PHYSICS WALLAH

YAKEEN NEET

- Cell: The Unit of Life
- Cell Cycle and Cell Division
- Principles of Inheritance and Variation
- Molecular Basis of Inheritance
- The Living World
- Biological Classification

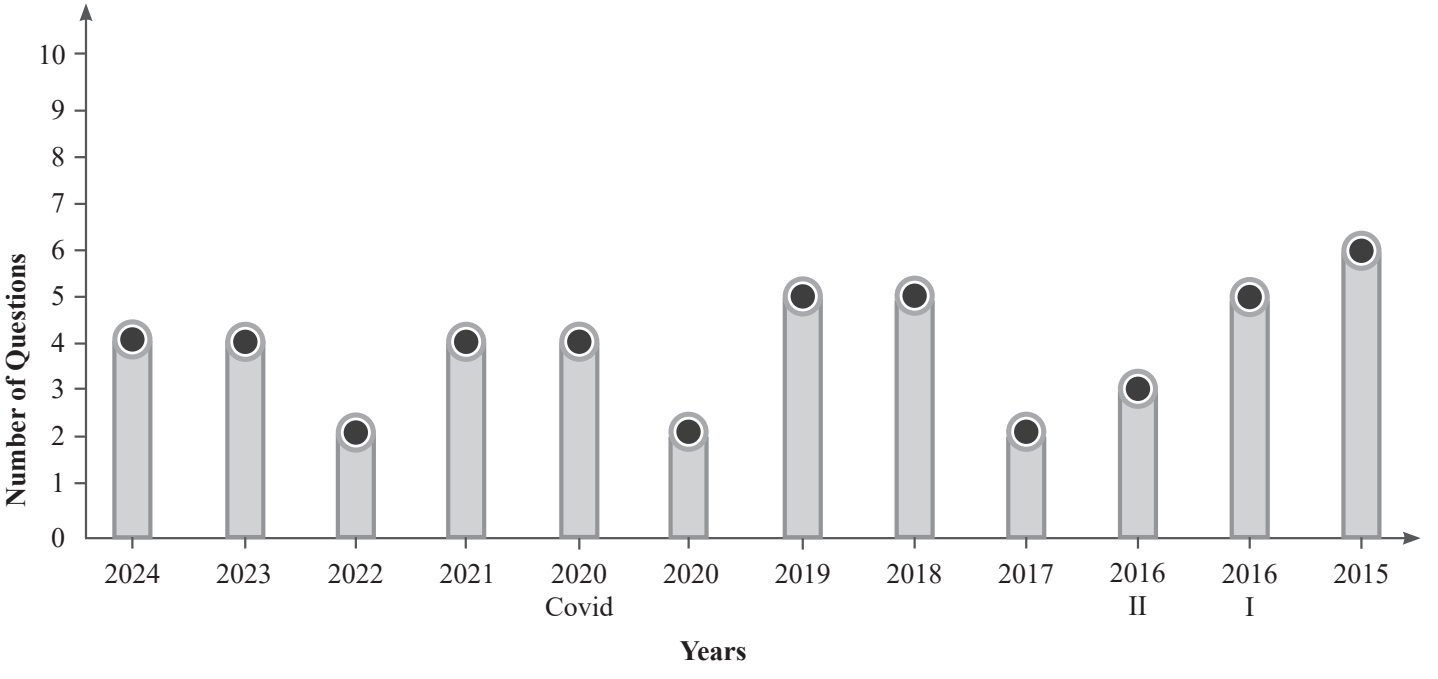
Botany

MODULE 1

CHAPTER

1 Cell: The Unit of Life

Year Wise Number of Questions Analysis (2024-2015)



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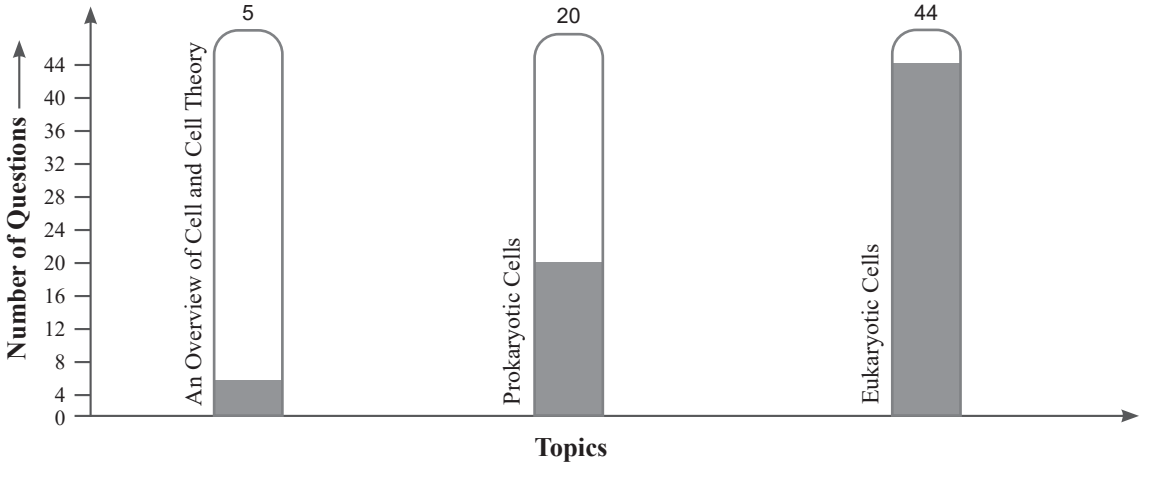
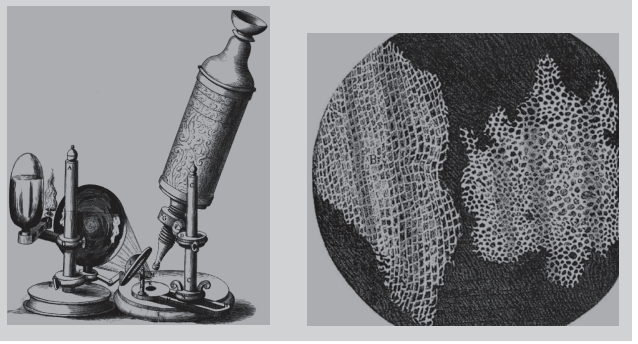


WHAT IS A CELL?

- Cell is the fundamental **structural and functional unit** of all living organisms., i.e., all organisms are composed of cells.

Discovery of the Cell

Cells were first observed by **1***_____ in 1665 using a simple microscope. When he observed thin slices of cork, he saw a network of chambers in a honey-comb structure. He named these structures as **cellula**. Robert Hooke's observation was published in his book *Micrographia*.



(*a*) (*b*)

Fig. 1: (*a*) Robert Hooke's microscope
(*b*) Honeycomb structure of Cork

Anton Von Leeuwenhoek was another scientist who observed live cells after Robert Hooke but with improved lenses in his microscope. His microscope could magnify the objects better.

He observed moving objects under the microscope which he called animalcules. These included protozoa and bacteria.

Based on number of cell, organisms are of two types:

1. **Unicellular organisms:** Composed of a single cell.
2. **2**_____ **organisms:** Composed of many cells.

- Unicellular organisms are capable of:
  (*i*) Independent existence
  (*ii*) Performing the essential functions of life
- A single cell is a small and complex structure, so the complete and clear view of all its components is revealed after the invention of **electron microscopes.**

Key Note

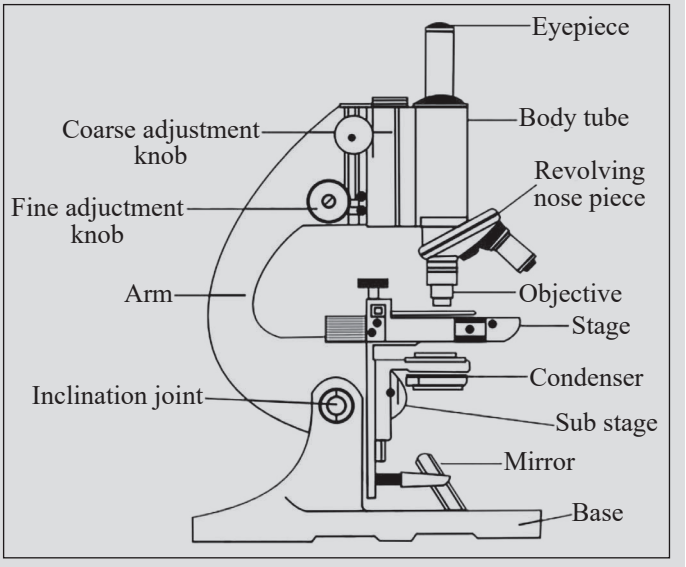
- **Robert Hooke** first observed dead cell in plant cork in 1665.
- **Anton Von Leeuwenhoek** first saw and described a live cell in 1674.
- **Robert Brown** discovered the nucleus in 1831.

EXTENDED LEARNING

Microscopy

Biological studies and explorations cannot be imagined without a microscope as it enables us to see something which is beyond the scope of our eyes.

The use of first microscope dates back to **1665** when the British Physicist **Robert Hooke** designed a simple microscope using combination of magnifying lenses and observed the slices of cork, and coined the term *Cellulae* or cell to that honeycomb like structure. Later **Matthias Jacob Schleiden** and **Theodore Schwann** proposed cell theory in **1838** on the basis of observation of cells in plants and animals. Since, then with development of technology, microscopy has undergone improvement.



- **Light microscopy:** Light microscopes, also known as optical microscopes, have been the workhorses of biology for centuries. Light microscope have magnification power upto 1000 X, these instruments employ lenses and illumination systems to magnify specimens and reveal their cellular and sub-cellular details.
- **An electron microscopy:** Electron microscopy is a highly sophisticated technique in which the object to be studied is bombarded with electron beam which is approximately 1,00,000 time shorter in wavelength than visible light. The electron beam in an electron microscope magnifies the image with the help of electromagnetic lenses. The wavelength of electrons is thousands of times shorter than visible light, hence electron microscopes would be able to resolve objects that are thousands of times smaller. However, due to use of electron beam, electron microscope are not used to study live material.

CELL THEORY

- A cell is the fundamental and structural unit of all living organisms. It is the smallest biological, structural and functional unit of all plants and animals. Therefore, cells are the 'Building Blocks of Life' or the 'Basic units of Life'. Organisms made up of a single cell are '**3**_____'

1* *"NCERT Focused Fill-ins" is an exercise with blanks in textbook passages that students fill in to test their NCERT-based knowledge and grasp over NCERT Textbook.*

whereas organisms made up of many cells are 'multicellular'. Cells perform many different functions within a living organism such as digestion, respiration, reproduction, etc.

- For example, within the human body, a lot of cells give rise to a tissue → multiple tissues make up an organ → many organs create an 4 _____ → several organ systems functioning together make up the human body.

Formulation of Cell Theory

- Cell theory was formulated by a **German botanist** Matthias Schleiden in 1838 and a **British zoologist**, Theodore Schwann in 1839.
- **Matthias Schleiden** examined a large number of plants and observed that all plants are composed of different kinds of cells which form the tissues of the plant.
- **Theodore Schwann** studied different types of **animal cells** and reported that cells had a thin outer layer which is today known as the '5 _____'.
- Based on his studies on **plant tissues**, he concluded that the presence of **cell wall is a unique** character of the plant cells.
- On this basis, he proposed the hypothesis that the bodies of animals and plants are composed of cells and products of cells.
- **Rudolf Virchow**: Cell theory did not explain the mechanism of formation of new cells. So, Rudolf Virchow (1855) first explained that cells divide and new cells are formed from 6 _____ cells (*Omnis cellula-e cellula*). He modified the cell theory to give it a final shape.

Features of cell theory

- All livings organisms are composed of cells and products of cells.
- All cells arise from pre-existing cells.

Need to Know

- Viruses represent a connecting link between living and non-living things. They are exception to cell theory because they do not grow or reproduce by themselves. This makes them non-living. However, when a virus enters a living cell of an organism, it obtains energy from the host cell and starts reproducing
- Anything less than a complete structure of a cell does not ensure independent living.

AN OVERVIEW OF CELL

- Onion peel cell is a typical plant cell which has a distinct cell wall as its outer boundary and just within it, is the cell membrane whereas the human cheek cell have an outer membrane as the delimiting structure of the cell **(cell wall is absent in animal cells)**.
- Dense membrane bound structure is found inside each cell which is called as **nucleus** which itself contains chromosomes which in turn contain the genetic material, DNA.
- Cells that have membrane bound nuclei are called eukaryotic whereas cells that lack a membrane bound nucleus are prokaryotic. In both prokaryotic and eukaryotic cells, a semi-fluid matrix called cytoplasm occupies the volume of the cell.

Key Note

- **Cytoplasm** is a semi-fluid matrix which occupies the volume of the cell. It is the **main arena** of cellular activities in both the plant and animal cells.
- Various chemical reactions occur inside the cytoplasm to keep the cell in the **'living state'**.

Types of Cells According to Size & Shape

- Cells differ greatly in size, shape and activities. They may be disc-like, polygonal, columnar, cuboid, thread-like, or even irregular. **The shape of the cell may vary with the function they perform**.

Table 1: Some important cells and their features with their dimensions

Cell type	Feature/Size/Shape
Mycoplasma	Smallest cell; 7 _____ µm in length
Bacteria	3-5 µm
Ostrich egg	Largest isolated single cell
8 _____ _____	7.0 µm in diameter
Nerve cells (neurons)	Longest cells in humans

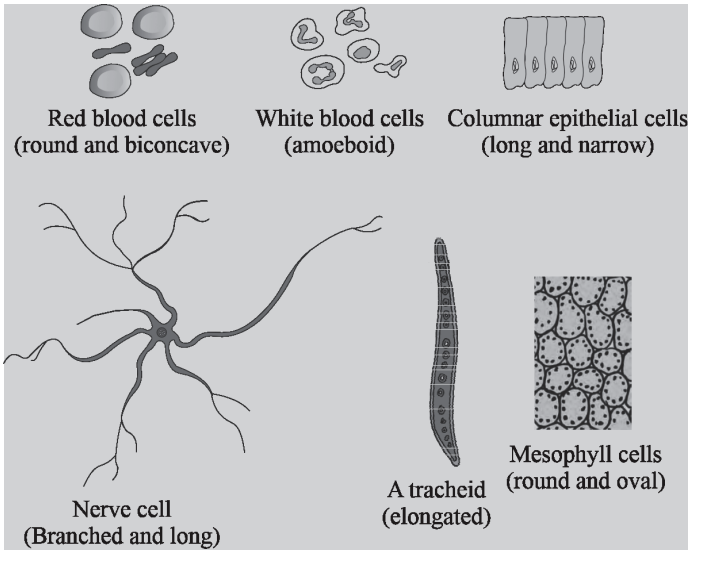


Fig. 2: Diagram showing different shapes of the cells

Concept Application

Fill in the Blanks:

1. First person who saw and described a living cell is_____.
2. Unicellular organisms are capable of _____ and _____.
3. The smallest cell is of _____and its size is _____.
4. "*Omnis cellula-e-cellula*" which means new cells arises from pre-existing cells was given by scientist_____.

True and False:

5. Cell theory was given by Matthias Schleiden (British Botanist) and Theodore Schwann (German Zoologist).

TYPES OF CELLS

According to the Nuclear Organisation

On the basis of nuclear organisation, cells are classified mainly into two types:

- Prokaryotic cell
- Eukaryotic cell

PROKARYOTIC CELLS

- The cells which lack a well defined nucleus and membrane bound organelles are called **prokaryotic** cells.
- These cells are represented by bacteria, blue-green algae, mycoplasma and PPLO (Pleuro Pneumonia Like Organisms).

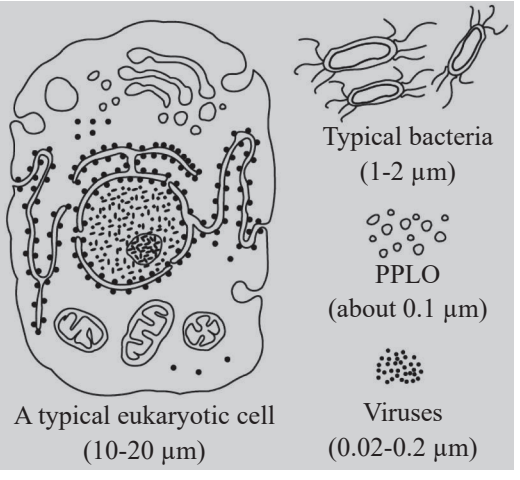


Fig. 3: Diagram showing comparison of eukaryotic cell with other organisms

- They are generally smaller and **multiply more rapidly** than the 9_____ cells.
- Prokaryotic cells may **vary greatly** in shape and size. The **four basic shapes** of bacteria are as follows:
  - **Bacillus (rod-like):** These are rod-shaped bacteria that occur singly or in groups of two or three joined together to form a long chain. Example: *Bacillus coagulans.*
  - **Coccus (spherical):** These bacteria are spherical or oval in shape. Example: *Streptococcus pyogenes*.
  - **Vibrio (10_____):** These are comma-shaped bacteria. Example: *Vibrio cholerae.*
  - **Spirillum (spiral):** These are spiral-shaped bacteria. Example: *Spirillum minus*.

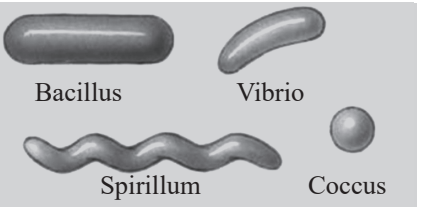


Fig. 4: Bacteria of different shapes

Structure of Prokaryotic Cell

- The organisation of the prokaryotic cell is fundamentally similar even though prokaryotes exhibit a wide variety of shapes and functions.
- All prokaryotes are surrounded by plasma/cell membrane which is itself surrounded by a cell wall. 11_____ **is an exception** where the cell wall is absent.
- The fluid matrix filling the cell is called cytoplasm.
- There is no well-defined nucleus.
- The genetic material is basically 12_____, i.e., not enveloped by a nuclear membrane.
- In addition to the genomic DNA (the single chromosome/circular DNA), many bacteria have small circular DNA outside the genomic DNA. These smaller DNA are called 13_____.
- The plasmid DNA confers certain unique **phenotypic** characters to such bacteria. One such character is resistance to **antibiotics**.

3D Model

Scan this QR code to understand the ultra structure of Prokaryotic cell through 3D model. To learn more download the Physics Wallah App.

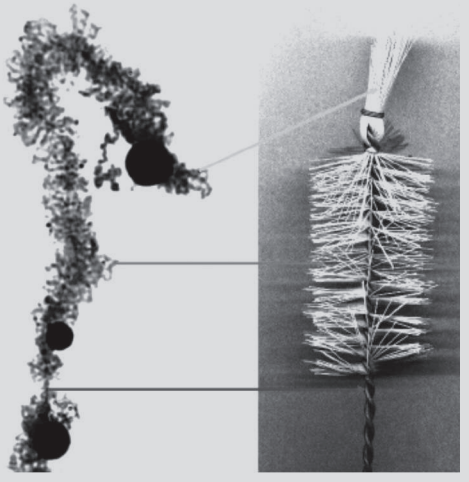
Key Note

- Plasmid DNA is used to monitor bacteria transformation with foreign DNA.
- Nuclear envelope and membrane bound cell organelles are absent in prokaryotic cells.
- Ribosome is the only cell organelle found in prokaryotes.

Cell Envelope and its Modifications

- Most prokaryotic cells, particularly the bacterial cells, have a chemically complex **cell envelope** which consists of a tightly bound **three layered** structure, i.e., the **outermost** 14_____ followed by the middle **cell wall** and then the innermost **plasma membrane**.
- They act together as a single 15_____ **unit** but each layer of the envelope performs distinct function as well.

