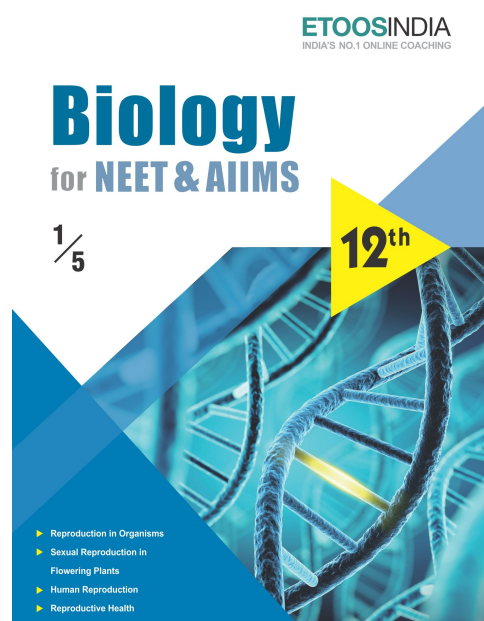
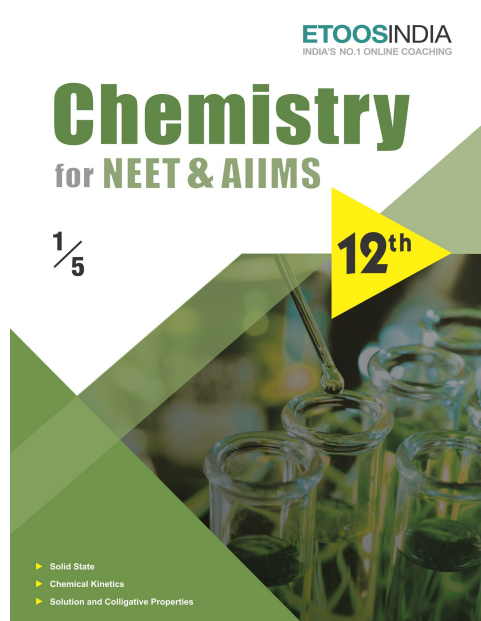
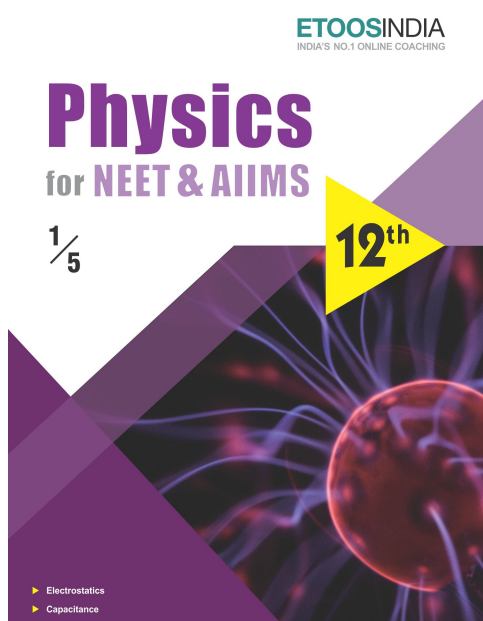
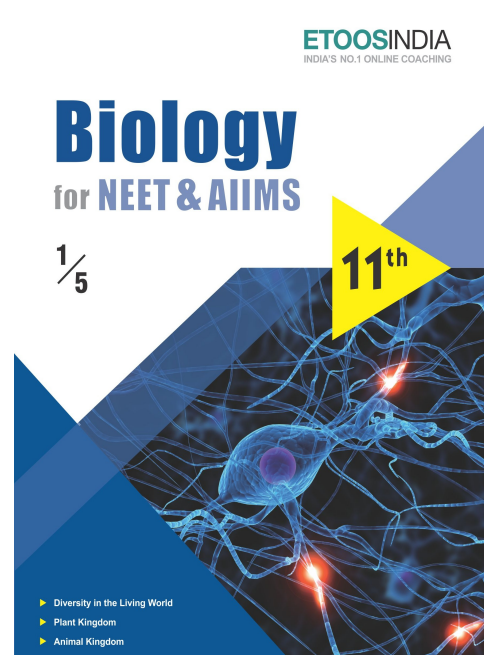
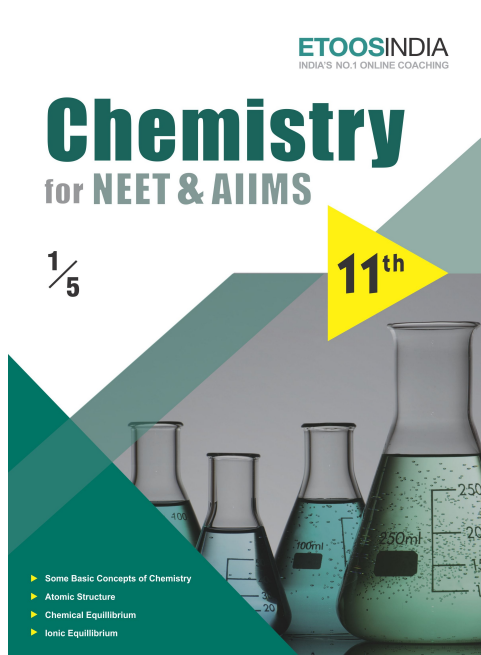
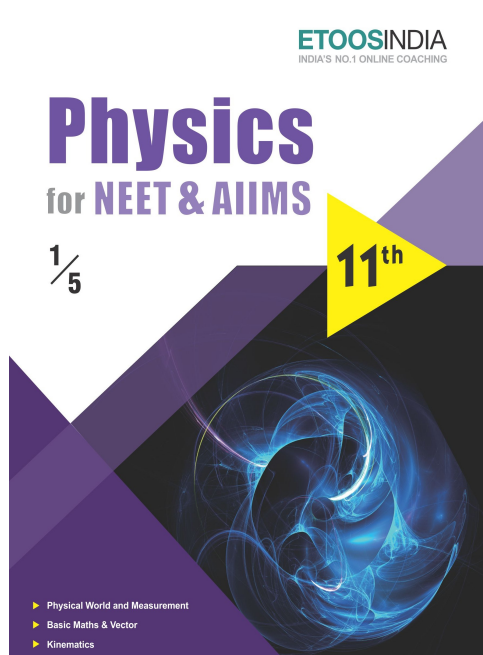


