Example

Sodium (Na) has a valency of 1. It easily loses its outermost one electron and forms a sodium ion (Na^+) with a positive charge. Chlorine (Cl) has a valency of 1. It gains one electron to achieve a stable electron configuration and forms a chloride ion (Cl^-) with a negative charge. The oppositely charged sodium and chloride ions then attract to form sodium chloride (NaCl).

2. Differentiate between ionic bonds and covalent bonds.

Answer:

Difference between ionic bonds and covalent bonds

The differences between ionic bonds and covalent bonds are given in the table.

Ionic bonds	Covalent bonds
An ionic bond is formed from the electrostatic force of attraction between oppositely charged ions in a chemical compound.	The covalent bonds are formed from the electrostatic attraction of their nuclei for the same electrons.
Ionic bonds are formed when the valence (outermost) electrons of one atom are transferred permanently to another atom.	A covalent bond that results from the sharing of an electron pair between two atoms.
An ionic bond is formed between metal and non-metal atoms.	A covalent bond is formed between two non-metal atoms.
They have high melting and boiling points.	They have low melting and boiling points.
Ionic compounds have strong forces of attraction.	Forces of attraction are weaker in covalent compounds.
Ionic compounds are crystalline solids (made of ions).	Covalent compounds are usually volatile liquids or gases.
Ionic solids are insulators. However, ionic compounds are often capable of conducting electricity in molten or solution form when the ions are free to	Covalent compounds do not conduct electricity.

move.	
Ionic compounds are highly soluble in water.	Covalent compounds are insoluble in water but soluble in organic solvents.
Examples: Sodium chloride (NaCl) and calcium carbonate ($CaCO_3$).	**Examples:** Water (H_2O) and methane (CH_4).

3. What are the types of covalent bonds? Explain with examples.

Answer:

Types of covalent bonds

Based on the number of pairs of electrons being shared, covalent bonds are divided into three categories:

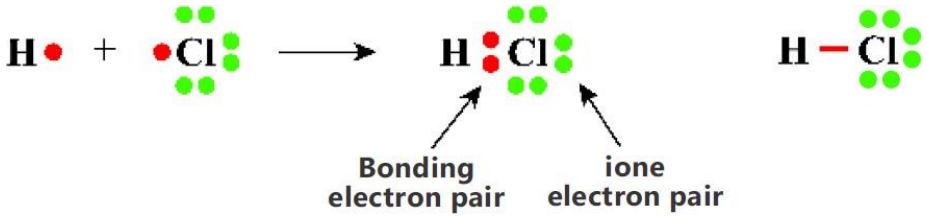
- Single Covalent Bond
- Double Covalent Bond
- Triple Covalent Bond

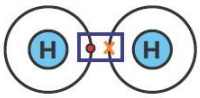
Single covalent bond

A single covalent bond is formed when only one pair of electrons is shared between atoms.

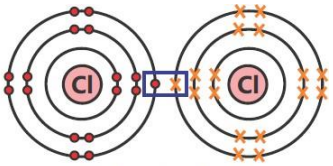
Example

Hydrogen and chlorine (H – Cl) coming together is an example of a single covalent bond. Hydrogen (H – H), halogens like Fluorine (F – F), Chlorine (Cl – Cl), Bromine (Br – Br), Iodine (I – I) and Ammonia (H – N – H) H are some examples of single covalent bond.

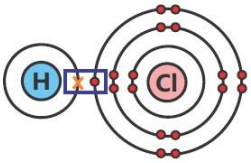




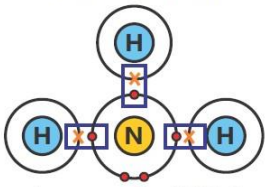
Hydrogen (H_2)



Chlorine (Cl_2)



Hydrogen Chloride (HCl)



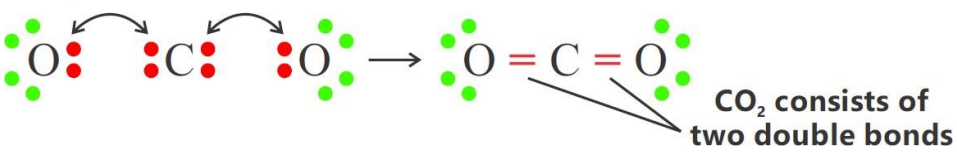
Ammonia (NH_3)

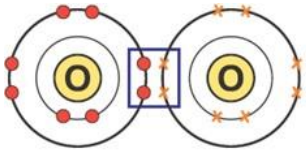
Double covalent bond

A double covalent bond is formed when two pairs of electrons are shared between two similar or different atoms.

