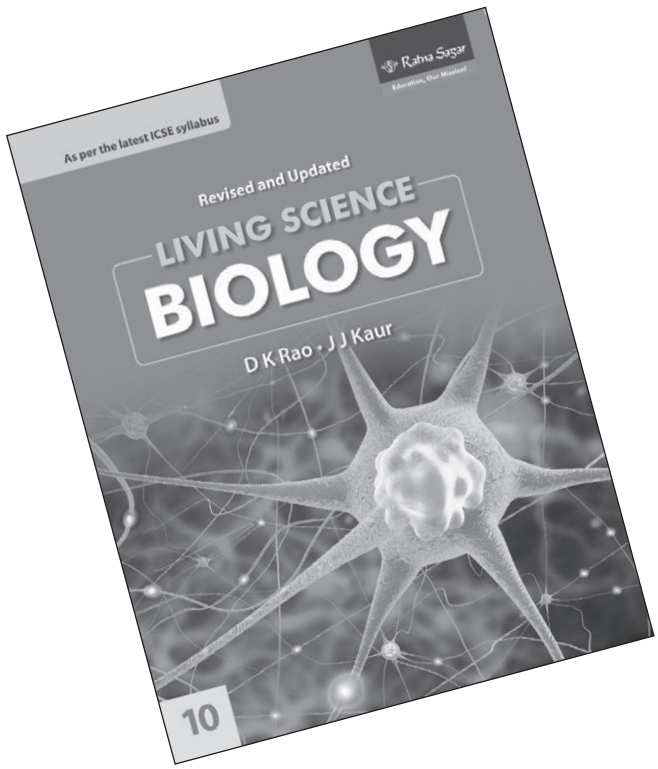
TEACHER'S HANDBOOK

ICSE Living Science
BIOLOGY
Book 10



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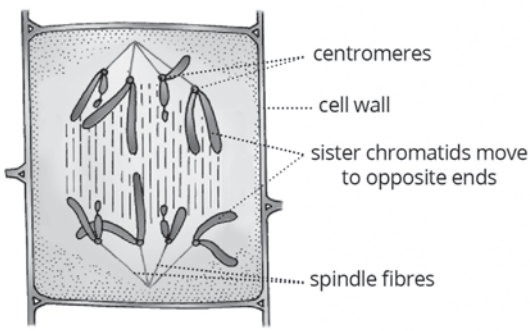
Contents

CHAPTER – 1

CELL CYCLE AND CELL DIVISION

P. 12 Check Your Progress 1

A. Answer these questions.

1. Mitosis and Meiosis
2. Mitosis is responsible for the growth of an organism. It plays a significant role in replacement of cells lost during wear and tear, and in wound healing. It is a method of asexual reproduction in unicellular organisms.
3. Cytokinesis is the division of cytoplasm to form two daughter cells. It begins during late anaphase and is completed soon after telophase. In plant cells, cytokinesis starts from the centre due to cell plate formation, and extends towards the periphery.
4. 

Early anaphase

B. Name the stage of mitotic cell division showing following events.

1. Prophase
2. Metaphase
3. Anaphase
4. Cytokinesis

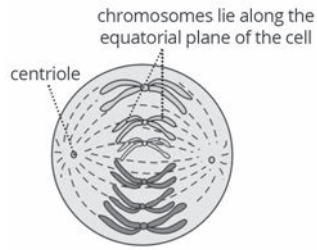
C. Name the kind of cell division that takes place in

1. Meiotic cell division or Meiosis
2. Mitotic cell division or Mitosis
3. Mitotic cell division or Mitosis

D. The diagram given below shows a stage during cell division. Study the same and answer the questions that follow.

1. The stage shown in the diagram is anaphase of mitotic cell division. The stage can be identified as anaphase because the sister chromatids separate and begin to move towards the opposite poles due to the contraction of spindle fibres.

   The given diagram is of an animal cell since centriole can be seen in the diagram, that is only present in an animal cell.
2. i. Centriole
   ii. Chromosome
   iii. Spindle fibre
3. The stage prior to this stage is metaphase.



Metaphase

4. The spindle fibres help in the chromosomal movement during mitosis.
5. Mitosis occurs in all the somatic cells of the body.

P. 15 Check Your Progress 2

A. Answer these questions.

1. a. Crossing over of meiosis
   b. i. Homologous chromosomes
      ii. Chromatids exchanging parts
   c. During crossing over which occurs in meiosis, part of chromatids are exchanged between homologous chromosomes which bring about variations in the offsprings.
   d. The non-sister chromatids of a tetrad break open and rejoin each other. Exchange of some genes or portions of chromatids takes place between paternal and maternal chromatids of a pair of homologous chromosomes during meiosis. This is known as crossing over.

B. State whether following statements are True or False.

1. False
2. True
3. False
4. True
5. True
6. True

P. 16 Exercises

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. b
2. c
3. c
4. a
5. c
6. c

II. Very Short Answer Type Questions

A. Fill in the blanks.

1. reproductive
2. somatic
3. daughter
4. 2, 4
5. one, two

B. Match the items in Column A with those in Column B and write down the matching pairs.

1. d **2.** c **3.** b **4.** a

III. Short Answer Type Questions

A. Differentiate between the following.

1.

Cytokinesis	Karyokinesis
It refers to the division of cytoplasm leading to the division of parent cells into daughter cells.	It refers to the nuclear division leading to the division of parent nucleus into daughter nuclei.

2.

Prophase	Metaphase
This is the first and longest phase of mitosis. The chromatin material undergoes condensation (becomes short and thick) and changes into thread-like structures called chromosomes.	The chromosomes arrange themselves on the equatorial plane.
Centromere is not attached to spindle fibre.	Each chromosome is attached by a spindle fibre at its centromere.

3.

Anaphase	Telophase
This is the shortest phase of mitosis. The centromere of each chromosome divides into two halves (sister chromatids) so that each chromatid has its own centromere.	This is the last phase in karyokinesis (nuclear division). The chromatids (daughter chromosomes) uncoil, elongate and change into network of chromatin threads.
The sister chromatids separate and begin to move towards the opposite poles due to the contraction of spindle fibres.	The nuclear membrane reappears around the chromatin network at each pole.

4.

Diploid	Haploid
The diploid number is the number of chromosomes required for two complete copies of the organism's genome.	The number of chromosomes in gametes is called haploid number, which is equal to half the number of diploid number.
In humans, the diploid number is 46.	In humans, the haploid number in gametes is 23.

5.

Centrosome	Centromere
The centrosome initiates and regulates the cell division.	The two sister chromatids lie close to each other and remain attached at a point called centromere.
The centrosome splits into two small round bodies called centrioles. The two centrioles migrate to the opposite poles of the cell.	The centromere of each chromosome divides into two halves (sister chromatids) so that each chromatid has its own centromere.

6.

Chromosome	Chromatid
The chromatin material undergoes condensation (becomes short and thick) and changes into thread-like structures called chromosomes.	Each chromosome duplicates to form two sister chromatids. The two sister chromatids lie close to each other and remain attached at a point called centromere.
Each chromosome is attached by a spindle fibre at its centromere.	The centromere of each chromosome divides into two halves (sister chromatids) so that each chromatid has its own centromere.

B. Answer these questions.

1. Karyokinesis refers to the nuclear division leading to the division of parent nucleus into daughter nuclei. Whereas cytokinesis refers to the division of cytoplasm leading to the division of parent cells into daughter cells.
2. In meiotic cell division, crossing over takes place.
3. The spindle fibres help in the chromosomal movement during mitosis. The sister chromatids separate and begin to move towards the opposite poles due to the contraction of spindle fibres, and due to the repelling force developed between them.
4. Interphase is the growth period between two successive divisions of a cell. Thus it is a preparatory phase just before the cell starts dividing. The cell is metabolically most active and prepares itself for the division by synthesizing DNA (the genetic material) and RNA to almost double amount.

   It has three sub-phases:

   (i) **G1 or first growth phase:** This is the first gap (interval) phase of cell growth when RNA and proteins are synthesized.

   (ii) **S or synthesis phase:** This is the phase of DNA replication.

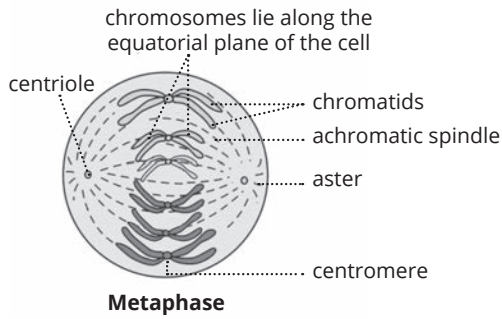
   (iii) **G2 or second growth phase:** It is the second gap phase after DNA replication in which RNA and proteins necessary for cell division continue to be synthesized.

   Since all these activities occur during the interphase, it is incorrect to call it as a resting stage.
5. Meiosis is a modified mitosis in which chromosomes divide once and the nucleus divides twice. As a result of which, the number of chromosomes is reduced to half. Thus, the four cells resulting from a meiotic division have a haploid number of chromosomes. Since the number of chromosomes is reduced to half in the daughter cells, meiosis is called a reductional cell division.
6. The non-sister chromatids of a tetrad break open and rejoin each other. Exchange of some genes or portions of chromatids takes place between paternal and maternal chromatids of a pair of homologous chromosomes during meiosis. This is known as crossing over.

   During crossing over which occurs in meiosis, part of chromatids are exchanged between homologous chromosomes which bring about variations in the offsprings.

IV. Long Answer Type Questions

A. Draw a diagram of the nucleus of a cell, having 6 chromosomes, as it would appear in the metaphase stage of mitosis and label the following parts in the diagram.



Metaphase

B. Answer these questions.

1.

Cytokinesis in plant cells	Cytokinesis in animal cells
In plant cells, a cell plate is formed in the centre of the cell at the equator. The cell plate extends on either side until it completely divides the cell into two daughter cells.	In animal cells, a constriction (or furrow) appears in the cell (or plasma) membrane. This constriction deepens by the end of the telophase, finally completing the division of cytoplasm.
Cytokinesis starts from the centre due to cell plate formation, and extends towards the periphery.	Cytokinesis starts from the periphery and proceeds towards the centre.

2. **Significance of mitosis**

   - Mitosis maintains the same number of chromosomes in all the cells of an individual. In other words, mitosis is an equational division in which two daughter cells produced are identical to each other and even to their parent cell. This type of cell division usually takes place in the somatic cells such as tips of roots, stems, etc.
   - It plays a significant role in replacement of cells lost during wear and tear, and in wound healing.
   - It is responsible for the growth of an organism. A fertilized cell develops into an

embryo and finally into an adult as a result of mitotic cell division. It is a method of asexual reproduction in unicellular organisms.

3. **Significance of meiosis**

- It results in the formation of haploid sex cells (sperms and ova), which after fertilization restore the diploid number of chromosomes in the zygote.
- During crossing over which occurs in meiosis, part of chromatids are exchanged between homologous chromosomes which bring about variations in the offsprings.
- The four chromatids of a homologous pair of chromosomes are passed on to four different daughter cells. This also causes gametic variation.

4. Homologous chromosomes come together (associate) and subsequently segregate into daughter cells. Each daughter nucleus formed at the end of the meiosis I, has half the number of chromosomes as compared to the parent cell. Thus, the number of chromosomes is reduced from diploid (double) to the haploid (single) state. Hence, the word reduction here refers to decrease in number of chromosome from diploid state to haploid state.

5. Meiosis takes place in the reproductive cells that produce gametes (sperms and ova). In meiotic cell division, chromosomes divide once and the nucleus divides twice. As a result of which the number of chromosomes is reduced to half. Thus, the four cells resulting from a meiotic division have a haploid number of chromosomes. It means that the number of chromosomes becomes half in each sex cell. This is because when the male and female gametes fuse during fertilization, the diploid (double) number of chromosome pairs is restored.

6. During meiotic cell division, homologous chromosomes come together and subsequently segregate into daughter cells. The non-sister chromatids of a tetrad break open and rejoin each other. Exchange of some genes or portions of chromatids takes place between paternal and maternal chromatids of a pair of homologous chromosomes during meiosis. This is known as crossing over.

   Due to crossing over of homologous chromosomes, part of chromatids are exchanged between homologous chromosomes which bring about variations in the offsprings.

V. Structured / Application / Skill Type Questions

A.

Feature	Mitosis	Meiosis
Occurrence	Occurs in somatic cells	Occurs in reproductive cells
Number of daughter cells formed at the end of division	Two daughter cells	Four daughter cells
Number of chromosomes in daughter cells (haploid/ diploid)	Diploid set	Haploid set
Exchange of genetic material between homologous chromosomes	No exchange takes place	Exchange of genetic material takes place

B. 1. Since centrioles can be seen in the given diagram, it can be said that this is an animal cell. Centrioles are only seen in animal cells and cannot be seen in plant cells.

2. The stage shown in the diagram is late prophase. This stage can be identified because of following reasons:

- Each chromosome has two sister chromatids. The two sister chromatids lie close to each other and remain attached at a point called centromere.
- Two radiating fibres known as asters can be seen around the centriole at each pole.
- The duplicated chromosomes can be seen moving towards the equator.
- Nuclear membrane disappears.

3. Centriole

4. i. Chromosomes (Sister chromatids)

ii. Equator of spindle

iii. Spindle fibres

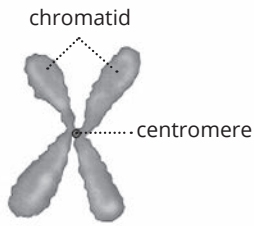
5. Metaphase follows this stage which can be identified by the arrangement of chromosomes on the equatorial plane in such a way that their centromeres lie on the equator and arms face towards the poles.

6. a. In mitotic cell division, two daughter cells are formed whereas in meiotic cell division, four daughter cells are formed.

b. In mitotic cell division, the daughter cells contain the same number of chromosomes as in the parents cells.

In meiotic cell division, the daughter cells contain half the normal number (diploid) of chromosomes.

7. Duplicated chromosome



C. 1. **ii → i → v → viii → iii → vi → iv → vii**

2. In **iii**, the sister chromatids separate and begin to move towards the opposite poles due to the contraction of spindle fibres.

In **iv**, the chromatids uncoil, elongate and change into network of chromatin threads. The nuclear membrane reappears around the chromatin network at each pole.

3. Mitosis is an equational division in which two daughter cells produced are identical to each other and even to their parent cell in every respect. The same diploid chromosome number of the parent cell is maintained at each stage of mitotic division of the cell. Since no crossing over takes place in mitosis, the daughter cells produced are genetically identical.

D. 1. Meiotic cell division

2. Animal cells

3. **iii → ii → iv → i**

4. The last stage is the cytokinesis.

four daughter cells

E. 1. The stage shown in the diagram is anaphase of mitotic cell division. The stage can be identified as anaphase because the sister chromatids separate and begin to move towards the opposite poles due to the contraction of spindle fibres.

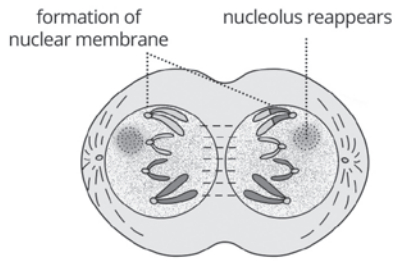
2. **i.** Centriole

ii. Spindle fibres

iii. Chromatid

3. Four

4.



Early telophase

5.

Mitosis in animal cells	Mitosis in plant cells
Occurs in all somatic cells of the body for growth and replacement of worn out cells.	Occurs only in the meristematic (growing) parts of the plant for lengthening and increasing the girth.
Cytokinesis occurs by constriction or furrow formation in the cytoplasm. It starts from the periphery and proceeds towards the centre.	Cytokinesis occurs by cell plate formation. It starts at the center and proceeds towards the periphery.

F. 1. It is a plant cell. The cell can be identified as plant cell due to the presence of cell wall.

2. Anaphase

3. **i.** Chromatids

ii. Pole

iii. Spindle fibres

4. Sequence of events during anaphase:

The centromere of each chromosome divides into two halves (sister chromatids) so that each chromatid has its own centromere.

The sister chromatids separate and begin to move towards the opposite poles due to the contraction of spindle fibres, and due to the repelling force developed between them.

The anaphase ends when all the chromatids (now behaving like chromosomes) reach the opposite poles.

5. **a.** Mitosis **b.** Meiosis

CHAPTER – 2

HUMAN CHROMOSOMES

P. 22 Check Your Progress 1

A. Fill in the blanks.

1. 44, 2
2. nucleosome

B. State whether true or false. Rewrite the false statements correctly.

1. False.

   DNA is the segment of chromatid that carries heredity information.

2. True

P. 23 Exercises

I. Very Short Answer Type Questions

A. Name the following.

1. Chromosome
2. Sex chromosomes
3. Chromatin
4. Hydrogen bond
5. A pentose sugar, a phosphate group and a nitrogenous base
6. Allele
7. Nucleotides

B. State whether true or false. Rewrite the false statements correctly.

1. True
2. False

   DNA molecule is a double-helical structure.

3. False

   A chromosome at the start of cell division consists of two joined chromatids.

4. False

   A nucleotide is composed of a sugar (pentose), a phosphate and a nitrogenous base.

C. Fill in the blanks.

1. gene
2. Centromere
3. Chromatin
4. nucleosome

II. Short Answer Type Questions.

A. Differentiate between the following.

1.

Autosomes	Sex Chromosomes
The autosomes carry genes which control somatic traits and play no role in sex determination.	The sex chromosomes determine the sex of the individual.
There are 22 pairs of autosomes.	There is one pair (23rd) of sex chromosome.
The two members of each pair of autosomes are similar in size and shape.	The two members of the pair are not always equal in size.

2.

Homomorphic chromosomes	Heteromorphic chromosomes
They are morphologically identical members of a homologous chromosome.	They are morphologically non-identical members of a homologous chromosome.
The sex chromosomes of human females are described as homomorphic.	The sex chromosomes of human males are described as heteromorphic.

3.

Chromosomes	Genes
Chromosome can be defined as a strand of DNA molecule associated with proteins.	A gene (segment of DNA) codes for the synthesis of a specific protein which controls the expression of a particular characteristic in an individual.
Chromosomes are the hereditary vehicles found in the nucleus of a cell.	Gene is the basis of heredity found on a chromosome.

B. Answer these questions.

1. Chromosome can be defined as a strand of DNA molecule associated with proteins. Chromosomes are the hereditary vehicles found in the nucleus of a cell. Chromosomes contain genes which are carriers of heredity.
2. Gene is the basic unit of heredity. It is located on a chromosome.
3. Chromosomes are referred to as hereditary vehicles as the characteristics travel from parents to offsprings in the form of genes situated on the chromosome.
4. A gene (segment of DNA) codes for the synthesis of a specific protein which controls the expression of a particular characteristic in an individual. Thus, gene is the basis of heredity found on a chromosome. Genes are composed of DNA.
5. Human skin cell is diploid (2n) in nature whereas ovum is haploid (n). Therefore, human skin cell has 46 (23 pairs) chromosomes and ovum has 23 chromosomes.
6. Adenine, Guanine, Cytosine and Thymine

III. Long Answer Type Questions

A. Answer these questions.

1. The heterogametic sex is the one in which the sex chromosomes differ. In human males, one sex chromosome is smaller than the other. The larger one is known as X chromosome and the smaller one is known as Y chromosome. During gamete formation they produce two types of gametes, 50% with X chromosome and 50% with Y chromosome. Thus, the human males are described as heterogametic.
2. Adenine, Guanine, Cytosine and Thymine
3. Each chromosome consists of two chromatids joined at some point along the length. At the point of joining, a constriction is formed called the centromere. Centromere is the point on the chromosome where the spindle fibres are attached. If the centromere is at the middle position, the chromosome is metacentric. If the centromere is towards one end (away from the centre), the chromosome is acrocentric. If the centromere is at an extreme end, the chromosome is telocentric.
4. A nucleosome is a section of DNA that is wrapped around a core of proteins. Inside the nucleus, DNA forms a complex with proteins called chromatin, which allows the DNA to be condensed into a smaller volume. When the chromatin is extended and viewed under a microscope, the structure resembles beads on a string. Each of these tiny beads is called a nucleosome. The nucleosome is the fundamental subunit of chromatin. Each nucleosome is composed of a little less than two turns of DNA wrapped around a set of eight proteins called histones, which are known as a histone octamer. Each histone octamer is composed of two copies each of the histone proteins H2A, H2B, H3, and H4. The chain of nucleosomes is then compacted further and forms a highly organized complex of DNA and protein called a chromosome.
5. DNA–histone complex is called chromatin. DNA forms about 40% and histones (proteins) form about 60% of the overall part of chromosome. DNA has negative charge while histones are positively charged basic protein molecules which are bound to it. This DNA–histone complex is called chromatin.

   Difference between chromosome and chromatin.

Chromatin	Chromosome
Thin, long, uncoiled structure	Thick, compact, ribbon-like structure
Composed of nucleosomes	Composed of chromatin fibres
It is unpaired.	It is paired.
It is undercondensed part of nucleoprotein.	It is condensed part of nucleoprotein.
It is observable in the interphase nucleus.	It is observable in the M-phase or nuclear division.

IV. Structured/Application/Skill Type Questions

A. Given below is a figure of certain structure found in human cells.

1. Chromosome
2. i. Centromere. It is the point on the chromosome, where spindle fibres are attached during cell division.
3. ii. Chromatids

CHAPTER – 3
HEREDITY AND GENETICS

P. 26 Check Your Progress 1

A. Match the Column A with Column B.

1. c **2.** a **3.** e **4.** b **5.** d

P. 31 Check Your Progress 2

A. Mendel conducted his experiments on garden pea (*Pisum sativum*) because of the following reasons:

- Pea plants have several distinct varieties.
- Pea plant bears bisexual flowers.
- Due to self-fertilization, it is easy to get pure lines for several generations.
- As it is an annual plant, it is possible to study several generations within a short span of time.
- The flowers of pea plant are easy to handle.
- Each plant can produce large number of seeds in single generation.

B. Fill in the blanks.

1. 3 : 1
2. 9 : 3 : 3 : 1
3. homozygous
4. heterozygous
5. Dominance

P. 34 Check Your Progress 3

A. Answer these questions.

1. Sex chromosomes

2. In human beings, out of 23 pairs of chromosomes, a specific pair, i.e., the 23rd pair of chromosomes determines the sex of the individual. These are called sex chromosomes. All the other 22 pairs of chromosomes are termed as autosomal chromosomes or autosomes.

The sex chromosomes determine the sex of the individual but autosomes carry genes which control somatic traits and play no role in sex determination.

3. Odd one out – Night blindness

Category – Sex-linked inheritance

4. Inheritance of non-sexual characters or traits due to the presence of an allele on sex chromosome is called sex-linked inheritance.

5. Genetic engineering is a technique in which the genetic constitution of an organism can be altered by introducing new genes or replacing existing genes into its chromosomes. For example, insulin producing genes are introduced in a bacteria to produce insulin.

P. 35 Exercises

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. a **2.** b **3.** b **4.** b **5.** b
6. b

II. Very Short Answer Type Questions

A. Fill in the blanks.

1. variations **2.** dominant gene
3. Gametes **4.** autosomes
5. pea **6.** dominant, recessive
7. law of segregation **8.** Haemophilia

B. Name the following.

1. Haemophilia **2.** Defective tooth enamel
3. Genotype **4.** Homogametic
5. Heterogametic **6.** Phenotype
7. *Pisum sativum* **8.** Recessive allele
9. Monohybrid cross **10.** Chromosome

C. Identify the odd term in each set and name the category to which the remaining three belong.

1. Odd term – Night blindness; category of other three – Sex-linked inheritance

2. Odd term – Typhoid; category of other three – Sex-linked inheritance

III. Short Answer Type Questions

A. Define the following terms.

1. Dominant gene: One of the two alleles of a gene which masks any phenotypic effect of any recessive allele.

2. Allele: Alternating molecular forms of genes affecting the same characteristics but in two different ways.

3. Phenotype: Externally visible expression of genes, which is an inherited feature in an individual's appearance.

4. Genotype: The genetic constitution of an organism.

5. Heredity: The phenomenon by which living organisms transmit parental characteristics to the successive generation is called heredity or inheritance.

6. Gene: A unit of inheritance passed from parents to offsprings via chromosomes.

B. Differentiate between the following.

1. Genes are the units of heredity. A gene is a specific DNA segment on a chromosome which controls the expression of a character.

The genetic constitution of an organism in which the genes are present in various combinations is called genotype.