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# CELL CYCLE AND CELL DIVISION

*“ Belief begins where science leaves off and ends where science begins. “*

“RUDOLF VIRCHOW ( 1821-1902)”

## INTRODUCTION

**I**n ability to grow and reproduce is the fundamental property of all living organisms. These organism grow by addition of new cells which arise by division of pre-existing cells. Thus, cell division or cell reproduction maintains the continuity of life. Cell division is defined as the process in which a single parent cell divides into two daughter cells. All cells reproduce by dividing into two, with each parental cell giving rise to two daughter cells each time they divide. These daughter cells grow and attain maturity and give rise to another two daughter cells. This process continues and a single cell divides into millions cells which form the body of organisms. This chapter will help us to understand the significance of cell division.

# CELL DIVISION

## INTRODUCTION

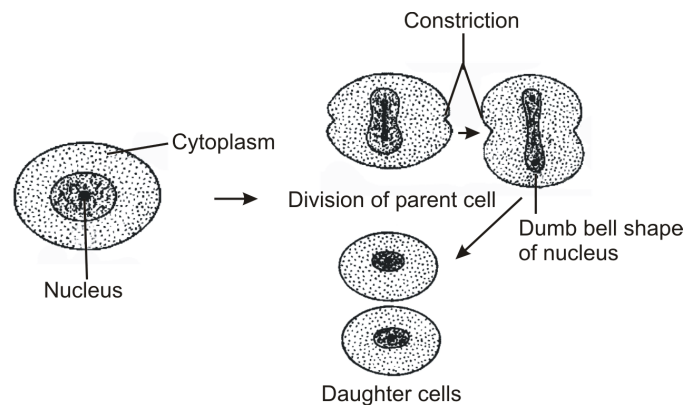
- **W.Flemming** at first studied mitotic division in **Salamander**.
- Strasburger discovered meiosis and gave name prophase, metaphase, anaphase, telophase.
- Meiosis name was given by **Farmer** and **Moore**.
- It is important for development, regeneration and reproduction.
- **Hormone cytokinin increases rate of cell division.**

## TYPES OF DIVISION

- **AMITOSIS**
- **MITOSIS**
- **MEIOSIS**

### AMITOSIS (No Spindle, No Chromosome)

- It is the simplest mode of cell division at first described by **REMAK** (1841).
- This type of division starts with elongation of nucleus.
- Nucleus division is followed by the division of cytoplasm its results in formation of two daughter cells.
- Nucleus becomes dumbbell shaped, and get divided into two daughter nucleus.
- In this division, **no spindle formation** and **no distinct chromosome** formation occurs. Nuclear envelope remains intact. The daughter cells are approximately the two equal halves of a parental cell.  
e.g. PPLO, Blue-green algae, Bacteria and Eukaryotic cells. Examples are yeast-budding occurs by amitosis.
- Amoeba multiple fission occurs by amitosis.
- Mammals-growth of foetal membranes (amnion, chorion, allantois, yolk sac).
- Paramecium division of meganucleus.
- Division of mitochondria and chloroplasts.



