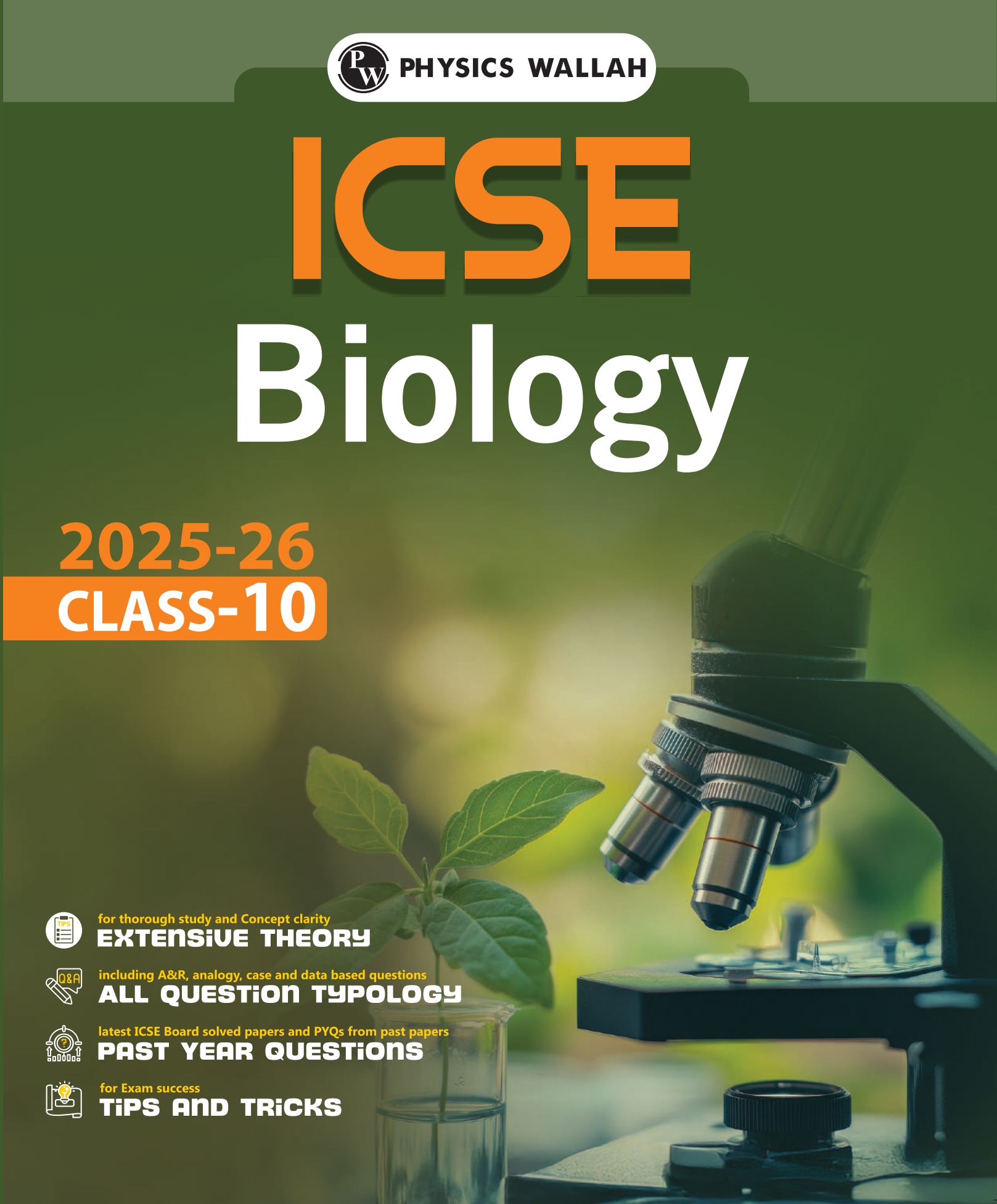
PHYSICS WALLAH

ICSE Biology

2025-26
CLASS-10



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2024

ICSE Solved Paper

Time allowed : 2 hours **Maximum Marks : 80**

General Instructions:

(i) Answers to this Paper must be written on the paper provided separately.

(ii) You will **not** be allowed to write during first **15** minutes.

(iii) This time is to be spent in reading the question paper.

(iv) **The time given at the head of this Paper is the time allowed for writing the answers.**

(v) **Section A** is compulsory. Attempt **any four** questions from **Section B**.

(vi) The intended marks for questions or parts of questions are given in brackets [ ].

Section-A (40 Marks)

(Attempt **all** questions from this **Section.**)

1. Select the correct answers to the questions from the given options. **[15]**

(Do not copy the questions, write the correct answer only).

(i) Duplicated chromosomes are joined at a point termed:

(a) Centrosome (b) Centromere

(c) Centriole (d) Chromatid

(ii) The process of conversion of ADP to ATP during photosynthesis is called:

(a) Photolysis

(b) Phagocytosis

(c) Photophosphorylation

(d) Polymerisation

(iii) The process in which water is lost from the margins of strawberry leaves is:

(a) Osmosis (b) Imbibition

(c) Diffusion (d) Guttation

(iv) The hormone that affects urination is:

(a) Adrenaline (b) Vasopressin

(c) Oestrogen (d) Thyroxine

(v) Which one of the following helps in the opening of stomata:

(a) Cobalt ions (b) Potassium ions

(c) Magnesium ions (d) Aluminium ions

(vi) A zygote which has **Y** chromosome inherited from the father will develop into a:

(a) Will depend on the chromosome inherited from the mother

(b) Girl

(c) Either boy or a girl

(d) Boy

(vii) The ear ossicle that transports sound vibrations to the inner ear:

(a) Stapes (b) Malleus

(c) Incus (d) Cochlea

(viii) If a person has a heart attack, what must be done immediately?

P. Loosen his/her clothing

Q. Make him/her lie down in an airy room

R. Rush him/her to the hospital

S. Engage him/her in a conversation

(a) P and Q (b) P and S

(c) R and S (d) P, Q and R

(ix) Adjusting the focal length of the eye lens to view objects at different distances is done by:
(a) Cornea (b) Iris
(c) Ciliary muscles (d) Sclera

(x) Four friends **P**, **Q**, **R** and **S** were discussing the examples of genetic disorders. The examples they quoted were as follows:
P. Colour blindness and Malaria
Q. Albinism and Cholera
R. Haemophilia and Colour blindness
S. Haemophilia and Albinism
Who gave the correct examples?
(a) **P** and **Q** (b) **R** and **S**
(c) **P** and **R** (d) **Q** and **S**

(xi) Osmosis takes place when there is:
(a) A freely permeable membrane
(b) A cell wall
(c) A selectively permeable membrane
(d) An impermeable membrane

(xii) A male gorilla has 48 chromosomes in each of its body cells. How many chromosomes will each of the sperms have?

(a) 24 (b) 48
(c) 12 (d) 16

(xiii) **Assertion (A):** Sympathetic nervous system prepares the body for violent action against abnormal conditions.
Reason (R): Sympathetic nervous system accelerates heartbeat.
Which of the following is correct?
(a) Both A and R are True
(b) A is True, R is False
(c) A is False but R is True
(d) Both A and R are False

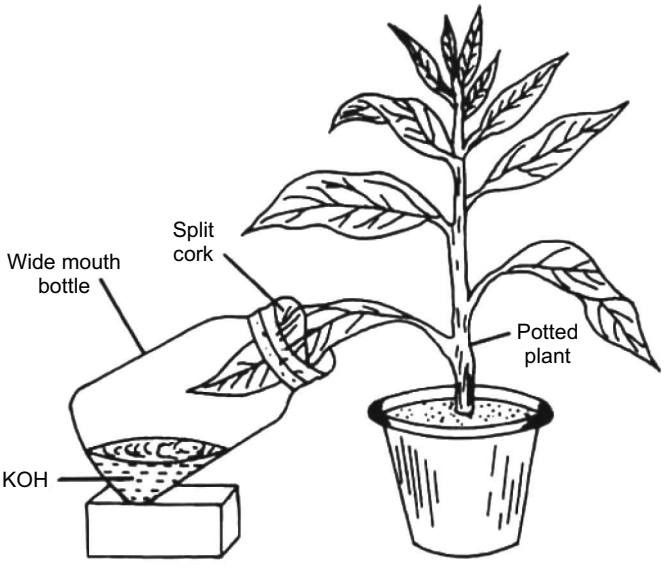
(xiv) Birth rate is the number of live births per thousand persons in:
(a) 1 year (b) 2 years
(c) 10 years (d) 20 years

(xv) Industrial Melanism was observed in:
(a) Mice (b) Peppered Moth
(c) House Flies (d) Crow

2. (i) **Name the following:** **[5]**
(a) Unicellular outgrowths from the epidermis of roots.
(b) A defect in our eyes, in which some parts of the object are in focus while the other parts are blurred.
(c) The tropic movement of plant parts in response to chemicals.
(d) The main nitrogenous waste formed in the body.
(e) The process of attachment of fertilized ovum to the wall of uterus.

(ii) **Arrange and rewrite the terms in each group in the correct order to be in a logical sequence beginning with the term that is underlined:** **[5]**
(a) Australopithecus, Cro-Magnon, Homo erectus, Neanderthal man.
(b) Pupil, Aqueous humour, Retina, Vitreous humour.
(c) Effector, Receptor, Motor neuron, Sensory neuron.
(d) Loop of Henle, Distal convoluted tubule, Bowman's Capsule, Proximal convoluted tubule.
(e) Water vapour, Soil water, Leaves, Ascent of Sap

(iii) **Study the diagram given below and fill in the blanks with suitable words:** **[5]**



In order to prove that carbon dioxide is necessary for **(a)** _____, a potted plant is placed in dark for 48 hours to **(b)** _____ the leaves. A part of a leaf is inserted into a conical flask containing potassium hydroxide solution. This is to absorb **(c)** _____ from the flask. The plant is then placed in sunlight for a few hours. The experimental leaf is tested for starch. The part of the leaf that was inside the conical flask turns **(d)** _____, whereas the part of the leaf outside turns **(e)** _____ in colour.