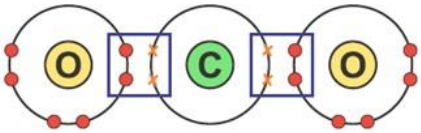
Example

A simple example of a double covalent bond is the formation of carbon dioxide ($O = C = O$). Oxygen has six valence electrons and requires two more for stability, while carbon has four valence electrons and requires four more. Therefore, two oxygen atoms share two pairs of electrons each with carbon to form carbon dioxide, thus forming two double covalent bonds. Ethene is also an example of a double covalent bond ($H - C = C - H$).

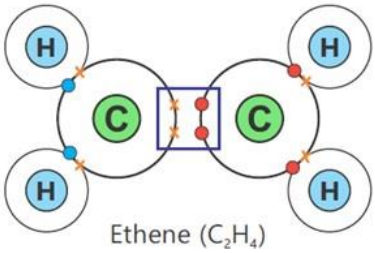




Oxygen (O_2)



Carbon dioxide (CO_2)



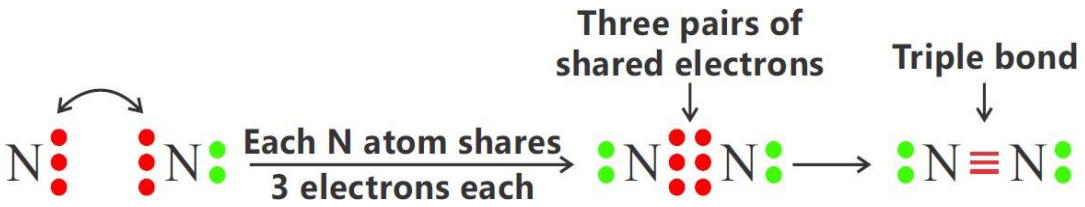
Ethene (C_2H_4)

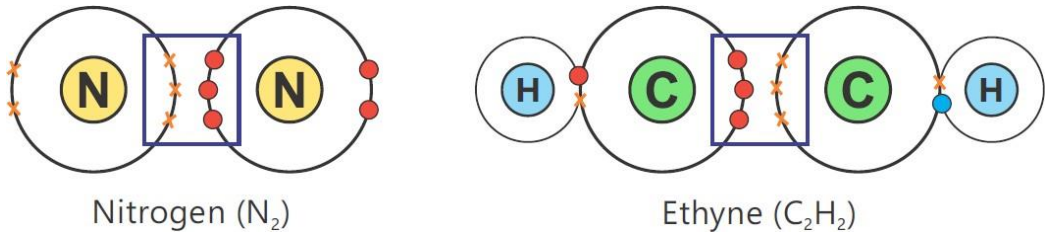
Triple covalent bond

The type of bond formed by the sharing of three pairs of electrons is called a triple covalent bond.

Example

The most common example of a triple covalent bond is Nitrogen gas ($N \equiv N$), in which each nitrogen atom contains 5 electrons in its outermost shell and needs 3 electrons to complete its octet. Therefore, the mutual sharing of three electron pairs forms a triple covalent bond between two atoms of nitrogen. A triple covalent bond can also be seen in Ethyne (H - C ≡ C - H).





Nitrogen (N_2) Ethyne (C_2H_2)

Term 2 Periodic Unit 2
Unit 7: Solutions

A. Choose the correct option.

1. A solution which has the ability to dissolve more solute at a given temperature is called a/an :
   a. dilute solution
   b. concentrated solution
   c. saturated solution
   d. unsaturated solution
   The correct answer is d.
2. Which one is not a solution?
   a. muddy water
   b. blood
   c. lemonade
   d. lassi
   The correct answer is a.
3. The correct equation is:
   a. solute + solution = solvent
   b. solvent + solution = solute
   c. solute + solvent = solution
   d. solute + solute = solution
   The correct answer is c.
4. A solution that contains a small amount of a solute is a/an:
   a. dilute solution
   b. concentrated solution
   c. saturated solution
   d. unsaturated solution
   The correct answer is a.
5. The solubility of some solids increases with an increase in:
   a. temperature
   b. pressure
   c. mass
   d. volume
   The correct answer is a.
6. Adding salt to the water will lower its:

a. freezing point
b. boiling point
c. solubility
d. density

The correct answer is a.

