2. Life Processes in Living Organisms :

Part – 1

(1) After complete oxidation of a glucose molecules, 38 number of ATP molecules are formed.
Explanation :
I. Glycolysis : No. of ATP molecules formed = 4
No. of ATP molecules used = 2
II. Krebs cycle : No. of ATP molecules formed 2
III. ETC Reaction :
$NADH_2$: 10 $NADH_2$ x 3 ATP = 30 ATP
$FADH_2$ = 2$FADH_2$ ×2 ATP = 4 ATP
Total ATP molecules produced = (4+2+34)
= 40 ATP
ATP molecules used = 2ATP
Therefore, total ATP molecules = 38 ATP

(2) At the end of glycolysis, pyruvate molecules are obtained.
Explanation : The process of glycolysis takes place in the cytoplasm of the cell. One molecule of glucose is gradually oxidized step by step forming two molecules of each pyruvic acid, ATP, $NADH_2$, and water. Of these, pyruvate or pyruvic acid takes part in the further reactions.

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(3) Genetic recombination occurs in pachytene phase of prophase of meiosis-I.
Explanation : In prophase of meiosis I there are total 5 stages, viz. leptotene, pachytene, diplotene, zygotene and diakinesis. Of these in pachytene the process of crossing over takes place between homologous chromosomes.

(4) All chromosomes are arranged parallel to equatorial plane of cell in metaphase of mitosis.
Explanation : In mitosis, the metaphase is the stage when dividing chromosomes lie on the equatorial plane of the cell. They are later pulled by the spindle fibres to the opposite poles.

(5) Forformation of plasma membrane, phospholipid molecules are necessary.
Explanation :

On the digestion of fats, fatty acids and glycerol are formed. The fatty acids can be converted into phospholipid which are essential molecules for development of plasma membrane.

(6) Our muscle cells perform anaerobic type of respiration during exercise.
Explanation : When the proportion of oxygen is less, then the cells switch over to anaerobic respiration. When we are exercising there is increased demand of oxygen for muscle cells. If this is not fulfilled, they perform anaerobic respiration during exercise.

2. Write definitions :
(a) Nutrition : The process of taking nutrients in the body and utilizing them by an organism is known as nutrition.

(b) Nutrients : The Substances like carbohydrates, proteins, lipids, vitamins, minerals etc which are components of the food are called nutrients.

(c) Proteins : Protein is a macromolecule which is formed by many amino acids which are joined by peptide bonds.

(d) Cellular respiration : Oxidation of glucose
and other food components which takes place inside the cell in presence or absence of oxygen, is known as cellular respiration.

(e) Aerobic respiration : Cellular respiration taking place in presence of oxygen is known as aerobic respiration.

(f) Glycolysis: The process occurring in the cell where a molecule of glucose is oxidized in step by step process forming two molecules of each of pyruvic acid, ATP, $NADH_2$ and water, is calledglycolysis.

3. Distinguish between :
a. Glycolysis and TCA cycle :

Glycolysis	TCA cycle
1. The process of glycolysis occurs in the cytoplasm of the cell. 2. In glycolysis, one molecule of glucose is oxidized step-by-step to produce two molecules each of pyruvic acid, ATP, $NADH_2$ and water. 3. Glycolysis can take place in both aerobic and anaerobic respiration. 4. The first step in cellular respiration is glycolysis where glucose is converted into pyruvate 5. Two molecules of pyruvate are obtained in glycolysis. 6. Two molecules of ATP are used up in glycolysis. 7. Four molecules of ATP are	1. TCA cycle takes place in mitochondria. 2. In TCA cycle, molecule of acetyl-co-A is completely oxidized and in the process CO_2, H_2O, $NADH_2$, $FADH_2$, and ATP is produced. 3. TCA cycle takes place only during aerobic respiration 4. The second step in cellular respiration is TCA cycle. 5. Pyruvate is converted into CO_2 and H_2O during TCA cycle. 6. ATP molecules are not used up in TCA cycle. 7. Two molecules of ATP are produced in

produced in glycolysis. 8. CO_2 is not produced during glycolysis.	TCA cycle. 8. CO_2 is produced in TCA cycle.

b. Mitosis and meiosis.