- **Lampbrush chromosomes**: These are the largest known chromosomes found in the yolk rich oocytic nuclei of certain vertebrates such as fishes, amphibians, reptiles and birds. They can be seen with naked eye and are characterized by fine lateral loops, arising from the chromomeres, during first prophase (diplotene) of meiosis. These loops give it a brush-like appearance; that is why these are called lampbrush chromosomes, first discovered by **Flemming** in **1882** and were described in **shark oocytes by Ruckert (1892)**.



Microbodies

- Microbodies are **single membrane** bound small spherical structures. *e.g.*, peroxisomes, glyoxisome etc.
- Present in both plant and animal cells.
- They contain various enzymes.

Concept Application

True and False:

32. Nucleus as a cell organelle was first described by Robert Brown in 1831.

33. Nuclear envelope consists of two parallel membranes with a space between (10 to 20 nm) called the perinuclear space.

34. Erythrocytes of many mammals and sieve tube cells of vascular plants lack nucleus.

35. Nucleolus is a site of active ribosomal RNA synthesis.

Fill in the Blanks:

36. Term chromatin was given by _____.

37. A single human cell has approximately _____ long thread of DNA distributed among its _____ chromosomes.

38. Chromatin is stained with a _____ dye.

39. Metacentric chromosome has _____ centromere forming _____ arms of the chromosome.

40. In _____ chromosome, centromere is present at the terminal end.

Table 3: Difference Between Prokaryotic Cell and Eukaryotic Cell

	Prokaryotes	Eukaryotes
Type of Cell	Always unicellular	Unicellular and multicellular
Cell size	Ranges in size from 0.2 μm – 2.0 μm in diameter	Size ranges from 10 μm – 100 μm in diameter
Cell wall	Usually present; chemically complex in nature	When present, chemically simple in nature
Nucleus	Absent. Instead, they have a nucleoid region in the cell	Present
Ribosomes	Present smaller in size and spherical in shape	Present comparatively larger in size and linear in shape
DNA arrangement	Circular	Linear
Mitochondria	Absent	Present
Cytoplasm	Present, but cell organelles absent	Present, cell organelles present
Endoplasmic reticulum	Absent	Present
Plasmids	Present	Very rarely found in eukaryotes
Ribosome	Small ribosomes	Large ribosomes
Lysosome	Lysosomes and centrosomes are absent	Lysosomes and centrosomes are present
Cell division	Through binary fission	Through mitosis
Flagella	The flagella are smaller in size and not covered by plasma membrane	The flagella are larger in size and covered by plasma membrane
Reproduction	Asexual	Both asexual and sexual
Example	Bacteria and Archaea	Plant and Animal cell

Cell

- Cell is the fundamental structural and functional unit of all living organisms.
- **Anton Von Leeuwenhoek** first saw and described a live cell.

Cell Theory

- Cell theory was given by two scientists **Schleiden** and **Schwann.**
- It states that all plants or animals are composed of cells and their products.
- **Rudolf Virchow** explained that new cells arise from pre-existing cells (*Omnis cellula-e cellula*) and finally modified the cell theory as:
  (*i*) All living organisms are composed of cells and products of cells.
  (*ii*) All cells arise from pre-existing cells.

An Overview of Cell

- Cells differ greatly in size, shape and activities for example, **Mycoplasma** is smallest cell (0.3µm), egg of an ostrich is the largest isolated single cell.
- **Cytoplasm** is main arena of cellular activities in both plant and animal cells.

Prokaryotic Cells

- Lack membrane bound nucleus and cell organelles.
- Represented by bacteria, blue-green algae, mycoplasma and PPLO (0.1µm).
- In addition to genomic DNA, many bacteria have small circular DNA outside the genomic DNA called **plasmids**.
- All prokaryotes have a cell wall surrounding the cell membrane (except mycoplasma).
- Most prokaryotic cells have cell envelope which is tightly bound three layered structure i.e., the outermost **glycocalyx** followed by the **cell wall** and then the **plasma membrane**.
- **Mesosomes are** extensions of plasma membrane into the cell. It helps in cell wall formation, DNA replication, distribution of daughter cells, respiration, secretion process and increase the surface area of plasma membrane.
- In cyanobacteria, chromatophores contain pigments.
- Prokaryotic cells have surface structures - **flagella**, **pili** and **fimbriae**. Pill and fimbriae are also surface structures of the bacteria but do not play a role in motility.
- Bacteria may be motile or non-motile. If motile they have flagella, composed of three parts: **Filament** (longest portion), **hook** and **basal body**.
- Bacteria, on the basis of the staining, can be **Gram positive** or **Gram negative**.
- Ribosomes are non-membrane bound organelles.
- Ribosomes are 70S, has subunits 50S and 30S. Several ribosomes may attach to a single mRNA and form a chain called **polyribosome** or **polysome**.
- **Reserve material** is stored in the form of inclusion bodies in prokaryotic cytoplasm. E.g., phosphate granules, cyanophycean granules and glycogen granules.
- **Gas vacuoles** are found in blue-green, purple and green photosynthetic bacteria.

Eukaryotic Cells

- The eukaryotes include all the protists, plants, animals and fungi.
- Besides the nucleus, eukaryotic cells have other membrane bound structure called **organelles** like **ER**, **Golgi complex** etc.
- Cell membrane is mainly composed of proteins and lipids (**mainly phospholipids**).
- Membrane proteins can be **integral** or **peripheral**.
- Most accepted model for structure of cell membrane is **fluid mosaic model** given by **Singer and Nicolson** (1972).
- Membrane is **selectively permeable**.
- The **quasi-fluid** nature of lipid enables **lateral** movement of proteins within the overall bilayer. This ability to move within the membrane is measured as its fluidity.
- The fluid nature of membrane is important for cell growth, formation of intercellular junctions, secretion, endocytosis, cell division etc.
- Cell wall is a non-living rigid structure forms an outer covering of the plasma membrane in fungi and plants.
- **Primary wall:** Cell wall of a young plant cell is capable of growth which gradually diminishes as the cell matures.
- **Secondary wall:** As cell matures, it is formed on inner side (towards membrane) of the cell.
- **Middle lamella:** It is a layer mainly composed of calcium pectate that holds the different neighbouring cells together.
- **Cell wall of algae:** Cellulose, galactans, mannans and calcium carbonate.
- **Cell wall of plants:** Cellulose, hemicellulose, pectin and proteins.
- Endomembrane system is made up of ER, GC, lysosomes and vacuole.
- **RER** (Rough endoplasmic reticulum) is involved in protein synthesis and **SER** (Smooth endoplasmic reticulum) is involved in lipid synthesis.
- **Golgi apparatus** has cisternae that perform processing, packaging and transporting the materials for secretions.
- **Lysosomes** contain hydrolytic enzymes

1. Which of the following pair is **correctly** matched?

(1) Microtubules – Structural components of cilia

(2) Centrioles – Store hydrolytic enzymes

(3) Amyloplasts – Store oil,protein and starch in plants

(4) Passive transport - Na^+/K^+ Pump

Sol. Hydrolytic enzymes are stored in lysosomes. Amyloplasts are responsible for the storage of starch. Na^+/K^+ pump involves active transport.

Therefore, option (1) is the correct answer.

2. Select the **incorrectly** matched pair:

(1)	Inclusion bodies	-	Stores reserve materials in prokaryotes
(2)	Fimbriae	-	Helps bacteria in attachment
(3)	Secondary wall	-	Formed towards membrane
(4)	Quasi-fluid nature of lipids	-	Flip-flop movement of proteins

Sol. The Quasi-fluid nature of lipid enables lateral movement of proteins within the overall lipid bilayer.

Therefore, option (4) is the correct answer.

3. Select the **incorrectly** matched pair:

(1) Camillo Golgi-Golgi bodies.

(2) Robert Brown-Nucleus.

(3) Flemming-Chromatin .

(4) George Palade-Mitochondria.

Sol. Ribosomes were discovered by George Palade.

Therefore, option (4) is the correct answer.

4. Choose the option containing the set of structures which are **not** surrounded by any membrane.

(1) Ribosome and mitochondria

(2) Mitochondria and chloroplast

(3) Ribosome and nucleolus

(4) Nucleolus and chloroplast

Sol. Ribosomes and nucleous are non-membrane bound structures whereas mitochondria and chloroplast are bound by double membrane.

Therefore, option (3) is the correct answer.

5. The function of polysome in prokaryotic cell is to:

(1) translate m-RNA into protein.

(2) store reserve food materials.

(3) synthesize pigments.

(4) help in lipid synthesis.

Sol. Polysome form when several ribosomes are attached to a single m-RNA molecule. It helps in translation of mRNA into a functional protein.

Therefore, option (1) is the correct answer.

6. The matrix of mitochondria possess;

(1) a single circular ds DNA molecule.

(2) 70S ribosomes.

(3) the components required for the synthesis of proteins.

(4) All of these

Sol. The matrix of mitochondria possesses single circular DNA molecule, a few RNA molecules, ribosomes (70S) and the components required for the synthesis of proteins.

Therefore, option (4) is the correct answer.

7. Proteins synthesized by endoplasmic reticulum are modified in the cisternae of Golgi apparatus before they are released from its:

(1) *trans* face. (2) *Cis* face

(3) Forming face (4) Convex *trans* face

Sol. A number of proteins synthesised by ribosomes on the endoplasmic reticulum are modified in the cisternae of the golgi apparatus before they are released from its trans face.

Therefore, option (1) is the correct answer.

8. Enzymes like lipases, proteases and carbohydrases are found in

(1) Lysosome (2) Golgi bodies

(3) ER (4) Mitochondrion

Sol. Hydrolytic enzymes such as lipases, proteases, and carbohydrases are abundant in lysosomal vesicles.

Therefore, option (1) is the correct answer.

9. What is a tonoplast?

(1) Outer membrane of mitochondria

(2) Inner membrane of chloroplast

(3) Membrane of the vacuole of plant cells

(4) Cell membrane of a plant cell

Sol. The vacuole in a plant cell is separated from the rest of the cell by a single membrane called the tonoplast.

Therefore, option (3) is the correct answer.

10. A cell organelle in prokaryotes is concerned with storage of reserve food materials, e.g., cyanophycean granules, etc. It is a non-membrane bound cell organelle. Identify it among the following

(1) Gas vacuoles (2) Mesosomes

(3) Plasmids (4) Inclusion bodies

Sol. Inclusion bodies are non-membrane bound cell organelles that store reserve food materials such as cyanophycean granules.

Therefore, option (4) is the correct answer.

11. What is associated with the name of Schleiden and Schwann?

(1) *Omnis cellula-e cellula*

(2) Cell theory

(3) Fluid mosaic model

(4) Nucleus functions as control centre of cell.

Prarambh Exercise-1 (Topicwise)

AN OVERVIEW OF CELL AND CELL THEORY

1. Plant cell differs from animal cell in the:
(1) presence of centriole.
(2) presence of cell wall and chloroplast.
(3) absence of cell wall.
(4) absence of chloroplast.

2. Cell was discovered by:
(1) Flemming (2) Leeuwenhoek
(3) Robert Hooke (4) Robert Brown

3. Ribosomes are found in;
(1) Prokaryotic cells only
(2) Prokaryotic cells, chloroplasts, mitochondria and eukaryotic cell cytoplasm.
(3) Prokaryotic cells, chloroplasts and vacuole
(4) Lysosome, mitochondria

4. Which of the following cell has a diameter of 7 micrometre?
(1) Erythrocyte (2) Monocyte
(3) Neuron (4) Blood platelets

5. Theodore Schwann, reported that cells had a thin outer layer which is today known as the:
(1) Tonoplast (2) Plasma membrane
(3) Basement membrane (4) Biological membrane

6. *Omnis cellula-e cellula* is a generalisation given by:
(1) Schwann. (2) Camillo
(3) Leeuwenhoek (4) Virchow

7. The main arena of cellular activities in plant and animal cells is:
(1) Cell membrane (2) Mitochondria
(3) Cytoplasm (4) Ribosome

8. Which of the following is present in both prokaryotes and eukaryotes?
(1) Golgi complex (2) Mitochondria
(3) Chloroplast (4) Plasma membrane

9. Who proposed the theory that states all cells arise from the pre-existing cells?
(1) Mohl (2) Virchow
(3) Haeckel (4) Robert Brown

10. Cell theory states that:
(1) all cells arise from pre-existing cells.
(2) all living organisms are composed of cells and products of cells.
(3) all cells are living.
(4) both (1) and (2).

11. Which of the following is the largest isolated single cell?
(1) Nerve cell (2) Mycoplasma
(3) Ostrich egg (4) RBCs

12. The simplest way to distinguish a prokaryotic from a eukaryotic cell is to check for:
(1) a plasma membrane (2) a nucleus
(3) DNA (4) proteins

13. All plants are composed of different kind of cells. This statement belongs to:
(1) Lamarck (2) Von Helmont
(3) Hugo de Vries (4) Schleiden

14. The shape of human red blood cell is:
(1) round and biconcave. (2) flat and thread like.
(3) irregular. (4) round and oval.

PROKARYOTIC CELLS

15. Cell envelope of prokaryotes consists of:
(1) Glycocalyx (2) Cell wall
(3) Cell membrane (4) All of these

16. The genetic material of prokaryotic cells is called:
(1) Nucleus (2) Nucleolus
(3) Nucleoid (4) Centrosome

17. Polysomes have two components. One is ribosome while another is:
(1) ER (2) mRNA
(3) Golgi bodies (4) Mitochondria

18. Which of the following is **NOT** a function of mesosomes?
(1) Respiration
(2) DNA replication
(3) Increases enzymatic content
(4) Reproduction

19. Larger subunit of prokaryotic ribosome is:
(1) 30 S (2) 40 S (3) 50 S (4) 60 S

20. Which of the following structures is **NOT** found in a prokaryotic cell?
(1) Nuclear envelope (2) Ribosome
(3) Mesosome (4) Plasma membrane

21. Gas vacuoles are found in:
(1) Blue-green photosynthetic bacteria
(2) Purple and green photosynthetic bacteria
(3) Both (1) and (2)
(4) All bacteria

22. Prokaryotic cell does not have:
(1) Nucleolus
(2) Membrane bound organelles
(3) Centrioles
(4) All of these

110. Within nucleus, DNA is organised along with proteins into material called:

(1) Nuclear lamina (2) Chromosome

(3) Chromatid (4) Chromatin

111. rRNA is synthesised in:

(1) E.R. (2) Nucleus

(3) Nucleolus (4) Cytoplasm

112. Which of the following is/are the nucleoprotein structure(s)?

(1) Chromatin (2) DNA

(3) Centromere (4) All of these

113. In which type of chromosome, one arm is very long and one arm is very short?

(1) Acrocentric (2) Metacentric

(3) Sub-metacentric (4) Telocentric

114. Where in a eukaryotic cell can DNA be found?

(1) Nucleus (2) Mitochondrion

(3) Chloroplast (4) All of these

115. Which of the following organelles are double membrane-bound?

(1) Nucleus (2) Chloroplast

(3) Mitochondria (4) All of these

116. Sometimes a few chromosomes have ____**A**____ secondary constrictions at a constant location. This gives the appearance of a small fragment called the ____**B**____.

(1) A-non-staining , B-satellite.

(2) A- staining, B - satellite.

(3) A- non-staining, B -kinetochore.

(4) A- non-staining, B - Nucleoplasm

117. Who proposed the fluid mosaic model of plasma membrane?

(1) Camillo Golgi

(2) Schleiden and Schwann

(3) Singer and Nicolson

(4) Robert Brown

Prabal Exercise-2 (Learning Plus)

1. Different cells have different sizes. Arrange the following cells in an ascending order of their size. Choose the **correct** option among the followings.

I. Mycoplasma II. Ostrich eggs

III. Human RBC IV. Bacteria

(1) I, IV, III, II (2) I, II, III, IV

(3) II, I, III, IV (4) III, II, I, IV

2. Which of the following features is common to prokaryotes and many eukaryotes?

(1) Chromatin material present

(2) Cell wall present

(3) Nuclear membrane present

(4) Membrane bound sub-cellular organelles present

3. Reserve material in prokaryotic cells are stored in the cytoplasm in the form of:

(1) Pyrenoid

(2) Mesosome

(3) Inclusion bodies which are bounded by single membrane

(4) Inclusion bodies which are not bounded by any membrane system

4. How many of the given cell organelles are found only in prokaryotic cells?

[Vacuoles, Mesosomes, Ribosomes, Chloroplast, Cell wall, Mitochondria]

(1) 1 (2) 2 (3) 3 (4) 4

5. Bacterial cells have a chemically complex cell envolope. The cell envelope consists of a tightly bound three layered structure, i.e., the

(1) Outermost cell wall followed by the plasma membrane and then the glycocalyx

(2) Outermost glycocalyx followed by plasma membrane and the cell wall

(3) Outermost cell wall followed by the glycocalyx and then the plasma membrane

(4) Outermost glycocalyx followed by the cell wall and then the plasma membrane

6. A common characteristic feature of plant sieve tube cells and most of mammalian erythrocytes is

(1) Absence of mitochondria

(2) Presence of cell wall

(3) Presence of haemoglobin

(4) Absence of nucleus

7. Which of the following is **NOT** true for a eukaryotic cell?

(1) ER is the important site of formation glycoproteins and glycolipids

(2) It has 80S type of ribosome present in the cytoplasm

(3) Mitochondria contain circular DNA

(4) Membrane bound organelles are present

Parikshit Exercise-3 (Multiconcept)

MATCH THE COLUMN MCQs

1. Match the lists and select the **correct** option:

List-I		List-II	
A.	Lysosomes	P.	Protein synthesis
B.	Ribosomes	Q.	Hydrolytic activity
C.	Smooth endoplasmic reticulum	R.	Synthesis of steroid hormones
D.	Centriole	S.	Formation of spindle apparatus

(1) A-(Q); B-(P); C-(R); D-(S)
(2) A-(Q); B-(R); C-(S); D-(P)
(3) A-(P); B-(S); C-(R); D-(Q)
(4) A-(S); B-(R); C-(P); D-(Q)

2. Match the lists and select the **correct** option:

List-I		List-II	
A.	*Omnis cellula-e cellula*	P.	Singer and Nicolson
B.	Fluid mosaic model	Q.	Robert Brown
C.	Ribosomes	R.	Rudolf Virchow
D.	Nucleus	S.	George Palade

(1) A-(P); B-(R); C-(Q); D-(S)
(2) A-(P); B-(R); C-(S); D-(Q)
(3) A-(R); B-(P); C-(Q); D-(S)
(4) A-(R); B-(P); C-(S); D-(Q)

3. Match the lists and select the **correct** option:

List-I		List-II	
A.	Golgi apparatus	P.	Actively involved in protein synthesis and secretion
B.	Smooth Endoplasmic reticulum	Q.	Divides by fission
C.	Rough Endoplasmic reticulum	R.	Formation of glycoproteins and glycolipids
D.	Mitochondria	S.	Major site for synthesis of lipid

(1) A-(Q); B-(S); C-(P); D-(R)
(2) A-(R); B-(S); C-(P); D-(Q)
(3) A-(R); B-(S); C-(Q); D-(P)
(4) A-(P); B-(S); C-(Q); D-(R)

4. Match the lists and select the **correct** option:

List-I		List-II	
A.	Cristae	P.	Golgi apparatus
B.	Cisternae	Q.	Cilia
C.	Flattened membranous structures	R.	Mitochondria
D.	Axoneme	S.	Thylakoid

(1) A-(S); B-(P); C-(Q); D-(R)
(2) A-(Q); B-(R); C-(S); D-(P)
(3) A-(R); B-(P); C-(S); D-(Q)
(4) A-(Q); B-(S); C-(R); D-(P)

5. Match the lists and select the **correct** option:

List-I		List-II	
A.	Amyloplasts	P.	Store proteins
B.	Chromoplasts	Q.	Store oils and fats
C.	Aleuroplasts	R.	Store carbohydrates
D.	Elaioplasts	S.	Carotenoid pigments

(1) A-(S); B-(R); C-(P); D-(Q)
(2) A-(Q); B-(R); C-(S); D-(P)
(3) A-(R); B-(S); C-(P); D-(Q)
(4) A-(S); B-(Q); C-(P); D-(R)

6. Match the lists and select the **correct** option

List-I		List-II	
A.	Red blood cells	P.	Long and narrow
B.	White blood cells	Q.	Round and biconcave
C.	Columnar epithelial cells	R.	Amoeboid
D.	Tracheid	S.	Elongated

(1) A-(Q); B-(P); C-(R); D-(S)
(2) A-(Q); B-(R); C-(P); D-(S)
(3) A-(S); B-(R); C-(Q); D-(P)
(4) A-(R); B-(P); C-(Q); D-(S)

7. Match the lists and select the **correct** option:

List-I		List-II	
A.	Double membrane	P.	Vacuole
B.	Single membrane	Q.	Mitochondria
C.	Non- membranous	R.	Mesosomes
D.	Extensions of plasma membrane	S.	Ribosome

(1) A-(Q); B-(P); C-(S); D-(R)
(2) A-(R); B-(S); C-(Q); D-(P)
(3) A-(S); B-(R); C-(P); D-(Q)
(4) A-(R); B-(P); C-(S); D-(Q)

PYQ's Exercise-4 (Important NEET PYQ's)

1. Given below are two statements: **(2024)**

Statement-I: Mitochondria and chloroplasts both double membranes bound organelles.