**Fig. Amitosis**

## MITOSIS

- Mitosis was discovered by **Flemming** in 1879 in animal cell and in plants cells by **Strasburger** in 1875.
- Mitosis is a cell division in which parent cell divide to form two daughter cell, in which **number of chromosome, amount of DNA**, number and types of gene are equal to parent cell.
- It occurs in **somatic cell (n, 2n, polyploid any)**.
- It is called **indirect division**.

### *Etoos Tips & Formulas*

#### 1. Significance of mitosis :

- Mitosis or the equational division is usually restricted to the diploid cell. Where as some lower plants and some insects haploid cells mitotically divide.
- Mitosis results in the production of daughter cell with identical genetical complement usually.
- The growth of multicellular organism is due to mitosis.
- Cell growth results in disturbing the ratio between the nucleus and cytoplasm, which is restored by mitosis.
- The cells of the upper layer of the epidermis, cells of the lining of the gut, and blood cells are being constantly replaced by mitosis.
- Mitosis in the meristematic tissue - the apical and the lateral meristem (cambium), results in a continuous growth of plants throughout their life.

#### 2. Significance of meiosis :

- Conservation of specific chromosome number of each species is achieved across generation in sexually reproducing organism.
- Increases the genetic variability in the population of organisms from the one generation to the next.
- Variations are very important for the process of evolution.

**SOLVED EXAMPLE**

- Ex.1** Which of the following events are not characteristic features of telophase.
- A. Chromosome material condenses to form compact mitotic chromosomes  
 B. Nucleolus, Golgi complex and ER reform  
 C. Nuclear envelope assembles around the chromosome clusters  
 D. Centromeres split and chromatids separate  
 E. Chromosomes cluster are opposite, spindle poles and their identify as discrete elements is lost
- (A) A, B and D only      (B) A and D only  
 (C) B and C only      (D) C, D and E only  
 (E) A and B only
- Sol.** (B)
- Ex.2** The terms synaptonemal complex refers to site of
- (A) Chromatids separation  
 (B) Spindle attachment  
 (C) Replication  
 (D) Chromosome alignment and recombination
- Sol.** (D)
- Ex.3** A stage in mitosis that starts towards the middle of anaphase and is completed with the telophase is
- Or
- Division of cytoplasm after completion of nuclear division is called
- (A) Cytokinesis      (B) Karyokinesis  
 (C) Crossing over      (D) Interkinesis
- Sol.** (A)
- Ex.4** Which of the following statements is incorrect about  $G_0$  phase
- (A) Mitosis occurs after  $G_0$  phase  
 (B) Biocatalysts can be used to exit  $G_0$  phase  
 (C) Cell volume keeps on increasing during this phase  
 (D) Cell metabolism occurs continuously in  $G_0$  phase
- Sol.** (A)
- Ex.5** Arrange the following events of meiosis in correct sequence
- (A) Crossing over  
 (B) Synapsis  
 (C) Terminalisation of chiasmata  
 (D) Disappearance of nucleolus
- (A) (B), (A), (C) (D)      (B) (A), (B), (C), (D)  
 (C) (B), (C), (D), (A)      (D) (B), (A), (D), (C)
- Sol.** (A) : In prophase I of meiosis I, the correct sequence of events are  
 B - synapsis in Zygotene  
 C - crossing over in pachytene in diakinesis  
 D - disappearance of nucleolus in diakinesis
- Ex.6** The best stage to count the number of chromosomes during mitosis is or structure of chromosomes can be best seen at
- Or
- In which phase of mitosis the chromosomes are arranged around the equator of the spindle
- (A) Prophase  
 (B) Metaphase  
 (C) Anaphase  
 (D) Telophase
- Sol.** (B) : Because in metaphase, chromosomes are present in bivalent form on equator. Chromosomes are much condense and well visible.
- Ex.7** Identify the meiotic stage in which the homologous chromosomes separate while the sister chromatids remain associated at their centromeres
- (A) Metaphase I      (B) Metaphase II  
 (C) Anaphase I      (D) Anaphase II
- Sol.** (C)
- Ex.8** Chromosome number is halved in meiosis during
- (A) Metaphase - I      (B) Anaphase - I  
 (C) Metaphase - II      (D) Anaphase - II
- Sol.** (B)
- Ex.9** Yeast cell can progress through the cell cycle in about
- (A) 30 minutes      (B) 60 minutes  
 (C) 90 minutes      (D) 120 minutes
- Sol.** (C)
- Ex.10** The process of mitosis can be studies in
- (A) Onion root tip      (B) Garlic root tip  
 (C) Tendril tip      (D) All of the above
- Sol.** (D)
- Ex.11** What is not seen during mitosis in somatic cells
- (A) Spindle fibres  
 (B) Chromosome movement  
 (C) Disappearance of nucleolus  
 (D) Synapsis

