform anaerobic respiration type of respiration during exercise.

Explanation:

When we do exercise, our body requires more energy, in such case our body cells under goes respiration without oxygen (anaerobic respiration) to fulfill its energy requirement.

Q. 2. Write definitions.

a. Nutrition.

b. Nutrients

c. Proteins.

d. Cellular respiration

e. Aerobic respiration.

f. Glycolysis.

Answer : **a. Nutrition:** Food is needed by all living organisms for growth and repair. Variety of substances are taken as food from single cellular organisms like *Amoeba* to the complex multicellular organisms like the human body. The method of taking food by organism is called nutrition.

b. Nutrients: A *nutrient* is a substance which is used by an organism to survive, grow, and reproduction. Living organisms obtained *nutrients* from the food. Carbohydrates, fats, proteins, vitamins, minerals, etc., are the nutrients obtained from food.

c. Proteins: Proteins are the large complex molecules formed by bonding together many **amino acids** by peptide bonds. Examples, hair, nail muscles are proteins.

d. Cellular respiration: Cellular respiration is the process by which cells get their energy in the form of ATP from oxidation of food. Cellular respiration takes place in presence or in absence of oxygen.

e. Aerobic respiration: It is the process of producing cellular energy by the oxidation of food such as glucose in the presence of oxygen. It is a multistep process that produces 38 ATP.

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 38 \text{ ATP (net gain 36 ATP)}$
Glucose + oxygen \rightarrow carbon dioxide + water + energy

f. Glycolysis: Glycolysis is the first step in cellular respiration. It takes place in the cytoplasm of a cell. In this process 1 molecule of glucose is converted into 2 molecules of pyruvic acid or pyruvate.

Q. 3. A. Distinguish between

Glycolysis and TCA cycle.

Answer :

| | |
|--|--|
| Glycolysis | TCA cycle. |
| It is the first step of cellular respiration in which a molecule of glucose is oxidized into two molecules of each i.e. pyruvic acid, ATP, NADH ₂ and water are formed. | Tricarboxylic acid cycle (TCA cycle) is set of cyclic chain reactions in which acetyl-CoA is completely oxidized to give CO ₂ , H ₂ O, NADH ₂ , and FADH ₂ . |
| It is common for both aerobic and anaerobic respiration. | It is occurring only in aerobic respiration. |
| It takes place in cytoplasm of the cell. | It takes place in mitochondria of the cell. |

Q. 3. B. Distinguish between

Mitosis and meiosis.

Answer :

| Mitosis | Meiosis |
|---|--|
| Mitosis is a method of cell division in which a divide into two daughter cells. | Mitosis is a method of cell division in which a cell divides into four daughter cells. |
| It occurs in all the body cells (somatic cells) except reproductive cells. | Meiosis occurs only in reproductive cells or germ cells. |
| Resulting daughter cells are same as the parent cell. | Resulting daughter cells have half of the chromosomes as compared to parent cell. |
| Mitosis is necessary for growth and repair | Meiosis is necessary for sexual reproduction |

Q. 3. C. Distinguish between

Aerobic and anaerobic respiration.

Answer :

| | |
|---|---|
| Aerobic respiration. | Anaerobic respiration. |
| Aerobic respiration takes place in the presence of O ₂ . | Anaerobic respiration takes place in the absence of O ₂ . |
| It occurs in cytoplasm and mitochondria of the cell | It occurs only in cytoplasm. |
| The end product is CO ₂ and H ₂ O and 36 ATP. | The end products varies. It may be CO ₂ , alcohol or may lactic acid and only 2 ATP. |

Q. 4. A. Give scientific reasons.

Oxygen is necessary for complete oxidation of glucose.

Answer : All living organism requires energy to live and to perform any useful functions. This energy they get from food they eat. Energy is released when food contains nutrients, let's say carbohydrate (glucose). Energy released in the cells when oxidation of glucose occurs which means the carbohydrates which we eat converted into simpler substances with the help of oxygen. For complete oxidation of glucose(i.e the breakdown into simpler substances) oxygen is necessary.