2. Each gene has two alternative forms of a character producing different effects. These alternative forms are called alleles.

Genes are the units of heredity. A gene is a specific DNA segment on a chromosome which controls the expression of a character.

3. Chromosomes are filamentous bodies present in the nucleus, composed of chromatin material (DNA–RNA protein complex). They can be defined as a strand of DNA molecule associated with proteins. Chromosomes are the hereditary vehicles found in the nucleus of a cell. Chromosomes contain genes which are carriers of heredity.

Genes are composed of DNA and proteins. A gene (segment of DNA) codes for the synthesis of a specific protein which controls the expression of a particular characteristic in an individual. Thus, gene is the basis of heredity found on a chromosome.

4. The genetic constitution of an organism in which the genes are present in various combinations is called genotype.

Phenotype is the externally visible expression of genes, which is an inherited feature in an individual's appearance.

5. Law of Dominance states that when two homozygous individuals with one or more sets of contrasting characteristics are crossed, the characteristics which appear in the F_1 hybrids are dominant and those which do not appear in F_1 generation are recessive.

Law of Segregation states that when a pair of allele is brought together in a hybrid, the members of the allelic pair remain together without mixing and separate or segregate from each other when the hybrid forms gametes. It is also known as the law of purity of gametes.

6. Out of the two alleles of a gene, the allele which masks any phenotypic effect of any recessive allele is called dominant allele or gene.

The allele that is masked or suppressed is the recessive allele or gene.

7. In human beings, out of 23 pairs of chromosomes, a specific pair, i.e., the 23rd pair of chromosome determines the sex of the individual. These are called sex chromosomes.

All the other 22 pairs of chromosomes are termed as autosomal chromosomes or autosomes. The autosomes carry genes which control somatic traits and have no bearing on the sex. The two members of each pair of homologous autosomes are similar in size and shape, but this may not be true for the sex chromosomes.

8. A cross between two parents representing contrasting forms of a single trait is called monohybrid cross.

A dihybrid cross is one in which parents with two pairs of traits with contrasting characters are crossed.

C. Answer these questions.

1. Mendel named the heredity units as 'factors'.

2. Determining the sex of an individual at prenatal stage is called sex determination. In human beings there are two types of sex chromosomes – X and Y. An egg contains X chromosomes, while a sperm contains either X or Y chromosome.

When the sperm and the egg unite to form a zygote, each individual inherits one of the two possible combinations of sex chromosomes.

A zygote with two X chromosomes (one from mother and one from father) develops into a girl while a zygote with one X chromosome (from mother) and one Y chromosome (from father) develops into a boy.

Sex of an individual is determined purely due to chance and neither mother nor father can be blamed for it.

3. Colour blindness and haemophilia.

4. Selecting pea plants was one of the most important factors in the success of Mendel's experiment because of his meticulous and careful observations about its features.

The features that were advantageous for the experiments were:

Shorter lifespan so that a large number of generations can be studied and examined.

Presence of contrasting variants of features.

Ease of rearing or cultivation.

Since all these features were present in the garden pea plant, Mendel's experiment was successful.

5. Law of Segregation states that when a pair of allele is brought together in a hybrid, the members of the allelic pair remain together without mixing and separate or segregate from each other when the hybrid forms gametes. It is also known as the law of purity of gametes.

6. Haemophilia is caused by recessive allele located on the X chromosome. It is more common in males than females since males are XY, so they only have one X chromosome that they inherit from their mother. So, if the X chromosome contains the gene responsible for hemophilia, there is no normal X chromosome to mask it.
7. The branch of science that deals with the mechanism responsible for similarities and differences among closely related species is called genetics.
8. Law of Dominance states that when two homozygous individuals with one or more sets of contrasting characteristics are crossed, the characteristics which appear in the F_1 hybrids are dominant and those which do not appear in F_1 generation are recessive.
9. A dihybrid cross is one in which two varieties of pea plants having two contrasting characters are crossed to study inheritance of two pairs of triats simultaneously.
10. Autosomes are chromosomes that carry genes which control somatic traits and play no role in sex determination. There are 22 pairs of autosomal chromosomes.

IV. Long Answer Type Questions

A. Answer these question.

1. Genotype of offsprings when both parents are Bb or heterozygous for black fur – BB, Bb and bb.

   The genotype of offsprings can be deduced on the basis of the following Punnet square.

Father ↓ / Mother →	B	b
B	BB	Bb
b	Bb	bb

V. Structured/Application/Skill Type Questions

A. 1. 50% probability that the son will have haemophilia.
2. X-linked inheritance
3. X chromosome

B. 1. **i** – YR, **ii** – YR, **iii** – yr, **iv** – YyRr, **v** – YyRr, **vi** – YyRr
2. Yellow round seeds.
3. Yellow round seeds, Green wrinkled seeds, Yellow wrinkled seeds and Green round seeds.
4. 9 : 3 : 3 : 1
5. Law of independent assortment

C. 1. Genotype of mother – bb
2. Phenotype – Blue eye
3. 1 : 1

D. 1. Punnet Square

♀ / ♂	TR	TR
tr	TtRr	TtRr
tr	TtRr	TtRr

2. Genotype – TtRr

   Phenotype – Tall plant bearing red-coloured flowers
3. Law of independent assortment states that when a dihybrid organism forms gametes, each gamete receives one allele from each allelic pair and the assortment of alleles of different characteristics during gamete formation is independent of their parental combinations.
4. Tall plant with red-coloured flowers, Tall plant with white-coloured flowers, Dwarf plant with red-coloured flowers and Dwarf plant with white-coloured flowers.
5. 9 : 3 : 3 : 1
6. TR, Tr, tR and tr

E. 1. *Pisum sativum*
2. YyRr
3. Dihybrid phenotypic ratio – 9 : 3 :3 : 1

   Phenotype - Yellow round seeds, Green wrinkled seeds, Yellow wrinkled seeds and Green round seeds.
4. Law of independent assortment – It states that when a dihybrid organism forms gametes, each gamete receives one allele from each allelic pair and the assortment of alleles of different characteristics during gamete formation is independent of their parental combinations.
5. Gametes – YR, Yr, yR and yr

F. 1. Sweet pea plant having axial flowers with round seeds.
2. Axial flowers with round seeds, Terminal flowers with round seeds, Axial flowers with wrinkled seeds and Terminal flowers with wrinkled seeds.
3. 9 : 3 : 3 : 1
4. Law of independent assortment – It states that when a dihybrid organism forms gametes, each gamete receives one allele from each allelic pair and the assortment of alleles of different characteristics during gamete formation is independent of their parental combinations.

CHAPTER – 4

ABSORPTION BY ROOTS

P. 39 Check Your Progress 1

A. Answer these questions.

1. Three major functions of roots:

- Absorption of water and inorganic nutrients
- Anchoring of the plant body to the ground
- Storage of food and nutrients

2. Nitrogen, Phosphorus and Potassium are three minerals in plants.

- Nitrogen (N) is a part of chlorophyll, the green pigment of the plant that is responsible for photosynthesis. It helps plants with rapid growth, increasing seed and fruit production and improving the quality of leaf and forage crops as it forms part of nucleic acids and proteins.
- Phosphorus (P) is an essential part of the process of photosynthesis. It is involved in the cell division.
- Potassium (K) is absorbed by plants in larger amounts than any other mineral element except nitrogen and, in some cases, calcium. It helps in the building of protein, photosynthesis and activating the enzymes.

3. Main characteristics of root hair that help them in absorption of water:

- Roots contain root hair that provide enormous surface area for absorption of water.
- The epidermis of root hair is permeable to water. Most of the absorption of water and minerals occurs near root tips.
- Root hair grows from the outer layer of the cortex. Between the cells of the cortex are large air spaces that allow diffusion of gases and movement of water. The spaces allow water to get into the root by capillary action.

4. Root hair have large vacuoles to absorb water quickly and transport it to the next cells. The vacuoles have salts, which speed up water absorption from soil water.

5. a. Water is one of the most essential requirements of photosynthesis. Water provides electrons to replace those removed from chlorophyll in photosystem II. Also, water produces oxygen as well as reduces NADP to NADPH. Roots absorb water from soil and supply this to the leaves for photosynthesis.

b. The presence of water in a plant body gives it a shape and mechanical support. Loss of water from the plant body makes it wilt. and the plant will not have the mechanical support to stand straight.

P. 43 Check Your Progress 2

A. Differentiate between diffusion and osmosis with respect to the following features.

	Feature	Diffusion	Osmosis
1.	Medium	Solid, liquid, gas	Liquid
2.	Type of membrane	Not required	Semi-permeable membrane
3.	Speed	Rapid process in gases and slow process in liquids	Slow process

B. State whether the following statements are True (T) or False (F).

1. F **2.** T **3.** F **4.** T **5.** F

C. 1. An isotonic solution contains the same concentration of solute as in a cell. If plant cells are kept in isotonic solution then cells will not swell or shrink. Hence, there will not be any change in cells.

2. If the plant cell is placed in a hypotonic solution, it takes up water by endosmosis and begins to swell. The rigid cell wall in plants prevents the cell from bursting. The plant cell is said to have become turgid.

3. If plant cells are placed in the hypertonic medium, it will lose water due to the process of exosmosis. Such a cell is called plasmolysed cell.

P. 47 Check Your Progress 3

A. Name the following.

1. Imbibition
2. Active Transport
3. Turgid
4. Flaccidity
5. Plasmolysis
6. Deplasmolysis
7. Root pressure

P. 50 Check Your Progress 4

A. Answer the following.

1. Xylem

2. The twig wilts because water was not transported from the roots to the leaves due to absence of xylem. The experiment proves that water rises through the xylem vessels.

3. In the centre of the stem, the xylem vessels appear red due to conduction of eosine stain dye. This shows that coloured water of the beaker is conducted through xylem tissue.

P. 51 Exercises

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. b **2.** d **3.** d **4.** b **5.** c

6. a

II. Very Short Answer Type Questions

A. Name the following.

1. Endosmosis

2. Plasmolysed/Flaccid

3. Turgid

4. Turgor pressure

5. Osmosis

6. Endosmosis

7. Xylem

8. Flaccidity

9. Diffusion

10. Imbibition

11. Hypertonic

12. Root

13. Selectively permeable

14. Active transport

15. Isotonic

B. Complete the following sentences given below by filling in the appropriate word or terms.

1. diffusion

2. cytoplasm of

3. turgor pressure

4. Imbibition

5. active transport

6. imbibition

7. Plasmolysis

8. root pressure

C. Mention if the following statements are True (T) or False (F). Rewrite the false statements correctly.

1. True

2. False

Cells that have lost their water contents are said to be plasmolysed.

3. False

Diffusion and osmosis are basically same process in which the molecules move from it's higher concentration to lower concentration.

4. False

A plant cell kept in a hypertonic solution gets plasmolysed.

5. True

D. Explain the following terms.

1. Osmosis: Osmosis can be defined as the movement of water across a semipermeable membrane from an area of high water concentration to an area of lower water concentration.

2. Turgidity: Turgidity is the state of the cell of being swollen or turgid, especially due to high fluid content.

3. Turgor pressure: Turgor pressure is the pressure which is exerted by the cytoplasm on the cell wall.

4. Diffusion: Diffusion is the movement of molecules from a region of higher concentration to a region of lower concentration down the concentration gradient.

5. Hypotonic solution: The outside solution is less concentrated than the cell cytoplasm. Thus, water molecules move inside the cell from outside.

E. Write the following in a logical sequence.

1. Soil water, root hair, cortical cells, endodermis, xylem

2. Soil water, root hair, cortex, endodermis, xylem

III. Short Answer Type Questions

A. Differentiate between the following.

1. The diffusion of water molecules through a semi-permeable membrane from a region of its higher concentration (more dilute solution) to its lower concentration (less dilute solution) is called osmosis.

The movement of molecules of a substance from a region of their higher concentration to a region of their lower concentration is called diffusion.

2. The shrinkage of the cytoplasm (cell content) of a cell from a cell wall when placed in a hypertonic solution is called plasmolysis. If we place a living turgid cell in a hypertonic solution, outer movement of water (exosmosis) occurs from the central region of the cell. As a result the size of the protoplasm becomes reduced and the plasma membrane is withdrawn from the cell wall. This is called plasmolysis and the cell is a plasmolysed cell.

   If a plasmolysed cell is placed in water, its shrunk cytoplasm swells up against the cell wall. This happens due to endosmosis. The swelling up of a plasmolysed cell under influence of hypotonic solution or water is called deplasmolysis.

3. A condition in which a cell reaches a state when it cannot accommodate any more water is called turgidity. The pressure of the cell contents against the cell wall is called turgor pressure.

   Flaccidity is the reverse of turgidity. If a fully-distended or turgid cell is placed in a hypertonic solution, the water moves out of the cell due to exosmosis, cytoplasm will shrink and the plasma membrane will withdraw from the cell wall. The cell is called flaccid and the condition is called flaccidity.

4. Imbibition is the process by which plant cells (living or dead) absorb water by surface attraction. Imbibition results in swelling of tissues for germination of seeds. Swelling of wooden doors during the rainy season is due to imbibition.

   The passage of salt or ions of a substance from its lower concentration to higher concentration utilizing the energy from the cell through a living membrane is known as active transport.

5. A hypertonic solution has higher solute concentration than the cell cytoplasm. Thus water molecules from inside the cell move to the outside.

   A hypotonic solution is less concentrated than the cell cytoplasm. Thus water molecules move from the solution into the cell cytoplasm.

6. The primary difference between the targor pressure and wall pressure is that wall pressure is applied by the cell wall on the cell's contents. Turgor pressure is the pressure which is exerted by the cytoplasm on the cell wall.

B. Give reasons for the following.

1. When a layer of a high-salt or high-sugar substance is used to preserve food, the food is protected from microbial invasions due to plasmolysis. This is a more sophisticated way to preserve food than the oldest method – simply letting it dry out.

2. Absorption of mineral elements by the root from the soil takes place by active transport. The water film along with the soil particles also contains a low concentration of mineral elements. These mineral elements move from soil into the root cells against the concentration gradient. Energy in the form of ATP is required by the cell for the absorption of minerals.

3. A very strong sugar solution is a hypertonic solution. If we place soft-skinned grapes in the sugar solution, the water content will come out through the soft skin and the grapes will shrink.

4. The potato strips appear soft and shrivelled as there is no water in them. This is because the concentration of water is lower in the sugar solution than inside the potato. As a result water moves out of the potato to the sugar solution due to exosmosis and the potato strips become flaccid.

5. The solution containing fertilizers is hypertonic to the root hair. This causes exosmosis from root hair cell, thus resulting in flaccid root hair.

6. Leaves of wilted lettuce leaves are plasmolysed and when put in cold water get deplasmolysed and become turgid and hence become crisp.

7. During photosynthesis, glucose is synthesized from CO_2 and H_2O. This causes an increase in the osmotic pressure of the contents of guard cells. As a result, the guard cells absorb more water from the neighbouring cells, thus becoming turgid. The high turgor pressure causes the guard cells to bulge out and the stoma opens. At night, since no photosynthesis takes place, there is a shortage of water in the leaf, and the guard cells become flaccid, their inner walls become straight and the stomata are closed.

8. The function of roots is to absorb water and minerals from the ground. The xylem vessels transport water to all the parts of the plant body, including the leaves. When you uproot the plant from the soil, the roots cannot absorb water and after a while the water in the plant cells moves outwards because there is not enough water outside the cell's environment. Turgor pressure is lost and the leaves wilt.

9. In the evening, the stomata of the plants will close, and this will slow the loss of water through the leaves. Since the roots may be stressed by the transplanting, doing this in the evening will help prevent too much water loss and wilting

in the newly transplanted seedlings. In the morning, the stomata will be open for an entire day, losing water vapour all the while. So this is not the best time for transplanting.

10. When a plant cell is placed in a hypertonic solution, exosmosis takes place, i.e., it loses water and becomes flaccid where the contents of the cell have shrunk and pulled away from the cell wall.

11. On a hot day, herbaceous plants wilt even in well-watered soil because their rate of transpiration exceeds the rate of water absorption by the roots. Due to less water in the cells, they become flaccid and leaves become soft and wilt.

IV. Long Answer Type Questions

A. Answer these questions.

1. The absorption of water occurs through root hairs. Root hairs are thin-walled extensions of the outer layer of the root. The roots are surrounded by a thin film of water and soil particles.

The adaptation of roots to absorb water are as follows:

The root hair contains cell sap which has a higher concentration of salts than the outside soil water. This causes osmosis and the water from outside diffuses into the cells of root hair. This is due to root pressure.

The root hairs have a large surface area over which absorption of minerals and water can occur faster.

Roots and root hair are long in shape for faster and easier transport.

2. The root hair of plants are permeable to water. The cell sap inside the vacuole contains salts and sugars and is highly concentrated. If this cell is surrounded by water, osmosis of water will cause water to enter the cell sap. As a result, the vacuole would expand, pushing the cell cytoplasm against the cell wall. Such a cell cannot accommodate any more water and is called turgid and the condition is called turgidity.

In the plant *Mimosa pudica*, turgor pressure keeps the leaves fully-expanded and oriented towards light.

In case of loss of turgidity, the leaves of *Mimosa pudica* wilt and the shoots droop down. The condition of the shoots and leaves are said to be flaccid.

3. During photosynthesis, glucose is synthesised from CO_2 and H_2O. This causes an increase in the osmotic pressure of the contents of guard cells. As a result, the guard cells absorb more water from the neighbouring cells, thus becoming turgid. The high turgor pressure causes the guard cells to swell and bulge out and the stomata open. At night since no photosynthesis takes place, there is a shortage of water in the leaf, and the guard cells become flaccid and shrink and their inner walls become straight and the stomata are closed.

4. Concentration of mineral elements is higher inside the root hair. Absorption of mineral elements by the root from the soil takes place by active transport. The water film along with the soil particles also contains a low concentration of mineral elements. These mineral elements move from soil into the root cells against the concentration gradient. Energy in the form of ATP is required by the cell for the absorption of minerals.

5. The seed coat is selectively permeable to water. The majority of a seed is made up of two cotyledons which require water in order to trigger certain hormones within the seed and get it to start growing. The water on the outside of the seed will diffuse into the seed by way of osmosis because inside is an area with a very low concentration of water. The cotyledons are basically like sponges which inflate as water enters them and the seed begins to grow and ultimately the seedcoat bursts.

6. Water is pulled from the soil up to the leaves by the adhesive-cohesive force.

7. The relative concentration of a solution which determines the direction and extent of diffusion is called tonicity.

An isotonic solution has the same concentration as the cell cytoplasm. Thus, no net movement of water molecules across the cell membrane occurs.

A hypertonic solution has higher solute concentration than the cell cytoplasm. Thus, water molecules move from inside the cell to the outside.

A hypotonic solution is less concentrated than the cell cytoplasm. Thus, water molecules move from the solution into the cell cytoplasm.

8. A plant cell placed in a hypertonic solution shrinks due to exosmosis, i.e., water comes out of the plant cell as the surrounding hypertonic solution is more concentrated.

9. The inward diffusion of water through a semi-permeable membrane when the surrounding solution is less concentrated is called endosmosis (endo=inward). Endosmosis leads to swelling up of cells.

   The outward diffusion of water through a semi-permeable membrane when the surrounding solution is more concentrated is called exosmosis (exo=outward). Exosmosis leads to shrinking of cells.

10. Xylem vessels are largely pulled upwards by transpiration pull (cohesion-tension mechanism).

11. The absorption of water occurs through root hair. Root hair are thin-walled extensions from the cells of the outer layer of a root. The root hair contains cell sap which has a higher concentration of salts than the outside soil water. This causes osmosis and the water from outside diffuses into the cells of root hair. This is due to root pressure. As water enters the vacuole of cell, it dilutes the concentration of sugar and salts in its cell sap. Another cell (assume cell B) next to cell A has a higher concentration of cell sap (salts and sugars). As a result water from cell A moves to cell B. The water entering cell B makes its cell sap dilute and then moves to cell C. This way water moves from one cell to another by cell to cell osmosis. The water ultimately passes into the xylem vessels at the centre of root and is conducted up the root and stem into the leaves.

12. The various causative forces are root pressure, capillary nature of xylem vessels and pulling of xylem sap.

V. Structured/ Application/ Skill Type Questions

A. 1. Root Pressure

2. Root pressure is the pressure developed in roots due to continuous inflow of water by cell-to-cell osmosis.

3. We observe that water starts coming out of the cut end of the plant and exerts pressure and raises the level of mercury in the connected manometer. This upward movement of water is due to heavy root pressure.

4. The upward movement of water is due to heavy root pressure. This helps in the ascent of sap upward through the stem.

B. 1. Turgor pressure in plant cell.

2. The pressure of the cell contents against the cell wall is called turgor pressure.

3. i. Salts and sugars in the cell sap make it concentrated inside.

   ii. Water enters the cell by osmosis.

   iii. The cell sap volume increases, pushing the cell wall outward making it turgid.

4. As water enters the cell sap by osmosis, the vacuole will expand in size, pushing the cell cytoplasm against the cell wall.

C. 1. Osmosis

2. Osmosis is the diffusion of water molecules through a selectively permeable membrane to reach equilibrium.

3. Occurs in roots of plants.

4. Sugar solution

5. The level of the solution in the capillary tube will rise as water enter the tube due to endosmosis.

D. 1. i. Root hair

   ii. Soil particles

   iii. Cortical cells

   iv. Xylem vessel

2. Unicellular

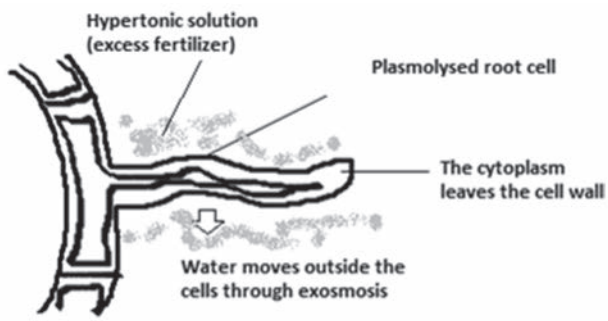
3. Cell-to-cell osmosis

4. Root pressure

5. The root hair contains cell sap which has a higher concentration of salts than the outside soil water. This causes osmosis and the water from outside diffuses into the cells of root hairs. Therefore, a root pressure is built-up.

6. Guttation

7.



E. 1. Plasmolysed state of the cell is shown.

2. Cell membrane

3. The cell would have become turgid and there would be no sugar solution between cell membrane and protoplasm.

F. 1. Osmosis

2. The diffusion of water molecules through a

semi-permeable membrane from a region of its higher concentration (more dilute solution) to its lower concentration (less dilute solution) is called osmosis.

3. The level of sugar solution rises in the thistle funnel and drops in the beaker.
4. In the control experiment, instead of sugar solution, water should be taken in the thistle funnel.
5. **a.** Cell sap of root hair **b.** Semi-permeable cell membrane **c.** Water in the surrounding soil.
6. Cellophane paper
7. The two advantages of this process are :
   - Entry of water from soil into roots.
   - Cell-to-cell movement of water.

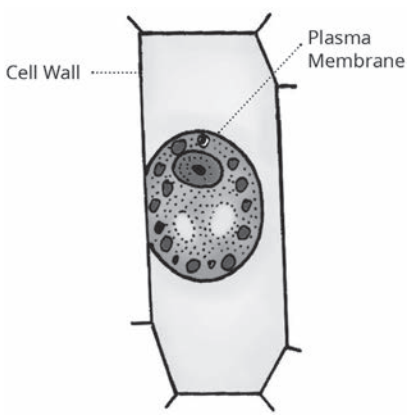
G. 1. Conduction of ascent of sap by xylem

2. The upward movement of water from roots to aerial parts against gravitational force.
3. Water rises through xylem vessels, but in set-up **ii** water has not risen because xylem vessels have been removed.
4. From this experiment, we conclude that xylem is the path of ascent of sap.

H. 1. Ascent of sap.

2. **i.** Root hair **ii.** Soil particles **iii.** Epidermis **iv.** Xylem
3. Osmosis
4. Root pressure

I. 1.



2. Plasmolysis
3. The plasmolysed cell should be transferred in distilled water to restore the cell back to its original state.
4. Deplasmolysis
5. Osmosis can be defined as the movement of water across a semipermeable membrane from an area of high water concentration to an area of lower water concentration.