**Exercise # 1****SINGLE OBJECTIVE****NEET LEVEL**

1. The main difference between a dividing animals and plant cell lies in-  
(A) Cell plate formation  
(B) Coiling of chromosome  
(C) Chromosome movement  
(D) Types of spindle fibres
2. Cytoplasmic structures involved in cell division are-  
(A) Mitochondria            (B) Ribosomes  
(C) Lysosomes                (D) Centrioles
3. Cell division is not present in the cells of-  
(A) Skin                        (B) Gonads  
(C) Brain                       (D) Bone marrow
4. Tetrad is made of-  
(A) Four non homologous chromatids  
(B) Four homologous chromosomes with four chromatids  
(C) Four non homologous chromosomes  
(D) Two homologous chromosomes each with two chromatids
5. During meiotic cells division, genetic recombinations between two homologous chromosomes are facilitate by-  
(A) Movement of centromeres  
(B) Extrusion of polar bodies  
(C) Movement of centrioles  
(D) Formation of synaptonemal complex
6. In the somatic cell cycle-  
(A) In  $G_1$  phase DNA content is double the amount of DNA present in the original cell  
(B) DNA replication takes place in S-phase  
(C) A short interphase is followed by a long mitotic phase  
(D)  $G_2$  phase is followed by mitotic phase
7. Mitosis is not found in -  
(A) Cartilage cells            (B) Bone cells  
(C) Nerve cells                (D) All of the above
8. At which stage during meiotic prophase I the synaptic forces, between homologous chromosomes, are the maximum ?  
(A) Leptotene                (B) Zygotene  
(C) Pachytene                (D) Diplotene
9. The number of chromatids in a chromosome at metaphase is -  
(A) Two each in meiosis and mitosis  
(B) Two in mitosis and one in meiosis  
(C) Two in mitosis and four in meiosis  
(D) One in mitosis and two in meiosis
10. Decondensation of chromosome occurs in -  
(A) Prophase                 (B) Metaphase  
(C) Anaphase                 (D) Telophase
11. A red blood cell was kept in a solution for a few minutes, where it got burst. The solution taken was-  
(A) Hypotonic  
(B) Concentrated sugar solution  
(C) Isotonic  
(D) Hypertonic
12. Function of telomeres in nucleus is -  
(A) Poleward movement  
(B) To initiate the RNA synthesis  
(C) To seal the ends of chromosome  
(D) To recognise the homologous chromosome
13. When pairing occurs in chromosomes (meiosis) -  
(A) Leptotene                (B) Zygotene  
(C) Pachytene                (D) Diakinesis

**Exercise # 2**

**SINGLE OBJECTIVE**

**AIIMS LEVEL**

1. Meiosis not occurs in -  
 (A) Ovule (B) Anther  
 (C) Microsporangia (D) Shoot tip
2. Which of the two events restore the normal number of chromosomes in life cycle -  
 (A) Mitosis and Meiosis  
 (B) Meiosis and fertilisation  
 (C) Fertilisation and mitosis  
 (D) Only meiosis
3. Number of meiosis required to produce 100 ovules in angiosperms -  
 (A) 125 (B) 100  
 (C) 25 (D) 75
4. Amitosis is characteristic of -  
 (A) Higher plants (B) Higher animals  
 (C) Bryophyta (D) Lower organisms
5. Slipping of chiasmata towards the ends of bivalent is called -  
 (A) Terminalisation (B) Diakinesis  
 (C) Interkinesis (D) Heteropycnosis
6. Which does not occurs in prophase -  
 (A) Hydration of chromatin  
 (B) Dehydration of chromatin  
 (C) Appearance of chromosome  
 (D) Disappearance of nuclear memb. and nucleolus
7. During cell cycle, RNA and protein synthesis takes place during -  
 (A)  $G_1$  and  $G_2$  - phase (B) S - Phase  
 (C) M - phase (D) Cytokinesis
8. In which stage of cell division, number of chromosomes best counted -  
 (A) Prophase (B) Metaphase  
 (C) Telophase (D) Interphase
9. The synaptonemal complex was first observed by  
 (A) Moore (1905)  
 (B) Farmer and moore (1905)  
 (C) Mosses (1956)  
 (D) Flemming (1882)
10. How many Chromosome shall be present in a diploid cell at mitotic anaphase if its egg cell has ten chromosome -  
 (A) 10 (Ten) (B) 20 (Twenty)  
 (C) 30 (Thirty) (D) 40 (Forty)
11. If crossing-over occur at two strand stage then percentage of crossing over is -  
 (A) 50% (B) 60%  
 (D) 70% (D) 100%
12. Meiosis which occur at the time of spore formation is called -  
 (A) Zygotic meiosis  
 (B) Haplontic meiosis  
 (C) Terminal meiosis  
 (D) Intermediate meiosis
13. Chromosome exhibit high level of coiling at which phase of karyokinesis -  
 (A) Prophase (B) Metaphase  
 (C) Telophase (D) Interphase
14. The synaptonemal complex appears -  
 (A) Between homologous chromosomes  
 (B) In zygotene stage  
 (C) Composed of DNA + protein  
 (D) All the above
15. At anaphase - II of meiosis each chromosome contains  
 (A) 4 DNA (B) 3 - DNA  
 (C) 2 - DNA (D) 1 - DNA
16. During cell division chromosome move towards different poles due to -  
 (A) Centriole (B) Vacuole formation  
 (C) Microtubules (D) Cytokinesis