7. The solvent which is commonly used for cooking, drinking, washing and cleaning is:
   a. oil
   b. petrol
   c. clay
   d. water

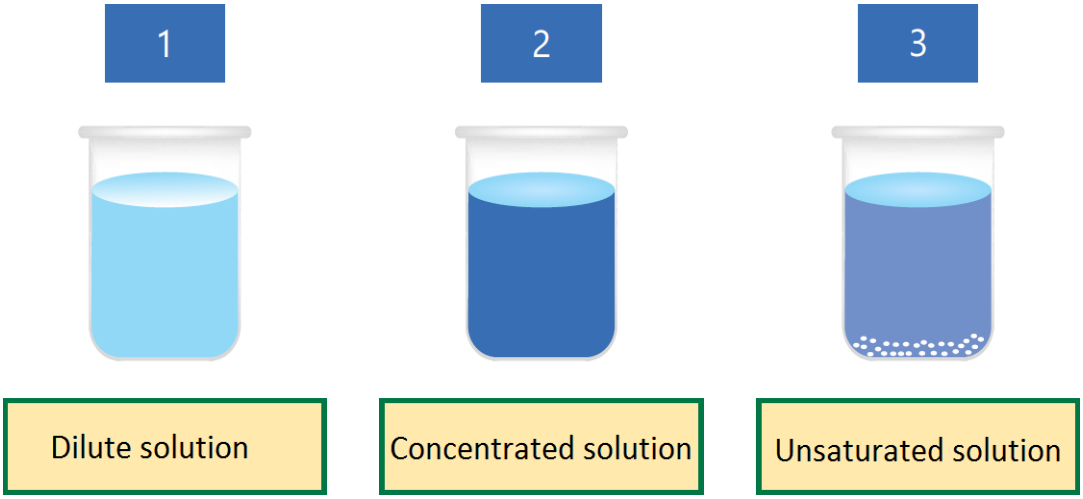
   The correct answer is d.
8. The most dilute solution is:
   a. 10 g of a solute in 1 L of a solvent
   b. 50 g of a solute in 1 L of a solvent
   c. 10 g of a solute in 0.5 L of a solvent
   d. 50 g of a solute in 0.5 L of a solvent

   The correct answer is a.
9. A binary solution has _____main components.
   a. 1
   b. 2
   c. 3
   d. 4

   The correct answer is b.
10. A solid solution is:
    a. air
    b. brass
    c. lemonade
    d. tea

    The correct answer is b.

B. Label the following as dilute, concentrated or unsaturated solutions.



C. Constructive response questions.

i. Write examples of three types of solutions in gaseous, liquid and solid states.

Answer:

Examples of three types of solutions in gaseous, liquid, and solid states:

- Brass is a solid solution formed from copper (solid) and zinc (solid).
- Lemonade is a liquid solution formed from lemon juice (liquid) and water (liquid).
- Air is a gaseous solution of various gases such as nitrogen, oxygen, carbon dioxide and traces of other gases.

ii. Investigate the solubility of sugar at room temperature and 50°C in 100 g of water. Explain all the steps.

Answer:

To investigate the solubility of sugar in water at room temperature and 50°C in 100 g of water, we can follow these steps:

- The solubility of sugar in water refers to the maximum amount of sugar that can dissolve in a given amount of water at a specific temperature. The solubility of sugar in water at room temperature is approximately 2000 g/L, and it increases with temperature.

- For both room temperature and 50°C, take 100 g of water and measure the amount of sugar needed to reach the point of saturation.
- At room temperature, slowly add sugar to the water while stirring continuously. Keep adding sugar until no more sugar dissolves and starts accumulating at the bottom of the container. This indicates the saturation point has been reached.
- Measure the amount of sugar that was added to the water before reaching saturation. This represents the solubility of sugar at room temperature in 100 g of water.
- Repeat the same process at 50°C by heating the water to the desired temperature using a water bath or other suitable means. Stir the water to ensure even heating. Add sugar gradually while stirring until saturation is reached.
- Measure the amount of sugar added to the water at 50°C before reaching saturation. This represents the solubility of sugar at 50°C in 100 g of water.