Mitosis	Meiosis
1. In mitosis the chromosome number does not change. Diploid cells remain diploid, without change. 2. One cell gives rise to two daughter cells in mitosis. 3. Karyokinesis of mitosis has four stages, viz. prophase, metaphase, anaphase and telophase. 4. Prophase of meiosis-I is very lengthy. 5. Genetic recombination takes place in homologous chromosomes as there is crossing over during prophase-1. 6. Meiosis is essential for formation of gametes in sexual reproduction. 7. Meiosis takes place in only germinal cells. It does not take place in somatic cells.	1. In meiosis, the chromosome number is reduced to half. The diploid cells become haploid. 2. One cell gives rise to four daughter cells in meiosis. 3. Meiosis has two major stages, viz. meiosis-I and meiosis-II. Each is further subdivided into prophase, metaphase, anaphase and telophase. 4. Prophase of meiosis-I is very lengthy. 5. Genetic recombination takes place in homologous chromosomes as there is crossing over during prophase-I. 6. Meiosis is essential for formation of gametes in sexual reproduction. 7. Meiosis takes place in only germinal cells. It does not take place in somatic cells.

c. Aerobic and anaerobic respiration :

Aerobic respiration	Anaerobic respiration
1. Oxygen is required for aerobic respiration. 2. Aerobic respiration takes place in nucleus as well as in cytoplasm. 3. At the end of aerobic respiration CO_2 and H_2O is formed. 4. Energy is produced in large amount in aerobic respiration 5. Glucose is completely oxidized in aerobic respiration 6. 38 molecules of ATP are formed during aerobic respiration 7. Chemical reaction :$C_6H_{12}O_6 + 60_2 \rightarrow 6H_20 + 6CO_2 + 686$ Kcal	1. Oxygen is not required for anaerobic respiration. 2. Anaerobic respiration occurs only in the cytoplasm. 3. At the end of anaerobic respiration CO_2 and C_2H_5OH are formed. 4. Energy is produced in lesser amount in anaerobic respiration. 5. Glucose isincompletely oxidized in anaerobic respiration. 6. 2 molecules of ATP are formed during anaerobic respiration. 7. Chemical reaction : $C_6H_{12}0_6 \rightarrow C_2H_5OH + 2CO_2 + 50$ Kcal.

4. Give scientific reasons.

a. Oxygen is necessary for complete oxidation of glucose.
Ans. When glucose is completely oxidized in aerobic cellular respiration, it produces 38 molecules of ATP. In cellular respiration, three processes take place one after the other, these

are glycolysis, Krebs cycle and electron transport chain reactions. In absence of oxygen only glycolysis can occur but further two reactions will not take place. If glycolysis occurs in absence of oxygen, it produces alcohol. By anaerobic glycolysis only two molecules of ATP are produced. This results in less energy supply to the body. Therefore, oxygen is necessary for complete oxidation of glucose.

b. Krebs cycle is also known as citric acid cycle.
Ans. Sir Hans Kreb proposed this cycle and hence it is called Krebs cycle. These are series of cyclic chain reactions which begins with acetyl- coenzyme-A molecules which act with molecules of oxaloacetic acid. The reactions are catalysed with the help of specific enzymes. The first molecule formed in this reaction is called citric acid. Therefore, Krebs cycle is also called citric acid cycle.

c. Cell division is one of the important properties of cells and organisms.
Ans: Cell division is very essential for all the living organisms. The growth and development is possible only due to cell division. The emaciated body can be restored only through the cell division which adds new cells. Offspring is produced only through the cell division that take place in parents.
In asexual reproduction, mitosis helps to give rise to new generation. In sexual reproduction, meiosis helps to form haploid gametes. All such functions show that cell division is one of the important properties of cells and organisms.