(iv) Choose the **odd** one out from the following terms and name the **category to which the others belong**: **[5]**

(a) Prothrombin, Thrombin, Fibrinogen, Albumin

(b) Tonsils, Glomerulus, Spleen, Lymph nodes

(c) Neutrophils, Basophils, Monocytes, Eosinophils

(d) Leaves, Styrofoam, Grass, Cow Dung

(e) Pulmonary artery, Renal artery, Coronary artery, Hepatic artery

(v) Match the items given in **Column I** with most appropriate ones in **Column II** and **rewrite the correct matching pairs**: **[5]**

Column I	Column II
(a) Leydig Cells	1. Lack of thyroxine in children
(b) Stoma	2. 12 pairs
(c) Ova	3. Testosterone
(d) Cranial nerve	4. Diffusion of respiratory gases
(e) Cretinism	5. Haploid cells
	6. 31 Pairs
	7. Diploid cells

Section-B (40 Marks)

(Attempt **any four** questions from this **Section.**)

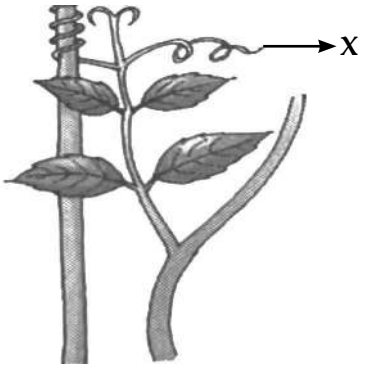
3. (i) Expand the abbreviation-NADP. **[1]**

(ii) Mention two adaptations in roots for absorption of water from the soil. **[2]**

(iii) Differentiate between Afferent arteriole and Efferent arteriole **(diameter)**. **[2]**

(iv) Give two examples of water pollutants. **[2]**

(v) Ali has some pea plants in his garden which need a support to grow as seen in the picture given below: **[3]**



(a) Name the phenomenon depicted by the shoot in the given figure.

(b) Define the above phenomenon.

(c) Write the name of the part marked **X**.

4. (i) Give the biological term for the surgical method of contraception in human females. **[1]**

(ii) State two harmful effects of acid rain on the environment. **[2]**

(iii) Mention two advantages of Transpiration. **[2]**

(iv) Write any two objectives of Swachh Bharat Abhiyan. **[2]**

(v) Mohan is fond of playing basketball. His concentration is on shooting the ball into the opponent's basket as given in the picture. **[3]**

(a) Which part of the brain helps Mohan to concentrate in putting the ball into the basket?

(b) Name the sense organ that helps to gauge the distance between the ball and the basket.

(c) Name the part of the brain that co-ordinates all the voluntary muscles of his body.

5. (i) Name the type of nerve which has the fibres of both sensory and motor neurons. **[1]**

(ii) Differentiate between Australopithecus and Modern man based on body hair. **[2]**

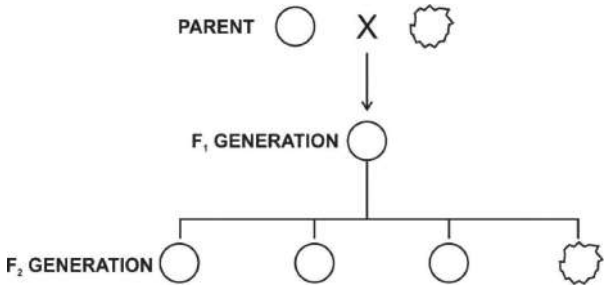
(iii) "Birth rate in India is very high." Mention two reasons in support of the statement. **[2]**

(iv) Give the exact location of: **[2]**

(a) Pericardium

(b) Bicuspid valve

(v) Given below is a schematic representation of the inheritance of the shape of seeds of garden pea. Answer the questions that follow: **[3]**



(a) Which is the dominant and recessive allele of the trait?

(b) What does the ratio 3 : 1 in the F_2 generation represent?

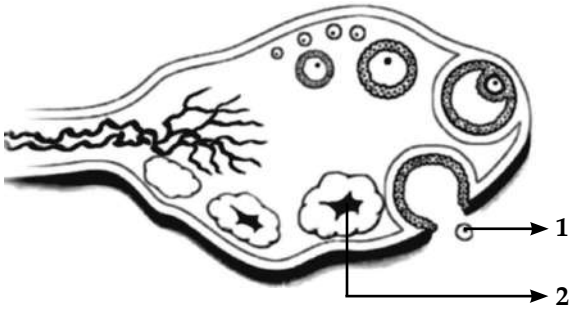
(c) State Mendel's Law of Dominance.

6. (i) Define the term-Diapedesis. **[1]**

(ii) Distinguish between Diabetes mellitus and Diabetes insipidus **(endocrine gland concerned)**. **[2]**

(iii) Carbon monoxide is dangerous when inhaled in excess. Comment on the statement. **[2]**

(iv) The diagram given below shows a section of the human ovary. **[2]**



(a) Name the process for the release of the part labelled **1**.

(b) Write the name of the structure marked **2**.

(v) Draw a neat, labelled diagram of a chloroplast. **[3]**

7. (i) Define the term hormone. **[1]**

(ii) Which parts of the ear are responsible for: **[2]**

(a) Static equilibrium?

(b) Dynamic equilibrium?

(iii) Mention two structural differences between an artery and a vein. **[2]**

(iv) Write any two limitations of using a Ganong's Potometer to demonstrate the uptake of water. **[2]**

(v) A teacher drew the diagram of heart on the blackboard and told the students to copy it in their notebooks. Mahesh couldn't see the diagram clearly as it appeared blurred to him. **[3]**

(a) Name the defect of the eye Mahesh is suffering from.

(b) Where is the image formed in this defect?

(c) Mahesh consults an eye doctor and is prescribed suitable lenses to correct the defect. Which type of lens do his spectacles have?

8. (i) Define the term ultrafiltration. **[1]**

(ii) Name the mineral elements required for: **[2]**

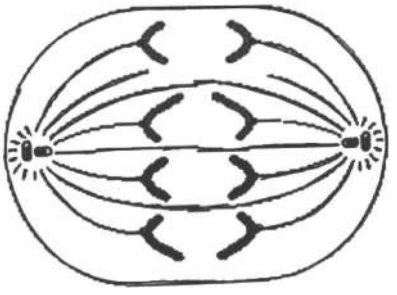
(a) Clotting of blood

(b) Synthesis of thyroxine

(iii) Mention two harmful effects of noise pollution. **[2]**

(iv) Why are RBCs efficient in their functions though they lack nucleus and mitochondria? **[2]**

(v) The diagram given below represents a stage in mitosis. **[3]**



(a) Identify the stage given above.

(b) Give one reason to support your answer in (a).

(c) Mention the number of chromosomes given in the diagram.

EXPLANATIONS

Section-A

1. (i) (b) The two chromatids of duplicated chromosomes are joined at some point along its length. This point of attachment is called as centromere. It also serve as the point where the spindle fibers attach during cell division.

(ii) (c) The conversion of ADP to ATP during photosynthesis is known as photophosphorylation. This process occurs in the chloroplasts, where light energy is used to add a phosphate group to ADP, forming ATP.

(iii) (d) Guttation is the process where water is exuded from the tips or edges of leaves, typically occurring during the night when soil moisture levels are high, and transpiration is low.

(iv) (b) Vasopressin, also known as antidiuretic hormone (ADH), regulates water balance in the body by controlling the amount of water reabsorbed by the kidneys, thus affecting urination.

(v) (b) Potassium ions (K^+) are essential for the opening of stomata. During the daytime, ATP produced by photosynthesis in guard cells is used to actively pump K^+ ions into the guard cells. This increases the concentration of K^+ inside the guard cells, making them turgid and causing the stomata to open.

(vi) (d) The presence of the Y chromosome determines male sex in humans, as it carries genes crucial for male development.Thus, if a zygote inherits a Y chromosome from the father, it will develop into a boy.

(vii) (a) The stapes, one of the three ear ossicles, transmits sound vibrations from the middle ear to the oval window of the cochlea in inner ear, facilitating hearing.

(viii) (d) If a person has a heart attack, it is crucial to loosen their clothing to ensure comfort, make them lie down in an airy room to aid breathing, and rush them to the hospital for immediate medical attention.

(ix) (c) Ciliary muscles adjust the focal length of the eye lens by changing its shape, allowing the eye to focus on objects at various distances. This process is called accommodation.

(x) (b) R and S correctly identified the genetic disorders. Haemophilia, colour blindness and albinism are genetic disorders. Malaria and cholera are infectious diseases.

(xi) (c) Osmosis occurs when there is a selectively permeable membrane, allowing water to move from a region of higher water concentration (or lower solute concentration) to a region of lower water concentration or (higher solute concentration).

(xii) (a) In gorillas, as in all sexually reproducing organisms, body cells (somatic cells) have a diploid number of chromosomes, which is 48 in this case. Sperms are gametes and have half the number of chromosomes (haploid) as compared to somatic cells, thus 24 chromosomes.

(xiii) (a) The sympathetic nervous system indeed prepares the body for violent action against abnormal conditions, a response known as "fight or flight." It accelerates the heartbeat, increasing blood flow to muscles, and other organs essential for rapid response.

(xiv) (a) The birth rate is defined as the number of live births per thousand persons in a given year. It is a common measure used to assess population growth and demographic changes.

(xv) (b) Industrial melanism was observed in the peppered moth during the Industrial Revolution in England, where darker moths thrived due to better camouflage against soot-covered trees.

2. (i) (a) Root hairs

(b) Astigmatism

(c) Chemotropism

(d) Urea

(e) Implantation

Chapter 1

Cell Cycle, Cell Division and Structure of Chromosomes

TOPICS COVERED

- ☑ Cell Cycle
- ☑ Cell Division
- ☑ Mitosis
- ☑ Meiosis
- ☑ Chromosomes

Each and every living organism begins its life on Earth as a single cell. **Cell** is a structural and functional unit of life. The cells divides repeatedly to produce a group of cells that forms the **tissue**. These tissues further form organs to perform different activities of life.