Q. 4. B. Give scientific reasons.

Fibers are one of the important nutrients.

Answer : Besides carbohydrate, proteins, fats, vitamins, minerals, and water, fibres are also essential nutrients. Fibres cannot be digested but, help in the digestion of other substances and egestion of undigested substances.

Q. 4. C. Give scientific reasons.

Cell division is one of the important properties of cells and organisms.

Answer : By cell division, new cells are formed, new cells can be used to form new individual from existing one, and for example one Amoeba forms another amoeba by cell division. In multicellular organism cell division is essential for growth and repair. For example, healing of wound.

Q. 4. D. Give scientific reasons.

Sometimes, higher plants and animals too perform anaerobic respiration.

Answer : Some higher plants, animals under goes anaerobic respiration, when their deficiency of oxygen in the surrounding. For example, anaerobic respiration occurs during seed germination when the soil is submerged under water. Similarly, our muscle cells also perform anaerobic respiration while do heavy exercise. Due to this, less amount of energy is produced in our body.

Q. 4. E. Give scientific reasons.

Krebs cycle is also known as citric acid cycle.

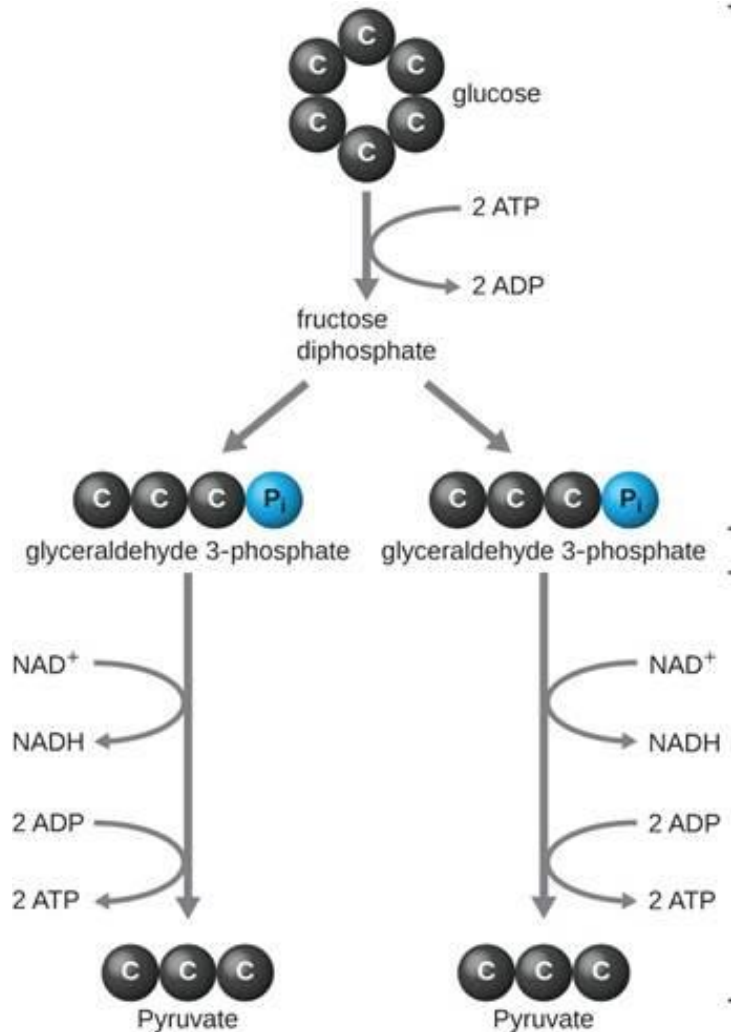
Answer : The tri-carboxylic acid cycle is discovering by Sir Hans Krebs. This also called citric acid cycle the first stable product of the Krebs cycle is citric acid or citrate which is a 6-carbon compound. This is the reason why the Krebs cycle is called the citric acid cycle.

