

# Teacher Energized Resource Manual

**Class : 9<sup>th</sup>**  
**Subject : Science**



CENTRAL BOARD OF SECONDARY EDUCATION

# Preface

In consonance with the move towards outcome-based education where focus is on developing competencies in students, the Central Board of Secondary Education is delighted to share the *Teacher Energized Resource Manual* that will aid teachers in aligning their classroom transaction to a competency framework.

Each chapter of the Resource Manual corresponds to the respective chapters in the NCERT textbooks. The chapters have been chunked by concept; these concepts have been linked to the NCERT Learning Outcomes; and an attempt has been made to delineate Learning Objectives for each concept. Every chapter has a set of assessment items, where two items have been provided as examples for each Learning Objective. Teachers can use these to assess if the learner has acquired the related concept. Needless to say, the items are illustrative examples to demonstrate how competency-based items can be prepared to measure Learning Objectives and Outcomes. The variety in item forms is suggestive of the ways in which a particular concept can be assessed to identify if the learner has attained different competencies. We trust and hope that teachers would be able to generate many more similar test items for use in practice.

Your observations, insights and comments as you use this Resource Manual are welcome. Please encourage your students to voice their suggestions as well. These inputs would be helpful to improve this Manual as these are incorporated in the subsequent editions. All possible efforts have been made to remove technical errors and present the Manual in a form that the teachers would find it easy and comfortable to use.

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## HOW TO USE THIS MANUAL

The goal of the Teacher Energized Resource Manual (TERM) is to provide teachers with competency-based education resources aligned to NCERT textbooks that would support them in the attainment of desired Learning Outcomes and development of requisite competencies of the learner. The TERM has equal number of corresponding chapters as NCERT Textbooks with listing of concepts, Learning Outcomes developed by NCERT and Learning Objectives. Competency based test items for each corresponding Learning Objective and sample activities for enrichment have been provided.

### **Learning Objectives:**

Each chapter begins has a *Learning Objectives* table. The table lists the concept covered in the chapter. Learning Objectives are broken down competencies that a learner would have acquired by the end of the chapter. They are a combination of skills and what the learner would use this skill for. For example, the first Learning Objective in the table below relates to the skill of *analysis* and the students will use this competency to identify ingredients in different food items. Teachers can use these specific Learning Objectives to identify if a student has acquired the associated skills and understands how that skill can be used.

Content area/ Concepts	Learning Objectives
Food variety	Analyse common food items in order to identify various ingredients for their preparation
Food material and sources	Identify the sources of ingredients used to prepare food items

### **Content Area/ Concepts:**

The important concepts and sub-concepts covered in a particular chapter are listed in the first section. Most often, they follow a logical order and present a sequence in which these are likely to be covered while teaching. In case, your teaching strategy is different and presents them in a different order, you need not worry. Teach the way, you consider the best. You only need to ensure their understanding and the attainment of desired Learning Objectives.

**Learning Outcomes (NCERT):**

NCERT Learning Outcomes are in each chapter along with delineated Learning Objectives. As shown below, each Learning Objective is mapped to NCERT Learning Outcomes and helps teachers to easily identify the larger outcome that a child must be able to demonstrate at the end of the class/chapter.

As the NCERT LOs are generic, they may relate to many content areas / concepts together. However in the mapped table, they have been reproduced ad verbatim for easy identification.

Learning Objectives	Learning Outcomes
Compare the advantages of three major tools used for tilling and ploughing to justify the variety of agricultural practices	Differentiates materials and organisms, such as, natural and human made fibres; contact and non-contact forces; liquids as electrical conductors and insulators; plant and animal cells; viviparous and oviparous animals, on the basis of their properties, structure and functions.
Analyse the quality of seeds with respect to their germinability	
Compare the advantages of two major tools used for sowing to justify the variety of agricultural practices used in the country	
Distinguish between manure and fertilisers to identify ways in which nutrients in soil is replenished	
Evaluate how weeds adversely affects the growth of the plants in order to justify their removal and control	

**Test items:**

For each Learning Objective, at least two competency-based test items have been provided. Although, the items in this resource manual are multiple choice questions, which assess developed competencies of a child rather than only knowledge, it must be kept in mind that there can be different kinds of test items that can easily align with competency-based education. Teachers can use these items to assess if a child has achieved a particular learning objective and can take necessary supportive actions. Teachers are also encouraged to form similar questions which assess skills of students.

**LOB:** Recall details/definitions specific to autotrophic mode of nutrition in plants/photosynthesis/detection of photosynthetic activity of plants/nutrients other than carbohydrates, in plants

- 1) Which option correctly lists the nutrients other than carbohydrates, in plants?
- (a) Water, fibres, minerals
  - (b) Fat, proteins, vitamins
  - (c) Fibres, vitamins, water
  - (d) Flavouring agents, water, vitamins

**Correct Answer:**(b)

### **Suggested Teacher Resources**

At the end of each chapter, certain activities have been suggested which can be carried out by the teachers with learners to explain a concept. These are only samples and teachers can use, adapt, as well as, create activities that align to a given concept.

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# 1. Matter in Our Surroundings

**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Physical nature of matter	Classify matter into solids, liquids and gases based on characteristic properties of the particles in them.
Characteristics of particles of Matter	Demonstrate that matter is made up of tiny particles.
	Infer that intermolecular space between particles of solids makes diffusion possible between matter.
	Conclude that particles of matter continuously move during interaction between various forms and change in temperature changes the kinetic energy of particles.
States of matter	Conclude that particles of matter attract each other and depict the molecular arrangement of particles in the three states of matter, i.e., solids, liquids and gases.
	Describe the physical properties of solids and illustrate their molecular arrangements.
	Identify the distinguishing characteristics of liquids.
	Identify the characteristic features of gases and compare the three states of matter.
Diffusion	Provide scientific explanation for diffusion in examples of gases and liquids witnessed in real life.
Change of State of Matter	Explain the effect of change in temperature on states of matter.
	Relate the effect of pressure on different states of matter and its applications.
	Identify the various processes during change of substances from one physical state to another and classify substances on this basis.
Latent Heat	Postulate the reason for constancy of temperature during the change in states of matter.
Evaporation	Explain situations that demonstrate factors affecting evaporation.
	Provide explanation for life situations that demonstrate effects of evaporation.

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Describe the physical properties of solids and illustrate their molecular arrangements.	Differentiates materials / objects / organisms / phenomena / processes, based on such as prokaryote and eukaryote, plant cell and animal cell, diffusion and osmosis, simple and complex tissues, distance and displacement, speed and velocity, balanced and unbalanced forces, element, compound and mixture, solution, suspension and colloid, isobars and isotopes, etc.
Identify the distinguishing characteristics of liquids.	
Classify matter into solids, liquids and gases based on characteristic properties of the particles in them.	Classifies materials / objects / organisms / phenomena / processes, based on, properties / characteristics, such as classification of plants, animals under various hierarchical sub-groups, natural resources, classification of matter based on their states (solid / liquid / gas) and composition (element / compound / mixture), etc.
Identify the various processes during change of substances from one physical state to another and classify substances on this basis.	
Demonstrate that matter is made up of tiny particles.	Plans and conducts investigations / experiments to arrive at and verify the facts / principles / phenomena or to seek answers to queries on their own, such as how does speed of an object change? How objects float / sink when placed on surface of liquid? Is there any change in mass when chemical reaction takes place? What is the effect of heat on state of substances? What is the effect of compression on different states of matter? Where are stomata present in different types of leaves? Where are growing tissues present in plants?
Conclude that particles of matter continuously move during interaction between various forms and change in temperature changes the kinetic energy of particles.	
Identify the characteristic features of gases and compare the three states of matter.	
Describe the effect of change in temperature on the state of matter to explain why ice melts when heated	
Make inferences about the effect of temperature on the states of matter.	
Postulate the reason for constancy of temperature during the change in states of matter.	
Provide explanation for life situations that demonstrate effects of evaporation.	

Infer that intermolecular space between particles of solids makes diffusion possible between matter.	Relates processes and phenomena with causes / effects, such as symptoms with diseases / causal agents, tissues with their functions, production with use of fertilizers, process of evaporation with cooling effect, various processes of separation with the physical and chemical properties of the substances, production of sound with vibrations of source, etc.
Provide scientific explanation for diffusion in examples of gases and liquids witnessed in real life.	Explains processes and phenomena, such as function of different organelles, spread of diseases and their prevention, effect of force on the state of motion of objects, action and reaction, revolution of planets and satellites, conservation laws, principle of separation of different gases from air, melting / boiling / freezing, how bats use ultrasound to catch prey, etc.
Explain situations that demonstrate factors affecting evaporation.	
Explain the effect of change in temperature on states of matter.	Calculates using the data given, such as distance, velocity, speed, frequency, work done, number of moles in a given mass of substance, concentration of solution in terms of mass by mass percentage of substances, conversion of Celsius scale to kelvin scale and vice versa, number of neutrons in an atom from atomic number and mass number, speed of sound, kinetic and potential energies of an object, boiling points of liquids to predict the order of their separation from the mixture, etc.
Relate the effect of pressure on different states of matter and its applications.	
Conclude that particles of matter attract each other and depict the molecular arrangement of particles in the three states of matter, i.e., solids, liquids and gases.	Draws labelled diagrams / flow charts / concept map / graphs, such as biogeochemical cycles, cell organelles and tissues, human ear, distance-time and speed-time graphs, distribution of electrons in different orbits, process of distillation / sublimation, etc.
Hypothesize why the temperature remains same during the change in state	Measures physical quantities using appropriate apparatus / instruments / devices, such as weight and mass of an object using spring balance, mass using a physical balance, time period of a simple pendulum, volume of liquid using measuring cylinder, temperature using thermometer, etc.

# Test items



**LOB : Classify matter into solids, liquids and gases based on characteristic properties of the particles in them**

1) A student notices that a substance "X" has fixed volume and can be transferred from one container to another. Which option correctly classifies the substance "X"?

(a)

Solid	Liquid	Gas
	X	X

(b)

Solid	Liquid	Gas
X	X	

(c)

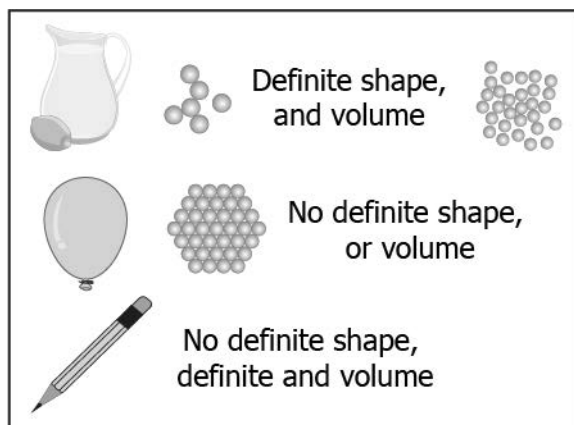
Solid	Liquid	Gas
X		

(d)

Solid	Liquid	Gas
	X	

**Correct Answer:** Option (d)

2) The image given below shows data about the different types of matter.



Which option correctly classifies the data?




(a)

Solid	Liquid	Gas
Definite shape, and volume	No definite shape, definite volume	No definite shape, or volume




(b)

Solid	Liquid	Gas
Definite shape, and volume	No definite shape, definite volume	No definite shape, or volume

(c)

Solid	Liquid	Gas
Definite shape, and volume	No definite shape, definite volume	No definite shape, or volume
		

(d)

Solid	Liquid	Gas
No definite shape, or volume	No definite shape, definite volume	Definite shape, and volume
		

**Correct Answer:** Option (b)**LOB : Demonstrate that matter is made up of tiny particles.**

1) A student adds 5 g sugar in 100 mL water. The student stirs the contents for 2 minutes. After some time, the student notices a clear solution. Why the student was unable to see sugar particles?

- (a) they are colorless
- (b) they settle at the bottom
- (c) they are too small to be seen
- (d) they evaporate when added to water

**Correct Answer:** Option (c)

2) A student pours 20 mL flavored water in a glass containing plain water and notices that the taste of the water changes. The students repeat the activity for 10 times and reports that the water still has some flavor. What can be the possible reason for this?

- (a) The flavor from the water can never be removed by any method.

(b) The water is made flavored in such a way that it remains the same until it is consumed.

(c) Sieves were not used in the experiment which would have helped to remove flavored particles from the water.

(d) The particles of flavored water are very small and are transferred to plain water even when added in very small quantities.

**Correct Answer:** Option (d)

**LOB : Infer that intermolecular space between particles of solids makes diffusion possible between matter.**

1) A student adds ink to water. The ink particles spread throughout the water. Which property of water allows other particles to diffuse in it?

(a) fixed volume

(b) inability to compress

(c) intermolecular spaces

(d) ability to change shape

**Correct Answer:** Option (c)

2) A student put an equal amount of potassium permanganate powder over a glass plate and in a beaker filled with water. The student rubbed the surface of the plate and stir the contents of the beaker. It was observed that the permanganate powder dissolved in the water and formed a colored solution. Which option explains the reason for the student's observation?

(a) Water is a liquid and can dissolve and solid particles in it

(b) The ability of water to exist in any state allows it to dissolve any substance

(c) Water has large intermolecular spaces which allow molecules of other substances to get between those spaces

(d) Water particles are tightly arranged in an orderly fashion which allows the binding of the molecules of other substances

**Correct Answer:** Option (c)

**LOB : Conclude that particles of matter continuously move during interaction between various forms and change in temperature changes the kinetic energy of particles.**

1) A student learns that the speed of the formation of a solution increases when the heat is supplied. How does heat affect the formation of the solution?

- (a) change in temperature increases the size of the water particles
- (b) change in temperature changes the shape of the water particles
- (c) change in temperature changes the kinetic energy of the particles
- (d) change in temperature decreases the intermolecular spaces between the particles

**Correct Answer:** Option (c)

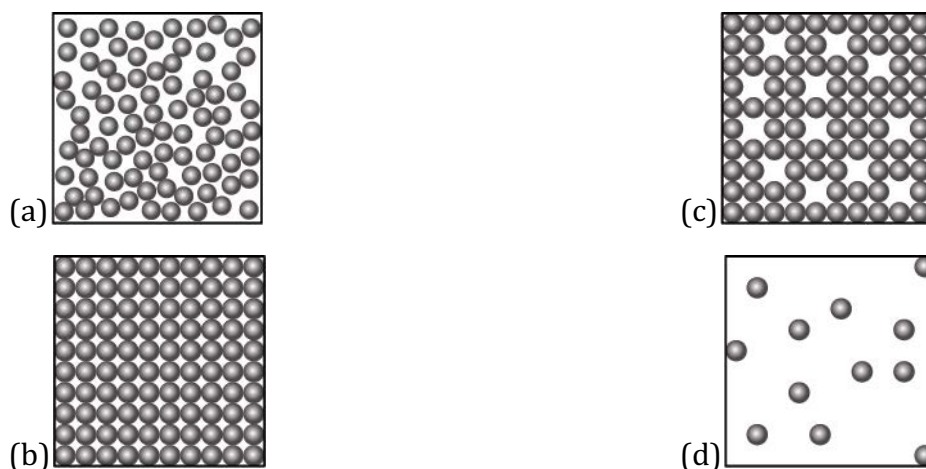
2) A student puts one drop of food colour in 100 mL of water. The student notices that the food colour gradually spreads in the water. What is the possible reason for this phenomenon?

- (a) a close arrangement of the water particles
- (b) the ability of the water particles to move continuously
- (c) the ability of the water to stay warm at room temperature
- (d) small intermolecular space between the water particles

**Correct Answer:** Option (d)

**LOB : Conclude that particles of matter attract each other and depict the molecular arrangement of particles in the three states of matter, i.e., solids, liquids and gases.**

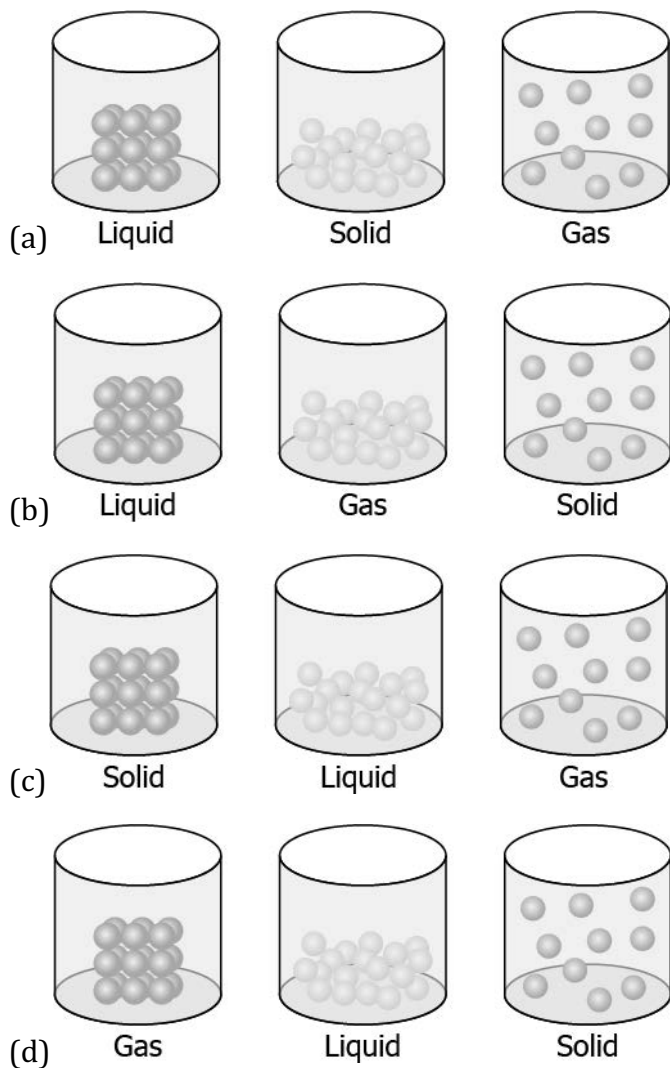
1) A student learns that the particles of brick are arranged in a manner so that they attract each other with greater force. Which diagram shows the arrangement of particles in a brick?



**Correct Answer:** Option (b)

2) A student has a glass of hot water which is covered with a plate. The student wants to transfer the hot water into another glass. The student notices that as he lifts the plate, some air flows upwards as he carefully pours water. The student makes particle diagrams of steam, water and gas. Which diagram correctly shows the particle arrangement?





**Correct Answer:** Option (c)

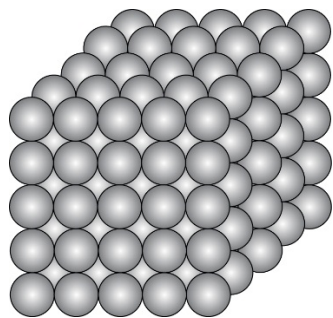
**LOB : Describe the physical properties of solids and illustrate their molecular arrangements.**

1) What is the property of a solid substance?

- (a) It retains its shape.
- (b) It changes its volume.
- (c) It retains its colour.
- (d) It changes its mass.

**Correct Answer:** Option (a)

2) A student made a model to show how particles of a substance X are arranged.



His friends observed the model and concluded that Substance X is a solid. What supports their conclusion?

- (a) The particles are closely packed that allows Substance X to change its volume.
- (b) The particles are fixed at their positions that allows Substance X to retain its shape.
- (c) The particles are bonded to each other that allows Substance X to maintain a fixed mass.
- (d) The particles are identical to each other that allows Substance X to have a uniform composition.

**Correct Answer:** Option (b)

**LOB : Identify the distinguishing characteristics of liquids**

1) A liquid substance retains its

- (a) volume but not its shape.
- (b) shape but not its volume.
- (c) volume but not its mass.
- (d) mass but not its volume.

**Correct Answer:** Option (a)

2) Mohit has a bowl filled with a Substance P. He notes some of his observations.

<b>Observations</b>
---------------------

- |   |
|---|
| <ol style="list-style-type: none"> <li>1. A pencil can run through the substance.</li> <li>2. It takes the shape of the bowl.</li> <li>3. Its volume remains 100 mL when put in different measuring cylinders.</li> <li>4. The mass of the substance remains 100 g when put in different containers.</li> </ol> |
|---|

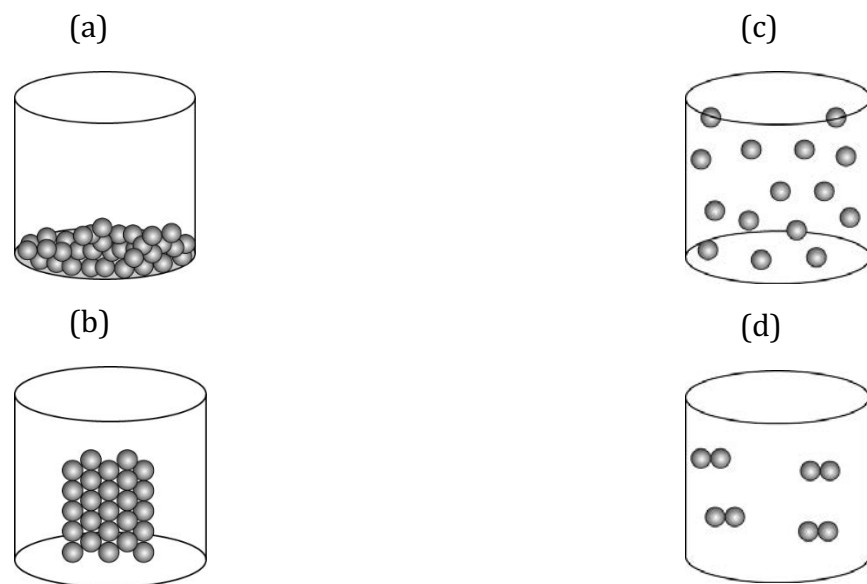
What can Substance P be classified as?

- (a) A gas because it has a volume.
- (b) A solid because it has a fixed mass.
- (c) A liquid because its shape changes.
- (d) A gas because objects can pass through it.

**Correct Answer:** Option (c)

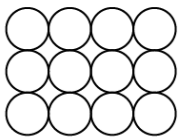
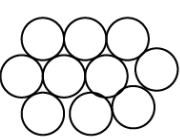
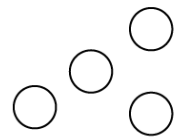
**LOB : Identify the characteristic features of gases and compare the three states of matter.**

1) A student wants to make a model to show how particles of a gas are arranged. He uses red marbles, where each marble represents one gas particle. Which model should the student make?



**Correct Answer:** Option (c)

2) The table shows three substances and their properties.

State	Substance A	Substance B	Substance C
Arrangement of Particles	Close together regular pattern	Close together random	Far apart Random
Movement of Particles	Vibrate on the Spot	Move around each other	Move quickly in all directions
Diagram			

Which substances are NOT in gaseous state?

- (a) Substance A only
- (b) Substance C only
- (c) Substance A and B
- (d) Substance B and C

**Correct Answer:** Option (c)

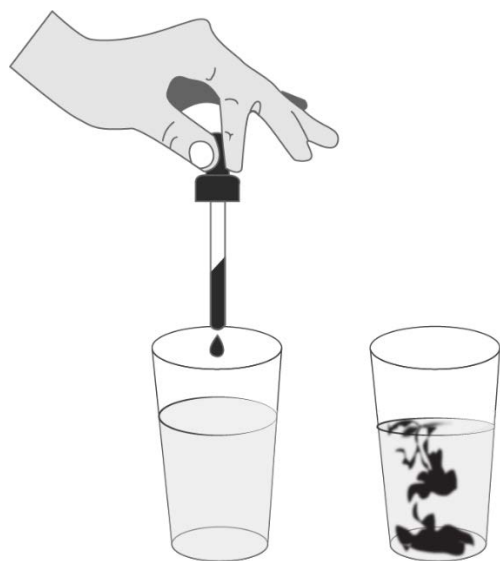
**LOB : Provide scientific explanation for diffusion in examples of gases and liquids witnessed in real life.**

1) Meenal lights an incense stick in her room. A moment later the fragrance of the stick spreads throughout the house. What explains the phenomenon?

- (a) Gas particles carry a specific odour.
- (b) Gas particles are found everywhere in air.
- (c) Gas particles move fast and spread everywhere.
- (d) Gas particles are closely spaced and vibrate fast.

**Correct Answer:** Option (c)

2) A student did an activity where he put a drop of ink in water. He noticed that as soon as the drop falls in water, the blue ink spreads throughout.



A drop of ink in water

Why does diffusion happen in liquids?

- (a) because liquids have a fixed volume
- (b) because liquids do not have a fixed shape
- (c) because the particles of liquids can move around
- (d) because the particles of liquids are closely spaced

**Correct Answer:** Option (c)

**LOB : Explain the effect of change in temperature on states of matter.**

1) Why does an ice cube melt when put out of the refrigerator?

- (a) because it loses heat and its particles move faster and farther causing melting
- (b) because it loses heat and its particles gain kinetic energy changing from solid to liquid
- (c) because it gains heat and its particles come closer since the force of attraction increases
- (d) because it gains heat and its particles start moving faster and overcome the force of attraction

**Correct Answer:** Option (d)

2) What happens when the temperature of ice is increased above 0°C?

- (a) The molecules gain kinetic energy and ice changes into water

- (b) The molecules lose kinetic energy and ice changes into water
- (c) The molecules gain kinetic energy and ice changes into vapour
- (d) The molecules lose kinetic energy and ice changes into vapour

**Correct Answer:** Option (a)

**LOB : Relate the effect of pressure on different states of matter and its applications.**

1) Cooking gas is known as LPG (Liquified Petroleum Gas). How can a gas be liquified?

- (a) when pressure is applied to the gas
- (b) when temperature of the gas is increased
- (c) when gas is mixed with a liquid substitute
- (d) when the force of attraction between particle is reduced

**Correct Answer:** Option (a)

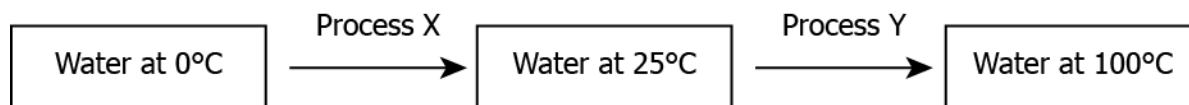
2) Gases are easily compressible by applying pressure. The same volume of gas can fill up a small can and can spread into a big room. What is the relationship between the property of gases and compressibility?

- (a) Gas particles have large spaces between them, so when pressure is applied, the particles compress.
- (b) Gas particles have strong intermolecular forces, so when pressure is applied, the particles liquify.
- (c) Gas particles have high kinetic energy, so when pressure is applied, the particles lose their energy.
- (d) Gas particles have more speed, so when pressure is applied, the particles move farther away and compress.

**Correct Answer:** Option (a)

**LOB : Identify the various processes during change of substances from one physical state to another and classify substances on this basis.**

1) The image shows two changes.

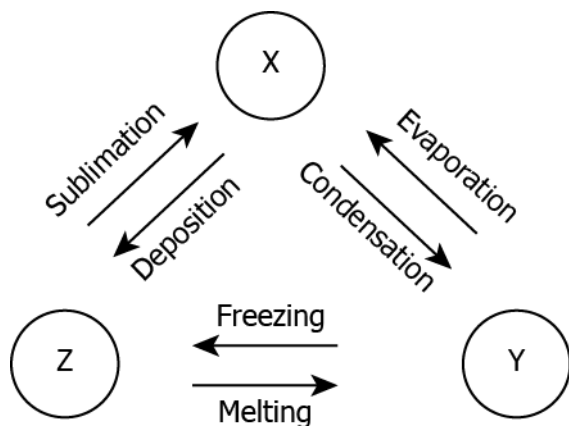


Identify Process X and Y.

- (a) Process X - freezing; Process Y - melting
- (b) Process X - melting; Process Y - evaporation
- (c) Process X - condensation; Process Y - melting
- (d) Process X - evaporation; Process Y - condensation

**Correct Answer:** Option (b)

2) The image shows three substances that can change from one physical state to another by different processes.



What are X, Y, and Z?

- (a) X - gas, Y - liquid, Z - solid
- (b) X - liquid, Y - solid, Z - gas
- (c) X - gas, Y - solid, Z - liquid
- (d) X - solid, Y - gas, Z - liquid

**Correct Answer:** Option (a)

**LOB : Postulate the reason for constancy of temperature during the change in states of matter.**

1) The melting point of ice is  $0^{\circ}\text{C}$ . At this temperature, both ice and water exist. However, the particles of water at  $0^{\circ}\text{C}$  have more energy than particles of ice at  $0^{\circ}\text{C}$ . What explains this?

- (a) at melting point, water particles absorb more heat and change into ice
- (b) at melting point, ice particles raise their temperature and change to water
- (c) at melting point, water particles raise their temperature and change into ice
- (d) at melting point, ice particles absorb latent heat and change into water particles

**Correct Answer:** Option (d)

2) When ice is given heat, it reaches a temperature of  $0^{\circ}\text{C}$  and starts melting. The more heat is gained, the more it changes to water. However, the temperature remains constant at  $0^{\circ}\text{C}$  until all ice changes to water. Why does the temperature remain constant?

- (a) because of the latent heat of fusion
- (b) because of the kinetic energy of ice particles
- (c) because of the latent heat of vaporization
- (d) because of the kinetic energy of water particles

**Correct Answer:** Option (a)

**LOB : Explain situations that demonstrate factors affecting evaporation.**

1) Clothes do not dry quickly when there is more humidity in air. What explains the phenomenon?

- (a) high humidity decreases the rate of evaporation
- (b) high humidity increases the rate of evaporation
- (c) high humidity decreases the rate of condensation
- (d) high humidity increases the rate of condensation

**Correct Answer:** Option (a)



2) A student has four containers of different shapes and sizes but made of steel.



Container 1



Container 2



Container 3



Container 4

He adds 200 mL water to each container and places them on equal heat. In which container the evaporation of water would be the fastest?

- (a) container 1
- (b) container 2
- (c) container 3
- (d) container 4

**Correct Answer:** Option (a)

**LOB : Provide explanation for life situations that demonstrate effects of evaporation.**

1) Kabir came back home after playing football. He felt hot and sweaty. He stood under the fan. He noticed he started feeling cool and dry. What explains his observation?

- (a) When sweat evaporates, warm air moves away from the body.
- (b) When sweat evaporates, it gains heat energy from the surroundings.
- (c) When sweat evaporates, it absorbs energy from the body making it cooler.
- (d) When sweat evaporates, cooler air from the surroundings reaches the body.

**Correct Answer:** Option (c)

2) During summers people sprinkle water on the rooftops because


- (a) water keeps heat away from the house.
- (b) when water evaporates, it absorbs the heat from the rooftops.
- (c) when water condenses on the rooftops, the house remains cool.
- (d) water absorbs cold from the surroundings and keeps the house cool.

**Correct Answer:** Option (b)

# Suggested Teacher Resources




## Activity

Activity	Describe the phenomenon of diffusion to understand the real situation of diffusion of gases and diffusion of liquids
Prerequisite	Combination of two or more substances is called a mixture
Material Required	Tea bags, hot water, cold water, 2 transparent glasses
Vocabulary	Diffusion: the movement of a substance from an area of high concentration to an area of low concentration.
Procedure	<ol style="list-style-type: none"> <li>1. Take one glass of cold water and one glass of hot water.</li> <li>2. Put 1 tea bag into a glass of cold water and 1 tea bag into a glass of boiling water. Write down your observation.</li> </ol>  <p>Note: Different type of tea could have different colour</p>
Let's think	<ol style="list-style-type: none"> <li>1. What do you observe?</li> <li>2. In which glass does tea dissolve faster?</li> <li>3. What can you conclude from the above observation?</li> </ol>
Text to real world connection	<ol style="list-style-type: none"> <li>1. Water diffuses into plants through their root hair cells. The water moves from an area of high concentration (in the soil) to an area of lower concentration (in the root hair cell).</li> <li>2. In living things, substances move in and out of cells by diffusion. For example: Carbon dioxide in the respiration process.</li> </ol>

Beyond the classroom	Why can we smell hot food from a distance?
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## 2

**Activity**

Material required	3 glasses,1 marker
Procedure	<ol style="list-style-type: none"> <li>1. Take 3 glasses and fill them with an equal amount of water.</li> <li>2. Mark the level of water for each glass.</li> <li>3. Label the glasses as A,B and C.</li> <li>4. Keep glass A under the fan, glass B at room temperature, and glass C in sunlight for 10-15 min.</li> <li>5. Mark the level of water again for each glass.</li> </ol> 
Reflection question	<ol style="list-style-type: none"> <li>1. In which glass was the level of water decreased the most? What do you think the reason is behind it?</li> <li>2. What are the factors responsible for evaporation?</li> <li>3. Can you give some examples of evaporation from you day today life?</li> </ol>

## 2. Is Matter around Us Pure?

**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Types of mixtures	Identify mixtures from your surroundings based on their characteristic properties.
	Differentiate between homogeneous and heterogeneous mixtures.
Different types of mixtures formed using liquids	Classify homogenous and heterogenous mixtures into solutions, suspensions and colloids.
	Determine the effect of concentration of solution on its physical properties.
Methods for separating mixtures of solids and solids	Classify substances into elements and compounds.
	Identify the processes to separate various mixtures.
	Become conversant with the basis for separation and suggest procedures to separate mixtures of solids in real life situations.
Methods for separating mixtures of solid and liquids	Identify different processes to separate mixtures and apply them to separate various mixtures.
	Suggest procedures to separate mixtures of solids and liquids.
	State the underlying principle behind centrifugation process and locate its use.
	Identify situations where basic principle of evaporation is used to separate solids from liquids.
	Explain the process of crystallization.
	Deduce the process of chromatography and identify mixtures that can be separated by the use of this procedure.
	Recognize the basis of distillation and identify mixtures that can be separated through this.
	Identify suitable processes of separation to separate mixtures in real life situations.

	Explain the principle of chromatography and identify mixtures that can be separated through this process.
Methods for separating mixtures of liquids	Elaborate the technique of fractional distillation to separate homogeneous (or miscible) liquids.
	Differentiate between distillation and fractional distillation procedures.
	Explain the basis for use of separating funnel to separate miscible liquids.
Methods for separating mixtures of gases	Describe the process of using fractional distillation to explain its use in separating gases from the air.
Properties of elements and compounds	Classify different substances based on their physical properties as metals, non-metals and metalloids.
	Differentiate between elements and compounds to classify different materials based on their physical and chemical properties.

### **Learning Objectives and Learning Outcomes:**

<b>Learning Objectives</b>	<b>Learning Outcomes</b>
Differentiate between homogeneous and heterogeneous mixtures to classify types of mixtures based on their properties	Differentiates materials / objects / organisms / phenomena / processes, based on such as prokaryote and eukaryote, plant cell and animal cell, diffusion and osmosis, simple and complex tissues, distance and displacement, speed and velocity, balanced and unbalanced forces, element, compound and mixture, solution, suspension and colloid, isobars and isotopes, etc.
Classify homogenous and heterogenous mixtures into solutions, suspensions and colloids.	
Classify substances into elements and compounds.	
Differentiate between distillation and fractional distillation procedures.	
Differentiate between elements and compounds to classify different materials based on their physical and chemical properties.	

Differentiate between homogeneous and heterogeneous mixtures.	Classifies materials / objects / organisms / phenomena / processes, based on, properties / characteristics, such as classification of plants, animals under various hierarchical sub-groups, natural resources, classification of matter based on their states (solid / liquid / gas) and composition (element / compound / mixture), etc.
Classify different substances based on their physical properties as metals, non-metals and metalloids.	
Determine the effect of concentration of solution on its physical properties.	Plans and conducts investigations / experiments to arrive at and verify the facts / principles / phenomena or to seek answers to queries on their own, such as how does speed of an object change? How objects float / sink when placed on surface of liquid? Is there any change in mass when chemical reaction takes place? What is the effect of heat on state of substances? What is the effect of compression on different states of matter? Where are stomata present in different types of leaves? Where are growing tissues present in plants?
Identify different processes to separate mixtures and apply them to separate various mixtures.	Relates processes and phenomena with causes / effects, such as symptoms with diseases / causal agents, tissues with their functions, production with use of fertilizers, process of evaporation with cooling effect, various processes of separation with the physical and chemical properties of the substances, production of sound with vibrations of source, etc.
Examine the process of crystallization to separate (explain how) mixtures of solid and liquid	
Identify mixtures from your surroundings based on their characteristic properties.	Explains processes and phenomena, such as function of different organelles, spread of diseases and their prevention, effect of force on the state of

Identify the processes to separate various mixtures	motion of objects, action and reaction, revolution of planets and satellites, conservation laws, principle of separation of different gases from air, melting / boiling / freezing, how bats use ultrasound to catch prey, etc.
State the underlying principle behind centrifugation process and locate its use.	
Deduce the process of chromatography and identify mixtures that can be separated by the use of this procedure.	
Explain the principle of chromatography and identify mixtures that can be separated through this process.	
Elaborate the technique of fractional distillation to separate homogeneous (or miscible) liquids.	
Explain the basis for use of separating funnel to separate miscible liquids.	
Describe the process of using fractional distillation to explain its use in separating gases from the air.	
Deduce/ determine the concentration of solution to predict the colour of the solution formed by colouring substance and the solvent	Calculates using the data given, such as distance, velocity, speed, frequency, work done, number of moles in a given mass of substance, concentration of solution in terms of mass by mass percentage of substances, conversion of Celsius scale to kelvin scale and vice versa, number of neutrons in an atom from atomic number and mass number, speed of sound, kinetic and potential energies of an object, boiling points of liquids to predict the order of their separation from the mixture, etc.
Recognize the basis of distillation and identify mixtures that can be separated through this.	Draws labelled diagrams / flow charts / concept map /graphs, such as biogeochemical cycles, cell organelles and tissues, human ear, distance-time and speed-time graphs, distribution of electrons in different orbits, process of distillation / sublimation, etc.
Elaborate the technique of fractional distillation to explain the process of separation of homogeneous (or miscible) liquid solution	

Explain the basis for use of separating funnel to separate miscible liquids.	
Describe the process of using fractional distillation to explain its use in separating gases from the air.	
Explain the process of crystallization	Analyses and interprets graphs / figures etc., such as distance-time and velocity-time graphs, computing distance / speed / acceleration of objects in motion, properties of components of a mixture to identify the appropriate method of separation, crop yield after application of fertilizers, etc.
Recognize the basis of distillation and identify mixtures that can be separated through this.	
Become conversant with the basis for separation and suggest procedures to separate mixtures of solids in real life situations.	
Suggest procedures to separate mixtures of solids and liquids.	Applies scientific concepts in daily life and solving problems, such as separation of mixtures, uses safety belts in automobiles, covers walls of large rooms with sound absorbent materials, follows intercropping and crop rotation, takes preventive measures to control disease causing agents, etc.
Identify situations where basic principle of evaporation is used to separate solids from liquids.	
Identify suitable processes of separation to separate mixtures in real life situations.	
Differentiate between elements and compounds to classify different materials based on their physical and chemical properties.	
Elaborate the technique of fractional distillation to separate homogeneous (or miscible) liquids.	Draws conclusion, such as classification of life forms is related to evolution, deficiency of nutrients affects physiological processes in plants, matter is made up of particles, elements combine chemically in a fixed ratio to form compounds, action and reaction act on two different bodies, etc.
	Designs models using eco-friendly resources, such as 3-d model of a cell, water purification system, stethoscope, etc.



# Test items



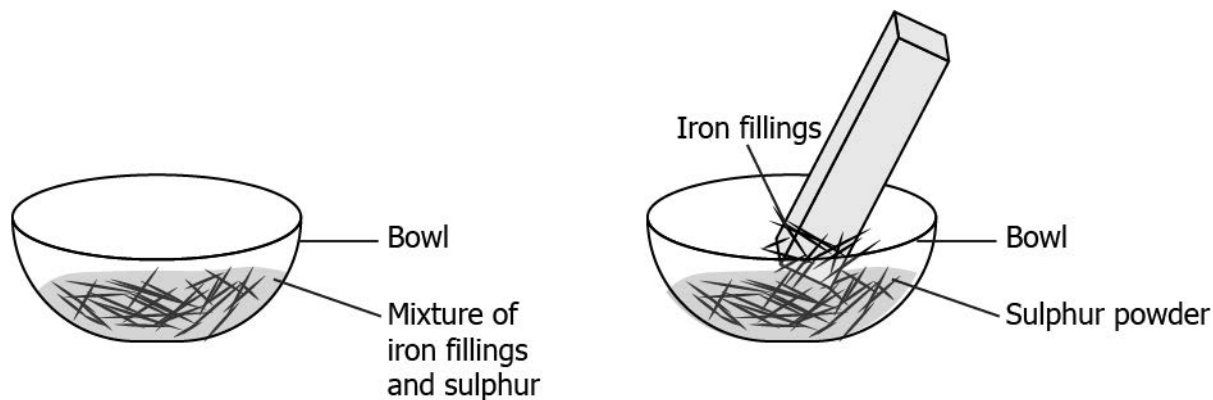
**LOB : Identify mixtures from your surroundings based on their characteristic properties.**

1) Which of the following can be classified as a mixture?

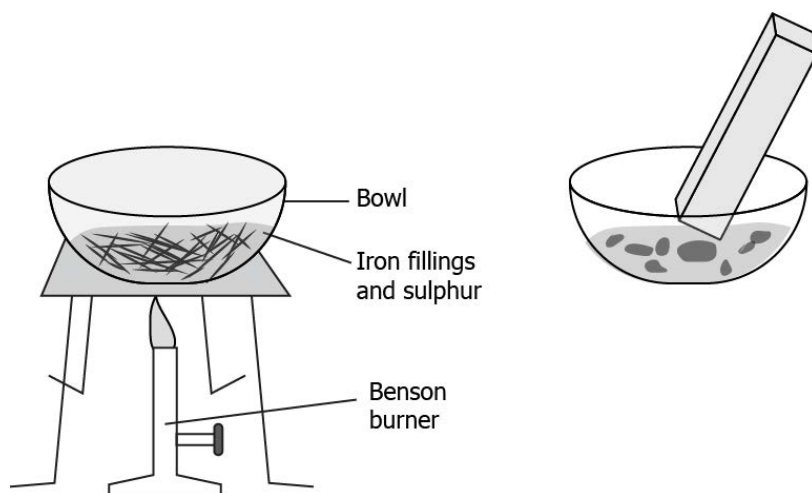
- (a) a clear white salt solution
- (b) a rusted iron nail
- (c) a piece of paper cut into different shapes
- (d) a bowl of water with floating ice cubes

**Correct Answer:** Option (a)

2) During an activity, a student added 10 g iron filings and 10 g sulphur powder in a bowl. He brought a magnet over the bowl and noticed that iron filings were picked up by the magnet.



He put sulphur and iron filings back into the bowl and put it on heat. After some time he brought the magnet over it again. This time, the iron filings were not attracted to the magnet.



Which can be inferred from the activity?

(a) The contents in the bowl before heating can be classified as a mixture because they appear different.

(b) The contents in the bowl before heating can be classified as a mixture because they could be separated.

(c) The contents in the bowl after heating can be classified as a mixture because they were not affected by the magnet.

(d) The contents in the bowl after heating can be classified as a mixture because their properties changed after heating.

**Correct Answer:** Option (b)

**LOB : Differentiate between homogeneous and heterogeneous mixtures.**

1) A student is asked to make a homogeneous mixture. He is provided with the following substances.

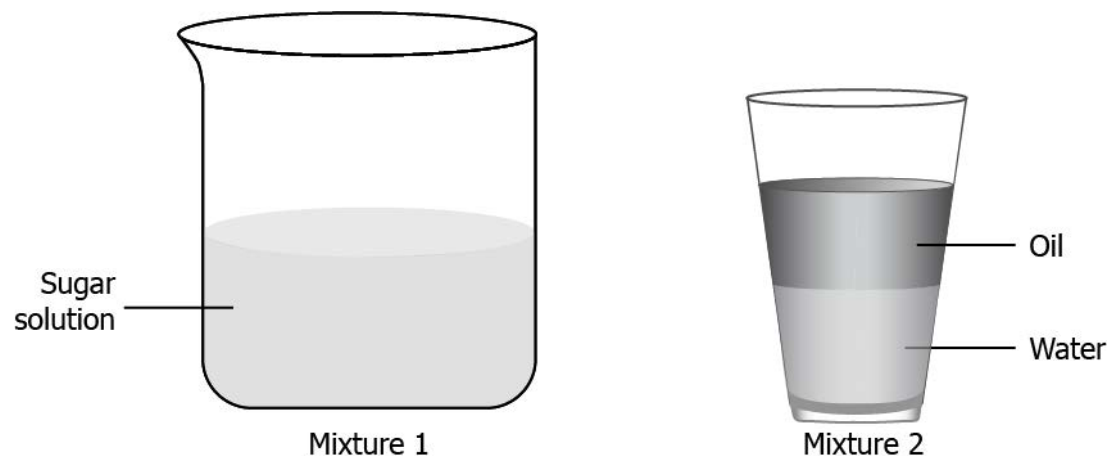
- A. Water
- B. Soil
- C. Milk
- D. Chocolate powder
- E. Salt

Which two substances should the student mix to form a homogeneous mixture?