Cell division is the method that enables life to perpetuate generation after generation. It is one of the most fundamental characteristic in all living organisms. Cell division produces new cells from pre existing ones in order to help in growth, replacement , repair, reproduction and death.

1.1 Cell Cycle

The cell cycle is the series of events that take place in a cell as it grows and divides. The sequence of events including duplication of DNA, synthesis of other cell constituents, growth and division that a cell undergoes from the time of its function upto its division into daughter cells is called cell cycle. In simple words the cell cycle is defined as orderly sequence of events taking place in a cell leading to its division.

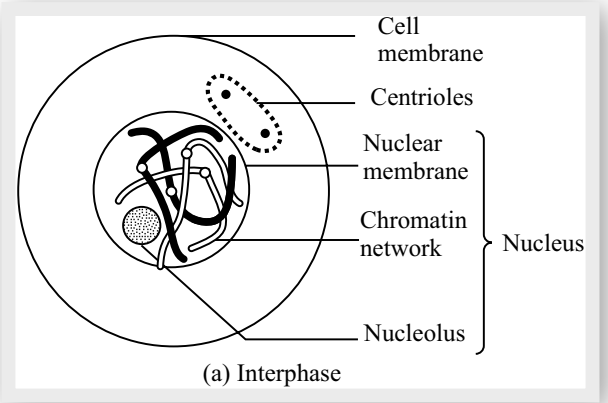
A cell cycle consists of two main phases as given below:

(i) Interphase (Non-dividing phase)

(ii) Mitotic phase

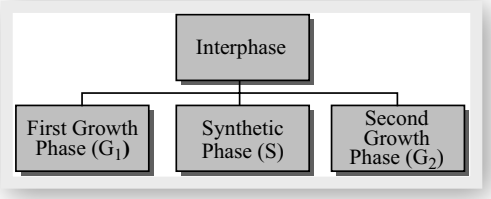
Interphase

The period between the two successive cell divisions, i.e. an interval between the end of one cell division to the beginning of the next cell division. It is commonly known as resting phase.



(a) Interphase

The interphase itself is divided further into three major stages on the basis of the synthetic activities they undergo.



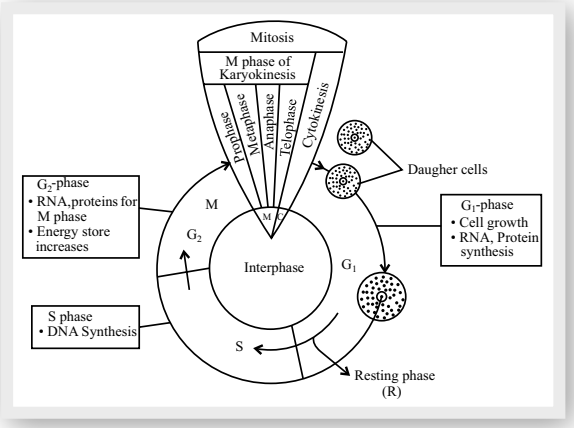
Each of these phases are described here under:

(i) **G_1-phase** (First Growth Phase): This phase is also known as **postmitotic phase**. It is the longest phase of the cell cycle. In this phase the cell grows continuously in size and becomes metabolically active. The cell carries out normal functions and prepare itself for DNA replication, synthesis of RNA and proteins.

At this stage one of the two paths is taken up by the cells. Some cells withdraw and go to resting phase (R) and others continue to divide and proceed to the next S-phase.

(ii) **S-phase** (Synthesis Phase): This is the phase in which the actual synthesis or DNA replication takes place . Also the chromosomes gets duplicated (makes its copy) during this phase.

(iii) **G_2-phase** (Second Growth Phase): This phase is also known as **premitotic phase**. During this phase the formation of RNA and proteins, necessary for the cell division continues. The cell also prepare itself to undergo mitotic phase and thus, about 15 days. the cell cycle goes on.



Cell Cycle

DO YOU KNOW

Amitosis

It is most common in certain lower algae, fungi, some protozoans (like Amoeba) and certain old cells in higher plants. During amitosis the nucleus of the organism gets elongated and develops a constriction, finally dividing into two equal sized daughter nuclei without any differentiation of chromosomes or spindle formation.

The nuclei during amitosis may or may not be of equal sizes.

Mitotic Phase

Following the interphase, cell enters into the M-phase. This phase is a actual phase of division. During this phase division of nucleus (i.e. karyokinesis) and cytoplasm(i.e. cytokinesis) occurs. This phase undergoing four important stages, i.e. prophase, metaphase, anaphase, telophase.

After telophase, the new cells formed continues with the cell cycle and the process, thus goes on. But the cell cycle not always goes on endlessly.

Instead, at some places it gets stopped permanently such as in brain and in nerve cells which once formed in an embryo does not divide further or if they are once dead cannot be replaced. At some places it gets stops temporarily such as in liver cells that divide only once every one to two years to replace the damaged cells.

At other places, it divides till it is needed such as the epithelial lining of the alimentary canal lasts for only 5 days and that of the epidermal cells of the skin for about two to four weeks.

Production of Cells and their Death in Our Body

In children, the new cells that are produced are actually more in number than the cells that die, hence, they grow. While in case of adults, the new cells produced are almost equal to the cells that die, hence the cell population stay constant. On the contrary, in older people, the number of cells produced are less than they die. Therefore, the cell population goes down in them making the activities go slow.

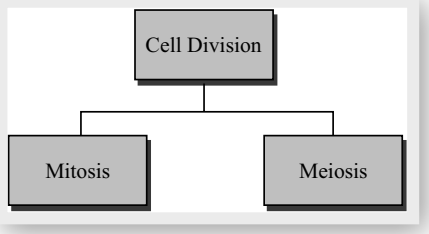
CHECK YOUR PROGRESS

Fill the blanks.

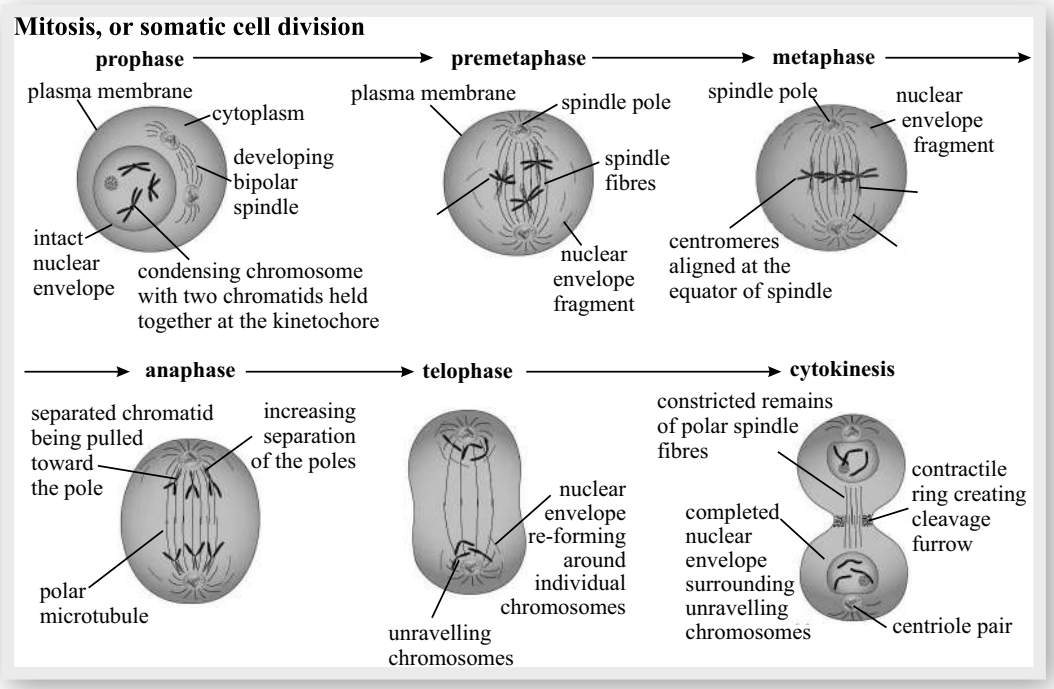
1. _____ is the interval between the end of one cell division to the beginning of the next cell division.
2. _____ is the method that enables life to perpetuate generation after generation.
3. The division of nucleus is known as _____
5. G_1-phase is also known as _____ phase.

1.2 Cell Division

Cell division is the process by which a mature cell divides and forms daughter cells, which resemble the parent cell in several characteristics. There are two types of cell division as given below:



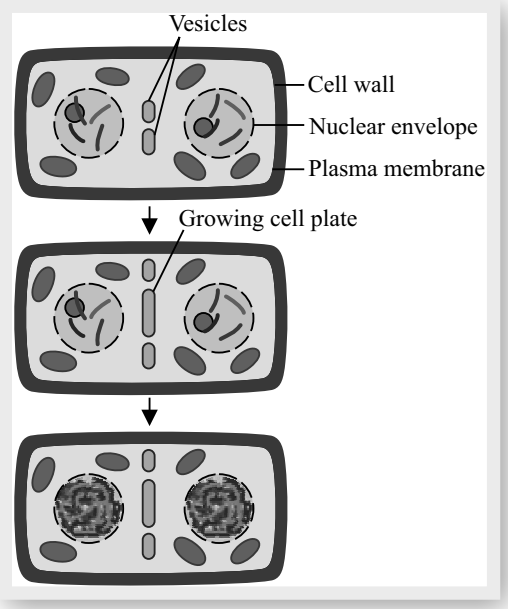
(iii) Nucleoli reappear in each daughter nucleus.
(iv) Spindle fibres, astral ray gets disappeared.
(v) The centrioles duplicate. They are surrounded by centrosphere again producing centrosome near each daughter nucleus.



Stages of mitosis in animal cell

Cytokinesis

The process of karyokinesis is soon followed by cytokinesis in which the division of cytoplasm occurs. The process of cytokinesis varies in both plant and animal cells.