Q. 5. A. Answer in detail.

Explain the glycolysis in detail.

Answer : Glycolysis is the first step of cellular respiration.

- It takes place in cytoplasm of the cell.
- It is common for both aerobic and anaerobic respiration.
- It is the in which a molecule of glucose is oxidized into two molecules of each i.e. pyruvic acid, ATP, NADH₂ and water are formed
- In this process a molecule of glucose is oxidized step by step in this process and two molecules of each i.e., pyruvic acid, ATP (adenosine triphosphate), NADH₂ (Nicotinamide Adenine dinucleotide) and water are formed.



Q. 5. B. Answer in detail.

With the help of suitable diagrams, explain the mitosis in detail.

Answer : Mitosis cell division is completed in two steps.

I. Division of nucleus (karyon (nucleus) + kinesis (division) = Karyokinesis)

II. Division of cytoplasm (cyto (cytoplasm) + kinesis (division) = cytokinesis)

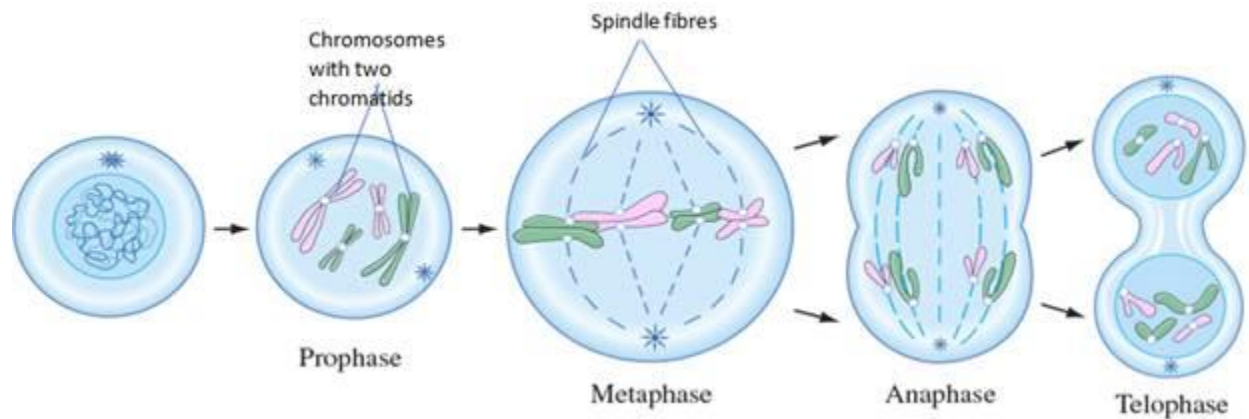
I. Karyokinesis is further divided into four steps:

i. Prophase: In prophase, thin thread-like chromosomes becomes thick and short due to condensation. Each chromosome now appears with two sister chromatids. Centrioles duplicate and each centriole moves to opposite poles of the cells. Nuclear membrane and nucleolus start to disappear.

ii. Metaphase: Nuclear membrane disappears completely. All chromosomes are arranged on the equatorial plane or metaphase plate of the cell. Special type of flexible protein fibers called spindle fibers are formed between centromere of each chromosome.

iii. Anaphase: In anaphase, centromeres split and sister chromatids of each chromosome separate and they are pulled apart in opposite directions with the help of spindle fibers. Separated sister chromatids are called as daughter chromosomes. Each set of chromosomes reach at two opposite poles of the cell.