- (a) A and B
- (b) C and D
- (c) B and E
- (d) A and E

**Correct Answer:** Option (d)

2) The image shows two solutions.



What differentiates a homogeneous mixture from a heterogeneous mixture?

- (a) Mixture 2 is homogeneous because the components of a homogeneous mixture always form separate layers.
- (b) Mixture 1 is homogeneous because the composition is uniform throughout the mixture.
- (c) Mixture 2 is heterogeneous because the components of a heterogeneous mixture are always liquid.
- (d) Mixture 1 is heterogeneous because the components of the mixture are not visible from the naked eye.

**Correct Answer:** Option (b)

**LOB : Classify homogenous and heterogenous mixtures into solutions, suspensions and colloids.**

1) A student listed some mixtures and classified them into various types.

Mixture	Components	Type of Mixture
W	Food colour + Water	Homogeneous solution
X	Sand + water	Colloidal solution
Y	Milk + sugar	Suspension
Z	Rice + Flour	Heterogeneous mixture

Which mixtures are classified correctly?

- (a) W and X
- (b) X and Y
- (c) Y and Z
- (d) W and Z

**Correct Answer:** Option (d)

2) A student crushed a piece of chalk and mixed the chalk powder in 100 mL water. The water appeared white and cloudy. After some time the particles settled at the bottom of the container. She claims that the mixture is a suspension. What justifies her claim?

- (a) The particles mix completely with water.
- (b) The particles of chalk form a separate layer.
- (c) The particles of chalk are visible through the naked eye.
- (d) The particles of chalk are uniformly distributed in water.

**Correct Answer:** Option (c)

**LOB : Determine the effect of concentration of solution on its physical properties.**

1) A student filled two glasses with 100 mL water in each. To glass 1, she added 5 mL orange food colour, and to glass 2 she added 10 mL orange food colour. Which water would appear darker of the two?

- (a) Glass 1 because it has less solute
- (b) Glass 2 because it has more solute
- (c) Glass 1 because it has more solvent
- (d) Glass 2 because it has more solvent

**Correct Answer:** Option (b)

2) A student made four solutions using different quantities of water and blue ink. The quantities are listed in the table.

Solution	Volume of Ink (mL)	Volume of Water (mL)
1	25	200
2	10	100
3	15	50
4	50	250

Which solution has the least concentration with the lightest blue colour?

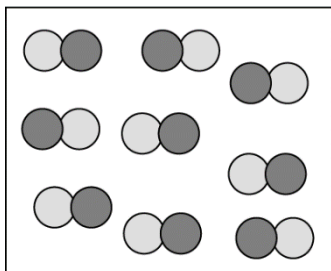
- (a) solution 1
- (b) solution 2
- (c) solution 3
- (d) solution 4

**Correct Answer:** Option (b)

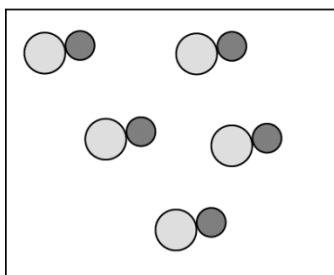
**LOB : Classify substances into elements and compounds.**

1) A student made models using gumballs. Which model would represent an element?

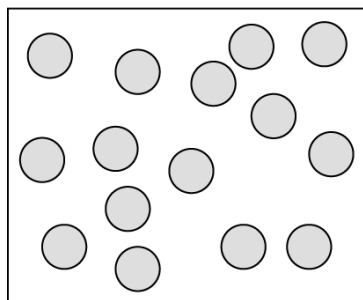
(a)



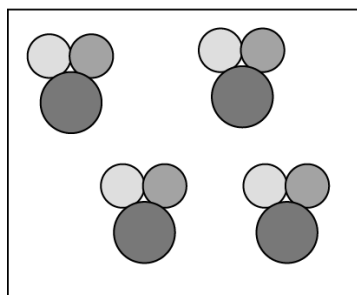
(b)



(c)



(d)



**Correct Answer:** Option (c)

2) The table lists properties of substance X.

1. It has a fixed composition throughout the substance.
2. Its properties are different from its constituents
3. It can be divided into smaller parts by chemical methods.
4. It is made of two different kinds of atoms.
5. It exists as a solid at room temperature.

What can substance X be classified as?

- (a) Element, because it has different properties.
- (b) Element, because it can be divided into smaller parts.
- (c) Compound, because it can change from one form to another.
- (d) Compound, because it is made of two kinds of atoms joined in definite proportion.

**Correct Answer:** Option (d)

**LOB : Identify the processes to separate various mixtures.**

1) A box contains iron nails in saw dust. Which method should be used to separate the two substances?

- (a) use a magnet
- (b) use a sieve with small holes
- (c) use the method of filtration
- (d) use hands to pick iron nails out

**Correct Answer:** Option (a)

2) Which separation technique can be used to separate salt from camphor?

- (a) sublimation
- (b) filtration
- (c) magnetic separation
- (d) centrifugation

**Correct Answer:** Option (a)

**LOB : Become conversant with the basis for separation and suggest procedures to separate mixtures of solids in real life situations.**

1) Mixture made of two solids can be separated by using various techniques. One of the techniques is adding a solvent, usually water, to the mixture. In which case do we add water to the mixture in order to separate the two solids?

- (a) when both solids in the mixture are soluble in water
- (b) when both solids in the mixture are insoluble in water
- (c) when only one of the components in the mixture is a liquid.
- (d) when only one of the solids in the mixture is soluble in water

**Correct Answer:** Option (d)

2) A student dropped iron filings in a bowl of sand. What should the student do to separate the two substances?

- (a) Add the mixture in water and then filter the iron filings out.
- (b) Mix the mixture with water and put it on heat to evaporate water.

(c) Pass the mixture through a funnel to separate smaller sand particles.

(d) Spread the mixture and bring a magnet over the contents to pick iron filings from the sand.

**Correct Answer:** Option (d)

**LOB : Identify different processes to separate mixtures and apply them to separate various mixtures.**

1) A student took a solution of salty water. He wants to separate the salt from the water. Which process would separate the salt from the water?

(a) filtration

(b) evaporation

(c) centrifugation

(d) chromatography

**Correct Answer:** Option (b)

2) Which mixture correctly aligns with their method of separation?

(a) oil and water ☑ filtration

(b) cream from milk ☑ distillation

(c) salt and water ☑ evaporation

(d) salt and sand ☑ centrifugation

**Correct Answer:** Option (c)

**LOB : Suggest procedures to separate mixtures of solids and liquids.**

1) A student studies that cream is obtained from milk. He also understands that cream is solid, and milk is liquid. Moreover, particles of cream are very small allowing them to pass through a filter paper. Which process should he adopt to separate the cream from the milk?

(a) filtration, as milk is liquid and hence it can easily be filtered out

(b) filtration, as the cream is solid and hence it can easily be filtered out

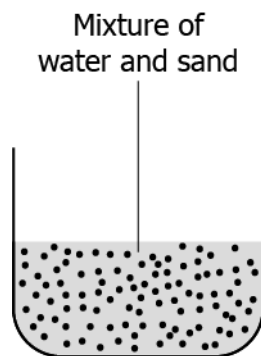
(c) centrifugation, as cream and milk have a difference in their chemical formula

(d) centrifugation, as particles of cream and milk have a difference in their density

**Correct Answer:** Option (d)

2) The image represents a mixture of sand and water.





Which process should one adopt to separate the two substances from each other?

- (a) filtration
- (b) centrifugation
- (c) crystallization
- (d) chromatography

**Correct Answer:** Option (a)

3) Which option explains the process of filtration?

- (a) it allows only liquid to pass from a mixture
- (b) it allows only solid particles to pass from a mixture
- (c) it allows the separation of substances based on colour
- (d) it allows the separation of substances based on density

**Correct Answer:** Option (a)

4) A student collected a mixture of sawdust and water to conduct an experiment. In order to separate the sawdust from the mixture, he poured the water through a funnel where a filter paper was already placed. He observed that the solid is collected in the funnel whereas the liquid is collected in the beaker below. What causes the separation of the mixture?

- (a) absorption of water into the filter paper
- (b) absorption of sawdust into the filter paper
- (c) allowing liquid to pass through the filter paper
- (d) allowing sawdust to pass through the filter paper

**Correct Answer:** Option (c)

**LOB : State the underlying principle behind centrifugation process and locate its use.**

1)The table lists a few properties of substances:

1. Density
2. Colour
3. Lustre

To apply the process of centrifugation in a mixture, which property of the substances should vary?

- (a)only colour
- (b)only density
- (c)both luster and colour
- (d)both colour and density

**Correct Answer:** Option (b)

2) A student studies that by using centrifugation process cream can be separated from milk. He also understands that cream is solid, whereas milk is a liquid. Both of these particles are very small which allows them to pass through a filter paper but vary in their densities. Why is the centrifugation process helpful in separating such mixture?

- (a) as the substances vary in colour
- (b)as the substances have a difference in density
- (c) as the substances are completely soluble in nature
- (d) as the substance have a difference in boiling temperature

**Correct Answer:** Option (b)

**LOB : Identify situations where basic principle of evaporation is used to separate solids from liquids.**

1) Aayush puts his wet clothes under the sun and observes that his clothes get warm and dries after some time. Which process helped him in this process?

- (a) evaporation as water changes from liquid to solid
- (b) evaporation as water changes from liquid to vapor
- (c) crystallization as water changes from liquid to solid

(d) crystallization as water changes from liquid to vapor

**Correct answer:** Option (b)

2) Hassan wants to separate sodium chloride dissolved in water. He uses evaporation for the separation. How does the process of evaporation help Hassan?

(a) Sodium chloride will change from solid to vapor and can be extracted.

(b) Sodium chloride will change from liquid to vapor and can be separated.

(c) Water will change from vapor to liquid and sodium chloride can be extracted.

(d) Water will change from liquid to vapor and sodium chloride can be extracted.

**Correct answer:** Option (d)

**LOB : Explain the process of crystallization**

1) Which option describes the process of crystallization?

(a) It involves the formation of crystals after solute evaporates.

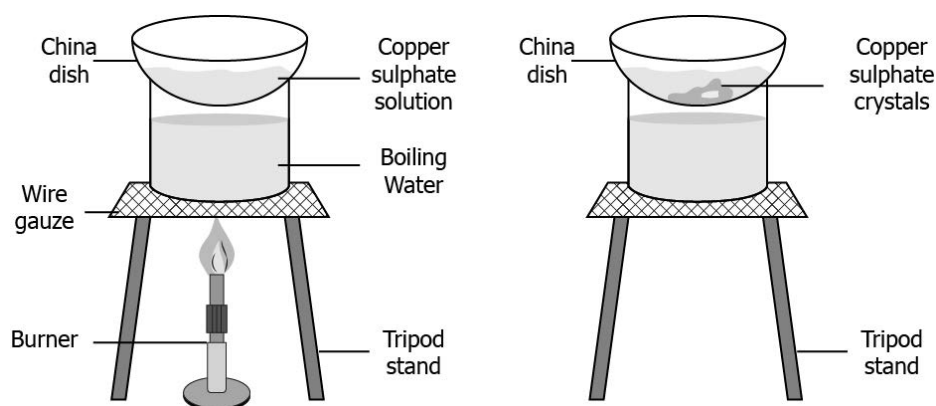
(b) It involves the formation of crystals after the solvent evaporates.

(c) It involves the decomposition of crystals after solute evaporates.

(d) It involves the decomposition of crystals after the solvent evaporates.

**Correct answer:** Option (b)

2) A student performs an experiment in which the copper sulphate solution was heated in a china dish.



She observes that solid copper sulphate deposits on the dish. Which experiment did she perform?

(a) filtration as it results in the formation of precipitate on heating

- (b) evaporation as heating evaporates the solute from the solution
- (c) crystallization as solid copper sulphate is left in the china dish
- (d) distillation as the colour of copper sulphate changed on heating

**Correct answer:** Option (c)

**LOB : Deduce the process of chromatography and identify mixtures that can be separated by the use of this procedure.**

1) Daisy wants to separate the coloured components of a dye as a part of a lab experiment. The dye contains water and coloured components. Which process should she perform?

- (a) Evaporation as water changes from liquid to vapor.
- (b) Crystallization as water changes from vapour to solid.
- (c) Distillation as it separates substance based on boiling point.
- (d) Chromatography as it separates the solutes that dissolve in the same solvent.

**Correct answer:** Option (d)

2) Himanshu wants to separate two photosynthetic pigments P and Q from the plant extract. He uses paper chromatography for the separation of these pigments and observes pigment P is separated first. What can be a likely reason for the same?

- (a) Pigment P has the low density.
- (b) Pigment Q has the high density.
- (c) Pigment P is more soluble in water and rises faster.
- (d) Pigment Q is more soluble in water and rises slower.

**Correct answer:** Option (c)

**LOB : Recognize the basis of distillation and identify mixtures that can be separated through this.**

1) Which method can be used to separate two liquids (different boiling point) from their mixture?

- (a) Distillation, as it separates liquid based on boiling point.
- (b) Evaporation, as it separates liquid based on melting point.
- (c) Chromatography as it separates components that have low melting point.
- (d) Centrifugation as it separates components that have higher boiling point.

**Correct answer:** Option (a)

2) A student wants to separate acetone and water from their mixture. The boiling temperature of acetone is higher than the boiling temperature of water. Which technique should she perform?

- (a) Distillation, as it separates liquids based on their boiling point.
- (b) Evaporation, as it separates liquids based on their boiling point.
- (c) Distillation, as it separates liquid based on their melting point.
- (d) Evaporation, as It separates liquids based on their melting point.

**Correct answer:** Option (a)

**LOB : Identify suitable processes of separation to separate mixtures in real life situations.**

1) A student has a mixture of sand, water, and salt. What is the order of separation techniques that he must perform to collect salt?

- (a) Filtration → Evaporation → Crystallisation
- (b) Filtration → Centrifugation → Crystallisation
- (c) Evaporation → Filtration → Chromatography
- (d) Chromatography → Centrifugation → Crystallisation

**Correct Answer:** Option (a)

2) A student performed an experiment to analyse the salt present in a sample. He passed the mixture through a sieve and collects the residue. The residue was kept on a porous funnel and the funnel was placed in a machine. The machine rotated the funnel and the liquid from the residue passed through the funnel while the solid salt was left on it. The solid was then kept under various instruments to check for the salt. Which two separation techniques did the student perform?

- (a) filtration followed by distillation
- (b) evaporation followed by filtration
- (c) centrifugation followed by filtration
- (d) filtration followed by centrifugation

**Correct Answer:** Option (d)

**LOB : Explain the principle of chromatography and identify mixtures that can be separated through this process.**

1) A student wants to separate the components of a dye. He studies that a specific technique is used to perform the experiment. Which option explains the technique that the student must perform?

(a) Evaporation as the denser components will evaporate leaving lighter components.

(b) Distillation as the different colours will separate when heated at specific temperatures.

(c) Filtration as the immiscible components will separate out easily when the solution is passed through a filter paper.

(d) Chromatography as the coloured component that is more soluble in water will rise faster and, in this way, the components will get separated.

**Correct Answer:** Option (d)

2) For which mixtures the technique of chromatography can be employed?

(a) It is used for the separation of those solutes that dissolve in the same solvent.

(b) It is used for the separation of those solutes that are solid at room temperature.

(c) It is used for the separation of the components of the mixture that have a similar density.

(d) It is used for the separation of the components of the mixture that have a high melting point.

**Correct Answer:** Option (a)

**LOB : Elaborate the technique of fractional distillation to separate homogeneous (or miscible) liquids.**

1) A researcher uses fractional distillation to separate the components of crude oil. Why she chose this method?

(a) crude oil has components that have very less difference in their mass

(b) crude oil has components that have very less difference in their density

(c) crude oil has components that have very less difference in their boiling points

(d) crude oil has components that have very less difference in their melting points

**Correct Answer:** Option (c)

2) How does a fractional column help in the separation of a miscible liquid solution in fractional distillation?

(a) It helps to separate the liquids that have a difference of less than 25K in their boiling points.

(b) It helps to separate the liquids that have a difference of less than 100K in their boiling points.

(c) It helps to separate the liquids that have a difference of more than 100K in their boiling points.

(d) It helps to separate the liquids that have a difference of more than 25K in their boiling points.

**Correct Answer:** Option (a)

**LOB : Differentiate between distillation and fractional distillation procedures.**

1) How distillation differs from fractional distillation, even though both are evaporation & condensation?

(a) a distillation setup has a heating source

(b) a fractional distillation setup has a water condenser

(c) a distillation setup does not have a fractional column

(d) a fractional distillation setup does not have a distillation flask

**Correct Answer:** Option (c)

2) A student wants to separate two liquids that differ in the boiling point. After learning the boiling point of the two liquids, he chose to perform fractional distillation. What differentiates the two techniques?

(a) fractional distillation is performed on samples that have a boiling point less than 100 K

(b) fractional distillation is performed on samples that have a boiling point higher than 100 K

(c) fractional distillation is performed on samples that have a difference of less than 25 K in boiling point

(d) fractional distillation is performed on samples that have a difference of more than 25 K in boiling point

**Correct Answer:** Option (c)

**LOB : Explain the basis for use of separating funnel to separate miscible liquids.**

1) The separating funnel is used to separate the components of the liquid solution. Which two components of the solution can be separated by the separating funnel?

- (a) oil and water
- (b) milk and water
- (c) sugar and water
- (d) color pigment and water

**Correct Answer:** Option (a)

2) A student uses a separating funnel to separate the mixture of liquid X and Y. How the layers of X and Y separates in the funnel?

- (a) the liquids separate based on their densities
- (b) the liquids separate based on their temperature
- (c) the liquids separate based on their boiling point
- (d) the liquids separate based on their melting point

**Correct Answer:** Option (a)

**LOB : Describe the process of using fractional distillation to explain its use in separating gases from the air.**

1) A student wants to separate gases from air. The student asked his teacher, the teacher suggested to use fractional distillation to separate gases from air. How the fractional distillation is suitable to separate gases from air?

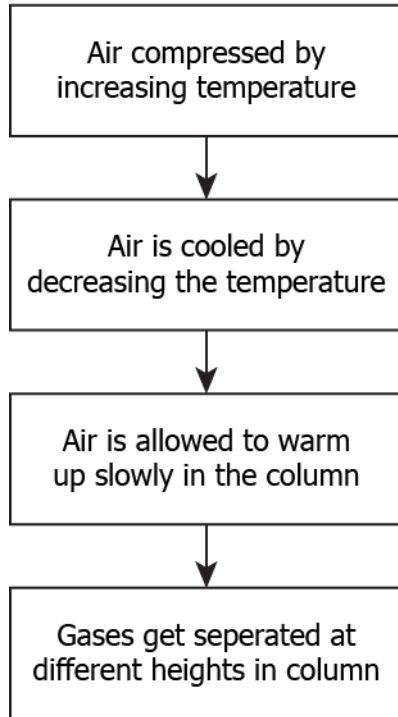
- (a) it arranges the gases in the column depending on their density
- (b) it arranges the gases in the column depending on their boiling point
- (c) it arranges the gases in the column depending on their freezing point
- (d) it arranges the gases in the column depending on their temperature

**Correct Answer:** Option (b)

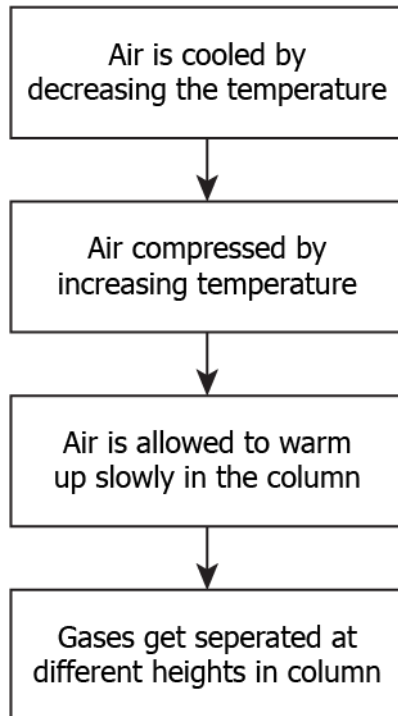
2) Which option explains the process of fractional distillation to separate the gases from air?

- (a)

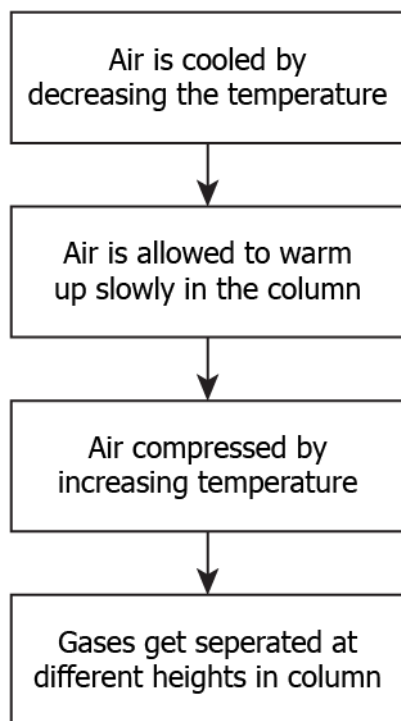




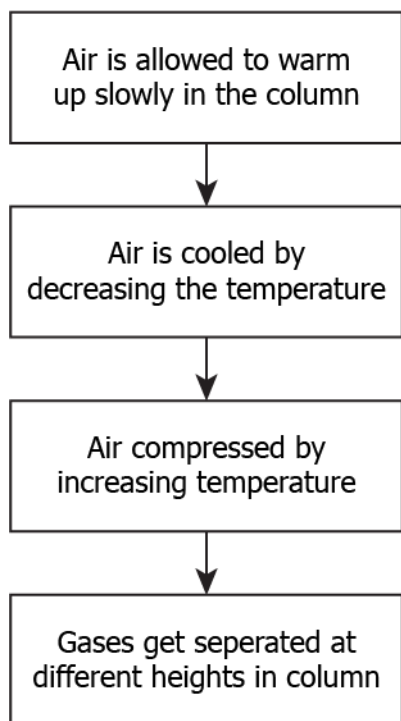
(b)



(c)



(d)



**Correct Answer:** Option (a)

**LOB : Classify different substances based on their physical properties as metals, non-metals and metalloids.**

1) A person has two objects X and Y. The student hit the objects X and Y. The object X makes the ringing sound, but Y does not make the ringing sound. What are X and Y?

- (a) X: iron; Y: coal
- (b) X: iron; Y: coke
- (c) X: coal; Y: coke
- (d) X: iron; Y: copper

**Correct Answer:** Option (a)

2) A student listed some items in a table as shown.

1. iron block
2. oxygen
3. chlorine
4. gold
5. silicon
6. germanium

Which option classifies the given items as metal, non-metal, and metalloids?

(a)

Metals	Non-Metals	Metalloids
iron block	chlorine	silicon
oxygen	gold	germanium

(b)

Metals	Non-Metals	Metalloids
iron block	oxygen	chlorine
silicon	gold	germanium

(c)

Metals	Non-Metals	Metalloids
iron block	oxygen	silicon
gold	chlorine	germanium

(d)

Metals	Non-Metals	Metalloids
iron block	silicon	oxygen
gold	germanium	chlorine

**Correct Answer:** Option (c)

**LOB : Differentiate between elements and compounds to classify different materials based on their physical and chemical properties.**

1) A student listed some items as shown.

- |   |
|---|
| <ol style="list-style-type: none"> <li>1. methane</li> <li>2. silicon</li> <li>3. acetic acid</li> <li>4. hydrogen</li> </ol> |
|---|

Which substances cannot be broken into simpler substances?

- (a) methane and silicon
- (b) silicon and hydrogen
- (c) acetic acid and hydrogen
- (d) methane and acetic acid

**Correct Answer:** Option (b)

2) The table shows the materials

- |   |
|---|
| <ol style="list-style-type: none"> <li>1. oxygen</li> <li>2. carbon</li> <li>3. salt</li> <li>4. water</li> </ol> |
|---|

Which option classify the given materials to differentiate between the elements and compounds?

(a)

Element	Compound
oxygen	water
salt	carbon

(b)

Element	Compound
oxygen	water
carbon	salt

(c)

**Correct Answer:** Option (b)

Element	Compound
water	carbon
salt	oxygen

(d)

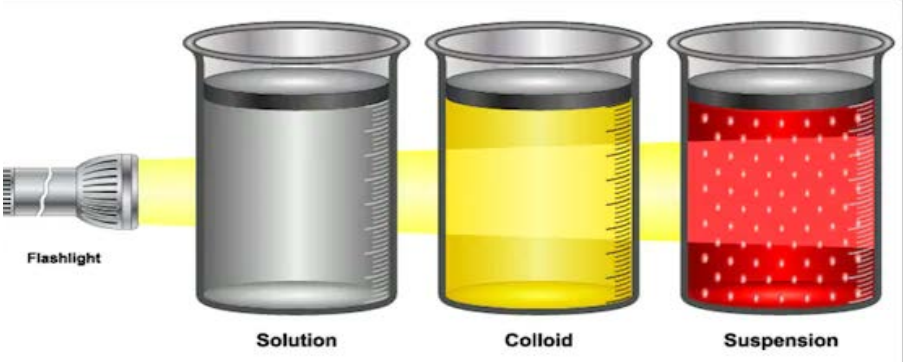
Element	Compound
water	salt
carbon	oxygen

## Suggested Teacher Resources



### Activity

Activity	Differentiate between solutions, suspensions, and colloids based on their characteristics to illustrate different kinds of homogenous and heterogeneous mixtures
Prerequisite	Knowing what pure substance and mixture are, and the difference between homogeneous and heterogeneous.
Material Required	Salt, wheat flour, milk, water, 3 transparent glasses and torch.
Vocabulary	Solution, suspension, colloidal solution, solute, solvent, saturated, concentration, dilution

<p>Procedure</p>	<ol style="list-style-type: none"> <li>1. Take 50 ml of water in each glass and label it A, B, and C.</li> <li>2. Add salt in glass A and mix it well.</li> <li>3. Add milk in glass B and wheat flour in glass C.</li> <li>4. Direct a beam of light from a torch through glasses containing mixture.</li> <li>5. Leave mixtures undisturbed and write your observation.</li> </ol> 
<p>Let's think</p>	<ol style="list-style-type: none"> <li>1. Are the particles visible in different glasses?</li> <li>2. Is the path of the beam of light visible?</li> <li>3. When you leave mixtures undisturbed, is the mixture stable or do the particles begin to settle after some time?</li> </ol>
<p>Text to real world connection</p>	<p>Carbonated soft drinks get their "fizz" from carbon dioxide gas dissolved, along with sugar and other flavourings, in a solution of water.</p>
<p>Beyond the classroom</p>	<p>Write some examples of solution, suspension and colloidal solution from your day today life.</p>

## 2

## Activity

<p>Material required</p>	<p>Potash Alum (aka <i>Fitkiri</i>), dirty water and two glasses.</p>
<p>Procedure</p>	<ol style="list-style-type: none"> <li>1. Constantly swirl the alum in dirty water for sometime.</li> <li>2. Let water remain still for over 4 hours or overnight.</li> <li>3. After a few hours, you can observe mud settling down.</li> <li>4. Drain upper layer of water or filter with fine cloth or filter paper.</li> </ol>

Let's think

1. What do you think residue contains?
2. If we drink dirty water, what problems can arise?
3. Do you know some other ways to filter the water?

# 3. Atoms and Molecules

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**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Law of conservation of mass	Apply the Law of Conservation of Mass to determine the mass of elements in a mixture.
Law of constant proportions	Apply the Law of Constant Proportions to estimate the amount of elements required in a chemical substance and identify postulates of Dalton's atomic theory.
Atoms and its scientific notations	Correlate the fact of invisibility of atoms to the size of atoms.
	List atomic symbols of commonly known elements as per IUPAC
Atomic mass	Recognise that different elements have different atomic mass.
Molecule	Determine the number of atoms present in an element on the basis of their atomicity.
	Apply the law of constant proportions to calculate the mass ratio of atoms in a molecule.
Writing chemical formulae	Write chemical formulae using symbols & valences.
Molecular mass and concept of mole	Identify ionic compounds whose formula unit mass can be calculated.
	Calculate the relative molecular mass of commonly known chemical compounds.
	Calculate the number of moles, mass, atoms and molecules using Avogadro's number.



**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Identify ionic compounds whose formula unit mass can be calculated.	Differentiates materials / objects / organisms / phenomena / processes, based on such as prokaryote and eukaryote, plant cell and animal cell, diffusion and osmosis, simple and complex tissues, distance and displacement, speed and velocity, balanced and unbalanced forces, element, compound and mixture, solution, suspension and colloid, isobars and isotopes, etc.
Apply the Law of Conservation of Mass to determine the mass of elements in a mixture.	Plans and conducts investigations / experiments to arrive at and verify the facts / principles / phenomena or to seek answers to queries on their own, such as how does speed of an object change? How objects float / sink when placed on surface of liquid? Is there any change in mass when chemical reaction takes place? What is the effect of heat on state of substances? What is the effect of compression on different states of matter? Where are stomata present in different types of leaves? Where are growing tissues present in plants?
Calculate the mass ratio of atoms in a molecule to validate law of constant proportions	
Correlate the fact of invisibility of atoms to the size of atoms.	Explains processes and phenomena, such as function of different organelles, spread of diseases and their prevention, effect of force on the state of motion of objects, action and reaction, revolution of planets and satellites, conservation laws, principle of separation of different gases from air, melting / boiling / freezing, how bats use ultrasound to catch prey, etc.
Determine the number of atoms present in an element on the basis of their atomicity.	Calculates using the data given, such as distance, velocity, speed, frequency, work done, number of moles in a given mass of substance, concentration of solution in terms of mass by mass percentage of substances, conversion of Celsius scale to kelvin scale
Apply the law of constant proportions to calculate the mass ratio of atoms in a molecule.	

Calculate the relative molecular mass of commonly known chemical compounds.	and vice versa, number of neutrons in an atom from atomic number and mass number, speed of sound, kinetic and potential energies of an object, boiling points of liquids to predict the order of their separation from the mixture, etc.
Calculate the number of moles, mass, atoms and molecules using Avogadro's number.	
List atomic symbols of commonly known elements as per IUPAC	Uses scientific conventions /symbols / equations to represent various quantities / elements /units, such as SI units, symbols of elements, formulae of simple compounds, chemical equations, etc.
Recognise that different elements have different atomic mass.	
Write chemical formulae using symbols & valences.	
Apply the Law of Conservation of Mass to determine the mass of elements in a mixture.	Derives formulae / equations / laws, such as mathematical expression for second law of motion, law of conservation of momentum, expression for force of gravity, equations of motion from velocity-time graphs, etc.
Apply the Law of Constant Proportions to estimate the amount of elements required in a chemical substance and identify postulates of Dalton's atomic theory.	Describes scientific discoveries / inventions, such as discovery of various atomic models, discovery of cell with invention of microscope, experiments of Lavoisier and Priestley, beliefs regarding motion, discovery of real cause for peptic ulcers, Archimedes principle, classification of living things, etc.
Recall atomic masses of a few elements to reinforce the idea of different atomic mass for different elements	

# Test items



**LOB : Apply the Law of Conservation of Mass to determine the mass of elements in a mixture.**

1) A student wants to make a homogeneous mixture of salt, sugar, and water that weighs 300 g. The student has 50 g sugar and 70 g salt. How much water should he add to the mixture?

- (a) 70 g
- (b) 120 g
- (c) 150 g
- (d) 180 g

**Correct Answer:** Option (d)

2) A student makes two solutions using components as listed in the table.

Component	Mass of Components in Solution 1	Mass of Components in Solution 2
Sand	50 g	0 g
Water	100 g	200 g
Salt	60 g	50 g
Sugar	50 g	50 g

The student notices that sand settles at the bottom of the beaker in Solution 1. Which solution would be heavier?

- (a) Solution 1, because sand is heavy.
- (b) Solution 2, because it has more water.
- (c) Solution 1, because it has more salt that disappears in water.
- (d) Solution 2, because the total mass of components is greater.

**Correct Answer:** Option (d)

**LOB : Apply the Law of Constant Proportions to estimate the amount of elements required in a chemical substance and identify postulates of Dalton's atomic theory.**

1) Which option supports Dalton's atomic theory?

- (a) Atoms of an element have identical mass.
- (b) Atoms can be created by chemical reactions.
- (c) Atoms of different elements have similar chemical properties
- (d) Atoms of an element change their properties in chemical reactions.

**Correct Answer:** Option (a)

2) A student has a sample of 200 g of table sugar (sucrose). For 200 g of sucrose, there are 84 g of carbon. Based on Dalton's atomic theory, how much carbon will be there in 300 g of sucrose?

(Sucrose =  $C_{12}H_{22}O_{11}$ )

- (a) 42 g
- (b) 23.8 g
- (c) 56 g
- (d) 126 g

**Correct Answer:** Option (d)

**LOB : Correlate the fact of invisibility of atoms to the size of atoms.**

1) A student argues that atoms are invisible to the eyes. Which option supports the student's argument?

- (a) they exist freely
- (b) they are in gaseous form
- (c) they are very small in size
- (d) they are in constant motion

**Correct Answer:** Option (c)

2) A student finds the atomic radii of some elements.

Element	Atomic Radii (m)
Aluminium (Al)	$143 \times 10^{-12}$ m
Iron (Fe)	$124 \times 10^{-12}$ m
Zinc (Zn)	$133 \times 10^{-12}$ m

To see how an atom would appear, he observes an aluminum foil with a hand lens but is unable to see atoms that made up the foil. What can be the possible reason for this?

- (a) Atoms of only gaseous substances can be observed.
- (b) Atoms are very tiny and cannot be observed by a simple hand lens.
- (c) Atoms are joined with great force, so it is difficult to distinguish one atom.
- (d) Atoms of metals are in constant motion so they cannot be observed with a hand lens.

**Correct Answer:** Option (b)

**LOB : List atomic symbols of commonly known elements as per IUPAC**

1) Which symbol is a correct representation of cobalt according to IUPAC?

- (a) CO
- (b) Co
- (c) co
- (d) cO

**Correct Answer:** Option (b)

2) A student lists four compounds.

$\text{PCl}_5$ ,  $\text{KBr}$ ,  $\text{P}_4\text{O}_{10}$ ,  $\text{Na}_2\text{CO}_3$

Which compound contains potassium?

- (a) KBr
- (b)  $\text{PCl}_5$
- (c)  $\text{P}_4\text{O}_{10}$
- (d)  $\text{Na}_2\text{CO}_3$

**Correct Answer:** Option (a)

**LOB : Recognize that different elements have different atomic mass**

1) The table lists the mass of some atoms.

Atom	Mass
P	12
Q	24
R	32
S	12

Which two atoms belong to the same element?

- (a) P and Q
- (b) R and S
- (c) Q and R
- (d) P and S

**Correct Answer:** Option (d)

2) The table lists atomic masses and atomic numbers of three elements.

Element	Atomic Number	Atomic Mass (amu)
Mg	12	24.305
Fe	26	55.845
O	8	16.0

A student studies that magnesium (Mg) and iron (Fe) react with oxygen (O) to form MgO and FeO. Although both compounds contain two atoms each of their molecular masses are different. What is the reason for the difference in their molecular masses?

- (a) Difference in the atomic mass of iron and magnesium
- (b) Difference in the number of iron and magnesium atoms
- (c) Different in the atomic number of iron and magnesium
- (d) Difference in the number of O atoms in the two compounds

**Correct Answer:** Option (a)

**LOB : Determine the number of atoms present in an element on the basis of their atomicity.**

1) The student lists some elements and their atomicity.

Element	Atomicity
Argon	Monoatomic
Oxygen	Diatomic
Hydrogen	Diatomic

What is the number of atoms in each element?

(a)

Element	Number of Atoms
Argon	1
Oxygen	2
Hydrogen	2

(b)

Element	Number of Atoms
Argon	2
Oxygen	1
Hydrogen	1

(c)

Element	Number of Atoms
Argon	1
Oxygen	3
Hydrogen	3

(d)

Element	Number of Atoms
Argon	3
Oxygen	1
Hydrogen	1

**Correct Answer:** Option (a)

2) The table shows the atomicity of different elements.

Element	Atomicity
Helium	Monoatomic
Oxygen	Diatomic
Ozone	Triatomic
Phosphorous	Tetra-atomic

Why is ozone labelled as triatomic?

- (a) because ozone can exist freely in nature
- (b) because ozone is a gas and gases are triatomic
- (c) because three atoms of oxygen combine to form ozone
- (d) because three molecules of oxygen combine to form ozone

**Correct Answer:** Option (c)

**LOB : Apply the law of constant proportions to calculate the mass ratio of atoms in a molecule.**

1) Which is the correct formula to calculate the mass ratio of ammonia (NH<sub>3</sub>)?

- (a)  $\frac{\text{mass of nitrogen}}{(\text{mass of hydrogen})^3}$
- (b)  $\frac{\text{mass of nitrogen}^3}{\text{mass of hydrogen}}$
- (c)  $\frac{\text{mass of nitrogen}}{3 \times \text{mass of hydrogen}}$
- (d)  $\frac{3 \times \text{mass of nitrogen}}{\text{mass of hydrogen}}$

**Correct Answer:** Option (c)



2) The table lists some compounds and their mass ratio.

Compound	Combining Elements	Ratio by Mass
Water (H <sub>2</sub> O)	Hydrogen, oxygen	1:8
Carbon dioxide (CO <sub>2</sub> )	Carbon, oxygen	3:4
Nitrogen dioxide (NO <sub>2</sub> )	nitrogen, oxygen	7:16
Magnesium sulphide (MgS)	Magnesium, sulphur	3:4

Which compound does NOT support the law of constant proportions?

(a) H<sub>2</sub>O

(b) CO<sub>2</sub>

(c) NO<sub>2</sub>

(d) MgS

**Correct Answer:** Option (b)

**LOB : Write chemical formulae using symbols & valencies.**

1) A student learns that aluminum forms compound with chlorine and oxygen. She records the valencies of the three elements.

Element	Valency
Aluminum	3+
Chlorine	1
Oxygen	2-

Which option gives the correct formula of aluminium oxide and aluminum chloride?

(a) aluminium oxide: Al<sub>2</sub>O<sub>3</sub>; aluminium chloride: AlCl<sub>3</sub>

(b) aluminium oxide: 3AlO<sub>2</sub>; aluminium chloride: 3AlCl<sub>2</sub>

(c) aluminium oxide: Al<sub>3</sub>O<sub>2</sub>; aluminium chloride: Al<sub>3</sub>Cl<sub>2</sub>

(d) aluminium oxide: 3(AlO)<sub>2</sub>; aluminium chloride: 2(Al<sub>3</sub>Cl)

**Correct Answer:** Option (a)

2) The table lists valencies of different elements.

Symbol of Element/Ion	Valency
O	2-
Na	1+
OH	1-

What will be the chemical formula of sodium oxide?

- (a)  $\text{Na}_2\text{O}$
- (b)  $\text{NaO}_2$
- (c)  $2\text{NaOH}$
- (d)  $2\text{Na}(\text{OH})$

**Correct Answer:** Option (a)

**LOB : Identify ionic compounds whose formula unit mass can be calculated.**

1) The table lists some compounds.

S.No.	Compounds
1	$\text{H}_2\text{O}$
2	$\text{NaCl}$
3	$\text{NO}_2$
4	$\text{CaCl}_2$

Identify the compounds whose formula unit mass can be calculated.

- (a) 1 and 3
- (b) 2 and 3
- (c) 2 and 4
- (d) 1 and 2

**Correct Answer:** Option (c)

2) What is the formula unit mass of  $\text{Na}_2\text{O}$ ?

- (a) 20 u
- (b) 39 u
- (c) 55 u
- (d) 62 u

**Correct Answer:** Option (d)

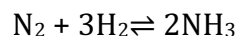
**LOB : Calculate the relative molecular mass of commonly known chemical compounds.**

1) Which option correctly represents the molecular mass of  $C_6H_{12}O_6$ ?

- (a) 29 u
- (b) 43 u
- (c) 96 u
- (d) 180 u

**Correct Answer:** Option (d)

2) A student is studying Haber's process to produce Ammonia. She learns that nitrogen and hydrogen react to form ammonia in the chemical reaction as shown.



Which option gives the ratio of nitrogen and hydrogen that participate in the reaction?

- (a) 14:3
- (b) 14: 1
- (c) 28: 3
- (d) 14: 6

**Correct Answer:** Option (a)

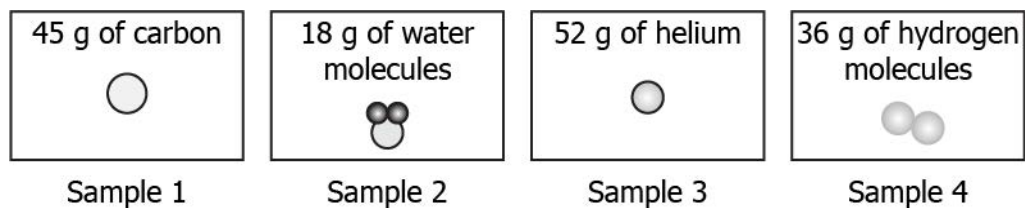
**LOB : Calculate the number of moles, mass, atoms and molecules using Avogadro's number.**

1) What will be the number of particles in 36 g of carbon atoms?

- (a)  $1.003 \times 10^3$
- (b)  $2.008 \times 10^3$
- (c)  $18.066 \times 10^3$
- (d)  $36.132 \times 10^3$

**Correct Answer:** Option (c)

2) The image shows four samples of elements.



Which sample contains the greatest number of atoms?


- (a) sample 1
- (b) sample 2
- (c) sample 3
- (d) sample 4

**Correct Answer:** Option (d)

# Suggested Teacher Resources



## Activity

Activity	Acquire the skill of writing chemical formulae using the symbols & valencies.
Prerequisite	Students should have the knowledge of elements, their IUPAC name and symbols.
Material Required	Clay of 2 different colours, chalk
Vocabulary	Ion, anion and cation.
Procedure	<ol style="list-style-type: none"> <li>1. Make small balls of clay to represent electrons.</li> <li>2. Draw orbits as shown.</li> <li>3. Use one color of clay to represent element of magnesium, and another to represent element of chlorine.</li> <li>4. Exchange the electrons to fill outermost shell completely.</li> </ol> 
Let's think	<ol style="list-style-type: none"> <li>1. Can Chlorine give its electron to magnesium? Why or why not?</li> <li>2. What is the first step in determining the formula for a molecule?</li> </ol>
Text to real world connection	<ol style="list-style-type: none"> <li>1. Salt contains sodium and chlorine i.e. NaCl.</li> <li>2. Sugar contains carbon, hydrogen and oxygen i.e. C<sub>12</sub>H<sub>22</sub>O<sub>11</sub></li> </ol>
Beyond the classroom	Write down the chemical formula of Baking soda, Washing soda, and Caustic Soda. Also write their common names.

## 4. Structure of the Atom

**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Charged particles in matter	Know the different constituents of an atom and differentiate between electrons and protons.
The structure of an atom	Explain Thomson's model of an atom and its incoherent features with the results of other experiments.
	Draw logical conclusions from Rutherford's experiment to understand the structure of an atom.
	Compare Rutherford's model with Thomson's atomic model and state their relative advantages and limitations.
	Highlight the limitations of Rutherford's model.
State the postulates of Neils Bohr's model of an atom and their significance.	
How Electrons are distributed in different orbits (shells)?	Get conversant with the Bohr and Bury rules for distribution of electrons into different orbits.
Valency	Find the valency of elements on the basis of their electronic configuration and relate inertness and reactivity of elements.
	Calculate the number of electrons distributed in different orbits(shells) according to Bohr and Bury rules and find out valence electrons for different elements.
Atomic mass, Isotopes and Isobars	Write the scientific notations of atoms of commonly known elements and calculate their atomic mass and atomic number.
	Postulate the reason for different atomic numbers for isotopes of an element.
	Identify isobars on the basis of scientific notation of their atoms.