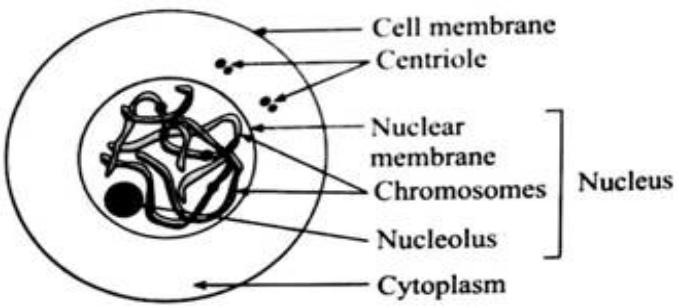
d. Sometimes, higher plants and animals too perform anaerobic respiration.
Ans. When there is deficiency of oxygen in the surrounding, the aerobic respiration is not possible. In such case to survive, higher plants switch over to anaerobic respiration. In some animal tissues in case of oxygen deficiency cells/perform anaerobic respiration.

b. Fibres are one of the important nutrients.
Ans. Fibres are indigestible substance. They are thrown out along with other useless and undigested matter. This aids in digestion.Some fibres also help in digestion Of other substances. Green leafy vegetables, fruits, cereals etc are considered as important in diet as they supply nutritious fibres.
Thus, fibres are considered as one of the important nutrients.

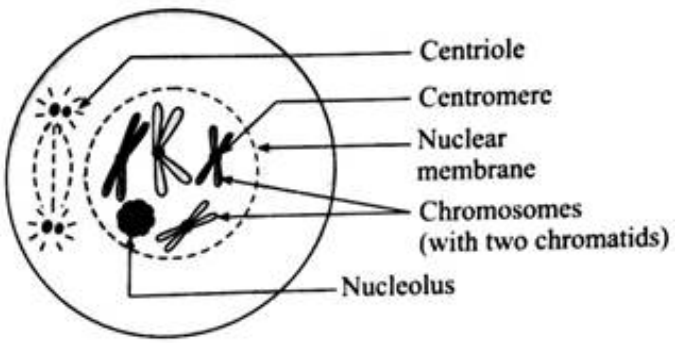
5. Answer in detail.
a. Explain the glycolysis in detail.
Ans. (1) Carbohydrates are converted to glucose after the process of digestion is completed. The oxidation of glucose for releasing energy is called glycolysis which takes place in cytoplasm.
(2) Glycolysis can occur in presence of oxygen or without oxygen to. The first type of glycolysis takes place in aerobic respiration and the second type is in anaerobic respiration.
(3) In aerobic respiration, there is step-wise oxidation of glucose molecule forming two molecules each of pyruvic acid, ATP, $NADH_2$ and water.
(4) Later the pyruvic acid formed in this process is converted into molecules of Acetyl-Coenzyme-A along with two molecules of $NADH_2$ and two molecules of CO_2
(5) During anaerobic respiration along with glycolysis there is fermentation too. This is

incomplete oxidation of glucose and thus it results in formation of lesser energy.
(6) The process of glycolysis was discovered by Gustav Embden, Otto Meyerhof, and Jacob Parnas.
Therefore, in their honour, glycolysis is also called as Embden-Meyerhof-Parnas pathway (EMP pathway). For the discovery they had performed experiments on muscles.

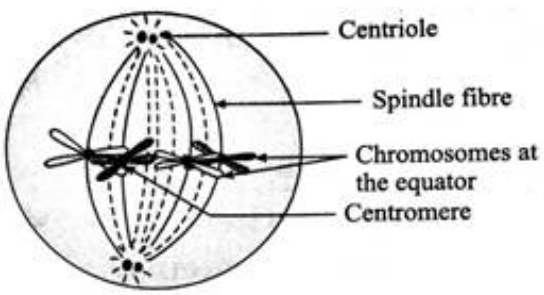
b. With the help of suitable diagrams, explain the mitosis in detail.
Ans. (1) There are two stages of mitosis. These are (a) Karyokinesis or nuclear division and (b) Cytokinesis or cytoplasmic division.
Karyokinesis takes place in further four phases, viz prophase, metaphase, anaphase and telophase.