Statement-II: Inner membrane of mitochondria is relatively less permeable, as compared chloroplast.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) **Statement-I** is correct but **Statement-II** is incorrect.

(2) **Statement-I** is incorrect but **Statement-II** is correct.

(3) Both **Statement-I** and **Statement-II** are correct.

(4) Both **Statement-I** and **Statement-II** are incorrect.

2. Match the List-I with List-II. **(2024)**

List-I		List-II	
A.	Nucleolus	I.	Site of formation of glycolipid
B.	Centriole	II.	Organization like the cartwheel
C.	Leucoplasts	III.	Site for active ribosomal RNA synthesis
D.	Golgi apparatus	IV.	For storing nutrients

Choose the **correct** answer from the options given below.

(1) (A)-(III); (B)-(II); (C)-(IV); (D)-(I)

(2) (A)-(II); (B)-(III); (C)-(I); (D)-(IV)

(3) (A)-(III); (B)-(IV); (C)-(II); (D)-(I)

(4) (A)-(I); (B)-(II); (C)-(III); (D)-(IV)

3. The DNA present in chloroplast is: **(2024)**

(1) Linear, double stranded

(2) Circular, double stranded

(3) Linear, single stranded

(4) Circular, single stranded

4. Match the List-I with List-II. **(2024)**

List-I		List-II	
A.	Axoneme	I.	Centriole
B.	Cartwheel pattern	II.	Cilia and flagella
C.	Crista	III.	Chromosome
D.	Satellite	IV.	Mitochondria

Choose the **correct** answer from the options given below.

(1) (A)-(IV); (B)-(III); (C)-(II); (D)-(I)

(2) (A)-(IV); (B)-(II); (C)-(III); (D)-(I)

(3) (A)-(II); (B)-(IV); (C)-(I); (D)-(III)

(4) (A)-(II); (B)-(I); (C)-(IV); (D)-(III)

5. Movement and accumulation of ions across a membrane against their concentration gradient can be explained by **(2023)**

(1) Facilitated Diffusion (2) Passive Transport

(3) Active Transport (4) Osmosis

6. How many different proteins does the ribosome consist of? **(2023)**

(1) 60 (2) 40

(3) 20 (4) 80

7. Which of the following are **NOT** considered as the part of endomembrane system? **(2023)**

A. Mitochondria B. Endoplasmic reticulum

C. Chloroplasts D. Golgi complex

E. Peroxisomes

Choose the most appropriate answer from the options given below:

(1) A, C and E only (2) A and D only

(3) A, D and E only (4) B and D only

8. Which of the following functions is carried out by cytoskeleton in a cell? **(2023)**

(1) Protein synthesis (2) Motility

(3) Transportation (4) Nuclear division

9. Given below are two statements: **(2023 manipur)**

Statement-I: In bacteria, the mesosomes are formed by the extensions of plasma membrane.

Statement-II: The mesosomes, in bacteria, help in DNA replication and cell wall formation.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) **Statement-I** is correct but **Statement-II** is incorrect.

(2) **Statement-I** is incorrect but **Statement-II** is correct.

(3) Both **Statement-I** and **Statement-II** are correct.

(4) Both **Statement-I** and **Statement-II** are incorrect.

10. Which of the following statements are **correct** with respect of Golgi apparatus? **(2023 manipur)**

A. It is the important site of formation of glycoprotein and glycolipids.

B. It produces cellular energy in the form of ATP.

C. It modifies the protein synthesized by ribosomes on ER.

D. It facilitates the transport of ions.

E. It provides mechanical support.

Choose the most appropriate answer from the options given below:

(1) B and C only (2) A and C only

(3) A and D only (4) D and E only

ANSWER KEY

CONCEPT APPLICATION

1. Anton Von Leeuwenhoek
2. Independent existence and perform essential functions of life
3. Mycoplasma and 0.3 micrometer
4. Rudolf Virchow
5. False
6. Mesosome
7. Chromatophore
8. Circular DNA
9. Flagella, pili, fimbriae
10. Glycocalyx, cell wall, cell membrane
11. True
12. False
13. False
14. 80S, 70S
15. 52, 40
16. Mannans, calcium carbonate
17. Middle lamella
18. SER [Smooth endoplasmic reticulum]
19. Camillo Golgi
20. Glycoproteins, glycolipids
21. Osmoregulation and excretion
22. False
23. True
24. True
25. Sausage-shaped
26. 70S
27. Aleuroplast
28. 9 + 0
29. 9
30. False
31. True
32. True
33. False
34. True
35. True
36. Flemming
37. 2 m, 46 (23 Pairs)
38. Basic
39. Middle, two equal
40. Telocentric

NCERT FOCUSED FILL-INS

1. Robert Hooke
2. Multicellular
3. Unicellular
4. Organ system
5. Plasma membrane
6. Pre-existing
7. 0.3
8. Human red blood cell (erythrocyte)
9. Eukaryotic
10. Comma shaped
11. Mycoplasma
12. Naked
13. Plasmids
14. Glycocalyx
15. Protective
16. Capsule
17. Plasma membrane
18. 70S
19. Cyanophycean
20. Purple
21. Outer
22. Inner
23. Singer
24. Nicolson
25. Passive
26. ATP
27. Active
28. Rigid
29. Calcium pectate
30. Peroxisomes
31. Nucleus
32. Concentrically
33. Trans
34. Acidic
35. Increase
36. Circular
37. Aerobic
38. Proteins
39. Elaioplast
40. Grana
41. Thylakoids
42. 60S
43. 40S
44. Axoneme
45. 9 + 2
46. 9
47. Tubulin
48. Interphase
49. Kinetochores
50. Short

PRARAMBH EXERCISE-1 (TOPICWISE)

1. (2)	**2.** (3)	**3.** (2)	**4.** (1)	**5.** (2)	**6.** (4)	**7.** (3)	**8.** (4)	**9.** (2)	**10.** (4)
11. (3)	**12.** (2)	**13.** (4)	**14.** (1)	**15.** (4)	**16.** (3)	**17.** (2)	**18.** (4)	**19.** (3)	**20.** (1)
21. (3)	**22.** (4)	**23.** (4)	**24.** (4)	**25.** (1)	**26.** (3)	**27.** (2)	**28.** (1)	**29.** (1)	**30.** (3)
31. (4)	**32.** (3)	**33.** (2)	**34.** (3)	**35.** (4)	**36.** (2)	**37.** (1)	**38.** (1)	**39.** (4)	**40.** (1)
41. (3)	**42.** (3)	**43.** (2)	**44.** (4)	**45.** (2)	**46.** (3)	**47.** (3)	**48.** (3)	**49.** (3)	**50.** (3)
51. (2)	**52.** (3)	**53.** (4)	**54.** (3)	**55.** (4)	**56.** (4)	**57.** (4)	**58.** (3)	**59.** (1)	**60.** (4)
61. (4)	**62.** (3)	**63.** (3)	**64.** (3)	**65.** (2)	**66.** (2)	**67.** (1)	**68.** (1)	**69.** (4)	**70.** (1)
71. (2)	**72.** (2)	**73.** (2)	**74.** (3)	**75.** (1)	**76.** (3)	**77.** (4)	**78.** (1)	**79.** (2)	**80.** (1)
81. (3)	**82.** (1)	**83.** (4)	**84.** (4)	**85.** (2)	**86.** (3)	**87.** (4)	**88.** (1)	**89.** (2)	**90.** (1)
91. (4)	**92.** (3)	**93.** (2)	**94.** (4)	**95.** (4)	**96.** (1)	**97.** (2)	**98.** (1)	**99.** (3)	**100.** (4)
101. (3)	**102.** (4)	**103.** (4)	**104.** (3)	**105.** (4)	**106.** (1)	**107.** (1)	**108.** (3)	**109.** (4)	**110.** (4)
111. (3)	**112.** (1)	**113.** (1)	**114.** (4)	**115.** (4)	**116.** (1)	**117.** (3)			

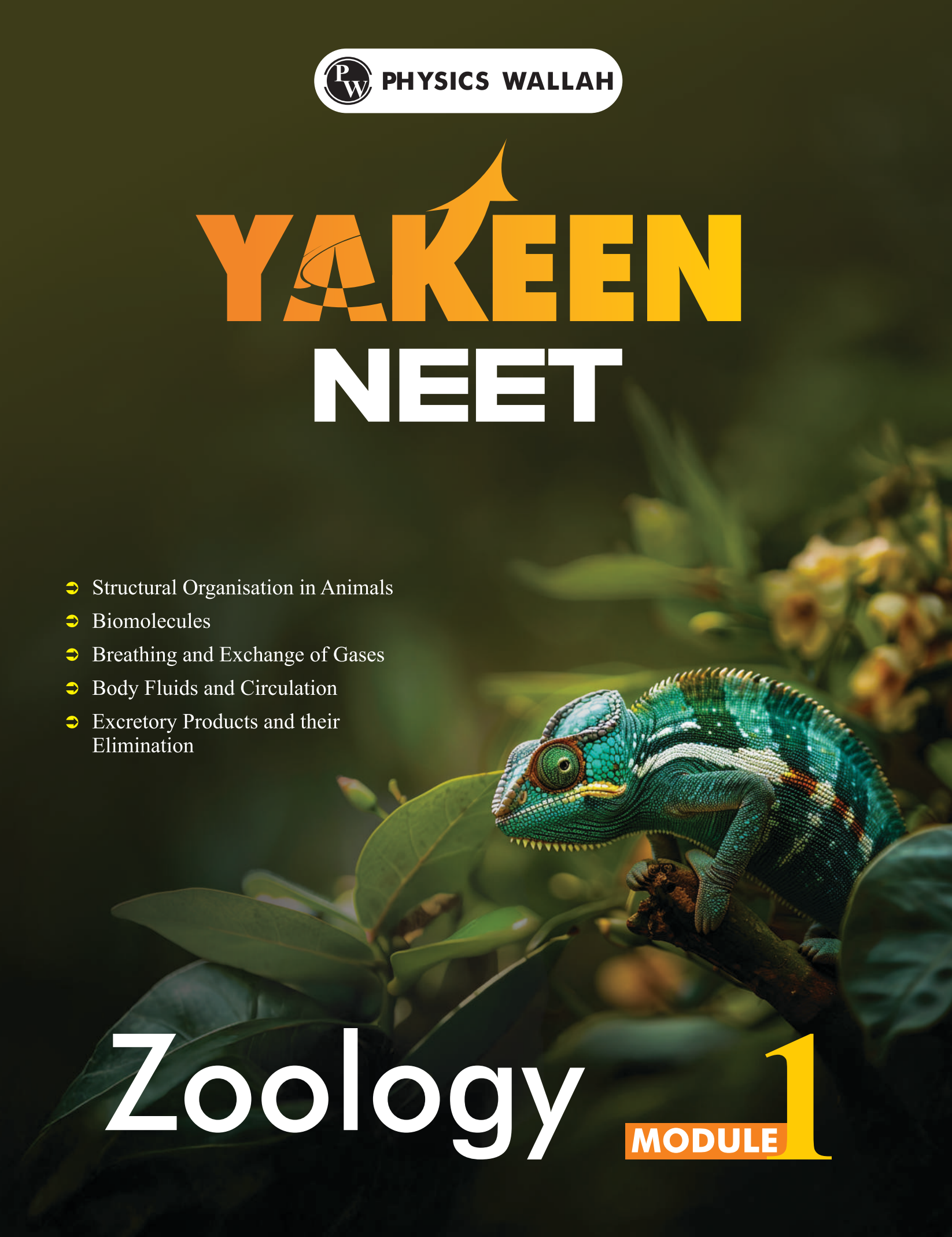
PRABAL EXERCISE-2 (LEARNING PLUS)

1. (1)	**2.** (2)	**3.** (4)	**4.** (1)	**5.** (4)	**6.** (4)	**7.** (1)	**8.** (4)	**9.** (3)	**10.** (2)
11. (3)	**12.** (3)	**13.** (3)	**14.** (2)	**15.** (4)	**16.** (3)	**17.** (4)	**18.** (4)	**19.** (3)	**20.** (2)
21. (4)	**22.** (3)	**23.** (4)	**24.** (1)	**25.** (3)	**26.** (3)	**27.** (2)	**28.** (3)	**29.** (1)	

PHYSICS WALLAH

YAKEEN NEET

- Structural Organisation in Animals
- Biomolecules
- Breathing and Exchange of Gases
- Body Fluids and Circulation
- Excretory Products and their Elimination



Zoology

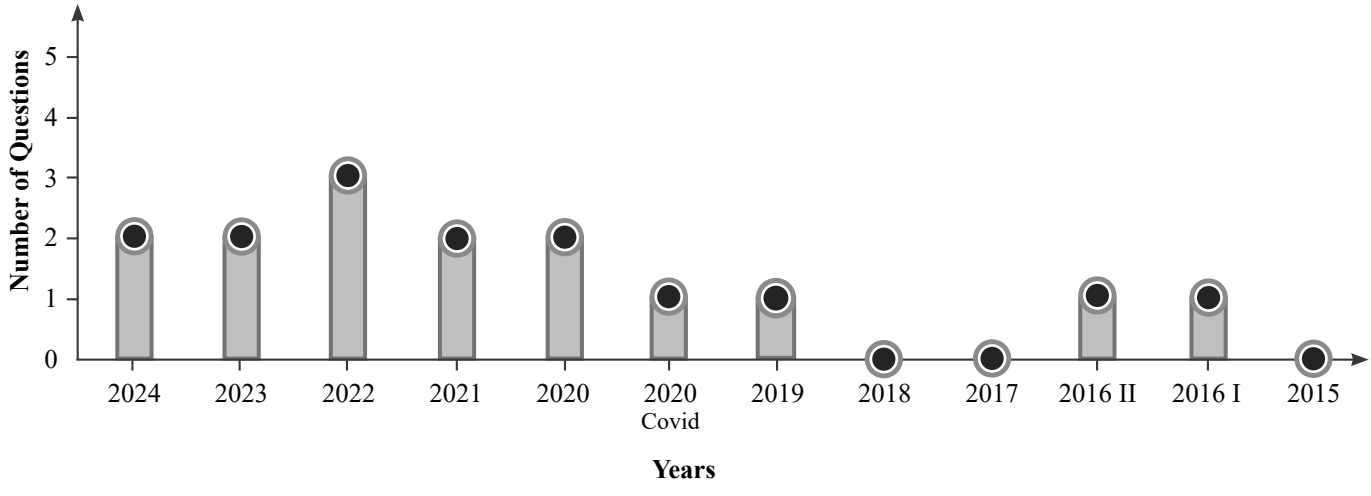
MODULE 1

CHAPTER

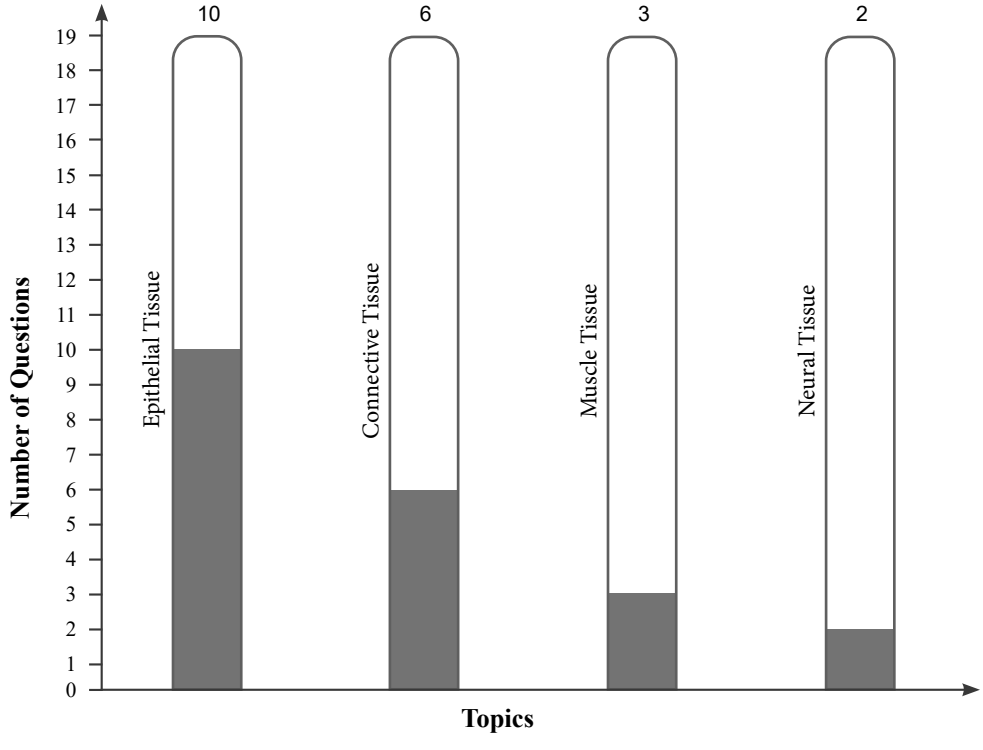
1

Structural Organisation in Animals

Year Wise Number of Questions Analysis (2024-2015)



Topicwise Number of Questions Analysis (2024-2015)



Classification of Epithelium Tissues

Types of Epithelium Tissues
(On the basis of number of cell layers)

Simple epithelium	Compound epithelium
• Composed of single layer of cells	• Consists of 2 or more cell layers
• Functions as lining for body cavities, ducts and tubes	• It has protective function as it does in our skin

(A) Simple Epithelium

Simple epithelium is composed of a single layer of cells. This type of epithelium forms the lining for body cavities, ducts and tubes.

Simple Epithelial Tissues
On the basis of shape/structural modification of cells

- Squamous epithelium
- Cuboidal epithelium
- Columnar epithelium

Types of Simple Epithelial Tissue

(*i*) Simple Squamous Epithelium

- This epithelium is involved in functions like forming a diffusion boundary.
- They are found in the walls of blood vessels, lymph vessel, heart, peritoneum, pleura, bowman's capsule, thin segment of loop of henle and air sacs of lungs.