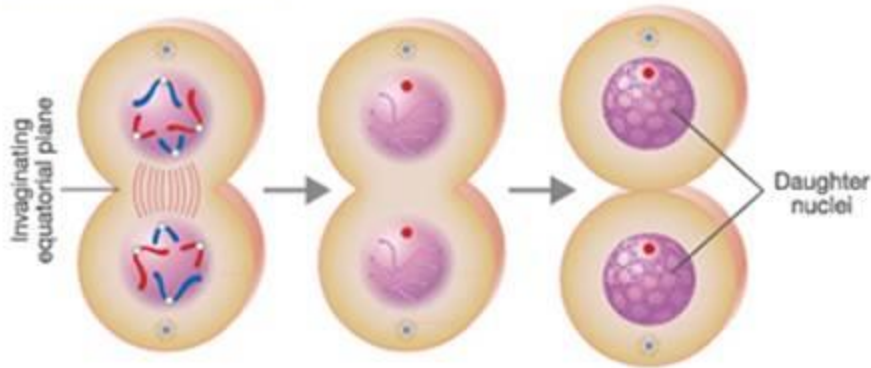
iv. Telophase: The chromosomes which have reached at opposite poles of the cell, start again becomes thread-like thin and invisible. Nuclear membrane is formed around each set of chromosomes reached at poles. Thus, two daughter nuclei are formed in a cell. Nucleolus also appears in each daughter nucleus. Spindle fibers completely disappear.



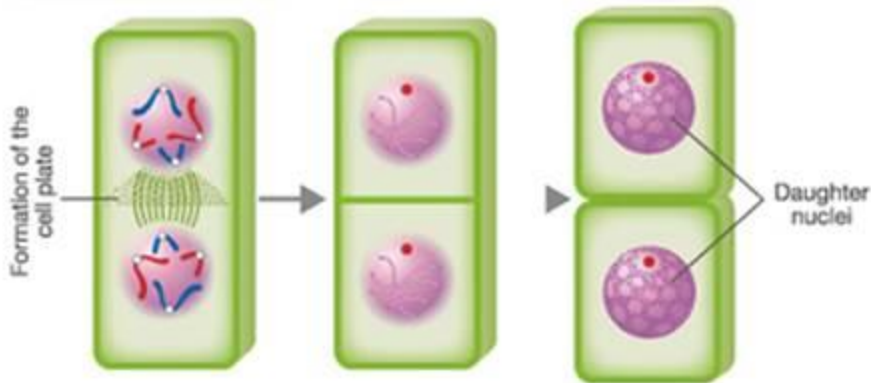
II. Cytokinesis:

In animal cells, an invagination is formed at the equatorial plane of the cell which deepens gradually which results into two new cells are formed. However, in plant cells cytokinesis takes place by a cell plate is formation along midline of the cell resulting into two daughter cells.

Animal cytokinesis



Plant cytokinesis



Q. 5. C. Answer in detail.

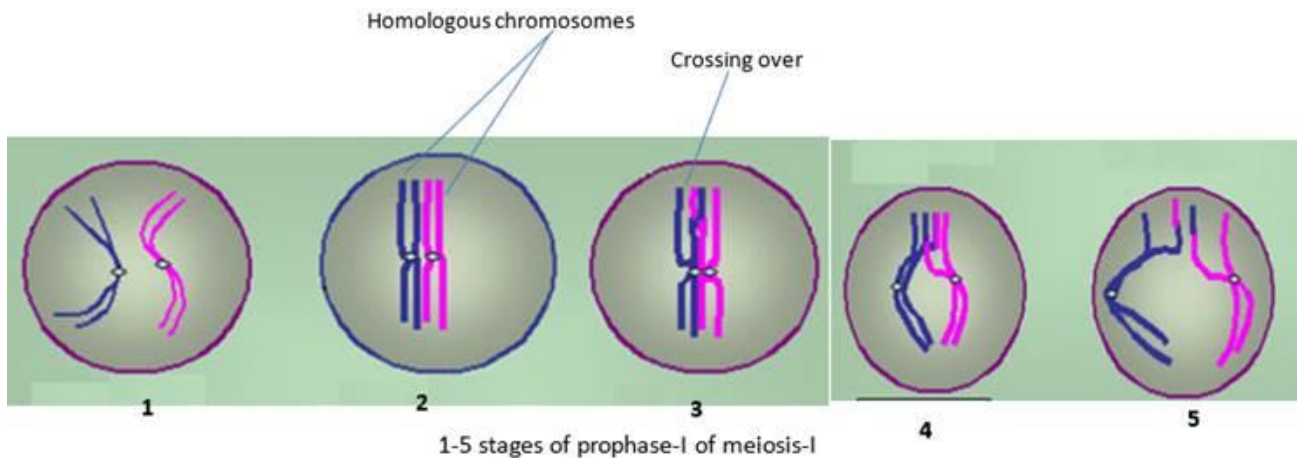
With the help of suitable diagrams, explain the five stages of prophase-I of meiosis.