J. 1. a. Flaccid

b. Plasmolysed

2. **a.** Water

b. Strong sugar solution

3. **a.** Cell A
4. Osmotic pressure is responsible for the movement of water from the root hairs to the cortical cells and then finally to the xylem vessels. It is the force required to resist the movement of water through a semi-permeable membrane down the concentration gradient.
5. The pressure with which water is pushed into the xylem tubes of the root is called root pressure. The water moving upwards forms a column, which is maintained up to a certain height due to root pressure.

K. 1. The cell is in plasmolysed state.

2. Hypertonic solution
3. Part 1: Nucleus

   Part 2: Chloroplast

   Part 3: Vacuole

   Part 4: Hypertonic solution within the cell wall and plasma membrane
4. The given cell is a plant cell.

   It shows cell wall and chloroplasts.
5. The plasmolysed cell should be transferred in distilled water to restore the cell back to its original state.

L. 1. Solutions in beaker 1: Hypotonic solution

Beaker 2: Hypertonic solution

Beaker 3: Isotonic solution

2. An isotonic solution contains the same concentration of solute as in a cell. If plant cells are kept in isotonic solution then cells will not swell or shrink. Hence, there will not be any change in cells. Therefore, no change occurred in potato cube in beaker 3.
3. Cell sap of root hair is hypertonic to the surrounding soil water, so, water from soil enter within the root hair by osmosis.
4. Refer to solution I. 5, Structured/Application/Skill Type Questions
5. Cell wall is permeable and cell membrane is semipermeable or selectively permeable in nature.

CHAPTER – 5

TRANSPIRATION

P. 61 CHECK YOUR PROGRESS 1

A. Answer these questions.

1. The loss of water as water vapour from the aerial parts of plants is called transpiration.

2. Refer Table 5.1, Page 58 of the Textbook.

3. In an experimental set-up, polythene bags are tied around the plant. Drops of water vapour appear on the inner side of polythene bag tied around the plant (experimental set-up) if kept in sunlight for 2-3 hours. This happens due to saturation of water vapour given out by the leaves. The experiment shows that water vapour is given out during transpiration.

4. Maximum transpiration occurs through stomata on the leaves, i.e., stomatal transpiration. Lenticular transpiration shows the minimum rate of transpiration which accounts for only 0.1% of the total transpiration.

5. Xylem tissue

6. The flaccidity and turgidity of guard cells regulates stomatal transpiration.

P. 65 CHECK YOUR PROGRESS 2

A. Answer these questions.

1. Cobalt chloride paper acts as an indicator of moisture. It is blue when dry but becomes pink when exposed to moisture. Therefore, it is used to demonstrate transpiration by leaves.

2. Limitations of using a potometer:

- It is very difficult to introduce bubble in the capillary tube.
- Any change in external temperature may affect the position of air bubble in the capillary tube.

3. a. Moving air sweeps away the water vapour in the air outside the stomata. This speeds up diffusion of water vapour from stomata. Thus, the rate of transpiration increases with the velocity of wind.

b. Shortage of water in the soil affects the water supply to the leaf and in turn the stomata close and the leaf wilts. This reduces the rate of transpiration.

c. High humidity in the air on a cloudy day reduces the rate of outward diffusion of water from the sub-stomatal cavity and reduces the rate of transpiration because the air is already laden with the water vapour.

d. Decrease in atmospheric pressure increases diffusion of water vapour from stomata. The lower the atmospheric pressure, the greater is the rate of evaporation of water from leaves.

e. High temperature increases rate of transpiration by providing the latent heat of vaporization.

4. Two adaptations in plants to reduce transpiration:

- The stomata may be sunken or covered by hair as in oleander.
- The number of stomata may be reduced as in xerophytes, e.g. cactus.

5. Two advantages of transpiration to the plants:

- **Removal of excess water:** Plants absorb far more amount of water than is actually required by them. Thus, transpiration helps in removing excess of water.
- **Cooling effect:** Solar heat during summers increases the temperature of plants which may be dangerous to the plants. Transpiration helps in reducing temperature of the leaf surface by evaporation of water vapour from it, which in turn cools the plant.

6. Transpiration is the process by which plants loose excess water from their body through stomatal pore in the gaseous state. It is useful because when water in gaseous form are released, it moves upwards and accumulates in the cloud. This will cause rain to occur in the earth.

7. Hydathodes are the structures that discharge water from the interior of the leaf to its surface in a process called guttation.

P. 66 EXERCISES

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. a **2.** d **3.** c **4.** d **5.** a

6. a

II. Very Short Answer Type Questions

A. Name the following.

1. Guttation
2. Potometer
3. Ganong's potometer
4. Lenticels
5. Cuticular transpiration
6. Exosmosis
7. Hydathodes
8. Oleander
9. Lenticels
10. Bleeding
11. Cuticle

B. Mention, if the following statements are True (T) or False (F). Rewrite the wrong statements correctly.

1. True
2. True
3. True
4. False

   During transpiration, the water vapour escapes from stomata by the process of diffusion.
5. False

   Most transpiration occurs through stomata on leaves.
6. False

   Low humidity in the atmosphere results in increase in the rate of transpiration.

C. Given below is an example of a certain structure and its main functional activity.

e.g. Mitochondrion and respiration

On a similar pattern fill in the blanks by completing the relationships.

1. guttation
2. lenticular transpiration
3. decreasing transpiration
4. stomatal transpiration
5. transport of water
6. stomatal closing

D. Complete the following statements by choosing the correct alternative out of those given in brackets.

1. guttation
2. Potometer
3. Stomatal

E. Find the odd-one out.

Phagocytosis

F. Rewrite the following terms in a correct order so as to be in a logical sequence.

1. Upper epidermis, palisade tissue, spongy cells, substomatal space, stoma
2. Soil water, root hair, cortical cells, endodermis, xylem

III. Short Answer Type Questions

A. Define the following terms.

1. **Transpiration:** The loss of water as water vapour from the aerial parts of plants is called transpiration.
2. **Guttation:** Guttation is loss of water from the leaf margins of plants in the form of droplets during hot and humid conditions.
3. **Bleeding:** During injury to certain plant tissues, the plant sap escapes (bleeds) from the ruptured or cut surface of the plant. This is brought about by the root pressure generated by the plant.

B. Give suitable explanations for the following.

1. Moving air sweeps away the water vapour in the air outside the stomata. This speeds up diffusion of water vapour from stomata. Thus, the rate of transpiration increases with the velocity of wind . This is the reason why a higher rate of transpiration is recorded on a windy day rather than on a calm day.
2. During the day, the cell-sap concentration becomes high due to accumulation of sugar in the guard cells as a result of photosynthesis. This results into movement of water into guard cells from the neighbouring cells. This makes the guard cells turgid and guard cells bulge out and pull apart their inner walls and stomata open.
3. The leaves of certain plants such as balsam, wilt during midday (mostly during summers) inspite of being well-watered, but recover in the evening. This is because of the high rate of vaporization of water during midday, the rate of transpiration is higher than the rate of absorption of water. Thus, the stomata become flaccid (lose turgidity) and close and the leaves wilt.
4. More transpiration occurs from the lower surface of a dicot leaf on a relatively dry and non-cloudy day. This is because dicot leaf has more stomata on lower surface and very few on the upper surface.

C. State the exact location and main function of the following.

1. **Lenticels:** Location – Stem; Function: Lenticular transpiration
2. **Guard cells:** Location- Leaf surface; Function – Opening and closing of stomata
3. **Hydathodes:** Location – Leaf margins; Function – Guttation
4. **Xylem:** Location – Vascular bundle; Function – Transport of water

D. Answer these questions.

1. Please refer to Table 5.1 from page 58 of textbook
2. Guttation is loss of water from the leaf margins of plants in the form of droplets during hot and humid conditions.

   Please refer Table 5.2 from Pg 65 of textbook.

3. On the basis of occurrence from different regions of a plant, transpiration is of three types:
   i. Stomatal transpiration (from the leaves through the stomata)
   ii. Cuticular transpiration (from the waxy cuticle layer of leaves and stems)
   iii. Lenticular transpiration (from the lenticels present on the surface of old stems)

   Stomatal transpiration shows maximum rate of transpiration.

   Lenticular transpiration shows minimum rate of transpiration.
4. Xylem is responsible for movement of water from stems to leaves.
5. Lenticular transpiration occurs in the lenticels which are special openings on the older stem in place of stomata. The lenticular transpiration accounts for only 0.1% of the total transpiration. It continues day and night because lenticels do not close. They remain open always. In lenticular transpiration, water from cell surface facing the lenticels evaporates directly. Plants have an internal mechanism of controlling stomatal transpiration by adjusting the size of stomata whereas, this does not happen in cuticular or lenticular transpiration. Cuticular transpiration accounts for 3–10% of the total transpiration.

IV. Long Answer Type Questions

A. Answer these questions.

1. Three factors that increase the rate of transpiration:
   - The humidity of the atmosphere affects the rate of diffusion of water vapour from the stomata. Low humidity in the atmosphere increases the rate of transpiration.
   - High temperature increases rate of transpiration by providing the latent heat of vaporization.
   - A decrease in atmospheric pressure increases diffusion of water vapour from stomata. The lower the atmospheric pressure, the greater is the rate of evaporation of water from leaves. Thus, the rate of transpiration increases with the decrease in atmospheric pressure.
2. Three factors that decrease the rate of transpiration:
   - High humidity in the air reduces the rate of outward diffusion of water from the sub-stomatal cavity and reduces the rate of transpiration, because the air is already laden with water vapour.
   - Low temperature reduces evaporation and so also transpiration.
   - Carbon dioxide concentration also plays a vital role in rate of transpiration. If the increase in the concentration of carbon dioxide is more than the normal (0.03%), the stomata closes. This reduces the rate of transpiration.
3. Stomata are minute openings found in the epidermis of leaves, stem and in some cases even flowers. Each stoma contains a pore surrounded by two guard cells. Both guard cells are firmly joined at both ends but separate in the mid-region of their length. Stomata are mostly present on the lower epidermis of the leaf. The open stomata account for diffusion of water vapour through them. During the day, the cell-sap concentration becomes high due to accumulation of sugar in the guard cells as a result of photosynthesis. This results into movement of water into guard cells from the neighbouring cells. This makes the guard cells turgid and guard cells bulge out and pull apart their inner walls and stomata open. If the availability of water is reduced, the guard cells lose their turgidity and they become flaccid (lose turgidity) by exosmosis of water from guard cells. This leads to the closing of stomata and transpiration stops.
4. The water vapour escapes from the stomata by the process of diffusion. The molecules of water move from the region of their higher concentration to the region of their lower concentration.

   Refer to Fig 5.4a. from page 59 of the textbook.
5. Accumulation of water droplets on the surface of leaves early in the morning is due to guttation. Guttation is exudation of water droplets on the leaf margins of plants during hot and humid conditions as on the leaves of banana plant. It is caused due to root pressure. When rate of transpiration is low, the roots of some plants keep on accumulating minerals and absorbing water. Thus, more water enters the leaves than is transpired. As a result, the excess water is forced out through specialized structures on the margins of the leaves.

V. Structured/ Application/Skill Type Questions

A. 1. Stomata with their guard cells

2. **i** – Chloroplast
   ii – Thick inner wall
   iii – Nucleus
   iv – Guard cell wall
   v – Stomatal opening

3. In figure **P** the stoma is open whereas in figure **Q** the stoma is closed.
4. The open stomata account for diffusion of water vapour through them. During the day, the cell-sap concentration becomes high due to accumulation of sugar in the guard cells as a result of photosynthesis. This results into movement of water into guard cells from the neighbouring cells. This makes the guard cells turgid and guard cells bulge out and pull apart their inner walls and stomata open. If the availability of water is reduced, the guard cells lose their turgidity and they become flaccid (lose turgidity) by exosmosis of water from guard cells. This leads to the closing of stomata and transpiration stops.

B. 1. To measure the rate of transpiration by weighing method.
2. To prevent evaporation.
3. We would observe a loss in the level of water and loss in the weight of plant in first test tube.
4. The loss in the weight of the plant is due to loss of water by the shoot due to transpiration.
5. The test tube without a plant was taken as a control experiment to show no change in the water level (with oil on the surface) if there is absence of shoot.

C. 1. The process shown by arrows is called stomatal transpiration through a leaf. The loss of water as water vapour from the leaves through the stomata is called stomatal transpiration.
2. **i** – Stomata
ii – Palisade mesophyll tissue
iii – Xylem vessel
3. The stages of stomatal transpiration occurring in **i** and **ii** are as follows:
- The water is absorbed by root hair from the soil. This water then moves up through xylem vessels [iii] via stem into the mesophyll cells of the leaves through veins.
- The mesophyll cells [ii] in the leaves have large number of intercellular spaces. These cells give out some water as a thin film.
- The water from this thin film evaporates in the form of water vapour. The water vapour formed then saturates the air in the intercellular spaces.
- This water vapour then accumulates and reaches the substomatal space through various connecting intercellular spaces by diffusion. The water vapour escapes from the stomata [i] by the process of diffusion.

D. 1. The process being studied is transpiration. The loss of water as water vapour from the aerial parts of plants is called transpiration.
2. To prevent evaporation of water from the soil.
3. Control – A polythene bag with its mouth tied.
4. Benefits of transpiration:
- Excess water is removed by the plants.
- Transpiration contributes to lowering of the temperature.
5. Adaptations in plants to reduce excessive transpiration:
- The stomata may be sunken or covered.
- The number of stomata may be reduced as in xerpohytes.
- The leaves may become narrow to reduce leaf surface area.

E. 1. The aim of this experiment is to show that more transpiration occurs from the lower surface of a leaf.
2. Blue
3. To prevent the exposure of cobalt chloride to the atmosphere.
4. The cobalt chloride paper on the lower surface of the leaf turns pink very fast and the paper on the upper surface of the leaf remains blue for a longer time because more transpiration occurs from the lower surface of leaves.
5. The process shown in the experiment is transpiration. The loss of water as water vapour from the aerial parts of plants is called transpiration. More transpiration occurs through the lower surface of leaves (dicots).

F. 1. The apparatus is Ganong's potometer.
2. Limitations of this apparatus
- It is very difficult to introduce air bubble in the capillary tube.
- The twig does not remain alive for a long time.
3. The phenomenon studied during the experiment is to measure the volume of water uptake by plant during transpiration.
4. The reservoir is used to adjust the position of air bubble in graduated capillary tube.
5. As the twig transpires, water vapour is lost and the coloured water from the beaker rises up. The air bubble which was introduced moves forward in the capillary tube. The reading in the capillary tube gives the volume of water lost in a given time.
6. Stomata

CHAPTER – 6
PHOTOSYNTHESIS

P. 72 CHECK YOUR PROGRESS 1

A. State whether the following statements are True (T) or False (F).

1. T **2.** F **3.** T **4.** T **5.** F **6.** T

P. 75 CHECK YOUR PROGRESS 2

A. Answer these questions.

1. The 6 molecules of H_2O liberated at the end of the reaction are those that have been reformed.

2. a. Photophosphorylation is the conversion of ADP to ATP using the energy of sunlight by activation of photosystem-II.

b. Photolysis is the splitting of water molecules in the presence of light into proton, electron and oxygen. It takes place during non-cyclic photophosphorylation.

3. This reaction occurs in the thylakoids of grana in chloroplasts.

4. Splitting of water (photolysis): The splitting of water also known as photolysis ('photo' means light and 'lysis' means breaking) takes place in light reaction during which, water is broken down into highly reactive hydrogen (H) ions and oxygen.

$$2H_2O \rightarrow 4H^+ + O_2 + 4e^-$$

The free oxygen is the oxygen gas given off during photosynthesis.

5. $NADP^+ + 2e^- + H^+ \rightarrow NADPH$

6. H_2O is the source of oxygen during photosynthesis.

7. Dark reaction is the biosynthetic phase of photosynthesis. The dark reaction occurs in the stroma of chloroplasts. This reaction does not require light energy, but it does not mean that it occurs during dark only. This is a light independent reaction.

8. Photophosphorylation

P. 79 CHECK YOUR PROGRESS 3

A. Give reasons for the following.

1. Boiling will kill protoplasm and enzymes in the leaf, so that no further chemical change takes place.

2. Potassium hydroxide absorbs the carbon dioxide.

3. Leaf becomes colourless or pale yellow due to the removal of chlorophyll.

4. A plant is kept in darkness for 2–3 days before conducting an experiment on photosynthesis to destarch its leaves.

B. Answer the following.

1. Potassium hydroxide

P. 80 EXERCISES

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

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

II. Very Short Answer Type Questions

A. Name the following.

1. Thylakoids of grana in chloroplast
2. Oxygen
3. Chloroplasts
4. Compensation point
5. Chlorophyll a and b
6. Thylakoids of grana in chloroplast
7. Photolysis
8. Glucose
9. Carbon dioxide dissolved in water
10. Stroma of chloroplast
11. Thylakoids of grana
12. Stroma
13. Photophosphorylation

B. 1. Oxygen gas is released during photosynthesis and carbon dioxide is released during respiration.

2. In photolysis (in light reaction), water is broken down into highly reactive hydrogen (H^+) ions and oxygen. The released H^+ (hydrogen ions) reduce NADP molecule (nicotinamide adenine dinucleotide phosphate) into NADPH.

In dark reaction, NADPH molecules and ATP molecules, both produced during light reaction are utilized to produce sugar ($C_6H_{12}O_6$) from carbon dioxide.

3. Grana plays a vital role for photophosphorylation during photosynthesis.

Dark reaction of photosynthesis takes place in stroma.

4. Chloroplast organelles are plastids containing chlorophyll pigments and are mostly present in leaves. The green colour of plants is due to the presence of the pigment chlorophyll.

5. The splitting of water that takes place in light reaction is known as photolysis.

The synthesis of adenosine triphosphate (ATP) from adenosine diphosphate (ADP) and inorganic phosphate (Pi) is called photophosphorylation.

C. Grana, photons, water molecules, hydrogen and hydroxyl ions, O_2.

D. **1.** grana **2.** iodine
3. increase **4.** photochemical phase
5. Calvin cycle **6.** chloroplast

E. **1.** Nicotinamide Adenine Dinucleotide Phosphate
2. Adenosine Diphosphate
3. Adenosine Triphosphate
4. Ribulose –1, 5-bisphosphate carboxylase

F. **1.** Destarching a plant means removing the starch from the leaves of the plant.
2. The splitting of water molecules takes place in a light reaction into hydrogen ions and hydroxyl ions and is termed photolysis.

G. Cristae : Mitochondria :: Thylakoid : Chloroplast

H. **1.** False **2.** False **3.** True **4.** False
5. True **6.** True **7.** True **8.** False
9. False **10.** True

III. Short Answer Type Questions

A. Comment on the following statements.

1. Plants manufacture food by the process of photosynthesis. They require chlorophyll for photosynthesis. These green plants are consumed by herbivores such as deers, wild buffaloes, zebras. These herbivores are in turn consumed by carnivores such as tigers for their living. Therefore it can be said that a tiger owes its existence to chlorophyll.

2. The overall chemical equation of photosynthesis is as follows:

$6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6H_2O + 6O_2$

In this process, using light energy from sunlight, carbon dioxide and water are combined in the chloroplast with the help of a number of enzymes to yield sugar (glucose) which readily converts into starch. The oxygen evolved in the process is given out in the atmosphere through the stomata as a waste or bye product.

3. Plants kept in dark place use the starch already stored in its leaves during respiration. The plant will use up all the starch stored in its leaves in about three days time. So, after about three days, the plant leaves will not have any starch left in them and we say that the leaves have been destarched. This plant with destarched leaves can now be used in the photosynthesis experiments. Since the presence of starch is regarded as an evidence of photosynthesis, the experimental plant should be destarched before the experiment is started.

4. Water is one of the raw materials used in photosynthesis. The amount of water utilized in photosynthetic reactions is quite small. Therefore, water rarely becomes a limiting factor for photosynthesis. However, water deficit stress reduces the rate of photosynthesis by affecting the process indirectly.

5. At night, since photosynthesis does not occur, oxygen is not being produced by the trees. In addition to this, the trees continue respiring thereby releasing CO_2. Therefore, sleeping under a tree at night is not advisable.

6. During the process of photolysis under light reaction, the water molecule splits up to release H^+ and OH^- ions. These OH^- react to liberate oxygen. Thus we can say that oxygen liberated during photosynthesis comes from water.

7. The survival of almost all living organisms directly or indirectly depends upon the food made by the plants. Besides, oxygen which is essential for the survival of all living organisms is produced during photosynthesis.

B. Answer these questions.

1. Photosynthesis (photo = light; synthesis = combination) may be defined as a biochemical process by which living cells of plants containing chlorophyll manufacture their own food (glucose) using carbon dioxide and water as raw materials in the presence of sunlight.

CO_2 and H_2O are the raw materials required along with the presence of sunlight.

2. Three adaptations in plants for photosynthesis

- Leaves have large surface area for maximum absorption of light.
- The leaves have large number of stomata to allow rapid exchange of oxygen and CO_2 gases.
- The leaves are arranged at right angles to the light source so as to trap maximum light.

3. Stomata (singular=stoma) are minute pores present either on the lower or both the surfaces of the leaf to facilitate exchange of gases between the leaf and the atmosphere. Each stoma consists of a stomatal aperture and two surrounding guard cells.

Maximum number of stomata are found in lower surface of the leaves of dicot plant to allow rapid exchange of O_2 and CO_2 gases.

4. Water is the source of O_2 produced during photosynthesis.

5. Photosynthesis provides the free oxygen in Earth's atmosphere that is used by living beings

for other metabolic processes. Without it, the current carbon cycle (almost all life on Earth) could not exist. The atmosphere would be full of carbon dioxide which is an unbreathable gas.

6. In normal conditions, CO_2 is the major limiting factor in photosynthesis. The rate of photosynthesis increases with an increase of CO_2 concentration. The concentration of CO_2 in the atmosphere varies from 0.03 – 0.04 percent. A concentration of 0.02 per cent is optimum for increasing the rate of photosynthesis. However over long periods even 0.05 per cent CO_2 concentration in the atmosphere can increase the rate of photosynthesis, provided the light intensity is also increased to support it.

7. *Hydrilla* is an aquatic plant, which is used in the lab to demonstrate O_2 liberation during photosynthesis.

IV. Long Answer Type Questions

A. Answer these questions.

1. Refer to figure 6.3a from page 72 of the textbook.

2. Plants perform photosynthesis, where they fix carbon dioxide into sugars and release oxygen from water, thus being a producer of oxygen, and then consume these sugars using cellular respiration, releasing carbon dioxide from the sugars and taking in oxygen to create water, thus being a consumer of oxygen.

V. Structured/Application/Skill Based Questions

A. 1. – **1.** carbon dioxide; **2.** stomata; **3.** water; **4.** chlorophyll; **5.** light; **6.** $6CO_2$; **7.** $12H_2O$; **8.** light energy; **9.** chlorophyll; **10.** $C_6H_{12}O_6$; **11.** $6H_2O$; **12.** $6O_2$; **13.** chloroplasts; **14.** light; **15.** dark

2. – **1.** kill protoplasm; **2.** remove chlorophyll; **3.** iodine; **4.** blue-black; **5.** brown

B. 1. Test tube B

2. Test tube D

3. This experiment shows that photosynthesis increases with increase in intensity of light and temperature.

C. 1. b **2.** e **3.** a **4.** a **5.** e

D. 1. Light is necessary for photosynthesis.

2. The plant was kept in the dark before the experiment to destarch the leaves.

3. a. The leaf was boiled in water to kill protoplasm and enzymes in it so that no further chemical change takes place.

b. The leaf was boiled in methylated spirit to remove chlorophyll.

4. $6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6H_2O + 6O_2$

5. Refer to fig 6.2 from page 70 of the textbook.

E. 1. The plant was initially kept in darkness for 24 hours to stop the process of photosynthesis and thereby destarch the leaves.

2. Sodium hydroxide absorbs carbon dioxide present in the air.

3. a. iii. **b.** v

4. Photosynthesis requires carbon dioxide.

F. 1. Destarching a plant means devoiding the leaves of plant of starch.

The plant is destarched by keeping the plant in the dark for 24 hours.

2. To show that light is necessary for photosynthesis:

- Take a potted plant and destarch its leaves by keeping it in dark for 2 days.
- Take a black paper and cut simple 'L' shape in it making a stencil. Cover one leaf on either side with one such paper by clipping it. Leave the set up in daylight for 4–6 hours.
- Detach the leaf and test it for presence of starch. You will observe that only the part of the leaf that could get sunlight through the cut out design and the other exposed parts of the leaf turn blue black with iodine solution, showing the presence of starch in it (Fig. 6.11). This proves that sunlight is necessary for photosynthesis and in the absence of light leaves cannot manufacture starch.