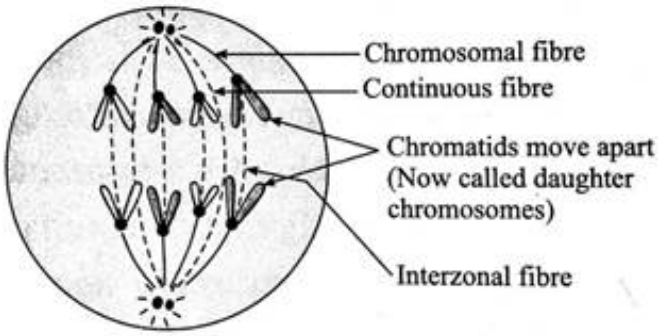
(a) Early Prophase



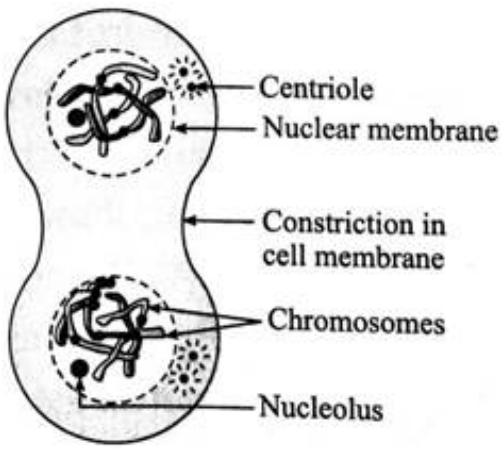
(b) Late Prophase



(c) Metaphase



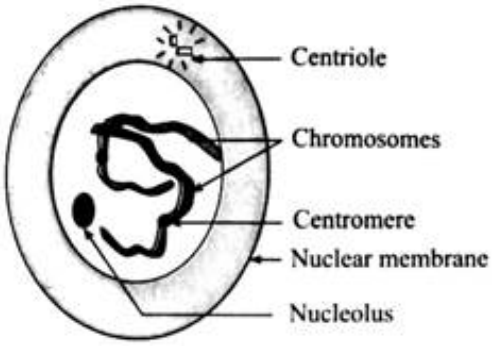
(d) Anaphase



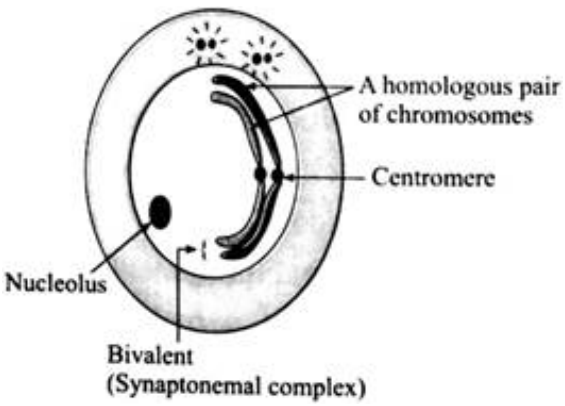
(e) Telophase

(a) Karyokinesis:
(1) Prophase : During prophase, condensation of chromosomes starts. The thin and thread like chromosomes start thickening. They are seen with their pair of sister chromatids. In animal cells the centrioles are seen to duplicate and move to opposite poles of the cell. Nuclear membrane and nucleolus disappear.
(ii) Metaphase : Chromosomes complete their condensation and each one is seen with its sister chromatids. The chromosomes are seen in equatorial plane of the cell. The spindle fibres are formed from polar region, where centrioles are present, and they attach themselves to the centromere of each chromosome. Nuclear membrane now disappears completely.
(iii) Anaphase : The centromeres of the chromosomes now divide forming two daughter chromosomes. The spindle fibres pull apart the chromosomes from equatorial region to the opposite poles. Chromosomes moving to the poles appear like bunch of bananas. One set of chromosomes reach each pole by the end of the anaphase.
(iv) Telophase : Telophase is reverse of events that occurred in prophase. The thickened chromosomes decondense. They again assume the thin and thread like appearance. Nuclear membrane and nucleolus appear again. The spindle fibres are completely lost. The cell looks as if it has two nuclei in one cytoplasm.
(b) Cytokinesis: In animal cells a notch develops in the middle of the cell. This notch goes on deepening down and later the cytoplasm divides into two. In plant cells, cell plate formation takes place and then cytokinesis takes place.