Answer : Meiosis is a cell division which takes place in germ cells during sexual reproduction. It is completed in stages Meiosis- I and Meiosis-II.

5 phases of prophase –I of meiosis given below:

- 1: The duplicated sister chromatids start to condense.
2. The homologous chromosomes (pair of chromosome having same set of genes) come close to each other and begins to form a paired homologous chromosome. Four chromatids, with one chromosome coming from each parent. Each pair of homologous chromosomes is known as a bivalent (Tetrad).

3. The paired chromosomes are held together tightly. Crossing over (exchange of chromosome segment between non-sister chromatids) between homologous chromosomes occurs. This results into genetic recombination.
4. The homologous chromosomes begin to separate.
5. The chromosomes continue to condense further and the nuclear membrane breaks.



Q. 5. D. Answer in detail.

How all the life processes contribute to the growth and development of the body?

Answer : The processes which maintain body functions and are necessary for survival of the living organisms are called life processes. The important life processes are nutrition, transportation, metabolism, reproduction, respiration, and excretion. Nutrition provides food, respiration provides energy, excretion is the removal of waste from the body, metabolism is the sum of chemical reactions and reproduction is the process through which organism produces offspring. All the organ systems of the body are performing their functions independently but through a complete co-ordination. This overall system is in action in more or less same way in all the organisms. Therefore, all the life processes together bring about growth and development of the body.

Q. 5. E. Answer in detail.

Explain the Krebs cycle with reaction.

Answer : The Krebs cycle is also called tricarboxylic acid (TCA) cycle or the citric acid cycle. It takes place in the matrix of the mitochondria.

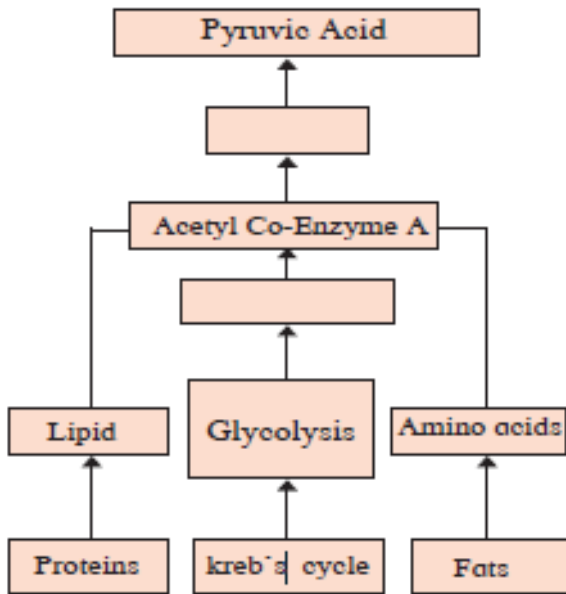
The cycle starts with the reaction between acetyl-CoA and the four-carbon oxaloacetate to form six-carbon citric acid. Through the next steps of the cycle, two of the six carbons of the citric acid removed as carbon dioxide (CO_2) to yield the four-carbon compound, oxaloacetate, which is used again in the first step of the next cycle. During the eight

reactions that take place, for every molecule of acetyl-CoA the cycle produces three NADH and one flavin adenine dinucleotide (FAD/FADH₂), along with one molecule of ATP.

The net equation of the Krebs cycle:



Q. 6. How energy is formed from oxidation of carbohydrates, fats and proteins? Correct the diagram given below.



Answer :