G. 1. To show that oxygen is given out during photosynthesis.

2. The physiological process mentioned in Q(1) is photosynthesis. Photosynthesis is biochemical process by which living cells of plants containing chlorophyll manufacture their own food (glucose and starch) using carbon dioxide and water as raw materials in the presence of sunlight. This process releases oxygen as a by-product.

3. i. Gas (Oxygen)

ii. *Hydrilla* plants

4. $6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6H_2O + 6O_2$

5. The rate of bubbling will increase on addition of a pinch of sodium bicarbonate to the water in the beaker. The addition of sodium bicarbonate results in the release of CO_2 which is utilized for photosynthesis. The increased amount of CO_2 will thus result in increase in the rate of release of oxygen as bubbles.

H. 1. b **2.** b **3.** c **4.** c **5.** b

CHAPTER – 7

CHEMICAL COORDINATION IN PLANTS

P. 89 CHECK YOUR PROGRESS 1

A. Answer these questions.

1. Two types of Tropism – Geotropism and phototropism.

2. a. Stimulus: Any change in the environment to which an organism responds and reacts.

b. Phototropism: The growth movement and orientation of a plant part in response to the light.

c. Geotropism: The growth movement of plant part in response to gravitational force of the earth.

d. Hydrotropism: The growth movement of plant parts towards water or moisture.

3. *Mimosa pudica*

P. 91 CHECK YOUR PROGRESS 2

A. Answer these questions.

1. Auxin is a growth hormone and helps the cells to grow longer. It also promotes cell enlargement and cell differentiation.

2. Abscisic acid

3. c. Cytokinin

P. 92 EXERCISES

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. b **2.** a **3.** b **4.** c **5.** d **6.** d

II. Very Short Answer Type Questions

A. Name a plant hormone which

1. Cytokinin

2. ABA

3. Gibberellin

4. Ethylene

5. ABA

6. ABA

7. Auxin

B. Give one word for each of the following.

1. Tropism

2. Hydrotropism

3. Phototropism

4. Nastic movements

C. Choose the odd one in each of the following.

1. Adrenaline

2. Gibberellins

III. Short Answer Type Questions

A. Answer these questions.

1. A growth response that results in the movement of plant part towards or away from stimuli is called tropism.

There are five tropical movements found in plants – phototropism, geotropism, hydrotropism, chemotropism and thigmotropism.

2. The growth movement and orientation of a plant part in response to the light is called phototropism. Auxin is the plant hormone that controls phototropism.

3. The growth movement of a plant part due to chemical stimuli is called chemotropism. For example, pollen tube grows through the style towards ovules in response to certain chemical secretions from stigma.

4. When the tip of a tendril touches a support, the auxin present in it moves away from the support. Therefore, the side of tendril away from support grows longer and faster.

5. Phytohormones are organic compounds which are released by the plant cells or synthesized outside, that modify or control the growth or physiological process within a plant. They are also called plant growth regulators.

6. Shoot will show negative geotropism whereas root will show positive geotropism.

7. Thigmotropism is the property that causes tendril to circle around the object. When the supporting organ touches a support, it results in a coiling response to catch hold the object and lighten its hold. For example, the tendrils of a plant grow towards a support , touch it and wind around that support.

IV. Long Answer Type Questions

A. Answer these questions.

1. Chemical coordination occurs in plants with the help of chemicals secreted in plants known as phytohormones or plant hormones. These chemicals are secreted in very minute quantity but have a substantial effect on physiological processes in a plant. These hormones regulate the growth of the plants. For example, auxin is responsible for the growth of the plants and cytokinin helps in cell division in the fast growing part of the plant such as plant hormones.

2. The growth movement of plant parts towards water or moisture is called hydrotropism. For example, the roots of plant growing in humid air bend towards a higher relative humidity level.

The growth movement of a plant part due to chemical stimuli is called chemotropism. For example, pollen tube grows through the style towards ovules in response to certain chemical secretions from stigma.

V. Structured/ Application/ Skill Type Questions

A. Complete the following table.

1. Promotes wilting of leaves

2. Cytokinin

3. Induces ripening of fruits

4. Abscisic acid

B. 1. i. Hypocotyl; **ii.** Epicotyl

2. Hydrotropism

3. Part **i** is affected by gravitational force and water. Water is more stronger stimulus in this case.

4. The growth movement of a plant part in response to the touch of an object is called thigmotropism. In some plants, when the plant organ touches a support, it results in a coiling response to catch hold the object and tighten its hold. For example, the tendrils of sweet pea plant grow towards a support, touch it and wind around that support.

5. Movement and growth of plant parts towards source of stimulus is called positive and away from source of stimulus is called negative tropic movement respectively.

CHAPTER – 8

THE CIRCULATORY SYSTEM

P. 101 Check Your Progress 1

A. Answer these questions.

1. Red blood corpuscles or erythrocytes are biconcave and enucleated (i.e. without a nucleus, young RBCs have a nucleus, but as they mature, the nucleus degenerates) disc-like biconcave shaped, flat in the centre, and thick and rounded at the periphery.

2. Different types of granulocytes:

- Neutrophils
- Basophils
- Eosinophils

Different types of agranulocytes:

- Lymphocytes
- Monocytes (macrophages)

3. Blood is made up of two main components—plasma (fluid part) and cellular or formed elements (blood corpuscles, solid part). Plasma is a straw-coloured aqueous solution. It forms about 55–60 per cent of the blood volume. Plasma contains water (about 90–92 per cent), inorganic salts (about 1–2 per cent) and organic compounds (about 7–8 per cent)

In human beings, the three types of cellular elements, i.e., red blood corpuscles, white blood corpuscles and platelets are solid part of blood which are found suspended in the plasma.

4. Blood is in a fluid state and does not clot when inside the blood vessels. Blood does not clot in uninjured vessels due to the presence of a strong, natural anticoagulant called heparin or antiprothrombin, produced in the liver. Blood usually clots after it escapes from the blood vessels.

5. Persons with blood group O are called universal donors.

Persons with blood group AB are called universal recipients.

6. Erythroblastosis foetalis

7. A mature mammalian erythrocyte lacks nucleus and mitochondria so as to make place for the accomodation of more haemoglobin and hence more oxygen molecules.

P. 110 Check Your Progress 2

A. Answer these questions.

1. Coronary arteries supply blood to the heart muscles.

2. Left side of heart, i.e., left auricle and left ventricle.

3. Cardiac cycle

4. The bicuspid valve also called the mitral valve or left auriculo-ventricular valve guards the opening of the left auricle into the left ventricle. It allows blood to pass from left auricle to the left ventricle and prevents the backflow of blood.

5. The circulation of blood in the human heart is called double circulation because the blood enters and leaves the heart twice in each heart beat. Circulation of blood between the heart and body organs (except lungs) is called systemic circulation. Circulation of blood between the heart and the lungs is called pulmonary circulation.

6. a. Pericardium

b. Haemoglobin

c. Serum

P. 111 Exercises

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. c **2.** b **3.** d **4.** c **5.** c **6.** b

7. c **8.** c **9.** b **10.** b **11.** a

II. Very Short Answer Type Questions

A. An example of a certain structure and its functional activity is kidney and excretion. On a similar pattern fill in the blanks given below.

1. transport of O_2

2. blood clotting

3. pumps oxygenated blood into aorta

B. Name the following.

1. Lymph

2. Tricuspid valve

3. Calcium

4. Haemoglobin

5. Hepatic artery

6. Haemoglobin

7. Auricular systole

8. Fibrinogen

9. Phagocytosis
10. Ventricular systole
11. Pulmonary veins
12. Hepatic portal vein

C. Complete the following statements by filling in the blanks with appropriate word from the choices given in brackets.

1. hepatic portal vein
2. 72
3. bicuspid value
4. cardiac muscles
5. aorta
6. phagocytosis

D. Note the relationship between the first two words and suggest the suitable word/words for the fourth place.

1. Semilunar valves
2. Liver

E. State the exact location of the following:

1. **Mitral valve:** In between left auricle and left ventricle
2. **Chordae tendineae:** Within both ventricles of the heart
3. **Pulmonary semilunar valve:** Between the right ventricle and the pulmonary artery
4. **Tricuspid valve:** In between right auricle and right ventricle
5. **Bicuspid valve:** In between left auricle and left ventricle

F. Give technical/biological term for the following.

1. 'lubb'
2. Diapedesis
3. Phagocytosis

III. Short Answer Type Questions

A. Differentiate between the following pairs on the basis of what is indicated in the brackets.

1. RBCs are bi-concave and disc-shaped while WBCs are irregular shaped.
2. 'Lubb' is produced by atrioventricular valves, whereas 'Dubb' is produced by semilunar valves
3. Erythrocytes transport oxygen to the cells and carbon dioxide from cells to the lungs. Leucocytes fight against infections.
4. The tricuspid valve is positioned between the right atrium and right ventricle, whereas the bicuspid valve is located between the left atrium and left ventricle. The bicuspid valve allows blood to flow from the left auricle to left ventricle and prevents blood from flowing backward. The tricuspid valve allows blood to flow from the right auricle to right ventricle and prevents blood from flowing backward.

B. Give suitable explanations for the following.

1. Ventricles have thicker walls than auricles because they have to pump blood to different organs and the pressure with which the blood flows through them is more than the auricles.
2. Carbon monoxide when inhaled and absorbed into the blood binds with haemoglobin and forms an irreversible complex called carboxyhaemoglobin. The formation of this complex reduces the oxygen-carrying capacity of the blood. Carboxyhaemoglobin is toxic in nature.

C. Explain the following briefly.

1. Capillaries are thin-walled because respiratory gases and nutrients diffuse out to the cells and waste product diffuse in to the capillaries through their walls.
2. The pulse rate is a measurement of the heart rate, or the number of times the heart beats per minute.
3. Blood is pushed through the body by the action of the pumping heart. As the ventricles of the heart contract, they push blood into the small lumen of the arteries with a great force, thus making the blood in the arteries flow in spurts and under pressure.
4. Refer to the Sol. 7, Check Your Progress 1.

D. State the main function of the following.

1. Thrombocytes help form blood clots to slow or stop bleeding and to help wounds heal.
2. Coronary arteries supply oxygenated blood to the heart muscles.
3. The chordae tendinae are the chord like structures connecting atrioventricular valve leaflets to the papillary muscle. They determine and maintain the position and tension on the valve leaflets at end of systole and prevent valves from opening in the wrong direction.
4. Lymphocytes are part of the immune system. There are two main types of lymphocytes, T cells and B cells. B cells produce antibody molecules that can destroy invading viruses or bacteria.

E. Answer these questions.

1. **i.** White blood cells.

ii. Red blood cells.

iii. Blood platelets.

2. Left atrium.

3. Bicuspid value – orifice between the left atrium and left ventricle.

Tricuspid value – orifice between the right atrium and right ventricle.

4. Left auricle receives oxygenated blood.

Left ventricle pumps oxygenated blood.

5. They have thick walls to withstand the arterial blood pressure.

6. Less output during circulation because less force will be generated by the thin muscular wall to be pumped to great distance.

7. **a.** Hepatic veins: From liver

b. Hepatic portal veins: from intestines, pancreas, spleen

8. RBCs are biconcave, enucleated, disk-like structures.

Such a shape of RBCs is of great advantage to these cells as it increases their surface area. This small size helps in absorbing O_2 and enables them to travelling very fine blood capillaries throughout the body of a person. They lack mitochondria otherwise it would have consumed the oxygen taken in.

IV. Long Answer Type Questions

A. Answer these questions.

1. The three events of a cardiac cycle are:

i. The auricular systole

ii. The ventricular systole

iii. The joint diastole

Duration of single cardiac cycle:

Complete cardiac diastole – 0.4 seconds.

Auricular systole – 0.1 second.

Ventricular systole – 0.3 seconds.

Total duration of cardiac cycle $\rightarrow$ 0.8 seconds.

2. Four types of blood groups:

A, B, AB, O

Please refer to table 8.1 from page 100 of textbook

3. The circulation of blood in human heart is called double circulation because the blood enters and leaves the heart twice in each heart beat. Circulation of blood between the heart and body organs (except lungs) is called systemic circulation. Circulation of blood between the heart and the lungs is called pulmonary circulation.

The four chambered heart does not allow any mixing of blood because the right auricle and right ventricle receives deoxygenated blood while the left auricle and left ventricle receive oxygenated blood.

V. Structured/ Application/ Skill Type Questions

A. 1. **A** – Vein (Thin muscular wall)

B – Artery (Thick muscular wall)

2. **i.** Endothelium

ii. Lumen

3. Lubb sound is caused by the vibrations set upon by the closure of tricuspid and bicuspid valves accompanied by contraction of ventricular muscles.

Dubb sound is caused by the closure of the semilunar valves and marks the end of ventricular systole.

4. **a.** Hepatic portal vein

b. Coronary arteries

B. 1. **i.** Lungs

ii. Pulmonary artery

iii. Pulmonary veins

iv. Right ventricle

v. Left ventricle

vi. Vena cava

vii. Aorta

viii. Body parts (organ)

2. To prevent the mixing of oxygenated and deoxygenated blood, the blood passes through the heart twice, once along a pulmonary circuit and then along a systemic circuit. This is called double circulation.

3. Diastole means relaxation of muscles.

C. 1. Ventricular systole

2. Ventricles are contracted and semilunar valves are opened.

3. **i.** Pulmonary artery

ii. Aorta

iii. Pulmonary vein

iv. Left atrium

v. Bicuspid valve

vi. Right ventricle

4. i. carries deoxygenated blood
   ii. carries oxygenated blood
5. Two valves i.e. AV valves are closed.
6. Pericardium

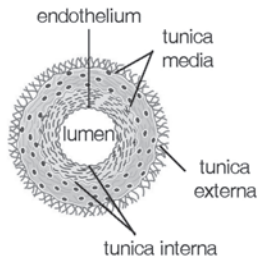
D. Numbers and Names:

i. Pulmonary vein
ii. Abdominal Aorta
iii. Hepatic artery
iv. Hepatic portal vein
v. Renal artery
vi. Renal vein
vii. Hepatic vein
viii. Inferior vena cava
ix. Pulmonary artery

1. Hepatic vein
2. Hepatic portal vein
3. Pulmonary artery
4. Pulmonary vein

E. 1. Tissue fluid (extra-cellular fluid)
2. RBCs
3. Lymphatic duct vessel consists of lymph.
4. i. It carries carbon dioxide and nitrogenous waste material that diffuse into the blood through the tissue fluid.
   ii. It carries lymphocytes and antibodies from the lymph nodes to the blood as well as the fatty acids and glycerol from the intestine to the blood.

F. 1. Veins.
2. Semilunar valves.
3. Semilunar valves prevent the backward flow of blood.
4. Pulmonary artery and systemic aorta.
5. Top.

G. 1. i. Pulmonary artery
   ii. Pulmonary vein
   iv. Renal artery
   vi. Hepatic artery
2. Hepatic Vein (no. **v**)
3. 

4.

Aorta (iii)	Inferior Vena Cava (viii)
Carries oxygenated blood away from heart to all parts of the body except lungs.	Receives deoxygenated blood from all veins below the diaphragm.

H. 1. The antigens of the donor's blood can react with antibodies of the recipient's blood and can cause the clumping of RBCs. This is called agglutination.
2. X – AB
3. Y – A
4. The blood from person X agglutinates when mixed with antibody a because of the presence of antigen A in the blood (since the blood group of the person X is AB, which contains both A ans B antigens).

I. 1. b
2. c
3. a
4. d

J. i. Ingests microorganisms
ii. Transports urea
iii. Clots blood
iv. Transports oxygen

CHAPTER – 9

EXCRETION – ELIMINATION OF BODY WASTES

P. 117 Check Your Progress 1

A. Answer these questions.

1. The removal of waste products formed in the body as a result of metabolism is termed as excretion.

2. Various waste products are formed in our body as a result of many metabolic activities taking place inside the body. These waste substances if accumulated would poison cells or slow down metabolism. Hence, the body must get rid of these unwanted substances. The metabolic wastes to be excreted include CO_2, H_2O, ammonia, urea, uric acid, etc. and the process is called excretion.

3. The wastes formed as a result of various metabolic activities are:

- Respiratory waste products are formed as a result of oxidation of glucose (food) (through cellular respiration).
- Nitrogenous waste products are formed as a result of deamination of unwanted amino acids, body's own proteins and nucleic acids.
- Other waste materials like salts (NaCl), vitamins and water.

P. 122 Check Your Progress 2

A. Answer these questions.

1. Nephron

2. Each nephron consists of – a Malpighian capsule, a nephric tubule (secretory part of uriniferous tubule) and a collecting tubule.

3. Collecting ducts are larger ducts, each receiving collecting tubules from several nephrons. These drain the urine collected from the nephrons into the pelvis which leads to the ureter.

4. Antidiuretic hormone (ADH) released from the posterior lobe of pituitary gland, increases the permeability of the renal tubule to water. When the blood plasma is concentrated, more ADH is secreted and more water is reabsorbed in the urinary tubules. Hence, urine passed out from body is concentrated, for example in summers. When the blood plasma is diluted, less ADH is secreted and less water is reabsorbed in the urinary tubule. In this case, dilute urine is passed out of the body, for example in winters.

Aldosterone, a hormone released from the adrenal cortex, influences reabsorption of sodium and potassium. This hormone regulates the amount of sodium and potassium that is to be retained in the blood and is to be excreted.

P. 124 Check Your Progress 3

A. Answer these questions.

1. Yellow colour of urine is due to a pigment urochrome derived from the breakdown of haemoglobin of worn out RBCs.

2. The water and solute content of body fluids is regulated by the kidney. This function of regulation of osmotic concentration of blood by the kidney is called osmoregulation.

3. Refer to Sol. 4 Check Your Progress 2.

4. When there is excess of water in body fluids urine is more dilute (hypotonic) than the body fluids. It is achieved by two processes:

i. Excess of water increases blood volume which increases the hydrostatic pressure in glomerulus, hence, more nephric or glomerular filtrates are formed.

ii. The sensation of excess of water in the body fluid is received by osmoregulator cells in the hypothalamus part of the brain. These cells in turn influence the posterior lobe of the pituitary gland to inhibit or reduce the release of antidiuretic hormone (ADH). Deficiency of this hormone lowers the permeability of cells in the distal convoluted tubule and collecting duct, thereby decreasing the reabsorption of water. More filtration and less reabsorption of water produces excessively dilute urine. This brings down the volume of the body fluids to normal.

P. 124 Exercises

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

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

II. Very Short Answer Type Questions

A. Name the following.

1. Hepatic vein **2.** Liver
3. Cortex **4.** Ureter
5. Kidney **6.** Urethra
7. Glomerulus **8.** Excretion

B. Match the items in Column A with those in Column B.

1. c **2.** a **3.** b **4.** d

C. Given below are sets of five terms. Rewrite the terms in correct order so as to be in logical sequence.

1. afferent arteriole → glomerulus → efferent arteriole → capillary network → renal vein

2. renal artery → kidney → ureter → urinary bladder → urethra

D. Odd term – Uterus

Category – Human urinary system

E. Renal artery, afferent arteriole, glomerulus, efferent arteriole, renal vein

F. Given below is an example of a certain structure and its special function, e.g. kidney and excretion. On a similar patter, fill in the blanks.

1. ultrafiltration **2.** conduction

3. reabsorption **4.** transport

G. Complete the following statements by choosing the correct alternative from those given in the brackets.

1. renal artery **2.** nephrons

3. 200 – 450 **4.** glomerulus

H. Complete the following paragraph by filling in the blanks (1) to (5) with appropriate words:

1. ADH

2. posterior

3. diabetes insipidus

4. insulin

5. diabetes mellitus

III. Short Answer Type Questions

A. Define the following terms.

1. The act of discharging urine is called **micturition**.

2. Filtration which occurs under high pressure is called **ultrafiltration** as in case of glomerulus of nephron to filter all the liquid part of the blood.

3. The process of maintaining the osmotic concentration of blood or right amount of water and proper ionic balance in the body is called **osmoregulation**.

4. Loop of Henle is U-shaped loop formed in the middle of the nephric tubule by the thin descending and a thick ascending limb.

5. Tubular secretion is the reverse process of tubular reabsorption. The cells of the renal tubule remove wastes from blood and pass into the filtrate by secretion. Removes NH_3, urea, uric acid, creatinine, hippuric acid from the blood and adds into the filtrate.

B. Differentiate between the following.

1.

Ascending limb of Henle's loop	Descending limb of Henle's loop
Thicker in size	Thin in size
Lined by cuboidal epithelium	Lined by flattened epithelial cells
Minerals (Na, Cl, K) are reabsorbed	Only water is reabsorbed

2.

Bowman's capsule	Malpighian capsule
Part of a Malpighian capsule. Dilated, blind-end, semi-permeable squamous epithelium. Bowman's cup has knot-like glomerulus.	Bowman's capsule and glomerulus together called Malpighian capsule or renal tubule.

3.

Renal cortex	Renal medulla
Outer dark red zone. The proximal and distal convoluted tubules and Bowman's capsule lie in the renal cortex.	Inner pale-red zone. The medullary zone 15-16 pyramid like structures made up of Henle's loop and collecting ducts – called renal pyramid are present in the renal medulla.

C. Answer these questions.

1. Urea, uric acid

2. Ascending limb of loop of Henle

3. Proximal convoluted tubule is the part of nephron present between Bowman's capsule and the loop of Henle. The Loop of Henle is a long, straight, tubular segment connecting the proximal tubule to the distal convoluted tubule and lies parallel to the collecting ducts.

4. Ascending limb (of the loop of Henle).

5. When enough urine gets accumulated, the conc. of urine is maximum in descending limb and in collecting tubule.

6. Ureter transports urine from the kidneys to the urinary bladder whereas urethra carries urine from urinary bladder to the exterior.

IV. Long Answer Type Questions

A. Answer these questions.

1. a. Refer to figure 9.1 from page 118 of ICSE BOOK 10.

b. Nitrogenous organic compounds – urea –

1.5 g, uric acid – 0.7 g, creatinine – 2.3 g, hippuric acid–negligible

Inorganic substances – NH_3 – 0.6 g/L, Na, K, Ca, Mg Salts.

Non-nitrogenous organic compounds – Vitamin C, oxalic acid, phenolic substances, water – 95%.

c. Renal artery and renal vein

2. a. Refer to figure 9.2c page 119 of the textbook.

b. Walls of glomerular capillaries and Bowman's capsule are very thin and semi-permeable in nature. Hence they act as 'ultrafilters'. The glomerular hydrostatic pressure or capillary pressure is the main driving force that tends to move fluid out of the glomeruli. Due to high filtration pressure in the blood of glomerulus, a part of water and dissolved constituents are filtered out in the Bowman's capsule. This is termed as ultrafiltration.

3. When enough urine gets accumulated in the bladder to raise its pressure sufficiently, a spontaneous activity is initiated. As the ureters pass obliquely through the bladder wall, their openings get shut due to compression by the contracting bladder muscles and backward flow of urine is prevented.

4. The function of regulation of osmotic pressure of blood by the kidney is called osmoregulation. During large amount of water intake, the urine passed out of the body is hypotonic. The glomerular filtrate contains some solutes that are reabsorbed by the renal tubules. Hence urine passed out is hypotonic. Keeps osmotic pressure of blood normal. Under scarce water conditions an isotonic glomerular filtrate is formed in the Bowman's capsule. Large quantity of water is reabsorbed in the nephric tubule. Thus urine passed out is hypertonic. The flexibility in the working of human kidney and renal tubules is brought about by the movement of H_2O and Na in and out of the nephron, under the influence of hormones, thus osmolarity is regulated.

V. Structured/ Application/ Skill Type Questions

A. 1. Excretion is defined as the process of removal of mainly nitrogenous waste products formed in the body as a result of metabolism.

2. Nephrons are the units of kidney.

3. Part **iv** is renal medulla. The medulla is subdivided into 15 to 16 conical masses, the renal pyramids. Due to the presence of renal pyramids, the medulla has a striped appearance.

4. i. Nitrogenous waste, salts are excreted by kidney.

ii. The excess water is removed through kidneys. It helps in osmoregulation.

5. i. → Renal artery.

ii. → Renal vein.