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Know the different constituents of an atom and differentiate between electrons and protons.	Differentiates materials / objects / organisms / phenomena / processes, based on such as prokaryote and eukaryote, plant cell and animal cell, diffusion and osmosis, simple and complex tissues, distance and displacement, speed and velocity, balanced and unbalanced forces, element, compound and mixture, solution, suspension and colloid, isobars and isotopes, etc.
Identify isobars on the basis of scientific notation of their atoms.	Relates processes and phenomena with causes / effects, such as symptoms with diseases / causal agents, tissues with their functions, production with use of fertilizers, process of evaporation with cooling effect, various processes of separation with the physical and chemical properties of the substances, production of sound with vibrations of source, etc.
Find the valency of elements on the basis of their electronic configuration and relate inertness and reactivity of elements.	Calculates using the data given, such as distance, velocity, speed, frequency, work done, number of moles in a given mass of substance, concentration of solution in terms of mass by mass percentage of substances, conversion of Celsius scale to kelvin scale and vice versa, number of neutrons in an atom from atomic number and mass number, speed of sound, kinetic and potential energies of an object, boiling points of liquids to predict the order of their separation from the mixture, etc.
Calculate the number of electrons distributed in different orbits(shells) according to Bohr and Bury rules and find out valence electrons for different elements.	
Postulate the reason for different atomic numbers for isotopes of an element.	
Enlist Bohr & Bury's rules for electronic configuration to show the distribution of electrons in elements from atomic number 1 to 20	Draws labelled diagrams / flow charts / concept map /graphs, such as biogeochemical cycles, cell organelles and tissues, human ear, distance-time and speed-time graphs, distribution of electrons in different orbits, process of distillation / sublimation, etc.
Write the scientific notations of atoms of commonly known elements and calculate their atomic mass and atomic number.	Uses scientific conventions /symbols / equations to represent various quantities / elements /units, such as SI units, symbols of elements, formulae of simple compounds, chemical equations, etc.
Explain Thomson's model of an atom and its incoherent features with the results of other experiments.	Describes scientific discoveries / inventions, such as discovery of various atomic models, discovery of cell with invention of microscope, experiments

Draw logical conclusions from Rutherford's experiment to understand the structure of an atom.	of Lavoisier and Priestley, beliefs regarding motion, discovery of real cause for peptic ulcers, Archimedes principle, classification of living things, etc.
Compare Rutherford's model with Thomson's atomic model and state their relative advantages and limitations	
Highlight the limitations of Rutherford's model	
State the postulates of Neils Bohr's model of an atom and their significance.	
Get conversant with the Bohr and Bury rules for distribution of electrons into different orbits.	

## Test items



### **LOB : Know the different constituents of an atom and differentiate between electrons and protons.**

1) How the sub atomic particles like Proton is different from electron?

- (a) An electron is much heavier than a proton.
- (b) An electron carries more charge than a proton.
- (c) A proton can be easily removed from the atom, but not an electron.
- (d) A proton is positively charged, whereas an electron is negatively charged.

**Correct Answer:** Option (d)

2) An atom has 4 electrons and 4 protons and 4 neutrons. The atom is electrically neutral. Which difference in the properties of protons and electrons affects the electrical neutrality of the atom?

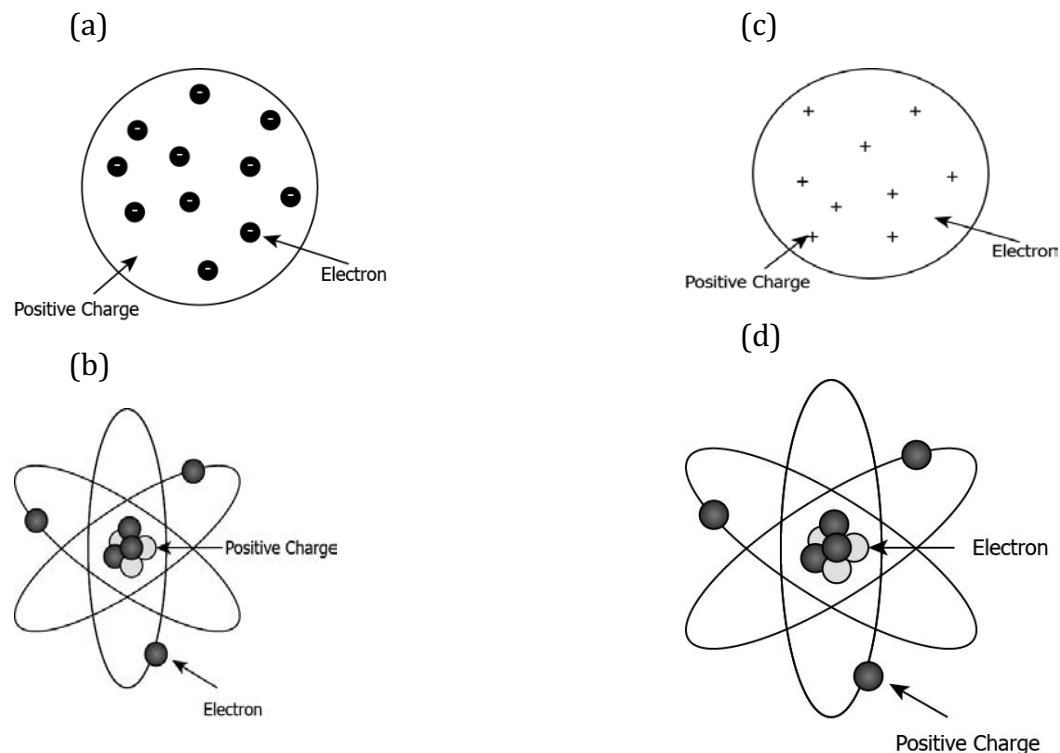
- (a) Electrons are 2000 times lighter than protons.
- (b) Electrons and protons have the same charge and mass.
- (c) Electrons and protons have opposite charges of the same magnitude
- (d) Electrons are present in the outer side of the atom compared to the protons.

**Correct Answer:** Option (c)



**LOB : Explain Thomson's model of an atom and its incoherent features with the results of other experiments**

1) Which of the following model describes the structure of an atom proposed by Thomson?



**Correct Answer:** Option (a)

2) Which of the following is NOT the correct explanation of Thomson's atomic model?

- (a) The atom is positively charged sphere.
- (b) Electrons are embedded in the positive sphere.
- (c) The positive and negative charges balance each other.
- (d) Protons and neutrons are embedded in the center of the sphere.

**Correct Answer:** Option (d)

**LOB : Draw logical conclusions from Rutherford's experiment to understand the structure of an atom.**

1) Rutherford conducted an experiment to study the structure of atom. He passed positively charged alpha particles through a thin gold foil. He studied the angle of deflection of the alpha particles. He noticed that most of the alpha particles passed through the gold foil without any deflection. What can be concluded from the observation?

- (a) Most of the space in an atom is empty.
- (b) Atoms have electrons, protons, and neutrons.
- (c) The nucleus of the atom is situated at the center.
- (d) Atoms do not have positively charged particles.

**Correct Answer:** Option (a)

2) Rutherford observed the following in his experiment.

<b>Observations</b>
1. Most of the alpha particles passed through the foil without any deflection. 2. Some alpha particles passed with small deflection. 3. One out of 12000 alpha particles appeared to rebound.

What does  $180^\circ$  deflection of only very few alpha particles indicate?

- (a) A large space in an atom is mostly empty.
- (b) Electrons in an atom revolve around the positively charged protons.
- (c) The positive charge and mass of the atom is concentrated at the center of the atom.
- (d) Atoms have positively and negatively charged species that are at the center of the atom.

**Correct Answer:** Option (c)

**LOB : Compare Rutherford's model with Thomson's atomic model and state their relative advantages and limitations.**

1) How Rutherford's atomic model could explain the drawbacks of Thomson's atomic model?

- (a) It was able to explain that an atom can have multiple electrons and protons.
- (b) It was able to explain that an atom has positively and negatively charged particles.
- (c) It was able to explain that an atom has a small neutral nucleus and electrons revolve around it.
- (d) It was able to explain that an atom has a small positive nucleus and electrons revolve around it.

**Correct Answer:** Option (d)

2) Which of the following is true for Rutherford's model but not for Thompson's model of an atom?

- (a) An atom is electrically neutral.
- (b) An atom contains many electrons.
- (c) An atom has positive and negative parts.
- (d) An atom contains a positively charged nucleus.

**Correct Answer:** Option (d)

**LOB : Highlight the limitations of Rutherford's model**

1) Which question Rutherford's model failed to answer?

- (a) What causes the atoms to stay electrically neutral?
- (b) Where are electrons, protons, and neutrons located in the nucleus?
- (c) Why is it easier to remove an electron from an atom compared to a proton?
- (d) If electrons revolve continuously, why do they not lose energy and collapse in the nucleus?

**Correct Answer:** Option (d)

2) What fact about electrons was not explained by Rutherford's model?

- (a) Electrons are much lighter than protons.

- (b) Electrons are negatively charged species.
- (c) Electrons revolve around nucleus but never lose energy.
- (d) Electrons can be removed from an atom by providing energy.

**Correct Answer:** Option (c)

**LOB : State the postulates of Neils Bohr's model of an atom and their significance.**

1) What part of Bohr's model of atomic structure explains why electrons do not crash into the nucleus?

- (a) Electrons are always repelled by the nucleus.
- (b) Electrons are much farther from the nucleus.
- (c) Electrons keep gaining energy while revolving.
- (d) Electrons revolve in orbits that have specific energy.

**Correct Answer:** Option (d)

2) Which of the following is a postulate of Bohr's model that explains why electrons do not lose energy as they revolve around the nucleus?

- (a) Every atom has a discrete number of orbits in which electrons revolve with fixed energy.
- (b) Every atom has a large amount of empty space where the electrons move around nucleus.
- (c) Every atom has as many electrons as there are protons which makes it electrically neutral.
- (d) Every atom has a positively charged nucleus where most of the mass of the atom is concentrated.

**Correct Answer:** Option (a)

**LOB : Get conversant with the Bohr and Bury rules for distribution of electrons into different orbits.**

1) Which of the following is NOT true about Bohr & Bury's rule for electronic configuration, where n is the shell no.?

- (a) The maximum number of electrons present in a shell is given by the formula  $2n^2$
- (b) The maximum number of electrons present in a shell is given by the formula  $2n$

(c) The maximum number of electrons that can be accommodated in the outer most orbit is 8.

(d) Electron are not accommodated in a given shell, unless the inner shells are filled

**Correct Answer:** Option (b)

2) Which of the following CAN NOT be the maximum number of electrons in a given shell according to the Bohr & Bury's rule for electronic configuration:

- (a) 2
- (b) 6
- (c) 18
- (d) 32

**Correct Answer:** Option (b)

**LOB : Find the valency of elements on the basis of their electronic configuration and relate inertness and reactivity of elements.**

1) The atomic number of sodium (Na) is 11. How many valence electrons does sodium have?

- (a) 1
- (b) 2
- (c) 7
- (d) 8

**Correct Answer:** Option (a)

2) The atomic number of Sulphur (S) is 16. Identify the number of electrons in each shell of Sulphur.

- (a) 2, 8, 6
- (b) 2, 8, 8
- (c) 2, 2, 8, 4
- (d) 2, 4, 8, 2

**Correct Answer:** Option (a)

**LOB : Calculate the number of electrons distributed in different orbits(shells) according to Bohr and Bury rules and find out valence electrons for different elements.**

1) The atomic number of some elements is shown.

Element	Atomic number
Beryllium (Be)	4
Oxygen (O)	8
Silicon (Si)	14
Chlorine (Cl)	17

Which elements have a valency of 2?

- (a) Be and Si
- (b) Si and Cl
- (c) Be and O
- (d) Cl and O

**Correct Answer:** Option (c)

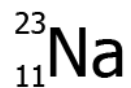
2) Which element would be inert in nature?

- (a) Element with 2 electrons
- (b) Element with 9 electrons
- (c) Element with 12 electrons
- (d) Element with 20 electrons

**Correct Answer:** Option (a)

**LOB : Write the scientific notations of atoms of commonly known elements and calculate their atomic mass and atomic number.**

1) The image shows the scientific notation of sodium.



What is the atomic mass of Na?

- (a) 11
- (b) 12
- (c) 23
- (d) 34

**Correct Answer:** Option (c)

2) An element X has an atomic number 6 and atomic mass 12. Which scientific notation can represent the element?

(a)



(b)



(c)



(d)



**Correct Answer:** Option (c)

**LOB : Postulate the reason for different atomic numbers for isotopes of an element.**

1) Chlorine has two isotopes, Cl-35 and Cl-37. These isotopes occur in nature in the ratio 3: 1. What would be the atomic mass for chlorine?

- (a) 35.0 u

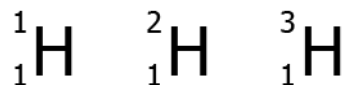
(b) 35.5 u

(c) 36.0 u

(d) 36.5 u

**Correct Answer:** Option (b)

2) The image shows the isotopes of hydrogen.



Why do they have the same atomic number but different mass number?

(a) because they have different number of protons

(b) because they have different number of neutrons

(c) because they have different number of electrons

(d) because they have different abundance in nature

**Correct Answer:** Option (b)

**LOB : Identify isobars on the basis of scientific notation of their atoms.**

1) Look at the given elements.



Which of the two are isobars?

(a) Ar and F

(b) Ca and Ar

(c) Ca and Ne

(d) Ne and F

**Correct Answer:** Option (b)

2) Ca and Ar are called isobars because they have the same

(a) mass number but different atomic number.



- (b) atomic number but different mass number.  
 (c) number of protons but different number of neutrons.  
 (d) number of electrons but different number of protons.


**Correct Answer:** Option (a)

## Suggested Teacher Resources



### Activity

Activity	List Bohr's postulates in order to explain how it improves the Thomson's model in explaining why electrons orbiting around nucleus does not lose energy and crash at the centre
Prerequisite	Students should have some knowledge of atoms as the basic building blocks of matter and subatomic particles.
Material Required	Clay (red, green, blue), matchsticks/ toothpick, black marker.
Vocabulary	Atomic structure, electrons, protons, neutrons, shell, electronic configuration, ions, valence electrons, valency.
Procedure	<ol style="list-style-type: none"> <li>1. Take clay of 3 different colors: Red, green and blue. Shape them into balls.</li> <li>2. Draw '+' on green clay, '-' on blue clay and '0' on red with black marker.</li> <li>3. Green clay represents protons which have a positive charge, blue represents electrons which have a negative charge and red represents neutrons which have no charge.</li> <li>4. Take 3 green balls and 4 red balls and combine them to form a nucleus.</li> <li>5. Place an electron on one end of a matchstick and add it to the nucleus to create an atom.</li> </ol>

	
<p>Let's think</p>	<ol style="list-style-type: none"> <li>1. What charge do you think a nucleus has?</li> <li>2. Is it a positive, negative or neutral atom?</li> <li>3. What will be the charge if you remove an electron?</li> <li>4. What happens when you add an electron?</li> </ol>
<p>Text to real world connection</p>	<p>Super-tiny subatomic particles are used to create the parts of atoms. Protons, neutrons, and electrons can then organize to form atoms. Atoms are then used to create the molecules around us.</p>
<p>Beyond the classroom</p>	<p>How hydrogen atom is different from atoms of all other elements?</p>

## 5. The Fundamental Unit of Life

**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Cells as unit of the living things	Cognize the variety in shape and size of cells in different organisms and infer that cells are functionally similar despite structural differences.
Types of living cells	Demonstrate the difference between animal and plant cells with appropriate experiments.
	Compare a Prokaryotic and an Eukaryotic cell
Parts of a cell	Locate different cell organelles in a plant cell and state their functions.
	Differentiate between types of endoplasmic reticulum and identify their functions.
	Name the cell organelle responsible for storage, modification and packaging of products in a cell
	Explain the functioning of Mitochondria in a cell.
	Relate the functions of Lysosomes in a cell
	Locate the cell organelle that helps cells prepare their food.
	Elaborate the role of chromosomes during cell division.
Relate the role of vacuoles in a cell.	

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Compare a Prokaryotic and an Eukaryotic cell	Differentiates materials / objects / organisms / phenomena / processes, based on such as prokaryote and eukaryote, plant cell and animal cell, diffusion and osmosis, simple and complex tissues, distance and displacement, speed and velocity, balanced and unbalanced forces, element, compound

Demonstrate the difference between animal and plant cells with appropriate experiments.	and mixture, solution, suspension and colloid, isobars and isotopes, etc.
Demonstrate the difference between animal and plant cells with appropriate experiments.	Plans and conducts investigations / experiments to arrive at and verify the facts / principles / phenomena or to seek answers to queries on their own, such as how does speed of an object change? How objects float / sink when placed on surface of liquid? Is there any change in mass when chemical reaction takes place? What is the effect of heat on state of substances? What is the effect of compression on different states of matter? Where are stomata present in different types of leaves? Where are growing tissues present in plants?
Compare a Prokaryotic and an Eukaryotic cell	Relates processes and phenomena with causes / effects, such as symptoms with diseases / causal agents, tissues with their functions, production with use of fertilizers, process of evaporation with cooling effect, various processes of separation with the physical and chemical properties of the substances, production of sound with vibrations of source, etc.
Differentiate between types of endoplasmic reticulum and identify their functions.	Explains processes and phenomena, such as function of different organelles, spread of diseases and their prevention, effect of force on the state of motion of objects, action and reaction, revolution of planets and satellites, conservation laws, principle of separation of different gases from air, melting / boiling / freezing, how bats use ultrasound to catch prey, etc.
Name the cell organelle responsible for storage, modification and packaging of products in a cell	
Explain the functioning of Mitochondria in a cell.	
Relate the functions of Lysosomes in a cell	
Locate the cell organelle that helps cells prepare their food	
Elaborate the role of chromosomes during cell division.	
Relate the role of vacuoles in a cell.	

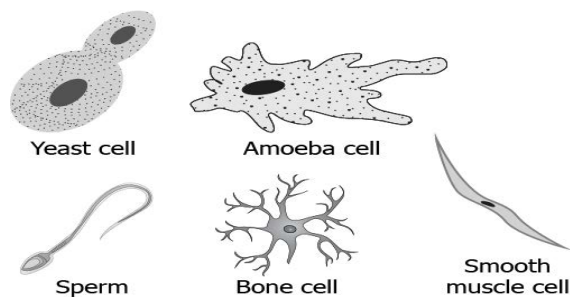
<p>Cognize the variety in shape and size of cells in different organisms and infer that cells are functionally similar despite structural differences.</p>	<p>Draws labelled diagrams / flow charts / concept map /graphs, such as biogeochemical cycles, cell organelles and tissues, human ear, distance-time and speed-time graphs, distribution of electrons in different orbits, process of distillation / sublimation, etc.</p>
<p>Locate different cell organelles in a plant cell and state their functions.</p>	
<p>Cognize the variety in shape and size of cells in different organisms and infer that cells are functionally similar despite structural differences.</p>	<p>Describes scientific discoveries / inventions, such as discovery of various atomic models, discovery of cell with invention of microscope, experiments of Lavoisier and Priestley, beliefs regarding motion, discovery of real cause for peptic ulcers, Archimedes principle, classification of living things, etc.</p>
<p>Compare a Prokaryotic and an Eukaryotic cell</p>	

# Test items



**LOB :** Enumerate different types of cells commonly found in nature in order to establish that building units can differ with different organism

1) The image shows some types of cells.

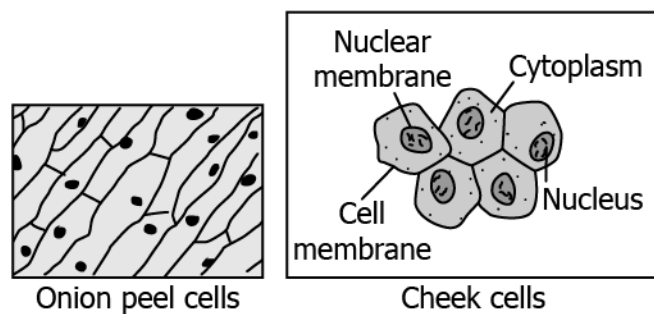


Based on the image what could be the reason for the different shape and size?

- (a) to suit their function
- (b) as they are formed first or last in the body
- (c) as they are all animal cells
- (d) as some are plant cells and some animal cells

**Correct Answer:** Option (a)

2) The image shows cells in the onion peel and human cheek.



What can be understood by observing these cells?

- (a) All living things made of cells that look similar.
- (b) All living things made up of cells that are structurally similar but functionally different.
- (c) All living things are made up of cells that are functionally similar but structurally different.
- (d) All living things are made of cells that look different from each other.

**Correct Answer:** (d)

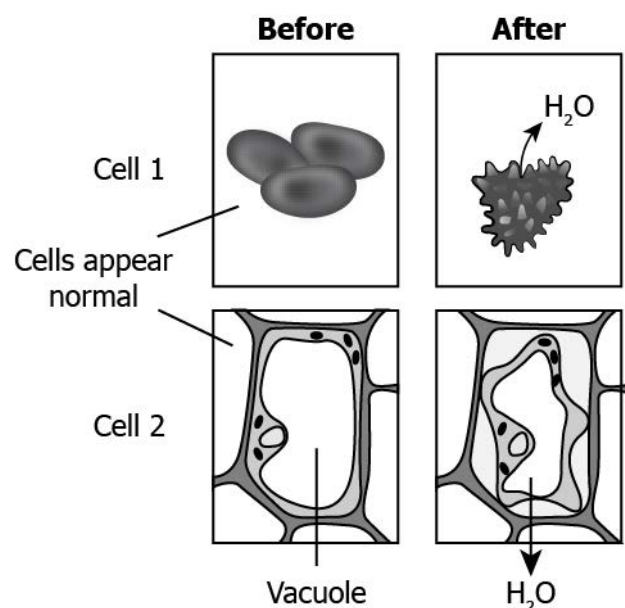
**LOB : Demonstrate the difference between animal and plant cells with appropriate experiments.**

1) What will likely happen if an animal cell and a plant cell are placed in a sugar solution that has water concentration more than that of the animal cell and the plant cell?

- (a) Both the animal and plant cell will burst.
- (b) Both the animal and plant cell will swell.
- (c) Animal cell will swell while the plant cell will burst.
- (d) Animal cell will burst while the plant cell will swell.

**Correct Answer:** Option (d)

2) The image shows how the two cells appear before and after placing in a hypertonic solution.



Based on the behavior of the cell, identify the cell types?

- (a) Cell 1: animal cell, Cell 2: plant cell
- (b) Cell 1: bacterial cell, Cell 2: plant cell
- (c) Cell 1: Plant cell, Cell 2: animal cell
- (d) Cell 1: animal cell, Cell 2: bacterial cell

**Correct Answer:** Option (a)

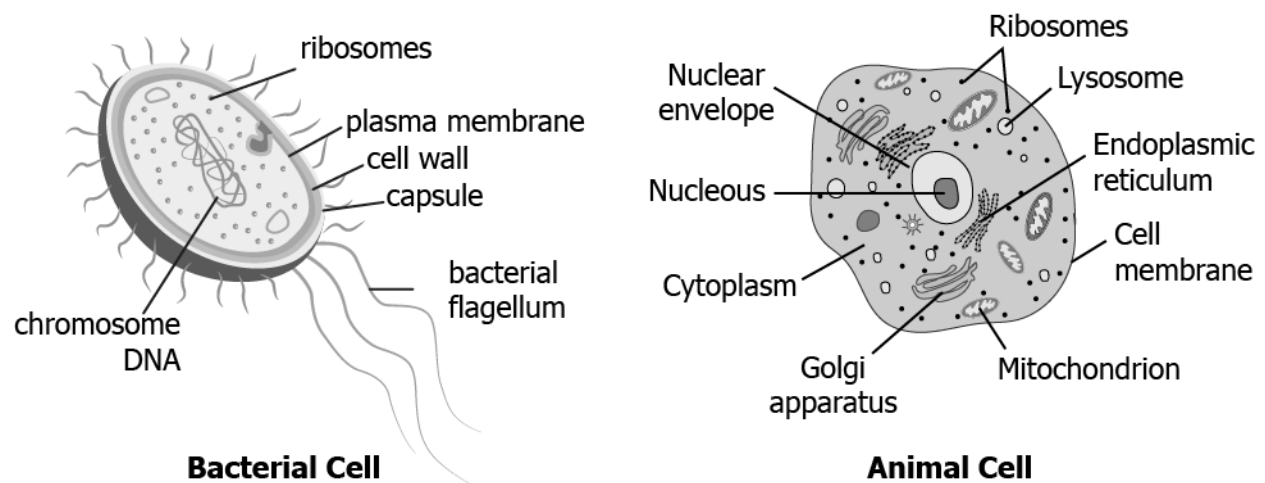
**LOB : Compare a Prokaryotic and a Eukaryotic cell**

1) What is a basis for differentiation of a prokaryotic cell from a eukaryotic cell?

- (a) presence or absence of cytoplasm
- (b) presence or absence of cell membrane
- (c) presence or absence of genetic material
- (d) presence or absence of membrane bound organelles

**Correct Answer:** Option (d)

2) The image shows a bacterial cell and an animal cell.



Based on the structures, a student claims that the animal cell contains complex structures that are absent in the bacterial cell. Which statement can the student make to support the claim?

- (a) Animal cell contains flagella that aids in locomotion that is absent in case of a bacterial cell.
- (b) Nuclear material of the bacterial cell is not enclosed in a nuclear envelope as in case of an animal cell. \*
- (c) Cytoplasmic content of the bacterial cell is not enclosed in a thick cell wall as in case of an animal cell.

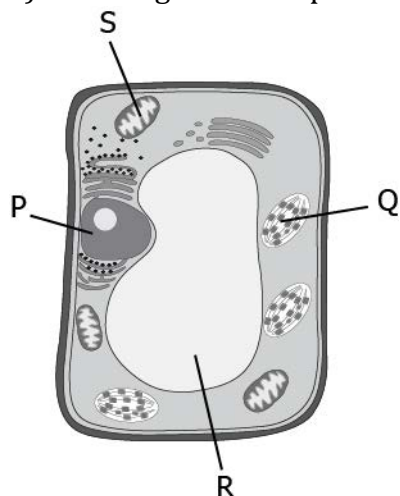


(d) Animal cell contains ribosomes spread across the cell whereas in case of bacterial cell they are clumped together.

**Correct Answer:** Option (b)

**LOB : Locate different cell organelles in a plant cell and state their functions.**

1) The image shows a plant cell.



Which marked part is responsible for the generation of energy in the cell?

- (a) P
- (b) Q
- (c) R
- (d) S

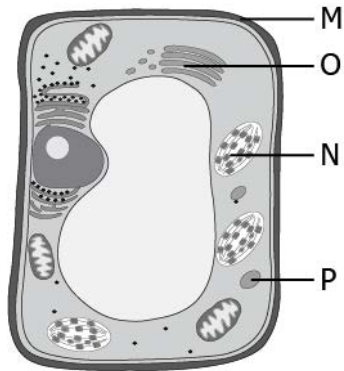
**Correct Answer:** Option (d)

2) The table lists functions performed by some plant cell organelles.

Organelle	Function
M	It allows transportation of materials in and out of the cells.
N	It stores the products of ER in vesicle.
O	It helps digest foreign molecules.
P	It produces food in the cell.

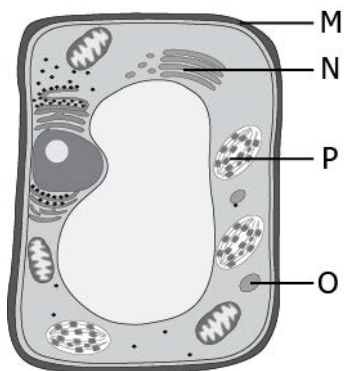
Which option shows the correctly labelled organisms in the plant cells that performs the respective function?

(a)



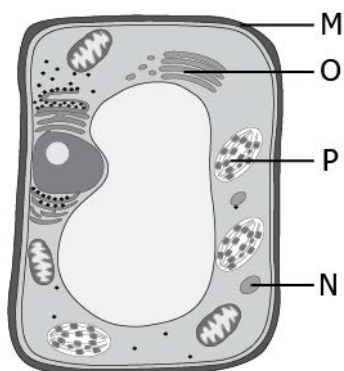
**Plant Cell**

(b)



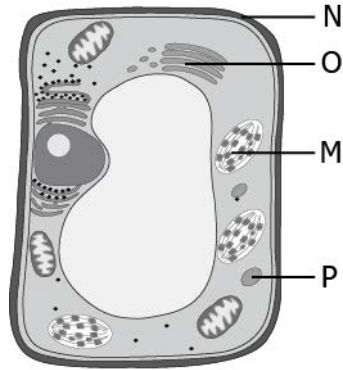
**Plant Cell**

(c)



**Plant Cell**

(d)



**Plant Cell**

**Correct Answer:** Option (b)

1) Which of following is the function of cytoplasm present in the cell?

- (a) It plays a central role in cellular reproduction.
- (b) It is involved in the formation of lysosomes.
- (c) It helps transport material into the cell.
- (d) It holds the organelles of the cell in place.

**Correct Answer:** Option (d)

2) The table lists some functions performed by some cell structures.

- P. It separates the content of the cell from the surroundings.
- Q. It is a site where many cellular processes occur.
- R. It controls the process of cell division.
- S. It controls the movement of substances in and out of the cells.

Which option shows the organelle correctly matched with the respective function?

- (a) Cytoplasm- Q and S, nucleus- P, plasma membrane- R
- (b) Cytoplasm- Q and R, nucleus- P, plasma membrane- S
- (c) Cytoplasm- Q, nucleus- R, plasma membrane- S and P

(d)Cytoplasm- R, nucleus- Q, plasma membrane- S and P

**Correct Answer:** Option (c)

**LOB : Differentiate between types of endoplasmic reticulum and identify their functions.**

1) Which of the following function is performed by smooth endoplasmic reticulum?

- (a)It helps expel excess water and waste out of the cell.
- (b)It helps produced ATP molecules.
- (c)It helps digest small foreign particles.
- (d)It helps detoxify the drugs.

**Correct Answer:** Option (d)

2) How endoplasmic reticulum helps transport protein between various regions of the cytoplasm?

- (a)by forming a network of membrane-bound tubes in the cytoplasm
- (b)by occupying most of the space in the cytoplasm
- (c)by generating small transport vesicles throughout the cell
- (d)by directing all cell organelles to perform the same biochemical activity

**Correct Answer:** Option (a)

**LOB : Name the cell organelle responsible for storage, modification and packaging of products in a cell**

1) Proteins are synthesized near the endoplasmic reticulum. Where are these proteins transported further in the cell?

- (a)to the nucleus
- (b)to Golgi body
- (c)to mitochondria
- (d)to the cell membrane

**Correct Answer:** Option (b)

2) The function of Golgi body includes:

- (a) degradation and elimination of waste substances
- (b) storage, modification, and packaging of products in vesicles
- (c) synthesis of lipids and proteins
- (d) providing rigidity and turbidity to the cell

**Correct Answer:** Option (b)

**LOB : Explain the functioning of Mitochondria in a cell.**

1) What is the main function of mitochondria?

- (a) to stop the chemical reaction in the cell and store ATP as energy
- (b) to perform all the chemical reactions of the cell using ATP
- (c) to use energy currency in the form of ATP
- (d) to produce ATP molecules

**Correct Answer:** Option (d)

2) A large amount of energy is required by the cell to carry out various cellular processes. Which part of mitochondria helps generate enough energy required for various chemical activities and how?

- (a) The folds present in the inner mitochondrial membrane decrease the surface area for more ATP production.
- (b) The folds present in the inner mitochondrial membrane increase the surface area for more ATP production.
- (c) The folds present in the outer mitochondrial membrane increase the surface area for more ATP production.
- (d) The folds present in the outer mitochondrial membrane decrease the surface area for more ATP production.

**Correct Answer:** Option (b)

**LOB : Relate the functions of Lysosomes in a cell**

1) Which of the following are usually digested or degraded by lysosomes?

- (a) ATP molecules
- (b) oxygen molecules
- (c) old organelles of the cell
- (d) carbon dioxide molecules

**Correct Answer:** Option (c)

2) Anil has bacterial infection. Which part of the cell will help him eliminate bacteria from his body and how?

- (a) Vacuoles as they can uptake any material and store it.
- (b) Vacuoles as they can expel substance out of the cell.
- (c) Lysosomes as they have digestive enzymes to breakdown foreign material.
- (d) Lysosomes as they can destroy their own cell.

**Correct Answer:** Option (c)

**LOB : Locate the cell organelle that helps cells prepare their food.**

1) What is the function of chromoplast in a cell?

- (a) It helps plant utilize energy.
- (b) It helps plant breakdown food.
- (c) It helps plant make food.
- (d) It helps plant release energy to the surroundings.

**Correct Answer:** Option (c)

2) In plants, cells in the leaves mainly make food for the plant. Which organelle does these cells have that enables them to make food?

- (a) These cells have plastids with pigment chlorophyll that helps photosynthesize.
- (b) These cells have mitochondria that provides ATP as energy to photosynthesize.
- (c) These cells have colorless plastids that absorb sunlight to help plant photosynthesize.
- (d) These cells have vacuoles that provide essential nutrients required for photosynthesis.

**Correct Answer:** Option (a)

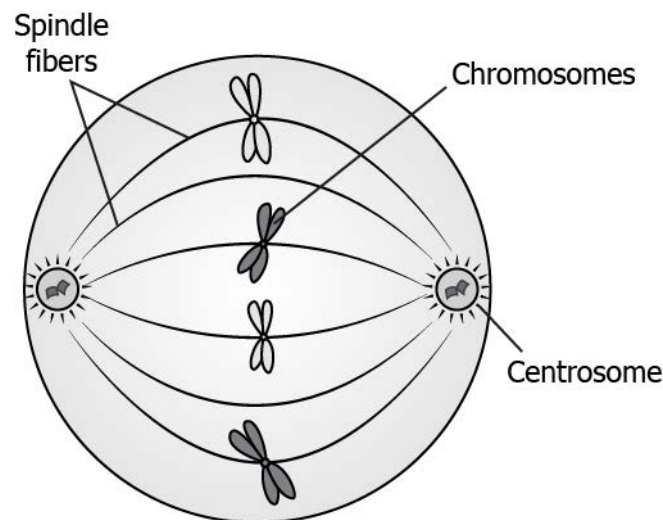
**LOB : Elaborate the role of chromosomes during cell division.**

1) What is the role of centrosomes in cell division?

- (a) It helps the cell to enlarge to undergo division
- (b) It helps the cell to divide into two daughter cells.
- (c) It helps join the chromosomes together.
- (d) It helps separate sister chromatids apart.

**Correct Answer:** Option (d)

2) The image shows a stage of cell division.



Based on the image, what can be a likely function of centrosome in cell division?

- (a) It organizes spindle fibers and allows equal distribution of chromosome in the daughter cells.
- (b) It forms spindle fibers before the cell division starts.
- (c) It degrades the spindle fibers and chromosomes when the division completes.
- (d) It releases spindle fibers that hold the chromosomes during division.

**Correct Answer:** Option (a)

**LOB : Relate the role of vacuoles in a cell.**

1) What is the function of vacuoles?

- (a) It digests sugars.
- (b) It stores amino acids.
- (c) It synthesizes proteins.
- (d) It encloses nuclear material.

**Correct Answer:** Option (b)

2) In summers, leaves of a potted plant droop when the soil becomes dry. Which cell organelle makes the leaves to droop?

- (a) Nucleus, as it stops making DNA.
- (b) Cell wall, as it starts to shrink.
- (c) Lysosome, as it is releasing the digestive enzymes.
- (d) Vacuole, as it loses all the water.

**Correct Answer:** Option (d)



# Suggested Teacher Resources



## Activity

Activity	Compare Prokaryotic and Eukaryotic cell to explain why complex cell structure is not found in bacterial cells but found in plant or animal cells
Prerequisite	Cell is the basic unit of life. Living organisms and non- living organisms.
Material Required	4 glasses, soap solution, straw, thread, and scissors.
Vocabulary	Prokaryotic and eukaryotic cells.
Procedure	<ol style="list-style-type: none"> <li>1. Find waste material like use card board, paper, used ball, thread etc.</li> <li>2. Draw the diagram of prokaryotic and eukaryotic cell on the piece of card board</li> <li>3. Use the similar looking/ shaped waste material and place it on at appropriate locations to mark respective organelle</li> <li>4. Label the respective organelle using marker</li> </ol>
Let's think	<ol style="list-style-type: none"> <li>1. Draw a labelled diagram of and Prokaryotic and Eukaryotic cell.</li> <li>2. Differentiate between Prokaryotes and Eukaryotes.</li> </ol>
Text to real world connection	Blue-green algae, bacteria and mycoplasma are some examples of prokaryotes. Animals are an example of Eukaryotes.
Beyond the classroom	What is the function of eukaryotic cell?

# 6. Tissues

**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Meristematic tissue	Describe the locations and function of meristematic tissue plants.
	Classify the meristematic tissue based on their location in the plant body.
Simple permanent tissue	Identify the type of simple permanent tissues and their functions in a plant.
Complex permanent tissue	Identify the type of complex permanent and their role in a plant.
Animal tissues	Classify different animal tissues based on their functions in the body
Epithelial tissue	Corelate the structure of epithelial tissues to their functions in an organism.
Connective tissue	Describe different types of connective tissues and relate their structure to specific functions.
Muscular tissue	Compare the structure of different types of muscular tissues and relate it to their functions.
Nervous tissue	Describe the structure of a neuron and explain the functioning of nervous tissue.

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Classify the meristematic tissue based on their location in the plant body.	Classifies materials / objects / organisms / phenomena / processes, based on, properties / characteristics, such as classification of plants, animals under various hierarchical sub-groups, natural resources, classification of matter based on their states (solid / liquid / gas) and composition (element / compound / mixture), etc.
Classify different animal tissues based on their functions in the body	

Describe the locations and function of meristematic tissue plants.	Plans and conducts investigations / experiments to arrive at and verify the facts / principles / phenomena or to seek answers to queries on their own, such as how does speed of an object change? How objects float / sink when placed on surface of liquid? Is there any change in mass when chemical reaction takes place? What is the effect of heat on state of substances? What is the effect of compression on different states of matter? Where are stomata present in different types of leaves? Where are growing tissues present in plants?
Describe the locations and function of meristematic tissue plants.	Relates processes and phenomena with causes / effects, such as symptoms with diseases / causal agents, tissues with their functions, production with use of fertilizers, process of evaporation with cooling effect, various processes of separation with the physical and chemical properties of the substances, production of sound with vibrations of source, etc.
Identify the type of simple permanent tissues and their functions in a plant.	<p><b>Explains processes and phenomena</b>, such as function of different organelles, spread of diseases and their prevention, effect of force on the state of motion of objects, action and reaction, revolution of planets and satellites, conservation laws, principle of separation of different gases from air, melting / boiling / freezing, how bats use ultrasound to catch prey, etc.</p>
Identify the type of complex permanent and their role in a plant.	
Corelate the structure of epithelial tissues to their functions in an organism.	
Describe different types of connective tissues and relate their structure to specific functions.	
Compare the structure of different types of muscular tissues and relate it to their functions.	
Describe the structure of a neuron and explain the functioning of nervous tissue.	
Corelate the structure of epithelial tissues to their functions in an organism.	
Describe different types of connective tissues and relate their structure to specific functions.	Draws labelled diagrams / flow charts / concept map /graphs, such as biogeochemical cycles, cell organelles and tissues, human ear, distance-time and speed-time graphs, distribution of electrons in different orbits, process of distillation / sublimation, etc.

Compare the structure of different types of muscular tissues and relate it to their functions.	
Describe the structure of a neuron and explain the functioning of nervous tissue.	

## Test items

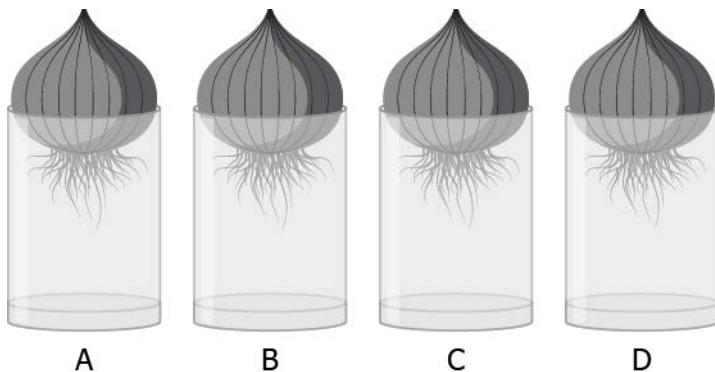


### **LOB : Describe the locations and function of meristematic tissue plants.**

- 1) What property does the meristematic tissue have that results in growth of the plants?
- (a) It is a large tissue.
  - (b) It is a dead tissue.
  - (c) It is a dividing tissue.
  - (d) It is a flexible tissue.

**Correct Answer:** Option (c)

2) A student did an experiment to study the role of meristematic tissue in onion roots. For the experiment, an onion was kept in each of the four glasses that were filled with same amount of water.



The student measures the length of the roots in all the glasses on day 3. The student then cuts about a 1 cm of the onion roots in glass B, C, and D every next day and measures the length of the root on day 10. The table shows the result of the experiment.

Glass	Root Length Day 3 (cm)	Day on which Onion was Root Cut	Length of Root on Day 10 (cm)
A	2.0	-	6.0
B	2.0	Day 4	1.0
C	2.0	Day 5	3.5
D	2.0	Day 6	5.0

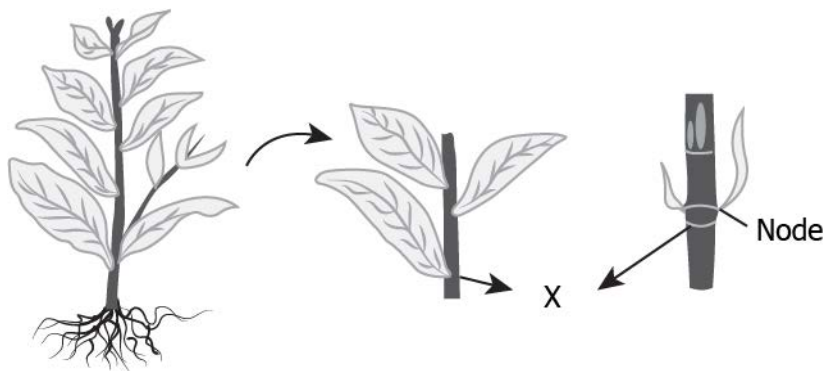
What can the student conclude from the experiment?

- (a) Roots develop meristematic tissue again when cut.
- (b) Roots grow faster after meristematic tissue is removed.
- (c) Roots stops growing when meristematic tissue is removed.
- (d) Roots with and without meristematic tissue had same growth.

**Correct Answer:** Option (c)

**LOB : Classify the meristematic tissue based on their location in the plant body.**

1) The image shows the stem of a plant.



Which type of meristematic tissue is present at the labelled part 'X'?

- (a) apical meristem

- (b) intercalary meristem
- (c) lateral meristem
- (d) both apical and lateral meristem

**Correct Answer:** Option (b)

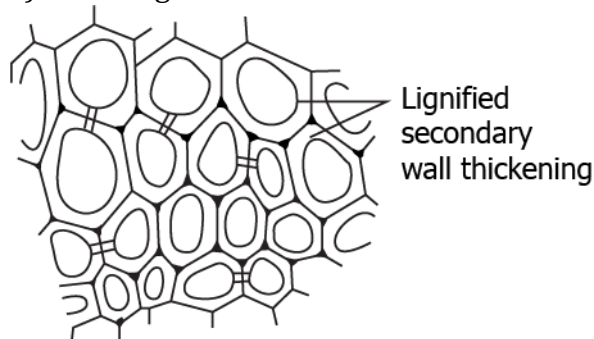
2) A student observes that the tree near his house is growing more in width than height. Which tissue is responsible for this type of growth?

- (a) apical
- (b) intercalary
- (c) lateral
- (d) both apical and intercalary

**Correct Answer:** Option (c)

**LOB : Identify the type of simple permanent tissues and their functions in a plant.**

1) The image shows the transverse structure of a sclerenchyma tissue.

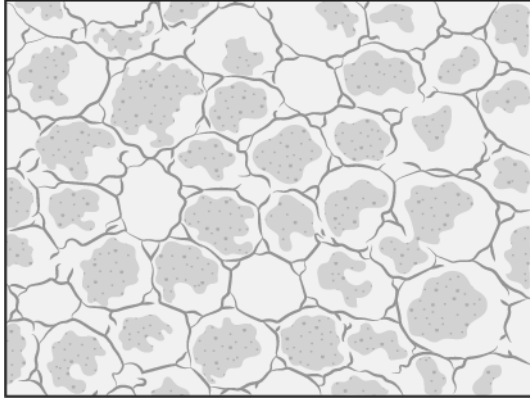


Which characteristic of sclerenchyma cells provides strength to the plant parts?