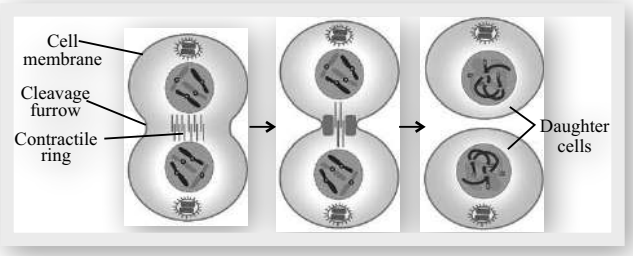


Cytokinesis in plant cells

It completes the formation of the two daughter cells. They contain exactly similar and the same number of chromosomes as present in the parent cell.

In plant cells, the cytokinesis takes place by the cell plate method. The cell plate is formed by the vesicles from the Golgi bodies at the equator of the spindle. It divides the cytoplasm into two equal halves, i.e. one around each daughter nucleus. Then the primary cell wall is laid on either side of the cell plate.

In animal cells, a constriction (furrow) appears parallel to the equator of the spindle, in the cell membrane . It deepens towards the centre of the cell, finally diving the cytoplasm in two equal halves. One half of the cytoplasm is around one daughter nucleus and the other around the second daughter nucleus.



Cytokinesis in animal cells

The process of meiotic division is completed in two stages as given below:

(i) Meiosis-I

(ii) Meiosis-II

(i) Meiosis-I: During meiosis-I or first meiotic division, the diploid parent cell ($2n$) is divided into two haploid daughter cells (n). This is known as **reductional division** because during meiosis-I the number of chromosomes in daughter cells reduces to half.

It is mostly seen in the cells in which the chromosomes are present in the form of pairs (or homologous chromosomes).

(ii) Meiosis-II: It is a homotypic or mitosis like **equational division**, where the haploid nuclei divides mitotically to produce four daughter nuclei. In meiosis-II, the chromosome number remain same received by the daughter cells at the end of meiosis-I. Hence, in the end of meiosis-II four haploid cells (n) are produced from one diploid cell in which each daughter cell has half number of chromosomes as compared to the parent cell.

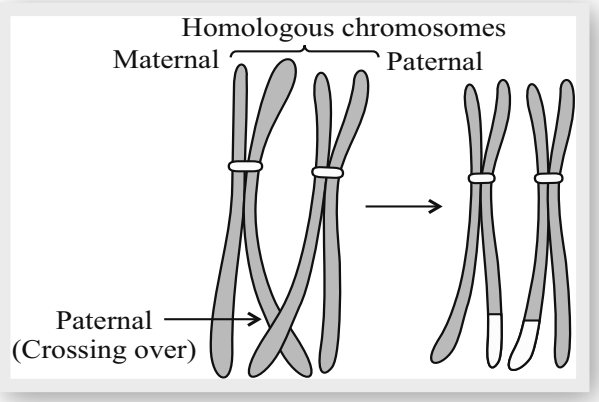
Significance of Meiosis

The major significances of meiosis are given below:

(i) Reproduction: Meiosis takes place during the formation of gametes or sex cells. It takes place inside the reproductive organs (testis and ovary) in animals to produce sperms and ova.

In flowering plants, it takes in anthers to produce pollen grains and ovules to produce eggs.

(ii) Variations due to crossing over: It is a phenomenon in which the both maternal and paternal chromatids of the homologous chromosomes during the first reductional division, link together to form chiasmata through which exchange of genetic material takes place, resulting in genetic recombination (produces new combinations of genes). The combination produced by this has innumerable variations in the progeny due to which the children of the same parents being similar are different from each other in certain aspects.



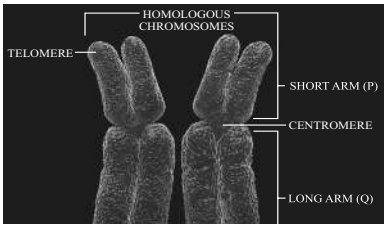
Chromatids exchange between non-sister chromatids

DO YOU KNOW

Homologous Chromosomes

The type of chromosomes that are similar in shape, size and position of contromeres. However, they may contain different alleles of the gene.

These are the chromosome pairs that contains a maternal (female parent) and paternal chromatid (male parent) of equal length.



Differences between Mitosis and Meiosis

Parameters	Mitosis	Meiosis
Occurrence	Somatic cells	Germ (sex) cells
Period of occurrence	Occurs repeatedly throughout the life.	Occurs only during the reproductive stage.
Number of daughter cells produced	Two daughter cells.	Four daughter cells.
Function	Growth and development of various body parts and organism as a whole.	Occurs only during the formation of gametes.
Number of chromosomes	A full set of chromosomes is passed to each daughter cell, i.e. a diploid ($2n$) set.	Half the total chromosomes, i.e. a haploid (n) set is passed to each daughter cell.
Variation	Mitosis doesn't introduce variation.	It generates variation in the organisms.

CHECK YOUR PROGRESS

Answer the following:

1. Which division is called equational division?
2. How many daughter cells are produced after meiosis II
3. Why meiosis-II is called homotypic division?
4. How mitosis differentiates from meiosis on the basis of number of chromosomes?

1.3 Chromosomes

The term chromosome is derived from the word "*chrome*" means coloured and "*soma*" means body. (i.e coloured body). These are small , thick and darkly stained structures. The chromosomes are known as the highly condensed coiled **chromatin fibres**. Chromosomes are the units of heredity, i.e. transfers genes from one generation to the next.

These were first discovered by the Swiss botanist **Karl Wilhelm von Nageli** in plant cells in the year 1842.

While, in animals the chromosomes were first studied by the German scientist named **Walter Flemming** in rapidly dividing cells of the larvae of the salamander (an amphibian). The chromosomes can be easily observed in the nuclei of the dividing cell especially during the metaphase and anaphase stages of the cell division.

Chromosome Number

Each and every species has a fixed number of chromosomes. All somatic cell of that species has the same number of chromosomes. On the basis of the number of chromosomes present in any cell, it may be either known as **diploid** (2*n*) cell, which contains two sets of each type of chromosome or a haploid (*n*) cell which contains single set of chromosome.

Some common species and their diploid number of chromosomes is tabulated below:

Diploid number of chromosomes in some species

S. No.	Name of the species	Total number of chromosomes
1.	Frog	26
2.	Rat	42
3.	Corn	20
4.	Onion	16
5.	Garden pea	14
6.	Crayfish	200
7.	Human being	46

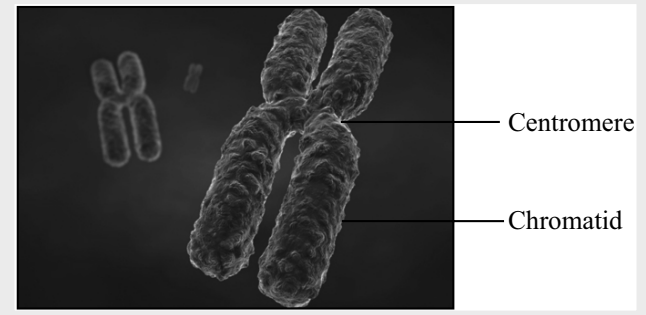
Structure of Chromosome

We have learnt till now that chromosomes are the highly condensed chromatin fibres, whose formation occurs at the prophase stage of the cell division.

Structurally, each chromosome consists of two exactly similar shaped rod like structures called **chromatids** that joined together at a point known as **centromere** (primary constriction). It is located at a particular site in the chromosome and helps in attachment of the spindle fibres to form the chromosome. The parts of chromatids on the side of the centromere are referred to as arms. The centromere also serves to attach to the spindlefibre during cell division. Each chromosome centromere is located at a particular site. As the spindle fibrecontracts, the sister chromatids are separated at the centromere and each is pulled away from the other towards the two poles of the dividing cell.

DO YOU KNOW

- The diploid number of chromosome is always even because the number of chromosomes is always paired.
- Chromosome number is not related to the complexity of an organism.
- **Roger Korenberg** in the year 1974 reported that chromosome is made of DNA and proteins.



Structure of Chromosomes

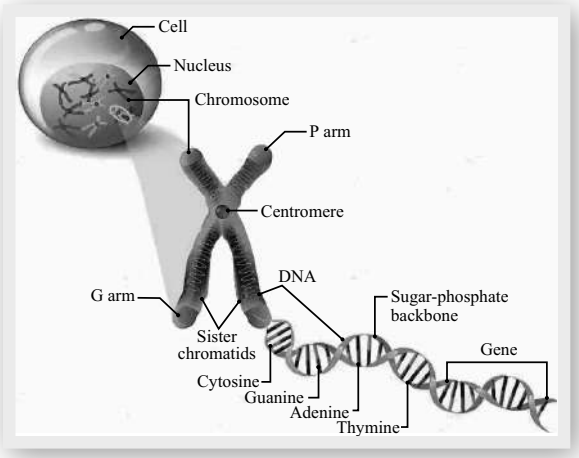
The Chromatin

It is a thread like structure present in the resting state of the nucleus of the cell. When the cell is not dividing it is called **chromatin** or **chromatin fibre**. The chromatin material is mainly formed of two substances.

(i) 40 % DNA and

(ii) 60 % histones (a particular type of protein)

Both DNA and histones form a kind of complex in which the DNA strands wind around a core of eight histone molecules. Such complex is known as **nucleosome**. The entire chromatin fibre is coiled and supercoiled.



Structure of chromatin fibres showing the enlarged view of DNA strand

The nucleic acids have a complex chemical structure composed of pentose sugar, nitrogenous base and phosphoric **acid.** It was discovered by **Frederick Miescher**. DNA is the genetic material that carries information in mostly every living organisms.

Structure of DNA

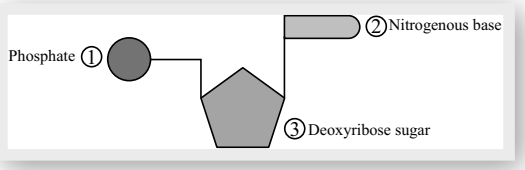
DNA or Deoxyribonucleic acid is the chemical basis of gene, which acts as the genetic material in most of the organisms. **Rosalind Franklin** in the year 1953 studied about the shape of the DNA molecule for the first time. DNA is a long polynucleotide molecule that is composed of two complimentary strands that are coiled around a common axis in a double helix. The double helical form of DNA molecule was given by **James D Watson** and **Francis Crick** in the year 1953 on the basis of the X ray diffraction studies.