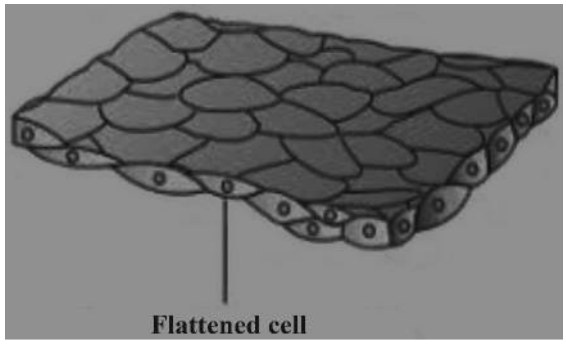


Fig. 2: Simple Squamous Epithelium

EXTENDED LEARNING

- Single thin layer of wavy flattened cells with **3** _____ known as **tesselated epithelium**.
- It is also known as **pavement epithelium** due to its tiles-like appearance.

(*ii*) Simple Cuboidal Epithelium

- Single layer of cube-like cells resting on a basement membrane.
- The nuclei is situated centrally.
- Found in the ducts of glands (salivary and pancreatic duct) and tubular parts of nephrons in the kidney.
- Its main functions are secretion and **4** _____.
- The epithelium of **5** _____ of nephron in the kidney has microvilli.

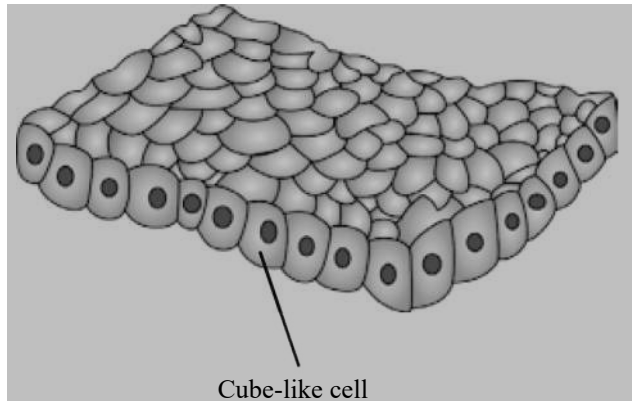


Fig. 3: Simple Cuboidal Epithelium

EXTENDED LEARNING

- Simple cuboidal epithelium also known as **germinal epithelium**, is a thick layer of cells that lines the sex organs during the early developmental stage of the embryo. These are cuboidal cells found in both testes and ovary.

Simple Cuboidal Epithelium (Modifications)

(a) Brush Bordered Cuboidal Epithelium

- It is the microvillus-covered surface of simple cuboidal. Cuboidal epithelium with brush border of microvilli is found in the proximal convoluted tubule (PCT) of the nephron. It increases cell surface area.

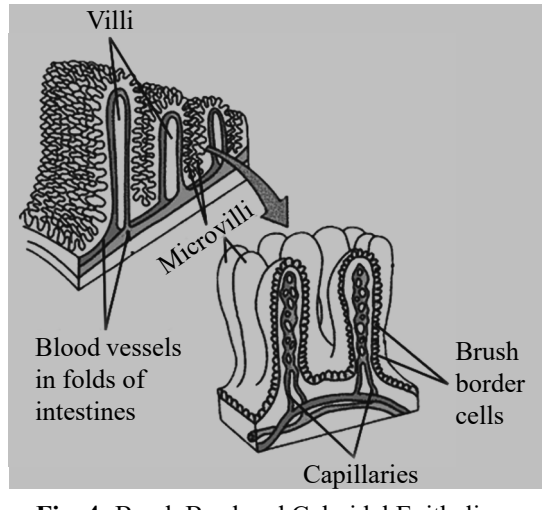


Fig. 4: Brush Bordered Cuboidal Epithelium

(b) Ciliated Cuboidal Epithelium

- The apical surface of cuboidal epithelial cells with cilia are termed as ciliated cuboidal epithelial cells. These cilia facilitate movement. Ciliated cuboidal cells are present in the respiratory **6** _____.

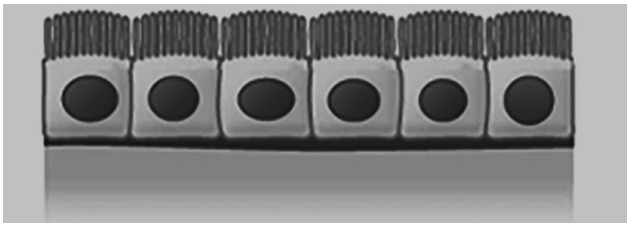


Fig. 5: Ciliated Cuboidal Epithelium

(*iii*) Simple Columnar Epithelium

- It is composed of single layer of **7** _____ and slender cells.
- Their nuclei are located at the **8** _____.
- Free surface may have microvilli.
- Main functions are secretion and absorption.
- They are found in the lining of stomach, intestine and gall bladder.

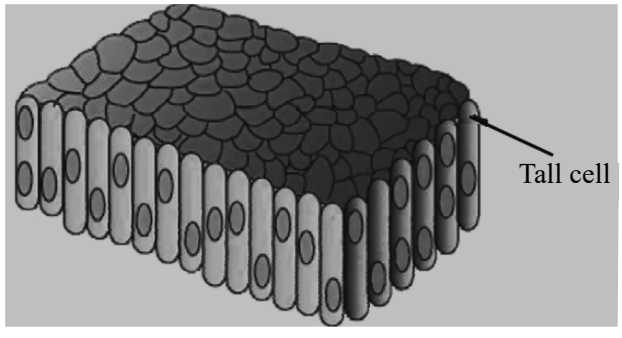


Fig. 6: Simple Columnar Epithelium

Modification of Simple Columnar

(a) Brush Bordered Columnar Epithelium

- A brush bordered columnar epithelium is a columnar epithelium that is secured with microvilli that are protoplasmic extensions of the cell on the uncovered surface, helps in absorption. It is found in the small intestine.

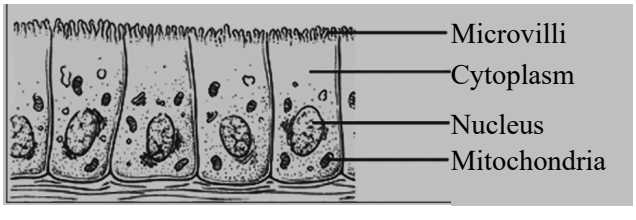


Fig. 7: Brush Bordered Columnar Epithelium

(b) Ciliated Columnar

- As their name suggests, ciliated columnar epithelial cells are rectangular in shape and have hair-like protrusions called cilia, the cells nuclei are found towards the base and are often elongated, plays a role in clearing or moving substances or very small foreign bodies.
- Ciliated columnar epithelia are found in fallopian tube and ependymal epithelium of brain ventricles.

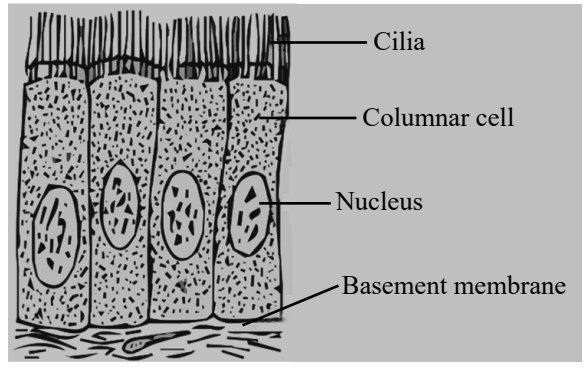


Fig. 8: Ciliated Columnar Epithelium

Glandular Epithelium

- Glandular epithelium is a kind of epithelial tissue that produces and releases a variety of secretory products.
- Some of the columnar or **9** _____ cells get specialised for secretion and are called **glandular epithelium**.

Glands

- They are mainly of two types: **unicellular**, consisting of isolated glandular cells (**10** _____ cells of the alimentary canal), and **multicellular**, consisting of cluster of cells (salivary gland).

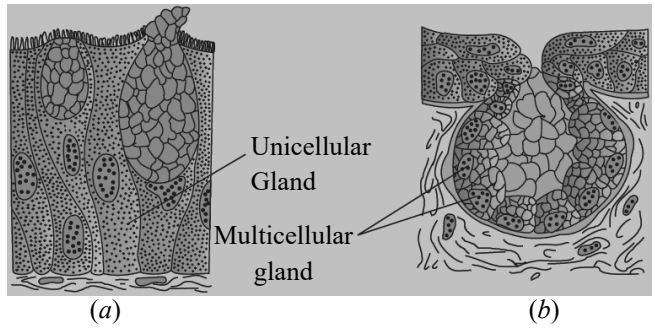


Fig. 9: Glandular Epithelium: (*a*) Unicellular (*b*) Multicellular

- On the basis of the mode of pouring of their secretions, glands are divided into two categories namely **exocrine** and **endocrine**.
  - **Exocrine gland** secrete mucus, saliva, earwax, oil, milk, digestive enzymes and other cell products. These products are released through ducts and tubes.
  - **Endocrine glands** do not have ducts. Their products called **11** _____ are secreted directly into the fluid bathing the gland.
- Another types of gland also find named as heterocrine gland.
  - **Heterocrine glands** are those glands which have both exocrine and endocrine part such as pancreas because it secretes the hormone insulin into the blood which is an endocrine function and enzymes into the digestive tract which is an exocrine function.

(B) Compound Epithelium

- It is made of more than **12** _____ layer (multi-layered) of cells.

Epithelial Tissue

- Has a free surface (faces either a body fluid or the outside environment).
- Compactly packed (with little intercellular matrix).

I. Simple Epithelium (Composed of a single layer of cells).

- Function: Diffusion, secretion and absorption.
- Simple epithelium can be of following types on the basis of structural modifications of cells:

Features	Squamous	Cuboidal	Columnar	Ciliated	Glandular
Cells	Flattened cells	Cube-like cells	Tall and slender cells	Cells bear cilia	Cells get specialised for secretion
Location	Walls of blood vessels and air sacs of lungs	In ducts of glands and tubular parts of nephrons in kidneys	In the lining of stomach and intestine	In the inner surface of hollow organs	Goblet cells of alimentary canal and salivary gland

II. Compound Epithelium (Composed of a multiple layer of cells)

- Function: Provide protection.
- Location: Dry surface of the skin, the moist surface of buccal cavity.

Connective Tissue

- The cells secrete fibres of structural proteins called collagen or elastin (except blood), also secrete modified polysaccharides (ground substance).

I. Loose connective tissue

- Cells and fibres loosely arranged in a semi-fluid ground substance

Areolar Tissue	Adipose Tissue
❖ Present beneath the skin. ❖ Contains fibroblasts (cells that produce and secrete fibres), macrophages and mast cells.	❖ Located mainly beneath the skin. ❖ Specialised to store fat.

II. Dense connective tissue

Dense Regular Tissues	Dense Irregular Tissues
❖ Regular pattern in orientation of fibres ❖ Tendons and ligaments	❖ Irregular pattern in orientation of fibres ❖ Present in the skin

III. Specialised connective tissues

Cartilage	Bones	Blood
❖ Solid and pliable intercellular material ❖ Cells: Chondrocytes ❖ Functions: Tip of nose, outer ear joints, for protection, etc.	❖ Hard and non-pliable intercellular material ❖ Cells: Osteocytes ❖ Functions: Provides structural framework to the body, etc.	❖ Fluid connective tissue ❖ Cells: WBC, RBC and platelets ❖ Functions: Circulating fluid that help in transportation of substances

Muscle Tissue

- Myofibrils (fine fibrils) → Fibres → Muscle.
- Muscles are of three types: skeletal, smooth and cardiac.

1. Which of the following functions is **not** performed by unicellular organisms?
(1) Digestion (2) Respiration
(3) Reproduction (4) Neural coordination

Sol. Neural coordination is not performed by unicellular organisms because neural coordination requires a complex set of cells and tissues to carry out the process which is not present in a single cell. It is coordination between different cells of the neural tissue.
Therefore, option (4) is the correct answer.

2. The spaces in which the bone cells are present are called _____.
(1) leucocytes (2) lacunae
(3) lacteals (4) Both (2) and (3)

Sol. The bone cells or osteocytes are present in the spaces called lacunae.
Therefore, option (2) is the correct answer.

3. Which one of the given cells is **not** the part of connective tissue?
(1) Macrophages (2) Fibroblasts
(3) Glial cells (4) Mast cells

Sol. Glial cells also called neuroglia are the part of neural tissue and its primary function is to protect and support the neurons.
Therefore, option (3) is the correct answer.

4. The human body is composed of how many cells?
(1) Billions (2) Millions
(3) Thousands (4) Quadrillion

Sol. The human body is composed of billions of cell to perform various functions. These cells aggregate to form tissues which in turn aggregate to form organs. Many organs coordinate with each other to form the organ system.
Therefore, option (1) is the correct answer.

5. Communication junctions are present at some fusion points between the cells of cardiac muscle tissue. What do you think is the function of them?
(1) To adhere the cells together
(2) To stop leakage across the tissue
(3) To contract the cells as a unit
(4) To transfer substances from one cell to another

Sol. Communication junctions of intercalated discs allow the cells of cardiac tissues to contract as a unit.
Therefore, option (3) is the correct answer.

6. What is meant by a tissue?
(1) Group of dissimilar cells but their origin is similar.
(2) Group of cells of dissimilar origin.
(3) Group of similar cells.
(4) All of these

Sol. The group of similar cells that have a common origin and perform a similar function is called tissue. These tissues are organised in specific proportion and pattern to form an organ like stomach, lung, heart and kidney.
Therefore, option (3) is the correct answer.

7. Which of the following tissues has the **most** regenerative power?
(1) Epithelial tissue (2) Connective tissue
(3) Muscular tissue (4) Neural tissue

Sol. Epithelial tissue has the most regenerative power while neural tissue has the least regenerative power. We commonly refer to an epithelial tissue as epithelium.
Therefore, option (1) is the correct answer.

8. How do endocrine glands differ from exocrine glands?
(1) Endocrine glands secrete their products through ducts.
(2) Endocrine glands secrete their products directly into the fluid surrounding the gland.
(3) Endocrine glands secrete mucus and earwax.
(4) Endocrine glands consist of isolated glandular cells only.

Sol. Endocrine glands do not have ducts; instead, they release hormones directly into the bloodstream or the fluid surrounding the gland, unlike exocrine glands that use ducts to transport their secretions.
Therefore, option (2) is correct answer.

9. Which of the following is **not** a characteristic of compound epithelium?
(1) It is multi-layered.
(2) It plays a major role in secretion and absorption.
(3) It provides protection against mechanical stress.
(4) It covers the inner lining of ducts in salivary glands.

Sol. Compound epithelium consists of multiple layers of cells and primarily functions in protection, not secretion and absorption, which are mostly performed by simple epithelia. Its thick, multi-layered structure limits its role in absorption and secretion.
Therefore, option (2) is the correct answer.

10. What is the primary function of loose connective tissue, such as areolar tissue, in the body?
(1) Absorption of nutrients
(2) Supporting the epithelium and acting as a framework
(3) Conduction of nerve impulses
(4) Storing calcium for bone formation

Sol. Loose connective tissue, like areolar tissue, is loosely arranged and provides structural support to the epithelium. It acts as a framework beneath the skin and in various other parts of the body.
Therefore, option (2) is the correct answer.

Prarambh Exercise-1 (Topicwise)

ANIMAL TISSUES

1. Animal tissues are broadly classified into four types as;
(1) Squamous, columnar, cuboidal and ciliated
(2) Simple, compound, special and glandular
(3) Epithelial, connective, neural and skeletal
(4) Neural, connective, epithelial and muscular

2. On the basis of structural modification of the cells, simple epithelium is further divided into;
(1) Two types–ciliated and glandular epithelium
(2) Three types–squamous, cuboidal and columnar epithelium
(3) Four types–squamous, cuboidal, columnar and ciliated epithelium
(4) Two types–unicellular and multicellular epithelium

3. Fill in the Blanks.
A. The ____ 1 ____ consists of two or more cell layers and has protective function as it does in our skin.
B. The ____ 2 ____ is composed of single layer of cells and functions as a lining for body cavities, ducts and tubes.
(1) 1–squamous epithelium, 2–cuboidal epithelium
(2) 1–columnar epithelium, 2–squamous epithelium
(3) 1–simple epithelium, 2–compound epithelium
(4) 1–compound epithelium, 2–simple epithelium

4. Epithelium present in salivary gland and pancreatic ducts is;
(1) Compound epithelium
(2) Cuboidal epithelium
(3) Ciliated epithelium
(4) Columnar epithelium

5. Epithelium present in ducts of glands and tubular parts of nephrons is;
(1) Columnar (2) Stratified
(3) Cuboidal (4) Squamous

6. Which of the following pair is **not** having similar epithelial tissue?
(1) Blood vessels and alveoli
(2) Stomach and intestine
(3) Blood vessels and bronchioles
(4) Buccal cavity and pharynx

7. The epithelium found in the lining of stomach and intestine is;
(1) Columnar (2) Squamous
(3) Stratified (4) Cuboidal

8. Salivary glands are;
(1) Unicellular (2) Acellular
(3) Multicellular (4) All of these

9. Mucus, saliva, earwax, oil, milk and digestive enzymes are secreted by;
(1) Exocrine glands (2) Endocrine glands
(3) Heterocrine glands (4) Compound glands

10. Type of junction helps to stop substance from leaking across a tissue;
(1) Tight junction (2) Gap junction
(3) Adhering junction (4) None of these

11. Which of the following tissues perform special function of linking and supporting other tissues and organs of the body?
(1) Epithelial tissue (2) Connective tissue
(3) Muscular tissue (4) Neural tissue

12. Which of the following connective tissue often serves as a support framework for epithelium?
(1) Areolar tissue
(2) Adipose tissue
(3) Dense regular connective tissue
(4) Dense irregular connective tissue

13. Fibroblast, macrophages and mast cells are seen in;
(1) Epithelial tissues
(2) Loose connective tissue
(3) Skeletal muscle tissue
(4) Smooth muscle tissue

14. Muscles are connected to bone by means of;
(1) Cartilage (2) Ligament
(3) Tendon (4) Adipose tissue

15. Cartilage is present;
A. in the tip of nose and outer ear joints.
B. between adjacent bones of vertebral column.
C. between adjacent bones of limbs and hands in adults.
(1) A, B and C (2) A and B
(3) B and C (4) A and C

16. The smooth muscle fibres are;
(1) cylindrical at both ends.
(2) rectangular at both ends.
(3) circular at both ends.
(4) taper at both ends.

17. What type of muscle tissue is found in the wall of internal organs?
(1) Smooth muscles (2) Cardiac muscle
(3) Skeletal muscle (4) Straited muscle

18. Presence of intercalated disc is the feature of;
(1) Smooth muscle (2) Skeletal muscle
(3) Cardiac muscle (4) None of these

19. Which of the following tissue exerts the greatest control over the body's responsiveness to changing conditions?
(1) Epithelial tissue (2) Connective tissue
(3) Muscular tissue (4) Neural tissue

Prabal Exercise-2 (Learning Plus)

1. Epithelial tissues are of;
(1) Three types: squamous, cuboidal and columnar epithelium
(2) Four types: squamous, cuboidal, columnar and ciliated epithelium
(3) Two types: simple and compound epithelium
(4) Two types: simple and complex epithelium

2. Excess of nutrients which are **not** used immediately are converted into fats and stored in;
(1) Areolar tissue
(2) Adipose tissue
(3) Dense regular connective tissue
(4) Dense irregular connective tissue

3. Which of the following functions is **not** performed by epithelial tissue?
(1) Protection (2) Secretion
(3) Absorption (4) Conduction

4. Which of the following statements is **incorrect** regarding epithelial tissue?
(1) It does not have a free surface.
(2) Provides a covering for some parts of the body.
(3) Cells are compactly packed.
(4) It is of two types.