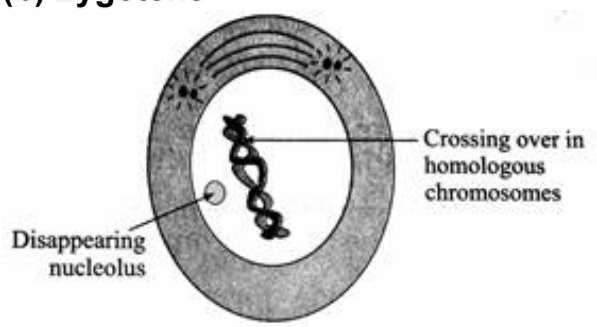
c. With the help of suitable diagrams, explain the five stages of prophase-I of meiosis.
Ans:



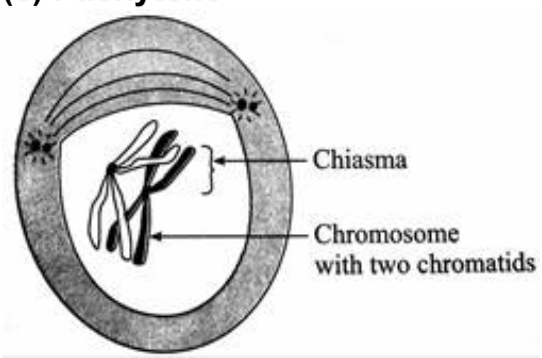
(a) Leptotene



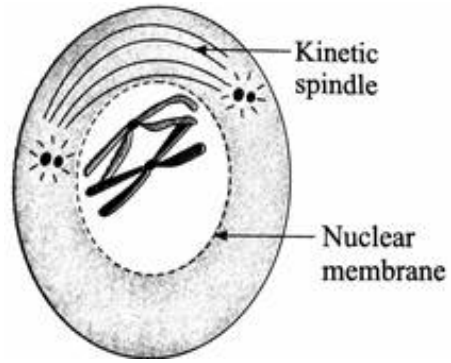
(b) Zygotene



(c) Pachytene



(d) Diplotene



(e) Diakinesis

Prophase-I: Prophase - I of meiosis is much longer phase of the meiosis.
It is subdivided into 5 substages, namely leptotene, zygotene, pachytene, diplotene, and diakinesis.
(1) Leptotene : Initially the chromosomes start condensation and they become compact during leptotene.
(2) Zygotene : In zygotene, homologous chromosomes start pairing. This pairing is called synapsis. The structure called synaptonemal complex develops to hold chromosomes in place during this pairing. Each chromosome's chromatid arm divides and forms structure called bivalent or tetrad.
(3) Pachytene : During pachytene stage, crossing over of non-sister chromatids of homologous chromosomes takes place. Genetic recombination is produced due to such exchange. The homologous chromosomes still remain paired together at the sites of crossing over.
(4) Diplotene : During diplotene, synaptonemal complex dissolves and the homologous chromosomes of the bivalents separate except at the point of crossing over. Thus, it looks like X-shaped structures called the chiasmata.
(5) Diakinesis: The last phase of prophase is for termination of chiasmata. The spindle fibres originate, and the crossover homologous chromosomes are now separated. The nucleolus disappears, and the nuclear envelope breaks down.