**Exercise # 3****PART - 1****MATRIX MATCH COLUMN**

1. Match Column - I with Column - II and select the correct option from the codes given below.
- |   |                    |
|---|--------------------|
| <b>Column - I</b>                           | <b>Column - II</b> |
| A. Division of nucleus                      | i. Interphase      |
| B. Division of cytoplasm                    | ii. Cytokinesis    |
| C. DNA replication                          | iii. Syncytium     |
| D. Karyokinesis not followed by cytokinesis | iv. Karyokinesis   |
- (A) A-ii, B-iv, C-i, D-iii      (B) A-iv, B-ii, C-i, D-iii      (C) A-iv, B-ii, C-iii, D-i      (D) A-iii, B-ii, C-iv, D-i
2. Match Column - I with Column - II and select the correct option from the codes given below.
- |                         |                                |
|-------------------------|--------------------------------|
| <b>Column - I</b>       | <b>Column - II</b>             |
| A. V-shaped at anaphase | i. Acrocentric chromosome      |
| B. L-shaped at anaphase | ii. Metacentric chromosome     |
| C. J-shaped at anaphase | iii. Telocentric chromosome    |
| D. I-shaped at anaphase | iv. Sub-metacentric chromosome |
- (A) A-iv, B-ii, C-i, D-iii      (B) A-ii, B-iv, C-i, D-iii      (C) A-ii, B-iv, C-iii, D-i      (D) A-iv, B-iii, C-ii, D-i
3. Match Column - I with Column - II and select the correct option from the codes given below.
- |                                       |                    |
|---------------------------------------|--------------------|
| <b>Column - I</b>                     | <b>Column - II</b> |
| A. Disintegration of nuclear membrane | i. Anaphase        |
| B. Appearance of nucleolus            | ii. Prophase       |
| C. Division of centromere             | iii. Telophase     |
| D. Replication of DNA                 | iv. S-phase        |
- (A) A-ii, B-iii, C-i, D-iv      (B) A-ii, B-iii, C-iv, D-i      (C) A-iii, B-ii, C-i, D-iv      (D) A-iii, B-ii, C-iv, D-i
4. Match Column - I with Column - II and select the correct option from the codes given below.
- |   |                    |
|---|--------------------|
| <b>Column - I</b>                               | <b>Column - II</b> |
| A. Chromosomes move to spindle equator          | i. Pachytene       |
| B. Centromere splits and chromatids apart       | ii. Zygotene       |
| C. Pairing between homologous chromosomes       | iii. Anaphase      |
| D. Crossing over between homologous chromosomes | iv. Metaphase      |
- (A) A-i, B-ii, C-iii, D-iv      (B) A-ii, B-iii, C-iv, D-i      (C) A-iv, B-iii, C-ii, D-i      (D) A-iii, B-i, C-iv, D-ii
5. Select the incorrectly matched pair.
- |                          |                              |
|--------------------------|------------------------------|
| (A) Phragmoplast         | – Persistent spindle         |
| (B) Reductional division | – Meiosis - I                |
| (C) Equational division  | – Meiosis - II               |
| (D) Crossing over        | – Non-homologous chromosomes |
6. Find the correctly matched pairs and choose the correct option
- |               |   |
|---------------|---|
| A. Leptotene  | – The chromosomes become invisible                    |
| B. Zygotene   | – Pairing of homologous chromosomes                   |
| C. Pachytene  | – Dissolution of the synaptonemal complex takes place |
| D. Diplotene  | – Bivalent chromosomes appear as tetrads              |
| E. Diakinesis | – Terminalization of chiasmata takes place            |
- (A) A and B are correct      (B) B and D are correct      (C) B and E are correct      (D) B and C are correct  
(E) C and D are correct



