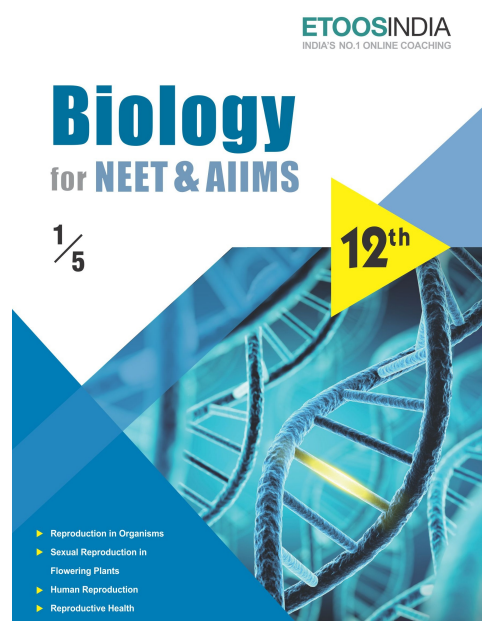
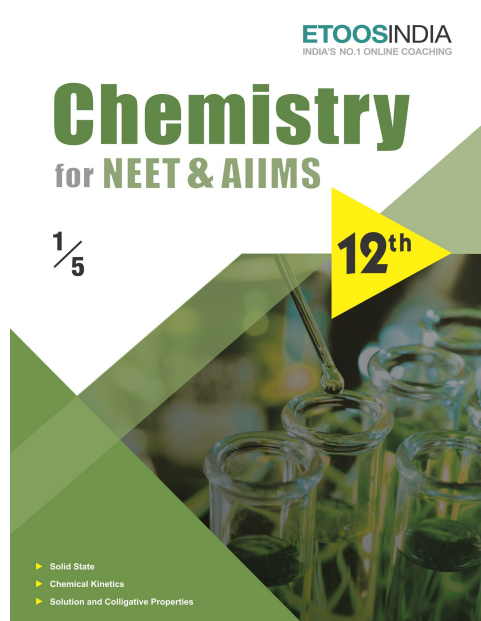
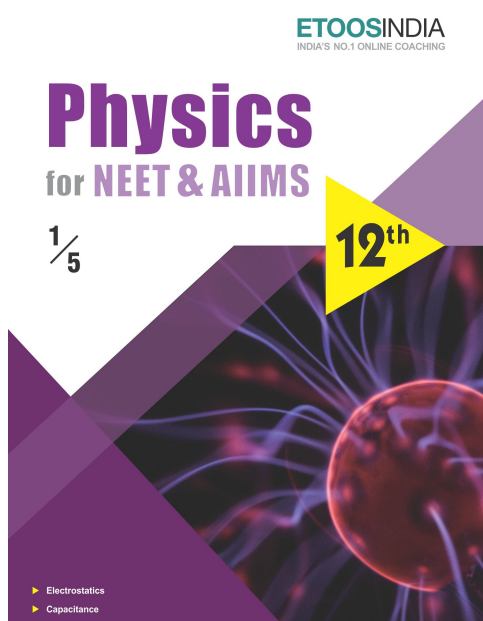
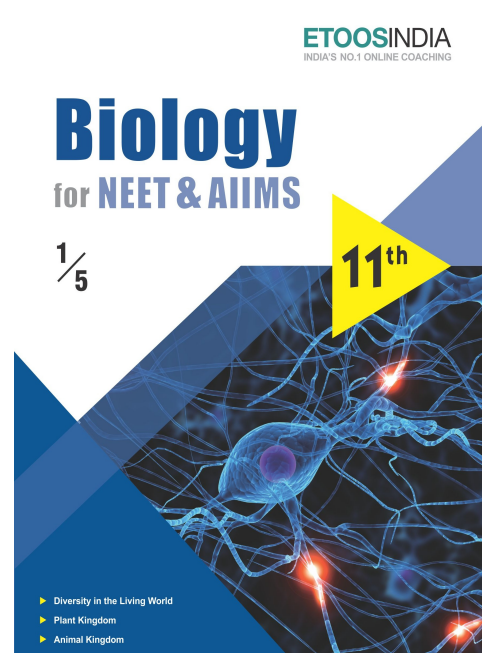
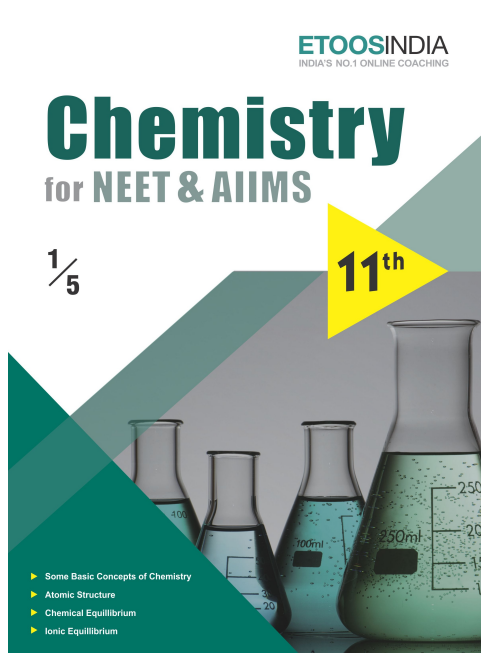
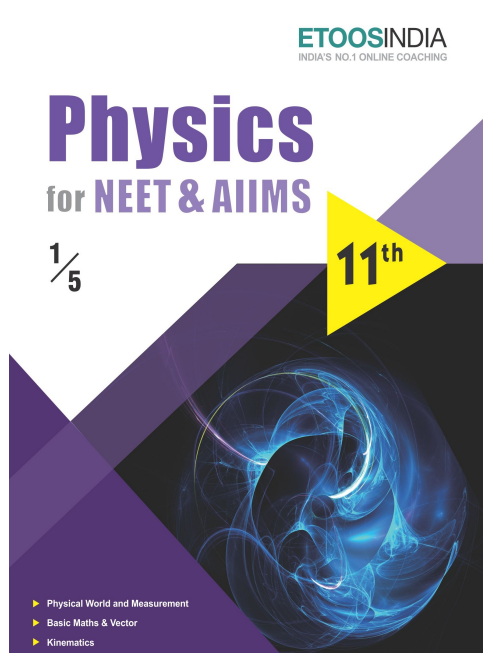