Renal artery	Renal vein
It supplies oxygenated blood from heart to the kidneys	It carries deoxygenated blood from kidney to the infenior vena cava
Contains more urea	Contains less urea

B. 1. Excretory system and skeletal system

2. i. Kidneys

ii. Posterior vena cava

iii. Ureter

iv. Urinary bladder

v. Urethra

vi. Renal vein

vii. Renal artery

3. Nephron is the structural and functional unit of part marked **i**.

4. Urea and uric acid

5. Ultrafiltration and tubular reabsorption

6. Adrenal glands on the top of each kidney

C. 1. i. Collecting tubule

ii. Distal convoluted tubule with arteries

iii. U-shaped loop of Henle

iv. Proximal convoluted tubule with blood capillaries

v. Bowman's capsule

vi. Afferent arteriole from renal artery

vii. Glomerulus

viii. Venule to renal vein

2. Glomerulus, Bowman's capsule

3. Highest concentration of urea – Renal artery

Lowest concentration of urea – Renal vein

4. Collecting tubule

5. Proximal convoluted tubule

6. Ultrafiltration and tubular reabsorption

7. Loop of Henle

8. The afferent arteriole entering the Bowman's capsule is wider than the efferent arteriole which leave it. So more blood entering and less blood is moving out of the glomerulus.

CHAPTER – 10
NERVOUS SYSTEM

P. 133 Check Your Progress 1

A. Name the following.

1. Sensory nerves
2. Motor neuron
3. Neuron
4. Dendrites
5. Axolemma
6. Receptor organs are eyes, ears, muscles, skin, etc.
7. Synapse
8. Neurotransmitters
9. Acetylcholine, Norepinephrine

P. 138 Check Your Progress 2

A. State whether the following statements are True or False.

1. True **2.** False **3.** False
4. False **5.** False **6.** False

B. Cerebrum

C. Given below are some sensory capabilities of human brain. Name the structures associated with these.

1. Cerebrum
2. Hypothalamus
3. Cerebellum
4. Cerebrum
5. Medulla oblongata

P. 141 Check Your Progress 3

A. Answer these questions.

1. The peripheral nervous system (PNS) comprises the nerves that connect the central nervous system with different parts of the body. Peripheral nervous system is divided into two sub-divisions – somatic nervous system and autonomic nervous system.

2. The PNS comprises of cranial nerves connected directly to the brain and spinal nerves emerging from spinal cord. The autonomic nervous system also being a part of the PNS consists of 22 pairs of ganglia and lie close to the spinal cord and are associated with organs they control.

The central nervous system consists of the brain and the spinal cord.

3. These two divisions are anatomically and functionally distinct. The sympathetic fibres arise from the thoracic (chest) and lumbar (waist) region of the spinal cord, whereas the parasympathetic fibres arises from the brain and the sacral (pelvic) region of the spinal cord. The effect of the two systems is antagonistic.

In general, the sympathetic system stimulates a particular function and prepares the body for violent actions against unusual emergency conditions, while the parasympathetic system has inhibitory or calming down effect, i.e. it reestablishes normal conditions after the violent action is over.

Also refer Table 10.5 from Pg 140 of textbook.

4. ANS is primarily a motor system consisting of neurons that control the functioning of many organs:

i. Heart muscles **ii.** Glands **iii.** Smooth muscles (muscles of blood vessels, digestive, respiratory and reproductive tracts)

5.

Organ	Sympathetic nervous system	Parasympathetic nervous system
Heart	It increases the heartbeat rate.	It decreases the heartbeat rate.
Eyes	It dilates the pupils of the eyes.	It constricts the pupils of the eyes.
Stomach	It inhibits gastric and pancreatic activities.	It stimulates gastric and pancreatic activities.
Blood vessels	It results in the constriction of blood vessels and increases blood pressure. It stimulates sweat glands.	It results in the dilation of blood vessels and lowers blood pressure. It stimulates tear glands.
Bronchi	Bronchi dilate	Bronchi constrict.
Urinary bladder	Bladder relaxes.	Bladder constricts.

6. The hand automatically shows the direction to turn a cycle without thinking because it is a reflex action. Due to previous learning about directions the brain actually remembers its reflex that is called conditioned reflex.

P. 141 Exercises

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

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

II. Very Short Answer Type Questions

A. Name the following.

1. Corpus callosum
2. Cerebrum
3. Hypothalamus
4. Cerebrospinal fluid
5. Medulla oblongata
6. Cerebellum
7. Motor neuron
8. Myelin sheath
9. Acetylcholine
10. Sympathetic nervous system

B. Identify the odd term in each set and name the category to which the remaining three belong.

1. Odd term- Cerebrum, Category- Hindbrain
2. Odd term- Crenium, Category- Parts of brain
3. Odd term- Photon, Category- Parts of neuron
4. Odd term- Typing, Category- Natural reflexes

C. Given below is an example of a certain structure and its special functional activity.

e. g. Kidney and excretion

Fill in the blanks on a similar pattern.

1. body balance
2. helps in conduction of nerve impulses
3. protective covering of brain
4. neurotransmitter
5. signalling process
6. reflex action
7. cardiac centre
8. protective brain box
9. to control movement, memory and emotion

D. Given below in the box is a set of 13 terms. Of these 10 can be paired into 5 matching pairs. Match the pairs.

Neurotransmitter – Acetylcholine

Dorsal horn of spinal cord – Spinal nerve

Spinal cord – Adipose tissue

Neuron – Nerve impulse

Cerebellum – Equilibrium

E. State whether the following statements are True or False. Rewrite the wrong statements correctly.

1. True **2.** True **3.** True

4. False

Cerebrum is concerned with intelligence.

5. False

Acetylcholine is a neurotransmitter.

6. True

7. True

F. Give one difference between the following on the basis of what indicated in brackets.

1. The outer layer of the cerebrum is the cerebral cortex that contains cell bodies of neurons (grey matter). The inner region of cerebrum consists of white matter that has axons of nerve cells.

In the spinal cord, the clusters of cytons forming the grey matter lie in the inner region whereas axons forming the white matter lie in the outer region.

2. Refer to Answer **1** above.

3. Cerebrum governs mental abilities like thinking, reasoning, learning, memorizing, intelligence and emotions.

Cerebellum maintains body balance and controls postures and coordinates muscular activities.

4. The sympathetic system stimulates a particular function and prepares the body for violent actions against unusual emergency conditions.

The parasympathetic system has inhibitory and calming down effect, i.e., it re-establishes normal conditions after the violent action is over.

5. Sensory nerves are also called afferent nerves. They contain neurons which carry messages (impulse) from sensory receptors (in sense organs) towards the central nervous system (brain or spinal cord).

Motor nerves are also called efferent nerves. These contain neurons which take messages away from the central nervous system towards the effector organ , such as muscles and glands.

G. Match the terms of Column A with those of Column B and write down the matching pairs.

1. d **2.** a **3.** b **4.** c **5.** f

6. e

H. Complete the following statements by choosing the correct alternative from the brackets.

1. sensory
2. cerebrum
3. hypothalamus

III. Short Answer Type Questions

A. Answer these questions.

1. Optic lobes on the dorsal side of the midbrain enable us to perceive the objects around us.

2. Meninges are protective coverings of the brain that consist of three layers.
   i. The outer tough, protective layer dura mater is formed of fibrous tissue.
   ii. The middle arachnoid layer is a delicate membrane.
   iii. The inner thin, transparent and highly vascular layer is the pia mater.
3. Cerebrospinal fluid is present in the membranes of the brain.
4. Cranium (brain box of the skull) protects the brain.
5. **a.** Cerebellum; **b.** Synapse
6. Stimulus, receptor organ, sensory nerve, spinal cord, motor nerve, muscle action
7. Corpus callosum is a thick band of nerve fibres that divides the cerebrum into left and right hemispheres. It helps in the transfer of information from one hemisphere to another.

   Corpus callosum is situated beneath the cortex of the brain.
8. The hindbrain comprises of cerebellum, pons and medulla oblongata. Cerebellum maintains body balance and controls postures and coordinates muscular activities.

   Medulla oblongata is the lowermost part of the brain located at the base of the skull. It contains vital reflex centres and controls the activities of the internal organs.

   Pons forms the part of the brain stem at the floor of hindbrain. It is a bridge of transverse nerve tracts extending from the cerebrum to the cerebellum. It also connects the forebrain to the spinal cord.
9. **a.** Simple reflex
   b. Simple reflex
   c. Simple reflex
   d. Conditioned reflex
   e. Conditioned reflex
   f. Conditioned reflex

IV. Long Answer Type Questions

A. Answer these questions.

1. Cerebrum governs mental abilities like thinking, reasoning and learning.

   Refer to page 134, ICSE Living Science Biology 10
2. Sympathetic nerve fibres arise from the thoracic and lumbar region of the spinal cord and prepare the body for violent actions against unusual emergencies.
3. The parasympathetic nervous system in our body has an inhibitory or calming down effect, i.e. it re-establishes normal conditions after a violent action is over.
4. The cerebrum (because of highly developed grey matter) governs mental abilities like thinking, reasoning, learning, memory and intelligence. It also controls all voluntary functions, will power, emotions and speech. It enables us to observe things around us through sense organs. This part of the brain also controls feelings of love, admiration and hatred. Centres for subconscious mind are also located in the cerebrum.

   Cerebellum maintains body balance and controls muscular activities. It makes the body movements smooth, steady and coordinated. It regulates and coordinates contraction of skeletal muscles.
5. A reflex action may be defined as a spontaneous, automatic and mechanical response to stimulus controlled by the spinal cord without the involvement of the brain. The pathway followed by sensory and motor nerves in a reflex action is called the reflex arc. An example of reflex action is knee jerk response in which if a sharp tap is made below the knee cap, then the leg is involuntarily extended.

   Refer to figure 10.12 on page 136 of textbook.

V. Structured/ Application/ Skill Type Questions

A.

	Parts	Location	Function
1.	Neurotransmitter	Synapse	Transfers information from one neuron to another
2.	Cerebrospinal fluid	Brain	Protects brain from shocks
3.	Medullary sheath	Neuron	To transfer nerve impulse across the axon more quickly
4.	Cerebellum	Hindbrain	Maintains body balance and controls muscle activities
5.	Corpus callosum	Cerebrum	Joins the two cerebral hemispheres
6.	Gyri and Sulci	Cerebrum	Increases surface area for more nerve cells

B. 1. i. Cerebrum

ii. Cerebellum

iii. Pons

iv. Medulla oblongata

v. Spinal cord

2. i. Cerebrum (because of highly developed grey matter) governs mental abilities like thinking, reasoning, learning, memory and intelligence. It also controls all voluntary functions; will power,emotions and speech.

iii. Pons forms the part of the brain stem at the floor of hindbrain. It is a bridge of transverse nerve tracts extending from the cerebrum to the cerebellum. It also connects the forebrain to the spinal cord.

3. If a person's cerebellum gets damaged, he or she may not be able to walk. Such a person can learn to walk again but with difficulty.

Functions that would be affected if a medulla oblongata was damaged would include one's respiration, reflexes, defecation, blood pressure, swallowing, etc, as the nerve signals between the brain and spinal cord would no longer be working.

C. 1. Reflex action

2. Synapse

3. i. Sensory neuron

ii. Dorsal roof ganglia

iii. White matter

iv. Grey matter

4. v. (Synapse) – It allows information to pass from one neuron to another.

vi. (Motor neuron) – These neurons take messages away from the CNS towards the effector organ.

5. In spinal cord,the grey matter is inside and white matter is outside around it. In brain, grey matter is outside and white matter is inside.

6. The arrows indicate the sequence of events that constitute a reflex arc. The pathway indicates the pathway of reflex action.

7. Spinal nerve

D. 1. i. Sensory neuron

ii. Sensory cell body

iii. White matter

iv. Grey matter

v. Ventral root

2. Q → R → P

3. Simple or natural reflexes are those reflexes which do not require any previous learning experience. Such reflexes are inborn and inherited from parents.

Examples:

i. Blinking of eyelids in response to a foreign particle that enters the eye. The stimuli in this case is 'entrance of a foreign particle into the eye'.

ii. Closing of eyelid in response to a strong beam of light being flashed on the eyes. The stimuli in this case is ' strong beam of light being flashed on the eyes'.

E. 1. i. Cerebrum

ii. Cerebellum

iii. Medulla oblongata

iv. Spinal cord

2. The outer layer of the cerebrum is the cerebral cortex that contains cell bodies of neurons (grey matter). The inner region of cerebrum consists of white matter that has axons of nerve cells.

In the spinal cord, the clusters of cytons forming the grey matter lie in the inner region whereas axons forming the white matter lie in the outer region.

3. Function of medulla oblongata [iii] – It contains vital reflex centres such as cardiac centre, respiratory centre and centres for swallowing, sneezing, coughing and vomiting. Thus, it controls involuntary functions of the body like heart beat, swallowing and breathing.

Function of spinal cord [iv] – The spinal cord conducts reflexes below the neck. It conducts sensory impulses from skin and muscles to the brain, and motor responses from brain to the muscles of trunk and limbs.

4. Corpus callosum

F. 1. i. Frontal lobe (cerebrum)

ii. Auditory area (cerebrum)

iii. Occipital lobe (cerebrum)

iv. Cerebellum

v. Medulla Oblongata

2. a. Blindness

b. Unable to walk

3. i. Functions for thinking

ii. Functions for hearing

v. Controls the reflex centres like that of respiratory, cardiac and swallowing mechanisms

CHAPTER – 11
SENSE ORGANS

P. 151 CHECK YOUR PROGRESS 1

A. Fill in the blanks.

1. Tear glands/Lacrimal glands
2. Nasolacrimal glands
3. lysozyme
4. Conjunctiva
5. vitreous humour
6. ciliary body, iris
7. Retina
8. concave lens
9. aqueous humour
10. yellow spot

B. State the functions of the following parts of the eye.

1. **Lens:** Refraction and focussing of light
2. **Pupil:** Allows light rays to enter eyeball
3. **Cornea:** Refraction of light
4. **Eyelids:** They protect the eyes from excessive light and foreign particles, cover the eye during sleep and spread lubricating secretions over the eyeballs.
5. **Eyelashes:** Eyelashes protect the eye from debris. They are sensitive to being touched, thus providing a warning that an object (such as an insect or dust mite) is near the eye (which is then closed reflexively).
6. **Iris:** Regulation of entry of light
7. **Choroid:** Absorption of stray light rays

C. State whether the following statements are True or False.

1. True
2. False

P. 154 CHECK YOUR PROGRESS 2

A. State the functions of the following parts of the ear.

1. The external ear – Collects and directs sound waves
2. Tympanic membrane – Vibrates in response to sound energy and transmits the resulting mechanical vibrations to the structures of the middle ear.
3. Ear ossicles – Amplifies sound waves
4. Oval window – Transmits vibrations to cochlea
5. Cochlea – Conversion of sound waves into nerve impulse
6. Utriculus and sacculus – Static balance
7. Semicircular canals – Dynamic balance

B. Note the relationship between first two words and suggest the suitable word/words for fourth place.

1. Semicircular canals
2. Semicircular canals

C. Write in logical sequence without changing the first term.

Pinna, auditory canal, tympanum, ear ossicles, cochlea

P. 155 EXERCISES

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. d **2.** a **3.** a **4.** a

II. Very Short Answer Type Questions

A. Name the following.

1. Cones
2. Rhodopsin
3. Malleus
4. Auditory nerve
5. Eustachian tube
6. Presbyopia
7. Inverted image
8. Yellow spot/Macula/Fovea centralis
9. Blind spot
10. Iodopsin
11. Concave lens
12. Convex lens
13. Suspensory ligament
14. Astigmatism
15. Aqueous humour
16. Choroid
17. Conjunctiva

B. Given below is an example of a certain structure and its special functional activity.

e.g. **Kidney** and **excretion.**

Mention the function of structures given below in the similar manner.

1. Conversion of sound waves into nerve impulse
2. Hearing
3. Colour vision
4. Vision
5. Allows light rays to enter eyeball
6. Sense of smell

C. Differentiate between the following on the basis of what is given in brackets.

1. In myopia, a person cannot see distant objects clearly, because either the eyeball is elongated or the lens has become too thickened or curved but in hypermetropia the person cannot see nearby objects clearly due to shortening of the eyeball or the lens has become too thin.
2. Rod cells are sensitive to dim light. The cone cells are sensitive to bright light.
3. Iris regulates the entry of light by its radial and circular muscles. Light rays enter the eyeball through the pupil.
4. Rhodopsin is the pigment of the rod cells and Iodopsin is the pigment of the cone cells.
5. Sclera is the outermost layer of human eye. The function of sclerotic layer is to protect the eye from the mechanical injuries. Choroid layer, which the second layer of eye, is present between sclera and retina. Choroid contains a large number of blood vessels. It provides oxygen and nourishment to the outer retina.
6. Static balance is our ability to hold our body in a specific position and posture while dynamic balance is our ability to maintain balance while moving our body and walking.
7. Near vision happens because either the eyeball is elongated or the lens has become too thickened or curved. Long-sightedness or distant vision results due to shortening of the eyeball or the lens has become too thin.

D. Given below are sets of five terms. In each case rewrite the terms in the correct order so as to be in logical sequence.

1. Pinna, auditory canal, tympanum, ear ossicles, cochlea
2. Cornea, iris, pupil, lens, retina
3. Pupil, eyelens, vitreous humour, fovea, auditory nerve
4. Cornea, aqueous humour, pupil, lens, yellow spot
5. Auditory canal, tympanum, ear ossicles, oval window, cochlea

E. Give appropriate term for the following.

1. Accommodation
2. Astigmatism
3. Cataract

F. Complete the following sentences by filling in the appropriate word or terms from the list given below.

1. ciliary muscles
2. stapes
3. retina

G. Mention if the following statements are True or False. Rewrite the wrong statements correctly.

1. False
   Rods are the receptors in the retina of the eye sensitive to dim light.
2. False
   The part of the ear associated with balance are utriculus, sacculus and semicircular canals.
3. False
   Myopia is a defect of the eye caused due to the eyeball being elongated.
4. False.
   Deafness is caused due to the rupturing of the tympanic membrane.

III. Short Answer Type Questions

A. Answer these questions.

1. Two functions of choroid layer:
   i. The choroid absorbs light rays so that they are not reflected within the eyeball.
   ii. The numerous blood vessels in the choroid layer nourish the retina.
2. Adaptation is the ability of the eye to adjust to various levels of darkness and light. The pupil dilates to allow more light to enter through retina to allow viewing of objects in dim light. This is called dark adaptation. Further pupil constricts and size of the pupil is reduced to reduce the amount of light entering the eyes. This is called light adaptation.

   The process of focussing by the eye at different distances is called accommodation. The accommodation is brought about by adjusting the curvature of the elastic lens making it thinner or thicker.
3. The middle ear contains three tiny bones called ear ossicles. These bones are named as malleus (or hammer), incus (or anvil) and stapes (or stirrup). The ear ossicles amplify sound waves.
4. Tear glands or lacrimal glands (collectively known as lacrimal apparatus) are a group of glands that manufacture and pour tears (lacrima: tears). A lacrimal gland is a compound gland located at the upper sideward portion of each eyelid.
5. Yellow spot – the area of best vision: The yellow spot or macula (Fovea centralis) is a spot located in the centre at the back of the eyeball. It contains maximum number of light sensitive cells, especially the cone cells. The rest of retina has lesser cone cells and more rod cells.

The yellow spot is the region of colour vision and also the brightest vision (best vision).

Blind spot – the area of no vision: Blind spot is the region of retina just below the yellow spot. Since, there are no light receptors here, no image is formed here, i.e. blind spot is the area of no vision.

6. Presbyopia is an old-age eye defect. In this condition, the lens loses its flexibility and as a result the near objects cannot be seen clearly. This defect normally occurs in the older people.
7. In a normal eye, an object at a distance 6 metres away would be in perfect focus on the retina. The process of focussing by the eye at different distances is called accommodation. The ability of the eye to see objects equally clear from various distances is called the power of accommodation.
8. The eye focusses an image by refracting, or bending the light rays using cornea and the lens. An upside down or inverted image is formed at the yellow spot on the retina.
9. The photoreceptors found in the eye are rod cells and cone cells.
10. One feels blinded for a short while on coming out of a dark room. It is due to the sudden constriction of the pupil to prevent the entry of light into the eyes and pigment rhodopsin is bleached to reduce the sensitivity of the rods. In bright light cone cells are then activated.

IV. Long Answer Type Questions

A. Answer these questions.

1. Long-sightedness or hypermetropia is a condition in which light is focussed behind the retina (the image is formed behind the retina). As a result, the distant objects are seen clearly, while the near objects appear blurred. Long-sightedness results due to shortening of the eyeball or the lens has become too thin. Hypermetropia can be corrected by using a convex (converging) lens.
2. **Short-sightedness or Myopia:** In this condition, light is focussed in front of the retina, and a blurred image is formed in front of retina. In myopia, the near objects are seen clearly while the distant objects appear blurred. This happens because either the eyeball is elongated or the lens has become too thickened or curved.

   Myopia can be corrected by using a concave (diverging) lens.

   Long-sightedness or Hypermetropia: In this condition, the light is focussed behind the retina (the image is formed behind the retina). As a result, the distant objects are seen clearly, while the near objects appear blurred. Long-sightedness results due to shortening of the eyeball or the lens has become too thin.

   Hypermetropia can be corrected by using a convex (converging) lens.

   Astigmatism: This is a more complicated defect in vision. In this, the surface of cornea becomes irregular and therefore some of the light rays are focussed while others are not. As a result, some parts of the object appear blurred while other parts appear clear.

   Astigmatism can be corrected by using a cylindrical lens that bends light rays in one direction only.

   Presbyopia: In this condition, the lens loses its flexibility and as a result the near objects cannot be seen clearly. This defect normally occurs in the older people.

   Presbyopia can be corrected by using a convex lens.

   Night blindness: In this condition, there is difficulty in seeing in the dim light. This is because of non-production of rhodopsin pigment in the rod cells, which function in dim light. In the absence of rhodopsin, these cells cannot function. Thus, there is lack of normal night vision. It is most often caused due to deficiency of vitamin A. Night blindness can be cured by having vitamin A rich diet.

   Colour blindness: In this condition, a person is unable to discriminate between red and green colours. This is a genetic defect (X-linked inheritance). Colour blindness cannot be treated during the lifetime of an individual.

   Cataract: In this condition, the lens of the eye becomes opaque and as a result the vision is cut down. Cataract can be treated by surgical removal of lens and using convex lenses in the spectacles which compensate for the removed lens. Nowadays, a small plastic lens is implanted behind the iris to correct the defect.

   Squint: In this condition, either the two eyes somewhat converge (known as cross-eye) or diverge (known as wide-eye). In both these conditions, a person may have double vision. Squint in the eyes can be treated by surgery or by suitable exercises.
3. A receptor is a molecule most often found on the surface of a cell, which receives chemical signals originating externally from the cell. Receptors are protein molecules, embedded

in either the plasma membrane (cell surface receptors) or the cytoplasm or nucleus (nuclear receptors) of a cell, to which one or more specific kinds of signalling molecules may attach.

We all have special cells called receptors which receive stimuli from the environment. Some of these are contained in the sense organs. Eyes, ears, tongue, nose and skin are the major sense organs in our body which are sensitive to light, sound, taste, smell and touch, respectively. Each of these sense organs is directly connected with the brain.

V. Structured/ Application/ Skill Type Questions

A.

Structure	Location	Function
Eustachian tube	Middle ear	Equalizes air pressure on both sides of the ear drum.
Organ of Corti	Internal ear	Helps in hearing
Oval window	Middle ear	Middle ear is separated from the internal ear by a thin bony partition containing oval windows.
Tympanum	Middle ear	Separates middle ear from external ear.
Fovea centralis	In the centre of the eye and at the back of the eyeball	Colour vision and brightest and best vision
Ear ossicles	Middle ear	Transmits sound from air to cochlea
Iris	Choroid layer (Middle layer of eyeball)	Regulates the amount of light entering though pupil to reach retina.

B. 1. Separates middle ear from internal ear

2. Ciliary muscles

3. Helps in equalizing pressure on both sides of ear drum

4. Auditory nerve

5. Receptor for hearing

C.

Category	Odd term
Internal ear	Malleus
Common defects of eye	Xeropthalmia
Middle ear	Sacculus

D. 1. Short-sightness or myopia

2. This happens because either the eyeball is elongated or the lens has become too thickened or curved.

3. i. Vitreous humour

ii. Image focussed in front of retina

iii. Lens is too curved

iv. Pupil

4. Concave lens is used to correct this eye defect.

5. Refer to fig 11.8 on page 150 of the textbook.

E. 1. The middle ear contains three tiny bones called ear ossicles.

The biological name for malleus is hammer, for incus it is anvil and for stapes it is stirrup.