- (a) Presence of cells with regular shape
- (b) Presence of thin walls and dead cells
- (c) Presence of large spaces between the cell
- (d) Presence of thick walls and no internal space

**Correct Answer:** Option (d)

2) A class of students were shown a microscopic slide of a permanent tissue in plant for a test.



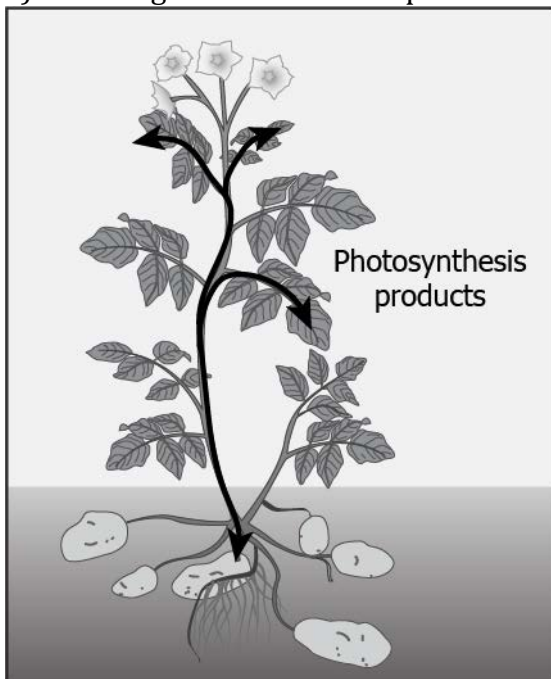
Which statement made by the student is correct about the tissue shown?

- (a) It is aerenchyma tissue as the large air spaces are present.
- (b) It is parenchyma tissue as the cells have intercellular spaces and thin walls.
- (c) It is sclerenchyma tissue as the cells are thick walled with no internal spacing.
- (d) It is collenchyma tissue as the cells are elongated with irregular thick corners.

**Correct Answer:** Option (b)

**LOB : Identify the type of complex permanent and their role in a plant.**

1) The image shows the transport of food after photosynthesis in parts of plant from leaves.

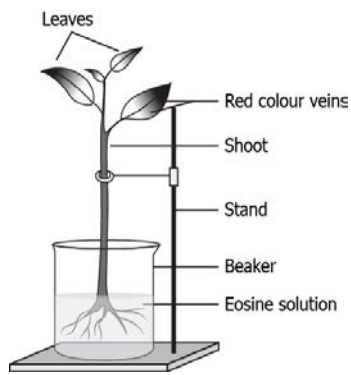


Which type of tissue is responsible for this transport?

- (a) collenchyma
- (b) phloem
- (c) sclerenchyma
- (d) xylem

**Correct Answer:** Option (b)

2) The image shows a setup of an experiment.



A student takes a leafy green Balsam plant and places it in Eosin solution. The solution is a red coloured dye. After 4 hours, the student observes that the red colour appears on the parts of the plant body. Which type of tissue is responsible for these changes?

- (a) xylem as it helps in the movement of water from roots to stem and leaves
- (b) phloem as it helps in the movement of water from roots to stem and leaves
- (c) xylem as it helps in the movement of water from leaves to roots and stem
- (d) phloem as it helps in movement of water from leaves to roots and stem

**Correct Answer:** Option (a)

**LOB : Classify different animal tissues based on their functions in the body**

1) Which animal tissue acts as a protective tissue of animal's body?

- (a) connective
- (b) epithelial
- (c) muscular



(d)nervous

**Correct Answer:** Option (b)

2) Muscles that are present in the eye helps the eyelids to blink when dust particles enter the eye. Which animal tissue signals the muscles in the eyelid to blink?

(a)connective tissue

(b)epithelial tissue

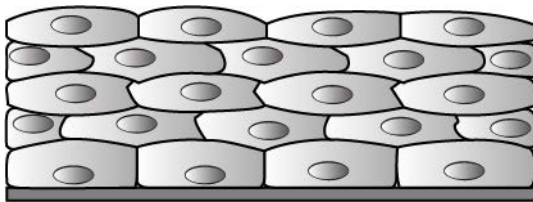
(c)muscular tissue

(d)nervous tissue

**Correct Answer:** Option (d)

**LOB : Corelate the structure of epithelial tissues to their functions in an organism.**

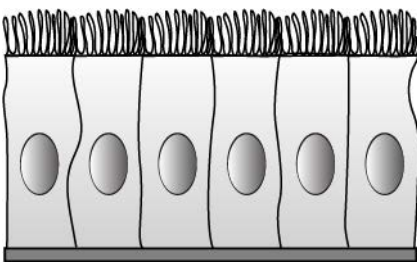
1) Which type of epithelial tissue will help in the movement of particles such as mucus out of the respiratory tract?



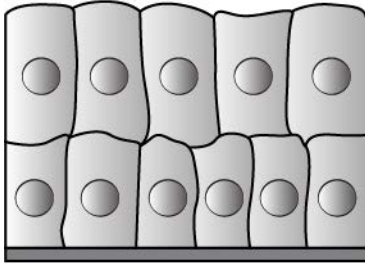
(a) Stratified squamous



(b) Simple cuboidal



(c) Simple columnar



(d) Stratified columnar

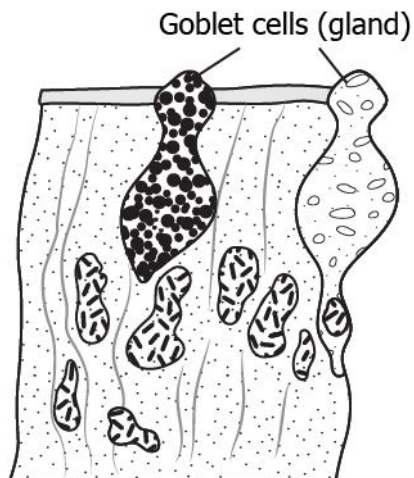
**Correct Answer:** Option (c)

2) Skin is the outermost layer of the body which provide protection from mechanical injuries as well as help in secretion of sweat and oils. Which type of epithelium is the skin likely composed of to facilitate all the mentioned functions?

- (a)epithelium having flat surface
- (b)epithelium arranged in many layers
- (c)epithelium with irregular shaped cells
- (d)epithelium with hair-like projections for particle movement

**Correct Answer:** Option (b)

3) The image shows the structure of a specialised epithelium.



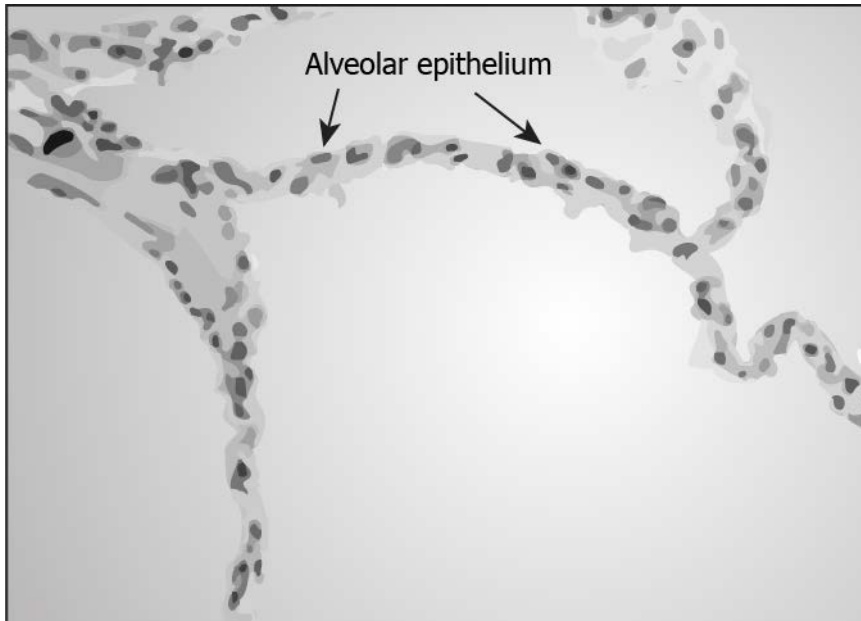
What will be the likely function of this epithelium?

- (a)secretion of substances
- (b)protection from wear and tear
- (c)restrict movement of the tissue

(d)transport of substances across permeable surface

**Correct Answer:** Option (a)

4) The image shows the microscopic view of lung alveoli.



What can be concluded about the function of the epithelium based on its structure?

- (a)multiple layer of the alveolar cells forms different tissues
- (b)single layer of alveolar cells supports easy transport of gases
- (c)single layer of alveolar cells provides the protection to the lungs
- (d)multiple layer of the alveolar cells facilitates movement of particles

**Correct Answer:** Option (b)

**LOB : Describe different types of connective tissues and relate their structure to specific functions.**

1) What should be the likely structure of a connective tissue whose framework supports the organs of the body?

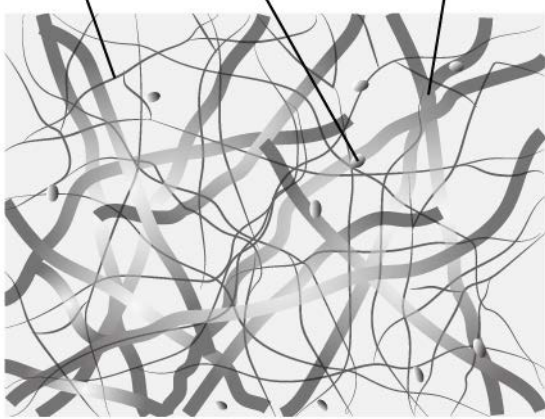
- (a) multiple layers like the skin
- (b) bundle of neurons like nerve
- (c) strong and non-flexible like bones

(d) relaxing and contracting like muscles

**Correct Answer:** Option (c)

2) A student studies the structure of areolar connective tissue found in blood vessels.

Elastin fiber      Fibroblasts      Collagen fiber

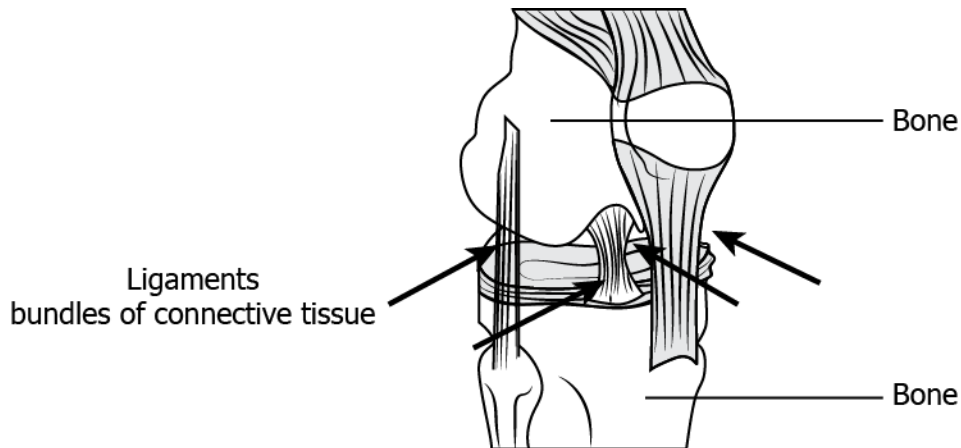


Which statement about the structure of the tissue is correct?

- (a) compact structure of fibers increases the strength
- (b) low number of fibers provide rigidity to the structure
- (c) loose arrangement of fibers fills the space inside organs and support it
- (d) random arrangement of fibers running in same direction provides elasticity

**Correct Answer:** Option (c)

3) The image shows the location of a connective tissue.

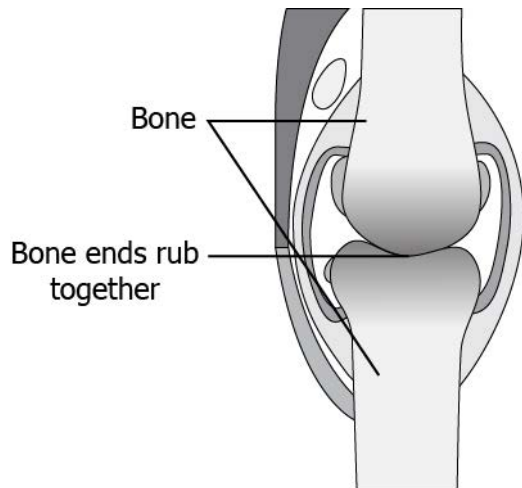


What will be the likely function of this connective tissue?

- (a) allow bones to move
- (b) provides strength to the bones
- (c) prevent the bones from bending
- (d) connects one bone with the other bones

**Correct Answer:** Option (d)

4) A student observes image of the knee bones of a person who is suffering from a condition called arthritis due to inflammation of joints.



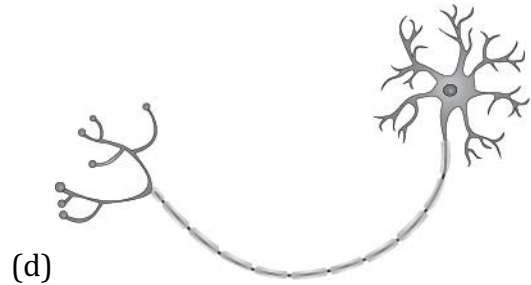
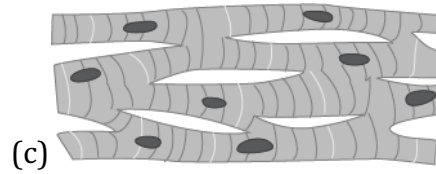
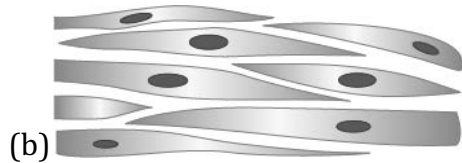
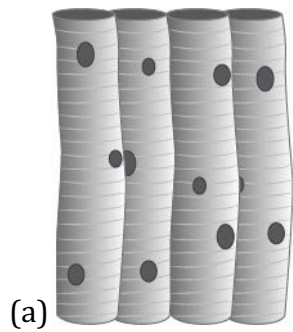
Which connective tissue can *likely* be added between the bones to ease the movement of joints?

- (a) blood as it contains proteins
- (b) areolar tissue as it repairs the tissue
- (c) ligament as it joins the two bones easily
- (d) cartilage as it smoothens surface of the bones

**Correct Answer:** Option (d)

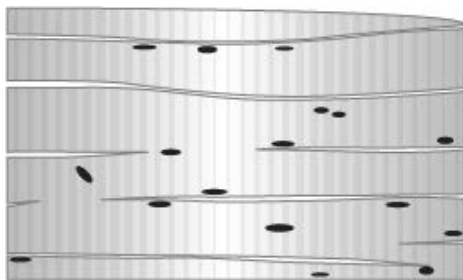
**LOB : Compare the structure of different types of muscular tissues and relate it to their functions.**

1) What is the structure of a muscle that supports voluntary movements of the body?



**Correct Answer:** Option (a)

2) The image shows the microscopic view of a type of muscle.

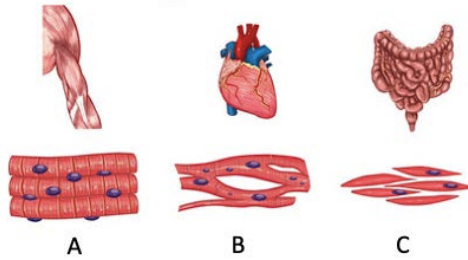


Which statement can be made by the student to confirm that the tissue is skeletal muscle?

- (a) repetitive rows of nuclei with long cells
- (b) cylindrical cell with single nucleus in each cell
- (c) alternative light and dark coloured cell with branching
- (d) alternative bands of light and dark colour with multinucleated cells

**Correct Answer:** Option (d)

3) The image shows the structure of different types of tissues.

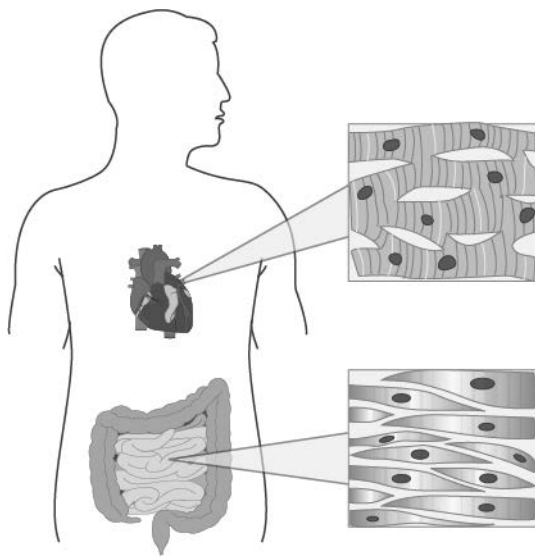


Which function is likely performed by the tissue B?

- (a) movement of body
- (b) rapid movement of iris of the eye
- (c) contraction and relaxation of heart
- (d) downward movement of food in the alimentary canal

**Correct Answer:** Option (c)

4) The image shows the structure of two type of muscles that are present in two different locations in the human body.



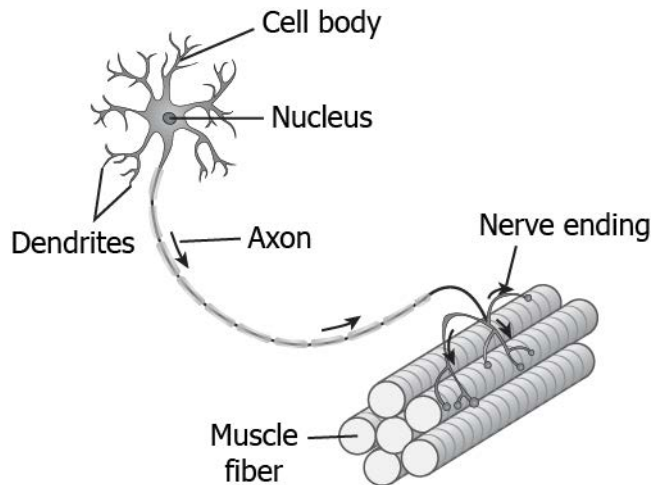
Based on their location what can be concluded about their function?

- (a) both the muscles protects body organs
- (b) both the muscles show voluntary movements
- (c) both the muscles helps in movement of body
- (d) both the muscles show involuntary movements

**Correct Answer:** Option (d)

**LOB : Describe the structure of a neuron and explain the functioning of nervous tissue.**

1) The image shows the transfer of nerve impulse to muscles for their movement.



Which structure of neuron is responsible for transfer of impulse to muscles?

- (a) cell body
- (b) dendrites
- (c) nerve endings
- (d) nucleus

**Correct Answer:** Option (c)

2) A person accidentally touches a hot plate. What makes the person to move its fore limb away from the hot plate?

- (a) smooth muscle
- (b) nerve impulse
- (c) size of the plate
- (d) temperature of the body

**Correct Answer:** Option (b)

3) In case of an injury, the tissue senses the pain. Which statement correctly describe how the nerve impulse will reach the tissue?



- (a) From axon of a neuron to the nucleus that are present in the tissue
- (b) From cell body of a neuron to the nerve ending that are located on the tissue
- (c) From nerve ending of a neuron to the cell body that are present in the neuron
- (d) From dendrite of a neuron to the other dendrite that are located on the tissue

**Correct Answer:** Option (b)

4) A student conducts an experiment by applying placing an ice cube on the hands of four different individuals. The student recorded the time they took to respond towards the stimuli by dropping the ice cube

What can be concluded from the experiment about the function of nervous tissue?

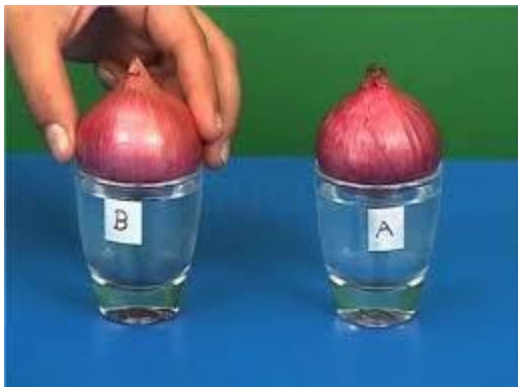
- (a) nerve fibers passes signals very fast
- (b) nerve impulse depends on the length of the hand
- (c) response by nerve fibers depend on duration of the stimuli
- (d) different individuals have different types of nervous tissue

**Correct Answer:** Option (a)

# Suggested Teacher Resources



## Activity

Activity	Growth in Meristematic tissue																					
Vocabulary	Meristematic tissue,																					
Procedure	<ol style="list-style-type: none"> <li>1. Take two glasses and fill them with water.</li> <li>2. Take two onions and place one on each glass</li> </ol>  <ol style="list-style-type: none"> <li>3. Observe the growth of roots in both the onions for a few days and record the length of the root on Day 1,2, and 3.</li> <li>4. On day 4, cut the root tips of onion in glass B by about 2 cm, and observe the growth of root of both onions and record the length of the root for the next 3 days.</li> </ol> <table border="1" data-bbox="404 1339 1455 1549"> <thead> <tr> <th>Length</th> <th>Day 1</th> <th>Day 2</th> <th>Day 3</th> <th>Day 4</th> <th>Day 5</th> <th>Day 6</th> </tr> </thead> <tbody> <tr> <td>Glass A</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Glass B</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Length	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Glass A							Glass B						
Length	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6																
Glass A																						
Glass B																						
Let's think	<ol style="list-style-type: none"> <li>1. Which of the two onions has longer roots. Why?</li> <li>2. Do the roots continue growing even after we have removed the their tips?</li> <li>3. Why would the tips stop growing in glass B after we cut them?</li> </ol>																					

Text to real world connection	The growth of the plants occurs in certain regions like roots and branches.
Beyond the classroom	Is there any plant which doesn't have meristematic tissue?

## 2

## Activity

Activity	Make model of different types of cells
Material required	Big coloured beads, and thread.
Procedure	<ol style="list-style-type: none"> <li>1. Weave beads to make different parts of a neuron.</li> <li>2. Weave beads in circle to make the cell body.</li> <li>3. Bind all the parts together as shown in picture.</li> </ol>
Reflection question	<ol style="list-style-type: none"> <li>1. What is the function of neuron?</li> <li>2. How is different from other cells?</li> </ol>

## 7. Diversity in Living Organisms

**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Classification and evolution	Identify the characteristic difference between earlier evolved and later evolved living beings.
The hierarchy of classification groups	Identify the basis for classification of organisms into kingdoms and name the various levels in a kingdom.
	Examine the characteristic criterion between the five kingdoms (monera, protista, fungi, plantae and animalia) and categorise species into a particular kingdom on this basis.
Plantae and Animalia	Identify the characteristic differences in order to categorise living organisms into two biggest kingdoms, i.e., plantae and animalia kingdom.
Classification of plants	Acquire the skill of classifying a plant species into different groups on the basis of their characteristic features.
	Classify plants into different groups based on characteristic features of body design and presence of vascular tissues.
	Classify plants into different groups based on their ability to bear seed and the nature of seeds.
Classification of animals	Acquire the skill of classifying animals into different groups on the basis of their body design.
	Identify the characteristic features of different animal groups and distinguish between them. (cyclostomata, pisces, amphibia, reptilia, aves and mammalia)

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Identify the characteristic features of different animal groups and distinguish between them. (cyclostomata, pisces, amphibia, reptilia, aves and mammalia)	Differentiates materials / objects / organisms / phenomena / processes, based on such as prokaryote and eukaryote, plant cell and animal cell, diffusion and osmosis, simple and complex tissues, distance and displacement, speed and velocity, balanced and unbalanced forces, element, compound and mixture, solution, suspension and colloid, isobars and isotopes, etc.
Examine the characteristic criterion between the five kingdoms (monera, protista, fungi, plantae and animalia) and categorise species into a particular kingdom on this basis.	Classifies materials / objects / organisms / phenomena / processes, based on, properties / characteristics, such as classification of plants, animals under various hierarchical sub-groups, natural resources, classification of matter based on their states (solid / liquid / gas) and composition (element / compound / mixture), etc.
Identify the characteristic differences in order to categorise living organisms into two biggest kingdoms, i.e., plantae and animalia kingdom.	
Acquire the skill of classifying a plant species into different groups on the basis of their characteristic features.	
Classify plants into different groups based on characteristic features of body design and presence of vascular tissues.	
Classify plants into different groups based on their ability to bear seed and the nature of seeds.	
Acquire the skill of classifying animals into different groups on the basis of their body design.	

Identify the characteristic difference between earlier evolved and later evolved living beings.	Explains processes and phenomena, such as function of different organelles, spread of diseases and their prevention, effect of force on the state of motion of objects, action and reaction, revolution of planets and satellites, conservation laws, principle of separation of different gases from air, melting / boiling / freezing, how bats use ultrasound to catch prey, etc.
Examine the characteristic criterion between the five kingdoms (monera, protista, fungi, plantae and animalia) and categorise species into a particular kingdom on this basis.	Draws labelled diagrams / flow charts / concept map / graphs, such as biogeochemical cycles, cell organelles and tissues, human ear, distance-time and speed-time graphs, distribution of electrons in different orbits, process of distillation / sublimation, etc.
Identify the characteristic differences in order to categorise living organisms into two biggest kingdoms, i.e., plantae and animalia kingdom.	
Identify the basis for classification of organisms into kingdoms and name the various levels in a kingdom.	Uses scientific conventions / symbols / equations to represent various quantities / elements / units, such as SI units, symbols of elements, formulae of simple compounds, chemical equations, etc.
Identify the characteristic difference between earlier evolved and later evolved living beings.	Draws conclusion, such as classification of life forms is related to evolution, deficiency of nutrients affects physiological processes in plants, matter is made up of particles, elements combine chemically in a fixed ratio to form compounds, action and reaction act on two different bodies, etc.
Identify the characteristic differences in order to categorise living organisms into two biggest kingdoms, i.e., plantae and animalia kingdom.	
Examine the characteristic criterion between the five kingdoms (monera, protista, fungi, plantae and animalia) and categorise species into a particular kingdom on this basis.	<b>Describes scientific discoveries / inventions</b> , such as discovery of various atomic models, discovery of cell with invention of microscope, experiments of Lavoisier and Priestley, beliefs regarding motion, discovery of real cause for peptic ulcers, Archimedes principle, classification of living things, etc.

# Test items

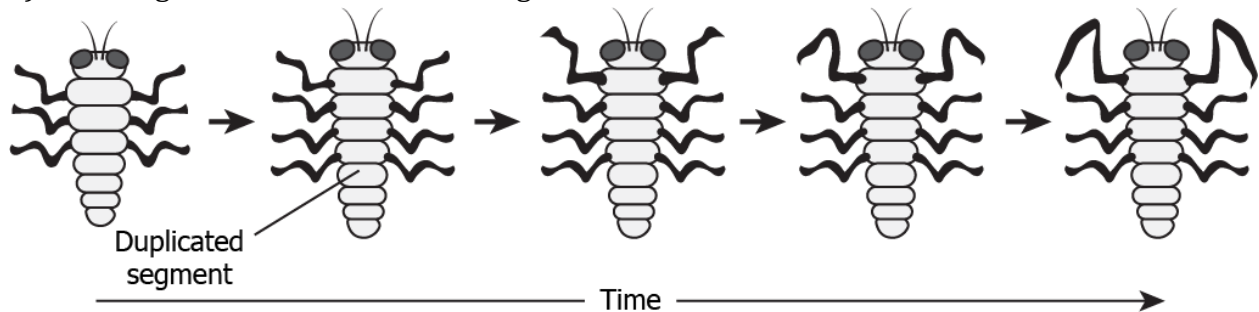


## **LOB : Identify the characteristic difference between earlier evolved and later evolved living beings**

- 1) Which statement is true about earlier and later living beings?
- (a) Both the earlier as well as later living beings have simple structures.
  - (b) Both the earlier as well as later living beings have the complexity structures.
  - (c) Earlier living beings had basic structure while later living beings have complex structure.
  - (d) Earlier living beings had complex structure while later living beings have simple basic structure.

**Correct Answer:** Option (c)

- 2) The image shows an insect evolving.



What can be inferred about the body of the insect from the image?

- (a) retains its body design of the past
- (b) changes in color over generations
- (c) loses a pair of limbs over generations
- (d) gains structural modifications with time

**Correct Answer:** Option (d)

## **LOB : Identify the basis for classification of organisms into kingdoms and name the various levels in a kingdom.**

- 1) In Whittaker's classification, what was the basis for classify organisms into five kingdoms?

- (a) Cell size, mode of locomotion, body size
- (b) Cell number, source of nutrition, body size

(c) Cell shape, mode of locomotion, body organization

(d) Cell structure, source of nutrition, body organization

**Correct Answer:** Option (d)

2) Himanshu wants to make a chart on classification of mimosa plant. Which hierarchy of classification will he choose?

(a)

Kingdom  
Phylum  
Class  
Order  
Family  
Genus  
Species

(b)

Kingdom  
Division  
Class  
Order  
Family  
Genus  
Species

(c)

Kingdom  
Phylum  
Order  
Class  
Family  
Genus  
Species

(d)



Kingdom  
 Division  
 Order  
 Class  
 Family  
 Genus  
 Species

**Correct Answer:** Option (b)

**LOB : Examine the characteristic criterion between the five kingdoms (monera, protista, fungi, plantae and animalia) and categorise species into a particular kingdom on this basis.**

1) Which option correctly differentiates the kingdom fungi from kingdom plantae?

(a)

<b>Kingdom Fungi</b>	<b>Kingdom Plantae</b>
It includes heterotrophs.	It includes heterotrophs as well as autotrophs.

(b)

<b>Kingdom Fungi</b>	<b>Kingdom Plantae</b>
It includes heterotrophs as well as autotrophs.	It includes heterotrophs.

(c)

<b>Kingdom Fungi</b>	<b>Kingdom Plantae</b>
It includes multicellular organisms that lack a cell wall.	It includes unicellular organisms that have a cell wall.

(d)

<b>Kingdom Fungi</b>	<b>Kingdom Plantae</b>
It includes unicellular organisms that lack a cell wall.	It includes multicellular organisms having a cell wall.

**Correct Answer:** Option (a)

2) The table lists characteristics of the cell of two species.

<b>Species P</b>	<b>Species Q</b>
<ul style="list-style-type: none"> <li>● The cells of these organisms do not have a defined nucleus or organelles.</li> </ul>	<ul style="list-style-type: none"> <li>● The cells of these organisms have appendages like cilia to move and have a nucleus.</li> </ul>
<ul style="list-style-type: none"> <li>● They may or may not contain a cell wall.</li> </ul>	<ul style="list-style-type: none"> <li>● They may or may not contain a cell wall.</li> </ul>

Based on the table, which kingdom does the organisms belong to?

- (a) Species P- Protozoa, Species Q- Monera
- (b) Species P- Animalia, Species Q- Protozoa
- (c) Species P- Monera, Species Q- Protista
- (d) Species P- Protista, Species Q- Animalia

**Correct Answer:** Option (c)

**LOB : Identify the characteristic differences in order to categorise living organisms into two biggest kingdoms, i.e., plantae and animalia kingdom.**

- 1) What is the basis for classification of organisms in the kingdom plantae and animalia?
- (a) presence of cell wall
  - (b) ability to prepare food
  - (c) ability to undergo reproduction

(d) presence of more than one cell

**Correct Answer:** Option (d)

2) A new organism was found by a biologist. The organism was a multicellular organism; however, it was not categorized into the kingdom plantae. What can be a likely reason for this?

(a) It cannot prepare its own food.

(b) It had cells with cell wall.

(c) It was very small in size.

(d) It could survive in water.

**Correct Answer:** (a)

**LOB : Acquire the skill of classifying a plant species into different groups on the basis of their characteristic features.**

1) Some plants have simple structures and do not have well differentiated body. These plants are classified as:

(a) gymnosperms

(b) pteridophytes

(c) thallophytes

(d) bryophytes

**Correct Answer:** Option (c)

2) A student was given two unknown plants 1 and 2. She classified plant 1 as pteridophyte and plant 2 as gymnosperm. What characteristic did plant 2 have that was missing in plant 1?

(a) leaves

(b) roots

(c) flowers

(d) woody stem

**Correct Answer:** Option (d)

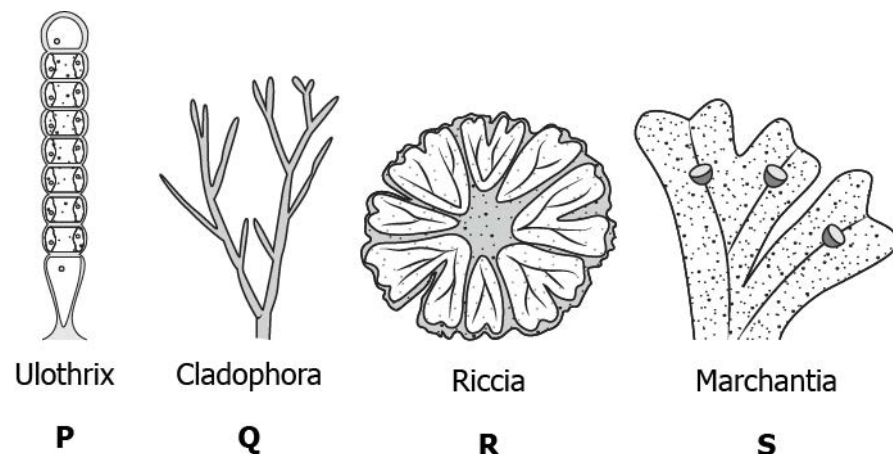
**LOB : Classify plants into different groups based on characteristic features of body design and presence of vascular tissues.**

1) Marsilea and fern are classified as pteridophytes rather than bryophytes because\_\_\_\_\_.

- (a) they have specialized tissue for transportation of water.
- (b) they have a body that is not differentiated into root, stem, and leaves.
- (c) they can reproduce only by asexual method.
- (d) they are found on both land and in water.

**Correct Answer:** Option (a)

2) The image shows some aquatic organisms.



Plant P and Q are classified as thallophytes and R and S as bryophytes. What criteria is used to classify them?

- (a) stem length
- (b) body design
- (c) presence of seeds
- (d) number and shape of leaves

**Correct Answer:** Option (b)

**LOB : Classify plants into different groups based on their ability to bear seed and the nature of seeds.**

1) An apple plant develops seeds inside an ovary that modifies and turns into a fruit. The characteristics of the apple plant helps classify it into which plant group?

- (a) Gymnosperm
- (b) Bryophyta
- (c) Angiosperm

(d)Pteridophyta

**Correct Answer:** Option (c)

2) A student is collecting plants that can be grouped as phanerogams. The table list some plants found by the student.

- Plant A: It has reproductive organs present underside the leaf and are hidden.
- Plant B: It has simple filamentous structure with no reproductive part visible.
- Plant C: It has well differentiated reproductive parts that can make seeds.
- Plant D: It has no reproductive organs and reproduces asexually.

Which plant can be grouped as phanerogams?

- (a)A
- (b)B
- (c)C
- (d)D

**Correct Answer:** 3

**LOB : Acquire the skill of classifying animals into different groups on the basis of their body design.**

1) Which group consists of animals with pores that help in circulating water by forming canal system?

- (a)Platyhelminthes
- (b)Cnidaria
- (c)Porifera
- (d)Annelida

**Correct Answer:** Option (c)

2) The table lists some features to classify animals into a group.

Group X
<ul style="list-style-type: none"><li>● The Body has bilateral symmetry.</li><li>● The body is divided into many segments.</li></ul>

Which animal can be added into the group X?

(a)



(b)



(c)



(d)



**Correct Answer:** Option (c)

**LOB : Identify the characteristic features of different animal groups and distinguish between them. (cyclostomata, pisces, amphibia, reptilia, aves and mammalia)**

1) Which characteristic of Pisces helps differentiates it from Reptilia?

- (a) absence of backbone
- (b) ability to lay eggs
- (c) presence of scales
- (d) two-chambered heart

**Correct Answer:** Option (d)

2) During a biology session, a teacher shows two specimens of organisms (P and Q) to the students. A student claimed specimen P belongs to the class Reptilia and Q belongs to the class Aves. Which option justifies the claim made by the student?

(a)

Specimen P	Specimen Q
The organism body is divided into segments.	The organism not divided into segments.

(c)

Specimen P	Specimen Q
The organism lacks scales.	The specimen has scales.

(b)

Specimen P	Specimen Q
The organism has three chambered heart.	The organism has four chambered heart.

(d)

Specimen P	Specimen Q
The organism respire through lungs.	The organism respire through gills.

**Correct Answer:** Option (b)

# Suggested Teacher Resources



## Activity

Activity	Classify plants depending on their ability to bear seeds and if seeds are enclosed within fruits to gain the skills of classification of species
Prerequisite	Classification of seeds
Material Required	Seeds of green gram, wheat, maize, peas and tamarind, water.
Vocabulary	Gymnosperms, angiosperms, dicots, monocots
Procedure	<ol style="list-style-type: none"> <li>1. Soak seeds of green gram, wheat, maize, peas and tamarind in water overnight.</li> <li>2. Once they become tender, try to split the seed.</li> </ol>
Let's think	<ol style="list-style-type: none"> <li>1. Do these seeds develop inside an organ of plant?</li> <li>2. Do all seeds break into two nearly equal halves?</li> </ol>
Text to real world connection	Most monocots are small herbaceous plants, whereas dicots come in all shapes and sizes. One of the reasons for this is that large plants need a good support system, which is provided in dicots by the woody stem and root. Monocots do not often grow into trees, because they do not have any woody tissue.
Beyond the classroom	<ol style="list-style-type: none"> <li>1. Take a look at the roots, leaves and flowers of these plants.</li> <li>2. Are the roots tap-roots or fibrous?</li> <li>3. Do the leaves have parallel or reticulate venation?</li> <li>4. How many petals are found in the flowers of these plants?</li> <li>5. Write down characteristics of monocots and dicots on the basis of these observations.</li> </ol>



# 8. Motion

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**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Motion along a straight line	Differentiate between the distance and displacement and calculate them in real situations.
Uniform motion and Non-uniform motion	Calculate and compare speed of an object at different intervals of time and differentiate between uniform and non-uniform motion.
	Calculate average speed of an object.
Speed with direction	Distinguish between speed and velocity and calculate average velocity.
Rate of change of velocity	Define accelerated motion and compute the change in velocity of a moving object in a non-uniform motion.
Graphical representation of motion	Plot distance-time graph for a moving object and determine its speed, velocity, acceleration.
	Construct velocity-time graphs and interpret them to determine speed, velocity, acceleration.
Equations of Motion by Graphical Method	Extrapolate velocity-time graphs to derive velocity-time, position-time & position-velocity relations.
Uniform Circular Motion	Calculate speed of an object traveling in a uniform circular motion.

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Differentiate between the distance and displacement and calculate them in real situations.	Differentiates materials / objects / organisms / phenomena / processes, based on such as prokaryote and eukaryote, plant cell and animal cell, diffusion and osmosis, simple and complex tissues, distance and displacement, speed and velocity, balanced and unbalanced forces, element, compound and mixture, solution, suspension and colloid, isobars and isotopes, etc.
Calculate and compare speed of an object at different intervals of time and differentiate between uniform and non-uniform motion.	
Calculate average speed of an object.	
Calculate and compare speed of an object at different intervals of time and differentiate between uniform and non-uniform motion.	<b>Calculates using the data given</b> , such as distance, velocity, speed, frequency, work done, number of moles in a given mass of substance, concentration of solution in terms of mass by mass percentage of substances, conversion of Celsius scale to kelvin scale and vice versa, number of neutrons in an atom from atomic number and mass number, speed of sound, kinetic and potential energies of an object, boiling points of liquids to predict the order of their separation from the mixture, etc.
Calculate average speed of an object.	
Distinguish between speed and velocity and calculate average velocity.	
Define accelerated motion and compute the change in velocity of a moving object in a non-uniform motion.	
Plot distance-time graph for a moving object and determine its speed, velocity, acceleration.	Draws labelled diagrams / flow charts / concept map /graphs, such as biogeochemical cycles, cell organelles and tissues, human ear, distance-time and speed-time graphs, distribution of electrons in different orbits, process of distillation / sublimation, etc.
Construct velocity-time graphs and interpret them to determine speed, velocity, acceleration.	
Plot distance-time graph for a moving object and determine its speed, velocity, acceleration.	<b>Analyses and interprets graphs / figures</b> etc., such as distance-time and velocity-time graphs, computing distance / speed / acceleration of objects in motion, properties of components of a mixture to identify the appropriate method of separation, crop yield after application of fertilizers, etc.
Construct velocity-time graphs and interpret them to determine speed, velocity, acceleration.	

Extrapolate velocity-time graphs to derive velocity-time, position-time & position-velocity relations.	
Extrapolate velocity-time graphs to derive velocity-time, position-time & position-velocity relations.	Derives formulae / equations / laws, such as mathematical expression for second law of motion, law of conservation of momentum, expression for force of gravity, equations of motion from velocity-time graphs, etc.
Calculate speed of an object traveling in a uniform circular motion.	

## Test items



### **LOB : Differentiate between the distance and displacement and calculate them in real situations**

1) A boy walks 10m in straight path moving away from a lamp pole in a garden and walks 5m back on the same path. What is the displacement of the boy from the lamp pole?

- (a) 0m
- (b) 5m
- (c) 10m
- (d) 15m

**Correct Answer:** Option (b)

2) A car travels 5 km towards north than turns right and travels 3km further, the car again turns right and travel 1 km and comes to rest. What is the distance travelled and displacement of the car?

- (a) Distance: 5km and Displacement: 9km
- (b) Distance: 9km and Displacement: 5km
- (c) Distance: 9km and Displacement: 7km
- (d) Distance: 7km and Displacement: 9km

**Correct Answer:** Option (b)

**LOB : Calculate and compare speed of an object at different intervals of time and differentiate between uniform and non-uniform motion.**

1) Two cars X and Y are travelling along a straight road. The two cars are said to be in uniform motion when:

- (a) the two cars travel with same speed
- (b) they continuously travel along the straight road
- (c) the speed of the cars reduces with the same rate
- (d) the two cars travel equal distance in equal interval of time

**Correct Answer:** Option (d)

2) The table shows the distance covered by three cars A, B and C at different times of a day.

	<b>Car A</b>	<b>Car B</b>	<b>Car C</b>
<b>Time</b>	<b>Distance Travelled (km)</b>	<b>Distance Travelled (km)</b>	<b>Distance Travelled (km)</b>
1:00 PM	0	0	0
1:30 PM	2	2	1
2:00 PM	5	4	3
2:30 PM	7	6	4

Which option classifies the cars in uniform motion and non-uniform motion?

(a)

<b>Uniform Motion</b>	<b>Non-Uniform Motion</b>
Car A	Car C
Car B	

(b)

<b>Uniform Motion</b>	<b>Non-Uniform Motion</b>
Car B	Car A
	Car C

(c)

Uniform Motion	Non-Uniform Motion
Car A	Car B
	Car C

(d)

Uniform Motion	Non-Uniform Motion
Car B	Car A
Car C	

**Correct Answer:** Option (b)**LOB : Calculate average speed of an object.**

1) A car travels 3 km of distance in 10 minutes to reach the destination. On the return journey, the car travels the same distance in 15 minutes. What is the average speed of car in entire journey?

- (a) 3 m/ s
- (b) 4 m/ s
- (c) 5 m/ s
- (d) 6 m/ s

**Correct Answer:** Option (b)

2) A student completes his journey from his house to school with an average speed of 5 m/ s in 10 minutes. If the student travels with the speed of 5 m/ s in first 4 minutes. What will be its speed in next 6 minutes?

- (a) 5 m/ s
- (b) 7.5 m/ s
- (c) 10 m/ s
- (d) 12.5 m/ s

**Correct Answer:** Option (a)

**LOB : Distinguish between speed and velocity and calculate average velocity.**

1) A car travels on a straight road with a velocity of 25km/ hour in first one hour and in the next one hour it changes its speed to 35km/ hour. What is the average velocity of the car?

- (a) 5 km/ hour
- (b) 10 km/ hour
- (c) 30 km/ hour
- (d) 60 km/ hour

**Correct Answer:** Option (c)

2) A student jogs on the track of 150m long. The student starts jogging on the track and reaches the end of the track in 1 minute 30 seconds and comes back to the middle of the track in 1 minute. What is the average velocity of the student?