DO YOU KNOW

- The genetic material in viruses is RNA (Ribonucleic Acid).
- RNA was the first genetic material to be discovered.
- DNA is the more stable genetic material when compared to RNA.

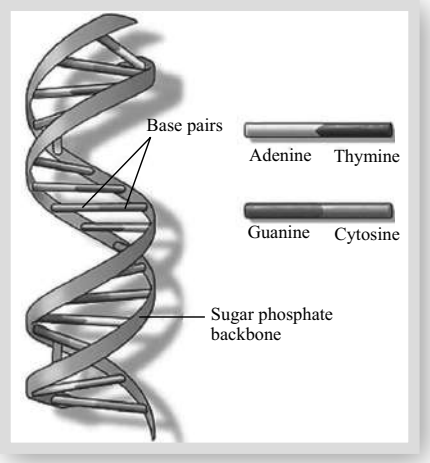
Structurally, each DNA strand is made up of repeating units of nucleotides that comprises of three main components as:

(i) Pentose sugar
(ii) Nitrogenous bases (Purine–Adenine and Guanine and pyrimidines—Thymine and cytosine.
(iii) Phosphoric acid



Components of DNA

Out of the three components, the sugar and phosphate molecule forms the backbone of the DNA molecule, while the nitrogenous bases are found attached to the sugar inwards extending to join the complimentary nitrogen bases of the other strand of the DNA by the help of hydrogen bonds where adenine pairs with thymine (A = T) by two hydrogen bonds and guanine pairs with cytosine (C≡G) with three hydrogen bonds. Thus, making the two strands together give the appearance of the spiral appearance.



Structure of DNA (double helical)

Differences between DNA and RNA

DNA	RNA
It is a double-stranded molecule.	It is a single-stranded molecule.
The nitrogenous bases present in DNA are adenine, cytosine, guanine, thymine.	The nitrogenous bases found in RNA are adenine, guanine, cytosine and uracil. In RNA in place of thymine uracil is present.
The lifetime of DNA is long lived.	RNA is short lived.
Sugar found is deoxy-ribose.	Sugar found is ribose.
It is found in nucleus.	It is found in nucleus and cytosol.

SUMMARY

- Cell is the structural and functional unit of life.
- Cell division is the method that enables life to perpetuate generation after generation.
- Cell cycle is defined as orderly sequence of events taking place in a cell leading to its division.
- A cell cycle consists of two main phases, i.e. interphase (Non-dividing phase) and mitotic phase
- Interphase is also known as **resting phase**.
- The interphase itself is divided further into three major stages on the basis of the synthetic activities they undergo, i.e. G_1, S and G_2-phase.
- Following the interphase, cell enters into the M phase . During this phase division of nucleus (i.e karyokinesis) and cytoplasm (i.e cytokinesis) occurs into two daughter cells
- There are two types of cell division, i.e. mitosis and meiosis
- Mitosis is the type of cell division of somatic or body cells, while meiosis occurs in the germ or sex cells.
- In mitosis, both parent cells and the daughter cell have equal number of chromosomes at the end of the division. Therefore, it is also known as equational division.
- Mitosis is divided into two parts karyokinesis and cytokinesis.
- All the changes that occurs in the nucleus during cell division are collectively known as **Karyokinesis**. It occurs in four different phases as prophase, metaphase, anaphase and telophase.
- Meiosis is the type of cell division in which the chromosome number is reduced in such a way that each daughter cell receives only half set of chromosomes.
- A special type of cell division that produces sex cells or gametes.
- The process of meiotic division is completed in two stages, i.e. meiosis-I and meiosis-II
- During meiosis-I or first meiotic division, the diploid parent cell ($2n$) is divided into two haploid daughter cells (n).
- Meiosis-II is a homotypic or mitosis like equational division where the haploid nuclei divides mitotically to produce four daughter nuclei.
- Genes are the units of heredity, i.e. transfers genes from one generation to the next.
- Each chromosome consists of two exactly similar shaped rod-like structures called **chromatids** that joined together at a point known as **centromere**.
- When the cell is not dividing it is called **chromatin** or **chromatin fibre**.
- On the basis of position of the centromere, chromosomes are divided into four main types as metacentric, sub metacentric, acrocentric and telocentric.
- DNA or Deoxyribonucleic Acid is the chemical basis of gene which acts as the genetic material in most of the organism.
- In DNA molecule, the sugar and phosphate molecule forms the backbone of the DNA molecule while, the nitrogenous bases are found attached to the sugar inwards.
- Replication of DNA is a process in which DNA makes its own copy.
- The segments of DNA responsible for the transmission of characters from one generation to next are called **genes**.

OBJECTIVE TYPE QUESTIONS

I. Choose the Correct Option (1 Mark Each)

1. Haploid number of chromosome are found in
(a) nephrons (b) neurons
(c) skin cells (d) sperms **(ICSE 2023)**

2. During the synthesis phase of the cell cycle, more of
(a) RNA is synthesised
(b) RNA and proteins are synthesised
(c) DNA is synthesised
(d) Glucose is synthesised **(ICSE 2023)**

3. The number of chromosomes in a human skin cell are **(ICSE specimen 2023)**
(a) 22 (b) 23
(c) 44 (d) 46

4. The sex chromosome in a human ovum is
(a) X-chromosome
(b) Y-chromosome
(c) Both X and Y-chromosomes
(d) Either X or Y-chromosome **(ICSE 2023)**

5. The cell component visible only during cell division
(a) chromosome (b) chromoplast
(c) chromatin (d) centriole
(ICSE specimen 2021-22 sem I)

6. Explain the term 'karyokinesis'.
(a) It is the division of nucleus during cell division
(b) It is the division of cytoplasm during cell division
(c) It is the division of centrosome
(d) It is the division of nucleolus
(ICSE 2021-22 sem 1)

7. Mention the exact location of 'centrioles'.
(a) Found only in plant cells
(b) Found inside nucleus
(c) Found only in animal cells
(d) Found in plant and animal cells
(ICSE 2021-22 sem 1)

8. Chromosomes
(a) are the carriers of heredity
(b) are the controlling centre of the cell
(c) are the site for various chemical reactions
(d) are intracellular digestion **(ICSE 2021-22 sem 1)**

9. The complex molecule consisting of DNA strand and a core of histones **(ICSE 2021-22 sem 1)**
(a) centrosome (b) nucleotides
(c) nucleosome (d) chromosome

10. A pair of corresponding chromosomes of the same shape and size, but one from each parent.
(ICSE 2021-22 sem 1)
OR
A pair of corresponding chromosomes of the same shape and size and derived one from each parent is named as **(ICSE 2019, 2017)**
(a) autosomes
(b) sex chromosomes
(c) homologous chromosomes
(d) analogous chromosome

11. A cell has five pairs of chromosomes. After mitotic division, the number of chromosomes in the daughter cells will be
(a) five (b) ten
(c) twenty (d) fourty
(ICSE 2019 specimen)

12. The cell component visible only during cell division
(a) mitochondria (b) chloroplast
(c) chromosome (d) chromatin
(ICSE 2013)

13. In human beings 22 pairs of chromosomes are
(a) allosomes (b) autosomes
(c) isosomes (d) both (a) and (b)

14. In which phase of mitosis, the nucleoli reappears with the disappearance of spindle fibres and astral rays.
(a) Metaphase (b) Anaphase
(c) Prophase (d) Telophase

15. Which out of the following are true for G_1-phase of cell cycle?
(a) RNA and proteins are synthesised
(b) No change in DNA content is seen
(c) Synthesis of DNA
(d) Both (a) and (b)

16. Crossing over during meiosis helps in.
(a) recombinations (b) variations
(c) evolution (d) All of these

17. Cytokinesis proceeds from the centre towards the periphery in the.
(a) animal cells (b) plant cells
(c) Both (a) and (b) (d) None of the above

18. Identify the name of the scientist who first studied the shape of the DNA molecule.
(a) Watson and Crick
(b) Rosalind Franklin
(c) Frederick Franklin
(d) Farmer and Moore

II. Fill in the Blanks (1 Mark Each)

1. During meiosis _____ daughter are formed.
2. G_2-phase is also known as _____ phase.
3. Each gene had two alternative forms of _____ .
4. Each chromosome consists of two exactly similar rods called _____ .
5. The cytokinesis in plant cells occurs by the _____ method.
6. The nitrogenous bases in DNA are adenine, thymine, cytosine and_____.
7. _____ is the longest and most complicated phase of mitosis.
8. Soon after karyokinesis, division of _____ takes place.
9. At the end of _____ cytokinesis is completed.
10. The _____ is the thread-like structure located in the nucleus of the cell.