**Exercise # 4**

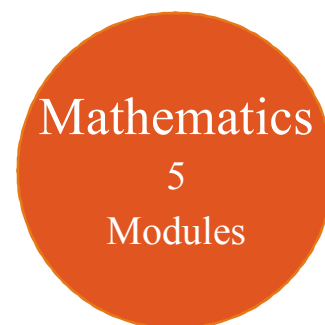
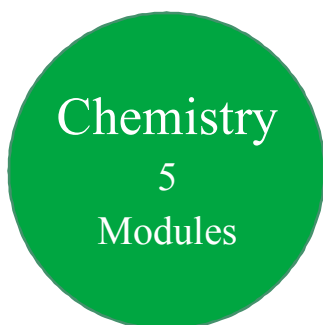
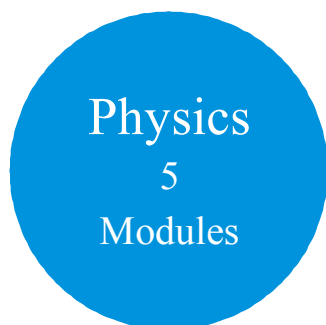
**PART - 1**

**PREVIOUS YEAR (NEET/AIPMT)**

1. During cell division, the spindle fibres attach to the chromosomes at a region called :  
[CBSE AIPMT 2000]  
(A) Chromocentre (B) Kinetochore  
(C) Centriole (D) Chromomere
2. If a diploid cell is treated with colchicine then it becomes :- [CBSE AIPMT 2002]  
(A) Triploid (B) Tetraploid  
(C) Diploid (D) Monoploid
3. Which of the following occurs more than one and less than five in a chromosome :-  
[CBSE AIPMT 2002]  
(A) Chromatid (B) Chromomere  
(C) Centromere (D) Telomere
4. Best material for the study of mitosis in laboratory : - [CBSE AIPMT 2002]  
(A) Anther (B) Root tip  
(C) Leaf tip (D) Ovary
5. Mitotic spindle is mainly composed of which protein :-  
(A) Actin (B) Tubulin  
(C) Actomyosin (D) Myoglobin
6. Crossing over that results in genetic recombination in higher organisms occurs between :-  
[CBSE AIPMT 2004]  
(A) Sister chromatids of a bivalents  
(B) Non-sister chromatids of a bivalent  
(C) Two daughter nuclei  
(D) Two different bivalents
7. In the somatic cell cycle :- [CBSE AIPMT 2004]  
(A) In  $G_1$  phase DNA content is double the amount of DNA present in the original cell  
(B) DNA replication takes place in S-phase  
(C) A short interphase is followed by a long mitotic phase  
(D)  $G_2$  phase follows mitotic phase
8. Which one of the following precedes reformation of the nuclear envelope during M- phase of the cell cycle :- [CBSE AIPMT 2004]  
(A) Decondensation from chromosomes and reassembly of the nuclear lamina  
(B) Transcription from chromosomes and reassembly of the nuclear lamina  
(C) Formation of the contractile ring and formation of the phragmoplast  
(D) Formation of the contractile ring and transcription from chromosomes
9. If you are provided with root-tips of onion in your class and are asked to count the chromosomes which of the following stages can you most conveniently look into :- [CBSE AIPMT 2004]  
(A) Metaphase (B) Telophase  
(C) Anaphase (D) Prophase
10. At what stage of the cell cycle are histone proteins synthesized in a eukaryotic cell - [CBSE AIPMT 2005]  
(A) During G-2 stage of prophase  
(B) During S-phase  
(C) During entire prophase  
(D) During telophase
11. Centromere is required for - [CBSE AIPMT 2005]  
(A) Movement of chromosomes towards poles  
(B) Cytoplasmic cleavage  
(C) Crossing over  
(D) Transcription
12. The salivary gland chromosomes in the dipteran larva, are useful in gene mapping because - [CBSE AIPMT 2005]  
(A) These are much longer in size  
(B) These are easy to stain  
(C) These are fused  
(D) They have endoreduplicated chromosomes