By comparing the amount of sugar dissolved at room temperature and 50°C, you can observe how temperature affects the solubility of sugar. Generally, as the temperature increases, the solubility of most solids in water also increases.

D. Answer the following questions briefly.

1. Why is water known as a universal solvent? Justify your answer by giving examples.

   Answer:

   Water is known as a universal solvent because it can dissolve more substances than any other solvent.

   Water can dissolve salt (NaCl) due to its ability to break the ionic bond between sodium and chloride ions. The water molecules surround the sodium and chloride ions, causing them to dissociate and form a solution.

2. Prepare a sugar solution by adding one spoonful of sugar to water. The resulting solution is both dilute and aqueous. Justify.

   Answer:

   The resulting solution is both dilute and aqueous.

- Adding one spoonful of sugar to water creates a dilute solution because the amount of sugar added is relatively small compared to the amount of water. The concentration of sugar in the solution is low, making it dilute.
- The resulting solution is aqueous because it is primarily composed of water. Water acts as the solvent, and the sugar gets dissolved in it, forming an aqueous solution.

3. Ahsan wants to prepare a dilute solution from a concentrated solution. What would you suggest for him to do?
   Answer:
   To prepare a dilute solution from a concentrated solution, Ahsan can follow these steps:
   - Measure the desired volume of the concentrated solution.
   - Gradually add the appropriate amount of solvent usually water to the concentrated solution while stirring.
   - Continue stirring until the concentrated solution is thoroughly mixed with the solvent.

4. How does temperature affect the solubility of a solute?
   Answer:
   Solubility depends on the ability of the solvent particles to break the solute particles and interact with them. There are some solutes whose particles are tightly bound together and unable to interact with the solvent particles due to which they do not dissolve in a solvent. Temperature can increase the solubility of such substances. The increase in temperature allows the particles of the solvent to break apart the solute particles and interact with them. The graph shows the solubility of different salts at different temperatures.

5. Make a list of 5 water-soluble and 5 water-insoluble materials that can be found in your house.
   Answer:
   Water-soluble materials found in households
   i. Salt (sodium chloride)
   ii. Sugar (sucrose)
   iii. Vinegar (acetic acid)

iv. Lemon juice (citric acid)
v. Coffee

Water-insoluble materials found in households

i. Cooking oil
ii. Wax
iii. Plastic
iv. Rubber
v. Sand

E. Investigating questions.

1. Prepare three different dilute solutions from 10 ml of a salt solution. Describe its procedure in your own words.

Answer:

Procedures to prepare three different dilute solutions from 10 ml of a salt solution are given below.

Solution 1

- Take a clean, empty container, beaker or flask and add 10 ml of distilled water to it.
- Gradually add 10 ml salt solution to the container while stirring continuously to mix properly.
- Continue stirring until the salt solution and water are thoroughly mixed.
- Measure the final volume of the solution.

Solution 2

- Take a separate clean container and add 15 ml of distilled water to it.
- Gradually add 10 ml salt solution to the container while stirring continuously.
- Stir the solution until the salt solution and water are mixed completely.
- Measure the final volume of the solution.

Solution 3

- Take a clean container and add 20 ml of distilled water to it.
- Gradually add 10 ml salt solution to the container.
- Stir the solution until the salt solution and water are mixed.
- Measure the final volume of the solution.

In each case, the resulting solutions are diluted as they are prepared by adding a smaller amount of the concentrated salt solution to a larger

amount of solvent (water). The dilution process involves reducing the concentration of the solute (salt) in the final solution.

2. Design and perform an experiment to check the effect of crushing, stirring and heating on solubility.

Answer:

Materials

- Three containers
- Solutes such as sugar or salt
- Mortar and pestle
- Burner
- Stirring rod
- Water

Procedure

- Add an equal amount of the solute (sugar or salt) in each of the three containers.
- Label the three containers as A, B and C.
- For container A, leave the solute as is uncrushed.
- Crush the solute in container B using a mortar and pestle.
- In container C, leave the solute as is but heat the container gently using a burner.
- Add an equal amount of solvent (water) to each container, ensuring that the solute is covered by the solvent.
- Stir the solute in all three containers using a stirring rod until it is fully dissolved.
- Record observations on the time taken for each solute to dissolve completely in each condition.