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## CELL : THE UNIT OF LIFE

*“The cause of nutrition and growth resides not in the organism as a whole, but in the separate elementary parts — the cells.”*

“THEODORE SCHWANN (1810-1882)”

### INTRODUCTION

**W**hen you look around, you see the diversity of living world comprising of various organisms like microscopic bacteria to huge multicellular plants and animals. You must have also wondered and asked yourself several times - “What is it that makes an organism living, or what is it that an inanimate thing does not have which a living thing has?” The answer to this is the presence of the basic unit of life--the cell in all living organisms.

All living organisms possess life and are made up of basic unit structure called **Cell**. An organisms consists of one or more cells. Accordingly there are of two types of organisms:

(i) Unicellular organisms-e.g. Amoeba, Diatoms etc. (ii) Multicellular organisms e.g. Plants,Animals etc.

**CELL : THE UNIT OF LIFE****What is Cytology?**

Cytology : Structural study of cell

**What is Cell Biology?**

Cell Biology : Structural & Functional study of cell.

**HISTORY**

**Discovery of cell** – In 1665 Robert Hooke examined thin slices of cork under his self made microscope (Magnification = 42 times). The cork seen was dead bark of spanish oak (*Quercus suber*). Robert Hooke coined the term "Cellula" for Honey comb like structure of bottle cork (Greek cellulae = Hollow space) which later modified to cell. Actually he saw only the dead cell walls of plant cells. He published his findings in his book 'Micrographia'.

**Karl Nageli** showed that cells in plants arises by the division of pre existing cell.

- Discovery of living cell by **Leeuwenhoek**–
- Leeuwenhoek examined mud, semen, saliva, blood, Insects etc. Under his self made microscope and observe protozoans, sperm, bacteria, RBC, muscle cells etc.
- He called these tiny creatures as "Animalcules" and published his finding in "Secrets of nature".
- He is known as father of microbiology, father of bacteriology, father of protozoology.