III. Match the Columns (1 Mark Each)

1. Match column-I and column-II.

Column-I	Column-II
1. Prophase	(a) Chromosomes aligns at equator
2. Metaphase	(b) Nucleolus reappears
3. Anaphase	(c) Spindle fibre appears between two centrioles
4. Telophase	(d) Chromosomes condense

2. Match column-I and column-II.

Column-I	Column-II
1. Mitosis	(a) Reductional divison
2. Meiosis	(b) Division of cytoplasm
3. Cytokinesis	(c) Division of nucleus
4. Karyokinesis	(d) Equational division

3. Match column-I and column-II.

Column-I	Column-II
1. G_1-phase	(a) Formation of RNA and proteins
2. S-phase	(b) Only RNA and protein are synthesised
3. G_2-phase	(c) Cell prepare itself for DNA replication
4. M-phase	(d) Starts with karyokinesis

IV. Assertion and Reason Type Questions (1 Mark Each)

In the questions below there are two statements marked as Assertion (A) and Reason (R). Read the statements given below and choose the correct option.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true, but R is not the correct explanation of A

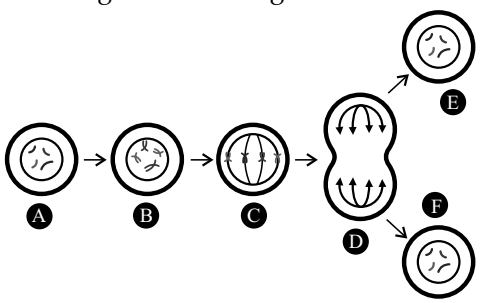
(c) A is correct, but R is wrong

(d) A is wrong, but R is correct

1. **Assertion (A):** Meiosis is called reductional division.
   Reason (R): During meiosis, the number of chromosomes is reduced to half in the daughter cells.
2. **Assertion (A):** The chemical analysis of chromosomes shows two types of nucleic acids.
   Reason (R): Nucleic acids have complex structures composed of nitrogenous bases, pentose sugar and phosphoric acid.
3. **Assertion (A):** In animal cells, the vesicles from the Golgi bodies appear at the equator of the spindle.
   Reason (R): A constriction in animal cells appears parallel to the equator of the spindle, in the cell membrane.
4. **Assertion (A):** Interphase is known as the non-dividing preparatory phase of the cell cycle.
   Reason (R): During interphase a cell prepare itself for the next cell division and grows to the same size as their mother cell.
5. **Assertion (A):** Meiosis always takes place in the diploid cells.
   Reason (R): A dipl)oid cell is the one in the nucleus of which chromosomes are found in the pairs.
6. **Assertion (A):** G_2-phase is the shorter growth phase .
   Reason (R): In G_2-phase, formation of RNA and proteins , necessary for cell division continues.
7. **Assertion (A):** In DNA molecule guanine is complimentary to cytosine.
   Reason (R): Guanine pairs with cytosine with two hydrogen bonds.

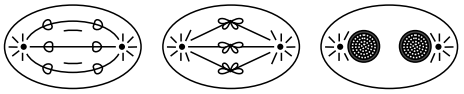
Competency Based Questions (1 Mark Each)

1. Observe the diagram given below and answer what does the figure is showing:



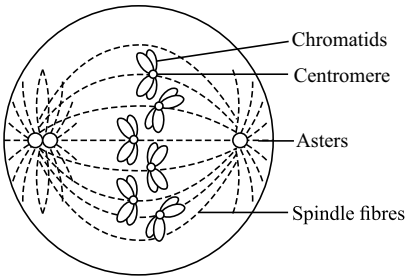
(a) Mitosis in animal cells
(b) Mitosis in plant cells
(c) Meiosis-I
(d) Meiosis-II

2. Identify the stages of mitosis and choose the correct option for (A-C).



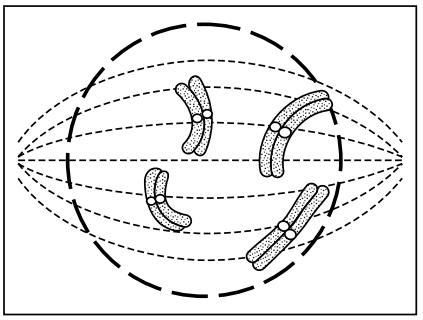
(a) *A*-Metaphase, *B*-Anaphase, *C*-Telophase
(b) *A*-Anaphase, *B*-Telophase, *C*-Metaphase
(c) *A*-Prophase, *B*-Metaphase, *C*-Anaphase
(d) *A*-Anaphase, *B*-Metaphase, *C*-Telophase

3. Identify the below given stage in the figure of mitosis.



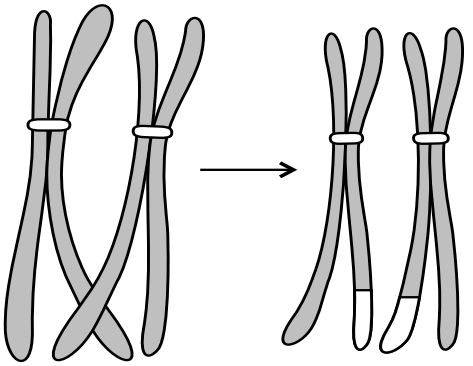
(a) Prophase (b) Metaphase
(c) Anaphase (d) Telophase

4. Identify whether the cell showing cell division is an animal or a plant cell.



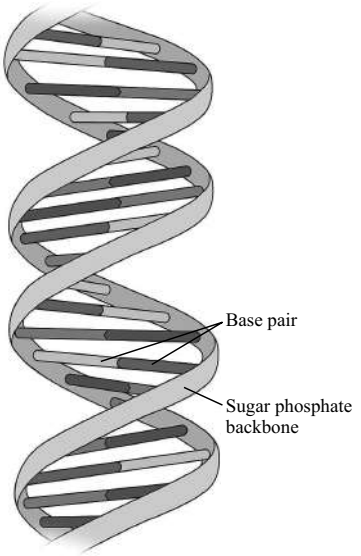
(a) Plant cell
(b) Animal cell
(c) Both (a) and (b)
(d) None of these

5. The diagram given below represents the phenomenon that occurs in meiosis. Choose the correct option for it.



(a) Karyokinesis (b) Cytokinesis
(c) Crossing over (d) Both (a) and (c)

6. Given below is the double helical DNA structure. Observe the figure and answer the questions that follows:



(i) The four bases of DNA are
(a) ATGC (b) AUGC
(c) AUCC (d) GUCT

(ii) The unit of heredity is called
(a) allele (b) gene
(c) chromosome (d) nucleus

SUBJECTIVE TYPE QUESTIONS

Very Short Answer Type Questions
(1 Mark Each)

1. Name the organelle that forms the aster during cell division. **(ICSE 2023)**
2. Given below are the five sets of terms. In each case arrange and rewrite each set so as to be in a logical sequence.
   One is done as an example for you
   Example 1. large intestine, stomach , mouth, small intestine, oesophagus
   Ans. Mouth, oesophagus, stomach, small intestine, large intestine
   Metaphase, interphase, anaphase, prophase. **(ICSE specimen 2019, 2004)**
3. Choose the odd one out from the given term and name the category to which the others belong.
   Example- Nose, Tongue, Arm , Eye
   Answer- Odd term- Arm
   Category- others are sense organs.
   Centrososme, cell wall, cell membrane, large vacuoles **(ICSE 2018)**
4. Given below are groups of terms. In each group the first pair indicates the relationship between the two terms. Rewrite and complete the second part on a similar basis.
   Example- Oxygen : Inspiration :: Carbon dioxide: Expiration
   Cytoplasm : Cytokinesis :: Nucleus : **(ICSE 2017)**
5. Name the exchange of chromatid parts between the maternal and paternal chromatids of a pair of homologous chromosomes during meiosis. **(ICSE 2016)**
6. Given below is the group of five terms, arrange and rewrite the terms in the correct order, so as to be in a logical sequence. Metaphase, telophase, prophase, anaphase, cytokinesis **(ICSE 2013)**
7. Given below are the sets of five terms, rewrite the terms in a logical sequence as directed at the end of the statement.
   Karyokinesis, S-phase, cytokinesis, G_1-phase, G_2-phase (cell cycle)
8. Name the type of cell division which occurs in the cells of reproductive organs.
9. State whether the following statement is true or false, if false rewrite the correct form of statement by changing the first and last word only.
   Mitosis is the type of division that occurs in the cells of injured parts of the body.
10. What is meant cell cycle?
11. What are the two different types of cell division?
12. Name the stage when sister chromosomes separate from their paired condition.
13. The type of cell division which occurs in the cells of the reproductive organs.
14. Give any one difference between mitosis of plant and animal cell.
15. List any one significance of meiosis.

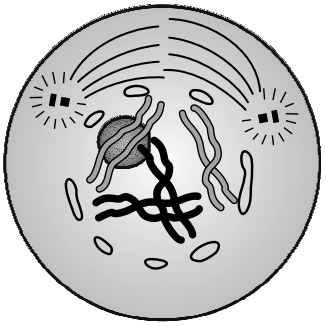
Short Answer Type Questions-1
(2 Marks Each)

1. Differentiate between karyokinesis and cytokinesis. **(ICSE 2023)**
2. Differentiate between cell wall and cell membrane with reference to permeability. **(ICSE Specimen 2023)**
3. Give one difference between each of the following pairs on the basis what is given in the brackets. Metaphase and Anaphase (position of centromere).
4. Given below is the biological/technical terms of the following:
   (i) The stage of cell division in which the nuclear membrane disappears and the chromosomes becomes short and thick.
   (ii) The repeating components of each DNA strand lengthwise. **(ICSE Specimen 2019)**
5. Draw a diagram of the nucleus of a cell, having chromosome number 6 as it would appear in the metaphase stage of mitosis and label the following:
   (i) Aster
   (ii) Acromatic spindle
   (iii) Chromatid
   (iv) Centromere **(ICSE 2018)**
6. Mention the two pairs of nitrogenous bases which pair with each other with the hydrogen bonds. **(ICSE 2017)**
7. Draw a well labelled diagram to show the anaphase stage of mitosis in a plant call having four chromosomes. **(ICSE 2013)**

8. Draw a well labelled diagram to show the metaphase stage of mitosis in an animal cell having four chromosomes.
9. First meiotic division is known as reductional division. What the term reduction refers to here?
10. Differentiate between the G_1 and G_2-phases of cell cycle.

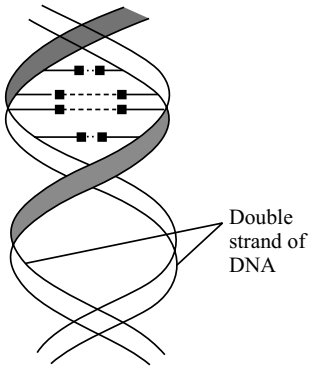
Short Answer Type Questions-2 (3 Marks Each)

1. Given below is a diagram representing a stage during the mitotic cell division. Answer the following questions. **[ICSE Specimen 2023 (3M)]**



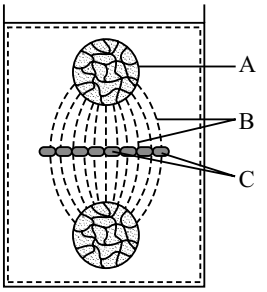
(i) Identify the stage.
(ii) Give a suitable reason for your answer in (i).
(iii) Name the stage that follows the one shown in the diagram.