2. i. Cochlea

ii. Semicircular canals

iii. Vestibular apparatus (ampulla, utriculus, sacculus)

3. Cochlea **(i)** helps in hearing.

Semicircular canals **(ii)** help in dynamic balancing.

4. Organ of Corti

F. 1. i. Sclera **ii.** Choroid

iii. Retina **iv.** Yellow spot

v. Optic nerve **vi.** Blind spot

vii. Lens **viii.** Anterior chamber

ix. Pupil **x.** Iris

xi. Posterior chamber **xii.** Cornea

2. Iris **(x)** regulates the entry of light by its radial and circular muscles.

3. If the optic nerve **(v)** is damaged in either optic tract, it would lead to loss of half the vision in either eye and cutting of optic nerve would lead to total loss of vision.

G. 1. Sound wave strikes the eardrum and causes vibrations in the tympanic membrane.

2. The common term for **i**, **ii** and **v** is ear ossicles (middle ear), i.e.,

i – malleus

ii – incus

v – stapes

3. There will be a difference if the three parts of the ear ossicles are replaced by a single bone.

The three bones act as a lever and increase the magnitude or power of vibrations. Sound waves are amplified as they strike the surface of each

of the three bones. If a single bone was there instead of three bones, the sound would not be amplified to the same extent.

4. **iii.** Semicircular canals; **iv**. Cochlea.
5. Endolymph
6. Ears are a pair of sense organs for hearing and balance.

H. 1. Long-sightedness or hypermetropia
2. A man with hypermetropia will see the near objects blurred.
3. Long-sightedness results due to shortening of the eyeball or the lens has become too thin.
4. It can be rectified by using a convex lens.
5. Refer to Fig 11.9 on page 150 of textbook.
6. An upside down or inverted image is formed at the yellow spot on retina.

I.
- **i.** Anterior chamber
- **ii.** Lens
- **iii.** Iris
- **iv.** Cornea
- **v.** Conjunctiva
- **vi.** Sclera
- **vii.** Choroid
- **viii.** Retina
- **ix.** Yellow spot
- **x.** Optic nerve

J. 1.
- **i.** Cochlea
- **ii.** Auditory nerves
- **iii.** Semicircular canals
- **iv.** Ear ossicles
- **v.** Auditory canal
- **vi.** Pinna
- **vii.** Ear drum
- **viii.** Round window
- **ix.** Eustachian tube
- **x.** Oval window

2. **a.** Ear drum
   b. Cochlea
   c. Semicircular canals
   d. Auditory nerve
   e. Eustachian tube

K. 1.
- **i.** Stapes
- **ii.** Semicircular canals
- **iii.** Auditory nerves
- **iv.** Cochlea
- **v.** Eustachian tube
- **vi.** Ear drum
- **vii.** Malleus
- **viii.** Pinna

2. Semicircular canals (ii) maintain the dynamic equilibrium which helps to maintain body balance in relation to position.

   Malleus (vii) or hammer is attached to the ear drum whose vibrations are transmitted through the bones to the membrane across the oval window and amplifies sound waves.

3. A pin or any sharp object may injure the ear drum and therefore should not be put into the ear to remove the wax from the ear.

L. For 1. to 3. Refer to Sol. D

For 4. Refer to Fig. 11.8, page 150 of the text book

M. Refer to fig 11.2 on page 146 of textbook and label the following parts.

1. Choroid layer
2. Ciliary muscle
3. Yellow spot
4. Optic nerve
5. Conjunctiva
6. Aqueous humour
7. Suspensory ligament
8. Sclera

CHAPTER – 12

ENDOCRINE SYSTEM

P. 162 Check Your Progress 1

A. The capacity of an organism to adjust itself to cope with the external changes and maintain a steady state of functioning is called homeostasis.

B. Name the following.

1. Hormones

2. Endocrine glands

3. Peptide or non-steroidal hormones

C. State the characteristic of hormones pertaining to

1. They act only on target organs or cells located usually away from their sources.

2. They are biologically very active and their action is very rapid.

3. Regulate the physiological process of the body by bringing about chemical changes.

4. They are biologically very active and their action is very rapid. They are destroyed soon after their action and thus, not stored in body.

P. 165 Check Your Progress 2

A. Fill in the blanks.

1. larynx

2. isthmus

3. thyroxine, calcitonin

4. thyroxine

5. Undersecretion

6. myxoedema

7. undersecretion

P. 166 Check Your Progress 3

A. Mention any one hormone secreted by the following.

1. Insulin

2. Aldosterone

3. Adrenalin

4. Glucagon

B. Two symptoms of diabetes mellitus:

i. The sufferer feels thirsty because of loss of water through excessive urination.

ii. Becomes weak.

C. Name the condition and hormone associated with the following.

1. Addison's disease, Glucocorticoids

2. Hypertension, Aldosterone

3. Diabetes mellitus, Insulin

P. 171 Check Your Progress 4

A. Name the hormone associated with the following.

1. Growth Hormone (GH)

2. Thyroid stimulating hormone (TSH)

3. Oestrogen and progesterone

4. Antidiuretic hormone (ADH)

5. Oxytocin

B. State if the following statements are True or False.

1. True **2.** False **3.** False

4. False **5.** False

C. Write the full form of the following.

1. TSH: Thyroid Stimulating Hormone

2. ACTH: Adrenocorticotropic Hormone

3. ADH: Antidiuretic Hormone

4. FSH: Follicle Stimulating Hormone

D. 1. Thyroxine

2. Stimulates the rate of cellular oxidation and regulates basal metabolism

3. Posterior pituitary

4. Controls reabsorption of water in kidney tubules

5. Pancreas

6. Insulin

7. Adrenalin

8. Prepares body for emergency

P. 172 Exercises

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. c **2.** c **3.** a **4.** b **5.** a

6. d **7.** b

II. Very Short Answer Type Questions

A. Name the following.

1. Adrenal glands **2.** Pituitary gland

3. Oxytocin **4.** Aldosterone

5. Glucagon **6.** Prolactin

7. Leydig cells **8.** Glucagon

B. Define the following terms and give one example of each.

1. An exocrine gland secretes material directly

into the duct. They have their own ducts which carry the secretions directly to the target organ. Example: Sweat gland.

2. Hormones are chemical messengers secreted by endocrine glands and carried by blood and lymph to the target organ elsewhere in the body to stimulate a specific activity that may be biochemical or physiological. Example: Thyroxine

3. The oversecretion of growth hormone in an adult leads to overgrowth of the jaw bone and bowing of the spine. This condition is called acromegaly.

C. Match the Column A with Column B. Rewrite the correct matching pairs.

1. d **2.** c **3.** a

4. e **5.** f **6.** b

D. Choose the odd one out in each of the following series.

1. Prostate gland **2.** Scurvy

3. Diabetes insipidus **4.** Vasopressin

5. Steroids

III. Short Answer Type Questions

A. Differentiate between the following.

1.

Diabetes mellitus	Diabetes insipidus
Hyposecretion of insulin causes diabetes mellitus in which glucose is present in excess in blood and is also excreted out along with the urine.	Deficiency of ADH causes diabetes insipidus.
High concentration of glucose is seen in the urine.	Urine does not contain any sugar.

2.

Cretinism	Acromegaly
Caused due to defective development or early atrophy of thyroid gland.	Caused due to oversecretion of growth hormone from the anterior pituitary.
Children suffering from cretinism have stunted growth, short club-like fingers, deformed bones and teeth.	In an adult leads to overgrowth of the jaw bone and bowing of the spine.

3.

Vasopressin	Insulin
Deficiency of this hormone causes diabetes insipidus.	Deficiency of insulin causes diabetes mellitus.
A person urinates more frequently and a large amount of urine is produced each time. Urine does not contain any sugar.	High concentration of glucose is found in the blood and urine.

B. Answer these questions.

1. Adrenal cortex – Glucocorticoids

Adrenal Medulla – Adrenalin

2. i. Diabetes mellitus

Causes: Undersecretion of insulin causes diabetes mellitus or hyperglycemia.

Symptoms: The sufferer feels thirsty because of loss of water through excessive urination and becomes weak. Urine contains sugar.

ii. Diabetes inspidus

Causes: Deficiency of ADH

Symptoms: Loss of water from the body and person feels thristy but the urine does not contain any sugar.

3. Adrenalin is called an emergency hormone because it prepares body for fight or flight situation. It increases heartbeat, increases blood supply to muscles and decreases supply to visceral organs.

IV. Long Answer Type Questions

A. Answer these questions.

1. Diabetes mellitus or hyperglycemia

Causes: Undersecretion or hyposecretion of insulin causes diabetes mellitus

Symptoms: A person suffering from diabetes mellitus has high concentration of glucose in the blood and urine. The sufferer feels thirsty because of loss of water through excessive urination and becomes weak. They can also experience unexplained weight loss and fatigue. Urine contains sugar.

2. Endocrine glands, also called ductless glands, do not have their own ducts, and their secretions are directly released into the tissue space next to them. These secretions are carried by blood and/or lymph to the target site.

3. Thyroid gland is a large endocrine gland located in the neck region just below the larynx in front of the trachea or windpipe of the human body.

Disorders caused due to undersecretion of thyroid hormone:

Myxoedema: In adults, facial tissues swell and look puffy.

Cretinism: Caused due to defective development or early atrophy of thyroid gland. This is observed in children who show stunted growth, short club-like fingers, deformed bones and teeth.

Simple goitre: In this, the thyroid glands of adults enlarges and becomes visible as swelling in the neck.

Disorder caused due to oversecretion of thyroid hormone:

Exopthalmic goitre: A person suffering from this disorder shows increased metabolic rate, rapid heartbeat, protruding eyes and short breathing rate.

V. Structured/ Application/ Skill Type Questions

A. 1. Insulin

2. Conversion of glucose to glycogen

3. Causes diabetes mellitus

4. Thyroid gland

5. Stimulates the rate of cellular oxidation and basal metabolism

6. Myxoedema

7. Anterior lobe of pituitary gland

8. Controls the overall growth of body, muscles and bones

9. Gigantism

10. Dwarfism

B.

Hormone	Category	Odd Term
Steroids, cortisone, adrenalin, testosterone, prolactin	Hormone	Steroids
GH, ACTH, oxytocin, FSH, LH	Hormones of the anterior pituitary gland	Oxytocin
Cortisone, cortisol, insulin, aldosterone, epinephrine	Hormones of adrenal glands	Insulin
Adrenalin, penicillin, insulin, thyroxine	Hormones	Penicillin

C. 1. Glucagon

2. Stimulates glycogen breakdown

3. Adrenal medulla

4. Prepares body for fight or flight situation

5. Thyroid gland

6. Regulates basal metabolism by stimulating rate of cellular oxidation.

7. Anterior lobe of pituitary gland

8. In males, it stimulates the secretion of testosterone. In females, it stimulates the secretion of oestrogen and progesterone

9. Glucocorticoids

10. Regulates the metabolism of protein, fats and carbohydrates.

D. 1. Thyroid

2. Thyroxine

3. Pituitary

4. In males – stimulates spermatogenesis. In females – stimulates development of follicle cells.

5. Andrenal medulla

6. Adrenalin

7. Anterior pituitary

8. Stimulates thyroid gland to produce thyroxine

E. 1. Pituitary gland.

It lies just below the hypothalamus (the mid brain) connected to it by a stalk-like structure.

2. ii. Posterior lobe of pituitary

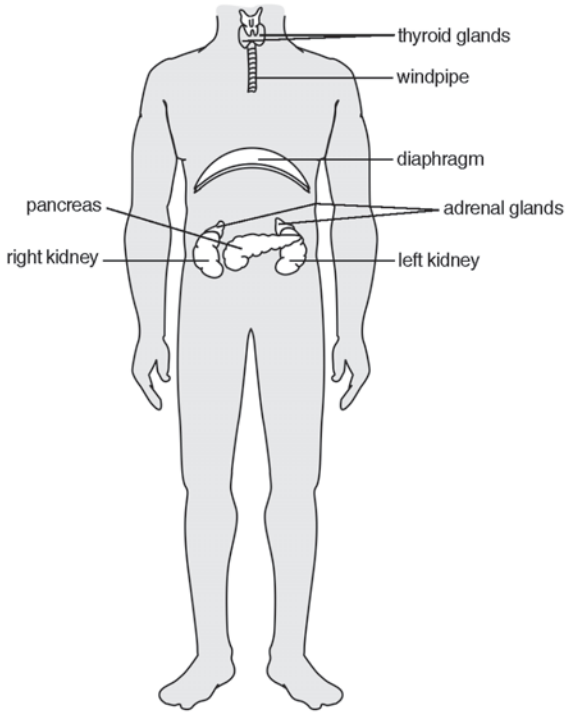
iii. Hypophyseal stalk

3. The posterior lobe of pituitary secretes oxytocin and antidiuretic hormone (ADH).

Undersecretion of ADH causes diabetes insipidus.

Oxytocin controls contraction of uterine muscles at the time of childbirth. It also helps in milk ejection from mammary glands. The undersecretion of the hormone will cause hindrance in the above-mentioned functions.

F.



1. The thyroid gland produces the hormone thyroxine.

Thyroxine stimulates rate of cellular oxidation and regulates basal metabolism.

2. A child suffers from cretinism due to hyposecretion of thyroxine.

3. Adrenal glands secrete:

- Glucocorticoids which regulate the metabolism of protein, fats and carbohydrates in the body and the level of blood sugar.
- Mineralocorticoids which control reabsorption of sodium in urinary tubules and maintains Na^+ and K^+ ratio in the extracellular and intracellular fluids.
- Adrenalin and noradrenalin together control emotions, fear, anger, blood pressure, heartbeat, respiration and relaxation of smooth muscles. Adrenalin is also known as emergency hormone as it prepares body for fight or flight situation.

G. 1. Thyroid gland **2.** Thyroxine hormone

3. Iodine **4.** Cretinism

5. Exopthalmic goitre

H. 1. Pituitary gland

It lies just below the hypothalamus

2. Pituitary gland is also known as master gland because it controls the functioning of all other endocrine glands. Most hormones secreted by pituitary stimulate other glands to produce their hormones.

3. Antidiuretic hormone (ADH) or vasopressin

Refer to sol. A. 3, (III. short answer type questions)

4. Hormones are chemical secretions secreted by specific endocrine glands, which are carried by blood to the target organs elsewhere in the body to stimulate a specific activity.

Tropic hormones are those hormones that stimulate other endocrine glands to secrete their own specific hormones.

5. a. Oxytocin- Posterior lobe of pituitary

b. ACTH- Anterior lobe of pituitary

c. GH- Anterior lobe of pituitary

I. 1. Gland 1- Pituitary; gland 2- Thyroid; gland 3- Pancreas; gland 4- Adrenalin

2. Thyroxine.

It stimulates the rate of cellular oxidation and regulates basal metabolism.

3. Islets of Langerhans

4. Pituitary gland (labeled 1) is also known as master gland because it controls the functioning of all other endocrine glands.

Hypothalamus produces hormones that control the secretions of the anterior pituitary gland.

5. Adrenal gland secretes 'emergency hormone' or adrenalin.

CHAPTER – 13

REPRODUCTIVE SYSTEM

P. 184 Check Your Progress 1

A. Answer the following.

1. Reproduction is a process by which a living organism is able to produce more of its own kind. Reproduction involves the transmission of genetic material from the parents to the children, thereby ensuring that characteristics not only of the species but also of the parents, are perpetuated.

2. The age of puberty in males is 13–14 years and in females is 12–13 years.

3. Seminiferous tubules

4. a. Organs of the male reproductive system – a pair of testes, a pair of epididymis, a pair of sperm duct (vasa deferentia; singular : vas deferens), urethra, penis and accessory glands.

b. Organs of the female reproductive system – a pair of ovaries, a pair of Fallopian tubes, uterus, vagina and external genitalia.

5. There are three accessory glands in males. These include – seminal vesicles, prostate gland and Cowper's glands.

6. a. Secondary sexual characteristics in males – deepening of voice, widening of shoulders, and appearance of beard and moustache.

b. Secondary sexual characteristics in females – growth of axillary and pubic hair, widening of pelvis and hip, and enlargement of breasts.

7. a. Seminal vesicles: It allows transportation of sperms that descend from the testis and to secrete seminal fluid. Sperms get active when mixed with seminal fluid.

b. Prostate gland: It surrounds the upper part of the urethra. It secretes alkaline fluid which keeps the sperms alive by nutralizing the acid in the female tract and helps them to swim vigorously.

c. Cowper's glands or Bulbourethral glands: These paired glands lie below the prostate gland and join the urethra at a short distance from that of the prostate gland. They secrete a white, viscous, alkaline secretion resembling mucus which acts as a lubricant.

d. Uterus: Inner lining of uterus receives, protects and nourishes embryo; contractions of muscular wall expel baby during birth (parturition).

e. Ovaries: They produce ova and secrete female sex hormones, oestrogen and progesterone.

P. 189 Check Your Progress 2

A. Answer these questions.

1. Placenta serves as a tissue through which oxygen and food are supplied from the maternal blood to the foetus. Oxygen and nutrients (glucose, amino acids and salts) from the mother's blood vessels diffuse across into the embryonic blood vessels through placenta. Placenta is permeable to respiratory gases, nutrients and antibodies.

2. a. Implantation: Fixing of morula in the endometrium wall of the uterus is called implantation.

b. Placenta: Placenta is an association between maternal and foetal tissue meant for physiological exchange. Oxygen and nutrients (glucose, amino acids and salts) from the mother's blood vessels diffuse across into the embryonic blood vessels through placenta. On the other hand, carbon dioxide and nitrogenous waste from the embryo pass to the mother's blood vessels through placenta.

c. Morula: Fertilization occurs in the Fallopian tube. The zygote immediately begins to divide and forms a mass of cells called morula.

d. Amnion: From the first few weeks of development, the embryo in the uterus is enclosed in a sac called amnion which is filled with amniotic fluid.

3. Fertilization: The act of fusion of male gamete (sperm) and female gamete (egg) to form zygote is called fertilization. Fertilization occurs in the fallopian tube.

4. Placenta produces hormones like, progesterone, oestrogen, hCG etc.

5. Carbon dioxide and nitrogenous waste from the embryo pass to the mother's blood vessels through the placenta.

B. 1. Follicle

2. Graafian follicle

3. Ovulation

4. Fallopian tube

5. Implantation

P. 190 EXERCISES

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. c **2.** b **3.** b **4.** c **5.** d

6. c

II. Very Short Answer Type Questions

A. Mention if the following statements are True (T) or False (F) and rewrite the wrong statements in the correct form by changing only one/two words.

1. False

Gestation in human female is completed in about 280 days.

2. False

Fertilization occurs in the Fallopian tube.

3. False

Oxygen and nutrients diffuse from mother's blood into foetus's blood through placenta.

4. True

5. False

Placenta serves to provide oxygen to the foetus.

6. False

One egg is released from alternate ovary every month and can be fertilized.

B. Choose the odd one out from the following terms given and name the category to which the others belong.

1. Odd term- ureter; Category- Female reproductive system

2. Odd term- uterus; Category- Male reproductive system

3. Odd term- cervix; Category- Internal structure of testis

4. Odd term- leydig cell; Category- Internal structure of ovary

5. Odd term- corpus luteum; Category- Developing foetus

6. Odd term- insulin; Category- Hormones related to pregnancy and child birth

7. Odd term- seminiferous tubule; Category- Accessory glands in male reproductive system

C. Match the terms of Column A with Column B and write down the matching pairs.

1. c **2.** d **3.** b **4.** a **5.** f

6. g **7.** e

D. Name the following.

1. Inguinal canal **2.** Gestation period

3. Fallopian tube **4.** Uterus

5. Testis **6.** Menarche

7. Placenta **8.** Fallopian tube

9. Menopause **10.** Umblical cord

E. Given below are certain biological statements which are incomplete and hence incorrect. Rewrite the correct form of the statement by inserting a suitable word/words at the right place. Underline the inserted word/words.

1. Zygote is the product of egg nucleus and sperm nucleus.

2. Spermatozoa are deposited high up in the epididymis.

3. The sperm and egg (ovum) meet in the Fallopian tube and the two fuse to form a zygote.

F. Give one point of difference between the following pairs on the basis of what is indicated in brackets.

1. Prostate gland secretes alkaline fluid which is discharged into the urethra. This fluid keeps the sperms alive and helps them to swim vigorously.

Cowper's glands or Bulbourethral glands secrete a white, viscous, alkaline secretion resembling mucus which acts as a lubricant.

2. A human sperm has three main parts – head, neck and tail. The tip of a sperm is covered by a cap-like structure called acrosome.

Human ovum is extremely minute, measuring about 0.2 mm in diameter, is generally round or spherical in shape and covered by a thin plasma membrane and enclosed within the egg follicles of the ovaries.

3. Oestrogen promotes the development of female secondary sexual characteristics and are also involved in the thickening of the endometrium of uterus.

Progesterone stimulates the growth of a thick endometrial lining in the uterus where the fertilized egg can grow and helps in breast milk formation. It also helps the endometrium to secrete nutrient-rich food and sustain the embryo until the placenta takes over.

4. Seminiferous tubules are involved in the formation of spermatozoa.

Epididymis stores spermatozoa (sperms) and serves as a passage for their transport from the testis.

5. Corpus callosum is the nerve fibres that join the cerebral hemispheres whereas corpus luteum is a hormone secreting body in female reproductive system after ovulation.

6. The function of sperm duct is to transport sperm cells that have been released during mating to the urethra. Fallopian tube transports the ova from the ovary to the uterus every month. Also, it is the site of fertilization where egg and sperm unite.

G. Given below are sets of terms. In each case, rewrite the terms in correct order so as to be in logical sequence. One has been done for you.

1. Menstrual phase, follicular phase, ovulatory phase, luteal phase
2. Testes, sperms, sperm duct, penis, semen
3. Ovulation, fertilization, implantation, gestation, childbirth
4. Ovary, oviduct, cervix, vagina
5. Puberty, menstruation, ovulation, menopause
6. Sperm duct, sperm, urethra, coitus, vagina, ovum

H. Complete the following statements by choosing the correct alternatives from those given in the brackets.

1. Fallopian tube
2. amniotic fluid
3. 6
4. progesterone

III. Short Answer Type Questions

A. Differentiate between the following.

1.

Implantation	Pregnancy
It is the fixing of morula in the endometrium wall of the uterus.	Pregnancy is the time period from implantation of morula up to the child birth.

2.

Graafian follicle	Corpus luteum
Graafian follicle is the final stage in the maturation of an ovum inside the ovary.	The cells of the ruptured follicle form the corpus luteum.
It produces a hormone, oestrogen.	It secretes the hormone progesterone.

3.

Amnion	Chorion
From the first few weeks of development, the embryo in the uterus is enclosed in a sac called amnion which is filled with amniotic fluid.	Other than the amnion, there is one more layer, chorion that helps in the formation of embryonic part of the placenta.

4.

Identical twins	Fraternal twins
Identical twins are the result of a fertilized egg separating into two sets of cells, both of which continue to divide, so two identical embryos come from the same egg and sperm.	Non-identical twins or fraternal twins occur when two eggs are produced at the same time and each is fertilized by a different sperm.
The twins look exactly alike.	These twins do not resemble each other physically.

5.

Menarche	Menopause
The onset of menstruation in a female is called menarche.	The permanent stoppage of menstruation in a female is called menopause.
It starts at an age of about 12–13 years.	It occurs at an age of about 45–50 years.

6.

Semen	Sperm
The secretions of various accessory glands along with sperms form the semen.	The spermatozoa or sperms are minute gametes produced by the testes in males. They are immotile when stored in the epididymis but get activated and motile by the secretions from the accessory reproductive glands in males.

B. Describe briefly the functions of the following.

1. **Sperm duct:** The sperm duct or ejaculatory duct opens into the urethra. The inguinal canal

allows the descent of the testes along with their ducts, nerves and blood vessels.