- (a) 0 m/ sec
- (b) 0.5 m/ sec
- (c) 1.25 m/ sec
- (d) 1.5 m/ sec

**Correct Answer:** Option (b)

**LOB : Define accelerated motion and compute the change in velocity of a moving object in a non-uniform motion.**

1) A person rides a motor bike at the speed of 30m/ s. The person applies the brake and the velocity of motor bike comes down to 20m/ s in 3 s. What is the magnitude of acceleration of motor bike?

- (a) - 3.3 m/ sec
- (b) - 6.6 m/ sec
- (c) 10 m/ sec
- (d) 16.6 m/ sec

**Correct Answer:** Option (a)

2) A car is travelling on a path. Below tables show the velocity of a car on each path at different intervals of time.

Path	Initial Velocity (m/s)	Final Velocity (m/s)	Time (s)
A to B	0	20	10
B to C	20	30	5
C to D	30	25	5

Which option is showing the magnitude of acceleration of the car on each path?

(a)

Path	Acceleration (m/s <sup>2</sup> )
A to B	2
B to C	2
C to D	-1

(b)

Path	Acceleration (m/s <sup>2</sup> )
A to B	2
B to C	6
C to D	5

(c)

Path	Acceleration (m/s <sup>2</sup> )
A to B	-2
B to C	-2
C to D	1

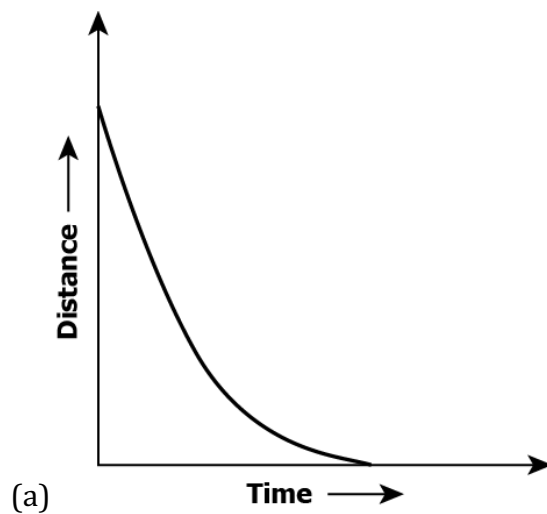
(d)

Path	Acceleration (m/s <sup>2</sup> )
A to B	1
B to C	2
C to D	1

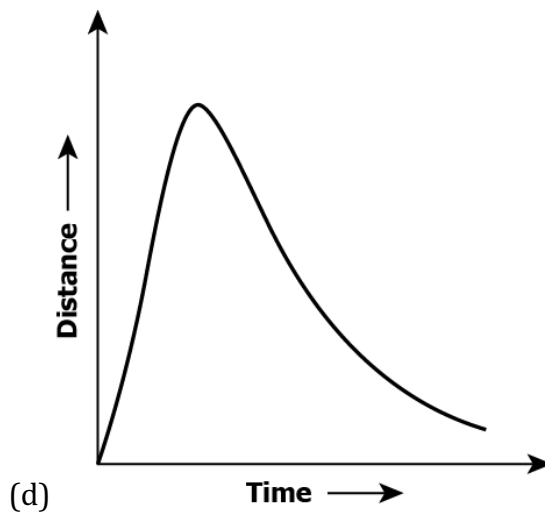
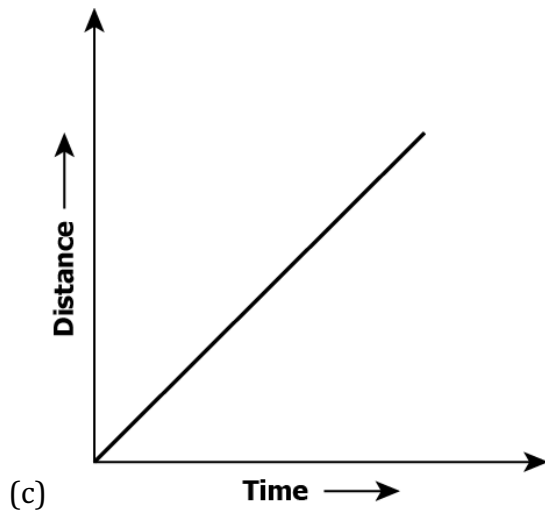
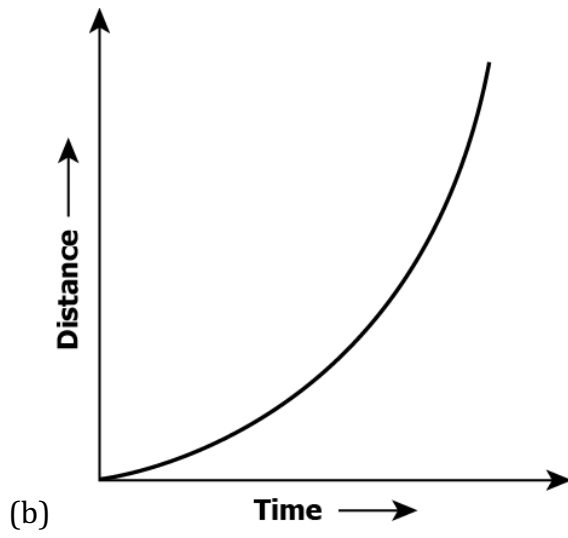
**Correct Answer:** Option (a)

**LOB : Plot distance-time graph for a moving object and determine its speed, velocity, acceleration.**

1) Which distance time graph is representing an object in uniform motion?

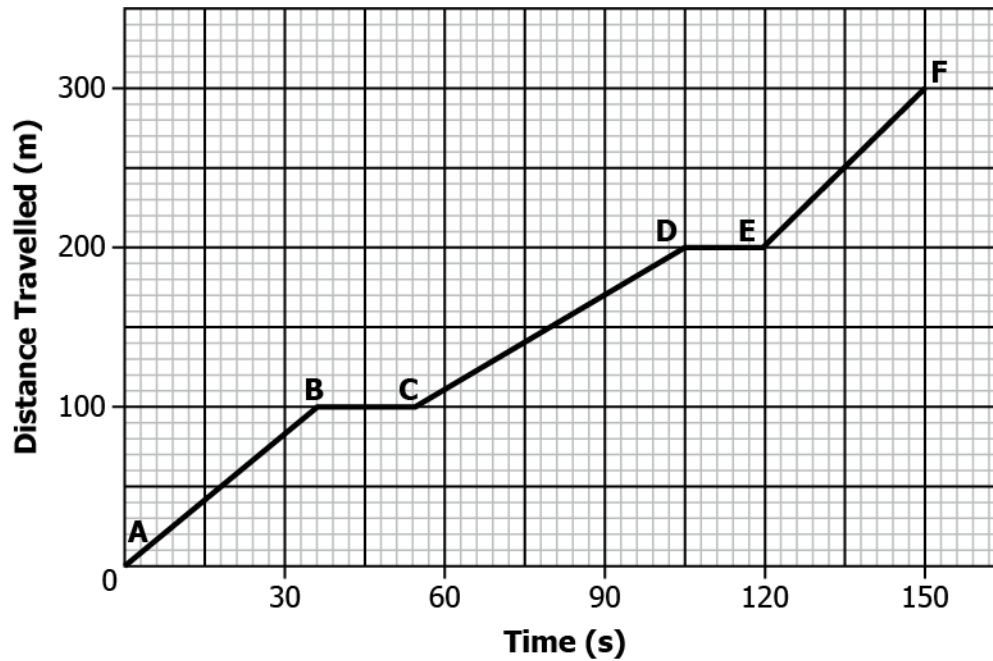






**Correct Answer:** Option (c)

2) The graph shows the distance travelled by a car and the time taken by the car.



Between which points the car travels the fastest?

- (a) A to B
- (b) B to C
- (c) C to D
- (d) E to F

**Correct Answer:** Option (d)

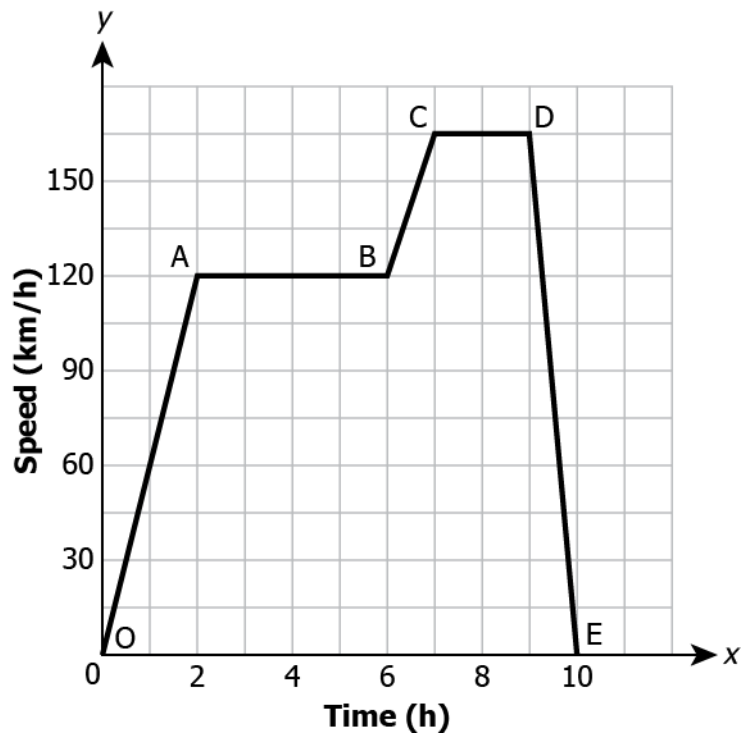
**LOB : Construct velocity-time graphs and interpret them to determine speed, velocity, acceleration.**

1) The area under the velocity-time graph of a body gives:

- (a) speed of the body
- (b) retardation of the body
- (c) acceleration of the body
- (d) distance travelled by the body

**Correct Answer:** Option (d)

2) The graph shows the change in velocity of a car with time.



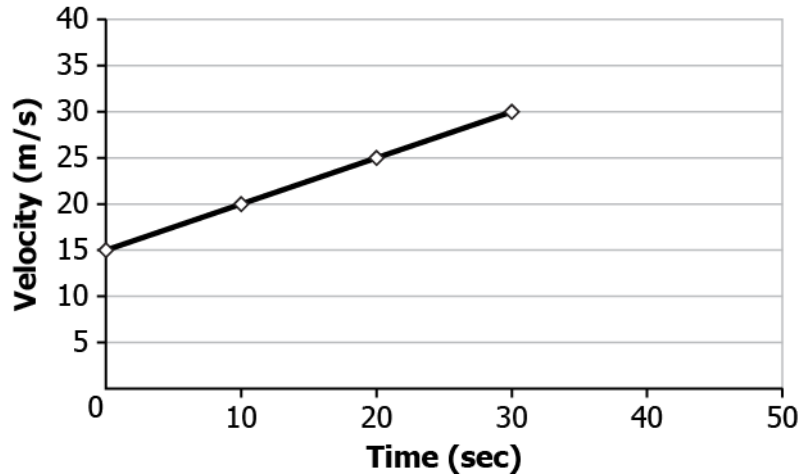
Which portion of the graph shows the negative acceleration for the car?

- (a) OA
- (b) AB
- (c) CD
- (d) DE

**Correct Answer:** Option (d)

**LOB : Extrapolate velocity-time graphs to derive velocity-time, position-time & position-velocity relations.**

1) The graph shows the rate of change of the speed of the car.

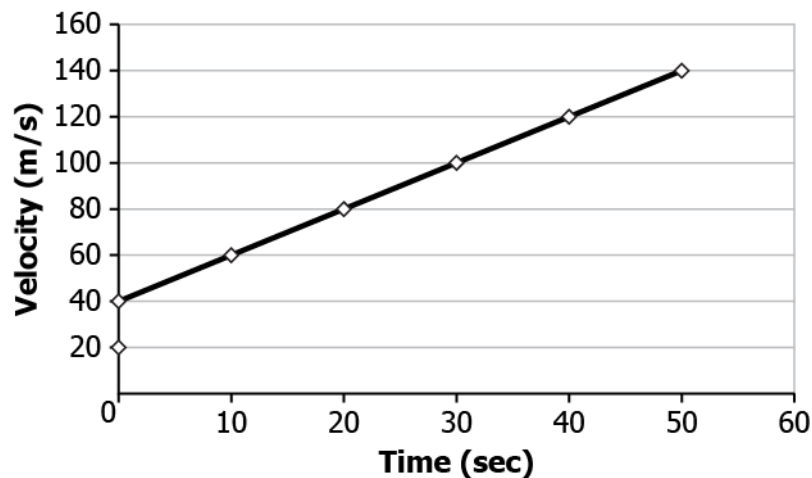


What will be the velocity of the car at 40 s?

- (a) 15 m/ s
- (b) 20 m/ s
- (c) 35 m/ s
- (d) 40 m/ s

**Correct Answer:** Option (c)

2) The graph shows the rate of change of speed of a train.



How much distance the train will cover at 60 seconds if it is accelerating with  $2 \text{ m/ s}^2$ ?

- (a) 2000 m
- (b) 4500 m
- (c) 6000 m
- (d) 8500 m

**Correct Answer:** Option (c)

**LOB : Calculate speed of an object traveling in a uniform circular motion.**

1) A student ties a stone to a thread of length 1 m and starts swinging it in a circular motion. The stone completes 20 rotations in 10 seconds. With what speed the stone is moving?

- (a)  $\pi \text{ m/ sec}$
- (b)  $2\pi \text{ m/ sec}$
- (c)  $4\pi \text{ m/ sec}$
- (d)  $8\pi \text{ m/ sec}$

**Correct Answer:** Option (c)

2) A cyclist riding a bicycle at a constant speed of  $10 \text{ m/ s}$  on a circular track. The cyclist completes the three rounds of a track in 6 minutes. What is the radius of the circular track?

- (a) 191 m
- (b) 573 m
- (c) 1200 m
- (d) 3600 m

**Correct Answer:** Option (a)

# Suggested Teacher Resources



## Activity

Objective	Compute the change in velocity of a moving object in a non-uniform motion, in order to correctly calculate its acceleration
Prerequisite	Motion, velocity, difference between distance and displacement.
Material Required	Cardboard, ball
Vocabulary	Rate, positive acceleration, negative acceleration, uniform and non-uniform acceleration
Procedure	<ol style="list-style-type: none"> <li>1. Fold the cardboard from both end and set it as shown in the picture.           <div data-bbox="548 1016 1273 1352" data-label="Image"> </div> </li> <li>2. Release the ball on an inclined plane.</li> </ol>
Reflection Questions	<ol style="list-style-type: none"> <li>1. Was there any change in the speed of the ball? If yes, then what can be the reason?</li> <li>2. When was the acceleration positive, negative and zero?</li> <li>3. With the help of V-T graph, can you represent uniform and non-uniform acceleration.</li> </ol>
Text to real world connection	<ol style="list-style-type: none"> <li>1. Bus slowing down or speeding up.</li> <li>2. When you try to stop a rolling ball.</li> </ol>

Beyond the classroom	A car starting from rest acquires a velocity of 36 km/ h in 5 s. Calculate: (1) its acceleration (2) distance covered by it?
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## 2

**Activity**

Material required	
Procedure	<ol style="list-style-type: none"> <li>1. Mark the initial points as A and final point as B.</li> <li>2. Take one step equal to one unit of distance.</li> <li>3. Students have to reach point B and count their steps( there is no competition and time limit).</li> <li>4. Put the time limit, ask students to move again from point B to A.</li> </ol>
Reflection question	<ol style="list-style-type: none"> <li>1. Did you take the same path in for the cases? Why or why not?</li> <li>2. How much distance have you covered in both cases?</li> <li>3. Overall, how much distance have you travelled? Also, what is the total displacement you have made?</li> </ol>

# 9. Force & Laws of Motion

**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Prerequisite	Interpret data to identify uniform and non-uniform motion of an object.
Balanced and Unbalanced forces	Examine forces acting on a body in order to determine change in body's motion as a consequence of resultant force
	Determine the impact of frictional force on the motion of an object.
First Law of Motion	Identify examples and situations that illustrate the use of Newton's first Law of motion and Inertia.
Second Law of Motion	Calculate the momentum of objects when two bodies collide.
	Apply Newton's Second Law of Motion and calculate rate of change of momentum in objects.
	Interpret SI unit of force and use formulas to calculate mass of an object.
Third Law of Motion	Illustrate Newton's Third Law of Motion.
	Identify situations that demonstrate the application of Newton's third Law of Motion.
Conservation of Momentum	Calculate momentum of bodies before and after a collision (when no external force is applied), and thus apply and derive law of conservation of momentum

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Interpret data to identify uniform and non-uniform motion of an object.	Differentiates materials / objects / organisms / phenomena / processes, based on such as prokaryote and eukaryote, plant cell and animal cell, diffusion and osmosis, simple and



Examine forces acting on a body in order to determine change in body's motion as a consequence of resultant force	complex tissues, distance and displacement, speed and velocity, balanced and unbalanced forces, element, compound and mixture, solution, suspension and colloid, isobars and isotopes, etc.
Determine the impact of frictional force on the motion of an object.	Explains processes and phenomena, such as function of different organelles, spread of diseases and their prevention, effect of force on the state of motion of objects, action and reaction, revolution of planets and satellites, conservation laws, principle of separation of different gases from air, melting / boiling / freezing, how bats use ultrasound to catch prey, etc.
Identify examples and situations that illustrate the use of Newton's first Law of motion and Inertia.	
Illustrate Newton's Third Law of Motion.	
Calculate the momentum of objects when two bodies collide.	Calculates using the data given, such as distance, velocity, speed, frequency, work done, number of moles in a given mass of substance, concentration of solution in terms of mass by mass percentage of substances, conversion of Celsius scale to kelvin scale and vice versa, number of neutrons in an atom from atomic number and mass number, speed of sound, kinetic and potential energies of an object, boiling points of liquids to predict the order of their separation from the mixture, etc.
Calculate momentum of bodies before and after a collision (when no external force is applied), and thus apply and derive law of conservation of momentum	
Calculate the momentum of objects when two bodies collide.	Analyses and interprets graphs / figures etc., such as distance-time and velocity-time graphs, computing distance / speed / acceleration of objects in motion, properties of components of a mixture to identify the appropriate method of separation, crop yield after application of fertilizers, etc.
Interpret SI unit of force and use formulas to calculate mass of an object.	Uses scientific conventions /symbols / equations to represent various quantities / elements /units, such as SI units, symbols of elements, formulae of simple compounds, chemical equations, etc.
Apply Newton's Second Law of Motion and calculate rate of change of momentum in objects.	Applies scientific concepts in daily life and solving problems, such as separation of mixtures, uses safety belts in automobiles, covers walls of large rooms with sound absorbent materials, follows intercropping and crop rotation, takes preventive measures to control disease causing agents, etc.
Identify situations that demonstrate the application of Newton's third Law of Motion.	
Interpret SI unit of force and use formulas to calculate mass of an object.	Derives formulae / equations / laws, such as mathematical expression for second law of motion, law of conservation of momentum, expression for

Calculate momentum of bodies before and after a collision (when no external force is applied), and thus apply and derive law of conservation of momentum

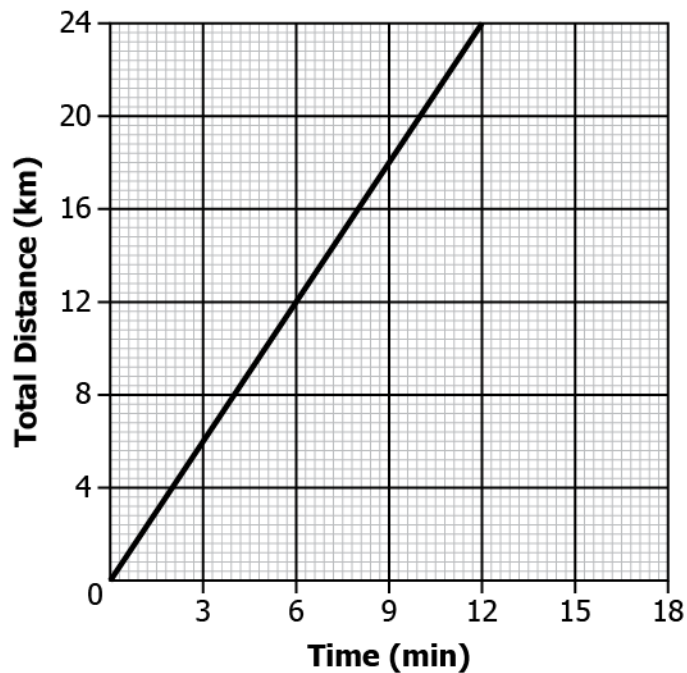
force of gravity, equations of motion from velocity-time graphs, etc.

## Test items



**LOB : Interpret data to identify uniform and non-uniform motion of an object.**

1) The image shows a distance time graph of a train's journey.

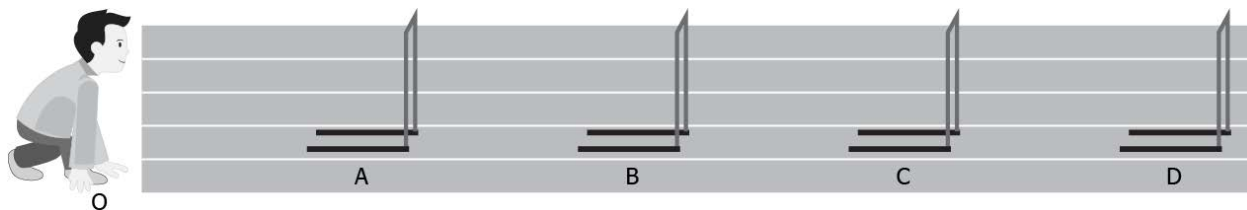


Which type of motion the train is following?

- (a) uniform motion
- (b) non-uniform motion
- (c) constant retardation
- (d) constant acceleration

**Correct Answer:** Option (a)

2) A student practicing for the hurdle race puts 4 hurdles A,B,C and D at equal distance on a straight track as shown in the image.



The student records the time at each hurdle.

Path	Time (seconds)
O to A	4
A to B	6
B to C	8
C to D	10

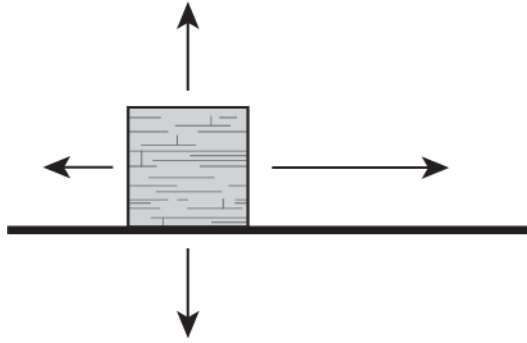
Based on the table, which option defines the motion of the student?

- (a) uniform motion because the student is travelling in a same direction from O to D
- (b) non-uniform motion because the student is moving over four hurdles between O and D
- (c) uniform motion because the time difference between two consecutive paths is equal
- (d) non-uniform motion because the student covers equal distance at unequal intervals of time

**Correct Answer:** Option (d)

**LOB : Examine forces acting on a body in order to determine change in body's motion as a consequence of resultant force**

1) The image shows the forces acting on a block. The length of the arrow shows the strength of the force and the direction of the arrow shows the direction of application of the force



What is the direction of the resultant force?

- (a) upwards
- (b) downwards
- (c) towards left
- (d) towards right

**Correct Answer:** Option (d)

2) A force of 10 N is acting on a block towards the left, if the force of 15 N is acting towards the right. How much net force is acting on the object?

- (a) 5 N towards left
- (b) 5 N towards right
- (c) 25 N towards left
- (d) 25 N towards right

**Correct Answer:** Option (b)

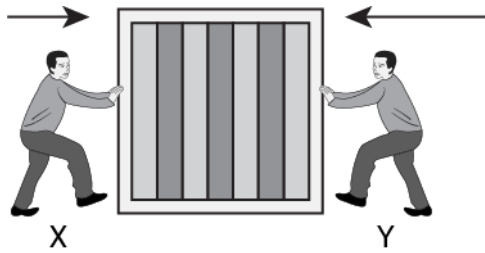
**LOB:** Determine the impact of frictional force on the motion of an object.

1) A block is at rest on a table. A girl applies a force towards the right. The applied force is equal to the frictional force between block and the surface. What will happen to the block?

- (a) it starts rotating
- (b) it does not move
- (c) it will start sliding towards left
- (d) it will start sliding towards right

**Correct Answer:** Option (b)

2) Two boys X and Y push a block in directions shown in the image.



If the block starts moving towards the left, what will be the direction of the frictional force acting on the block?

- (a) downward to the ground
- (b) upwards towards the block
- (c) opposite to the force applied by X
- (d) opposite to the force applied by Y

**Correct Answer:** Option (c)

**LOB : Identify examples and situations that illustrate the use of Newton's first Law of motion and Inertia.**

1) Which of the given example can be illustrated using the Newton's first law of motion?

- (a) rowing of boat
- (b) rocket propulsion
- (c) wearing a seat belt in a car
- (d) releasing an arrow from bow

**Correct Answer:** Option (c)

2) A tennis ball and a bowling ball are kicked with the same force; which option relates the distance travelled by the balls to the inertia of the balls?

- (a) tennis ball moves farther than bowling ball because it has less inertia
- (b) tennis ball moves farther than bowling ball because it has high inertia
- (c) bowling ball moves farther than tennis ball because it has less inertia
- (d) bowling ball moves farther than tennis ball because it has high inertia

**Correct Answer:** Option (a)

**LOB : Calculate the momentum of objects when two bodies collide.**

1) A ball of 150 g is hit with a bat; the ball starts travelling with a velocity of 3m/ s. What is the momentum of the ball?

- (a) 0.05 kg m/ s
- (b) 0.45 kg m/ s
- (c) 50 kg m/ s
- (d) 450 kg m/ s

**Correct Answer:** Option (b)

2) A bullet of mass 0.020 kg is fired; it strikes the wooden block of 0.50kg and sticks in it. The bullet and wooden block move off together with a velocity of 100 m/ s. What is the momentum of the bullet with wooden block?

- (a) 2 kg m/ s
- (b) 50 kg m/ s
- (c) 52 kg m/ s
- (d) 70 kg m/ s

**Correct Answer:** Option (c)

**LOB : Apply Newton's Second Law of Motion and calculate rate of change of momentum in objects.**

1) A marble of mass “m” at rest is pushed with force “F”, it starts travelling with velocity “v” in time “t”. Which option correctly relates the force with change in momentum?

- (a)  $F = (mv \cdot t)$
- (b)  $F = (mv / t)$
- (c)  $F = (mv) / t$
- (d)  $F = (mv \cdot t)$

**Correct Answer:** Option (b)

2) The image shows the forces acting on the car.



Which option defines the state of the car?

- (a) car is at rest
- (b) car is accelerating
- (c) car is slowing down
- (d) car is moving with a constant velocity

**Correct Answer:** Option (d)

**LOB : Interpret SI unit of force and use formulas to calculate mass of an object.**

1) The SI unit for force does not contain which of the following physical quantities?

- (a) Quantity
- (b) Length
- (c) Time
- (d) Luminosity

**Correct Answer:** Option (d)

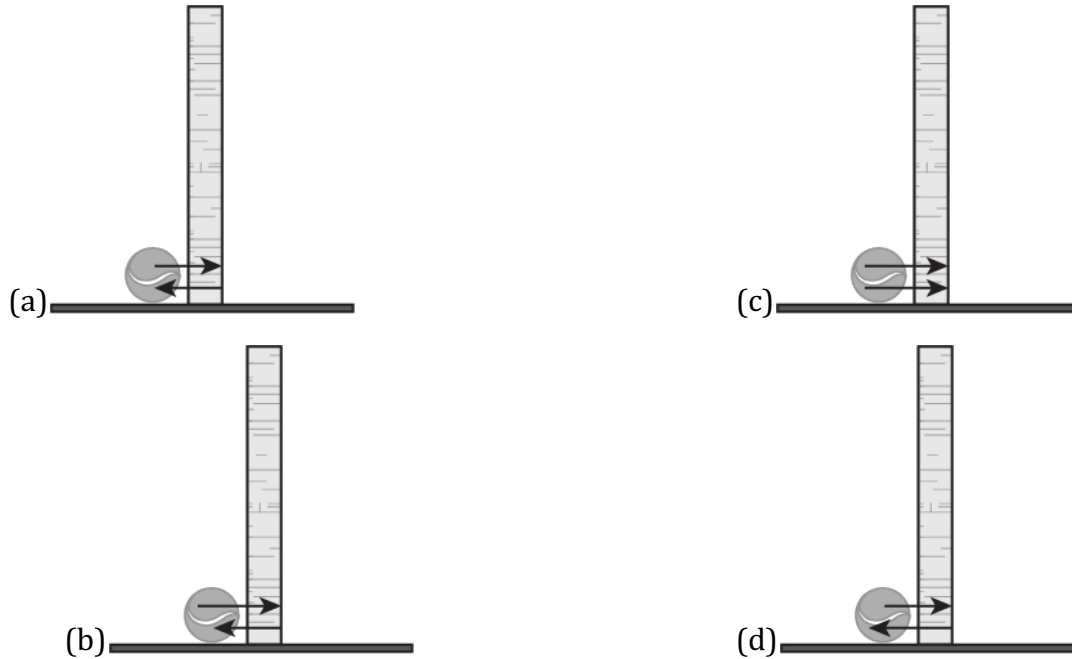
1) Earth pulls objects towards it due to gravity. If the force applied by the earth on an apple is 100 Newtons, what is the mass of the apple, given the acceleration that apple undergoes is  $10 \text{ m/s}^2$ ?

- (a) 5
- (b) 10
- (c) 15
- (d) 20

**Correct Answer:** Option (d)

**LOB : Illustrate Newton's Third Law of Motion.**

1) A cricket ball strikes the wall; which option shows the correct pair of forces acting on the ball?



**Correct Answer:** Option (a)

2) A block X of mass “m” strikes another block Y of mass “2m”. Both the blocks collide and at point of collision the block X exerts the force of 10 N to block Y. What will be the size and direction of the force exerted by block Y?

- (a) 10 N, in the same direction of force of block X
- (b) 20 N, in the same direction of force of block X
- (c) 10 N, opposite to the direction of force of block X
- (d) 20 N, opposite to the direction of force of block X

**Correct Answer:** Option (c)

**LOB : Identify situations that demonstrate the application of Newton’s third Law of Motion.**

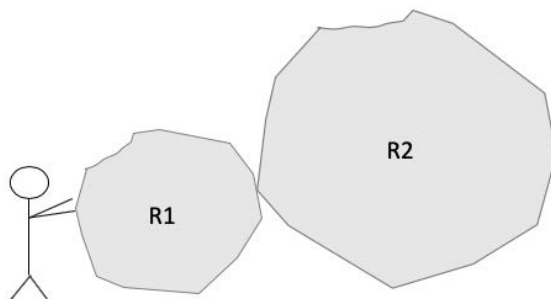
1) According to the third law of motion, every object acted upon by an external force applies an equal force in opposite direction. Which of the following phenomenon is best described by this law?



- (a) Recoil when a gun is fired
- (b) Engine thrust produced by rockets
- (c) An apple kept on the desk motionless
- (d) All of the above

**Correct Answer:** Option (d)

2) A person pushes a rock, R1, to the right while pushing another rock, R2, that is heavier than R1. The total mass of R2 is three times the total mass of R1. If the person is pushing with enough force that the two rocks accelerate to the right, what can be said for sure about the magnitudes of the forces on the rocks?



- (a) The force on R2 exerted by R1 is larger in magnitude than the force on R1 exerted by R2
- (b) The force on Cart 2 exerted by Cart 1 is smaller in magnitude than the force on Cart 1 exerted by Cart 2.
- (c) The force on Cart 2 exerted by Cart 1 is equal in magnitude to the force on Cart 1 exerted by Cart 2
- (d) The force on Cart 2 exerted by Cart 1 could be larger or smaller depending on the size of the acceleration.

**Correct Answer:** Option (c)

**LOB 0: Calculate momentum of bodies before and after a collision (when no external force is applied), and thus apply and derive law of conservation of momentum**

1) A Ball A of mass  $m_1$  travelling with a velocity  $u_1$  collides with another Ball B of mass  $m_2$  at rest. After collision the velocity of Ball A changes to  $v_1$  and velocity of Ball B changes to  $v_2$ . If the momentum is conserved, which option correctly relates the momentum before and after the collision?

(a)  $(m_1 \cdot u_1) + (m_1 \cdot v_1) = (m_2 \cdot v_2)$

(b)  $(m_1 \cdot u_1) = (m_1 \cdot v_1) + (m_2 \cdot v_2)$

(c)  $(m_2 \cdot v_2) - (m_1 \cdot u_1) = (m_1 \cdot v_1)$

(d)  $(m_1 \cdot u_1) = (m_1 \cdot v_1) - (m_2 \cdot v_2)$

**Correct Answer:** Option (b)

2) A boy of mass 40 kg jumps out of a boat of 200 kg on the bank, with a velocity of 2m/ s. If the momentum is conserved. With what velocity the boat will move backwards?

(a) 0.4 m/ s

(b) 0.8 m/ s

(c) 5 m/ s

(d) 10 m/ s

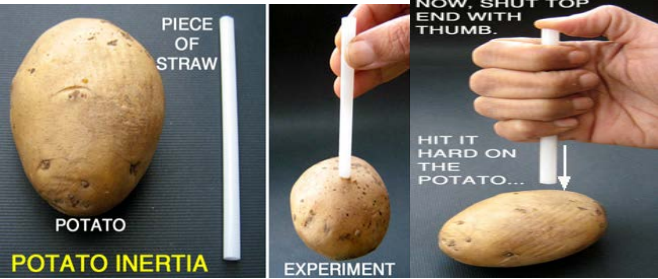
**Correct Answer:** Option (a)

## Suggested Teacher Resources



### Activity

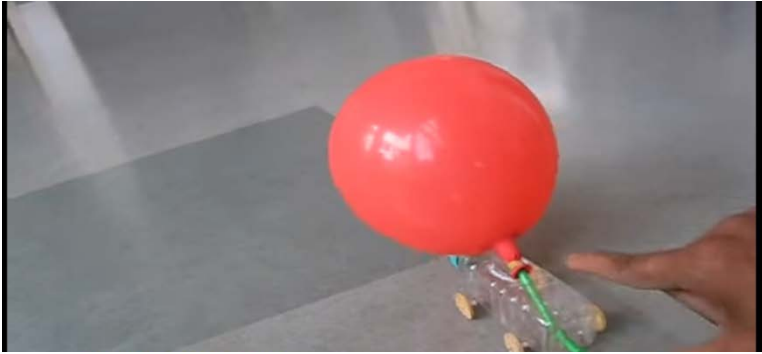
Objective	Explain Newton's First Law of Motion & Inertia in order to determine if a body will change its state of motion or rest
Prerequisite	Familiar with the concept of motion and rest.
Material Required	1 Potato, and 1 straw
Vocabulary	Property, Inertia

<p>Procedure</p>	<ol style="list-style-type: none"> <li>1. Take a medium stiff straw, press it hard on the potato and write your observation.</li> <li>2. Now shut the top end with thumb, hit it hard on the potato and again write your observation.</li> </ol> 
<p>Reflection Questions</p>	<ol style="list-style-type: none"> <li>1. What do you observe in both cases?</li> <li>2. In which case, does straw pierce into potato? Why?</li> <li>3. Why couldn't it pierce into potato in the first case?</li> </ol>
<p>Text to real world connection</p>	<ol style="list-style-type: none"> <li>1. One's body movement to the side when a car makes a sharp turn</li> <li>2. You fall in the forward direction when a moving bus brakes to a stop.</li> </ol>
<p>Beyond the classroom</p>	<p>Explain why some of the leaves may get detached from a tree if we vigorously shake it.</p>

2

## Activity

<p>Material required</p>	<p>Ball pen refill, small plastic bottle, 4 bottle lid, 1 flexible straw, cycle spoke, pieces of rubber, rubber band, glue and balloon.</p>
<p>Procedure</p>	<ol style="list-style-type: none"> <li>1. Make four holes in a bottle. weave cut cycle spokes through them to make wheel axles.</li> <li>2. Make holes in bottle lids to make wheels.</li> <li>3. Make two holes in the bottle. one on the base and the other on the top.</li> <li>4. Attach a balloon to the straw with a rubber band.</li> <li>5. Inflate the balloon and close the end of the straw with your thumb.</li> <li>6. When you place it on a smooth floor the car will shoot forwards.</li> </ol>

	 A photograph showing a red balloon inflated and attached to a small car. The car is constructed from a clear plastic bottle with a green straw inserted into the neck. The car is on a grey surface, and a hand is visible on the right side, pointing towards the car. The balloon is inflated and appears to be pushing the car forward.
Reflection question	<ol style="list-style-type: none"><li>1. What made the car move forward?</li><li>2. Which law of Newton is used?</li></ol>

# 10. Gravitation

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**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Prerequisite	Explain situations that are in coherence with concepts of motion, laws of motion and Inertia.
Introduction to Gravitation	Demonstrate a clear understanding of gravitational force.
	Explain the role of centripetal force in life situations.
	Relate Newton's third law of motion and gravitational force to explain the motion of bodies.
Universal Law of Gravitation	Calculate gravitational force and its impact on objects.
Free Fall	Estimate the acceleration due to gravity acting on a body.
	Relate change in acceleration due to gravity to Earth's shape and weight of objects.
	Calculate the magnitude of acceleration at different points on the path when the object is in motion.
	Interpret the relation between universal constant and acceleration due to gravity.
Mass & Weight	Assess the force of gravitation exerted and compute mass of an object on earth and moon.
Thrust and Pressure	Differentiate between thrust and pressure.
Pressure in Fluids	Examine the impact of buoyant force to determine if an object will sink or float in water.
	Calculate buoyant force acting on a body and determine its impact.

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Differentiate between thrust and pressure.	Differentiates materials / objects / organisms / phenomena / processes, based on such as prokaryote and eukaryote, plant cell and animal cell, diffusion and osmosis, simple and complex tissues, distance and displacement, speed and velocity, balanced and unbalanced forces, element, compound and mixture, solution, suspension and colloid, isobars and isotopes, etc.
Examine the impact of buoyant force to determine if an object will sink or float in water.	Plans and conducts investigations / experiments to arrive at and verify the facts / principles / phenomena or to seek answers to queries on their own, such as how does speed of an object change? How objects float / sink when placed on surface of liquid? Is there any change in mass when chemical reaction takes place? What is the effect of heat on state of substances? What is the effect of compression on different states of matter? Where are stomata present in different types of leaves? Where are growing tissues present in plants?
Explain the role of centripetal force in life situations.	Relates processes and phenomena with causes / effects, such as symptoms with diseases / causal agents, tissues with their functions, production with use of fertilizers, process of evaporation with cooling effect, various processes of separation with the physical and chemical properties of the substances, production of sound with vibrations of source, etc.
Relate Newton's third law of motion and gravitational force to explain the motion of bodies.	
Calculate gravitational force and its impact on objects.	Calculates using the data given, such as distance, velocity, speed, frequency, work done, number of moles in a given mass of substance, concentration of solution in terms of mass by mass percentage of substances, conversion of Celsius scale to kelvin scale and vice versa, number of neutrons in an atom from atomic number and mass number, speed of sound, kinetic and potential energies of an object, boiling points of liquids to predict the order of their separation from the mixture, etc.
Estimate the acceleration due to gravity acting on a body.	
Calculate buoyant force acting on a body and determine its impact.	

Relate change in acceleration due to gravity to Earth's shape and weight of objects.	Applies learning to hypothetical situations, such as weight of an object at moon, weight of an object at equator and poles, life on other planets, etc.
Assess the force of gravitation exerted and compute mass of an object on earth and moon.	
Calculate the magnitude of acceleration at different points on the path when the object is in motion.	Derives formulae / equations / laws, such as mathematical expression for second law of motion, law of conservation of momentum, expression for force of gravity, equations of motion from velocity-time graphs, etc.
Interpret the relation between universal constant and acceleration due to gravity.	
Demonstrate a clear understanding of gravitational force.	Describes scientific discoveries / inventions, such as discovery of various atomic models, discovery of cell with invention of microscope, experiments of Lavoisier and Priestley, beliefs regarding motion, discovery of real cause for peptic ulcers, Archimedes principle, classification of living things, etc.

# Test items



## LOB : Explain situations that are in coherence with concepts of motion, laws of motion and Inertia.

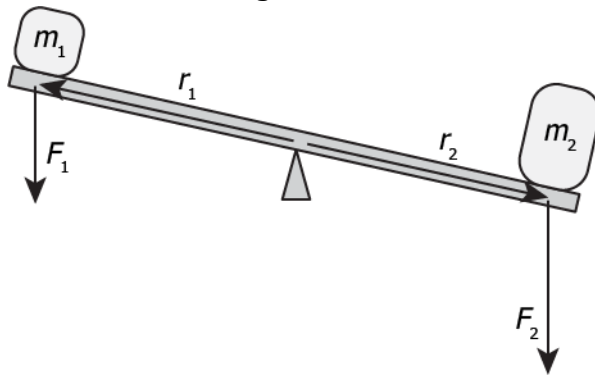
### Question Text:

1) Which law of motion explains the occurrence of tides due to the gravitational pull of the Moon and the Sun?

- (a) Newton's third law of motion, as their gravitational pull affects the motion of Earth.
- (b) Newton's first law of motion, as their gravitational pull changes the shape of Earth.
- (c) Newton's third law of motion, as their gravitational pull is balanced by the weight of ocean water.
- (d) Newton's second law of motion, as their gravitational pull is uniformly applied on the Earth's oceans.

**Correct Answer:** Option (c)

2) The image shows a two blocks of mass  $m_1$  and  $m_2$  on wooden plank, which is pivoted at its center. The weights are  $r_1$  and  $r_2$  distances apart from the point of pivot.



Under what condition do the weights get balanced on the wooden plank?

- (a) When  $m_1 < m_2$  and  $r_1 = r_2$ .
- (b) When  $m_1 < m_2$  and  $r_1 < r_2$ .
- (c) When  $m_1 > m_2$  and  $r_1 > r_2$ .
- (d) When  $m_1 = m_2$  and  $r_1 = r_2$ .

**Correct Answer:** Option (d)



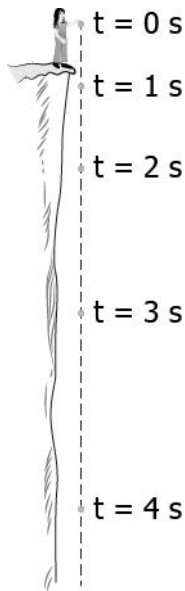
**LOB : Demonstrate a clear understanding of gravitational force.**

1) "An apple falls from its tree onto the ground". What does it tell about the nature of gravitational force?

- (a) It is a repulsive force, which acts at greater heights.
- (b) It is a repulsive force, which is independent of height.
- (c) It is an attractive force, which acts at greater heights.
- (d) It is an attractive force, which is independent of height.

**Correct Answer:** Option (d)

2) A ball is dropped from a height and the distance covered by the ball each second is recorded. The image shows the distance the ball covers each second.



What can be understood about the effect of gravitational force of Earth on the ball?

- (a) It causes the ball to decrease its speed of fall.
- (b) It causes the ball to fall with a constant speed.
- (c) It increases the distance covered by the ball with every passing second.
- (d) It decreases the distance covered by the ball with every passing second.

**Correct Answer:** Option (c)

**LOB : Explain the role of centripetal force in life situations.**

1) A student places a stone on a sling and moves it in circular motion, as shown.

Stone

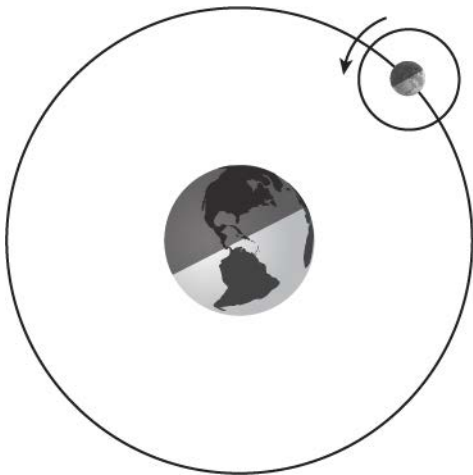


In which direction does the centripetal force act on the stone?

- (a) It acts towards the hand.
- (b) It acts towards the ground.
- (c) It acts tangential to the circular motion of stone.
- (d) It acts in the direction opposite to the direction of motion.

**Correct Answer:** Option (a)

2) The image shows the revolution of Moon around the Earth.



What is true for the force which keeps Moon in its orbit around the Earth?