2. There is a diagram of a double helical structure of DNA. **[ICSE 2010 (3M)]**



(i) Name the four nitrogenous bases that form a DNA molecule.
(ii) Give the full form of DNA.
(iii) Name the unit of heredity.
(iv) Mention two points of difference between Mitosis and Meiosis

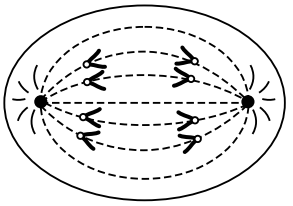
3. Draw a well labelled diagram of a cell cycle representing all phases occurring in it.
4. Draw a neat and a labelled diagram of a structure of DNA. Also explain what are the three major components that makes up the DNA.
5. Cytokinesis is the process of division of the cytoplasm of the dividing cell which leads to the formation of two daughter cells. But, it is different in both plants and animals. In plant, cytokinesis takes place by the cell plate formation. Observe the below given figure and answer the questions that follow:



(i) Label the parts marked as *A*-*C*.
(ii) State the phenomenon of cytokinesis in plants.
(iii) What are the basic differences between the mitosis in plant and animal cells?

Structured Questions (5 Marks Each)

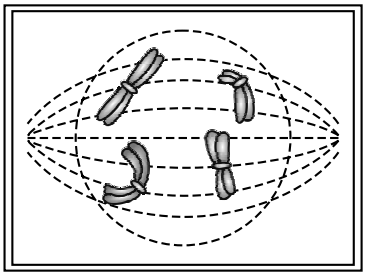
1. Given below is a diagram representing a stage during the mitotic cell division. Study the diagram and answer the following questions.
[ICSE Specimen 2019 (5 M)]



(i) Identify the stage by giving a suitable reason.
(ii) Is it a plant or an animal cell? Give a reason to support your answer.
(iii) Draw a neat, labelled diagram of the stage which follows the one shown in the question.
(iv) How many chromosomes will each daughter cell have after the completion of the above division?
(v) Name the four nitrogenous bases.

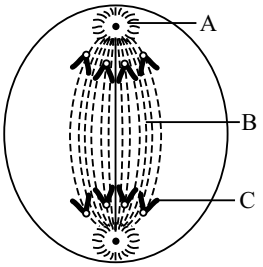
2. The diagram given below represents a stage during cell division. **[ICSE 2018 (5 M)]**

7. Given below is a diagram representing a stage during mitotic cell division. Study it carefully and answer the questions that follows:



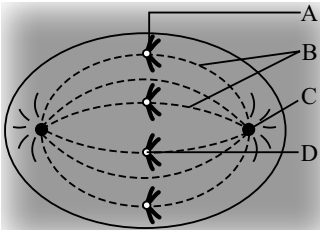
(i) Is it a plant cell or an animal cell? Give a reason to support your answer.
(ii) Identify the stage shown.
(iii) Name the stage that follows the one shown here. How is that stage identified?
(iv) How will you differentiate between mitosis and meiosis on the basis of the chromosome number in the daughter cells?

8. The diagram represents a stage during cell division. Study the same and then answer the questions that follows:



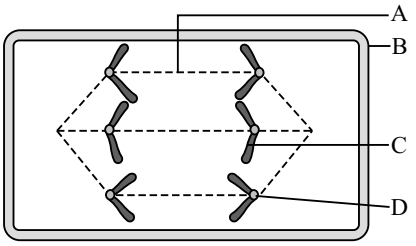
(i) Name the parts labelled *A*, *B* and *C*.
(ii) Identify the above stage and give a reason to support your answer.
(iii) Mention where in the body this type of cell division occurs.
(iv) Name the stage prior to this stage and draw a diagram to represent the same.

9. There is a diagram representing a stage during mitotic cell division in an animal cell.



(i) Identify the above stage. Give a reason to support your answer.
(ii) Name the parts labelled *A*, *B*, *C* and *D*.
(iii) What is the function of part *C*?
(iv) Name the stage that comes just after the stage shown in the diagram. Draw a well-labelled diagram of this stage.

10. The diagram represents a stage in cell division.



Study the same and answer the questions that follows:
(i) Identify the stage of cell division.
(ii) Name the parts labelled *A*, *B*, *C* and *D*.
(iii) What is the unique feature observed in this stage?
(iv) Where does this type of cell division usually occur?
(v) How many daughter cells are formed from this type of cell division?
(vi) Is the dividing cell shown a plant or an animal cell? Give a reason to support your answer.

Case Based Questions (4 & 5 Marks Each)

1. Mitosis is the type of cell division during which a cell divides itself into two daughter cells each containing similar and same number of chromosomes as in the parent cell. Since, the number of chromosomes in this type of division, remains the same. It is often termed as equational division. On the basis of the above given case answer the questions that follows:

(i) The term mitosis in plant cells was given by
(a) Walter Flemming (b) Strasburger
(c) Watson and Crick (d) Overi

(ii) The mitosis is studied in how many steps?
(a) 1 (b) 2
(c) 3 (d) 4

(iii) The animal cell may contain _____ or _____ centrioles in the centrosome.
(a) 2 or 1 (b) 2 or 3
(c) 3 or 4 (d) 4 or 5

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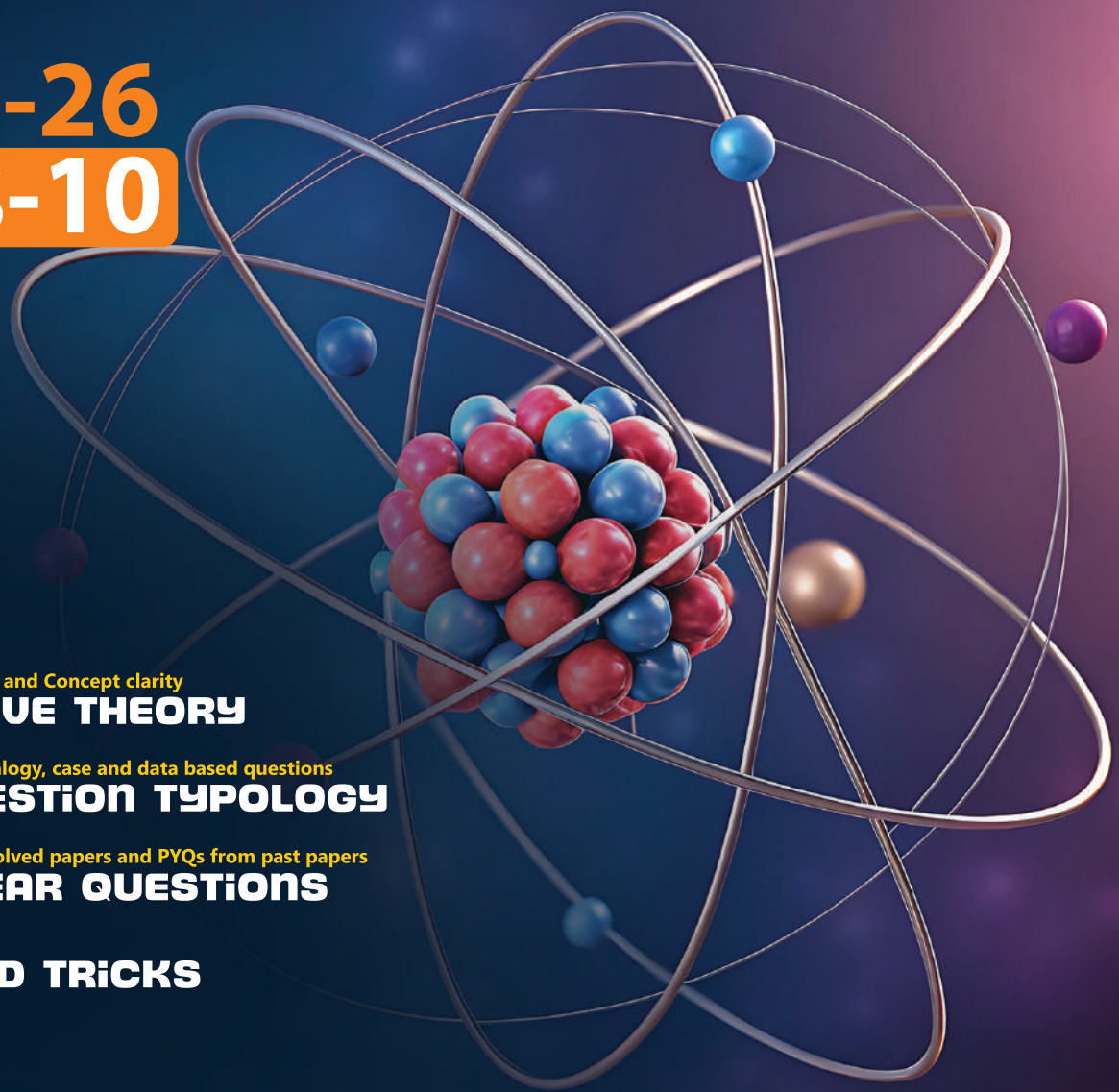