Results and conclusion

- The crushed solute is expected to dissolve faster as compared to the uncrushed solute due to the increased surface area, allowing for better interaction with the solvent.
- The heated solute is also expected to dissolve faster compared to the unheated solute due to the increased kinetic energy of the solvent molecules, which promotes solute-solvent interactions.

- By comparing the dissolution times, we can conclude that crushing and heating can enhance the solubility of certain solutes by increasing their dissolution rate.
- Stirring assists in the dissolution process by facilitating the mixing of solute and solvent.

F. Answer the following questions in detail.

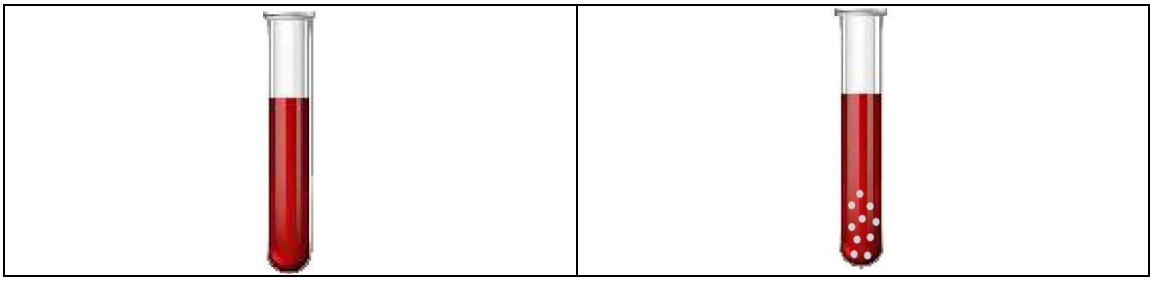
1. Differentiate between saturated and unsaturated solutions.

Answer:

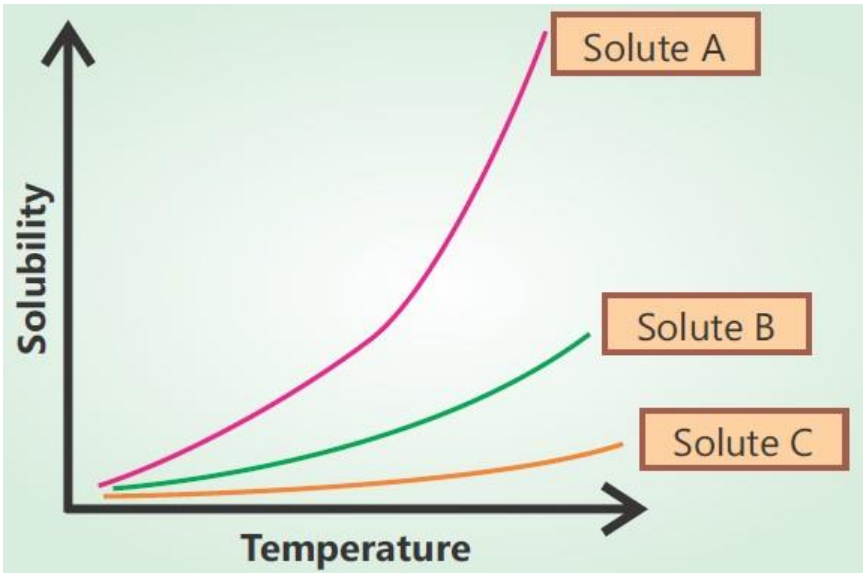
Difference between saturated and unsaturated solution

Differences between saturated and unsaturated solutions are given in the table.

Saturated solution	Unsaturated solution
A solution which cannot dissolve more solute at a specific temperature is called a saturated solution.	A solution which can dissolve more solute at a certain temperature is called an unsaturated solution.
It contains the maximum amount of solute.	It can dissolve more solute if the additional solute is added.
It is in a state of equilibrium, where the rate of dissolution of the solute is equal to the rate of precipitation or crystallization of the solute.	It is not at equilibrium, and the rate of dissolution is greater than the rate of precipitation.
No visible precipitation occurs under normal conditions.	Precipitation may occur when an additional solute is added.
Saturated solution temperature affects solubility (higher temperature can dissolve more solute).	The temperature has no significant effect on solubility.



2. What do you understand about the solubility of solutes A, B and C at different temperatures in the given graph? Explain.