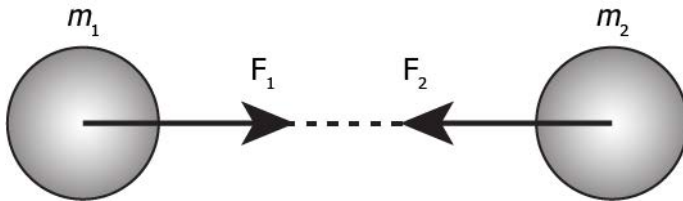
- (a) It changes the distance and velocity of Moon at every point on its orbit.
- (b) It changes the direction and distance of Moon at every point on its orbit.
- (c) It changes the direction and velocity of Moon at every point on its orbit.

(d) It changes the speed of rotation and direction of Moon at every point on its orbit.

**Correct Answer:** Option (c)

**LOB : Relate Newton's third law of motion and gravitational force to explain the motion of bodies.**

1) The image shows a model of Earth with mass  $m_1$  and its moon with mass  $m_2$ .

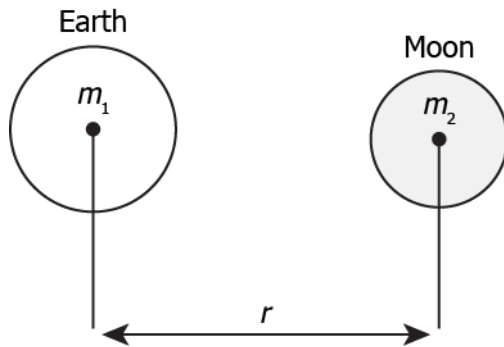


Based on the model, what should be the magnitude of forces  $F_1$  and  $F_2$  in accordance with the Newton's third law of motion?

- (a)  $F_1 = F_2$
- (b)  $F_1 > F_2$
- (c)  $F_1 < F_2$
- (d)  $F_1 = -F_2$

**Correct Answer:** Option (d)

2) The image shows Earth with its Moon.



The mass of Earth is  $m_1$  and that of Moon is  $m_2$ . They are separated by distance,  $r$ . Which statement is in accordance with the Newton's third law of motion?

- (a) The acceleration due to gravity on Earth is equal to that on Moon.
- (b) The acceleration due to gravity on Earth is greater than that on Moon.

(c) Gravitational force due to the Earth on Moon is equal to that due to Moon on the Earth.

(d) Gravitational force due to the Earth on Moon is greater than that due to Moon on the Earth.

**Correct Answer:** Option (c)

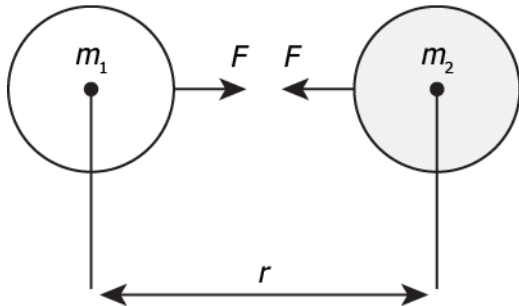
**LOB : Calculate gravitational force and its impact on objects.**

1) The magnitude of gravitational force between two objects is  $F$ . What change will increase the magnitude of gravitational force by three times the original magnitude?

- (a) distance between the objects is increased by half of the original distance
- (b) distance between the objects is decreased by half of the original distance
- (c) distance between the objects is decreased by one-third of the original distance
- (d) distance between the objects is increased by one-third of the original distance

**Correct Answer:** Option (b)

2) The image shows two objects of mass,  $m_1$  and  $m_2$  separated by distance,  $r$ .



If  $m_1$  is 10 kg,  $m_2$  is 100 kg, and  $r$  is 10 m, what is the amount of gravitational force,  $F$  between them? (Use the value of  $G$  as  $6.673 \times 10^{-11} \text{m}^3 \text{kg}^{-1} \text{s}^{-2}$ )

- (a)  $6.673 \times 10^{-9} \text{ N}$
- (b)  $6.673 \times 10^{-10} \text{ N}$
- (c)  $6.673 \times 10^{-11} \text{ N}$
- (d)  $6.673 \times 10^{-12} \text{ N}$

**Correct Answer:** Option (b)

**LOB : Estimate the acceleration due to gravity acting on a body**

1) An object has a mass of 163 kg. When the object is kept on a weighing scale, it exerts a force of  $1.597 \times 10^3$  N. What is the value of acceleration due to gravity?

- (a)  $9.8 \text{ m s}^2$
- (b)  $9.8 \text{ m s}^{-2}$
- (c)  $9.8 \times 10^2 \text{ m s}^{-2}$
- (d)  $9.8 \times 10^{-2} \text{ m s}^2$

**Correct Answer:** Option (b)

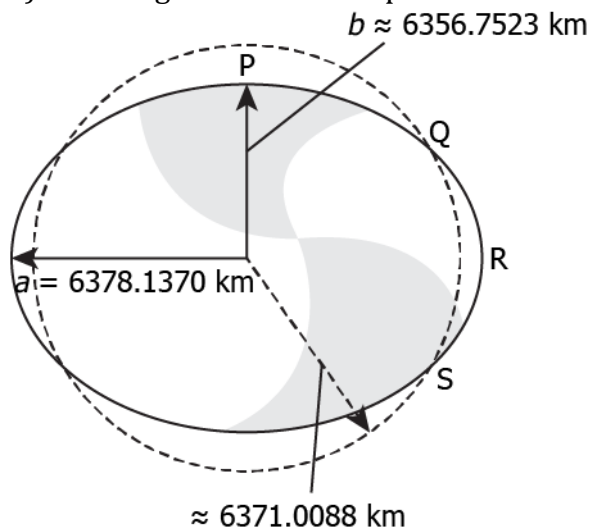
2) If the mass of a planet is  $6 \times 10^{26}$  kg and its radius is  $6.4 \times 10^3$  km, what is the estimated acceleration due to gravity on the surface of the planet?

- (a)  $9.8 \text{ m s}^{-2}$
- (b)  $9.8 \text{ m s}^2$
- (c)  $9.8 \times 10^2 \text{ m s}^{-2}$
- (d)  $9.8 \times 10^2 \text{ m s}^2$

**Correct Answer:** Option (c)

**LOB : Relate change in acceleration due to gravity to Earth's shape and weight of objects.**

1) The image shows the shape of Earth.

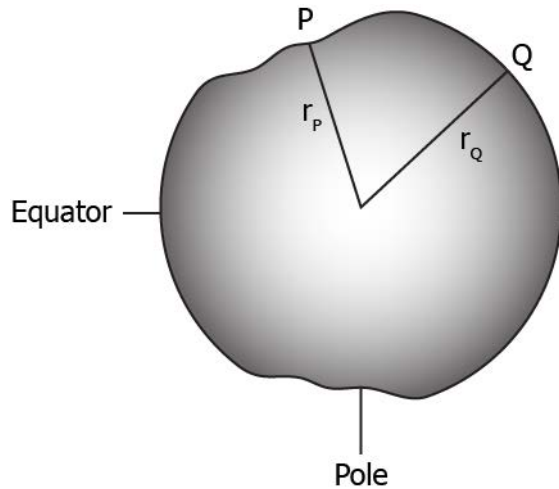


Which point on the surface of the Earth experiences greater acceleration due to gravity?

- (a) P
- (b) Q
- (c) R
- (d) S

**Correct Answer:** Option (a)

2) The image shows the distances of points P and Q from the Earth's center.



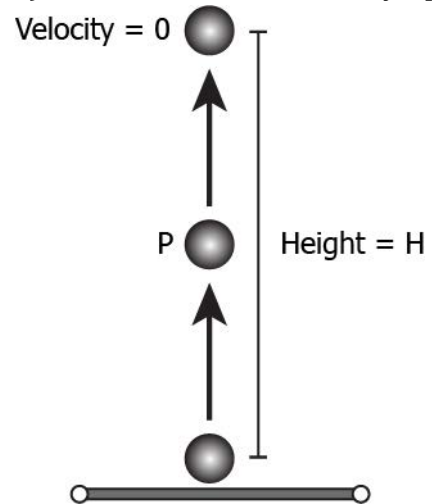
If  $r_Q > r_P$ , how would the acceleration due to gravity ( $g$ ) and weight of an object ( $W$ ) compare at these two points?

- (a)  $g_P > g_Q$  and  $W_P > W_Q$
- (b)  $g_P < g_Q$  and  $W_P < W_Q$
- (c)  $g_P > g_Q$  and  $W_P < W_Q$
- (d)  $g_P < g_Q$  and  $W_P > W_Q$

**Correct Answer:** Option (a)

**LOB : Calculate the magnitude of acceleration at different points on the path when the object is in motion.**

1) A ball is thrown vertically upwards as shown.

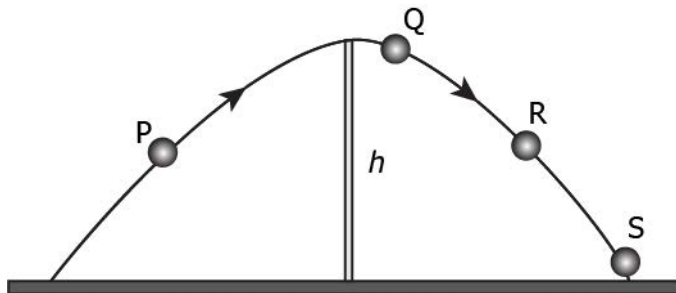


The ball reaches a height, H. What is the acceleration,  $a$  of the ball at point P?

- (a)  $a = g$
- (b)  $a = -g$
- (c)  $a > g$
- (d)  $a = 0$

**Correct Answer:** Option (b)

2) The image shows the path of a ball.



At which point, does the vertical component of acceleration of the ball has a negative magnitude?

- (a) P
- (b) Q

(c) R

(d) S

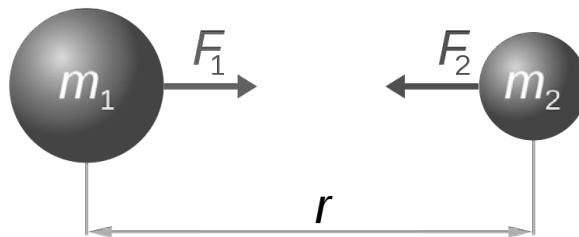
**Correct Answer:** Option (a)**LOB : Interpret the relation between universal constant and acceleration due to gravity.**

1) Which of the following is true about the SI unit of universal constant due to gravity and the acceleration due to gravity:

- (a) both have same SI unit
- (b) universal constant does not have an SI unit
- (c) acceleration due to gravity does not have an SI unit
- (d) Both universal constant and acceleration due to gravity does not have an SI unit

**Correct Answer:** Option (b)

2) The acceleration due to the force applied by  $m_1$  on  $m_2$  in the below given configuration can be represented by:



(a)  $G \frac{m_1}{r^2}$

(b)  $G \frac{m_1 \times m_2}{r^2}$

(b)  $G \frac{m_2}{r^2}$

(d)  $\frac{G}{r^2}$

**Correct Answer:** Option (a)



**LOB : Assess the force of gravitation exerted and compute mass of an object on earth and moon.**

1) The gravity on Moon is approximately one-sixth that on Earth. If an object weighs 100 N on Earth, how much would it weigh on Moon?

- (a) 2.77 N
- (b) 16.67 N
- (c) 33.33 N
- (d) 83.33 N

**Correct Answer:** Option (b)

2) An object of 5 kg mass has a weight of 8.15 N on Moon. How much would an object of 8 kg mass weigh on Moon?

- (a) 11.15 N
- (b) 13.04 N
- (c) 49.00 N
- (d) 78.40 N

**Correct Answer:** Option (b)

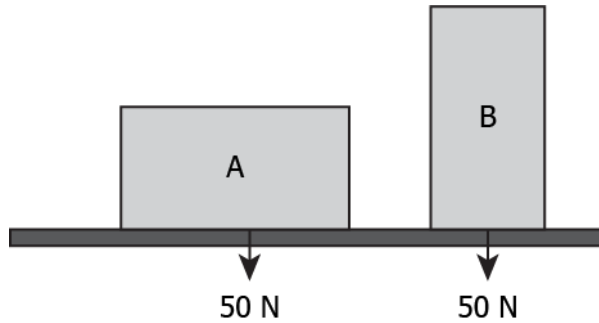
**LOB : Differentiate between thrust and pressure.**

1) What is true for thrust and pressure?

- (a) Pressure varies with area, while thrust remains constant.
- (b) Thrust varies with area, while pressure remains constant.
- (c) Magnitude of thrust is always greater than that of pressure.
- (d) Magnitude of pressure is always greater than that of thrust.

**Correct Answer:** Option (a)

2) The image shows a block of wood with height 2 cm, width 2 cm, and length 5 cm kept in two different orientations on a table.



How does the thrust and pressure applied by the block onto the table vary in these two orientations?

(a) Thrust of 50 N remains same, while pressure in orientation A is  $5 \text{ N/cm}^2$  and in orientation B is  $12.5 \text{ N/cm}^2$ .

(b) Thrust of 50 N remains same, while pressure in orientation A is  $12.5 \text{ N/cm}^2$  and in orientation B is  $5 \text{ N/cm}^2$ .

(c) Pressure of 50 N remains same, while thrust in orientation A is  $5 \text{ N/m}^2$  and in orientation B is  $12.5 \text{ N/m}^2$ .

(d) Pressure of 50 N remains same, while thrust in orientation A is  $12.5 \text{ N/m}^2$  and in orientation B is  $5 \text{ N/m}^2$ .

**Correct Answer:** Option (a)

**LOB : Examine the impact of buoyant force to determine if an object will sink or float in water.**

1) Why does a ship made of steel floats, while a slab of steel sinks in water?

(a) Ship has lower density than that of a slab of steel.

(b) Ship has lower mass than that of a slab of steel.

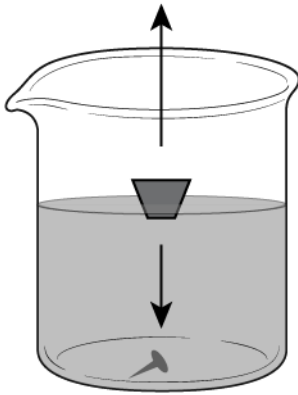
(c) Ship has greater volume than that of a slab of steel.

(d) Ship has thinner surface than that of a slab of steel.

**Correct Answer:** Option (c)

2) The image shows the forces acting on the cork floating on water.

$$\text{Buoyant force} = \text{density} \times \text{volume} \times g$$



$$\text{weight} = m \times g$$

What change causes the sinking of cork?

- (a) increase in the product of density and volume of cork
- (b) increase in the product of volume of water and density of cork
- (c) decrease in the product of mass of cork and acceleration due to gravity
- (d) decrease in the product of density of water and acceleration due to gravity

**Correct Answer:** Option (a)

**LOB : Calculate buoyant force acting on a body and determine its impact.**

1) An object of length 3 m, width 1 m, and thickness 1 m is immersed in water. It displaces 2 L of water. How much buoyant force is acting on the object? ( $g = 10 \text{ m s}^{-2}$ )

- (a) 6 N
- (b) 20 N
- (c) 30 N
- (d) 60 N

**Correct Answer:** Option (b)

2) An object of mass 2 kg is immersed in a tank containing 98 L of water. The buoyant force acting on the object is 19.60 N. How many liters of water gets displaced by the object?

- (a) 3.92 L
- (b) 2.00 L
- (c) 1.96 L
- (d) 1.00 L

**Correct Answer:** Option (c)

# Suggested Teacher Resources



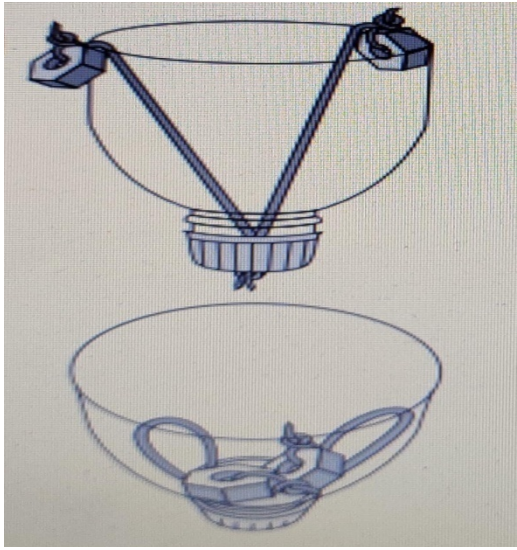
## Activity

Objective	Analyse buoyancy and forces acting on a body in fluid in order to judge if an object will sink or float
Prerequisite	Familiar with mass, weight, volume, fluid and thrust
Material Required	2 stones of different weights, 2 transparent glasses, thread, bicycle spoke.
Vocabulary	Up thrust, buoyant forces, buoyancy, displace.
Procedure	<ol style="list-style-type: none"> <li>1. Take two stones of different weights and attach them with bicycle spoke with the help of thread.</li> <li>2. Take 2 glasses filled with water.</li> <li>3. Balanced the stones in air as shown in picture.</li> <li>4. Put them in glasses filled with water.</li> </ol>
Let's think	<ol style="list-style-type: none"> <li>1. Are the stones still balanced in water?</li> <li>2. Which stone gets more push from below?</li> <li>3. What factors are responsible for it?</li> </ol>

Text to real world connection	Due to buoyancy the fish, human swimmers, icebergs, and ships stay afloat.
Beyond the classroom	If we take two balls of the same weight but different volumes, which one will float?

## 2

## Activity

Activity	Understanding motion of a constrained object
Material required	A plastic bottle, 1 steel nuts, 2 rubber bands, scissors
Procedure	<ol style="list-style-type: none"> <li>1. Take a plastic bottle and make a hole in the cap of the bottle.</li> <li>2. Tie cycle nuts to one end of the rubber bands. Tie their other ends to a bottle lid.</li> <li>3. Hang both nuts from the rim of plastic bottle as shown and drop the half bottle from a height.</li> <li>4. Ask a friend to catch it.</li> </ol> 
Reflection question	<ol style="list-style-type: none"> <li>1. What happened to the nuts when you dropped the bottle?</li> <li>2. What is the reason behind it?</li> </ol>

# 11. Work and Energy

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**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Work done by a constant force	Judge situations to identify where work is done according to scientific conception and calculate the magnitude of work.
	Calculate the total work done on an object when force is applied in varied directions and determine its nature.
Energy	Comprehend energy and calculate the amount of work an object is capable of doing.
Forms of Energy	Relate kinetic energy to motion and calculate kinetic energy possessed by the objects.
	Comprehend energy transfer and write an expression for the kinetic energy of an object.
	Relate potential energy to position and calculate potential energy possessed by the objects.
Law of conservation of Energy	Generalise the law of conservation of energy to situations of energy transfer and calculate the total energy of an object.
	Calculate power and assess the efficiency of work done.
Rate of doing work	Get conversant with commercial unit of energy.
Commercial Unit of Energy	Calculate total energy consumption and determine total cost in households and industries.

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Calculate the total work done on an object when force is applied in varied directions and determine its nature	Calculates using the data given, such as distance, velocity, speed, frequency, work done, number of moles in a given mass of substance, concentration of solution in terms of mass by mass percentage of substances, conversion of Celsius scale to kelvin scale and vice versa, number of neutrons in an atom from atomic number and mass number, speed of sound, kinetic and potential energies of an object, boiling points of liquids to predict the order of their separation from the mixture, etc.
Generalise the law of conservation of energy to situations of energy transfer and calculate the total energy of an object	
Calculate power and assess the efficiency of work done	
Get conversant with commercial unit of energy	
Calculate total energy consumption and determine total cost in households and industries	
Comprehend energy and calculate the amount of work an object is capable of doing	
Calculate power and assess the efficiency of work done	Uses scientific conventions /symbols / equations to represent various quantities / elements /units, such as SI units, symbols of elements, formulae of simple compounds, chemical equations, etc.
Get conversant with commercial unit of energy	Derives formulae / equations / laws, such as mathematical expression for second law of motion, law of conservation of momentum, expression for force of gravity, equations of motion from velocity-time graphs, etc.
Relate potential energy to position and calculate potential energy possessed by the objects	
Comprehend energy transfer and write an expression for the kinetic energy of an object	Draws conclusion, such as classification of life forms is related to evolution, deficiency of nutrients affects physiological processes in plants, matter is made up of particles, elements combine chemically in a fixed ratio to form compounds, action and reaction act on two different bodies, etc.
Judge situations to identify where work is done according to scientific conception and calculate the magnitude of work	
Comprehend energy and calculate the amount of work an object is capable of doing	

Relate kinetic energy to motion and calculate kinetic energy possessed by the objects	
Relate potential energy to position and calculate potential energy possessed by the objects	

## Test items



**LOB : Judge situations to identify where work is done according to scientific conception and calculate the magnitude of work.**

1) Which of these is an example of scientific work done?

- (a) Standing with a load of 2kg on the head for 5 minutes
- (b) Playing video games when sitting on a sofa
- (c) Sitting on a chair and reading a book
- (d) Climbing stairs of a bridge

**Correct Answer:** Option (d)

2) A force of 20N acts on an object. It causes a displacement of 500 cm in the direction of force. What would be the work done in Nm on the object?

- (a) 1000
- (b) 100
- (c) 25
- (d) 4

**Correct Answer:** Option (b)

**LOB : Calculate the total work done on an object when force is applied in varied directions and determine its nature**

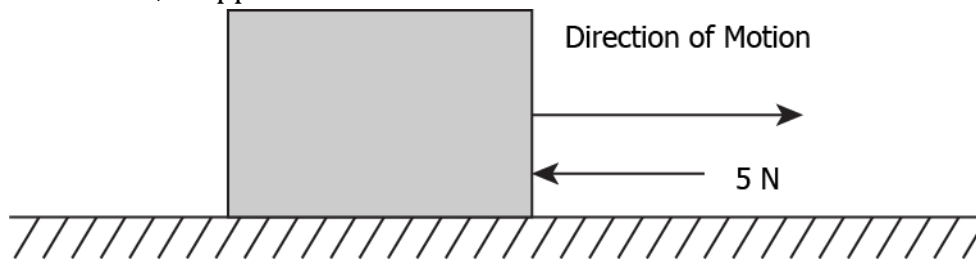


1) A boy pushes a lawn mower to a total distance of 125 m over the grass with a force of 60 N directed horizontally. How much work is done in joules by the boy?

- (a)+7500
- (b) -7500
- (c)+2.03
- (d)-2.03

**Correct Answer:** Option (a)

2) An object is moving with a uniform velocity along a particular direction. A retarding force of 5N, is applied in the direction as shown.



The object stops after a displacement of 5m. What is the work done by the retarding force?

- (a)-5J
- (b)-25J
- (c)5J
- (d)25J

**Correct Answer:** Option (b)

**LOB : Comprehend energy and calculate the amount of work an object is capable of doing.**

1) An object of mass 25 kg is at a height of 8 m above the ground. How much work is this object capable of doing? Given  $g = 9.8 \text{ m s}^{-2}$ .

- (a)1960J

- (b)2000 J
- (c)19600 J
- (d)20000 J

**Correct Answer:** Option (a)

2) The kinetic energy of an object weighing 10 kg moving with a velocity of 5m/ s is 125J. What is the maximum amount of work that can be done by the object?

- (a)5J
- (b)10 J
- (c)125J
- (d)1250J

**Correct Answer:** Option (c)

**LOB : Relate kinetic energy to motion and calculate kinetic energy possessed by the objects.**

1) What would be the kinetic energy possessed by an object of mass, '2m' and moving with a uniform velocity, 'v'?

- (a) $\frac{1}{2}mv^2$
- (b) $mv^2$
- (c) $2mv^2$
- (d) $4mv^2$

**Correct Answer:** Option (b)

2) A car weighing 500 kg is moving with a uniform velocity of 15m/ s. What is the kinetic energy possessed by the car?

- (a)56.250 kJ
- (b)112.500 kJ

(c)56250kJ

(d)112500 kJ

**Correct Answer:** Option (a)

**LOB : Comprehend energy transfer and write an expression for the kinetic energy of an object**

1) An object of mass 200 g moving with velocity 50 m/ s. What is its kinetic energy?

(a) $2.1 \times 10^5$  J

(b) $2.0 \times 10^5$  J

(c) $2.8 \times 10^5$  J

(d) $2.5 \times 10^5$  J

**Correct Answer:** Option (d)

2) A particle is thrown upward with some kinetic energy. What happened to its kinetic energy at the highest point or height it reaches?

(a) Its kinetic energy is lost;

(b) It's all kinetic energy is absorbed by the air;

(c) Its kinetic energy is converted to potential energy;

(d) Its kinetic energy is remain same;

**Correct Answer:** Option (c)

**LOB : Relate potential energy to position and calculate potential energy possessed by the objects.**

1) An object of mass 'x' kg is placed on the surface of Earth. What is the energy possessed by the object by the virtue of its position? Given  $g= 9.8\text{m/ s}$ .

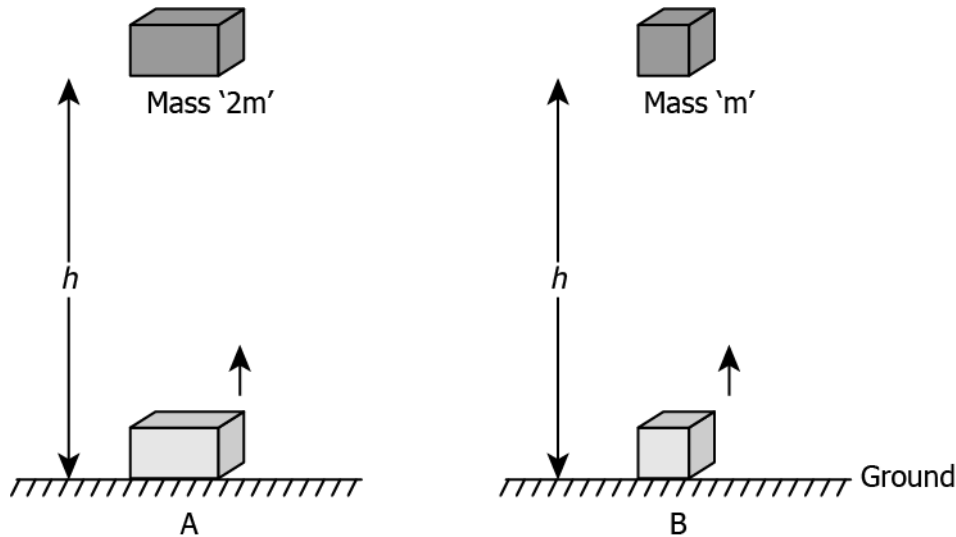
(a) $-9.8x$  J

(b)0 J

(c) $9.8x$  J

(d)  $\frac{x}{2}J$ **Correct Answer:** Option (b)

2) Compare the energy possessed by the virtue of position for the 2 bodies shown below.



(a) By virtue of their positions, the energy possessed by body A is half the energy possessed by body B.

(b) By virtue of their positions, the energy possessed by body A is twice the energy possessed by body B.

(c) By virtue of their positions, the energy possessed by body A is 4 times the energy possessed by body B.

(d) By virtue of their positions, the energy possessed by both Body A and Body B is the same.

**Correct Answer:** Option (b)

**LOB : Generalise the law of conservation of energy to situations of energy transfer and calculate the total energy of an object.**

1) A 50 kg skydiver jumps from a height of 20 m. What would be his kinetic and potential energies when he is halfway down? Assume  $g=10\text{m/s}^2$ .

(a) KE = 5,000 J; PE = 5,000 J

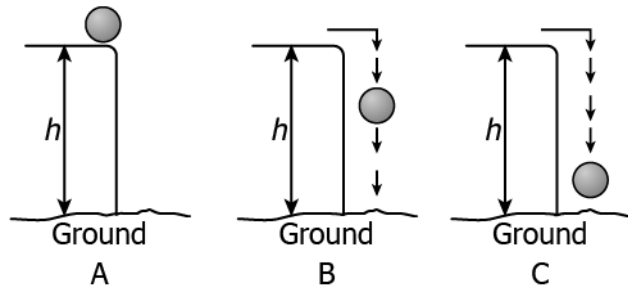
(b) KE = 0 J; PE = 10,000 J

(c) KE = 10,000 J; PE = 0 J

(d) KE = 10,000 J; PE = 10,000 J

**Correct Answer:** Option (a)

2) Refer to the image below.



Which option correctly compares the KE and PE of the ball in the stages A, B and C?

(a)

Stage	KE	PE
<b>A</b>	Maximum	Zero
<b>B</b>	Increases	Decreases
<b>C</b>	Zero	Maximum

(b)

Stage	KE	PE
<b>A</b>	Maximum	Zero
<b>B</b>	Decreases	Increases
<b>C</b>	Zero	Maximum

(c)

Stage	KE	PE
<b>A</b>	Zero	Maximum
<b>B</b>	Increases	Decreases
<b>C</b>	Maximum	Zero

(d)

Stage	KE	PE
A	Zero	Maximum
B	Decreases	Increases
C	Maximum	Zero

**Correct Answer:** Option (c)

**LOB : Calculate power and assess the efficiency of work done.**

1) The power expended by 4 persons to do a task is shown in the table below.

Person	Power (in W)
A	50
B	60
C	70
D	75

Who performed the task most efficiently?

- (a)A
- (b)B
- (c)C
- (d)D

**Correct Answer:** Option (d)

2) A man of mass is 60 kg climbs up 50 steps of a stair in 2 minutes. If each step is 20 cm high, calculate the power used in climbing the stairs. [Given  $g = 10 \text{ m/s}^2$ ]

- (a)50 W
- (b)250 W
- (c)3000 W
- (d)6000 W

**Correct Answer:** Option (a)

**LOB : Get conversant with commercial unit of energy**

1) A machine does a work of 100 joule in 20 second. What is its power?

- (a) 20 watt
- (b) 80 watt
- (c) 5 watt
- (d) 2000 watt

**Correct Answer:** Option (c)

2) Which of the following is equal with Newton-meter?

- (a) Joule
- (b) Horse Power
- (c) Watt
- (d) Pascal

**Correct Answer:** Option (a)

**LOB : Calculate total energy consumption and determine total cost in households and industries**

1) A factory has eight machines of 1200 W each. If each machine runs for 10 hours a day, find the cost of electrical units' consumption per day if the rate per unit is 4.00 rupees?

- (a) 96 rupees
- (b) 120 rupees
- (c) 384 rupees
- (d) 3840 rupees

**Correct Answer:** Option (c)

2) A household has four bulbs of 100 W each. If the bulbs operate for 10 hours daily, find the monthly expenditure incurred? (Cost of 1 unit = 2.50 rupees)

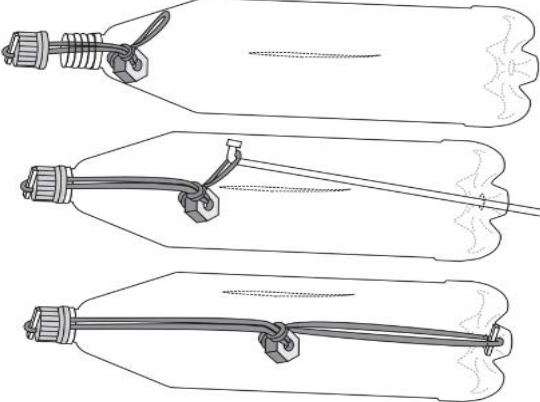
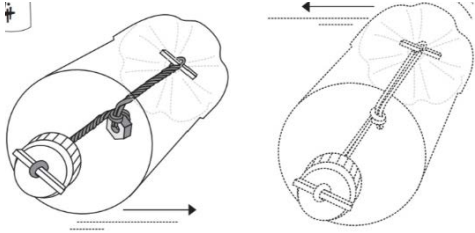
- (a) Rs 75
- (b) Rs 250
- (c) Rs 300
- (d) Rs 2500

**Correct Answer:** Option (c)

# Suggested Teacher Resources



## Activity


Objective	Recall the definition potential energy, in order to compute energy contained in a body by virtue of its position.
Prerequisite	Work, work done, energy, the relationship between work done and energy.
Material Required	1 Plastic bottle, rubber bands, nut, scissors, match sticks
Vocabulary	Kinetic Energy, potential energy, mechanical energy.
Procedure	<ol style="list-style-type: none"> <li>1. Make a hole in the bottle lid and also in its base.</li> <li>2. Slip a long rubber band in a heavy hex-nut and tie a knot.</li> <li>3. Cut a slit in the bottle to slip in the hex nut and rubber band. Attach the left end of the rubber band with a matchstick to the lid. Pull the other end and fix it to the base of the bottle with a matchstick. Let the nut be hanging.</li> </ol>  <ol style="list-style-type: none"> <li>4. Roll the bottle on the ground.</li> </ol> 



Reflection Questions	<ol style="list-style-type: none"> <li>1. What did you observe?</li> <li>2. Why did bottle come back?</li> <li>3. What is the relation between potential energy and kinetic energy?</li> </ol>
Text to real world connection	<ol style="list-style-type: none"> <li>1. Running water has <b>kinetic energy</b> and it is used to run water mills. Moving air has K.E and is used to derive windmills.</li> <li>2. Water that is behind a dam has potential energy.</li> </ol>
Beyond the classroom	Give an example in which a body possesses both kinetic energy and potential energy.

## 2

## Activity

Activity	Potential energy
Material required	1 Nut and string
Procedure	<ol style="list-style-type: none"> <li>1. Take a nut and tie one end of the string around the nut.</li> <li>2. Suspend the nut in the air by holding another end of the string.</li> <li>3. Case A: Lift the nut in the air and leave it.</li> <li>4. Case B: Lift the nut a little higher his time and again leave it.</li> </ol>
Reflection question	<ol style="list-style-type: none"> <li>1. Which energy did the nut possess when lifted in air?</li> <li>2. After leaving the nut, in which energy is potential energy converted?</li> <li>3. Why did it slow down later?</li> <li>4. In which case A or B nut started moving faster and why?</li> </ol>
	

# 12. Sound

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**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Production of Sound	Infer and demonstrate that sound is produced due to vibration of different objects.
Propagation of Sound	Generalise that sound travels as successive compressions and rarefactions in the medium.
Characteristics of a Sound wave	Relate frequency, amplitude and speed of a sound wave to determine its loudness and frequency.
	Interpret the graphical representation of sound waves to determine its frequency, amplitude, and speed.
Speed of sound in different medium	Relate properties of the medium through which sound travels to its speed.
Reflection of Sound	Examine the paths of reflection of sound on different surfaces.
Echo & Reverberation	explain propagation of sound in a medium based on their knowledge of echo and reverberation.
Range of hearing	Classify audible range of sounds of different organisms into ultra and infra sounds.
Application of Ultrasound	Demonstrate an understanding of application of ultrasound waves in medical, defence and other fields.
Structure of Human Ear	Explain the process of hearing in human beings.

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Generalise that sound travels as successive compressions and rarefactions in the medium.	<ul style="list-style-type: none"> <li>Explains properties/ characteristics in order to differentiate materials/ objects/ organisms/ phenomena/ processes: (such as, prokaryote and eukaryote, plant cell and animal cell, diffusion and osmosis, simple and complex tissues, distance and displacement, speed and velocity, balanced and unbalanced forces, element, compound and mixture, solution, suspension and colloid, isobars and isotopes, etc.)</li> </ul>
Examine the paths of reflection of sound on different surfaces.	Plans and conducts investigations / experiments to arrive at and verify the facts / principles / phenomena or to seek answers to queries on their own, such as how does speed of an object change? How objects float / sink when placed on surface of liquid? Is there any change in mass when chemical reaction takes place? What is the effect of heat on state of substances? What is the effect of compression on different states of matter? Where are stomata present in different types of leaves? Where are growing tissues present in plants?
Infer and demonstrate that sound is produced due to vibration of different objects.	Relates processes and phenomena with causes / effects, such as symptoms with diseases / causal agents, tissues with their functions, production with use of fertilizers, process of evaporation with cooling effect, various processes of separation with the physical and chemical properties of the substances, production of sound with vibrations of source, etc.
Relate frequency, amplitude and speed of a sound wave to determine its loudness and frequency.	
Relate properties of the medium through which sound travels to its speed.	
explain propagation of sound in a medium based on their knowledge of echo and reverberation.	
Classify audible range of sounds of different organisms into ultra and infra sounds.	Explains processes and phenomena, such as function of different organelles, spread of diseases and their prevention, effect of force on the state of motion of objects, action and reaction, revolution of planets and satellites, conservation laws, principle of separation of

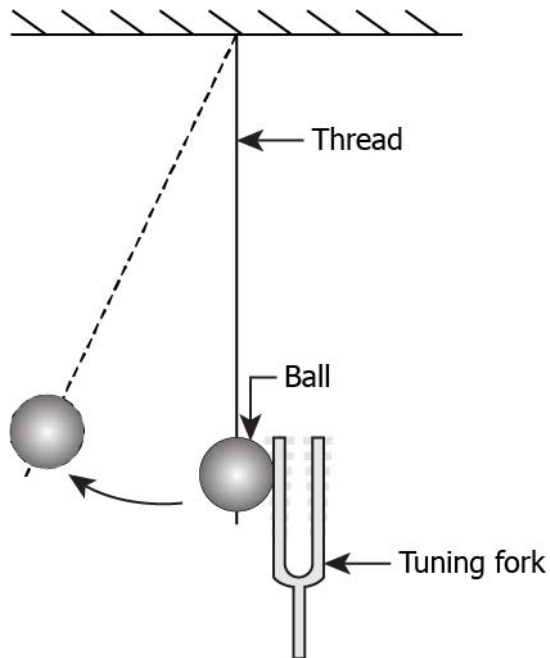
Explain the process of hearing in human beings.	different gases from air, melting / boiling / freezing, how bats use ultrasound to catch prey, etc.
Explain the process of hearing in human beings.	Draws labelled diagrams / flow charts / concept map /graphs, such as biogeochemical cycles, cell organelles and tissues, human ear, distance-time and speed-time graphs, distribution of electrons in different orbits, process of distillation / sublimation, etc.
Interpret the graphical representation of sound waves to determine its frequency, amplitude, and speed.	Analyses and interprets graphs / figures etc., such as distance-time and velocity-time graphs, computing distance / speed / acceleration of objects in motion, properties of components of a mixture to identify the appropriate method of separation, crop yield after application of fertilizers, etc.
Demonstrate an understanding of application of ultrasound waves in medical, defence and other fields.	Applies scientific concepts in daily life and solving problems, such as separation of mixtures, uses safety belts in automobiles, covers walls of large rooms with sound absorbent materials, follows intercropping and crop rotation, takes preventive measures to control disease causing agents, etc.
explain propagation of sound in a medium based on their knowledge of echo and reverberation.	

# Test items



**LOB : Infer and demonstrate that sound is produced due to vibration of different objects.**

1) The image shows a setup consisting of a tuning fork and a metallic ball suspended using a thread.

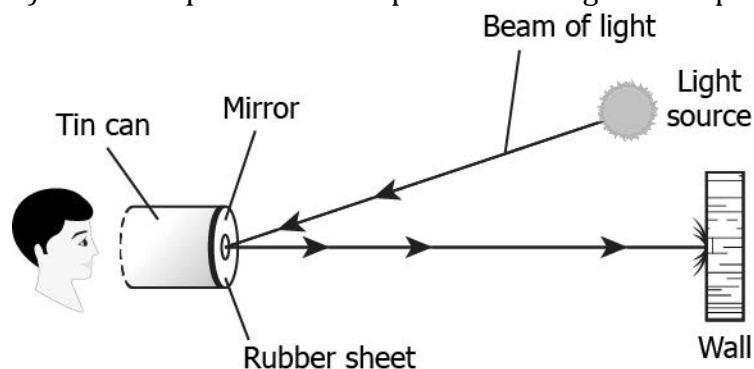


What happens when the metallic ball hits the tuning fork?

- (a) The tuning fork vibrates the ball to produce sound.
- (b) The tuning fork vibrates to-and-fro to produce sound.
- (c) The tuning fork gets heated by the collision of the ball.
- (d) The tuning fork generates heat by the vibrating to-and-fro.

**Correct Answer:** Option (b)

2) A student performs an experiment using the setup as shown.



The tin can is cut open from its bottom and a rubber sheet is stretched to cover it. A small mirror is glued to the rubber sheet. What would happen to the circular spot of light on the wall when the student speaks into the open end of the tin can?

(a) The sound produced vibrates the rubber diaphragm, which causes the movement of the light spot on the wall.

(c) The sound produced vibrates the surface of the mirror, which causes a change in the color of the light spot on the wall.

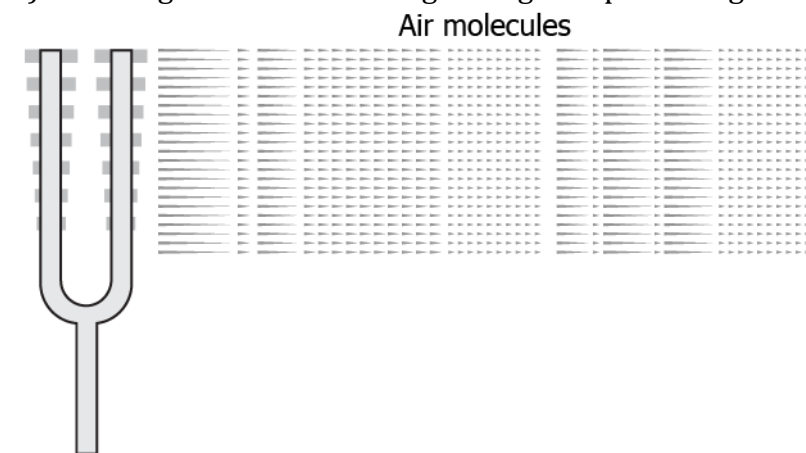
(b) The sound produced vibrates the rubber diaphragm, which causes the light spot to appear dim due to the scattering of light.

(d) The sound produced vibrates the walls of the tin can, which causes the light spot to appear diffused due to the scattering of light.

**Correct Answer:** Option (a)

**LOB : Generalise that sound travels as successive compressions and rarefactions in the medium**

1) The image shows a vibrating tuning fork producing sound in the air.

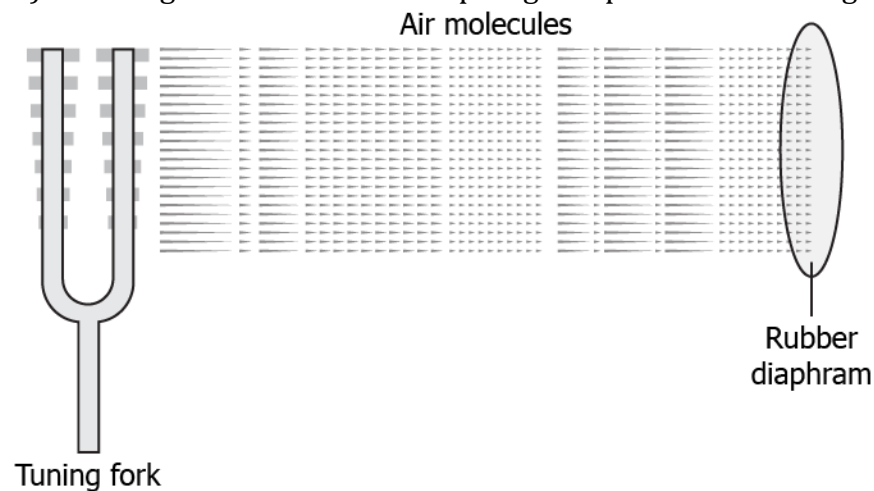


What can be inferred from the image?

- (a) The air molecules move down when the prongs of tuning fork push the air and move up when the prongs of tuning fork move back.
- (b) The air molecules move up when the prongs of tuning fork push the air and move down when the prongs of tuning fork move back.
- (c) The air molecules decompress when the prongs of tuning fork push the air and compress when the prongs of tuning fork move back.
- (d) The air molecules compress when the prongs of tuning fork push the air and decompress when the prongs of tuning fork move back.

**Correct Answer:** Option (d)

2) The image shows a rubber diaphragm kept near a vibrating tuning fork.