**R. Virchow** stated "Omnis cellula e cellula" which means all cells arises from pre existing cell. This is known as "**Law of Lineage**".

- Father of cytology is **Hertwig & R. Hooke**.
- Father of Indian cytology is **Dr. A.K. Sharma**.
- Father of modern cytology is **C.P. Swannson**.

**General facts Related With cells**

- **Longest cell** is nerve cell of Giraffe. (more than 1m) (90 cm in man).
- **Largest cell** is egg of ostrich (17cm x 13.5 cm dimension).
- Smallest cell is PPLO (Pleuro Pneumonia Like Organism).
- Smallest plant cell mycoplasma Laidlawii 0.1  $\mu$ .
- Largest plant cell – Acetabularia (10cm)
- Longest plant cell – Remie fibre (*Boehmeria nevia*)
- Centre for cellular and molecular biology is at **Hyderabad**.

**Cell Theory**

Cell theory → 

- Cell theory was proposed by **Schleiden** and **Schwann**.
- According to cell theory, all livings things are made up of cells.
- Cell is structural and functional unit of living being.
- They have power of Reproduction.

- Apposition

**Intussusception**

- When the particles are deposited between the substance which are already present then this types of growth is called **Intussusception Growth**
- This types of growth takes place in primary, secondary and tertiary cell wall.

**Apposition (Accretion)**

- When the **layers** are desposited on to the layers which are present already , then this types of growth is called apposition growth
- This types of growth takes place in **secondary cell wall**.

**Functions**

- Cell wall protects the protoplasm.
- Cell wall gives a particular size & shape to cell & functions in form of exoskeleton of cell.
- It gives a mechanical support to cell.
- Cell wall is permeable so it helps in transport of water & mineral substances
- Cell wall plays an important role in absorption, transpiration, transport and secretion etc.

**ETOOS KEY POINTS**

1. The middle lamella can be dissolved by strong acid only.
2. Bacterial cell without cell wall is called **Lister-Form**.(L-form)
3. **Mucopeptide** is a polymer of two amino-sugar, N-acetyl Glucosamine (NAG) and N-acetyl muramic acid (NAM).
4. In **cellulose**, a polymer of **unbranched chain of glucose** molecule linked by  **$\beta$ -1-4 glycosidic bond**.
5. The cellulose formation is takes place in presence of **celulose synthetase** enzymes which is present in membrane.

**Cell Coat (Glycocalyx)****Position –**

It is found outside the plasma membrane in many **protistants** and animals cell. Made by **sialic acid** mucin & Hyluronic acid

**Function –**

- It protects the underlying plasma membrane.
- It provides definite shape to the cell.
- It helps in recognition of microbes for defence.

**PLASMA MEMBRANE**

- Term **plasma lemma** was given by **J.Q. Plower (1885)**.
- Term cell membrane or **plasma membrane** was given by **Nagelli**.
- Term **unit membrane** was given by **Robertson**.
- At first, structure of cell membrane was studied by **Overton** and postulated that cell membrane is composed of a continuous layer of lipid material.
- It is outermost boundary of animal cell.



**ETOOS KEY POINTS**

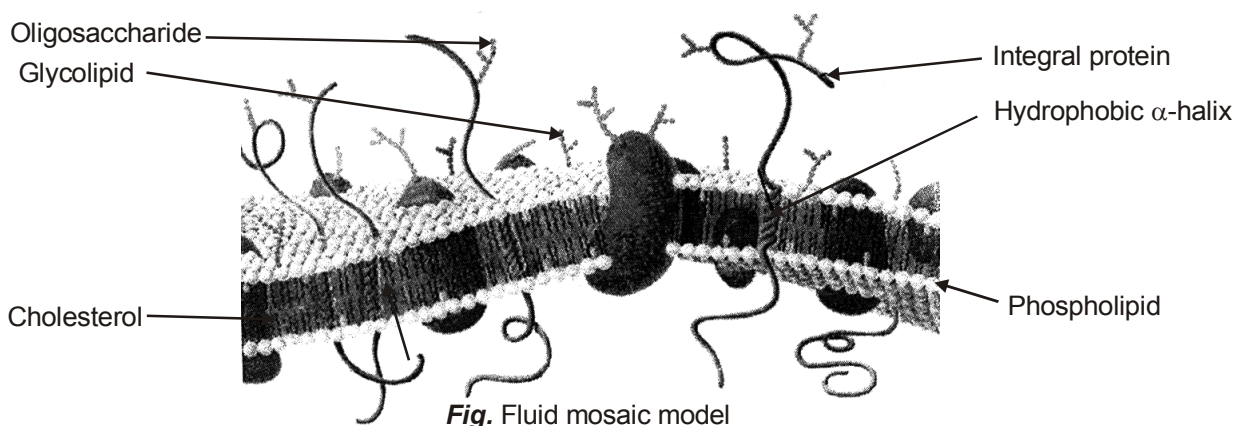
1. Plasma membrane is a thin selective permeable & living membrane.
2. It is flexible and porous membrane.
3. Plasmalemma of animal cells is elastic due to the presence of **lipids**.