Answer:

Solubility of solutes A, B, and C at different temperatures

The given graph likely represents the solubility of solutes A, B, and C at different temperatures. The x-axis represents temperature, and the y-axis represents solubility.

Solubility of Solute A

Solute A shows a large increase in solubility with increasing temperature. As the temperature increases, the solubility of solute A also increases. It requires more thermal energy to dissolve more of solute A in the solvent.

Solubility of Solute B

Solute B shows an increase in solubility to some extent with the increase in temperature. Its solubility does not significantly change with increasing

temperature. This indicates that solute B has a solubility that is a little bit dependent on temperature.

Solubility of Solute C

Solute C shows a relatively constant solubility across different temperatures. Its solubility almost does not change with increasing temperature. This indicates that solute C has a solubility that is almost independent of temperature. It has a dissolution process that is not significantly affected by changes in temperature.

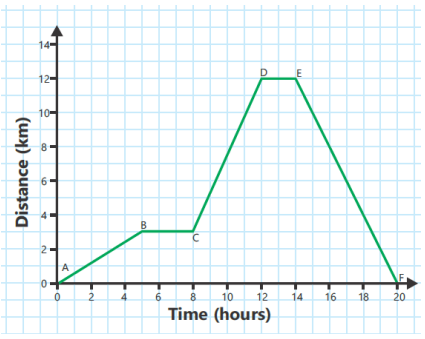
Term 2 Periodic Unit 2
Unit 8: Force and Motion

A. Choose the correct option.

1. Speed is:
   a. the distance covered per unit of time
   b. distance × time
   c. the time it takes something to move a certain distance
   d. time + distance

   The correct answer is a.

2. In the graph, from point A to B:



   a. the object is moving away from the reference point at a constant speed.
   b. the object is moving towards the reference point at a constant speed.
   c. the object is not moving.
   d. the object is speeding up.

   The correct answer is d.

3. A batsman hits a ball with a force of 1,000 N. The reaction force extended by the ball against the bat is:
   a. zero
   b. less than 1,000 N
   c. 1,000 N
   d. more than 1,000 N

   The correct answer is c.

4. What is the force that acts between two objects in contact because of action-reaction?
   a. gravitational force
   b. friction force
   c. magnetic force
   d. weight force

   The correct answer is b.

5. One newton =
   a. $kg\ ms^2$
   b. kg ms
   c. $kg\ ms^{-2}$

d. kg ms^{-1}

The correct answer is c.

6. A force on a body can change its:
   a. shape only
   b. speed only
   c. direction only
   d. shape, speed and direction

   The correct answer is d.
7. Distance is measured in terms of speed and time as:
   a. speed/time
   b. speed x time
   c. time/speed
   d. time x speed

   The correct answer is b.
8. SI unit for speed is:
   a. km/s
   b. km s
   c. s/m
   d. m/s

   The correct answer is d.
9. If an object is in a state of uniform motion, then the forces on it are:
   a. unbalanced
   b. unequal
   c. balanced
   d. equal

   The correct answer is c.

C. Constructive response questions.

i. What will be the speed of a car if the distance covered by it is zero?

Answer:

If the distance covered by a car is zero, it means that the car has not moved at all. In this case, the speed of the car would be zero because speed is defined as the distance covered per unit of time. When no distance is covered, the speed is zero.

ii. Find the speed of a train when it travels 450 km in 3 hours.

Answer:

Given data

Distance = 450 km

Time = 3 hours

To find

Speed =?

Solution

To find the speed of the train, we can use the formula:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

By putting values into the formula

$$\text{Speed} = \frac{450\ \text{km}}{3\ \text{hrs}}$$

$$\text{Speed} = 150\ \text{km/hr}$$

Therefore, the speed of the train is 150 kilometres per hour.

iii. A person travels at a speed of 60 kilometres per hour. How far will he travel in 4.5 hours?

Answer:

Given data

Speed = 60 km/hr

Time = 4.5 hours

To find

Distance =?