2. **Placenta:** Placenta is an association between maternal and foetal tissue meant for physiological exchange. Oxygen and nutrients (glucose, amino acids and salts) from the mother's blood vessels diffuse across into the embryonic blood vessels through placenta. On the other hand, carbon dioxide and nitrogenous waste from the embryo pass to the mother's blood vessels. Placenta is permeable to respiratory gases, nutrients and antibodies. The membrane prevents harmful material from reaching the embryo. It does not allow the passage of germs from the mother to the embryo.
3. **Inguinal canal:** Each epididymis continues from its lower end as a vas deferens. It enters the abdominal cavity through the inguinal canal. The inguinal canal allows the descent of the testes along with their ducts, nerves and blood vessels.
4. **Prostate gland:** It surrounds the upper part of the urethra. It secretes alkaline fluid which is discharged into the urethra. This fluid keeps the sperms alive and helps them to swim vigorously.
5. **Seminal vesicles:** The function of seminal vesicles is to allow transportation of sperms that descend from the testis and to secrete seminal fluid. The seminal fluid is a viscous fluid that provides nourishment to the sperms.
6. **Fallopian tubes (oviducts):** Fertilization occurs in the Fallopian tube. It also conveys the fertilized egg or embryo to the uterus.
7. **Leydig cells:** Leydig cells are interstitial cells located adjacent to the seminiferous tubules in the testes. Function of Leydig cells is to produce the testosterone.
8. **Corpus luteum:** During ovulation period, the Graafian follicle ruptures to release the ovum. The cells of the ruptured follicle form the corpus luteum that secretes the hormone, progesterone.

C. Answer these questions.

1. Reproduction is a process by which a living organism is able to produce more of its own kind. Reproduction involves the transmission of genetic material from the parents to the children, thereby ensuring that characteristics not only of the species but also of the parents, are perpetuated.
2. Mesovarium
3. Organs of the male reproductive system – a pair of testes, a pair of epididymis, a pair of sperm duct (vasa deferentia; singular : vas deferens), urethra, penis and accessory glands.
4. The number of sperms is always much more than the eggs because it is very difficult for the sperms to reach the Fallopian tube and only 0.02% of them actually reach the Fallopian tube to fertilize the egg. On the other hand, an egg is very well-protected and need not be produced in large numbers.
5. The prostate gland secretes an alkaline fluid which is discharged into the urethra. This fluid keeps the sperms alive and helps them to swim.
6. Testes in human males are present in scrotal sac or scrotum. In the scrotum, the temperature is about 2°C less than the body temperature. This temperature is suitable for the development of spermatozoa. At higher temperature the spermatozoa would die. The temperature of testicular sac, i.e. scrotum is regulated by contraction and relaxation of wall of the scrotum. Hence, the testes are located in scrotal sac outside the abdomen in human males.

IV. Long Answer Type Questions

A. Answer these questions.

1. The developing embryo is attached to the uterus by an organ called placenta. Placenta is an association between maternal and foetal tissue meant for physiological exchange.

   Placenta serves as a tissue through which oxygen and food are supplied from the maternal blood to the foetus. Oxygen and nutrients (glucose, amino acids and salts) from the mother's blood vessels diffuse across into the embryonic blood vessels through placenta.

   On the other hand, carbon dioxide and nitrogenous waste from the embryo pass to the mother's blood vessels.

   Placenta is permeable to respiratory gases, nutrients and antibodies. The membrane prevents harmful material from reaching the embryo. It does not allow the passage of germs from the mother to the embryo.
2. There are four phases of menstrual cycle as given below.
   i. **Menstrual phase:** The menstrual cycle starts with the menstrual flow, during which the cellular lining of the uterus, with blood flow, is shed off. This process continues

for 3–4 days. During menstrual phase the ovary starts to form a new egg in follicle.

ii. **Follicular phase:** From the 5th up to the 13th day of the onset of the menstrual cycle, growth and maturation of the Graafian follicle takes place. Graafian follicle produces oestrogen hormone that stimulates the uterus to prepare itself to receive the fertilized ovum. The cells lining the uterus grow rapidly and develop a dense network of blood vessels.

iii. **Ovulatory phase:** In this phase, ovulation takes place. The Graafian follicle ruptures to release the ovum. The cells of the ruptured follicle form the corpus luteum which secretes the hormone, progesterone. The ovum reaches the uterus via the Fallopian tube on the 13th or 14th day and remains there up to the 16th day (for 48–72 hours).

iv. **Luteal phase:** If the ovum does not get fertilized by any sperm during ovulatory period then it starts degenerating. At the end of the 28th day this ovum is rejected along with the uterine lining. This marks the start of a slow disintegration of the thickened lining of the uterus and the next menstrual cycle.

3. Sperms produced in seminiferous tubules in testes

↓

Sperms pass to efferent ducts through network of tubules

↓

Vas efferens

↓

Epididymis (sperms are stored here)

↓

Vas deferens (sperm ducts)

↓

Urethra in penis

4. Ovaries begin to mature many eggs each month. Due to hormonal stimulation, when one egg has completed maturation and been released from the ovary, the ovaries release a certain hormone that causes the other egg that are in the midst of being matured, to stop the maturation process, and they shrink and die. Therefore one egg is released at a time by the ovary although many eggs are matured each month.

V. Structured/ Application/ Skill Type Questions

A.

Structure	Location	Sperm
Epididymis	Scrotal sac	Stores spermatozoa and serves as a passage for their transport from the testis
Seminiferous tubules	Testes	Manufactures sperms
Prostate gland	Urethra	Secretes alkaline fluid which keeps the sperms alive and helps them to swim
Acrosome	Tip of the sperm	Helps the sperm to penetrate inside the egg during fertilization
Oviduct	Tube connecting ovaries to the uterus	Site of fertilization
Umbilical cord	Blood vascular connection between foetus and uterine wall	Carry nourishment and oxygen from placenta to the baby and returns waste products to the placenta from the foetus

B. 1. Refer to fig. 13.5b on page 180 of the textbook.

2. Placenta: Placenta serves as a tissue through which oxygen and food are supplied from the maternal blood to the foetus. Oxygen and nutrients (glucose, amino acids and salts) from the mother's blood vessels diffuse across into the embryonic blood vessels through placenta. On the other hand, carbon dioxide and nitrogenous waste from the embryo pass to the mother's blood vessels. Placenta is permeable to respiratory gases, nutrients and antibodies. The membrane prevents harmful material from reaching the embryo. It does not allow the passage of germs from the mother to the embryo.

Amniotic fluid: Acts as a shock-absorber and helps to protect the embryo from damage.

3. X – Fallopian tube

C. 1. Refer to fig 13.1b on page 177 of the textbook.

2. Testosterone

3. The number of sperms is always much more

than the eggs because it is very difficult for the sperms to reach the Fallopian tube and only 0.02% of them actually reach the Fallopian tube to fertilize the egg. On the other hand, an egg is very well-protected and need not be produced in large numbers.

4. The function of seminal vesicles is to allow transportation of sperms that descend from the testis and to secrete seminal fluid. The seminal fluid is viscous fluid that provides nourishment to the sperms.

D. 1. **i.** Placenta
ii. Muscular wall of uterus
iii. Umbilical cord
iv. Amniotic fluid
v. Mouth of uterus

2. Gestation period
3. 280 days
4. • Oxygen and nutrients (glucose, amino acids and salts) from the mother's blood vessels diffuse across into the embryonic blood vessels through placenta. On the other hand, carbon dioxide and nitrogenous waste from the embryo pass to the mother's blood vessels.
   • Placenta is permeable to respiratory gases, nutrients and antibodies. The membrane prevents harmful material from reaching the embryo. It does not allow the passage of germs from the mother to the embryo.
5. Progesterone
6. From the first few weeks of development, the embryo is enclosed in a sac called amnion which is filled with amniotic fluid (iv). This fluid acts as a shock-absorber and helps to protect the embryo from damage.

E. 1. **i.** Fallopian tube
ii. Funnel of oviduct
iii. Vagina
iv. Anus
v. Ovary
vi. Uterus
vii. Urinary bladder
viii. Urethra

2. The Graafian follicle produces a hormone, oestrogen. This hormone stimulates the uterus to prepare itself to receive the zygote after fertilization of the ovum. The cells lining the uterus grow rapidly and develop a dense network of blood vessels. The Graafian follicle ruptures to release the ovum. The ovum reaches the Fallopian tube for fertilization.
3. If the ovum receives a sperm during this period, the two fuse to form a zygote. This act of fusion of male gamete (sperm) and female gamete (egg) to form zygote is called fertilization. The zygote immediately begins to divide and forms a mass of cells called morula. It continues to re-divide and is called blastocyst. It passes down to the uterus and fixes itself to the endometrium wall of the uterus. This fixing of morula in the endometrium wall of the uterus is called implantation.
4. If the ovum does not get fertilized by any sperm during ovulatory period then it starts degenerating. At the end of the 28th day, this ovum is rejected along with the uterine lining. This marks the start of a slow disintegration of the thickened lining of the uterus. In a menstrual flow, the cellular lining of the uterus is shed off along with blood.

F. 1. **i.** Seminiferous tubules
ii. Testicular lobe
iii. Epididymis
iv. Vas deferens

2. Part **i.** seminiferous tubules are involved in the formation of spermatozoa.

   Part **iii.** epididymis stores sperms and serves as a passage for their transport from the testis.
3. In the scrotum, the temperature is about 2 °C less than the body temperature. This temperature is suitable for the development of spermatozoa. At higher temperature, the spermatozoa would die.
4. The inguinal canal allows the descent of the testes along with their ducts, nerves and blood vessels.
5. The secretions of various accessory glands along with sperms form the semen.

CHAPTER – 14

POPULATION – PROBLEMS AND CONTROL

P. 196 Check Your Progress 1

A. Answer these questions.

1. Six factors which are responsible for a rapid rise of Indian population in the recent times:

- Advancement in agriculture
- Advancement in medicine
- Illiteracy
- Desire of a male child
- Religious and social customs
- Industrialization

2. S-shaped curve is shown by human population in recent times.

B. Give the technical terms for the following.

1. Population

2. Population density

3. Growth rate of population

4. Demography

5. J-shape

P. 198 Check Your Progress 2

A. Answer these questions.

1. Population, environment and development are very much interrelated. With the population growth, uses of natural resources are also increased. The growth in urban population stresses the urban environment by increasing the number of squatter settlements, and slum dwellers in slums with no proper sanitation facilities, causing pollution of air, water and soil. Development activities like, construction of roads, increased agricultural production, industrial materials are necessary for economic development. Development also impose some negative effects on environment. To meet the requirements of the increasing population, industry has expanded and industrial growth has made many Indian cities, centres of health hazards, due to pollution of groundwater, air, water and waste hazards.

2. A high population growth in India has drastic environmental implications like over-crowding, decrease in per capita income, and depletion of food, land, fuel and consumer resources. Like atomic explosion, population explosion is also equally harmful for our existence.

3. Due to increasing population, farmlands in the rural areas can no longer support the living expenses of additional people. This has resulted in a continuous migration of a large number of people to urban areas with the hope of finding jobs and a better life. This has led to an increase in the urban population. The growth in urban population stresses the urban environment by increasing the number of squatter settlements, and slum dwellers in slums with no proper sanitation facilities, causing pollution of air, water and soil.

4. The increasing population in India has changed our economic standards and the standard of living and problems posed are of two types:

i. Problems posed to large families – The family members may not get enough food. This will lead to malnutrition and deficiency diseases. More family members means more space. The family may not afford a good, clean and spacious house. Proper educational facilities may not be provided to the children. The large family will need more resources. This will lead to immense economic pressure on the parents affecting the quality of life.

ii. Problems posed to the country – A high population growth in India has drastic environmental implications like over-crowding, decrease in per capita income, and depletion of food, land, fuel and consumer resources.

P. 200 Check Your Progress 3

A. Answer the following.

1. a. Vasectomy

b. Tubectomy

2. In males, condom or nirodh.

In females: Diaphragm or cervical cap, Intra uterine device (IUD) or loop, Spermicides, Oral contraceptives or pills.

3. Intra uterine device (IUD) or loop – It is a very effective method to avoid conception. IUD or loop is made of plastic or stainless steel. It is inserted in the uterus. Its insertion causes certain secretions which prevent the implantation of embryo in the uterine wall.

4. Medical Termination of Pregnancy (MTP).

MTP should be considered as a last step that can be taken for termination of pregnancy. It should be taken only in case of an emergency or if there is an evidence of a genetic disease in

the foetus and removal of foetus is necessary for the life of the mother. Abortion can be legally permitted only within 5 months of pregnancy by a trained doctor on the request of the would be mother. Even husband's consent is necessary for this.

P. 201 EXERCISES

I. Very Short Answer Type Questions

A. Define the following terms.

1. **Demography:** The statistical study of human population of a region is called demography. It deals with population growth, its ratio of age and sex and population density in a particular region.
2. **Birth rate or natality:** The number of live births per 1000 individuals of population per year.
3. **Census:** The official data of registered number of people (taking into account birth rate and death rate) in a selected area.
4. **Death rate or mortality:** The number of deaths per 1000 individuals of population per year.
5. **Vasectomy (for males):** This is a surgical method of sterilization in males. In this method, each sperm duct or vas deferens is cut and tied (ligated) at both ends by a thread. By doing so the sperms cannot reach the ejaculatory duct and hence cannot be deposited in the female reproductive tract during intercourse.
6. **Population density:** The number of individuals per square kilometre (km^2) at any given time.

B. Name the following.

1. Population density
2. Tubectomy
3. Demography
4. Census
5. Rhythm method of contraception

C. Mention if the following statements are True (T) or False (F). Rewrite the wrong statements correctly.

1. False

   Pregnancy in women can be prevented by the method of tubectomy.
2. False

   Death rate is the number of deaths per 1000 individuals of population per year.
3. False

   Vasectomy involves the cutting and tying of the vas deferens in a male.
4. True

II. Short Answer Type Questions

A. Write brief statements explaining the following.

1. Resources cannot keep pace with the rising population because:
   - Population grows by geometric progression but food production increases by arithmetic progression.
   - Natural resources like, fossil fuel is limited in amount. Indiscriminate use of fossil fuel due to the need of overpopulation will cause depletion of that natural resource.
2. Increasing population leads to depletion of energy resources. Energy is needed for almost all our day-to-day activities whether for cooking, transportation, factories or at home. Presently we are largely dependent on fossil fuels such as coal and petroleum for energy. At the current rate of consumption, our fossil fuel reserves will be exhausted within a few hundred years. Increasing population will need even more and more energy. This will further complicate the situation.
3. Industrialization has helped in immense population growth in India. Growth in human population has resulted in increased requirements of food, shelter and day-to-day products. Industrialization meets the requirements and also provides increased employment and thus increasing community income. Due to rapid industrialization human population started to grow fast.

B. Give technical term for the following.

1. Population density
2. Vasectomy
3. Vasectomy
4. Tubectomy
5. Census

C. Rewrite the sentence by inserting the keyword in the space provided at '↑'.

Birth rate is the number of 'live' births per thousand of the population per year.

D. Differentiate between the following.

1.

Birth rate	Death rate
The number of live births per 1000 individuals of population per year.	The number of deaths per 1000 individuals of population per year.

2.

Vasectomy	Tubectomy
It is a surgical method of sterilization in males.	It is a surgical method of sterilization in females.
In this method, each sperm duct or vas deferens is cut and tied (ligated) at both ends by a thread.	It involves cutting of the Fallopian tubes or oviducts and tying the ends to prevent passage of ova down the Fallopian tubes.

3.

Oral contraceptive pills	Spermicides
These prevent ovulation in females.	It is a chemical method of contraception.
Birth control pills contain synthetic hormones resembling oestrogen and progesterone which prevent ovulation but allow monthly shedding of the uterine lining through menstrual bleeding.	In this method, strong spermicidal (sperm-killing) chemical creams, jellies, etc. are applied in the vagina before copulation, which kill the sperms and prevent fertilization.

4.

Diaphragm	Intra uterine device (IUD)
It is a large thin rubber cap fixed on a flexible metal ring.	It is made of plastic or stainless steel.
It is fitted over the cervix of uterus in a woman's body by a doctor to prevent the passage of sperms into the cervical canal.	It is inserted in the uterus. Its insertion causes certain secretions which prevent the implantation of embryo in the uterine wall.

5.

Demography	Population density
It is the statistical study of human population of a region. It deals with population growth, its ratio of age and sex and population density in a particular region.	It denotes the number of individuals per square kilometre (km^2) at any given time.

6.

Natality	Mortality
The number of live births per 1000 individuals of population per year.	The number of deaths per 1000 individuals of population per year.

E. Answer these questions.

1. As per 2011 census of India, approximate population of India was 121.02 crores.

The population has increased by 17.83%

2. In a small family, the advantages are:

- Proper care can be taken for the nutrition of the child and a pregnant mother.
- Individualized attention and subsequent care of the child to ensure his survival by means of immunization, etc., good quantity of food and proper education.

3. A corresponding method of sterilization in females is called tubectomy. It involves cutting of the Fallopian tubes or oviducts and tying the ends to prevent passage of ova down the Fallopian tubes. In this method, the eggs continue to be released but do not pass through the oviducts and hence, no fertilization takes place. Further when sperms are deposited during intercourse they cannot travel to the oviduct and hence no fertilization can occur.

4. J-shaped population growth curve: During ideal conditions, a population keeps on increasing exponentially and becomes double in size during a constant period of time. The growth is exponential and the curve is known as J-shaped (Fig 14.2, P 196).

S-shaped (sigmoid) population growth curve: In this population growth curve, the population first increases slowly and then more rapidly. Finally it slows down and fluctuates within a narrow range due to limitation by environmental factors. Thus, an S-shaped (sigmoid) curve is obtained showing the maximum population size, an environment can sustain (Fig 14.3, P. 196).

5. The current legal age at marriage for girls in India is 18 years and for boys is 21 years.

III. Long Answer Type Questions

A. Answer these questions.

1. Knowledge of the process of reproduction helps in reducing the population growth by natural methods of contraception. If copulation is avoided for a few days, i.e. at +3 days of the first day of ovulation which is likely to be the time period when the ovum is available in the oviduct,

fertilization can be avoided. This is called rhythm method of contraception. Another natural method of contraception is coitus interruptus. In this method, the penis is withdrawn from the vagina prior to ejaculation. All these methods require extreme self-discipline and self-control.

2. Due to increasing population, farmlands in the rural areas can no longer support the living expenses of additional people. This has resulted in a continuous migration of a large number of people to urban areas with the hope of finding jobs and a better life. This has led to an increase in the urban population. The growth in urban population stresses the urban environment by increasing the number of squatter settlements, and slum dwellers in slums with no proper sanitation facilities, causing pollution of air, water and soil. Increasing population also demands more food and more natural resources. A large number of trees are cut down to increase farmland which also cause tremendous negative impact on environment.

Also, in order to meet the food requirement of the ever-increasing population of the country new agricultural techniques have been adopted. The application of modern scientific techniques, agrochemicals (fertilizers and pesticides), expansion in irrigation facilities and the development of high-yielding varieties of seeds have created hazardous environmental problems.

Growth in human population has resulted in increased requirements of food, shelter and day-to-day products. To meet these requirements, industry has expanded and industrial growth has made many Indian cities centres of health hazards due to pollution of groundwater, air, water and waste hazards.

3. Due to increasing population and population explosion, farmlands in the rural areas can no longer support the living expenses of additional people. Growth in human population has resulted in increased requirements of food, shelter and day-to-day products. The growth in urban population stresses the urban environment by increasing the number of squatter settlements, and slum dwellers in slums with no proper sanitation facilities, causing pollution of air, water and soil. All these result in deficiency of food that leads to poverty and unhygienic environmental conditions that cause deadly diseases. As a result there will be a population crash (significant decrease in population). Therefore population explosion and poverty are proportional to one another.

4. Overpopulation has occurred in the world due to:

- Major increase in births and a decline in mortality rates.
- An increase in immigration.
- Better healthcare facilities for all.

IV. Structured/ Application/ Skill Type Questions

A. 1. X, 1991—2001

2. X, 1981—1991

3. Y, 1981, 2001

B. 1. The diagram represents the process of sterilization in females. The process is named tubectomy. Tubectomy is a process applicable in females.

2. i. Vagina

ii. Fallopian tube (oviduct)

iii. Cut portion of fallopian tube

3. Part **iii.** denotes cutting of the Fallopian tubes or oviducts and tying the ends to prevent passage of ova down the Fallopian tubes. In this method, the eggs continue to be released but do not pass through the oviducts and hence, no fertilization takes place.

C. 1. i. Vas deferens (sperm duct)

ii. Urethra

iii. Testis

iv. Seminal vesicle

2. At part **(v)** each sperm duct or vas deferens was cut and tied (ligated) at both ends by a thread. The small piece between the two ligatures was then removed.

3. After the surgical method is performed, the sperms will not reach the ejaculatory duct and hence cannot be deposited in the female reproductive tract during intercourse.

4. The technique is called vasectomy. The technique used in females for similar purpose is called tubectomy.

CHAPTER – 15

HUMAN EVOLUTION

P. 206 CHECK YOUR PROGRESS 1

A. Answer the following.

1. Evolution is defined as a naturally occurring slow, continuous and irreversible process of change in the organism generation after generation.

2. a. *Homo sapiens fossilis*

b. *Dryopithecus*

3. Main stages of human evolution – *Australopithecus, Homo habilis, Homo erectus, Homo sapiens neanderthalensis, Homo sapiens fossilis, Homo sapiens sapiens*

P. 208 CHECK YOUR PROGRESS 24

A. Answer these questions.

1. a. Lamarck's theory of inheritance of acquired characters

b. Darwin's theory of natural selection

2. The case of the peppered moth in England with an increase in the number of dark-coloured moths due to industrial pollution is referred as industrial melanism.

P. 208 EXERCISES

I. Multiple-Choice Questions

A. Choose the most appropriate answer.

1. b **2.** c **3.** c **4.** b **5.** d

II. Very Short Answer Type Questions

A. Match the following.

1. d **2.** e **3.** a **4.** b **5.** c

B. Fill in the blanks with appropriate words.

1. Charles Darwin

2. slow, continuous and irreversible

3. Neanderthal

4. Cro-Magnon man

III. Short Answer Type Questions

A. Answer these questions.

1. Evolution is defined as a naturally occurring slow, continuous and irreversible process of change. The process of evolution involves a gradual change or variation in the organisms generation after generation.

2. Evolutionary changes in humans:

- Erect posture (to stand and walk straight)
- Bipedal locomotion (to free forelimbs)
- Forelimbs adapted to hold objects
- Increase in brain size and its complexity (to think intelligently and logically)
- Articulation of speech for better interaction and communication
- Formation of chin
- Reduction in size of canines
- Loss of brow ridges

3. Evolutionary changes in cranial capacity of humans:

- *Australopithecus* and *Homo habilis* had small brains with cranial capacities of 400-600 cc and 650-800 cc respectively.
- Neanderthal man and Cro-Magnon man had cranial capacities of 1300-1600 cc and about 1650 cc respectively.
- The cranial capacity in Modern man is about 1200-1600 cc.

4. Theory of inheritance of acquired characters or Lamarckism stressed on adaptation as means of evolutionary modification. According to his theory,

- every living organism tends to increase volume of its body and hence increase size upto a certain limit.
- The development of an organ is directly proportional to its use or disuse.
- All these changes or variations (called acquired characters) acquired during the life of an individual are transmitted to its offspring, i.e. they are inherited (hence the name theory of inheritance of acquired characters).
- The favourable variations caused by inheritance of acquired characters after long period of time results in evolution of a new species.

5. Characteristics of Neanderthal man:

- Compared to modern humans, they were short and had robust skeletons with muscular bodies.
- They had massive skulls with brain capacity of 1300–1600 cc and were 1.5 metres tall.
- They had protruding face, with thick but rounded brow ridge that lay under a flat and receding forehead and broad nose.

- They had larger teeth than those of modern humans.
- The Neanderthal man lived in caves and built hut-like shelters.
- They were skilled hunters, made flint-flake tools, cared for their sick and buried their dead.

IV. Long Answer Type Questions

A. Answer these questions.

1. According to Darwin's theory,

- Living beings have a biotic or reproductive potential and their number grows geometrically.
- Limited food and space together form major part of carrying capacity of environment, which is maintained by food chains and biogeochemical cycling.
- There is a competition amongst the organisms for obtaining resources. The struggle eliminates the unfit individuals. The fit organisms possess some favourable variations and they survive and reproduce. This is called natural selection.
- The organisms having favourable variations reproduce and pass on these variations to their progenies generation after generation.