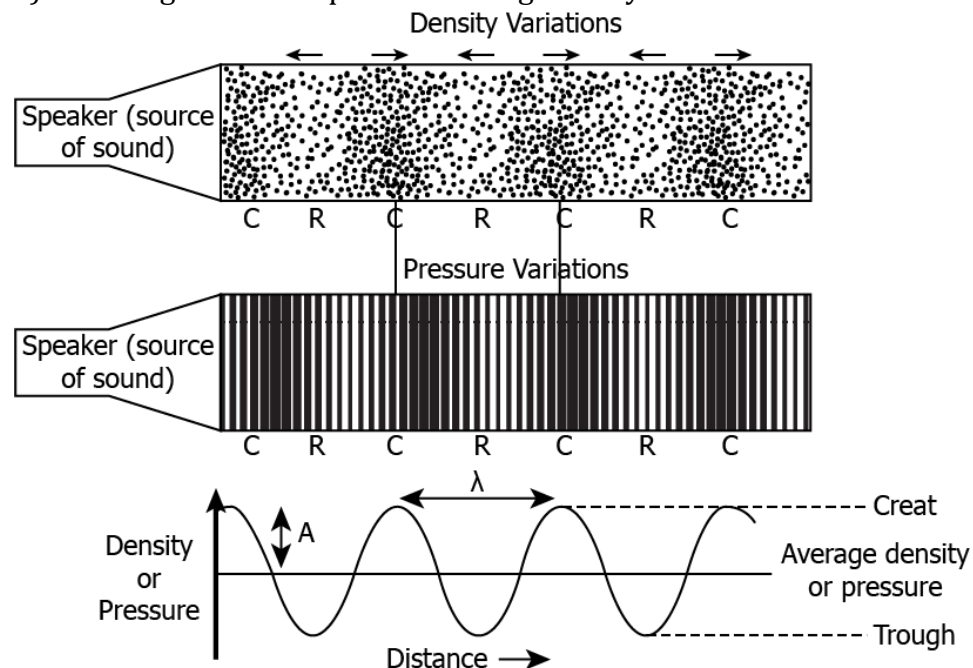
How would the tuning fork affect the rubber diaphragm?

- (a) The rarified air from the vibrating tuning fork causes the diaphragm to vibrate, while the compressed air causes no movement.
- (b) The compressed air from the vibrating tuning fork causes the diaphragm to vibrate, while the rarified air causes no movement.
- (c) The compressed air from the vibrating tuning fork pushes the diaphragm to the right and rarified air pulls the diaphragm to the left.
- (d) The rarified air from the vibrating tuning fork pushes the diaphragm to the right and compressed air pulls the diaphragm to the left.

**Correct Answer:** Option (c)

**LOB : Relate frequency, amplitude and speed of a sound wave to determine its loudness and frequency.**

1) The image shows a speaker causing density variation in air.

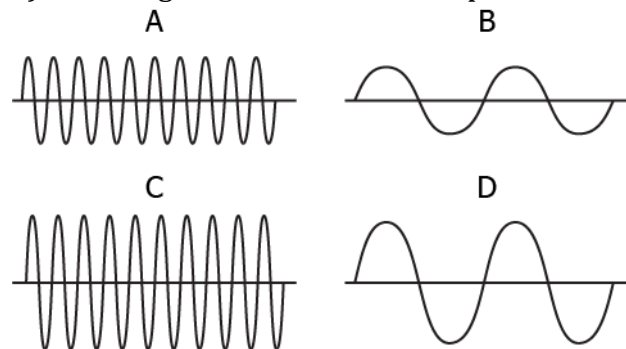


Based on the image, what can be inferred about the characteristics of sound waves?

- (a) The area of low density defines the wavelength of the sound wave.
- (b) The area of high density defines the frequency of the sound wave.
- (c) The rate at which density variations occur defines the frequency of the sound wave.
- (d) The rate at which pressure varies with density of air defines the wavelength of the sound wave.

**Correct Answer:** Option (c)

2) The image shows the wave shape of four different sound.



What is true about the characteristics of these sounds?

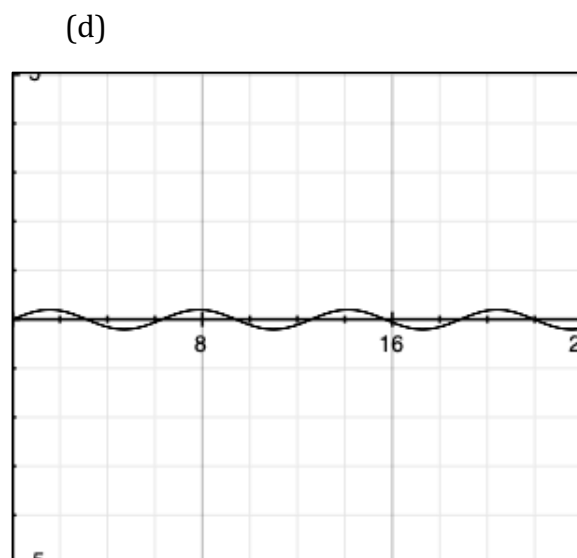
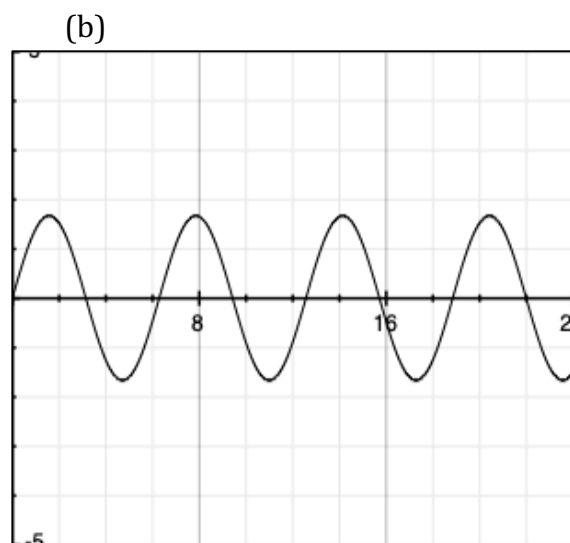
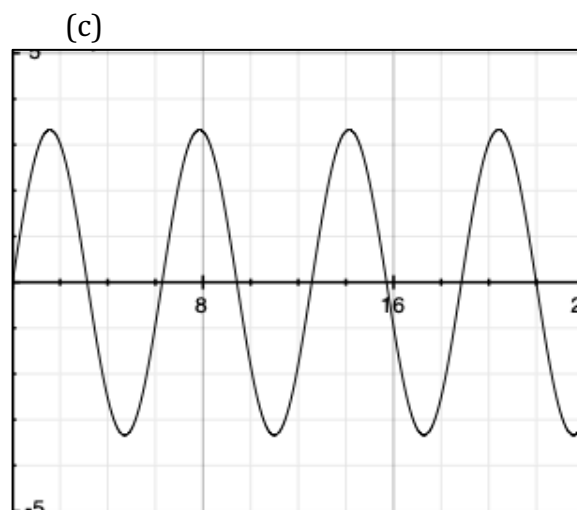
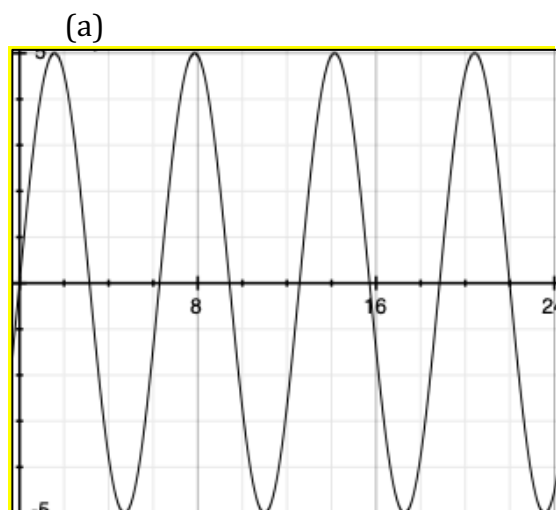


- (a) Sound wave A has higher frequency than sound waves B and D.  
 (b) Sound wave C has higher amplitude than sound waves A and D.  
 (c) Sound waves A and B have same frequency but different amplitudes.  
 (d) Sound wave A has higher amplitude and frequency than sound wave D.

**Correct Answer:** Option (d)

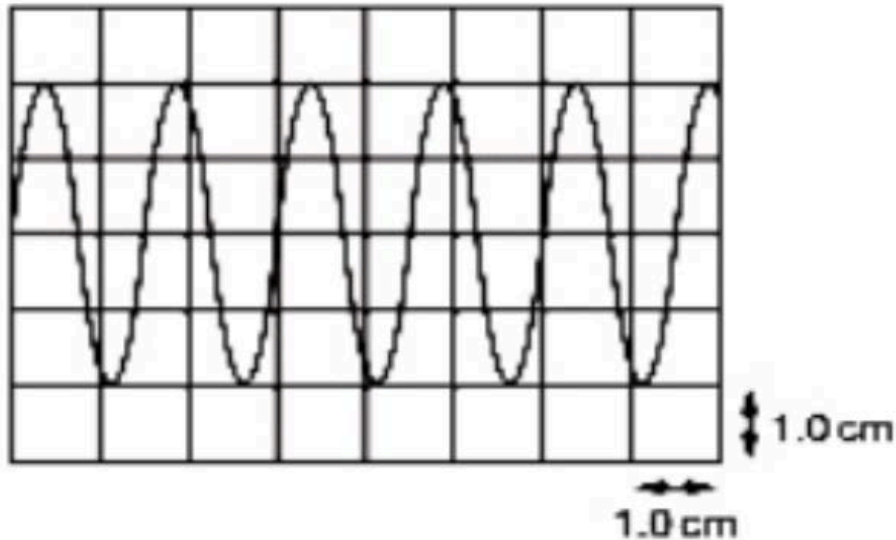
**LOB : Interpret the graphical representation of sound waves to determine its frequency, amplitude, and speed.**

1) A pianist is playing several notes which was graphed by a scientist. The scientist has been told that the loudest notes have the highest amplitude. Among the following notes, which one is the loudest note:



**Correct Answer:** Option (a)

2) Below is a wave form representation of a sound wave. What is the amplitude of the sound wave represented below? (Speed of the sound  $3.30 \times 10^4$  m/s)



- (a) 2 cm
- (b) 4 cm
- (c) 8 cm
- (d) 10 cm

**Correct Answer:** Option (b)

**LOB : Relate properties of the medium through which sound travels to its speed.**

1) Which medium will have sound waves propagating at a higher speed?

- (a) A liquid medium at  $25^{\circ}\text{C}$  temperature.
- (b) A liquid medium at  $50^{\circ}\text{C}$  temperature.
- (c) A gaseous medium at  $50^{\circ}\text{C}$  temperature.
- (d) A gaseous medium at  $25^{\circ}\text{C}$  temperature.

**Correct Answer:** Option (b)

2) The table lists speed of sound in different media.

Substance and Temperature	Speed (m/s)
Air at 0°C	330
Air at -10°C	325
Fresh water at 25°C	1,497
Sea water at 25°C	1,560
Steel at 20°C	5,000
Vacuum	0

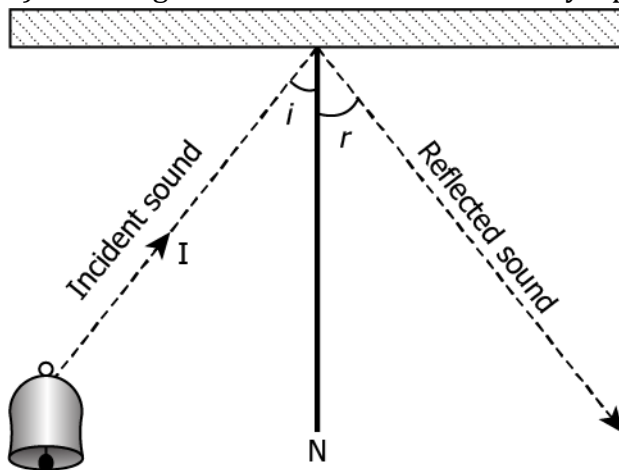
Based on the table, what characteristics of the medium affect the speed of sound?

- (a) Increase in density of the medium increases the speed of sound.
- (b) Decrease in density of the medium increases the speed of sound.
- (c) Decrease in temperature of the medium increases the speed of sound.
- (d) Increase in temperature of the medium decreases the speed of sound.

**Correct Answer:** Option (a)

**LOB : Examine the paths of reflection of sound on different surfaces.**

1) The image shows reflection of sound by a polished wall.



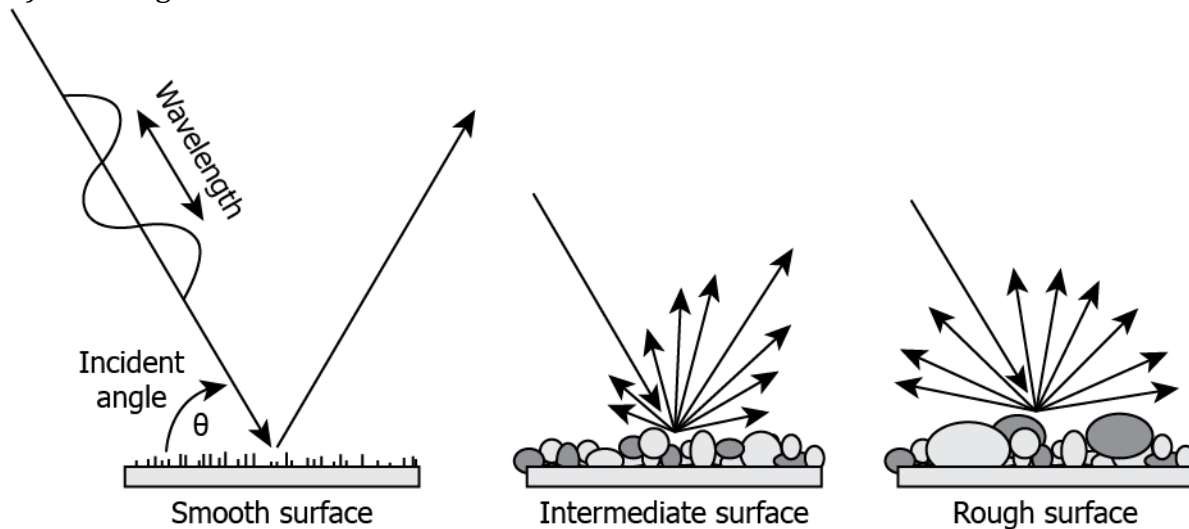
Based on the image, what can be inferred about how sound reflects off the polished wall?

- (a) The reflected sound follows the path of the incident sound.

- (b) The angle of incidence (i) is equal to the angle of reflection (r).
- (c) The angle of incidence (i) is smaller than the angle of reflection (r).
- (d) The reflected sound follows a shorter path than that of the incident sound.

**Correct Answer:** Option (b)

2) The image shows reflection of sound on three different surfaces.



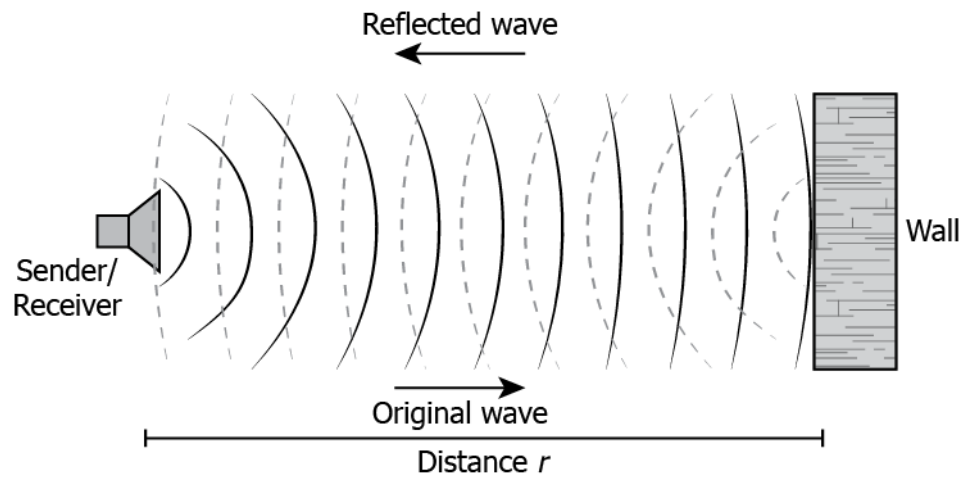
Based on the image, what can be inferred about how reflection of sound is affected on these surfaces?

- (a) The scattering of sound increases with the increasing roughness of the surface.
- (b) The scattering of sound decreases with the increasing roughness of the surface.
- (c) The angle of reflection is greater than the angle of incidence in the rough surface.
- (d) The angle of reflection is smaller than the angle of incidence in the intermediate surface.

**Correct Answer:** Option (a)

**LOB : explain propagation of sound in a medium based on their knowledge of echo and reverberation.**

1) The image shows reflection of sound by a wall



What change would cause reverberation of the sound?

- (a) Polishing the surface of the wall.
- (b) Erecting a wall behind the receiver.
- (c) Placing the sender closer to the wall.
- (d) Increasing the frequency of the emitted sound.

**Correct Answer:** Option (b)

2) The sensation of sound persists for 0.1 seconds in our brain. As a result, a clap near a tall building can be heard again. At what temperature of the air would the minimum distance required for differentiating the original sound of clap from its reflection be the greatest?

- (a) 0°C
- (b) 10°C
- (c) 20°C
- (d) 30°C

**Correct Answer:** Option (d)

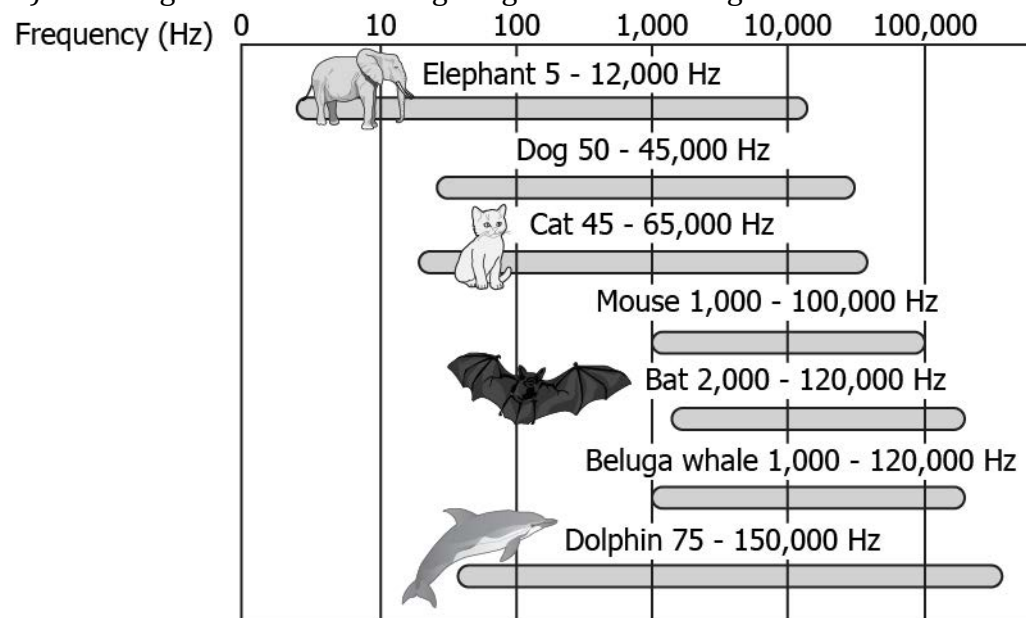
**LOB : Classify audible range of sounds of different organisms into ultra and infra sounds.**

1) People of old age have trouble hearing certain frequencies of sound. Which range of frequencies is mostly heard by these people?

- (a) 10 Hz – 1,000 Hz
- (b) 20 Hz – 10,000 Hz
- (c) 9,500 Hz – 20,000 Hz
- (d) 20,000 Hz – 22,000 Hz

**Correct Answer:** Option (b)

2) The image shows the hearing ranges of various organisms.



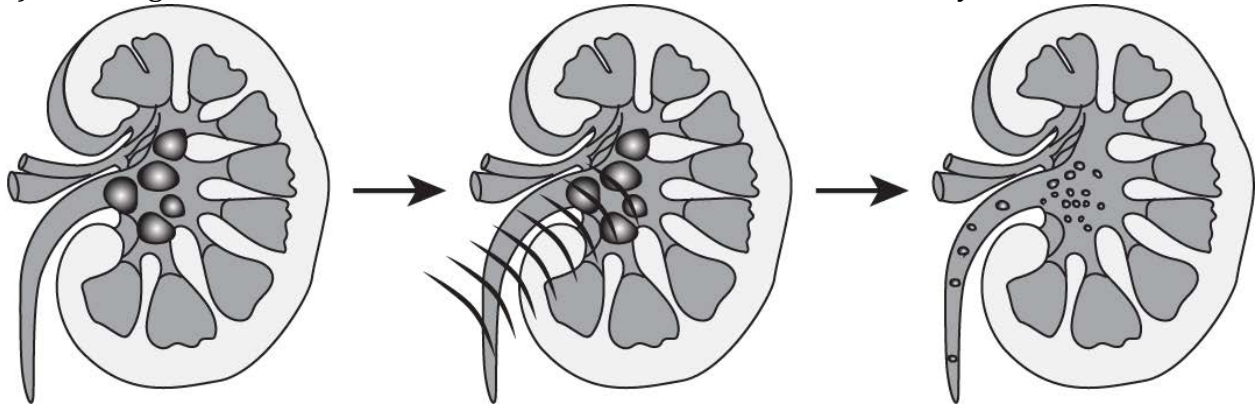
Based on the image, which organism has ability to hear infrasound?

- (a) bat
- (b) cat
- (c) dolphin
- (d) elephant

**Correct Answer:** Option (d)

**LOB : Demonstrate an understanding of application of ultrasound waves in medical, defence and other fields**

1) The image shows the use of ultrasound waves in treatment of kidney.

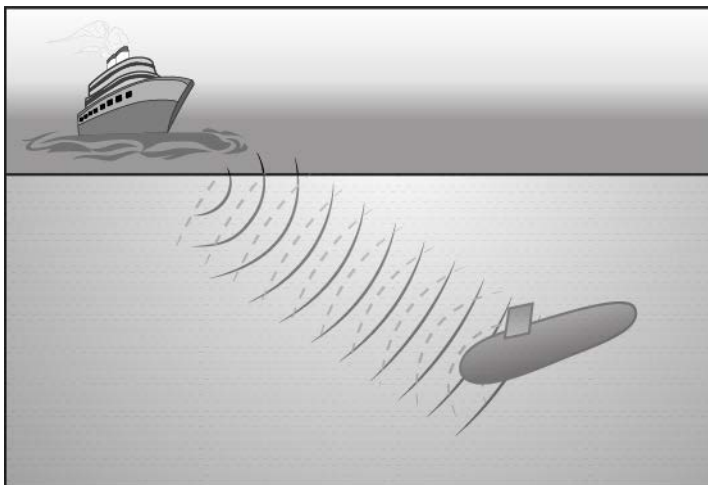


Based on the image, what is the advantage of using ultrasound waves to break the kidney stones?

- (a) It prepares the kidney for removal of stones by surgery.
- (b) It prevents the stones from forming again in the kidneys.
- (c) It helps remove stones from the kidney without any surgery.
- (d) It softens the tissues in the kidneys to allow for removal of stones.

**Correct Answer:** Option (c)

2) The image shows the use of ultrasound in a ship.



How does the ship locate the submarine using ultrasound waves?

- (a) The ship measures the time taken by the reflected waves to determine the distance of the submarine.

- (b) The ship senses the ultrasound waves passively emitted by the submarine while it moves near the ship.
- (c) The ship detects the amplitude of the ultrasound waves which get scattered by the body of the submarine to determine its depth.
- (d) The ship measures the change in the amplitude of the ultrasound waves after getting reflected by the submarine to determine its depth.

**Correct Answer:** Option (a)

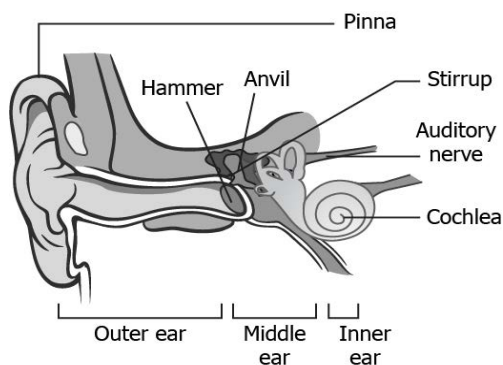
**LOB : Explain the process of hearing in human beings**

1) How does the human ear sense the fluctuations in the air pressure due to sound?

- (a) The pinna collects sound from the surrounding and amplifies the pressure variations, which get transmitted to the anvil.
- (b) The eardrum vibrates the bones inside the middle ear, which transmits the amplified pressure variations to the inner ear.
- (c) The eardrum vibrates the cochlea inside the middle ear, which transmits the amplified pressure variations to the inner ear.
- (d) The pinna collects sound from the surroundings and converts it into electrical signals, which are sent to the brain through the auditory nerve.

**Correct Answer:** Option (b)

2) The image shows the diagram of human ear.



Which part of the ear converts air pressure variations into electrical signals?

- (a) anvil
- (b) stirrup
- (c) cochlea
- (d) auditory nerve


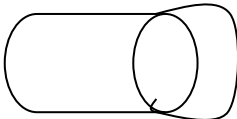
**Correct Answer:** Option (a)



# Suggested Teacher Resources



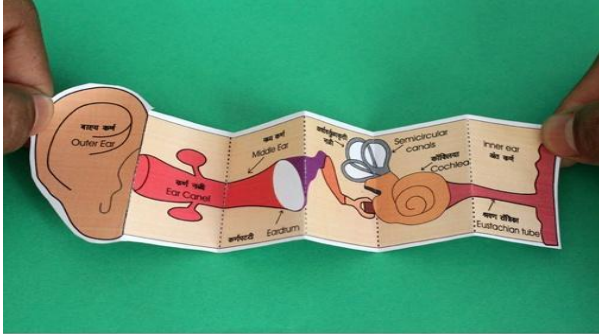

## Activity

Activity	Understand 'vibrations', in order to explain how sound is produced.
Material Required	Paper, glue, scissors
Vocabulary	Vibration: To and fro movement. Propagation: Spread
Procedure	<ol style="list-style-type: none"> <li>Cut the paper as shown in picture.</li> </ol>  <ol style="list-style-type: none"> <li>Make a roll of paper.</li> </ol>  <ol style="list-style-type: none"> <li>Suck air out through paper roll.</li> </ol>
Let's think	<ol style="list-style-type: none"> <li>Did you hear any sound?</li> <li>Will there be any sound if the attached piece of paper doesn't vibrate?</li> <li>What can you say about sound from above experiment?</li> </ol>
Text to real world connection	<ol style="list-style-type: none"> <li>Beating the drum.</li> <li>Vocal cord vibrates to produce a sound.</li> </ol>

Beyond the classroom	If you and your friend are on the moon, can you hear your friend's voice?
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## 2

## Activity

Activity	Construct a simple toy to show the structure of inner ear
Material required	White sheet, pencil, eraser, colours
Procedure	<ol style="list-style-type: none"> <li>1. Draw a structure of ear on white paper.</li> <li>2. Colour, label it and cut along the outline as shown.</li> <li>3. Make vertical dotted lines and fold the strip as shown in picture.</li> <li>4. Unfold it to show the sequence which sound takes to travel from the outer ear to our brain.</li> </ol>  <p>NOW FOLD THE STRIP ALONG THE VERTICAL DOTTED LINES. FROM THE OUTER EAR TO THE BRAIN - the strip shows the path which sound takes to reach us.</p>  <p>FOLD THE STRIP AS SHOWN.</p>
Reflection question	<ol style="list-style-type: none"> <li>1. What is the use of the middle ear?</li> <li>2. In which form does our brain receive signals?</li> </ol>

# 13. Why do We Fall Ill?

**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Health and its failure	Understand the requirements for being 'healthy', and thus differentiate between healthy, unhealthy & disease-free human body
Disease and its causes	Infer 'symptoms' and 'signs' of falling ill, in order to identify a disease
Acute and chronic disease	Identify acute and chronic diseases, in order to develop a better plan for recovery
Causes and precautions of diseases	Identify different causes/ agents for the diseases in order to prevent & cure them
Means of Spread	Predict how a disease (communicable) spreads in order to prevent it from affecting others
Principles of treatment	Identify causes of a disease, and use adequate medicines for cure
Principles of prevention	Tabulate different ways of prevent diseases, in order to stay healthy

**Learning Objectives and Learning Outcomes:**

Learning Objectives	Learning Outcomes
Understand the requirements for being 'healthy', and thus differentiate between healthy, unhealthy & disease-free human body	Relates processes and phenomena with causes / effects, such as symptoms with diseases / causal agents, tissues with their functions, production with use of fertilizers, process of evaporation with cooling effect, various processes of separation with the physical and chemical properties of the substances,
Infer 'symptoms' and 'signs' of falling ill, in order to identify a disease	

Identify acute and chronic diseases, in order to develop a better plan for recovery	production of sound with vibrations of source, etc.
Identify different causes/ agents for the diseases in order to prevent & cure them	
Predict how a disease (communicable) spreads in order to prevent it from affecting others	Explains processes and phenomena, such as function of different organelles, spread of diseases and their prevention, effect of force on the state of motion of objects, action and reaction, revolution of planets and satellites, conservation laws, principle of separation of different gases from air, melting / boiling / freezing, how bats use ultrasound to catch prey, etc.
Identify causes of a disease, and use adequate medicines for cure	
Tabulate different ways of prevent diseases, in order to stay healthy	
Identify different causes/ agents for the diseases in order to prevent & cure them	Applies scientific concepts in daily life and solving problems, such as separation of mixtures, uses safety belts in automobiles, covers walls of large rooms with sound absorbent materials, follows intercropping and crop rotation, takes preventive measures to control disease causing agents, etc.
Identify causes of a disease, and use adequate medicines for cure	Describes scientific discoveries / inventions, such as discovery of various atomic models, discovery of cell with invention of microscope, experiments of Lavoisier and Priestley, beliefs regarding motion, discovery of real cause for peptic ulcers, Archimedes principle, classification of living things, etc.

# Test items



**LOB : Understand the requirements for being 'healthy', and thus differentiate between healthy, unhealthy & disease-free human body**

1) Which example highlights good health for a musician?

(a) A musician whose lungs have slow breathing capacity that can control the notes of a flute.

(b) A musician whose lungs have high breathing rate that helps play higher notes on a flute

(c) A musician whose lungs have slow breathing rate that helps play higher notes on a flute.

(d) A musician whose lungs have enough breathing capacity to control the notes of a flute.

**Correct Answer:** Option (d)

2) Which option correctly differentiates between healthy and disease-free human body?

(a)

Healthy Human Body	Disease Free Human Body
It includes mental, social, and physical well-being.	It involves being comfortable.

(b)

Healthy Human Body	Disease Free Human Body
It involves being comfortable.	It includes mental, social, and physical well-being.

(c)

<b>Healthy Human Body</b>	<b>Disease Free Human Body</b>
It involves mental well-being due to social equality and harmony.	It involves being comfortable and healthy.

(d)

<b>Healthy Human Body</b>	<b>Disease Free Human Body</b>
It includes mental, social, and physical well-being.	It involves mental well-being due to social equality and harmony.

**Correct Answer:** Option (a)**LOB : Infer 'symptoms' and 'signs' of falling ill, in order to identify a disease**

1) How can a physician pinpoint or identify a disease after knowing some common symptoms of a patient?

- (a) by prescribing medications to the patient
- (b) by admitting the patient into the hospital
- (c) by conforming through laboratory tests
- (d) by keeping the patient under observation

**Correct Answer:** Option (c)

2) The table lists two person and respective diseases they are suffering from.

Person	Disease
P	Mental stress
Q	Meningitis

What is the common symptom that can be found in both the person?

- (a) joint pain
- (b) headache
- (c) constipation
- (d) sensitivity to light

**Correct Answer:** Option (b)

**LOB : Identify acute and chronic diseases, in order to develop a better plan for recovery**

1) Which option correctly classifies a chronic disease?

- (a) It can reoccur.
- (b) It is incurable.
- (c) It can last for a long time.
- (d) It causes no harm to the body organs.

**Correct Answer:** Option (c)

2) Raghav has common flu while his grandfather has asthma. Which option correctly classifies the time period for which these diseases will last?

(a)

Raghav	Grandfather
The disease will last or 5-15 days.	The disease will last for 3-5 days.

(b)

Raghav	Grandfather
The disease will last for a year.	The disease will last for 5-15 days.

(c)

Raghav	Grandfather
The disease will last for lifetime.	The disease will last for two or more year.

(d)

Raghav	Grandfather
The disease will last or 5-6 days.	The disease will last for lifetime.

**LOB : Identify different causes/ agents for the diseases in order to prevent & cure them**

1) What preventive action can save a person from diarrhea?

- (a) taking antibiotics regularly
- (b) doing regular exercise
- (c) eating hygienic food
- (d) going for regular health checkups

**Correct Answer:** Option (c)

2) Which group of diseases is caused by viruses?

- (a) AIDS, skin infection, influenza
- (b) AIDS, influenza, common cold



(c)Cholera, tuberculosis, AIDS

(d)Cholera, Anthrax, AIDS

**Correct Answer:** Option (b)

**LOB :Predict how a disease (communicable) spreads in order to prevent it from affecting others**

1) Shikhar has cholera from last week. What can shikhar do to prevent spread of the disease to other members of his family?

(a)by drinking boiled water

(b)by keeping his room clean

(c)by eating healthy food daily

(d)by avoiding sharing of utensils and food

**Correct Answer:** Option (d)

2) Which disease can be prevented by avoiding sexual contact with infected person?

(a)common flu

(b)syphilis

(c)diarrhea

(d)pneumonia

**Correct Answer:** Option (b)

**LOB : Identify causes of a disease, and use adequate medicines for cure**

1) Which disease can be treated by drugs that can kill protozoa?

(a)HIV

(b)malaria

(c)influenza

(d)typhoid

**Correct Answer:** Option (b)

2) Ravi is suffering from food poisoning. Doctor has prescribed him to take antibiotics for 3 days. How antibiotics help cure food poisoning?

- (a) They react with bacteria and eliminate them within 2 days.
- (b) They reduce the growth of bacteria by altering our body system.
- (c) They are consumed by bacteria that harms their cell function.
- (d) They block the bacterial synthesis pathway without affecting our own.

**Correct Answer:** Option (d)

**LOB : Tabulate different ways of prevent diseases, in order to stay healthy**

1) How can we prevent diseases that are vector borne?

- (a) by taking nutritional supplements
- (b) by keeping the surrounding clean
- (c) by drinking less water
- (d) by immunisation

**Correct Answer:** Option (b)

2) Jaundice is a viral disease that is transmitted through water. Which vaccination do we require in order to keep ourselves safe from jaundice and when?

- (a) vaccine against measles, after infection
- (b) vaccine against tetanus, by 10-20 years of age
- (c) vaccine against rabies, after few weeks of infection
- (d) vaccine against hepatitis A, by 5 years of age

**Correct Answer:** Option (d)

# Suggested Teacher Resources



## Activity

Objective	Infer 'symptoms' and 'signs' of falling ill, in order to identify a disease
Prerequisite	Students should know the difference between healthy and disease-free.
Material Required	Pen, paper.
Vocabulary	Symptoms, signs, nauseas, dizziness, fatigue, inflammation, acute and chronic disease, antibiotics.
Procedure	<ol style="list-style-type: none"> <li>1. Talk to neighbors in your community and ask about common diseases and their symptoms.</li> <li>2. Meet a local doctor and ask them about common treatment of these diseases.</li> <li>3. Observe the collected data and classify diseases on the basis of communicable/ non-communicable, acute/ chronic, vector borne diseases, congenital etc.</li> </ol>
Reflection Questions	<ol style="list-style-type: none"> <li>1. What were some common diseases you found in your neighborhood?</li> <li>2. What are some common treatments of these diseases?</li> <li>3. How many of them actually go to the doctor? Is the doctor certified?</li> </ol>
Text to real world connection	<p>Diabetes, dengue, respiratory disease are some common diseases in India.</p> <p>A study reported in WHO, conducted for the NCMH (National Care Of Medical Health), states that at least 6.5 per cent of the Indian population suffers from some form of serious mental disorder, with no discernible rural-urban differences.</p>
Beyond the classroom	<p>Conduct a survey on children's general health of well off families and poor families on the basis of parameters like Weight, height, living environment, vaccination, and balanced diet.</p> <p>Also, collect news articles related to swine flu, Dengue and arrange as a wall magazine.</p>

## 2

## Activity

Activity	Case study
Material required	Print out of case study
Procedure	<p><b>Students read the following case study in pairs/ teacher can read it aloud.</b></p> <p>Hari was harvesting potatoes when the devastating earthquake struck on 25th April 2015. He rushed back to find his house razed to the ground with his parents buried under the debris. His parents were rescued but Hari started displaying symptoms of Post-traumatic stress disorder. "I kept hearing my son's voice as if he was calling for help," recalls Hari. As well as experiencing hallucinations, his behaviour became irrational, convinced he was going to lose his piece of land he would hide his ownership papers. He took to drinking alcohol and roamed aimlessly without sharing any whereabouts to his family living in a temporary shelter. His wife, teenaged son and daughter watched helplessly as he kept living a nightmare. Hari was referred to a CBM-supported emergency mental health project. After a monthly session with a psychiatrist, subsidised medication and regular home visits from a counsellor he began to recover from the trauma and is working on a construction site. This support has also helped Hari realise that he is not alone and has nothing to be ashamed of: "I now know that there are many other people who are mentally affected due to the impact of the earthquake. I am also able to speak in social gatherings, allowing me to share my feelings."</p> <p>The ignorance, fear, misunderstanding and prejudice that surround mental illness deepen the severity of the illness as individuals withdraw further from the world around them. Due to the stigma associated with mental illness, a lack of awareness, and limited access to professional help, only 10-12% of these sufferers will seek help.</p>

Reflection  
question

1. Why is it important to talk about mental health?
2. What kind of prejudices are there in your community?
3. What are the reasons for rising cases of depression, anxiety and stress etc?
4. What are the signs and symptoms of mental illness?
5. How can we take care of our mental wellbeing?

# 14. Natural Resources

**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Introduction	Understand and Classify the resources present on Earth and ways to save them in order to protect our planet
Air	Tabulate the composition of air around us & their role, in order to understand role of atmosphere in climate control
Movement of air – winds	Comprehend how air moves, in order to explain winds
Rain	Describe movement of water particles and heating of land & water in order to explain process of raining
Air pollution	Enlist reasons for air pollution in order to prevent them and keep air clean
Water	List down uses & distribution of water, in order to efficiently use it around the world
Water pollution	List down reasons for water pollution in order to prevent them and keep air clean
Mineral riches in the soil	Explain ways of soil formation in order to understand diversity of life
	Elaborate components of soil and their significance in order to improve biodiversity of an area
	Explore reasons for soil erosion, in order to prevent them and thus improve flora
Biogeochemical Cycles	Describe & draw water cycle, and thus explain how water replenishes
	Describe & draw nitrogen cycle, in order to realize presence of different forms of nitrogen in our surroundings
	Describe & draw carbon cycle, in order to realize presence of different forms of carbon in our surroundings and reduce greenhouse effect

	Describe & draw oxygen cycle, in order to realize presence of different forms of oxygen in our surroundings
Ozone layer	Elaborate the importance of ozone layer and draw conclusions on causes for its depletion, and measures to prevent its depletion

### **Learning Objectives and Learning Outcomes:**

<b>Learning Objectives</b>	<b>Learning Outcomes</b>
Understand and Classify the resources present on Earth and ways to save them in order to protect our planet	Classifies materials / objects / organisms / phenomena / processes, based on, properties / characteristics, such as classification of plants, animals under various hierarchical sub-groups, natural resources, classification of matter based on their states (solid / liquid / gas) and composition (element / compound / mixture), etc.
Describe movement of water particles and heating of land & water in order to explain process of raining	Relates processes and phenomena with causes / effects, such as symptoms with diseases / causal agents, tissues with their functions, production with use of fertilizers, process of evaporation with cooling effect, various processes of separation with the physical and chemical properties of the substances, production of sound with vibrations of source, etc.
Enlist reasons for air pollution in order to prevent them and keep air clean	
Explain ways of soil formation in order to understand diversity of life	
Explore reasons for soil erosion, in order to prevent them and thus improve flora	
Elaborate the importance of ozone layer and draw conclusions on causes for its depletion, and measures to prevent its depletion	

Tabulate the composition of air around us & their role, in order to understand role of atmosphere in climate control	Explains processes and phenomena, such as function of different organelles, spread of diseases and their prevention, effect of force on the state of motion of objects, action and reaction, revolution of planets and satellites, conservation laws, principle of separation of different gases from air, melting / boiling / freezing, how bats use ultrasound to catch prey, etc.
Comprehend how air moves, in order to explain winds	
List down uses & distribution of water, in order to efficiently use it around the world	
List down reasons for water pollution in order to prevent them and keep air clean	
Elaborate components of soil and their significance in order to improve biodiversity of an area	
Describe & draw water cycle, and thus explain how water replenishes	Draws labelled diagrams / flow charts / concept map /graphs, such as biogeochemical cycles, cell organelles and tissues, human ear, distance-time and speed-time graphs, distribution of electrons in different orbits, process of distillation / sublimation, etc.
Describe & draw nitrogen cycle, in order to realize presence of different forms of nitrogen in our surroundings	
Describe & draw carbon cycle, in order to realize presence of different forms of carbon in our surroundings and reduce greenhouse effect	
Describe & draw oxygen cycle, in order to realize presence of different forms of oxygen in our surroundings	
Elaborate the importance of ozone layer and draw conclusions on causes for its depletion, and measures to prevent its depletion	Applies learning to hypothetical situations, such as weight of an object at moon, weight of an object at equator and poles, life on other planets, etc.

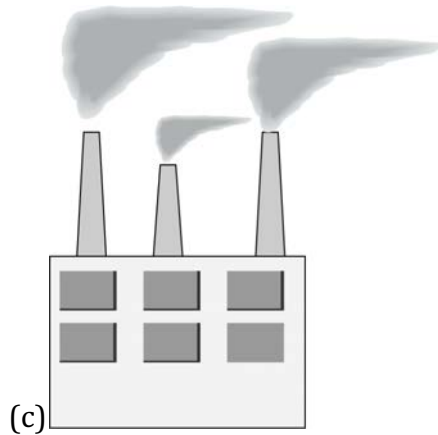
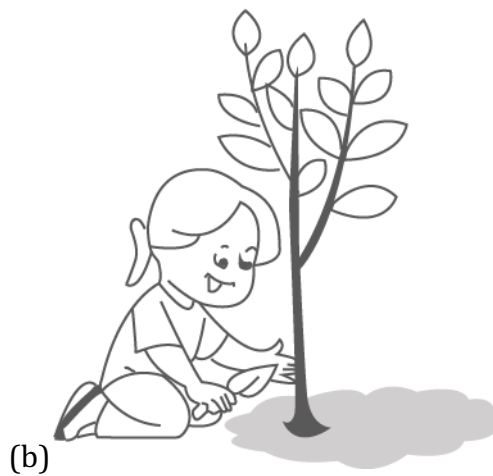
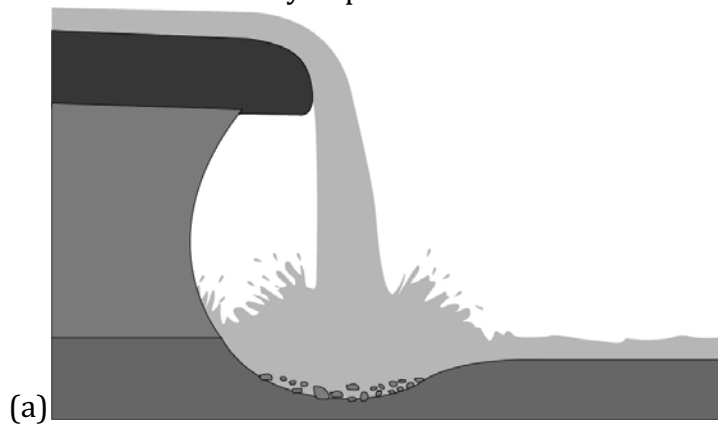


# Test items



**LOB : Understand and Classify the resources present on Earth and ways to save them in order to protect our planet**

1) Which of these is likely to pollute the resources of Earth?





(d)

**Correct Answer:** Option (c)

2) The table list few domains of Earth.