5. In which of the following places, the cuboidal epithelium is **not** found?
(1) Ducts of glands
(2) Tubular parts of the nephron
(3) Germinal epithelium of gonads
(4) Air sacs of lungs

6. Which of the following represents the intercellular matrix of cartilage?
(1) Solid and pliable (2) Solid and non-pliable
(3) Soft and non-pliable (4) None of these

7. Which of the following cellular junctions create a cytoplasmic connection between adjoining cells?
(1) Tight junctions (2) Adhering junctions
(3) Gap junctions (4) Neuromuscular junction

8. Inability to absorb digested nutrients may be due to damage of which type of epithelium?
(1) Stratified (2) Simple columnar
(3) Simple squamous (4) Simple cuboidal

9. What will happen if ligaments are cut or broken?
(1) Bones will move freely at joints.
(2) No movement at joints.
(3) Bone will become unfix.
(4) Bone will become fixed.

10. Difference between blood and lymph is;
(1) blood has WBCs while lymph has RBCs.
(2) blood has dissolved salts while lymph has no cells.
(3) blood has RBCs and WBCs while lymph has no cell.
(4) blood has RBCs and WBCs while lymph has only WBCs.

11. The classification of glands is based on which of the following?
(1) Mode of differentiation
(2) Mode of pouring of secretions
(3) Mode of cellular division
(4) Number of cells

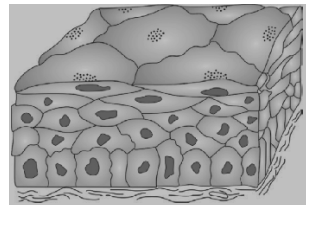
12. Microvilli is present in the epithelium of _____.
(1) walls of blood vessels
(2) air sacs of lungs
(3) proximal convoluted tubule of nephron
(4) skin surface

13. Mast cells occur in;
(1) Connective tissue (2) Epithelial tissue
(3) Skeletal tissue (4) Nervous tissue

14. Read the following statements.
(A) It is made up of a single thin layer of flattened cells with irregular boundaries.
(B) They are found in the walls of blood vessels and air sacs of lungs.
(C) They are involved in functions like forming a diffusion boundary.
Which of the following characteristics of tissue is being described by the above statements?
(1) Squamous epithelium
(2) Columnar epithelium
(3) Ciliated epithelium
(4) Compound epithelium

15. Which of the following types of connective tissue is **mismatched** with its matrix?
(1) Areolar: Loosely packed matrix of protein fibres
(2) Bone: Mineralised matrix
(3) Cartilage: Highly vascular matrix
(4) Blood: Liquid matrix

16. Read the following statements and find out how many of these are related to given figure.

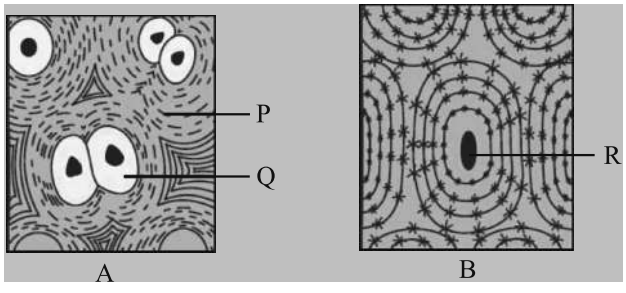


(A) Multilayered epithelium.
(B) Limited role in secretion and absorption.
(C) Main function is to provide protection against chemical and mechanical stresses.
(D) They cover the dry surface of skin, moist surface of buccal cavity and pharynx.

(1) 4 (2) 3
(3) 2 (4) 1

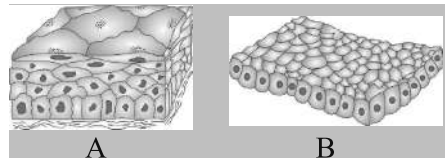
17. Function of adhering junction is to;
(1) perform cementing.
(2) facilitate communication.
(3) stop substances from leaking.
(4) secretion of hormones.

18. Identify the **correct** matching.



(1) A-Cartilage, P-Elastic fibres
(2) A-Bone, Q-Osteocyte
(3) B-Cartilage, R-Chondrocyte
(4) B-Bone, R-Haversian canal

19. Identify the **correct** option with respect to the figures (A & B) given below.



(1) A: Provide protection against chemical and mechanical stresses: Stomach
(2) A: Secrete mucus, saliva, earwax, oil, milk, digestive enzymes: Stomach
(3) B: Found in ducts of glands: Secretion and absorption
(4) B: Mainly present in the inner surface of hollow organs: Secretion and absorption

20. The large amoeboid cells found in areolar tissue and are also part of our innate immune system are known as;
(1) Mast cells (2) Macrophages
(3) Adipocytes (4) Fibroblasts

Parikshit Exercise-3 (Multiconcept)

MATCH THE COLUMN MCQS

1. Match the **List-I** and **List-II** to find out the **correct** combination.

List-I		List-II	
A.	Walls of alveoli	P.	Simple ciliated epithelium
B.	PCT of nephron	Q.	Simple squamous epithelium
C.	Bronchioles and fallopian tubes	R.	Brush-bordered columnar epithelium
D.	Lining of stomach and intestine	S.	Brush-bordered cuboidal epithelium

(1) A-(Q); B-(R); C-(P); D-(S)
(2) A-(Q); B-(P); C-(R); D-(S)
(3) A-(Q); B-(S); C-(P); D-(R)
(4) A-(S); B-(R); C-(P); D-(Q)

2. Match the **List-I** and **List-II** to find out the **correct** combination.

List-I		List-II	
A.	Skeletal muscles	P.	Involuntary and unstriated
B.	Smooth muscles	Q.	Voluntary and striated
C.	Cardiac muscles	R.	Have neurotransmitters
D.	Neurons	S.	Involuntary and striated

(1) A-(Q); B-(R); C-(P); D-(S)
(2) A-(Q); B-(P); C-(S); D-(R)
(3) A-(Q); B-(S); C-(P); D-(R)
(4) A-(S); B-(R); C-(P); D-(Q)

3. Match the **List-I** and **List-II** to find out the **correct** combination.

List-I		List-II	
A.	Neuron	P.	Tall and slender cells
B.	Neuroglia	Q.	Fat storage
C.	Columnar epithelium	R.	Supportive cells
D.	Adipose tissue	S.	Structural and functional unit of neural system

(1) A-(S); B-(R); C-(P); D-(Q)
(2) A-(R); B-(S); C-(P); D-(Q)
(3) A-(Q); B-(R); C-(S); D-(P)
(4) A-(P); B-(Q); C-(R); D-(S)

4. Match the **List-I** and **List-II** to find out the **correct** combination.

List-I		List-II	
A.	Heterocrine	P.	Histamine
B.	Exocrine	Q.	Pancreas
C.	Endocrine	R.	Liver
D.	Mast cell	S.	Adrenal gland

(1) A-(P); B-(Q); C-(R); D-(S)
(2) A-(Q); B-(S); C-(R); D-(P)
(3) A-(Q); B-(R); C-(S); D-(P)
(4) A-(P); B-(Q); C-(S); D-(R)

5. Match the **List-I** and **List-II** to find out the **correct** combination.

List-I		List-II	
A.	Blood vessels	P.	Simple squamous epithelium
B.	Buccal cavity	Q.	Compound epithelium
C.	PCT	R.	Exocrine gland
D.	Milk	S.	Microvilli

(1) A-(P); B-(Q); C-(R); D-(S)
(2) A-(Q); B-(P); C-(R); D-(S)
(3) A-(P); B-(Q); C-(S); D-(R)
(4) A-(S); B-(Q); C-(P); D-(R)

6. Match the **List-I** and **List-II** to find out the **correct** combination.

List-I		List-II	
A.	Areolar tissue	P.	Fibres
B.	Adipocyte	Q.	Fat cells
C.	Osteocytes	R.	Bone cells
D.	Collagen	S.	Support framework for epithelium

(1) A-(S); B-(Q); C-(R); D-(P)
(2) A-(Q); B-(R); C-(P); D-(S)
(3) A-(Q); B-(P); C-(R); D-(S)
(4) A-(R); B-(P); C-(Q); D-(S)

7. Match the **List-I** and **List-II** to find out the **correct** combination.

List-I		List-II	
A.	Fibres	P.	Mast cell
B.	Serotonin	Q.	Fibroblast
C.	Phagocytosis	R.	Macrophages
D.	RER and ribosome	S.	Nissl's granules

(1) A-(P); B-(Q); C-(R); D-(S)
(2) A-(P); B-(R); C-(S); D-(Q)
(3) A-(Q); B-(R); C-(P); D-(S)
(4) A-(Q); B-(P); C-(R); D-(S)

CORRECT-INCORRECT PAIR MCQs

8. Select the **incorrect** match.
(1) Skeletal muscle – Protects the heart
(2) Compound epithelium – Protection against chemical and mechanical stress
(3) Bones – Protects soft tissues and organs
(4) Neuroglia – Protects and support neurons

9. Select the **incorrect** match.
(1) Adipocytes – Fat storing cells
(2) Chondrocytes – Secrete matrix which is organised into lamellae
(3) Osteocytes – Present in spaces called lacunae
(4) Erythrocytes – Cells carrying oxygen transporting pigment in blood

10. Which of the following is **correct** pairing of a body part and the kind of muscle tissue that moves it?
(1) Wall of blood vessels – Involuntary smooth muscle
(2) Heart wall – Involuntary unstriated muscle
(3) Biceps of upper arm – Smooth muscle fibres
(4) Abdominal wall – Skeletal muscle

11. Select the **incorrect** match.
(1) Dense regular connective tissue – Tendons and ligaments
(2) Simple squamous epithelium – Walls of blood vessels and alveoli
(3) Compound epithelium – Moist surface of buccal cavity and pharynx
(4) Squamous epithelium – Inner lining of ducts of salivary glands.

12. Select the **incorrect** match.
(1) Smooth muscles – Uninucleated cells
(2) Columnar epithelium – Nuclei are located in the center of the cells
(3) Red blood cells – Anucleated
(4) Skeletal muscles – Multinucleated cells

PHYSICS WALLAH

YAKEEN NEET

- Units and Measurements
- Mathematical Tools
- Motion in a Straight Line
- Motion in a Plane
- Newton's Laws of Motion

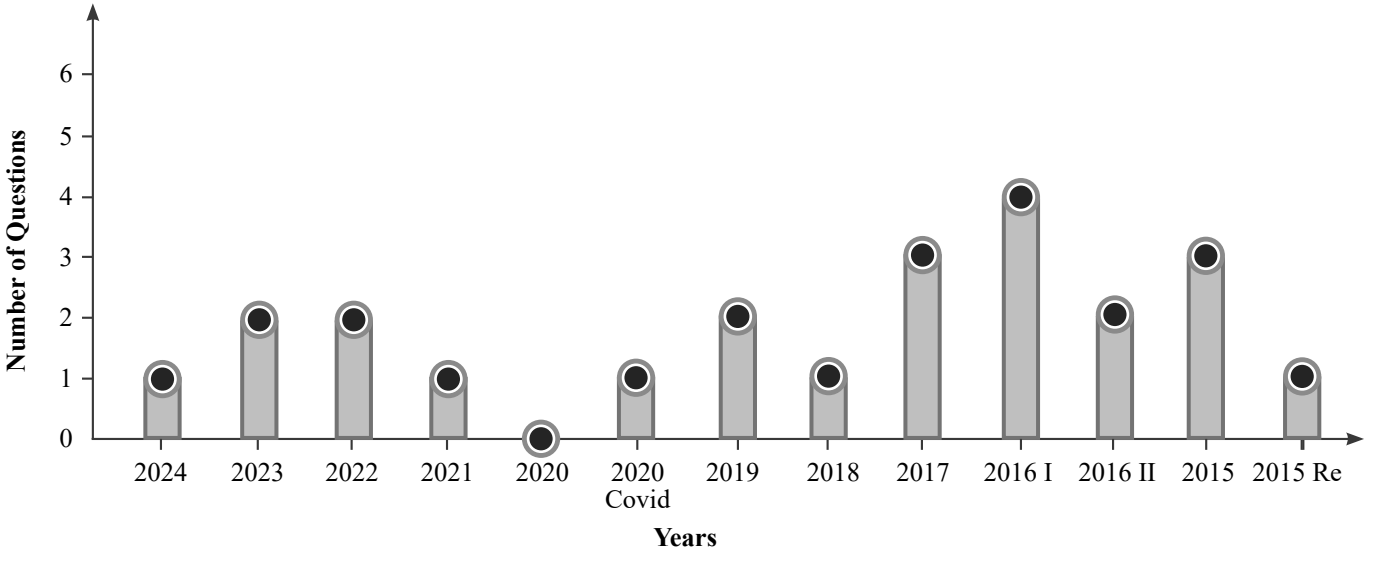
Physics

MODULE 1

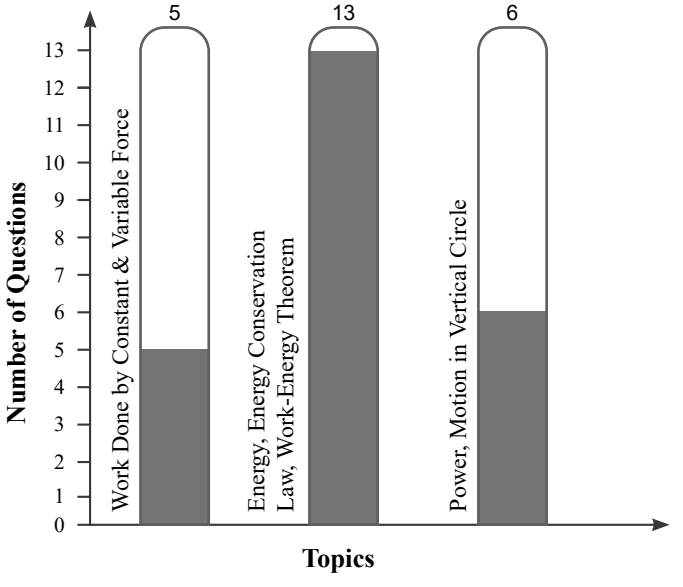
CHAPTER

6 Work, Energy and Power

Year Wise Number of Questions Analysis (2024-2015)



Topicwise Number of Questions Analysis (2024-2015)



3. **If resultant force acting on the body becomes zero, (F = 0)**

For examples:

(*i*) The work done by all forces acting on a raindrop falling down with terminal velocity is zero.

(*ii*) If body is moving with uniform velocity on a horizontal frictionless surface, then work done on the body is zero.

Work Done by a Constant Force

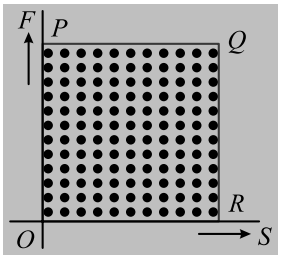
If a constant force $\vec{F}$ displaces a body by $\vec{S}$ then work done by the force $W = \vec{F}.\vec{S}$

Work done can be calculated from Force-displacement graph. The area enclosed by the graph on displacement axis gives the amount of work done by the force.

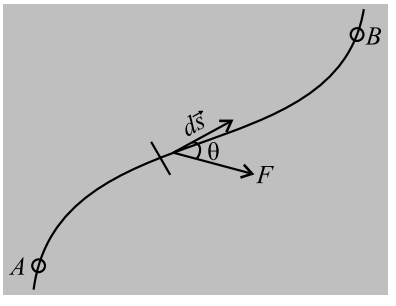
Force-displacement graph of a constant force is a straight line PQ are shown below.

Work = Area OPQR

= OP × OR = (F)(S)



Work Done by Variable Force



When the magnitude and direction of a force varies with position the work done by such a force for an infinite small displacement ds is given by $dw = \vec{F} \cdot d\vec{s}$

The total work done in going from A to B is

$$W_{AB} = \int_A^B \vec{F} \cdot d\vec{s} = \int_A^B (F\, ds \cos\theta)$$

In terms of rectangular components

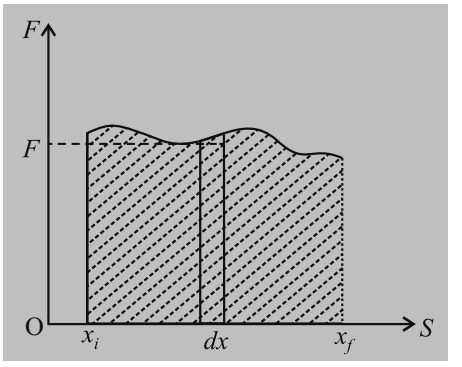
$$\vec{F} = F_x\hat{i} + F_y\hat{j} + F_z\hat{k}$$

$$d\vec{s} = dx\hat{i} + dy\hat{j} + dz\hat{k}$$

$$W = \int_A^B F_x dx + \int_A^B F_y dy + \int_A^B F_z dz$$

Graphical Interpretation of Work Done

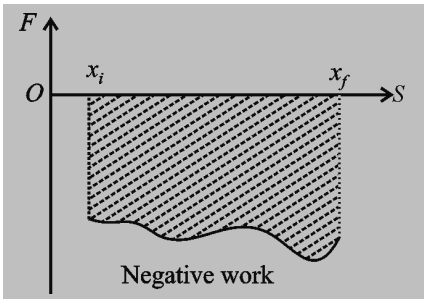
The area enclosed by the force-displacement graph on displacement axis gives the amount of work done by the force



$$W = \int_{X_i}^{X_f} dw = \int_{X_i}^{X_f} F\, dx$$

In this case work done is positive,

- If area lies above *X*-axis work done is *+ve* if the area lies below *X*-axis work done is *–ve*



Train Your Brain

Example 1: A force $F = (10 + 0.5x)$ N acts on a particle in x-direction, where x is in metre. Find the work done by this force during a displacement from $x = 0$ to $x = 2$.

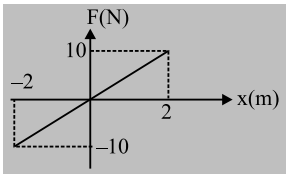
Sol. Work done for small displacement dx is $dW = \vec{F} \cdot \vec{dx}$ $= (10 + 0.5x)\, dx$

Total work done

$$W = \int_{x=0}^{x=2} (10 + 0.5x)\, dx = \left[10x + \frac{0.5x^2}{2}\right]_0^2$$

$$= 10\,(2 - 0) + \frac{0.5}{2}\,(2^2 - 0) = 21 \text{ J}$$

Example 2: A force F acting on a particle varies with the position x as shown in figure. Find the total work done by this force in displacing the particle from



(1) $x = -2$ m to $x = 0$

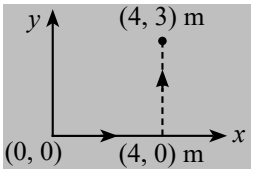
(2) $x = 0$ to $x = 2$ m

Sol. (1) $W = -\frac{1}{2}(2)(10) = -10\text{J}$

(2) $W = \frac{1}{2}(2)(10) = 10\text{J}$

Concept Application

1. A force $\vec{F} = (3\hat{i} + 4\hat{j})$N acts on a particle moving in x-y plane. Starting from origin, the particle first goes along x-axis to the point (4, 0) m and then parallel to the y-axis to the point (4, 3) m. The total work done by the force on the particle is



(1) +12 J (2) –6 J

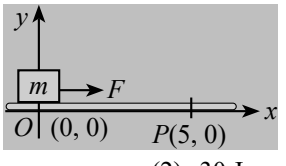
(3) + 24 J (4) –12 J

2. A force $\vec{F} = (2\hat{i} + 3\hat{j} + 2\hat{k})$N acts on a particle of mass *m*. The particle starts from points A (1, 2,1) m and moves to point B (3, 4, 3) m. What is the total work done by the force on the particle?