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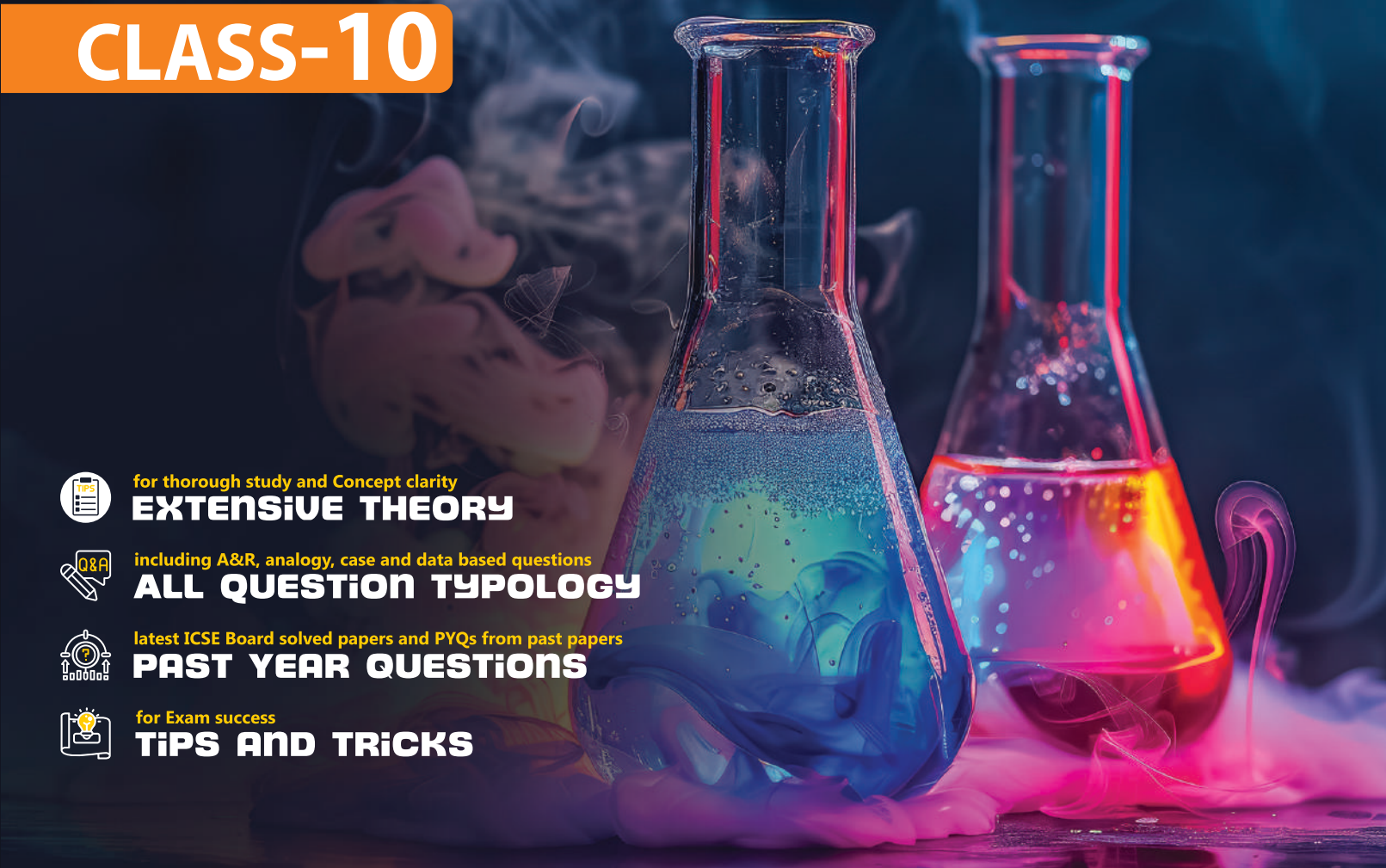

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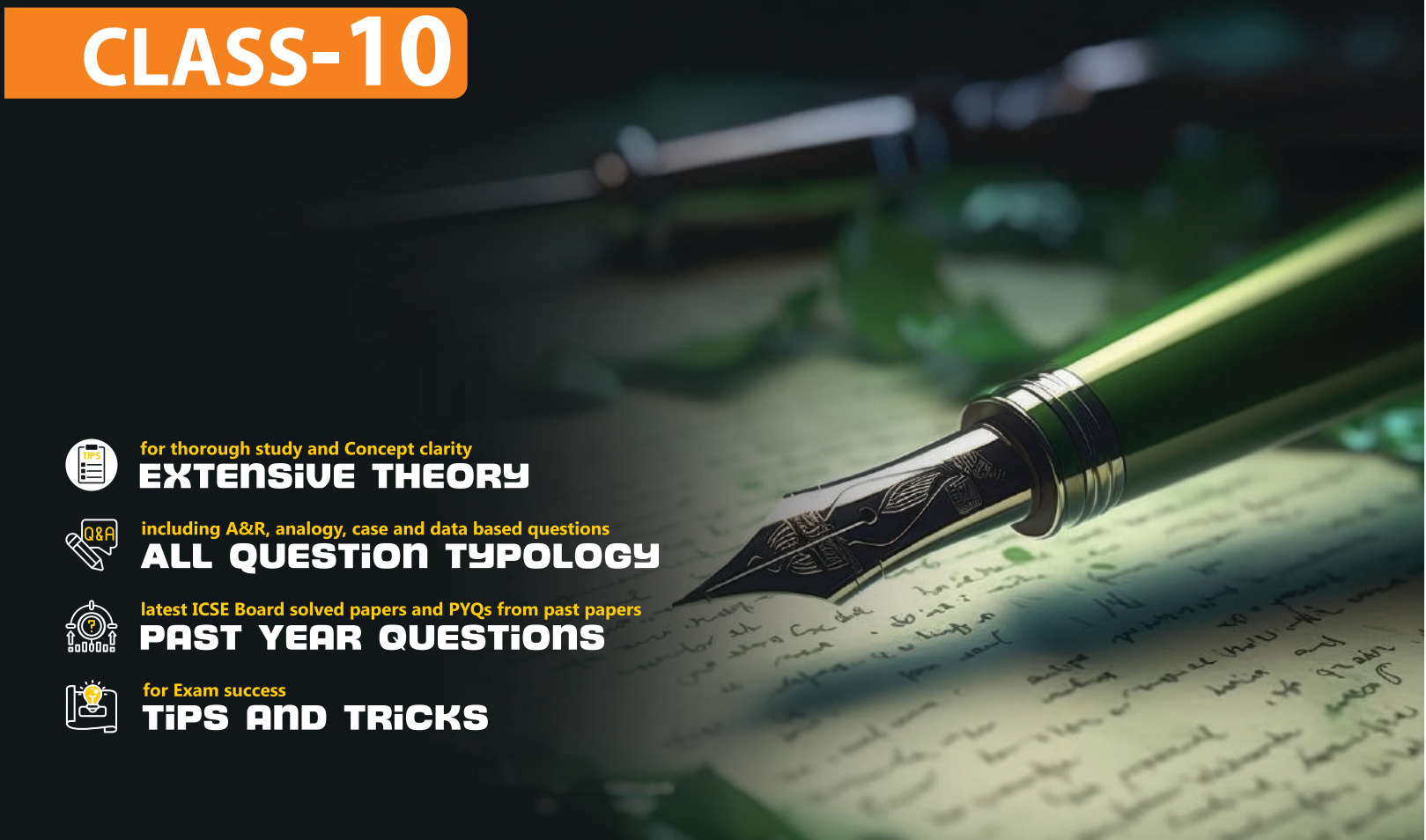

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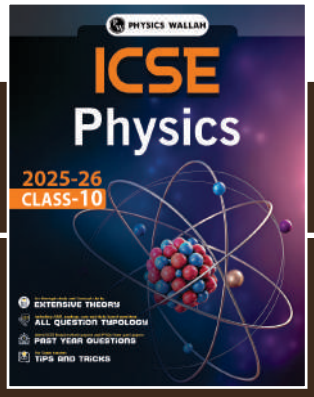

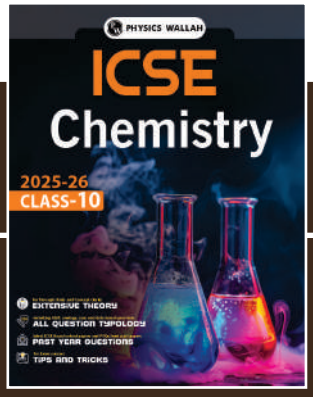

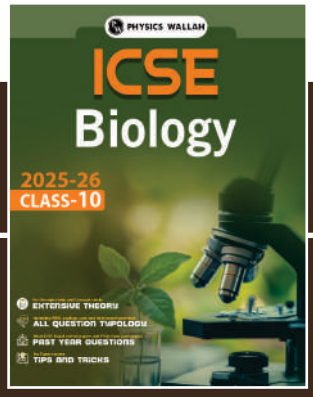

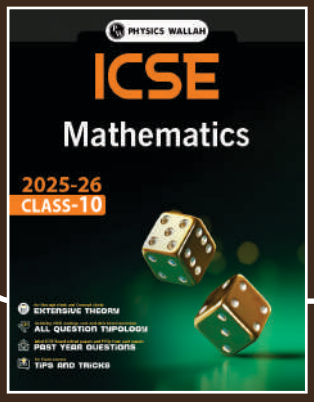

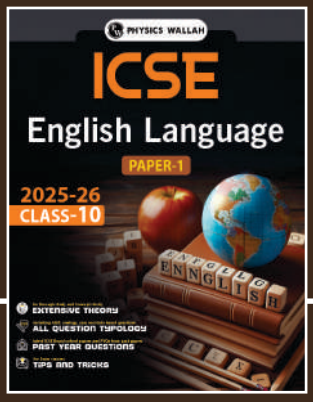

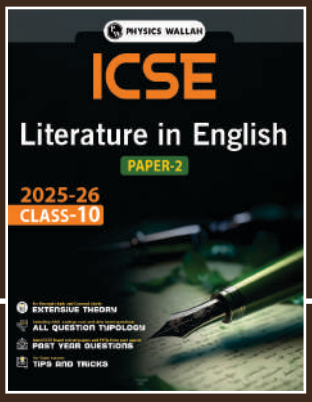

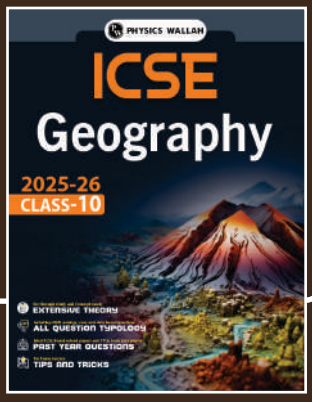

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