1. During cell growth, DNA synthesis takes place in  
(A) S-phase (B) G<sub>1</sub>-phase (C) G<sub>2</sub>-phase (D) M phase
2. When cell has stalled DNA replication fork, which checkpoint should be predominantly activated?  
(A) G<sub>1</sub>/S (B) G<sub>2</sub>/M (C) M (D) Both G<sub>2</sub>/M and M
3. Which of the following phases correspond to the interval between mitosis and initiation of DNA replication?  
(A) S phase (B) G<sub>1</sub> phase (C) G<sub>2</sub> phase (D) M phase  
(E) Telophase
4. The checkpoint in cell cycle plays important role in  
(A) repair DNA damage (B) apoptosis initiation  
(C) assess DNA damage (D) inhibit cell damage
5. In a typical eukaryotic cell cycle, Gap 1, Synthesis and Gap 2 are the three phases included in the  
(A) prophase (B) metaphase (C) anaphase (D) interphase  
(E) telophase
6. Compare the statements A and B.  
**Statement A** : Synthesis of DNA takes place in the S-phase of interphase.  
**Statement B** : Every chromosome, during metaphase, has two chromatids.  
Choose the correct description.  
(A) Statement A is wrong and B is correct.  
(B) Statement A is correct and B is wrong.  
(C) Both the statements A and B are correct and A is the reason for B.  
(D) Both the statements A and B are correct and A is not the reason for B.
7. Amitosis is shown by  
(A) bacteria (B) *Euglena* (C) *Syllis* (D) *Hydra*
8. Which of the following is not a characteristic feature during mitosis in somatic cells?  
(A) Chromosome movement (B) Synapsis  
(C) Spindle fibres (D) Disappearance of nucleolus
9. Find out the correct statement.  
(A) During mitosis endoplasmic reticulum and nucleolus disappear completely at early prophase.  
(B) Chromosomes are arranged along the equator during prophase of mitosis.  
(C) Chromosome is made up of two sister chromatids at anaphase of mitosis.  
(D) A cell plate is laid down during interphase.  
(E) Small disc shaped structures at the surface of the centromeres that appear during metaphase are kinetochores.
10. Select the correct statement related to mitosis.  
(A) Amount of DNA in the parent cell is first halved and then distributed into two daughter cells.  
(B) Amount of DNA in the parent cell is first doubled and then distributed into two daughter cells.  
(C) Amount of DNA in the parent cell is first halved and then distributed into four daughter cells.  
(D) Amount of DNA in the parent cell is first doubled and then distributed into four daughter cells.

# 11<sup>th</sup> Class Modules Chapter Details



PHYSICS	CHEMISTRY	BIOLOGY
<p><b>Module-1</b></p> <ol style="list-style-type: none"> <li>1. Physical World &amp; Measurements</li> <li>2. Basic Maths &amp; Vector</li> <li>3. Kinematics</li> </ol> <p><b>Module-2</b></p> <ol style="list-style-type: none"> <li>1. Law of Motion &amp; Friction</li> <li>2. Work, Energy &amp; Power</li> </ol> <p><b>Module-3</b></p> <ol style="list-style-type: none"> <li>1. Motion of system of particles &amp; Rigid Body</li> <li>2. Gravitation</li> </ol> <p><b>Module-4</b></p> <ol style="list-style-type: none"> <li>1. Mechanical Properties of Matter</li> <li>2. Thermal Properties of Matter</li> </ol> <p><b>Module-5</b></p> <ol style="list-style-type: none"> <li>1. Oscillations</li> <li>2. Waves</li> </ol>	<p><b>Module-1(PC)</b></p> <ol style="list-style-type: none"> <li>1. Some Basic Concepts of Chemistry</li> <li>2. Atomic Structure</li> <li>3. Chemical Equilibrium</li> <li>4. Ionic Equilibrium</li> </ol> <p><b>Module-2(PC)</b></p> <ol style="list-style-type: none"> <li>1. Thermodynamics &amp; Thermochemistry</li> <li>2. Redox Reaction</li> <li>3. States Of Matter (Gaseous &amp; Liquid)</li> </ol> <p><b>Module-3(IC)</b></p> <ol style="list-style-type: none"> <li>1. Periodic Table</li> <li>2. Chemical Bonding</li> <li>3. Hydrogen &amp; Its Compounds</li> <li>4. S-Block</li> </ol> <p><b>Module-4(OC)</b></p> <ol style="list-style-type: none"> <li>1. Nomenclature of Organic Compounds</li> <li>2. Isomerism</li> <li>3. General Organic Chemistry</li> </ol> <p><b>Module-5(OC)</b></p> <ol style="list-style-type: none"> <li>1. Reaction Mechanism</li> <li>2. Hydrocarbon</li> <li>3. Aromatic Hydrocarbon</li> <li>4. Environmental Chemistry &amp; Analysis Of Organic Compounds</li> </ol>	<p><b>Module-1</b></p> <ol style="list-style-type: none"> <li>1. Diversity in the Living World</li> <li>2. Plant Kingdom</li> <li>3. Animal Kingdom</li> </ol> <p><b>Module-2</b></p> <ol style="list-style-type: none"> <li>1. Morphology in Flowering Plants</li> <li>2. Anatomy of Flowering Plants</li> <li>3. Structural Organization in Animals</li> </ol> <p><b>Module-3</b></p> <ol style="list-style-type: none"> <li>1. Cell: The Unit of Life</li> <li>2. Biomolecules</li> <li>3. Cell Cycle &amp; Cell Division</li> <li>4. Transport in Plants</li> <li>5. Mineral Nutrition</li> </ol> <p><b>Module-4</b></p> <ol style="list-style-type: none"> <li>1. Photosynthesis in Higher Plants</li> <li>2. Respiration in Plants</li> <li>3. Plant Growth and Development</li> <li>4. Digestion &amp; Absorption</li> <li>5. Breathing &amp; Exchange of Gases</li> </ol> <p><b>Module-5</b></p> <ol style="list-style-type: none"> <li>1. Body Fluids &amp; Its Circulation</li> <li>2. Excretory Products &amp; Their Elimination</li> <li>3. Locomotion &amp; Its Movement</li> <li>4. Neural Control &amp; Coordination</li> <li>5. Chemical Coordination and Integration</li> </ol>