Domains	Facts
Atmosphere	It is the blanket of air surrounding the Earth
Hydrosphere	It comprises of the water bodies on the Earth
Lithosphere	The solid crust of the Earth

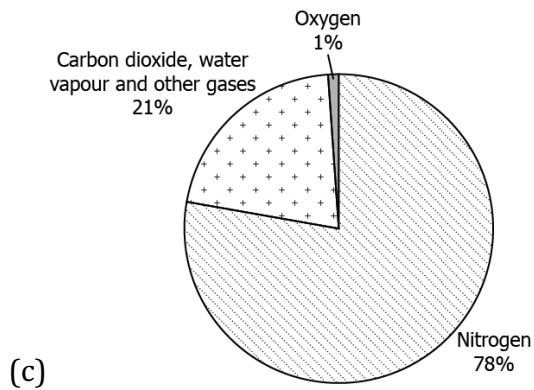
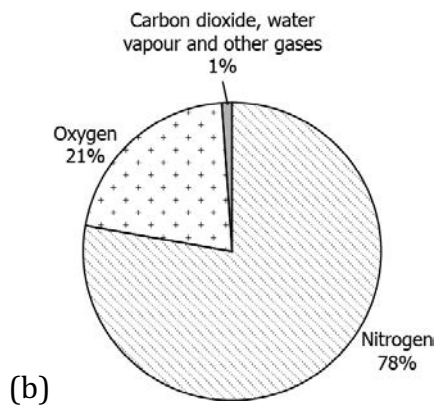
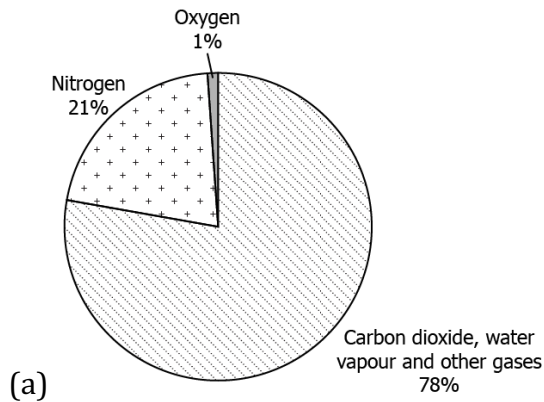
A water treatment plant in a region has been setup in a region to clean the sewage of the industries. Which domains of Earth can be protected by the water treatment plant?

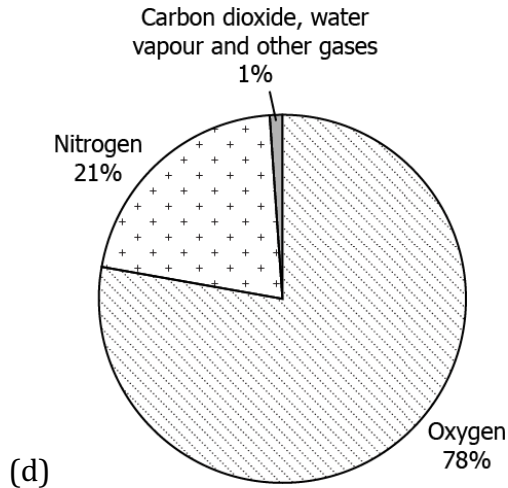
- (a) Only Atmosphere
- (b) Only Hydrosphere
- (c) Lithosphere and Atmosphere
- (d) Hydrosphere and Lithosphere

**Correct Answer:** Option (b)

**LOB : Tabulate the composition of air around us & their role, in order to understand role of atmosphere in climate control**

1) Which of these images represents the correct composition of air on Earth?





**Correct Answer:** Option (b)

2) A student studies that though Earth and Moon are almost of same distance from the Sun, temperature of the Moon varies from  $-190^{\circ}\text{C}$  to  $110^{\circ}\text{C}$ . But the average temperature on Earth is around  $14^{\circ}\text{C}$  which is suitable for supporting life. What helps Earth in maintaining this temperature?

- (a) presence of atmosphere on Earth
- (b) presence of rocks on Earth surface
- (c) occurrence of large number of water bodies
- (d) occurrence of tall buildings on Earth surface

**Correct Answer:** Option (a)

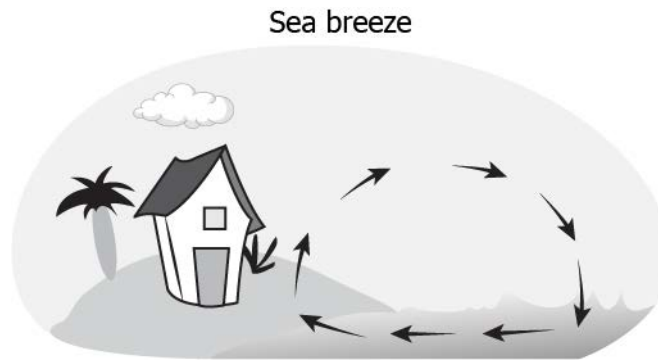
**LOB : Comprehend how air moves, in order to explain winds**

1) Which of this phenomenon is responsible for the movement of air?

- (a) revolution of Earth
- (b) uneven heating of Earth
- (c) wave action in the oceans
- (d) even pressure on Earth surface

**Correct Answer:** Option (b)

2) A student studies that during daytime air moves from sea towards the land which is known as sea breeze.



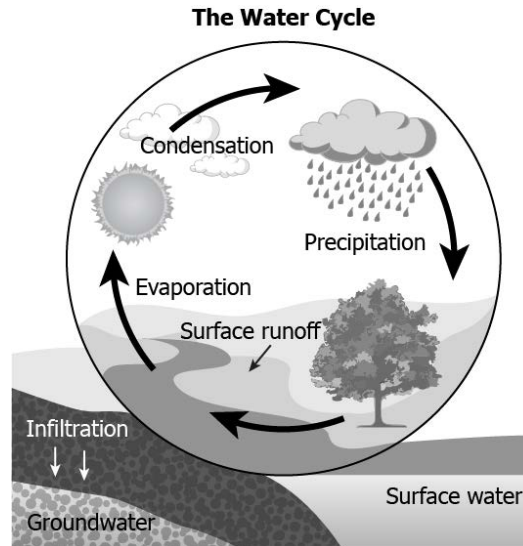
What cause results in this flow direction?

- (a) sea waves carry wind during daytime
- (b) landmass absorbs air during the daytime
- (c) air always moves from sea towards the land
- (d) the heated air above the landmass rises leaving vacancy

**Correct Answer:** Option (d)

**LOB : Describe movement of water particles and heating of land & water in order to explain process of raining**

1) The image represents the water cycle.



Which of these processes describes the movement of water vapour from water bodies to form clouds?

- (a) condensation
- (b) evaporation
- (c) precipitation
- (d) surface runoff

**Correct Answer:** Option (b)

2) A student studies that due to sunlight, the air gets heated up. This hot air carries water vapour along with it. He also studies that this water vapour expands and cools as it rises. What causes the water vapour to return as rainfall?

- (a) infiltration of water
- (b) surface runoff of the water
- (c) condensation of the water vapour
- (d) further expansion of the water vapour

**Correct Answer:** Option (c)

**LOB : Enlist reasons for air pollution in order to prevent them and keep air clean**

1) A student watched a news report which mentions the occurrence of acid rain in a region. What might have caused the acid rain in the region?

- (a) dissolving of oxygen in atmosphere with the rainwater
- (b) dissolving of hydrogen in atmosphere with the rainwater
- (c) dissolving of dust particles in atmosphere with the rainwater
- (d) dissolving of carbon particles in atmosphere with the rainwater

**Correct Answer:** Option (d)

2) A student studies that, during winters, visibility drops highly in urban region as compared to rural region. What could be the most possible reason that causes the difference in visibility?

- (a) high levels of pollutants in the air
- (b) reduce in level of oxygen in the air
- (c) low levels of water vapour in the air
- (d) increase in level of nitrogen in the air

**Correct Answer:** Option (a)

**LOB : List down uses & distribution of water, in order to efficiently use it around the world**

1) The table list some uses of the resources on Earth.

- |              |
|--------------|
| 1. Bathing   |
| 2. Drinking  |
| 3. Breathing |
| 4. Burning   |
| 5. Inflating |

Which of these listed require the use of water?

- (a) bathing and burning

- (b) bathing and drinking
- (c) inflating and burning
- (d) drinking and breathing

**Correct Answer:** Option (b)

2) After taking a bath, John left the tap open. Noticing that his father asked him to turn off the tap and never leave a tap unattended. What can be a reason for this?

- (a) water can overflow from the bucket and make the surface wet
- (b) it might result a flooding of the drains in the region
- (c) water wastage can result in scarcity of water
- (d) it might cause a drop in room temperature

**Correct Answer:** Option (b)

**LOB :List down reasons for water pollution in order to prevent them and keep air clean**

1) The table lists few processes polluting the resources of Earth.

- |   |
|---|
| <ol style="list-style-type: none"><li>1. Releasing of smoke by industries and vehicles</li><li>2. Dumping of sewage into the rivers</li><li>3. Suspension of dust particles from soil particles</li><li>4. Flow of dissolved fertilizers into a nearby lake</li></ol> |
|---|

Which of the listed processes can cause water pollution?

- (a) 1 and 2
- (b) 2 and 3
- (c) 2 and 4
- (d) 1 and 3



**Correct Answer:** Option (c)

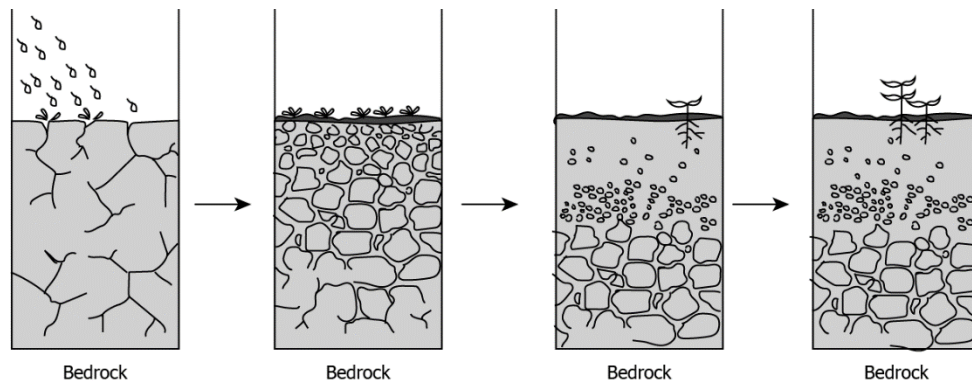
2) A student studies that the mixing of sewage from industries into the water bodies causes water pollution. How can this water pollution be reduced?

- (a) reducing the flow speed of the sewage into the river
- (b) increasing the amount of sewage that flows into the river
- (c) water treatment of the sewage before flowing into the river
- (d) holding the sewage in tank for few days before discharging into the river

**Correct Answer:** Option (c)

**LOB : Explain ways of soil formation in order to understand diversity of life**

1) The image given shows few steps involved in the process of soil formation.

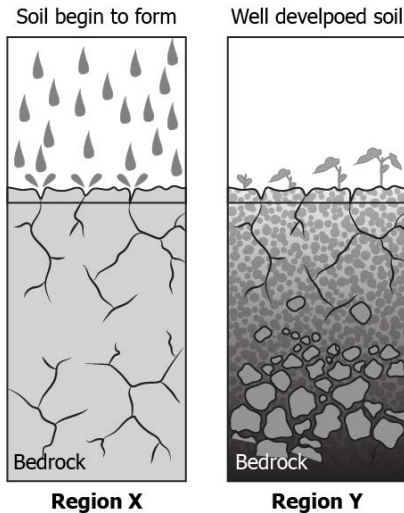


How does soil formation occur?

- (a) making the soil wet
- (b) compaction of loose particles
- (c) settling down of suspended particles
- (d) breaking down of rocks into fine particles

**Correct Answer:** Option (d)

2) The image shows the soil profile into regions X and Y.



What might have supported the growth of plants in the region “Y”?

- (a) lack of humus in the developed soil
- (b) well developed soil holds enough water
- (c) scarcity of minerals in the developed soil
- (d) well developed soil absorbs enough sunlight

**Correct Answer:** Option (b)

**LOB : Elaborate components of soil and their significance in order to improve biodiversity of an area**

1) The table lists few components observed on Earth:

- |   |
|---|
| <ol style="list-style-type: none"> <li>1. Humus</li> <li>2. Micro-organisms</li> <li>3. Sunlight</li> <li>4. Air</li> </ol> |
|---|

Which of these are component of soil?

- (a) sunlight and air
- (b) humus and sunlight
- (c) humus and micro-organisms
- (d) micro-organisms and sunlight

**Correct Answer:** Option (c)

2) A student list few components of the soil:

1. Air
2. Water
3. Humus
4. Micro-organisms
5. Minerals from rocks

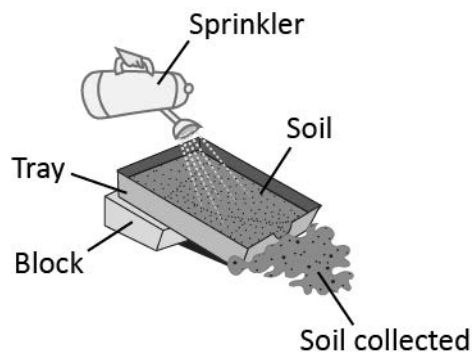
Which factor can improve the biodiversity of an area?

- (a) increase in the amount of annual rainfall
- (b) decrease in the amount of humus in the soil
- (c) increase in amount of pesticides in the soil
- (d) decrease in number of micro-organisms in the soil

**Correct Answer:** Option (a)

**LOB : Explore reasons for soil erosion, in order to prevent them and thus improve flora**

1) A student performs an activity by sprinkling water on a tray with soil as shown in the image.



He observes a large amount of soil has been eroded. What might have caused this?

- (a) temperature of the water
- (b) shape of the sprinkler
- (c) instability of the soil
- (d) large size of the tray

**Correct Answer:** Option (c)

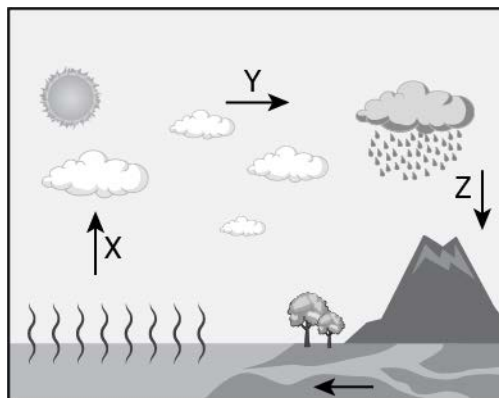
2) Sunil studies that covering a piece of land with vegetation can improve the rate of percolation of water. He and his friends plan to improve moisture content of the soil in a dry barren land in a region. Which steps can they adapt to improve the moisture content of the region?

- (a) plant trees
- (b) remove grasses
- (c) dig deeper wells
- (d) construct tall buildings

**Correct Answer:** Option (a)

**LOB : Describe & draw water cycle, and thus explain how water replenishes**

1) The image represents the water cycle.



Which option identifies the steps marked with X, Y and Z in a water cycle?

- (a) X→Precipitation, Y→ Evaporation, Z→ Condensation
- (b) X→Precipitation, Y→ Condensation, Z→ Evaporation
- (c) X→ Evaporation, Y→ Condensation, Z→ Precipitation
- (d) X→Condensation, Y→ Evaporation, Z→ Precipitation

**Correct Answer:** Option (c)

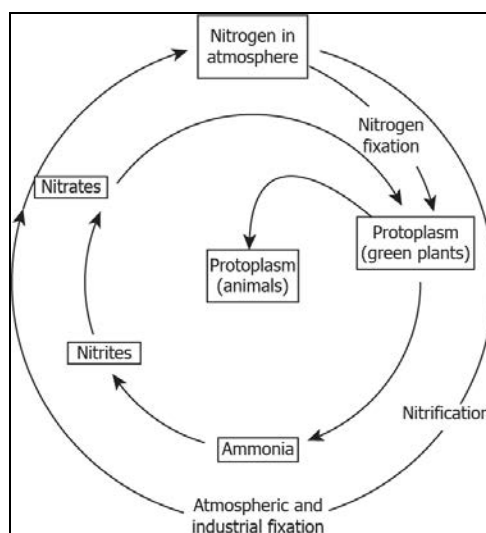
2) A student notices that during summer seasons the water level of a well drops. But during monsoons the water level replenish back to its normal level. What might have resulted the replenishment of the water level in the well during the monsoon season?

- (a) evaporation of surface water
- (b) transpiration of water vapor
- (c) condensation of ground water in soil pours
- (d) percolation of groundwater through the soil

**Correct Answer:** Option (d)

**LOB : Describe & draw nitrogen cycle, in order to realize presence of different forms of nitrogen in our surroundings**

1) The image represents the nitrogen cycle in the atmosphere.

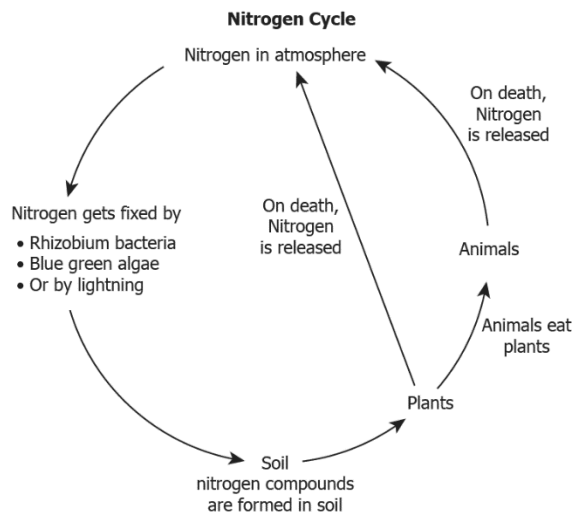


Which is the initial step involved in the process of conversion of nitrogen bound in plants after their death into atmospheric nitrogen?

- (a) Ammonification
- (b) Denitrification
- (c) Nitrification
- (d) Nitrogen fixation

**Correct Answer:** Option (a)

2) The image represents the nitrogen cycle occurring in Earth.



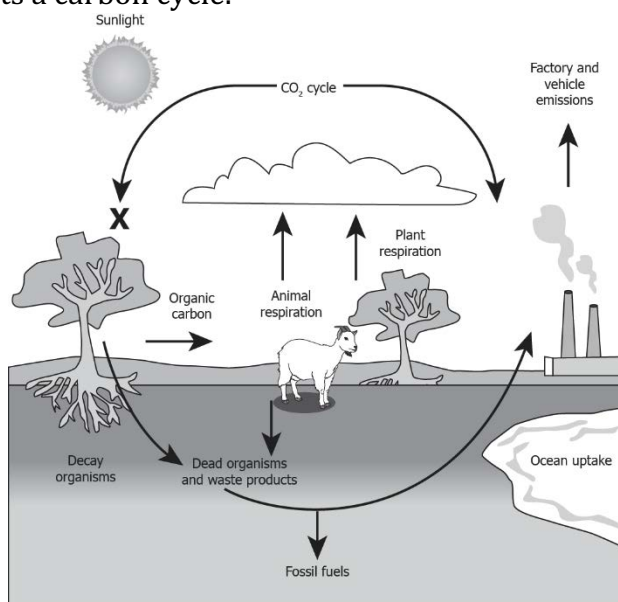
How does the nitrogen molecule in the atmosphere changes throughout the cycle?

- (a) initial elemental form of nitrogen converts to simpler form and releases back into the atmosphere
- (b) initial elemental form of nitrogen converts to complex form and then back again to simpler form
- (c) initial complex form of nitrogen converts to simpler form and then back again to complex form
- (d) initial complex form of nitrogen converts to more complex form and releases back again into the atmosphere

**Correct Answer:** Option (b)

**LOB : Describe & draw carbon cycle, in order to realize presence of different forms of carbon in our surroundings and reduce greenhouse effect**

1) The image represents a carbon cycle.



What does the “X” represent in the carbon cycle?

- (a) respiration by the plants
- (b) combustion by the plants
- (c) decomposition of the plants
- (d) photosynthesis by the plants

**Correct Answer:** Option (d)

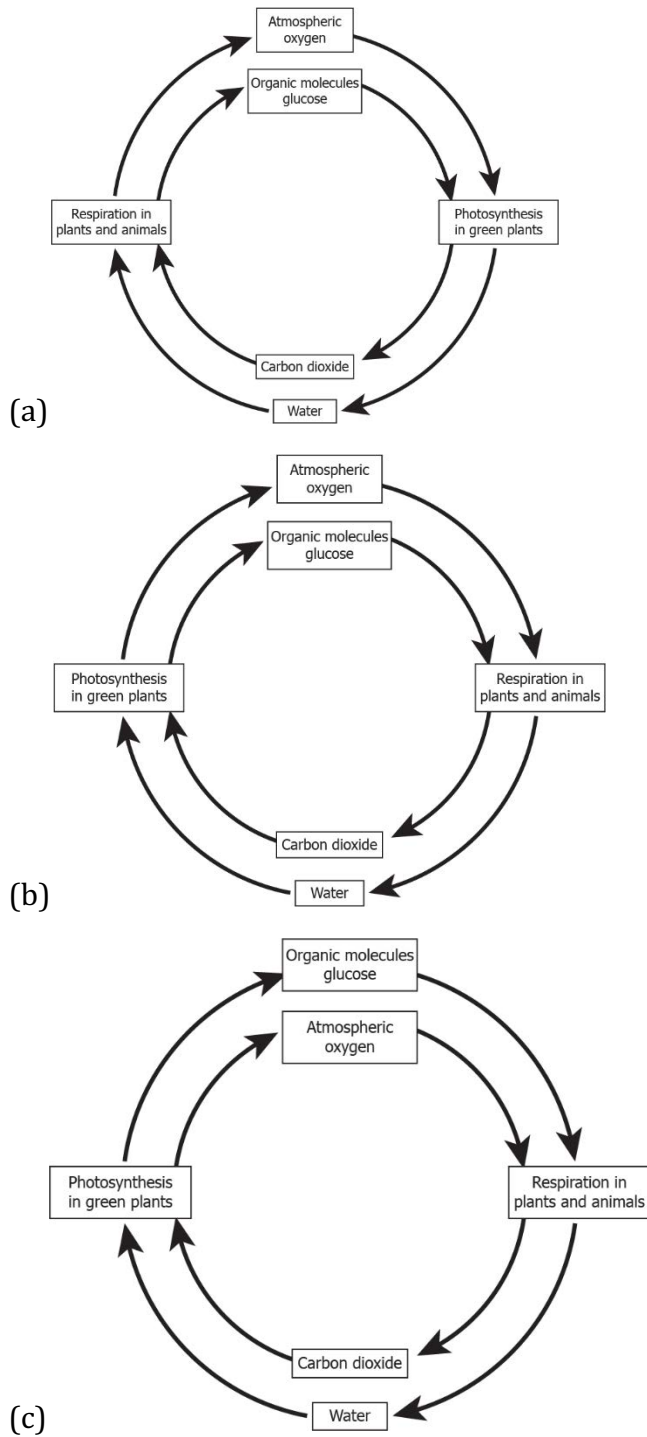
2) A student studies that carbon dioxide is a greenhouse gas. Rise in the amount of greenhouse gases in the atmosphere can rise global temperature. Which step can help in reducing the global warming?

- (a) setting up new industries
- (b) using cleaner source of fuels
- (c) increasing the use of petroleum
- (d) stopping use of vehicles for transportation

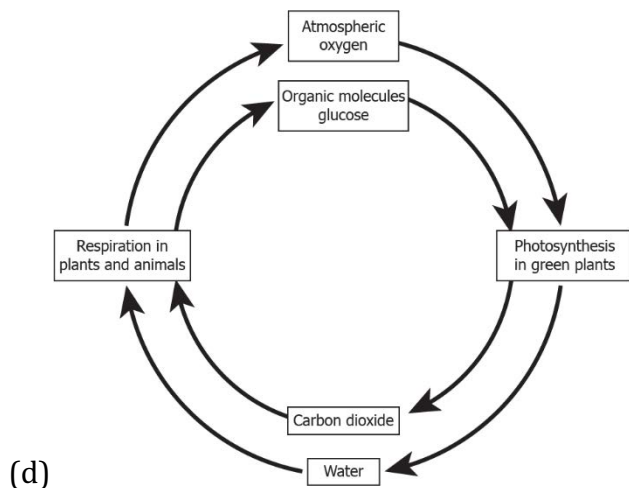
**Correct Answer:** Option (b)

**LOB : Describe & draw oxygen cycle, in order to realize presence of different forms of oxygen in our surroundings**

1) Which of this explains the oxygen cycle occurring in our biosphere?

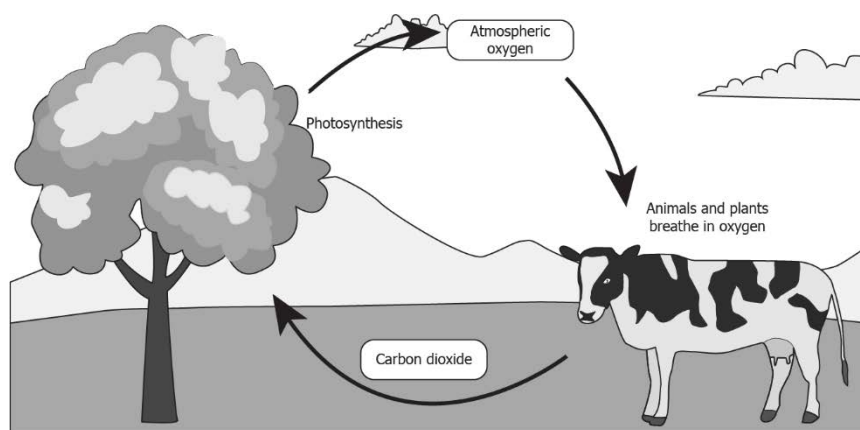






**Correct Answer:** Option (b)

2) The image given represents a part of the oxygen cycle.



Which process results in returning of the oxygen into the atmosphere?

- (a) transpiration by plants
- (b) respiration by animals
- (c) photosynthesis by plants
- (d) digestion of food by animals

**Correct Answer:** Option (c)

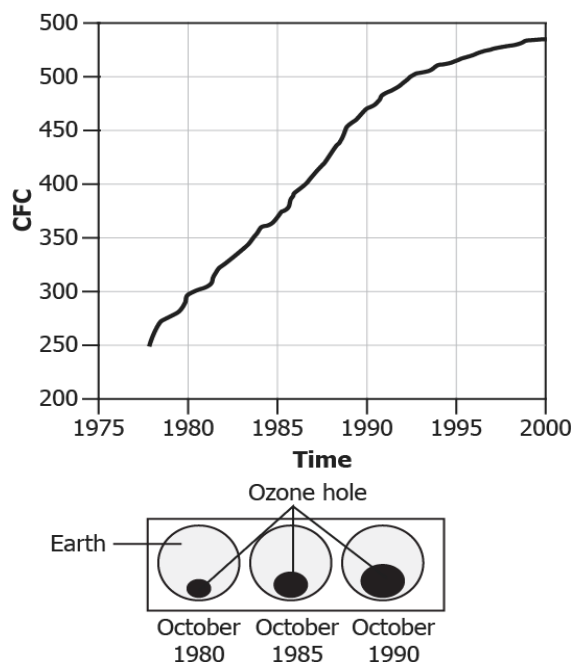
**LOB : Elaborate the importance of ozone layer and draw conclusions on causes for its depletion, and measures to prevent its depletion**

1) A student studies that ozone is an important layer in Earth's atmosphere in sustaining life on Earth. What function does ozone layer plays in sustaining life on Earth?

- (a) it releases oxygen to Earth's atmosphere
- (b) it causes the change in season through the year
- (c) it absorbs harmful radiations coming from the Sun
- (d) it causes condensation of water vapour resulting in rainfall

**Correct Answer:** Option (c)

2) The graph shows the increase in the amount of CFC in the atmosphere and the satellite images below shows the hole in ozone layer on the atmosphere over Antarctica.



What of these can best stop the formation of ozone hole in the atmosphere?


- (a) increase the number of refrigerant equipment that uses CFC
- (b) maintain the number of refrigerant equipment that uses CFC
- (c) reduce the use of refrigerant equipment that uses CFC by half
- (d) switching to alternative gas that could replace CFC in the refrigerant equipment

**Correct Answer:** Option (d)

# Suggested Teacher Resources



## Activity

Objective	Elaborate the importance of ozone layer and draw conclusions on causes for its depletion, and measures to prevent its depletion.
Prerequisite	Ozone layer composition
Material Required	2 plastic bottles, Chewing gum, Hot water
Vocabulary	Depletion, Ultraviolet rays, CFCs ( Chlorofluorocarbons)
Procedure	<ol style="list-style-type: none"> <li>1. Take two bottles A and B.</li> <li>2. Fill the bottle completely with hot water and bottle B half way.</li> <li>3. Spread the chew and cover the mouth of both the bottles with the chewing gum.</li> </ol>  <ol style="list-style-type: none"> <li>4. After 2 minutes, note down the observations.</li> <li>5. After 10 minutes, again note down the observations.</li> </ol>
Let's think	<ol style="list-style-type: none"> <li>1. What changes have you seen in the chewing gum?</li> <li>2. What caused hole in chewing gum?</li> <li>3. What causes Ozone layer depletion?</li> </ol>
Text to real world connection	Hot water in this activity represents CFCs and chewing gum represents Ozone layer. CFCs and other man-made compounds caused hole in the ozone layer.
Beyond the classroom	<p>Make the list of products in which CFCs is available.</p> <p>What actions have been taken by different countries to stop further damage?</p>

# 15. Improvement in Food Resources

**QR Code:**



**Learning Objectives:**

Content area/ Concepts	Learning Objectives
Improvement in crop yields	Identify the nutrients present in different foods, in order to have a balanced diet
	Recognize growth needs of different crops like temperature, in order to produce them effectively
Crop variety improvement	Discover ways of breeding a better variety of seeds, in order to improve quality of crops
Crop production management	Enlist various ways of enriching the soil in order to increase crop yield
	List down ways of irrigating a piece of land, in order to provide adequate water to all crops
	Analyse ways/ combinations of growing crops in order to maximize yield
Crop protection management	Describe ways/ organisms by which crops get affected, in order to develop a solution to prevent them from attacking crops
	Develop better storage strategies for crops, in order to minimize storage losses
Animal Husbandry	List down some characteristics local and Foreign breeds of cattle, in order to develop a cattle with desired qualities
	Outline food requirements and common diseases of cattle, in order to protect them better
Poultry farming	Analyse desirable traits in poultry in order to maximize egg production and chicken meat
Egg and broiler production	Identify housing, nutritional & environmental requirements of poultry in order to prevent and control diseases
Fish Production	Analyse the process of catching fish from seawater and fresh water, in order to maximize yield

Bee-keeping	Name different varieties of bees and examine their traits, in order to maximize output
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### **Learning Objectives and Learning Outcomes:**

<b>Learning Objectives</b>	<b>Learning Outcomes</b>
Recognize growth needs of different crops like temperature, in order to produce them effectively	Relates processes and phenomena with causes / effects, such as symptoms with diseases / causal agents, tissues with their functions, production with use of fertilizers, process of evaporation with cooling effect, various processes of separation with the physical and chemical properties of the substances, production of sound with vibrations of source, etc.
Analyse ways/ combinations of growing crops in order to maximize yield	
Develop better storage strategies for crops, in order to minimize storage losses	
Discover ways of breeding a better variety of seeds, in order to improve quality of crops	Applies scientific concepts in daily life and solving problems, such as separation of mixtures, uses safety belts in automobiles, covers walls of large rooms with sound absorbent materials, follows intercropping and crop rotation, takes preventive measures to control disease causing agents, etc.
Enlist various ways of enriching the soil in order to increase crop yield	
List down ways of irrigating a piece of land, in order to provide adequate water to all crops	
List down some characteristics local and Foreign breeds of cattle, in order to develop cattle with desired qualities	
Outline food requirements and common diseases of cattle, in order to protect them better	
Analyse desirable traits in poultry in order to maximize egg production and chicken meat	
Identify housing, nutritional & environmental requirements of poultry in order to prevent and control diseases	
Analyse the process of catching fish from seawater and fresh water, in order to maximize yield	

Name different varieties of bees and examine their traits, in order to maximize output	
List down some characteristics local and Foreign breeds of cattle, in order to develop cattle with desired qualities	<p>Draws conclusion, such as classification of life forms is related to evolution, deficiency of nutrients affects physiological processes in plants, matter is made up of particles, elements combine chemically in a fixed ratio to form compounds, action and reaction act on two different bodies, etc.</p>
Outline food requirements and common diseases of cattle, in order to protect them better	
Analyse desirable traits in poultry in order to maximize egg production and chicken meat	
Identify housing, nutritional & environmental requirements of poultry in order to prevent and control diseases	
Analyse the process of catching fish from seawater and fresh water, in order to maximize yield	
Name different varieties of bees and examine their traits, in order to maximize output	
Describe ways/ organisms by which crops get affected, in order to develop a solution to prevent them from attacking crops	<p>Applies the interdependency and interrelationship in the biotic and abiotic factors of environment to promote conservation of environment, such as organic farming, waste management, etc.</p>

# Test items



**LOB : Identify the nutrients present in different foods, in order to have a balanced diet**

1) Which of these foods are rich in carbohydrates?

- (a) gram
- (b) wheat
- (c) soyabean
- (d) pigeon pea

**Correct Answer:** Option (b)

2) Which combination of foods would provide a balanced diet?

- (a) pea, black gram, lentil, rice
- (b) rice, maize, millets, sorghum
- (c) rice, lentil, groundnut, vegetables and fruits
- (d) soyabean, groundnut, mustard, sunflower

**Correct Answer:** Option (c)

**LOB : Recognize growth needs of different crops like temperature, in order to produce them effectively**

1) Which of these crops require more water to grow?

- (a) peas
- (b) gram
- (c) paddy
- (d) wheat

**Correct Answer:** Option (c)

2) An experiment is designed to understand the growth requirements of crops. Mustard seeds were chosen and were exposed to different temperature conditions. The table lists the locations of the seeds sown with respective temperature conditions.

Location	Temperature Conditions
A	15°C to 18°C
B	35°C to 38°C
C	-1°C to 2°C
D	45°C to 48°C

At which location would the mustard grow most effectively?

- (a) location A
- (b) location B
- (c) location C
- (d) location D

**Correct Answer:** Option (a)

**LOB : Discover ways of breeding a better variety of seeds, in order to improve quality of crops**

1) Crop Y is grown only in few areas due to specific temperature requirements. To increase the productivity of crop Y, it is recommended to develop its different varieties. Which feature should be included while developing the different varieties of crop Y in order to increase its productivity?

- (a) Developing varieties with strong biotic resistance.

Option (b): Developing varieties with less dependence on water.

Option (c): Developing varieties with extended maturity duration.

Option (d): Developing varieties adaptable to different climatic conditions.

**Correct Answer:** Option (d)

2) Which of these would make a crop resistant to biotic stresses?

- (a) Using insecticides to kill insects and other pests.
- (b) Developing crop varieties that are tolerant to high soil salinity.
- (c) Developing crop varieties that can grow in scarce water conditions.
- (d) Growing crops in artificial set ups with fixed temperature and moisture content.



**Correct Answer:** Option (a)

**LOB : Enlist various ways of enriching the soil in order to increase crop yield**

1) What is the main input used in organic farming to enrich the soil?

- (a) manure
- (b) fertilizers
- (c) herbicides
- (d) pesticides

**Correct Answer:** Option (a)

2) A soil sample has adequate water holding capacity but is deficient in phosphorous and potassium. Which of these would improve the quality of crops grown in that field?

- (a) Removing weeds
- (b) Applying fertilizers
- (c) Modifying irrigation system
- (d) Growing two different crops at the same time

**Correct Answer:** Option (b)

**LOB : List down ways of irrigating a piece of land, in order to provide adequate water to all crops**

1) Which of these the run-off from smaller catchment areas?

- (a) tanks
- (b) canals
- (c) dug wells
- (d) tube wells

**Correct Answer:** Option (a)

2) Town X is situated at the banks of a river. Due to inadequate release from the reservoir, often the agricultural farms of the town suffer from crop failures. Which type of irrigation would be suitable for town X?

- (a) Building tanks
- (b) Constructing canals
- (c) Introducing river lift system
- (d) Irrigating fields through dug wells

**Correct Answer:** Option (c)

**LOB : Analyse ways/ combinations of growing crops in order to maximize yield**

1) Which statement correctly defines mixed cropping?

- (a) growing two or more crops on the same field
- (b) growing different varieties of same crop on the same field
- (c) growing different crops on rotation basis on the same field
- (d) growing two or more crops on the same field in a definite pattern

**Correct Answer:** Option (a)

2) A farmer in town X changed the cropping pattern of the farm. Earlier the farm had only soyabean but then the farm was divided into rows of different crops. Two rows of soyabean and alternate two rows had maize and the next two had cowpea. What would be the most likely effect of the new cropping pattern?

- (a) Increase in yield
- (b) Degradation of land
- (c) Increased growth of weeds
- (d) Reduced intake of nutrients by crops

**Correct Answer:** Option (a)

**LOB : Describe ways/ organisms by which crops get affected, in order to develop a solution to prevent them from attacking crops**

1) Which of these adversely affects the health of the crops?

- (a) weeds
- (b) nutrients
- (c) vitamins

(d)fungicides

**Correct Answer:** Option (a)

2) A crop X is to be grown in a field. It is seen that *Parthenium*, a type of weed usually affects crop X. What measure would help to protect crop X from Parthenium?

- (a)Spraying pesticides can we have 'because' element in this item?
- (b) Avoiding crop rotation
- (c) Burning the field before sowing the crop
- (d) Delaying the sowing of crops by a few days

**Correct Answer:** Option (a)

**LOB :Develop better storage strategies for crops, in order to minimize storage losses**

1) What should one select to store grains at home in order to prevent any spoilage?

- (a)jute bags
- (b)plastics bags
- (c)earthen pots
- (d)airtight glass jars

**Correct Answer:** Option (d)

2) Which strategy would help to minimize loss due to improper storage?

- (a)adding manure to the produce
- (b)drying the produce in sunlight before storage
- (c)keeping the produce in open sacs to maintain airflow
- (d)covering the produce with a wet cloth before putting on the lid of the container

**Correct Answer:** Option (b)

**LOB : List down some characteristics local and Foreign breeds of cattle, in order to develop a cattle with desired qualities**

1) If exotic breed of cattle have longer lactation period, which of these is a characteristic of Brown Swiss, a type of exotic breed?

- (a)It will produce less milk.

- (b) It will produce more milk.
- (c) It will have a short life span.
- (d) It will not catch diseases easily.

**Correct Answer:** Option (b)

2) The table lists the characteristics of few Milch breed of cattle.

Milch Breed of Cattles	Characteristics
Jersey	Long lactation period
Sahiwal	Resistant to diseases
Brown Swiss	Long lactation period
Red Sindhi	Resistant to diseases

Based on the characteristics listed in the table, what will be the characteristics of the new breed if Jersey and Red Sindhi are cross-bred?

- (a) The new breed will have a long lactation period and will be resistant to diseases.
- (b) The new breed will have a small lactation period but will be resistant to diseases.
- (c) The new breed will have a long lactation period but will not be resistant to diseases.
- (d) The new breed will have a small lactation period and will not be resistant to diseases.

**Correct Answer:** Option (a)

**LOB : Outline food requirements and common diseases of cattle, in order to protect them better**

1) Animal feed includes roughage and concentrates. What are the characteristics of concentrates?

- (a) high in fiber
- (b) very few nutrients

- (c) high level of proteins
- (d) less water content

**Correct Answer:** Option (c)

2) A cattle are affected by an external parasite. Which part of the cattle will most likely be affected?

- (a) skin
- (b) liver
- (c) stomach
- (d) intestine

**Correct Answer:** Option (a)

**LOB :Analyse desirable traits in poultry in order to maximize egg production and chicken meat**

1) Which of these is to be considered before developing new varieties in poultry?

- (a) Developing a breed with low maintenance
- (b) Developing a breed with high maintenance
- (c) Developing a breed that produces a smaller number of chicks
- (d) Developing a breed with more food requirement

**Correct Answer:** Option (a)

2) What is the desirable trait in poultry for developing new varieties?

- (a) tolerance to cooler temperatures
- (b) decrease in the number of chicks
- (c) Increase in the size of the egg-laying bird
- (d) control the occurrence of diseases in chicks

**Correct Answer:** Option (d)

**LOB : Identify housing, nutritional & environmental requirements of poultry in order to prevent and control diseases**

1) The table lists four types of food for broiler chickens.

Type of Food	Nutritional Value
P	Rich in fats
Q	Rich in proteins
R	Rich in fats with low levels of vitamin A
S	Low levels of fats and vitamin K

Which type of food is desirable for broiler chickens?

- (a) food P
- (b) food Q
- (c) food R
- (d) food S

**Correct Answer:** Option (b)

2) Virus, bacteria, fungi, and parasites affect the poultry fowl and often leads to the sudden deaths of poultry fowls. How can such loss of poultry be reduced?

- (a) By providing low protein diet to poultry fowls
- (b) By avoiding use of disinfectants on poultry fowls
- (c) By reducing the intake of vitamins in poultry feeds
- (d) By vaccinating the poultry fowls at regular intervals

**Correct Answer:** Option (d)

**LOB : Analyse the process of catching fish from seawater and fresh water, in order to maximize yield**

1) Why Catlas, Rohus, Mrigals, and Grass Carps are kept in combination in a single fishpond?

- (a) They have a short life span.
- (b) They are resistant to diseases.
- (c) They have less food requirement.
- (d) They do not compete with each other for food.

**Correct Answer:** Option (d)

2) Four groups capture marine fishes with different instruments as listed in the table.

Group	Tool/Equipment Used to Capture Marine Fishes
A	Hand-pulled fishing nets
B	Fishing nets guided by echo sounders
C	Fishing nets guided by satellites
D	Pulley based fishing nets

Which set of groups will most likely get the maximum fish catch?

- (a) groups A and B
- (b) groups B and C
- (c) groups C and D
- (d) groups D and A

**Correct Answer:** Option (b)

**LOB : Name different varieties of bees and examine their traits, in order to maximize output**

1) Which variety of bee is commonly used for producing honey commercially?

- (a) A. florum
- (b) A. dorsata
- (c) A. mellifera
- (d) Apis cerana indica

**Correct Answer:** Option (c)

2) The table describes the characteristics of Italian bees.

<b>Characteristics of Italian Bees</b>	<b>Description</b>
A	They sting less.
B	They stay in beehives for long period.
C	They have high honey collection capacity.
D	They breed well.

Which characteristic feature of Italian bees make them suitable for commercial honey production?

Option (a) characteristic A

Option (b): characteristic B

Option (c): characteristic C

Option (d): characteristic D


**Correct Answer:** Option (c)



# Suggested Teacher Resources



## Activity

Objective	List down ways of irrigating a piece of land, in order to provide adequate water to all crops
Prerequisite	Various irrigation techniques.
Material Required	Plastic bottle, 3 sticks of the same size, scissors and tape.
Vocabulary	Drip irrigation, sprinkle irrigation, surface irrigation, Manual irrigation.
Procedure	 <ol style="list-style-type: none"> <li>1. Take a plastic bottle and fix 3 sticks with the help of tape as shown in picture.</li> <li>2. Slit the bottom of the bottle to fill the water in.</li> <li>3. Fix the bottle in the ground near the roots of the plant.</li> <li>4. Loose the cap so that water drips.</li> </ol>
Reflection Questions	<ol style="list-style-type: none"> <li>1. What is the advantage of this irrigation technique?</li> <li>2. In which kind of region it can be useful?</li> </ol>

Text to real world connection	Maharashtra, Karnataka, and Tamil Nadu are some of the states where large areas have been brought under <b>drip irrigation</b> . Drip irrigation is a method which is used in those places where there is less water, Drip irrigation provides well growth of a plant with less water loss.
Beyond the classroom	Which type of irrigation technique is prevalent in your native place? Why?

## 2

**Activity**

Material required	3 Pots
Procedure	<ol style="list-style-type: none"> <li>1. First, segregate your household waste into dry and wet in your kitchen. Leftovers of food, fruit peels, and tea bags are wet waste whereas paper, plastic and packaging area dry waste.</li> <li>2. Secondly, put both these wastes in two different containers in the kitchen. When the wet waste container is full, put its contents into the first compost pot.</li> <li>3. Then add dry leaves of the same quantity as the waste and semi-composted material, buttermilk or cow dung to start with the decomposition process.</li> <li>4. Turn the pile around every other day. Keep the pile at the right level of dampness. If it is too wet, add dry leaves and stir and if it is too dry add water and stir.</li> <li>5. Once it is full, leave the pot open for 30-45 days for the composition to happen. Then move the semi-composted matter into a larger container or bin.</li> <li>6. After two months the waste will convert into rich compost that can be used or sold as manure.</li> </ol>
Reflection question	<ol style="list-style-type: none"> <li>1. Will you prefer manure or fertilizer for your garden? Why?</li> <li>2. Why are fertilizers used at large scale farming? How is it impacting the environment?</li> </ol>