2. The case of the peppered moth in England is the most frequently discussed example of natural selection. This refers to an increase in the number of dark-coloured moths due to increased industrial pollution. This is also referred as industrial melanism. Before industrial revolution, dark-coloured moths were hardly known. The light-coloured species were adapted to rest during the day on lichen-covered trunks of trees. But due to increase in sulphur dioxide in air (because of industries), the lichens started to reduce on tree trunks, exposing darker bark which was further darkened by falling smoke particles. Now, the light-coloured species became conspicuous and attracted its predators. Whereas dark-coloured moths were benefited by the dark tree trunks. This made the dark-coloured moths have a higher survival rate. Within a period of few years, the industrial or polluted areas saw that the dark species had almost replaced the light species. Through this, moth showed natural selection at work.

3. Lamarck took the example of giraffe in support of his theory. According to Lamarck, there was a time when the giraffes were short necked. When these short necked giraffe did not find any vegetation to feed on the ground, they tried to reach the upper part of a tree to eat its leaves. Thus, by making continuous efforts, the neck and forelimbs of giraffe started becoming longer gradually. These acquired characters were inherited by the offsprings of the giraffe in successive generations. After a considerable long period of time, the giraffe evolved having a long neck and longer forelimbs than hindlimbs. This is an example of effect of extra use and elongation of certain organs.

4.

Theory of acquired characters	Theory of natural selection
It was proposed by Jean Baptiste Lamarck.	It was proposed by Charles Robert Darwin.
It believed that the use and disuse of an organ leads to acquiring a variation or change in feature of that organ.	It believed that the struggle for food and space eliminates the unfit individuals and favours survival of the fittest.
During its life span, the organism acquires certain new characters due to environmental influences and are called acquired or adaptative characters.	The fit organisms possess some favourable variations and they survive and reproduce. This is called natural selection.
Example: Effect of extra use and elongation of neck of giraffe.	Example: Industrial melanism

CHAPTER – 16

POLLUTION

P. 216 Check Your Progress 1

A. Answer these questions.

1. Automobiles and industries release carbon monoxide in the air as a result of incomplete combustion of fuels like coal, petroleum, diesel and wood charcoal. Other pollutants released from automobiles are hydrocarbons, sulphur, oxides of nitrogen and SPM. Chemicals like hydrogen sulphide are also released from industries.

2. Carbon monoxide is more dangerous than carbon dioxide. It is a poisonous gas leading to respiratory problems. Due to its high affinity for haemoglobin, it replaces oxygen, and reduces oxygen carrying capacity of the blood. It also causes giddiness, headache and heart diseases.

3. Carbon dioxide

4. Carbon monoxide

5. Sulphur dioxide, nitrogen dioxide

6. Smog is a mixture of smoke, dust particles and small droplets of fog. Smog may cause necrosis and develop a white coating on the leaves (silvering) of plants. In human beings and animals, it may cause asthma and allergies.

7. Emissions of sulphur dioxide and oxides of nitrogen from power stations, factories and motor vehicles cause the formation of sulphuric and nitric acids in rain clouds. If rain falls through polluted air, it picks up more of these gases and increases its acidity. This is called acid rain.

Sulphur dioxide (SO_2) and oxides of nitrogen cause acid rain.

8. CFCs and halogen gases.

9. i. Using better-designed equipment and smokeless fuels/hearths in industries and at home.

ii. Using environment friendly fuels, such as compressed natural gas (CNG) in automobiles instead of petrol/diesel.

iii. Planting more and more trees surrounding industrial establishments, along the roadside and in residential area to reduce CO_2 level in the environment.

iv. Strictly adhering to emission-control standards for automobiles – BS-IV norms.

P. 219 Check Your Progress 2

A. Answer these questions.

1. Water pollution may be defined as a change in physical, chemical and biological properties of water by the addition of undesirable substances which may have harmful effects on human and aquatic life.

2. Oil pollution of rivers is caused due to accidental spillage of oils from oil tankers, refineries, offshore drilling and cleaning of fuel tanks of ships. On discharge in water, oil spreads on water and forms a layer of oil (oil slick). This is very harmful to aquatic life and sometimes a large number of fish in the rivers are found dead due to this reason.

3. Three sources of water pollution and the type of pollutants they have:

i. Domestic sewage discharged into rivers without treating it. Phosphate and nitrate ions from excretory wastes of humans and animals pollutes the water. This may cause diseases like typhoid, cholera, dysentery, etc. in the persons drinking such water.

ii. Organic wastes from agricultural fields with phosphate and nitrogen fertilizers that reach lakes, rivers and sea (water becomes deoxygenated and poisonous, thus, cannot support aquatic life).

iii. Industrial wastes (effluents) from urban areas containing high concentration of oil, heavy metals, synthetic detergents and alkalis.

4. Industrial wastes (effluents) from urban areas contain harmful chemicals, oils, heavy metals, radioactive waste and suspended solids which when discharged into water, poison it. Since it is difficult to breakdown waste, they affect the quality of water and pollute it. Thermal pollution is caused by the water which is used as a coolant by power plants, nuclear power plants and industries. When this water (after cooling) returns to the natural streams, it is at a very high temperature, making it inappropriate for use. Radioactive material enters the water through nuclear power plants, by conducting nuclear tests, spillage from industries.

5. On discharge in water, oil spreads on water and forms a layer of oil (oil slick) and gets contaminated. This is very harmful to aquatic life including fish and marine birds and results in the death of sea organisms including fish.

6. Domestic sewage is discharged into rivers without treating it. Phosphate and nitrate ions from excretory wastes of humans and animals pollutes the water. This may cause diseases like typhoid, cholera, dysentery, etc. in the persons drinking or, using such water.

7. Some steps to reduce water pollution in river are listed below:
   - Setting up sewage water treatment plants before its disposal into rivers.
   - Use of septic tanks in houses to avoid direct outlet of faecal matter and other wastes.
   - Avoid contamination of rivers, lakes and ponds by washing clothes, bathing, etc.
   - Not throwing waste food materials, paper, biodegradable vegetables and plastic into open drains.
   - Effluents from distilleries and solid waste containing organic matter diverted to biogas plants to generate energy.
   - Treating industrial effluents before discharging into rivers, separate channels for river and sewage water.
   - Generating public awareness about the maintenance of ponds, river, lakes and wells in rural and urban areas.
   - Biomedical waste like needles, syringes, soiled dressings, etc. to be disposed properly.

P. 221 Check Your Progress 3

A. Answer these questions.

1. Any substance that reduces the productivity of soil is known as soil pollutant and the process, as soil pollution.

2. Soil pollution (also known as land pollution) is mainly caused by the following:
   i. Solid waste (farm and animal manure).
   ii. Agricultural waste like plant remains, fertilizers, pesticides and other chemicals.
   iii. Dead animal carcasses.
   iv. Industrial waste chemicals like fly ash and residues of combustion of solid fuels.

3. Industrial waste chemicals like fly ash and residues of combustion of solid fuels causes soil pollution. Acid rain may also make the soil more acidic. It may cause mineral nutrients to be washed away. It can release toxic chemicals, such as aluminium and mercury into the soil. Thus, acid rain pollutes the soil and makes the soil less fertile.

4.
   - Effluents from industries and factories should not be allowed to enter the soil indiscriminately.
   - Drainage system should be so developed that the polluted water does not get mixed up with the soil.
   - Proper toilet facilities should be provided to all and awareness should be created about the harmful effects of defecation in open places.
   - Fertilizers, pesticides and insecticides should be used judiciously so that excess chemicals are not washed into the soil.
   - Safe methods of disposal of domestic, agricultural and industrial solid wastes should be adopted.

5. The waste materials that can be broken down or decomposed into simple substances in nature, by the action of microorganisms, such as bacteria, in due course of time are called biodegradable waste materials. The biodegradable waste decomposes naturally and becomes harmless to humans, other organisms and environment after some time.

   For example, dead plants and animals (including bones), animal excreta (cattle dung, urine), leather goods, tea leaves.

6. The waste materials that cannot be decomposed to simple, non-poisonous substances in the nature are called non-biodegradable waste materials.

   For example, plastic, polythene bags, synthetic fibres, glass objects.

7. DDT is a non-biodegradable waste since it cannot be degraded or decomposed into simple compounds by the action of microorganisms in nature. Thus, it gets accumulated in the environment and harms humans, other animals, and plants. Thus, DDT has been banned for use in most of the countries.

8. Biodegradable materials: egg shell, butter, leather shoes, coconut.

9. Non-biodegradable materials: silver foil, plastic mugs.

P. 223 Check Your Progress 4

A. Answer the following.

1. Noise pollution can be defined as unwanted or offensive sounds that unreasonably affect our daily activities.

2. i. Road traffic: Road traffic noise is one of the most widespread and growing environmental problems.

   ii. Air and rail traffic: In areas close to the airports and railway tracks, the sound of aeroplanes and trains are major sources of noise pollution.

   iii. Neighbourhood and domestic noise: Barking dogs, car horns, loud music, TVs, loudspeakers, construction and household noise are some of the major sources of noise pollution.

3. Harmful effects of noise pollution on human beings:
   - Noise can affect human health and well-being in a number of ways, including annoyance reaction, sleep disturbance, interference with communication, performance effects, effects on social behaviour and hearing loss.
   - People experiencing high noise levels have increased number of headaches, greater susceptibility to minor accidents, increased reliance on sedatives and sleeping pills, increased mental sickness.
   - Exposure to noise is also associated with a range of possible physical effects including, changes in blood pressure, other cardiovascular changes, problems with the digestive system and general fatigue.
   - Prolonged exposure to noise levels at or above 80 dB can cause deafness because of damage to the organ of Corti in the internal ear.

4. Noise pollution at home can be minimized in following ways:
   - Try not to put the TV on hi-fi speakers.
   - When playing music, turn it down at a reasonable level. Better still use headphones if you want to play your music loud or late at night.
   - Plant trees at roadsides, curtains on the doors and windows, glass panes at the windows etc. to interrupt the path of the noise. This will reduce the noise to some extent.

5. The radioactive substances are generated due to nuclear activities in nuclear reactors and nuclear power plants. The radiations from these radioactive substances harm human health and health of other flora and fauna.

6. There are three types of radiations generated from nuclear activities. They are alpha particles, gamma rays and beta rays.

7. Gamma rays are most harmful to human beings.

P. 223 EXERCISES

I. Very Short Answer Type Questions

A. Name the following.

1. CFCs and halogen gases
2. Carbon monoxide
3. Sulphur dioxide
4. Smog
5. Sulphur dioxide
6. DDT (Dichloro-diphenyl-trichloro ethane)
7. Methyl isocyanide (MIC) gas
8. Gamma rays
9. Euro-Bharat vehicular standards
10. Pollution

B. Give the sources of following pollutants and one major effect on living beings.

Carbon monoxide: Automobiles using diesel and petroleum are the major sources of carbon monoxide. Carbon monoxide combines with the haemoglobin molecules in human blood and causes suffocation.

Carbon dioxide: It is chiefly produced during the combustion of fuels in households, factories, power stations, etc. The rise in temperature due to more CO_2 would cause melting of continental and mountain glaciers leading to flooding of coastal areas of some countries.

Sulphur dioxide: It is produced by the burning of coal in powerhouses and automobiles. This gas interacts in the atmosphere to form fine sulphate particles that can be transported long distances by winds and inhaled deep into people's lungs.

Chlorofluorocarbons: Aerosols are a group of chemicals, which are released into the air with force in the form of vapours or fine mist. Aerosols contain chlorofluorocarbons (CFCs) which cause depletion of the ozone layer. Depletion of ozone layer due to CFCs causes skin cancer as a result of over exposure of the human skin to UV rays.

Fluorides: They are discharged into the atmosphere from the combustion of coal; the production of brick, tiles, enamel frit, ceramics and glass; the manufacture of aluminium and steel; and the production of hydrofluoric acid, phosphate chemicals and fertilizers. Dust containing

fluorides causes dental changes in man either as a contaminant of food or suspended in drinking water.

Nitrous oxide: They are discharged from thermal power stations, factories, automobiles and aircrafts (due to burning of coal and petroleum). Nitrous oxide reduces the oxygen carrying capacity of blood, may cause irritation in eyes and skin cancer in human beings.

C. Explain the following terms.

1. **Pollutant:** The substances that cause undesirable change in the physical, chemical and biological characteristics of our surroundings which adversely affect the natural quality of the environment, human life and other living beings.
2. **Greenhouse effect:** Gases like carbon dioxide, methane, nitrous oxide and chlorofluorocarbons impede the escape of longer, infrared wavelengths from the earth into the space. Thus, resulting in building of heat in lower atmosphere. This is called greenhouse effect.
3. **Biomedical waste:** The waste material generated in hospitals, nursing home etc., containing used needles, syringes, bandages and tissue remains.
4. **Swachh Bharat Abhiyan:** It is a campaign launched by the government of India to make India a clean and green country. It was officially launched by the Prime Minister of India on 2 October 2014 at Rajghat, New Delhi.

D. Fill in the blanks.

1. Acid rain
2. air
3. radiations

II. Short Answer Type Questions

A. Answer these questions.

1. Two sources of air pollution:
   - **i.** Natural sources include forest fires, ash from smoking volcanoes, dust from storm, decay of organic matter and pollen grains floating in air.
   - **ii.** Man-made sources include harmful gases from industries, motor transport emissions, burning of coal and petroleum, burning of garbage, etc.
2. Carbon dioxide is one of the natural gases present in the atmosphere and is used by plants for photosynthesis. It is chiefly produced during the combustion of fuels in households, factories, power stations, etc. and trap heat radiated from earth and lead to increase in earth's temperature.
3. Atmospheric concentrations of carbon dioxide, water, ozone, methane, nitrous oxide and chlorofluorocarbons are key role players in maintaining the global temperature.

   Collectively, these gases act somewhat like a pane of glass in a greenhouse. These impede the escape of longer, infrared wavelengths (heat) from the earth into the space. Thus, heat builds up in the lower atmosphere. This is called greenhouse effect. Greenhouse gases include water vapour (H_2O), ozone (O_3), carbon dioxide (CO_2), and methane (CH_4).
4. Fluorides are natural components of the earth's crust. They are discharged into the atmosphere from the combustion of coal; the production of brick, tiles, enamel frit, ceramics and glass;the manufacture of aluminium and steel; and the production of hydrofluoric acid, phosphate chemicals and fertilzers.

   Plants normally accumulate small amounts of this fluoride. Fluorides are absorbed by leaves (through stomata) and conducted towards the margins of leaves where they accumulate and cause tissue injury. The injury starts as a grey or light-green water-soaked lesion to a reddish brown lesion. The area of the necrotic lesion increases due to continued exposure spreading towards the broad leaves.
5. Two effects of air pollution on human health:
   - **i.** Carbon monoxide combines with the haemoglobin molecules in human blood and causes suffocation.
   - **ii.** Depletion of ozone layer due to CFCs causes skin cancer as a result of overexposure of the human skin to UV rays.
6. CFCs are very stable molecules,and persist for decades and even centuries, once released. When they diffuse into the atmosphere, the intense UV irradiation releases chlorine atoms that destroy ozone. As it is responsible for the depletion of ozone layer, CFCs are banned in many countries.
7. Any substance that reduces the productivity of soil is known as soil pollutant and the process, as soil pollution.

   Soil pollution (also known as land pollution) is mainly caused by the following:
   - Solid waste (farm and animal manure).
   - Agricultural waste like plant remains, fertilizers, pesticides and other chemicals.

- Dead animal carcasses.
- Industrial waste chemicals like fly ash and residues of combustion of solid fuels.
- Domestic garbage, paper pulp, plastic, rubber, cloth, leather, metal scrap and glass.

8. Two advantages of biodegradable waste materials are:

i. The biodegradable waste decomposes naturally and becomes harmless to humans, other organisms and environment after some time. For example, dead plants and animals (including bones), animal excreta (cattle dung, urine) etc. are all biodegradable materials.

ii. Some of the biodegradable wastes can be recycled to restore our natural resources and ecological balance. We may again use the products of recycled materials for our day-to-day activities.

9. PAN (Peroxyacetyl nitrate) is formed due to the photochemical reaction of nitrogen oxides and hydrocarbons. In human beings, it causes stinging of eyes, cough, headache, pulmonary congestion, haemorrhage, dry throat, breathing problems and early ageing of the lung tissues.

10. Emissions of sulphur dioxide and oxides of nitrogen from power stations, factories, and motor vehicles cause the formation of sulphuric and nitric acids in rain clouds. If rain falls through polluted air, it picks up more of these gases and increases its acidity. This is called acid rain.

Two harmful effects of acid rain:

i. Damage to plants: Acid rain causes progressive death of young shoots, leaves turn yellow and fall off, fine root structure is damaged and the whole tree eventually dies.

ii. Damage to soil: Acid rain may make the soil more acidic. It may cause mineral nutrients to be washed away. It can release toxic chemicals, such as aluminium and mercury into the soil. Thus, acid rain could make soil less fertile.

11. In the upper atmosphere, ozone is like a life cover that protects us by screening the dangerous ultraviolet (UV) rays of the sun. Without the ozone layer shield, the organisms on the earth would be subjected to life threatening radiation burns and genetic diseases. A 1 % loss of ozone in the stratosphere results in a 2 % increase in UV rays reaching the earth's surface. This could result in about one million times increase in the human skin cancer worldwide, if protective measures are not taken. Thus, ozone is very important in sustaining life on earth.

12. Depletion of ozone layer in the atmosphere – Causes: The exceptionally cold temperature (–85°C to –90°C) in Antarctica plays a role in ozone layer depletion. Ozone and chlorine containing molecules are absorbed on the surface of ice crystals at high altitudes in Antarctica. In the presence of sun's rays, these chlorine ions are liberated and destructive chemical reactions take place. We also release a variety of chlorine-containing molecules into the atmosphere, the most important for ozone depletion are CFCs and halogen gases. CFCs are stable molecules and persist for long time. When they diffuse into the atmosphere, the intense UV irradiation releases chlorine atoms that destroy ozone.

Effects: At ground level, ozone is a harmful pollutant that damages plants and building materials. Without the proper ozone layer shield, the organisms on the earth would be subjected to life threatening radiation burns and genetic diseases. An increase in the UV radiation reaching the earth's surface could lead to a rise in the air temperature (global warming). Global warming would cause melting of continental glaciers and ice caps. This would cause a rise in the sea level and consequent submergence of coastal lands and lowland countries.

13. Carbon monoxide and oxides of nitrogen

14. In the upper atmosphere, ozone is like a life cover that protects us by screening the dangerous ultraviolet (UV) rays of the sun. Without the ozone layer shield, the organisms on the earth would be subjected to life threatening radiation burns and genetic diseases. Chlorofluorocarbon (CFC) and halogen gases may destroy the natural process.

15. Carbon monoxide is produced as a result of incomplete combustion of fossil fuels like coal, petroleum and wood charcoal. Automobiles using diesel and petroleum are the major sources of carbon monoxide. It is a poisonous gas leading to respiratory problems. When it reaches the blood stream, due to its high affinity for haemoglobin, it replaces oxygen, and reduces oxygen carrying capacity of the blood. It also causes giddiness, headache and heart diseases.

III. Long Answer Type Questions

A. We all know that carbon dioxide causes air pollution. Now answer the following questions.

1. Carbon dioxide is chiefly produced during the combustion of fuels in households, factories, power stations, etc.

2. A rise in atmospheric temperature due to greenhouse effect would cause a decrease in the precipitation and soil moisture content. More CO_2 will dissolve in water and the water in the oceans would be more acidic. This will lead to reduced productivity of the marine ecosystem. The rise in temperature due to more CO_2 would cause melting of continental and mountain glaciers leading to flooding of coastal areas of some countries.

3. There are three primary methods for reducing the amount of carbon dioxide in the atmosphere:

i. Employing energy efficiency and conservation practices;

ii. Using carbon-free or reduced-carbon energy resources which include solar power, wind power, geothermal energy, low-head hydropower, hydrokinetics (e.g., wave and tidal power) and nuclear power.

iii. Capturing and storing carbon either from fossil fuels or from the atmosphere.

B. Air pollution has been a cause of worry to all of us. Write any two effects of air pollution on each of the following.

1. Two effects of air pollution on human health:

i. Carbon monoxide combines with the haemoglobin molecules in human blood and causes suffocation.

ii. Depletion of ozone layer due to CFCs causes skin cancer as a result of over exposure of the human skin to UV rays.

2. Two effects of air pollution on plants:

i. Acid rain causes progressive death of young shoots, leaves are damaged and the whole tree eventually dies.

ii. Acid rain may make the soil more acidic. It may cause mineral nutrients to be washed away. It can release toxic chemicals, such as aluminium and mercury into the soil. Thus, acid rain could make soil less fertile.

3. Two effects of air pollution on weather and climate:

i. Depletion of ozone layer caused by CFCs may change the radiation balance at global level. This may results in an increase in the harmful UV radiation reaching the earth's surface.

ii. Increase in the concentration of CO_2 and other greenhouse gases would cause greenhouse effect. This would lead to an increase in temperature (global warming) and result in climatic changes. Global warming would cause melting of continental glaciers and ice caps. This would cause a rise in the sea level and consequent submergence of coastal lands and lowland countries.

C. Answer these questions.

1. Water pollution may be defined as a change in physical, chemical and biological properties of water by the addition of undesirable substances which may have harmful effects on human and aquatic life.

Example: Industrial waste contain harmful chemicals, oils, heavy metals, radioactive waste and suspended solids which when discharged into water, poison it. Since it is difficult to breakdown waste, they affect the quality of water and pollute it.

The presence of acids/alkalis in water destroys microorganisms, thereby hindering the self-purification process in rivers. Water pollution adversely affects fish and other aquatic life. The toxic materials may enter the food chain and cause serious health hazards in human beings and other aquatic animals.

2. CO_2 in the atmosphere is a key role player in maintaining the global temperature. The greenhouse gases such as CO_2 and methane, produced by burning of fossil fuel, agriculture and deforestation trap heat radiated from earth and lead to increase in earth's temperature. Rays of sunlight penetrate the lower atmosphere and warm the earth's surface. As the concentration of greenhouse gases increases in the atmosphere, the surface temperature of the oceans rises, more water evaporates into the atmosphere and the earth's surface temperature also rises.

3. If a factory is set on the banks of a river, effluents from the factory containing high concentration of oil, heavy metals, synthetic detergents and alkalis, harmful chemicals, will be discharged into water and will poison it. Since it is difficult to breakdown waste, they will affect the quality of water and pollute it. Polluted water cause epidemics, such as cholera, jaundice, dysentery, typhoid and diarrhoea in human beings.

4. The burning of fossil fuels (coal and oil) by power-production companies and industries releases sulphur into the air that combines with oxygen to form sulphur dioxide (SO_2). From these gases, airborne sulphuric acid (H_2SO_4) can be formed when mixed with water vapour in the air to form acid rain which has a pH of 5–5.5 approximately. Acid rain affects marble and limestone primarily in two ways: dissolution and alteration. When sulphuric acids, in acid rain, react with the calcite in marble and limestone, the calcite dissolves. In exposed areas of old marble palaces, we see roughened surfaces, removal of material, and loss of lustre and shine and even the carved details.

5. The contamination will persist when it reaches Colony Q since it is downstream and the wastes will flow along with the running water and in the same direction as the water flows.

6. There are many effects of radiation pollution which may be short term and long term:

   i. The short term effects may be skin burns and skin cancer.

   ii. The long term effects of radiation include gene damage by mutation in genes, cancer of intestine, bone marrow, gonads and spleen.

   iii. Radiation can also cause loss of immunity, loss of hair and chromosomal abnormalities.

IV. Structured/ Application/ Skill Type Questions

A. 1. Air pollution may be defined as the occurrence or addition of foreign particles, gases and other materials into the air, which adversely affect the biological communities (human beings, plants, and animals) and physical surroundings (roads, buildings).

2. **Sulphur dioxide (SO_2):** It mainly reacts with water to form acid rain in the atmosphere and goes into the soil as sulphuric acid. It causes chlorosis and necrosis of vegetation.

   Carbon monoxide (CO): It is a poisonous gas leading to respiratory problems. When it reaches the blood stream in humans, due to its high affinity for haemoglobin, it replaces oxygen, and reduces oxygen carrying capacity of the blood.

   Hydrogen sulphide (H_2S): This gas causes irritation in the eyes and throat, and even causes nausea.

3. Two harmful effects of noise pollution:

   i. Noise can affect human health and well-being in a number of ways, including annoyance reaction, sleep disturbance, interference with communication, performance effects, effects on social behaviour and hearing loss.

   ii. Prolonged exposure to noise levels at or above 80 dB can cause deafness because of damage to the organ of Corti in the internal ear.