**Model of cell membrane**

To describe structure of plasma membrane numerous models have been proposed but the important model are as follow :-

**Fluid mosaic model (1973)**

- This model was proposed by **Singer** and **Nicholson**.
- It described protein as ice bergs in a sea of lipids.
- It is the most accepted model.
- There is a central bilipid layer (2 layer) composed of phospholipids arranged in a specific manner.
- Hydrophilic polar head constitute top and bottom surfaces.
- Hydrophobic non polar tail end-are buried in the membrane.
- Within phospholipid, bilayer, proteins are arranged in (2) forms
  - Intrinsic proteins
  - Extrinsic proteins



**Intrinsic proteins (70%)**

- Such protein partially or wholly remain embedded in phospholipid.

*Etoos Tips & Formulas*

- The cell is the basic structural, functional and biological unit of all known living organisms,
- Robert Hooke (1665) observedd honey-comb like dead cells in a thin slice of cork and named them 'cell'. Anton van
- Leeuwenhoek (1667) was the first to describe a living cell.
- The properties of a living organism depend on those of its individual and RNA found in the cell nucleus and cytoplasm.
- All cells are basically the same in chemical composition in organisms of similar species. Energy flow (metabolism and biochemistry) occurs within cells.)

**CELL THEORY** (Magna Carta of Cell Study)

- MJ Schleiden ; 1838 and Theodor Schwann; 1839.
- The postulates are:
  - (a) All living beings are made up of cells (cell is the basic unit of life).
  - (b) All cells arise from pre-existing cells (Omnis cellula e cellula - Rudolf Virchow).
  - (c) Cell is the smallest independent unit of life.
- Size of biological cell is generally too small to be seen without a microscope. There are exceptions as well as considerable range in the sizes of various cell types.

**→ Growth of Cell Wall**

The growth and formation of cell wall occurs by two ways:

- (i) By intussusception : It is the deposition of wall material in the form of fine grains.
- (ii) By apposition : In this method, the new cell wall material secreted by protoplasm is deposited by definite thin plates one after other.

**→ Function of the cell wall :**

- (i) It maintains the shape of plant cell and protects it from mechanical injury.
- (ii) It wards off the effect of pathogens.

**→ Plasma Membrane**

Plasmalemma contains about 58 - 59 % proteins, 40 % lipids and 1-2 % carbohydrates.

- Autosomes: These are the somatic chromosomes which do not take part in fertilisation process. These are also called allosomes and they are 44 in number in human body.

**MITOCHONDRIA**

- Visible under the microscope only after specific staining.
- Number per cell is variable, depending on the physiological activity of the cells.