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# 12<sup>th</sup> Class Modules Chapter Details

Physics  
5  
Modules

Chemistry  
5  
Modules

Mathematics  
5  
Modules

PHYSICS	CHEMISTRY	BIOLOGY
<p><b>Module-1</b></p> <ol style="list-style-type: none"> <li>1. Electrostatics</li> <li>2. Capacitance</li> </ol> <p><b>Module-2</b></p> <ol style="list-style-type: none"> <li>1. Current Electricity</li> <li>2. Magnetic Effect of Current and Magnetism</li> </ol> <p><b>Module-3</b></p> <ol style="list-style-type: none"> <li>1. Electromagnetic Induction</li> <li>2. Alternating Current</li> </ol> <p><b>Module-4</b></p> <ol style="list-style-type: none"> <li>1. Geometrical Optics</li> <li>2. Wave Optics</li> </ol> <p><b>Module-5</b></p> <ol style="list-style-type: none"> <li>1. Modern Physics</li> <li>2. Nuclear Physics</li> <li>3. Solids &amp; Semiconductor Devices</li> <li>4. Electromagnetic Waves</li> </ol>	<p><b>Module-1(PC)</b></p> <ol style="list-style-type: none"> <li>1. Solid State</li> <li>2. Chemical Kinetics</li> <li>3. Solutions and Colligative Properties</li> </ol> <p><b>Module-2(PC)</b></p> <ol style="list-style-type: none"> <li>1. Electrochemistry</li> <li>2. Surface Chemistry</li> </ol> <p><b>Module-3(IC)</b></p> <ol style="list-style-type: none"> <li>1. P-Block Elements</li> <li>2. Transition Elements (d &amp; f block)</li> <li>3. Co-ordination Compound</li> <li>4. Metallurgy</li> </ol> <p><b>Module-4(OC)</b></p> <ol style="list-style-type: none"> <li>1. HaloAlkanes &amp; HaloArenes</li> <li>2. Alcohol, Phenol &amp; Ether</li> <li>3. Aldehyde, Ketone &amp; Carboxylic Acid</li> </ol> <p><b>Module-5(OC)</b></p> <ol style="list-style-type: none"> <li>1. Nitrogen &amp; Its Derivatives</li> <li>2. Biomolecules &amp; Polymers</li> <li>3. Chemistry in Everyday Life</li> </ol>	<p><b>Module-1</b></p> <ol style="list-style-type: none"> <li>1. Reproduction in Organisms</li> <li>2. Sexual Reproduction in Flowering Plants</li> <li>3. Human Reproduction</li> <li>4. Reproductive Health</li> </ol> <p><b>Module-2</b></p> <ol style="list-style-type: none"> <li>1. Principles of Inheritance and Variation</li> <li>2. Molecular Basis of Inheritance</li> <li>3. Evolution</li> </ol> <p><b>Module-3</b></p> <ol style="list-style-type: none"> <li>1. Human Health and Disease</li> <li>2. Strategies for Enhancement in Food Production</li> <li>3. Microbes in Human Welfare</li> </ol> <p><b>Module-4</b></p> <ol style="list-style-type: none"> <li>1. Biotechnology: Principles and Processes</li> <li>2. Biotechnology and Its Applications</li> <li>3. Organisms and Populations</li> </ol> <p><b>Module-5</b></p> <ol style="list-style-type: none"> <li>1. Ecosystem</li> <li>2. Biodiversity and Conservation</li> <li>3. Environmental Issues</li> </ol>

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