(1) 14 J (2) 12 J

(3) 16 J (4) 10 J

3. A block of mass *m* is placed at origin (0, 0) and a force $F = (2x + 2)$ N, is applied on the block so that it reaches at some other point, *P*(5, 0) m. Find the work done by the force.



(1) 35 J (2) 30 J

(3) 15 J (4) 21 J

4. A position dependent force $F = 7 – 2x + 3x^2$ newton acts on a small body of mass 2 kg and displaces it from $x = 0$ to $x = 5$ m. The work done in joules is:

(1) 70 (2) 270

(3) 35 (4) 135

5. A body of mass 0.5 kg travels in a straight line with velocity $v = ax^{3/2}$ where $a = 5\text{m}^{\frac{-1}{2}}\text{s}^{-1}$. The work is done by the net force during its displacement from $x = 0$ to $x = 2$ m is

(1) 15 J (2) 50 J

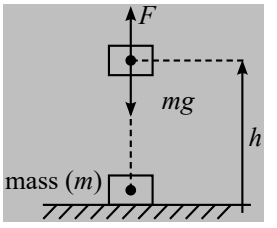
(3) 10 J (4) 100 J

THE WORK DONE BY A FORCE IN VARIOUS SITUATIONS

Application 1

A body of mass 'm' is lifted from ground to a height 'h' by using a minimum force F.

The minimum work done by the lifting force is $W_F = Fh = + mgh$



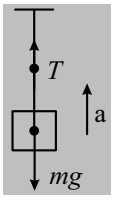
Work done by the gravitational force is $W_g = – mgh$

Application 2

One end of a string is fixed to a support and a body of mass 'm' is attached to the other end of the string.

- If the point of support moves with accelerations 'a' in the upward direction, work done by tension in the string when the body moves upward through a distance 'h' is

$$W = m(g + a)h$$



- If the body moves downward with acceleration 'a' then workdone by the tension in the string is

$$W = – m(g – a)h.$$

Here workdone is negative as force and displacement are opposite to each other.

Application 3

- A body of mass 'm' is placed on a frictionless horizontal surface. A force F acts on the body parallel to the surface, such that it moves with an acceleration 'a'. The work done by the force acting on the body when its displacement is *S* is given by

$$W = FS = maS$$

- If body moves with uniform velocity on a horizontal frictionless surface. The work done on the body is W = 0
- If frictional force is considered between the body and the surface, then the workdone by the force to move the body with uniform velocity is

$$W = fS = \mu_k mgS$$

- In the above case if the body moves with uniform acceleration 'a' workdone by the force is

$$W = (\mu_k mg + ma)\, S$$

Work Done by Constant Force

$$W = \vec{F} \cdot \vec{S}$$

Work Done by Multiple Forces

$$W = [\Sigma \vec{F}] \cdot \vec{S}$$

$$W = \vec{F}_1 \cdot \vec{S} + \vec{F}_2 \cdot \vec{S} + \vec{F}_3 \cdot \vec{S} + \cdots \left(\because \Sigma \vec{F} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \cdots\right)$$

or $W = W_1 + W_2 + W_3 + \ldots$

Work Done by Variable Force

$$W = \int dW = \int \vec{F} \cdot d\vec{s}$$

- Area under the force and displacement curve on displacement axes gives work done.

Relation between Momentum and Kinetic Energy

$K = \dfrac{p^2}{2m}$ and $p = \sqrt{2mK}$; p = linear momentum

Potential Energy

$$U_f - U_i = -\int_{r_i}^{r_f} \vec{F} \cdot d\vec{r} = -W_{Conservative}$$

Conservative Force

$$\vec{F} = -\frac{dU}{dr}\hat{r}, \quad \vec{F} = -\frac{\partial U}{\partial x}\hat{i} - \frac{\partial U}{\partial y}\hat{j} - \frac{\partial U}{\partial z}\hat{k}$$

Equilibrium Conditions

- Stable Equilibrium

$$F(r) = -\frac{\partial U}{\partial r} = 0; \quad \text{therefore} \quad \frac{\partial F}{\partial r} < 0; \quad \text{and} \quad \frac{\partial^2 U}{\partial r^2} > 0$$

- Unstable Equilibrium

$$F(r) = -\frac{\partial U}{\partial r} = 0; \quad \text{therefore} \quad \frac{\partial F}{\partial r} > 0; \quad \text{and} \quad \frac{\partial^2 U}{\partial r^2} < 0$$

- Neutral Equilibrium

$$F(r) = -\frac{\partial U}{\partial r} = 0; \quad \text{therefore} \quad \frac{\partial F}{\partial r} = 0; \quad \text{and} \quad \frac{\partial^2 U}{\partial r^2} = 0$$

Work-Energy Theorem

$$W_{All} = \Delta K \Rightarrow W_C + W_{NC} + W_{Ext} + W_{Pseudo} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

Law of Conservation of Mechanical Energy

If the net external force acting on a system is zero, then the mechanical energy is conserved.

$$K_f + U_f = K_i + U_i$$

Power

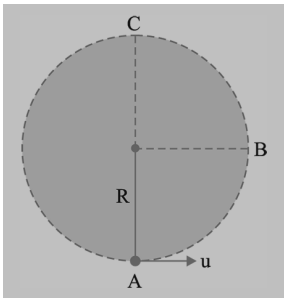
The average power delivered by an agent is given by

$$P_{avg} = \frac{W}{t}$$

The instantaneous average power delivered by an agent is given by

$$P_{inst} = \frac{d(\vec{F} \cdot \vec{S})}{dt} = \vec{F} \cdot \frac{d\vec{S}}{dt} = \vec{F} \cdot \vec{v}$$

Circular Motion in Vertical Plane



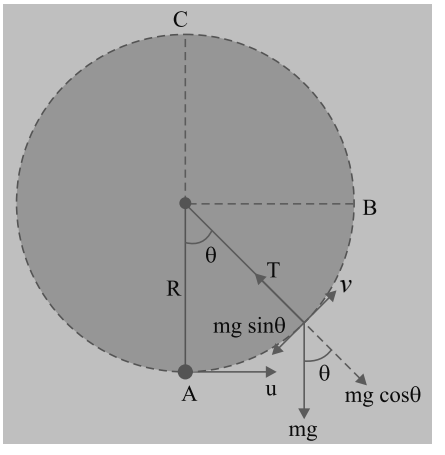
A. Condition to complete vertical circle $u \geq \sqrt{5gR}$

If $u = \sqrt{5gR}$ then Tension at C is equal to 0 and tension at A is equal to 6 mg.

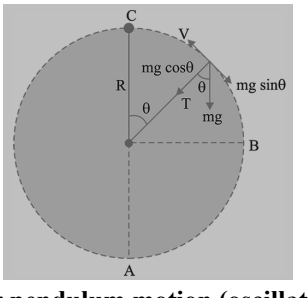
Velocity at B: $v_B = \sqrt{3gR}$

Velocity at C: $v_C = \sqrt{gR}$

From A to B: $T = mg\cos\theta + \dfrac{mv^2}{R}$



From B to C: $T = \dfrac{mv^2}{R} - mg\cos\theta$



B. Condition for pendulum motion (oscillating condition)

$u \leq \sqrt{2gR}$ (in between A to B)

Velocity can be zero but T never be zero between A and B.

Because T is given by $T = mg\cos\theta + \dfrac{mv^2}{R}$.

1. Three constant forces $F_1 = \hat{i} + \hat{j} - 2\hat{k}$, $F_2 = 2\hat{i} - 2\hat{j} - 3\hat{k}$ and $F_3 = \hat{i} + 2\hat{j} + 4\hat{k}$ in newton displace a particle from (1, –1, 2) to (–1, –1, 3) and then to (2, 2, 0) in metre. The total work done by the forces is

(1) 10 J (2) 9 J (3) 8 J (4) 6 J

Sol. $\bar{F}_{net} = (1+2+1)\hat{i} + (1-2+2)\hat{j} + (-2-3+4)\hat{k} = 4\hat{i} + \hat{j} - \hat{k}$ N

Resultant displacement,

$\bar{S} = \bar{S}_1 + \bar{S}_2 = (2-1)\hat{i} + (2+1)\hat{j} + (0-2)\hat{k}$

$\bar{S} = \hat{i} + 3\hat{j} - 2\hat{k}$

Now, work done, $W = \bar{F}.\bar{S} = (4\hat{i} + \hat{j} - \hat{k}).(\hat{i} + 3\hat{j} - 2\hat{k})$

= 4 + 3 + 2 = 9 J

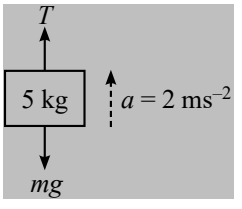
Therefore, option (2) is the correct answer.

2. A block of mass 5 kg is being raised vertically upwards by the help of a string attached to it. It raise with an acceleration of 2 ms^{-2}. The work done by the tension in the string if the block rises by 2.5 m is

(1) 147.5 J (2) 152.7 J

(3) 125.5 J (4) 135.5 J

Sol. $T - mg = ma$



$T - 5(9.8) = 5(2) \Rightarrow T = 59$ N

$S = 2.5$ m

$\therefore$ Work done by tension,

$W_r = TS \cos 0° = 59 \times 2.5 \times 1 = 147.5$ J

Therefore, option (1) is the correct answer.

3. A body is thrown on a rough surface such that friction force acting on it is linearly varying with distance travelled by it as $f = ax + b$. The magnitude of work done by the friction on the box if before coming to rest the box travels a distance s is

(1) $as + b$ (2) $\frac{1}{2}as^2 + bs$

(3) $a^2s + b$ (4) $\frac{1}{2}as^2 - bs$

Sol. As the force is acting in the direction opposite to the box motion, work done by this force must be negative. As force is not constant, we use

$$W = -\int_0^s f.dx = -\int_0^s (ax + b)dx$$

$$= -\left[\frac{ax^2}{2} + bx\right]_0^s \Rightarrow W = -\left[\frac{1}{2}as^2 + bs\right]$$

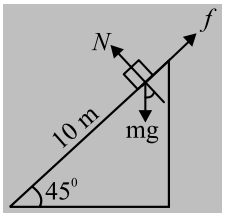
Therefore, option (2) is the correct answer.

4. A block of mass 5 kg slides down a rough inclined surface. The angle of inclination is 45^0. The coefficient of sliding friction is 0.20. When the block slides 10 m, the work done on the block by force of friction is:

(1) $50\sqrt{2}$ J (2) $-50\sqrt{2}$ J

(3) 50 J (4) – 50 J

Sol.



$W_F = -\mu Nx$

$W_F = -(\mu mg \cos\theta)\, x$

$$= -0.2 \times 5 \times 10 \times \frac{1}{\sqrt{2}} \times 10 = -50\sqrt{2} \text{ J}$$

$W_F = -50\sqrt{2}$ J

It will be negative as angle between displacement and force will be 180°.

Therefore, option (2) is the correct answer.

5. A particle moves in a straight line with retardation proportional to its displacement. The loss in kinetic energy of the particle, for any displacement x is proportional to:

(1) x^2 (2) e^x (3) x (4) log x

Sol. $a = -kx$ or $\frac{vdv}{dx} = -kx$, $vdv = -kxdx$

Let the velocity change from v_0 to v

$$\int_{v_0}^{v} vdv = -\int_0^x kxdx \Rightarrow \frac{v^2 - v_0^2}{2} = \frac{-kx^2}{2}$$

$$m\left(\frac{v^2 - v_0^2}{2}\right) = \frac{-mkx^2}{2}$$

$\Delta k \propto x^2$ [Δk is loss in kinetic energy]

Therefore, option (1) is the correct answer.

6. The momentum of a body is increased by 20%. The percentage increase in kinetic energy is:

(1) 54 % (2) 44 % (3) 100 % (4) 50 %

Sol. $P' = 1.2\ P$

$$E' = \frac{(1.2P)^2}{2m} = 1.44\frac{P^2}{2m}$$

$$E' - E = \frac{1.44P^2}{2m} - \frac{P^2}{2m} = \frac{0.44P^2}{2m}$$

$$\% \text{ change} = \frac{E' - E}{E} \times 100 = 44\%$$

Therefore, option (2) is the correct answer.

WORK DONE BY CONSTANT & VARIABLE FORCE

1. A man pushes a wall and fails to displace it. He does
(1) Negative work
(2) Positive but not maximum work
(3) No work at all
(4) Maximum work.

2. A force of 10 N acts on a 10 kg body initially at rest. The work done by the force during the first 5 second and 5th second of motion of body are (in joule)
(1) 3, 1.5 (2) 9, 4 (3) 11.5, 5 (4) 125, 45

3. A particle is moving under the influence of a force given by F = Kx where K is a constant and x is the distance moved. The energy gained by the particle in moving from x = 0 to x = 5 is
(1) 0.125 K (2) 0.185 K (3) 0.625 K (4) 12.5 K

4. A force $F = 5 + 2x$ acts on a body in x-direction where x is in metres and F in newton. Find the work done in displacing the body from $x = 0$ to $x = 2$ m.
(1) 14J (2) 18 J
(3) 16 J (4) 20 J

5. A particle of mass 2 kg travels according to equation $S = 3t^3 + 2t$. Find the work done in 3 second of its motion.
(1) 6889 J (2) 6885 J
(3) 1782 J (4) 6893 J

6. A rigid body of mass m kg is lifted uniformly by a man to a height of one metre in 30 sec. Another man lifts the same mass uniformly to the same height in 60 sec. The work done on the body against gravitation by them are in ratio
(1) 1 : 2 (2) 1 : 1
(3) 2 : 1 (4) 4 : 1

7. A particle moves from position $\vec{r}_1 = 3\hat{i} + 2\hat{j} - 6\hat{k}$ to position $\vec{r}_2 = 14\hat{i} + 13\hat{j} + 9\hat{k}$ under the action of force $\vec{F} = 4\hat{i} + \hat{j} + 3\hat{k}\,N$. The work done by this force will be
(1) 100 J (2) 50 J (3) 200 J (4) 75 J

8. A person holds a bucket of mass 6 kg. He walks 7m along the horizontal and then climbs a vertical distance of 5m. The work done by the man is:
(1) 300 J (2) 420 J
(3) 720 J (4) 350 J

9. A box of mass 1 kg is pulled on a horizontal plane of length 1m by a force of 8 newtons then it is raised vertically to a height of 2m, the net work done is:
(1) 28 joule (2) 8 joule
(3) 18 joule (4) 20 joule

10. A position dependent force $F = 7 - 2x + 3x^2$ newton acts on a small body of mass 2 kg and displaces it from $x = 0$ to $x = 5$m. The work done in joules is
(1) 70 (2) 270 (3) 35 (4) 135

11. A rope is used to lower vertically a block of mass M at a distance x at a constant downward acceleration g/2. The work done by the rope on the block is:
(1) Mgx (2) $\frac{1}{2}Mgx^2$ (3) $-\frac{1}{2}Mgx$ (4) Mgx^2

12. A 2 kg mass lying on a table is displaced in the horizontal direction through 50 cm. The work done by the normal reaction will be
(1) Zero (2) 100 Joule
(3) 100 erg (4) 10 Joule

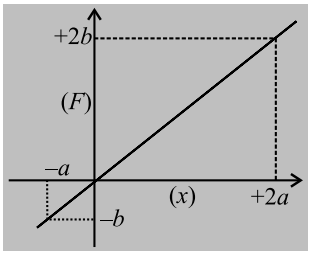
13. The work done against gravity in taking 10 kg mass at 1 m height in 1 s will be (Use $g = 9.8\ m/s^2$):
(1) 49 J (2) 98 J
(3) 196 J (4) 150 J

14. A body is displaced from (0,0) to (1m, 1m) along the path $x = y$ by a force $F = \left(x^2\hat{j} + y\hat{i}\right)$ N. The work done by this force will be
(1) $\frac{4}{3}$J (2) $\frac{5}{6}$J
(3) $\frac{3}{2}$J (4) $\frac{7}{5}$J

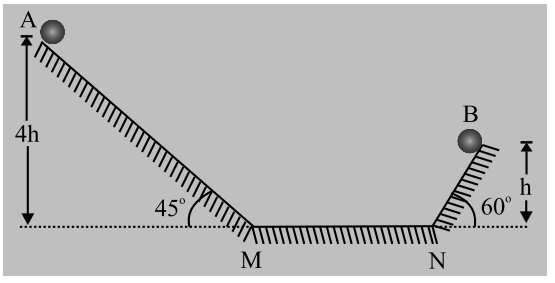
15. A particle of mass 0.5 kg is displaced from position $\vec{r}_1(2,3,1)$ to $\vec{r}_2(4,3,2)$ by applying a force of magnitude 30 N which is acting along $(\hat{i} + \hat{j} + \hat{k})$. The work done by the force is
(1) $10\sqrt{3}$ J (2) $30\sqrt{3}$ J
(3) 30 J (4) 10 J

16. A block of mass 5 kg initially at rest at the origin is acted upon by a force along the positive X– direction represented by $F = (20 + 5x)$ N. Calculate the work done by the force during the displacement of the block from $x = 0$ at $x = 4$ m
(1) 100 J (2) 150 J (3) 120 J (4) 75 J

17. A force F acting on a particle varies with the position x as shown in the graph. Find the work done by the force in displacing the particle from $x = -a$ to $x = +2a$



1. Two identical balls A and B are released from the positions shown in figure. They collide elastically on horizontal portion MN. The ratio of the heights attained by A and B after collision will be (neglect friction):



(1) 1 : 4 (2) 2 : 1
(3) 4 : 13 (4) 2 : 5

2. The vessels A and B of equal volume and weight are immersed in water to depth h. The vessel A has an opening at the bottom through which water can enter. If the work done in immersing A and B are W_A and W_B respectively, then

(1) $W_A = W_B$ (2) $W_A < W_B$
(3) $W_A > W_B$ (4) Data is insufficient to suggest

3. A vertical spring with force constant k is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring, so that the spring is compressed by a distance d. The net work done in the process is

(1) $mg(h+d)+\frac{1}{2}kd^2$ (2) $mg(h+d)-\frac{1}{2}kd^2$
(3) $mg(h-d)-\frac{1}{2}kd^2$ (4) $mg(h-d)+\frac{1}{2}kd^2$

4. A particle of mass m start from rest accelerating uniformly has velocity v at time t_1. What is work done on the particle in time t?

(1) $\frac{1}{2}\left(\frac{mv^2}{t_1^2}\right)t^2$ (2) $\frac{1}{2}\left(\frac{mv}{t_1^2}\right)^2 t^2$
(3) $\left(\frac{mv^2}{t_1^2}\right)^2 t^2$ (4) $\left(\frac{2mv^2}{t_1^2}\right)^2 t^2$

5. A weight lifter jerks 220 kg vertically through 1.5 meters and holds still at that height for two minutes. The work done by him in lifting and in holding it still are respectively

(1) 220J, 330J (2) 3234 J, 0
(3) 2334 J, 10 J (4) 0, 3234 J

6. A 60 kg boy lying on a surface of negligible friction throws horizontally a stone of mass 1 kg with a speed of 12 m/s away from him. As a result with what kinetic energy he moves back?

(1) 2.4 J (2) 72 J (3) 1.2 J (4) 36 J

7. A particle of mass m is moving in a circular path of constant radius r such that centripetal acceleration, a_c varying with time is $a_c = k^2 rt^2$, where k is a constant. What is the power delivered to the particle by the force acting on it?