**SOLVED EXAMPLE**

- Ex.1** Who invented the "electron microscope"  
(A) Knoll and Ruska  
(B) Robert Brown  
(C) Correns  
(D) Janssen and Janssen
- Sol.** (A)
- Ex.2** With the increase in diameter of the rotor, the effective RCF (relative centrifugal force) at a fixed RPM (revolutions per minute) will  
(A) Remain unaffected  
(B) Increase  
(C) Decrease  
(D) Be lower at the bottom of centrifugal tube
- Sol.** (B)
- Ex.3** Detailed structure of the membrane was studied after the advent of electron microscope during  
(A) 1930's (B) 1950's  
(C) 1970's (D) 1990's
- Sol.** (B)
- Ex.4** Which of the following is used for observing spindle fibres
- Or
- The microscope usually used for seeing living cells or tissues  
(A) Dark field microscope  
(B) Phase contrast microscope  
(C) Polarisation microscope  
(D) Scanning transmission electron microscope
- Sol.** (B) : Phase contrast microscope is used to observe living cells and cell organs i.e., spindle fibres, pinocytosis, karyokinesis, cytokinesis etc.
- Ex.5** Who proposed the "Cell theory"  
(A) Schleiden (botanist) and Schwann (zoologist)  
(B) Watson and Crick  
(C) Mendel and Morgan  
(D) Robert Hooke
- Sol.** (A) : M. J. Schleiden and T. Schwann (1838 - 39) proposed cell theory
- Ex.6** Which of the following is absent in prokaryotes  
(A) Nuclear membrane  
(B) Golgi bodies  
(C) Endoplasmic reticulum  
(D) All the above
- Sol.** (D)
- Ex.7** Middle lamella is made up of  
(A) Cellulose  
(B) Suberin  
(C) Calcium and magnesium pectate  
(D) Lignin
- Sol.** (C)
- Ex.8** Plant cell wall consists of  
(A) Lignin + hemicellulose + pectin + lipid  
(B) Lignin + protein + hemicellulose + pectin  
(C) Lignin + hemicellulose + pectin + cellulose  
(D) Lignin + hemicellulose + tubulin + lipid
- Sol.** (C)
- Ex.9** Cell wall is absent in  
(A) Gametes (B) Amoeba  
(C) Mycoplasma (D) All of these
- Sol.** (D)
- Ex.10** The type of cell junction which facilitates cell to cell communication is  
(A) Tight junction (B) Adhering junction  
(C) Gap junction (D) Desmosomes  
(E) Brush borders
- Sol.** (C)
- Ex.11** According to widely accepted "Fluid mosaic model" cell membranes are semi-fluid, where lipids and integral proteins can diffuse randomly. In recent years, this model has been modified in several respects. In this regard, which of the following statements is incorrect  
(A) Proteins in cell membranes can travel within the lipid bilayer  
(B) Proteins can also undergo flip-flop movements in the lipid bilayer.  
(C) proteins can remain confined within certain domains of the membrane  
(D) Many proteins remain completely embedded within the lipid bilayer

**Exercise # 1**

**SINGLE OBJECTIVE**

**NEET LEVEL**

1. Which of the following is the smallest cell-  
(A) Human nerve cells (B) Chlamydomonas  
(C) Virus (D) PPLO
2. Which of the following is true of the carbohydrate portion of the cell membrane-  
(A) It contributes to the polycationic charge on the extracellular surface  
(B) It is 1% of plasma membrane  
(C) It is found primarily in the form of free saccharide groups  
(D) It has a symmetric distributions
3. Plasmalemma of animal cells is elastic due to the presence of-  
(A) Proteins (B) Lipids  
(C) Carbohydrates (D) Microfilaments
4. The most abundant substance of middle lamella is-  
(A) Lignin (B) Suberin  
(C) Pectin (D) Cutin
5. Cell wall is the secretory product of-  
(A) Lysosomes (B) Cytoplasm  
(C) Plasmodesmata (D) Middle lamella
6. The size of the nucleolus is large where-  
(A) Protein synthesis is active  
(B) Protein synthesis is less  
(C) No protein synthesis occurs  
(D) None of the above
7. Aerobic respiration is performed by-  
(A) Iyosomes (B) Chloroplast  
(C) Mitochondria (D) Glyoxysomes
8. Mitochondria are most abundant in-  
(A) Heart muscle (B) Muscles of thigh  
(C) Wings of birds (D) None
9. Cytochrome oxidases are found-  
(A) On outer wall of mitochondria  
(B) In the matrix of mitochondria  
(C) In the lysosomes  
(D) On cristae of mitochondria
10. Small particles present on inner mitochondrial membrane are called-  
(A) Cristae (B) Ergatosomes  
(C) Elementary particles (D) Quantasome
11. Lysosomes are called "suicide bags" because they have-  
(A) Catabolic enzymes (B) Food vacuole  
(C) Hydrolytic enzymes (D) Parasitic activity
12. In which of the following cells the endoplasmic reticulum is absent-  
(A) Kidney cells  
(B) Liver cells  
(C) Mammalian mature erythrocytes  
(D) Mammalian eye cells
13. If cells are broken up and sedimented by centrifugation, the new structures formed in one of the fraction is-  
(A) Centrosomes (B) Microsomes  
(C) Peroxisomes (D) Lysosomes
14. The endoskeleton of the cell is made up of-  
(A) Cell wall (B) Cytoplasm  
(C) E.R. (D) Mitochondria
15. Match the following  
(A) Microtubules - Structural component of cilia  
(B) Centrioles - Store hydrolases  
(C) Peroxisomes - Stores carbohydrate, fats and proteins in plants  
(A) 1 correct, 2 and 3 false  
(B) 1 and 3 correct, 2 false  
(C) 1 and 2 correct, 3 false  
(D) All are false
16. The carbohydrates which project out of the lipid bilayer in animal cell membrane are linked to -  
(A) Lipids only (B) Proteins only  
(C) Peptidoglycan (D) Both lipid & protein