d. How do all the life processes contribute to the growth and development of the body?
Ans. (1) Different systems work in coordination with each other in the body of the living organisms.
In human body the homoeostasis is very advanced.
(2) Digestive system, respiratory system, circulatory system, excretory system, nervous system and all the external and internal organs in the body work independently but in coordination with each other.
(3) The digested and absorbed nutrients of the food are transported to various cells with the help of circulatory system due to pumping of the heart.
Simultaneously, the oxygen absorbed in the blood by lungs is also transported to each cell by RBCs.
(4) Mitochondria in every cell brings about oxidation of nutrients and produce energy required for all of these functions.
(5) The control is exercised by the nervous system on all these actions. This keeps the organism alive and helps in growth and development of the same.

e. explain the Krebs cycle with reaction.

Ans. (1) Krebs cycle was proposed by Sir Hans Kreb, This cycle is named after him. It is also called tricarboxylic acid cycle or citric acid cycle.

(2) The acetyl-coenzyme-A molecules enter the mitochondria located in the cytoplasm.

(3) They participate in the chemical reactions taking place in Krebs cycle.

(4) In the cyclic chemical reactions, acetyl- coenzyme-A is completely oxidised

(5) It yields molecules of CO_2, H_2O, $NADH_2$, $FADH_2$ and ATP upon complete oxidation.

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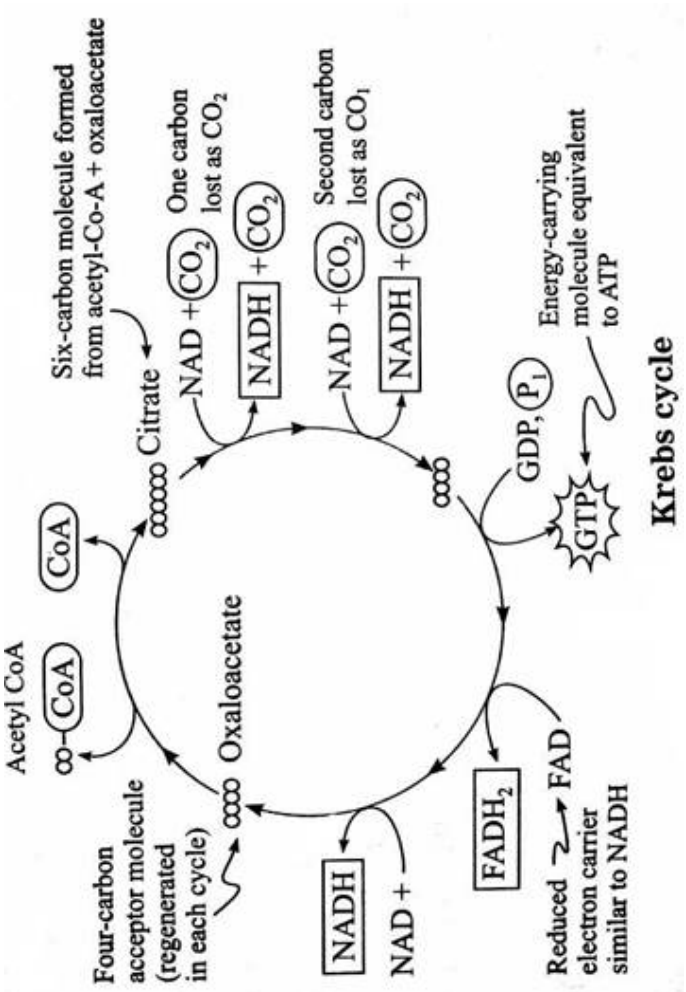

5. How energy is formed from oxidation of carbohydrates, fats and proteins? Correct the diagram given below.

Ans:

Correct diagram :