(1) $2mkr^2t$ (2) mkr^2t^2
(3) mk^2r^2t (4) mk^2rt

8. A person trying to lose weight by burning fat lifts a mass of 10kg upto a height of 1m 1000 times. Assume that the potential energy lost each time he lowers the mass is dissipated. How much fat will he use up considering the work done only when the weight is lifted up? Fat supplies 3.8×10^7J of energy per kg which is converted to mechanical energy with a 20% efficiency rate (take g = 9.8 ms^{-2})

(1) 12.89×10^{-3} kg (2) 9.89×10^{-3}kg
(3) 6.45×10^{-3} kg (4) 2.45×10^{-3} kg

9. A body of mass 0.5kg travels in a straight line with velocity $V = ax^{3/2}$ where $a = 5m^{-1/2}\ s^{-1}$. What is the work done by the net force during its displacement from $x = 0$ to $x = 2m$.

(1) 50J (2) 40J
(3) 30J (4) 60J

10. A boy whose weight is 600 N runs up a flight of stairs 10 m high in a time of 12s. The average power develops, in watt is

(1) 72 (2) 500 (3) 720 (4) 5000

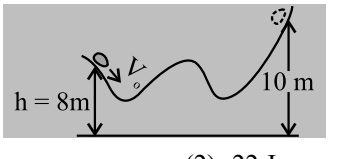
11. A force, $\vec{F} = 2x\hat{i} + 2\hat{j}$, acts on a particle placed at origin. What is the work done by this force in moving particle from origin to P(1, 1)?

(1) 3 J (2) 4 J
(3) 5 J (4) 6 J

12. A body is acted upon by a force which is inversely proportional to the distance covered(s). The work done will be proportional to:

(1) Constant (2) s^2
(3) $\sqrt{s}$ (4) log s

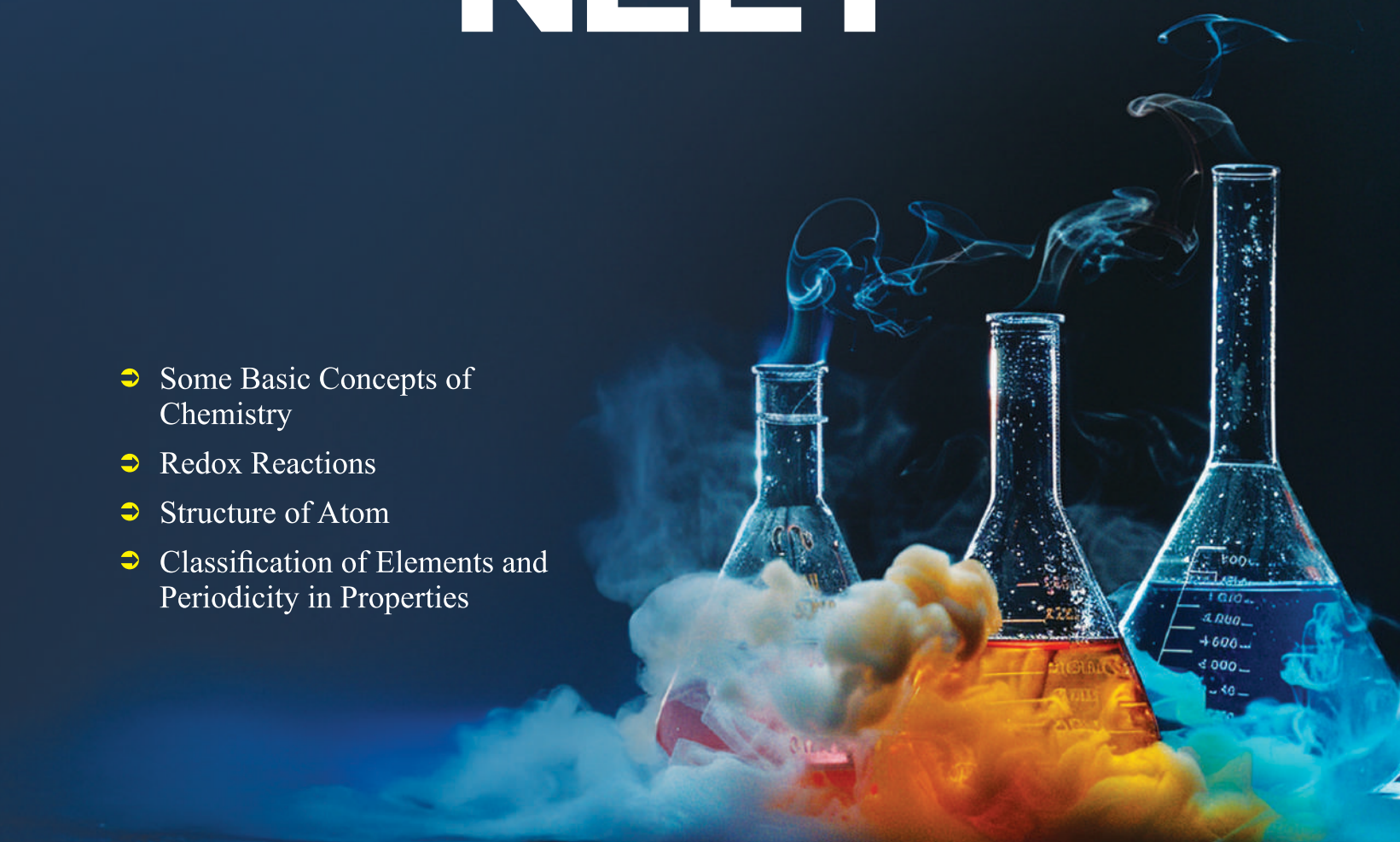
13. A dog of mass m = 4 kg runs from the left end of a curved ramp with speed $V_0 = 8$ m/s at height 8 m above the ground. It then slides to the right and comes to rest when it reaches a height 10 m from the ground. The maximum increase in thermal energy of the dog -ramp system because of sliding is ($g = 10\ m/s^2$)



(1) 0 (2) 22 J
(3) 48 J (4) 32 J

PHYSICS WALLAH

YAKEEN NEET



- Some Basic Concepts of Chemistry
- Redox Reactions
- Structure of Atom
- Classification of Elements and Periodicity in Properties

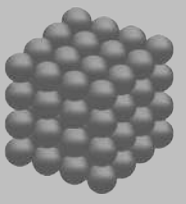
Chemistry

MODULE 1

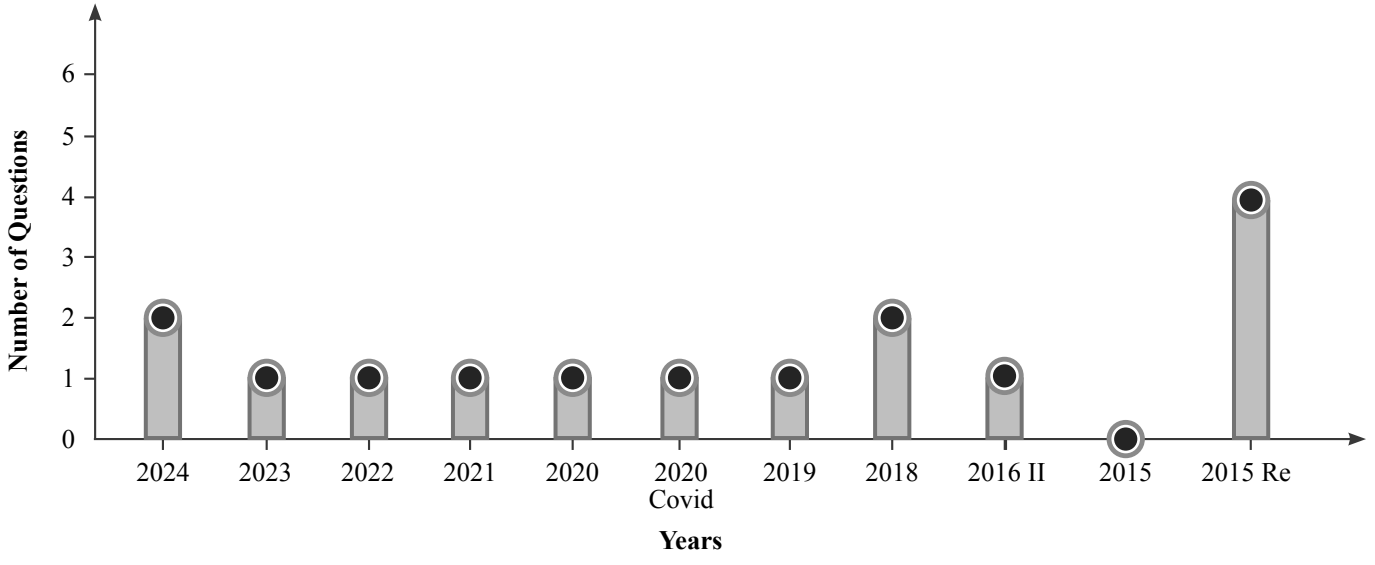
CHAPTER

1

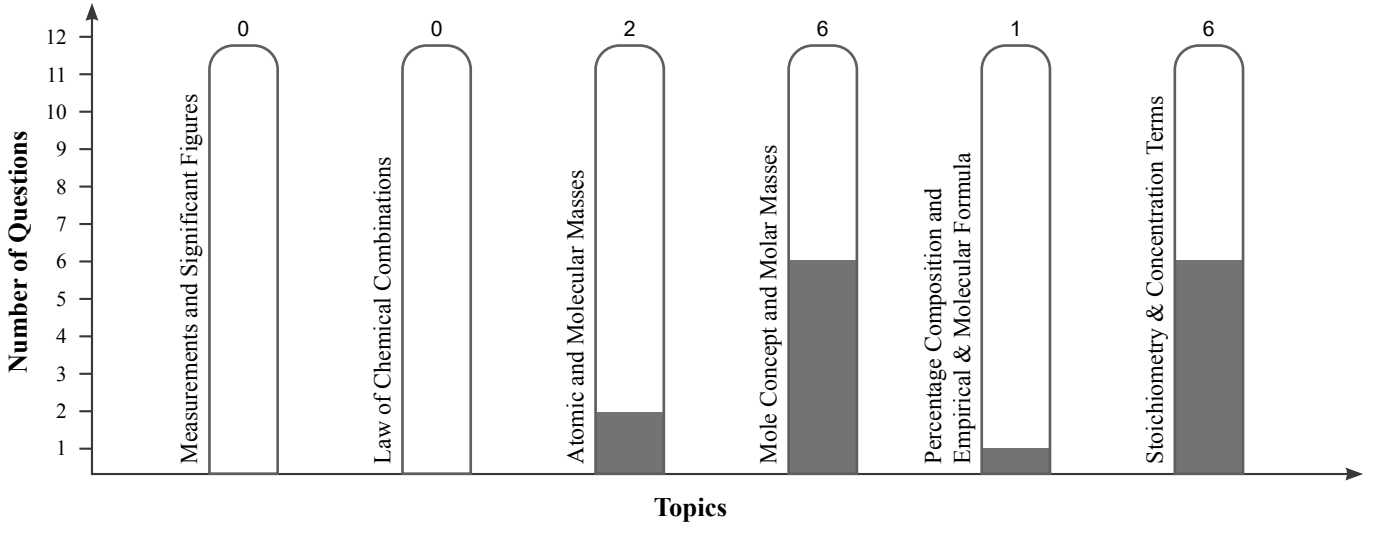
Some Basic Concepts of Chemistry



Year Wise Number of Questions Analysis (2024-2015)



Topicwise Number of Questions Analysis (2024-2015)



NATURE OF MATTER

- Chemistry is the branch of science that studies the composition, properties and interaction of matter.
- Anything that has mass and occupies space is called **matter**.

  For Example: book, pen, pencil, water, air, all living beings etc. are composed of matter. You know that they have mass and they occupy space.
- Material is another very common term used in chemistry. However, the term **material** has a limited meaning, which corresponds to matter having specific uses.

States of matter

Particles are held very close to each other in **solids** in an orderly fashion and there is not much freedom of movement. In **liquids**, the particles are close to each other but they can move around. However, in **gases**, the particles are far apart as compared to those present in solid or liquid states and their movement is easy and fast. Because of such arrangement of particles, different states of matter exhibit the following characteristics:

(i) Solids have definite volume and definite shape.

(ii) Liquids have definite volume but do not have definite shape. They take the shape of the container in which they are placed.

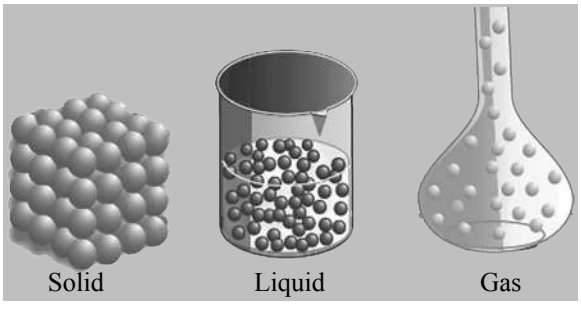


Fig. Arrangement of particles in solid, liquid and gaseous state

(iii) Gases have neither definite volume nor definite shape. They completely occupy the space in the container in which they are placed.

These three states of matter are interconvertible by changing the conditions of temperature and pressure.

$$\text{Solid} \underset{\text{cool}}{\overset{\text{heat}}{\rightleftharpoons}} \text{liquid} \underset{\text{cool}}{\overset{\text{heat}}{\rightleftharpoons}} \text{Gas}$$

On heating, a solid usually changes to a liquid, and the liquid on further heating changes to gas (or vapour). In the reverse process, a gas on cooling liquifies to the liquid and the liquid on further cooling freezes to the solid.

CLASSIFICATION OF MATTER

Matter can be classified in two ways:

(i) Physical classification of matter

(ii) Chemical classification of matter

Physical Classification of Matter

Depending upon the physical state of matter, it can be classified into three states, namely, **solid, liquid** and **gaseous state**.

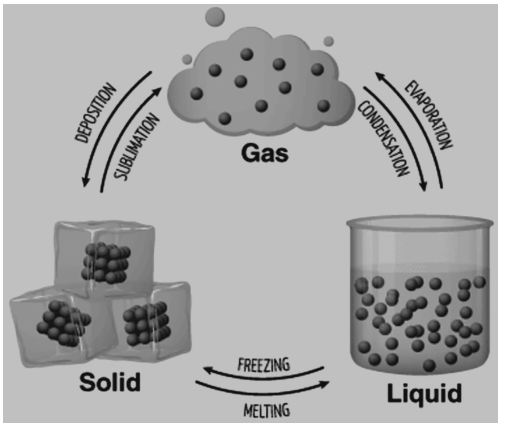
Table: Properties of Solids, Liquids and Gases

Properties	Solid	Liquid	Gas
Shape	Definite	Indefinite	Indefinite
Volume	Definite	Definite	Indefinite
Attraction Force	Strongest	Moderate	Weakest
Examples	Sugar, Iron, Gold, Wood etc.	Water, Milk, oil, Mercury	Dihydrogen, Oxygen, Carbon dioxide, etc.

$$\text{Solid} \underset{\text{cool}}{\overset{\text{heat}}{\rightleftharpoons}} \text{Liquid} \underset{\text{cool}}{\overset{\text{heat}}{\rightleftharpoons}} \text{Gas}$$

These three states of matter are interconvertible by changing temperature and pressure.

Changing States of Matter



Chemical Classification of Matter

The chemical classification of matter is based upon its composition. At the macroscopic or bulk level, matter can be classified as **mixture or pure substances**.

Mixtures

- Mixtures are defined as the substances which are made up of two or more pure substances. They can posses variable composition and can be separated into constituent components by some suitable physical means/methods.

  For Example: Alloys (Brass, Bronze) (Brass = Copper + Zinc) (Bronze = Copper + Tin), Water + alcohol, Water + Salt, Water + mustard Oil, Water + Sugar, Water + Kerosene etc.

  A mixture may be homogeneous or heterogeneous.
- In a **homogeneous mixture**, the components completely mix with each other and its composition is uniform throughout. The components of such a mixture cannot be seen even under a microscope. **For Examples:** Air, gasoline, sea water, brass, coloured glass, Alloys, Water + alcohol, Water + Salt, 22 carat Gold, Water + Sugar, etc.

- In **heterogeneous mixtures**, the composition is not uniform throughout. These consist of two or more parts (called phases) which have different compositions.

  For Example: Water + Sand, Water + Mustard oil, Milk, Blood, Air, plastic, smoke, petrol, etc.

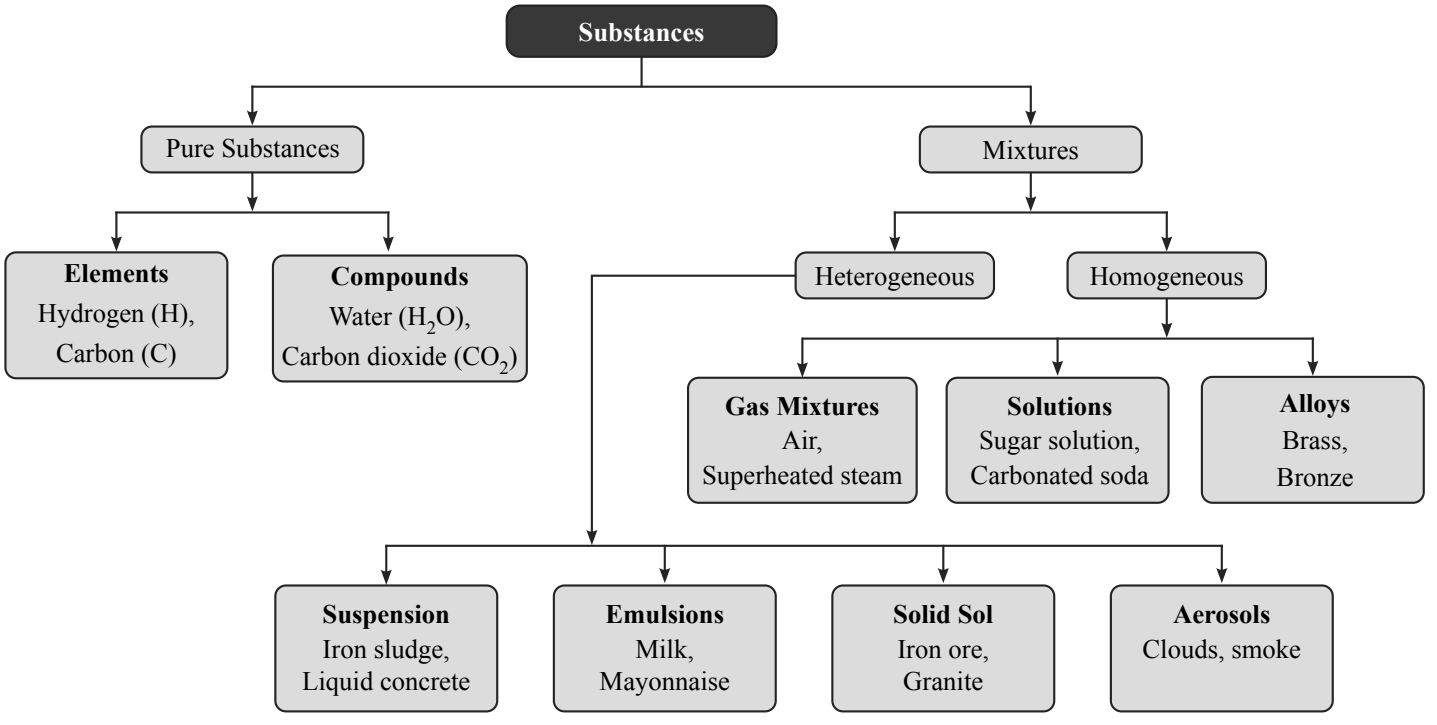
Pure Substances

- It consist of single type of particles.
- Pure substances can be further classified into elements and compounds.