**Exercise # 2****SINGLE OBJECTIVE****AIIMS LEVEL**

1. Butter Sandwich model of plasma membrane was proposed by -  
(A) Davson and Danielli  
(B) Robertson  
(C) Singer and Nicolson  
(D) Benson
2. Ingestion of solid food by plasma membranes is called -  
(A) Endosmosis (B) Pinocytosis  
(C) Cytokinesis (D) Phagocytosis
3. In order to find out quickly whether the cells are living one must observe -  
(A) Cell sap  
(B) Tonoplast  
(C) Movement of Cytoplasm  
(D) Starch granules
4. Maximum enzymes are found in -  
(A) Lysosomes (B) Mitochondria  
(C) Nucleus (D) E.R.
5. Rough E.R. mainly responsible for -  
(A) Protein synthesis  
(B) Cell wall formation  
(C) Lipid synthesis  
(D) Cholesterol synthesis
6. Mitochondria supply most of the necessary biological energy through -  
(A) Breaking down sugars  
(B) Reducing NADP  
(C) Oxidising substrates of TCA cycle  
(D) Breaking down proteins
7. Enzymes for ETS occurs in (mitochondria)-  
(A) Matrix  
(B) Outer wall  
(C) Inner membrane  
(D) Between inner & outer wall
8. Which cell organelle secretes zymogen granules  
(A) Lysosomes (B) Golgibody  
(C) Smooth E.R. (D) Sphaerosomes
9. Mitochondrial DNA is -  
(A) Naked (B) Circular  
(C) Double stranded (D) All the above
10. Lysosomes are not helpful in -  
(A) Osteogenesis  
(B) Cellular digestion  
(C) Metamorphosis in frog  
(D) Lipogenesis
11. Digestion of hormonal vesicle by lysosome is called -  
(A) Crinophagy (B) Heterophagy  
(C) Autophagy (D) Autolysis
12. In mammals, the mitochondrial ribosomes are  
(A) 55s (B) 70s  
(C) 80s (D) 100s
13. Mitochondria are site of respiration first reported by Kingsbury and supported by Hogeboom. Mitochondria are related with the oxidation of -  
(A) Carbohydrates (B) Fats  
(C) Proteins (D) All the above
14. Peptidyl transferase enzyme found on -  
(A) Cytoplasm (B) E.R.  
(C) Golgibody (D) Ribosomes
15. Which of the following is absent in an intact cell :-  
(A) Microsomes (B) Golgibody  
(C) Glyoxysomes (D) Microtubules
16. Which microscope is best study cell division in functional state -  
(A) EM  
(B) SEM  
(C) Phase contrast microscope  
(D) Simple microscope

**Exercise # 3**

**PART - 1**

**MATRIX MATCH COLUMN**

1. Match Column-I with Column-II and select the correct option from the codes given below

**Column - I**

- A. Leeuwenhoek
- B. Robert Brown
- C. Schleiden
- D. Schwann

- (A) A-i, B-iii, C-iv, D-ii
- (C) A-iii, B-i, C-iv, D-ii

**Column - II**

- i. First saw and described a living cell
- ii. Presence of cell wall is unique to plant cells
- iii. Discovered the nucleus
- iv. All plants are composed of different kind of cells