Solution

To calculate the distance travelled, we can use the formula:

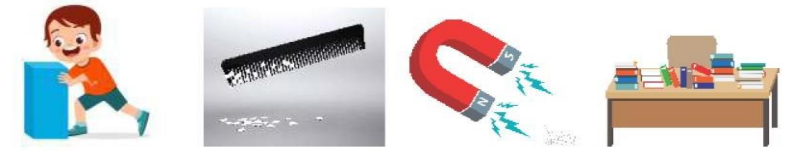
$$\text{Distance} = \text{Speed} \times \text{Time}$$

By putting values into the formula

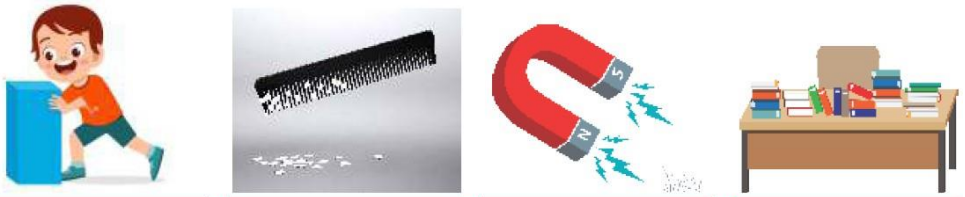
$$\text{Distance} = 60 \text{ km/hr} \times 4.5 \text{ hours}$$
$$\text{Distance} = 270 \text{ km}$$

Therefore, the person will travel a distance of 270 kilometres in 4.5 hours at 60 km/hr speed.

iv. Identify which is a contact force and which is a non-contact force. Also, describe the pair forces (action-reaction) acting in each example.



Answer:



Contact force	Non-contact force	Non-contact force	Non-contact force
Pair forces **Action:** The child is pusihng the box. **Reaction:** The box is also pushing the child with an equal and opposite force.	**Pair forces** **Action:** The comb exerts an electrostatic force on the pieces of paper. **Reaction:** The pieces of paper also exert an equal and opoosite electrostatic force on the comb.	**Pair forces** **Action:** The magnet exerts a magnetic force on the metal. **Reaction:** The metal also exerts a magnetic force on the magnetic with an equal and opposite force.	**Pair forces** **Action:** The lying books exerts a gravitational force on the table. **Reaction:** The table also exerts an equal and opposite pushing force on the lying books.

D. Answer the following questions briefly.

1. Define and state the unit of force.

   Answer:

   The unit of force in the International System of Units (SI) is Newton (N). One newton is defined as the force (N) which is acting on the body of mass (m) of 1 kg producing an acceleration (a) of 1 m/s2 in it. Isaac Newton was the first scientist who gave the concept of a force in his law. The unit of a force is named after him. Its symbol is N.

2. Find the speed when the distance is 142 km and the time is 2 hours.

   Answer:

   Given data

   Distance = 142 km

   Time = 2 hours

   To find

   Speed =?

   Solution

   To find the speed of the train, we can use the formula:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

   By putting values into the formula

$$\text{Speed} = \frac{142\ \text{km}}{2\ \text{hrs}}$$

$$\text{Speed} = 71\ \text{km/hr}$$

   Therefore, the speed is 71 kilometres per hour.

3. Differentiate between a contact and a non-contact force.

   Answer:

   Differences between contact and non-contact force are:

Contact force	Non-contact force
A contact force is the force between two objects that are in physical contact.	A non-contact force is the force between two objects that are not in physical contact.

The forces of friction, tension and applied forces are contact forces.	Gravitational force, electrostatic force and magnetic force are non-contact forces.
For example, kicking a football is a contact force since physical contact is between the foot and the ball.	**For example,** the attraction between the Earth and the Moon is a non-contact force since the two never come in contact.

4. Describe the relationship between speed, distance and time.
   Answer:
   Speed is the rate at which an object covers a certain distance in a given time.
   The relationship between speed, distance, and time can be described by the formula:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

   The greater the distance covered in a given time, the higher the speed. Conversely, if the time taken to cover a distance increases, the speed decreases, assuming the distance remains constant.

5. List down one example of an action-reaction pair due to a contact force and one example due to a non-contact force.
   Answer:
   Contact force: The example of action-reaction forces depends on the objects being in direct contact, meaning that the two objects involved are touching each other to exert forces on each other.
   Action: The tyres on a car push on the road.
   Reaction: The road pushes the tyres.
   Non-contact force: Action-reaction pairs can also happen without contact, or even with the objects not touching each other.
   Action: A rocket pushes out exhaust
   Reaction: The exhaust pushes the rocket upward.