1. **Element:** It is defined as the simplest form of a pure substance that can neither be decomposed nor built from simpler substances by any ordinary physical or chemical methods. **For Example;** Zn, B, Si etc.
2. **Compound:** A compound is defined as a pure substance that contains two or more than two elements combined together in a fixed proportion by mass and that can be break down into its constituent elements by suitable chemical methods.

Compounds are further classified into two categories.;

1. **Organic Compound:** Obtained from living sources.
   For Example: Oils, fats, derivative of hydrocarbon, etc.
2. **Inorganic Compound:** Obtained from non-living sources.
   For Example: HCl, H_2O, H_2SO_4, $HClO_4$, HNO_3, etc.



Train Your Brain

Example 1: Which of the following mixture(s) are homogeneous?

Tap water, Air, Soil, Smoke

Sol. Tap water, Air.

Example 2: Classify the following as pure substances or mixtures. Also separate the pure substances into elements and compounds and divide mixture, into homogeneous and heterogeneous categories:

(i) Graphite	(ii) Milk
(iii) Air	(iv) Oxygen
(v) 22 carat gold	(vi) Iodized table salt
(vii) Wood	(viii) Cloud

Sol. Element: (i), (iv)

Homogeneous Mixture: (iii), (v)

Heterogeneous Mixture: (ii), (vi), (vii), (viii)

PROPERTIES OF MATTER AND THEIR MEASUREMENT

Physical and Chemical Properties

Physical properties are those properties that can be measured or observed without changing the identity or composition of the substance. **For Example:** Colour, Odour etc.

Chemical properties are those in which a chemical change in the substance takes place. These chemical properties cannot be determined just by viewing or touching the substance. **For Example:** Acidity, basicity, ph, heat of combustion and reactivity etc.

Physical Quantities and Their Measurement in Chemistry

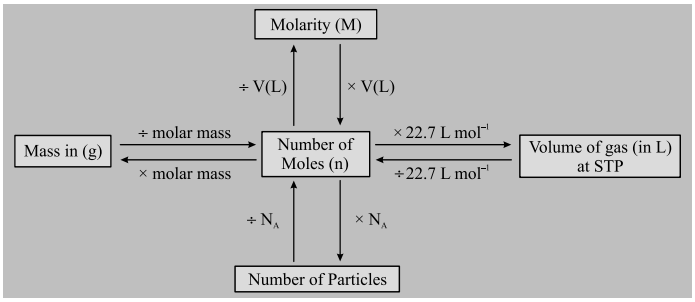
The value of a physical quantity is always expressed in two parts:

(i) Numerical value

(ii) Unit

- Diatomic (composed of two atoms). **For Example:** H_2, N_2, O_2, F_2, and Cl_2.
- Triatomic (composed of three atoms). **For Example:** include O_2.
- Polyatomic (composed of three or more atoms). **For Example:** include S_8.

MOLE CONCEPT



Mole Concept in Gaseous Reaction

Molar volume is related to volume of one mole of gaseous substance. The volume occupied by 1 mol of a gaseous substance is called molar volume. 1 mole occupies 22.414 L or 22414 mL at STP ie. 273 K and 1 atm.

$$\text{Number of moles} = \frac{\text{Volume}}{\text{Molar volume}}$$

Train Your Brain

Example 9: Which of the following contains the greatest number of atoms?

(1) 1.0 g of butane (C_4H_{10})
(2) 1.0 g of nitrogen (N_2)
(3) 1.0 g of silver (Ag)
(4) 1.0 g of water (H_2O)

Sol. (1) No. of atom of $(C_4H_{10}) = \frac{1}{58} \times 14\ N_A$

(2) No. of atom of $(N_2) = \frac{1}{28} \times 2\ N_A$

(3) No. of atom of $(Ag) = \frac{1}{108} \times N_A$

(4) No. of atom of water $(H_2O) = \frac{1}{18} \times 3\ N_A$

Hence greatest number of atoms = C_4H_{10}

Example 10: The number of sodium atoms in 2 moles of sodium ferrocyanide ($Na_4[Fe(CN)_6]$) is:

(1) 12×10^{23} (2) 26×10^{23}
(3) 34×10^{23} (4) 48×10^{23}

Sol. 1 mole of $Na_4[Fe(CN)_6]$ contains 4 mole of Na

So, 2 moles contains:

$= 8 \times N_A$ atoms of sodium

$= 8 \times 6.023 \times 10^{23}$

$= 48 \times 10^{23}$

Example 11: 5.6 litre of oxygen at STP contains:

(1) 6.02×10^{23} atoms (2) 3.01×10^{23} atoms
(3) 1.505×10^{23} atoms (4) 0.7525×10^{23} atoms

Sol. 22.4 L of oxygen at STP contains 6.02×10^{23} molecules. 5.6 L of oxygen at STP contains 1.505×10^{23} molecules which contains 3.01×10^{23} atoms of oxygen.

Example 12: The molecular mass of H_2SO_4 is 98 amu. Calculate the number of moles of each element in 294 g of H_2SO_4.

Sol. Gram molecular mass of H_2SO_4 = 98 g

Moles of $H_2SO_4 = \frac{294}{98} = 3$ moles

H_2SO_4	H	S	O
One molecule	2 atom	one atom	4 atom
$1 \times N_A$	$2 \times N_A$ atoms	$1 \times N_A$ atoms	$4 \times N_A$ atoms
$\therefore$ 1 mole	2 mole	1 mole	4 mole
$\therefore$ 3 mole	6 mole	3 mole	12 mole

Concept Application

9. 2 moles of N atoms at NTP occupy a volume of:
(1) 11.2 L (2) 44.8 L (3) 22.4 L (4) 5.6 L

10. Which of the following contains the largest number of oxygen atoms? 1.0 g of O atoms, 1.0 g of O_2, 1.0 g of ozone O_3.
(1) O_2
(2) O_3
(3) O atom
(4) All have the same number of oxygen atoms

11. The total number of gaseous molecules of SO_2Cl_2 in 13.5 g of sulphuryl chloride is;
(1) 0.1 (2) 0.2 (3) 0.3 (4) 0.4

12. 88 g of CO_2 contains _____ moles of carbon.
(1) 2 (2) 3
(3) 4 (4) 5

Conc. Terms	Formula
Absolute density	$\text{Absolute density} = \frac{\text{Mass}}{\text{Volume}}$
Relative density or specific gravity	$\text{Relative density} = \frac{\text{density of the substance}}{\text{density of water at 4°C}}$ (density of water at 4°C = 1 g/mL)
Vapour density	$\text{Vapour density} = \frac{(\text{Molar mass})_{gas}}{(\text{Molar mass})_{H_2}}$
Number of moles(n)	$\text{No. of moles (n)} = \frac{\text{Given mass (g)}}{\text{Molar mass (g/mol)}} = \frac{\text{Volume of gas at STP(L)}}{22.7\ \text{L/mol}} = \frac{\text{No. of particles}}{N_A}$
Mole Fraction	$\text{Mole fraction} = \frac{\text{Moles of component}}{\text{Total number of moles present in solution}}$ $x_A = \frac{n_A}{n_A + n_B + n_C .....}$
Parts per million	$\text{ppm of a solute in solution} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 10^6$
Degree of hardness of water	$\text{Hardness of water} = \frac{\text{mass of } CaCO_3}{\text{Total mass of water}} \times 10^6$
Mass Percentage	$\%w/w = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$
Mass by volume Percentage	$\%w/v = \frac{\text{Mass of solute}}{\text{Volume of solution}} \times 100$
Volume by volume percentage	$\%v/v = \frac{\text{Volume of solute (L)}}{\text{Volume of solution (L)}} \times 100$
Molarity	$\text{Molarity, (M)} = \frac{\text{Moles of solute}}{\text{Volume of solution (L)}}$
Molality	$\text{Molality, (m)} = \frac{\text{Moles of solute}}{\text{Mass of solvent (kg)}}$
Percent yield	$\text{Percent yield} = \frac{\text{Actual yield}}{\text{Theoretical maximum yield}} \times 100$

1. How many moles of hydrogen atoms present in 34 g of NH_3?

(1) 6 (2) 5

(3) 4 (4) 7

Sol. Number of moles of $NH_3 = \frac{34}{17} = 2$

Number of moles of hydrogen atoms = $2 \times 3 = 6$

Therefore, option (1) is the correct answer.

2. The mass of 12.044×10^{23} oxygen atoms will be:

(1) 16 g (2) 32 g

(3) 48 g (4) 64 g

Sol. Number of moles of oxygen atoms

$$= \frac{12.044 \times 10^{23}}{6.022 \times 10^{23}} = 2 \text{ mol}$$

Mass of oxygen atoms

= Number of moles × atomic mass = $2 \times 16 = 32$ g

Therefore, option (2) is the correct answer.

3. The standard molar volume of oxygen gas will be if the density of O_2 gas at NTP is 1.429 g/L.

(1) 44.8 L (2) 11.2 L

(3) 22.4 L (4) 67.2 L

Sol. Standard molar volume is volume of 1 mole of gas i.e., 32 g O_2 gas.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Volume} = \frac{\text{Mass}}{\text{Density}} = \frac{32}{1.429} = 22.39 \text{ L}$$

Therefore, option (3) is the correct answer.

4. An atom of some element Y weighs 6.644×10^{-23} g. Calculate the number of g-atoms in 40 kg of it.

(1) 40 (2) 1000

(3) 6.022×10^{23} (4) 40×10^3

Sol. Mass of 1 mole Y atoms

= mass of 1 atom × Avogadro constant

= $6.644 \times 10^{-23} \times 6.022 \times 10^{23} = 40$ g

So, the atomic mass of Y = 40 g

Number of g-atoms (or moles) of

$$Y = \frac{\text{Mass}}{\text{Atomic mass}} = \frac{40 \times 1000}{40} = 1000$$

Therefore, option (2) is the correct answer.

5. The percent loss in weight after heating a pure sample of potassium chlorate (molar mass = 122.5) will be:

(1) 12.25 (2) 24.50

(3) 39.18 (4) 49

Sol. $2KClO_3(s) \longrightarrow 2KCl(s) + 3O_2(g) \uparrow$

By stoichiometry,

245 g $KClO_3$ on heating shows a weight loss of 96 g

$$\therefore \text{ \% loss} = \frac{96}{245} \times 100 = 39.18\%$$

Therefore, option (3) is the correct answer.

6. Number of molecules in 1 litre of oxygen at NTP is:

(1) $\frac{6.02 \times 10^{23}}{22.4}$ (2) $\frac{6.02 \times 10^{23}}{32}$

(3) 32×22.4 (4) $\frac{32}{22.4}$

Sol. At NTP, 1 mole of oxygen occupies a volume of 22.4 L.

Hence, 1 L of oxygen at NTP = $\frac{1}{22.4}$ mol.

The number of oxygen molecules = $\frac{1}{22.4} \times 6.02 \times 10^{23}$

$$= \frac{6.02 \times 10^{23}}{22.4}$$

Therefore, option (1) is the correct option.

7. 12 g Mg react with dilute mineral acid to produce maximum hydrogen equal to:

(1) 0.5 mol (2) 1.5 mol

(3) 1.5 g (4) 0.5 g

Sol. $Mg + 2HCl \rightarrow MgCl_2 + H_2$

Moles of Mg = Moles of H_2

$$\text{Moles of Mg} = \frac{12}{24} = 0.5 \text{ mol}$$

So, Moles of $H_2 = 0.5$ mol

Therefore, option (1) is the correct option.

8. In water, the ratio of hydrogen to oxygen by mass is given as 1:8. The mass of oxygen required for 5 g of hydrogen is?

(1) 10 g (2) 20 g

(3) 40 g (4) 5 g

Sol. The ratio of H:O by mass = 1 : 8

Now, equating the actual masses with the ratio,

$$\frac{1}{8} = \frac{5}{y}$$

Here, y is the unknown mass of oxygen

$1 \times y = 8 \times 5 \Rightarrow y = 40$ g

40 g of oxygen is required for 5 g of hydrogen.

Therefore, option (3) is the correct option.

Prarambh Exercise-1 (Topicwise)

CLASSIFICATION OF MATTER AND UNCERTAINITY IN MEASUREMENT

1. Which of the following is **not** related to Dalton's atomic theory?
(1) Compounds are formed when atoms of different elements combine in fixed ratio.
(2) Matter consists of indivisible atoms.
(3) Matter can be classified into elements and compounds.
(4) All the atoms of a given element have identical chemical properties.

2. Identify the **incorrect** statement among the following.
(1) Constituents of compound can be separated by physical methods.
(2) Elements combine in a fixed proportion by mass in a compound.
(3) Compounds can be decomposed by chemical methods.
(4) Properties of a compound are different from those of its constituent elements.

3. The number, 0.00002795 can be **correctly** expressed in scientific notation as:
(1) 279.5×10^{-6} (2) 279.5×10^{-3}
(3) 2.795×10^{-5} (4) 2.795×10^{-4}

4. Counting numbers of objects, for example 6 pens and 15 eggs have:
(1) one and two significant figures respectively.
(2) one significant figures in both.
(3) infinite significant figures in both.
(4) two significant figures in both.

5. Round off value of 0.3648 upto one digit after decimal gives:
(1) 0.2 (2) 3.7×10^{-1}
(3) 0.4 (4) 3.7

6. Which of the following are **correct** statements?
I. Accuracy is closeness of various measurements for the same quantity.
II. Accuracy is the agreement of particular value to the true value of the result.
III. Precision refers to closeness of various measurements for the same quantity.
(1) I and II only (2) II and III only
(3) I and III only (4) I, II and III

LAW OF CHEMICAL COMBINATIONS

7. The percentage of copper and oxygen in samples of CuO obtained by different methods were found to be same. This proves the law of:
(1) constant proportion. (2) conservation of mass.
(3) multiple proportion. (4) None of these

8. The law of multiple proportions is illustrated by the two compounds:
(1) NaCl and NaBr (2) H_2O and D_2O
(3) KOH and CsOH (4) SO_2 and SO_3

9. Hydrogen and oxygen combine to form H_2O_2 and H_2O containing 5.93% and 11.2% hydrogen respectively, the data illustrates:
(1) law of conservation of mass.
(2) law of constant proportion.
(3) law of reciprocal proportion.
(4) law of multiple proportion.

10. If law of conservation of mass was to hold true, then 20.8 g of $BaCl_2$ on reaction with 9.8 g of H_2SO_4 will produce 7.3 g of HCl and $BaSO_4$ equal to:
(1) 11.65 g (2) 23.3 g
(3) 25.5 g (4) 30.6 g

ATOMIC AND MOLAR MASSES

11. Boron has two isotopes B^{10} and B^{11} whose relative abundances are 20% and 80% respectively. Atomic weight of Boron is:
(1) 10 g (2) 11 g
(3) 10.5 g (4) 10.8 g

12. Insulin contains 3.4% sulphur by mass. What will be the minimum molar mass of insulin?
(1) 94.117 u (2) 1884 u
(3) 941 u (4) 976 u

13. A 100 g sample of haemoglobin on analysis was found to contain 0.34% Fe by mass. If each haemoglobin molecule has four Fe^{2+} ions, the molar mass of haemoglobin is (Fe = 56 amu):
(1) 77099.9 g (2) 12735 g
(3) 65882 g (4) 96359.9 g

14. Copper has two naturally occurring isotopes ^{63}Cu and ^{65}Cu.If the average atomic mass of copper is 63.546 u, then natural abundance of lighter isotope of Cu will be:
(1) 46.4 % (2) 27.3 %
(3) 54.2 % (4) 72.7 %

MOLE CONCEPT

15. Which of the following has the highest mass?
(1) 20 g of sulphur.
(2) 4 mol of carbon dioxide.
(3) 12×10^{24} atoms of hydrogen.
(4) 11.2 L of helium at NTP.

16. Total number of atoms present in 64 g of SO_2 is:
(1) $2 \times 6.02 \times 10^{23}$ (2) 6.02×10^{23}
(3) $4 \times 6.02 \times 10^{23}$ (4) $3 \times 6.02 \times 10^{23}$

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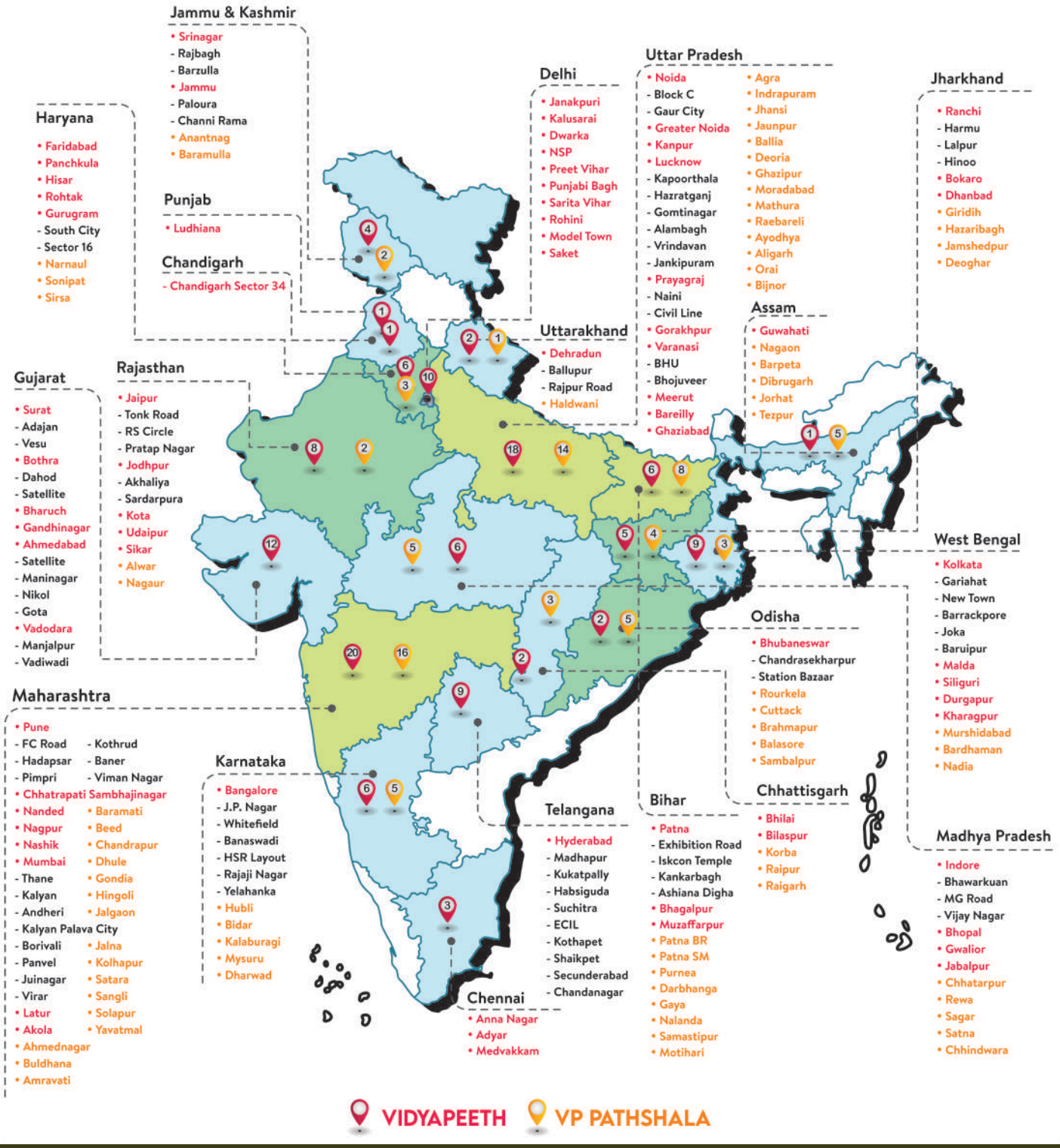

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