- (B) A-i, B-iii, C-ii, D-iv
- (D) A-i, B-iv, C-ii, D-iii

2. Which one is the mis-matched pair?

- A. Largest isolated single cell
- B. Golgi apparatus
- C. Mitochondria
- D. Lysosomes

- Egg of an ostrich
- Discovered by Altman
- Name was given by Benda
- Discovered by de Duve

3. Match Column-I with Column-II and select the correct option from the codes given below.

**Column - I**

- A. Mitochondria
- B. Lysosomes
- C. Ribosomes
- D. Nucleus

**Column - II**

- i. Without membrane
- ii. Single membrane
- iii. Double membrane

A	B	C	D
(A) i	ii	iii	iii
(B) iii	i	i	ii
(C) iii	ii	i	iii
(D) ii	iii	i	iii

4. Match Column - I with Column - II and select the correct option from the codes given below.

**Column - I**

- A. Dictyosomes
- B. Mitochondria
- C. Vacuoles
- D. Grana

**Column - II**

- i. Storage
- ii. Photosynthesis
- iii. Transport
- iv. Secretion
- v. Respiration

A	B	C	D
(A) iv	v	i	ii
(B) i	ii	iv	iii
(C) iv	i	ii	iii
(D) i	ii	iii	iv

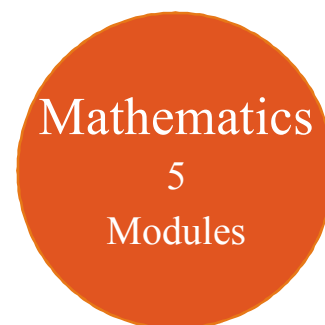
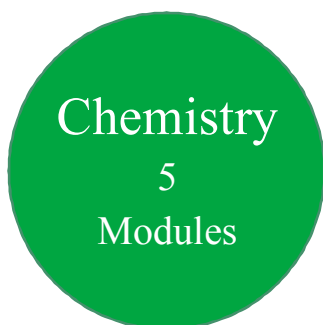
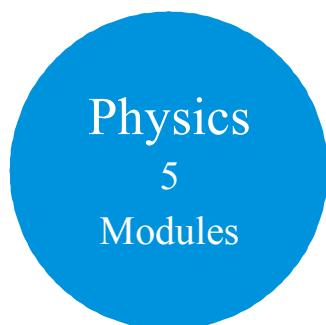
**Exercise # 4****PART - 1****PREVIOUS YEAR (NEET/AIPMT)**

1. The cell organelle involved in glycosylation of protein [CBSE AIPMT-2000]  
(A) ribosome (B) peroxisome  
(C) endoplasmic (D) mitochondria
2. Lysosomes are reservoirs of [CBSE AIPMT-2000]  
(A) RNA and protein  
(B) fats  
(C) secretory glycoproteins  
(D) hydrolytic enzymes
3. Microtubules are absent in [CBSE AIPMT-2001]  
(A) mitochondria (B) centriole  
(C) flagella (D) spindle fibres
4. In 'fluid mosaic model of plasm [CBSE AIPMT-2002]  
(A) upper layer is non-polar and hydrophilic  
(B) upper layer is polar and hydrophobic  
(C) phospholipids form a bimolecular layer in middle part  
(D) proteins form a middle layer
5. Ribosomes are produced in [CBSE AIPMT-2002]  
(A) nucleolus (B) cytoplasm  
(C) mitochondria (D) golgi body
6. Flagella of prokaryotic and eukaryotic cells differ in [CBSE AIPMT-2004]  
(A) type of movement and placement in cell  
(B) location in cell and mode of functioning  
(C) microtubular organisation and type of movement  
(D) microtubular organisation and function
7. In chloroplasts, chlorophyll is present in the [CBSE AIPMT-2004]  
(A) outer membrane (B) inner membrane  
(C) thylakoids (D) stroma
8. Extra nuclear inheritance is a consequence of presence of genes in [CBSE AIPMT-2004]  
(A) mitochondria and chloroplasts  
(B) endoplasmic reticulum and mitochondria  
(C) ribosomes and chloroplast  
(D) lysosomes and ribosomes
9. A student wishes to study the cell structure under a light microscope cell structure under a light microscope having 10X eyepiece and 45X objective. he should illuminate the object by which one of the following colours of light so as to get the best possible resolution ? [CBSE AIPMT-2004]  
(A) Blue (B) Green  
(C) Yellow (D) Red
10. Chlorophyll in chloroplast is located in [CBSE AIPMT-2005]  
(A) grana (B) pyrenoid  
(C) stroma (D) Both (A) and (C)
11. Protein synthesis in an animal cell occurs [CBSE AIPMT-2000,05]  
(A) only on the ribosomes present in cytosol  
(B) only on ribosomes attached to the nuclear envelope and endoplasmic reticulum  
(C) on ribosomes present in the nucleolus as well as in cytoplasm  
(D) on ribosomes present in cytoplasm as well as in mitochondria
12. According to widely accepted 'fluid mosaic model', cell membranes are semifluid, where lipids and integral proteins can diffuse randomly. In recent years, this model has been modified in several respects. In this regard, which of the following statements is incorrect? [CBSE AIPMT-2005]  
(A) Proteins in cell membranes can travel within the lipid bilayer  
(B) Proteins can also undergo flip-flop movements in the lipid bilayer  
(C) Proteins can remain confined within certain domains of the membrane  
(D) many proteins remain completely embedded within the lipid bilayer
13. The main organelle involved in modification and routing of newly synthesised proteins to their destinations is [CBSE AIPMT-2005]  
(A) chloroplast  
(B) mitochondria  
(C) lysosome  
(D) endoplasmic reticulum

## MOCK TEST

1. A nanometre is  
 (A)  $10^{-9}$  m                      (B)  $10^{-4}$  m                      (C)  $10^{-6}$  m                      (D)  $10^{-12}$  m  
 (E)  $10^9$  m
2. Objects less than  $0.2 \mu\text{m}$  in size cannot be seen under light microscope because  
 (A) the wavelength of visible light is  $3900 \text{ \AA}$  to  $7800 \text{ \AA}$   
 (B) only two types of lenses are used  
 (C) maximum magnifying power of ocular lens is 20 X  
 (D) maximum magnifying power of objective lens is 100 X.
3. The microscope usually used for seeing living cells or tissues is  
 (A) compound microscope                      (B) electron microscope  
 (C) phase contrast microscope                      (D) light microscope
4. Numerical aperture of microscope lens is expressed by  
 (A) angular aperture only                      (B) refractive index only  
 (C) both angular aperture and refractive index                      (D) wave length of the light used
5. “*Omnis cellula-e cellula*” was stated by  
 (A) Schwann                      (B) Schleiden                      (C) Purkinje                      (D) Virchow
6. Cells divide and new cells are formed from pre-existing cells. This concept was given by  
 (A) Matthias Schleiden  
 (B) Theodore Schwann  
 (C) Matthias Schleiden and Theodore Schwann  
 (D) Rudolf Virchow
7. **Assertion :** Pili are tubular structures present in bacteria which help in conjugation.  
**Reason :** Formation of pili is controlled by  $F^+$  or fertility factor.  
 (A) If both assertion and reason are true and reason is the correct explanation of assertion.  
 (B) If both assertion and reason are true but reason is not the correct explanation of assertion.  
 (C) If assertion is true but reason is false.  
 (D) If both assertion and reason are false.
8. Which of the following structures is not found in a prokaryotic cell?  
 (A) Mesosome                      (B) Plasma membrane                      (C) Nuclear envelope                      (D) Ribosome
9. Select the mismatch.  
 (A) Gas vacuoles – Green bacteria                      (B) Large central vacuoles – Animal cells  
 (C) Protists – Eukaryotes                      (D) Methanogens – Prokaryotes
10. Mitochondria and chloroplast are  
 (A) semi-autonomous organelles  
 (B) formed by division of pre-existing organelles and they contain DNA but lack protein synthesising machinery.  
 Which one of the following options is correct?  
 (A) (A) is true but (B) is false                      (B) Both (A) and (B) are false  
 (C) Both (A) and (B) are correct                      (D) (B) is true but (A) is false

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



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