E. Investigating questions.

1. Justify with the help of an example that action-reaction is a pair of forces equal in magnitude but opposite in direction.

Answer:

Forces always come in pairs and they are known as **"**action-reaction force pairs". The forces working in pairs are explained with the help of an example of a tennis ball and racket.

Example

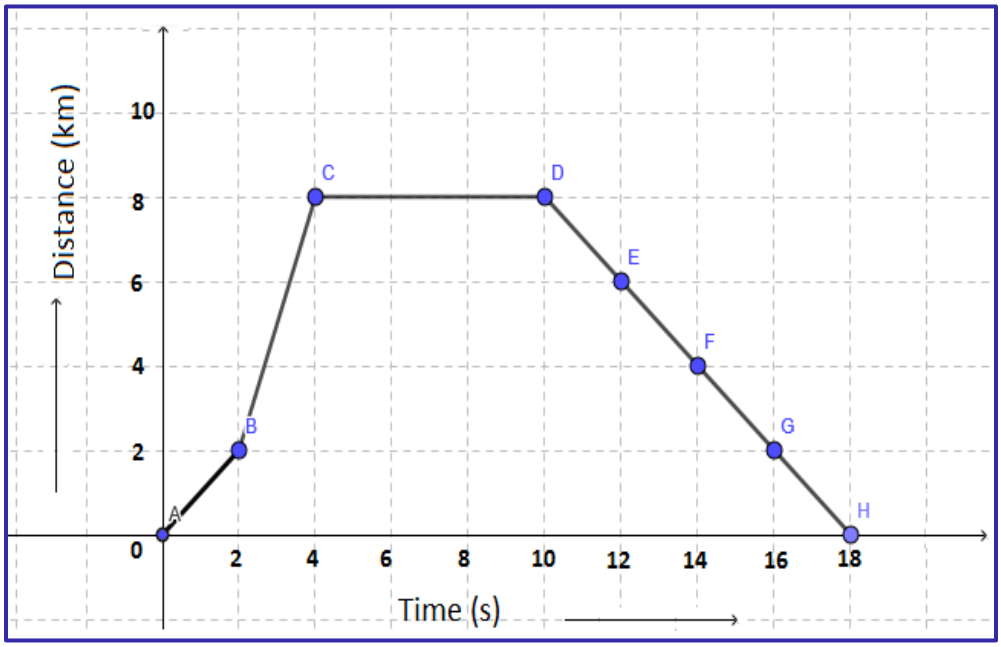
When a racket strikes a ball, a force is applied to the ball. It accelerates rapidly after being struck but the ball also applies a force to the racket. The movement of the ball is observable but the racket also does not stay still. It indicates that a force is being applied to the racket too. This force comes from the ball, and it's equal in magnitude and opposite in direction. The ball forces the racket to the left; the racket forces the ball to the right. Together, these two forces exert upon two different objects to form the action-reaction force pair.

2. Plot a distance-time graph using the following values and infer the variation occurring in the speed of the car.

Distance (km)	2	8	8	8	8	6	4	2	0
Time (s)	2	4	6	8	10	12	14	16	18

Answer:

A distance-time graph of the given values is:



Variation

- The car accelerates at a constant rate from 0 km to 2 km for 2 seconds.
- The car travels at a constant speed from 2 km to 8 km for 2 seconds.
- The car stops moving for 6 seconds.
- The car moves at a constant speed for 8 seconds, back towards its starting point from 8 km to 0 km.

F. Answer the following questions in detail.

1. A boy throws a basketball in the basket. Discuss all the effects of forces occurring while carrying out this activity.

Answer:

Effects of forces

When a boy throws a basketball into a basket, several forces such as applied force, gravity, air resistance, reaction force and friction come into play.

Applied force

The boy exerts a force on the basketball by pushing it with his hand. This applied force gives the basketball an initial velocity and imparts a certain amount of kinetic energy to it.

Gravity

As soon as the basketball leaves the boy's hand, gravity starts acting on it. Gravity pulls the basketball downward, causing it to eventually fall into the basket.

Air resistance

As the basketball moves through the air, it encounters air resistance or drag force. Air resistance acts in the opposite direction to the basketball's motion, slowing it down. The magnitude of air resistance depends on factors such as the speed, surface area, and shape of the basketball.

Reaction force

According to Newton's third law of motion, for every action, there is an equal and opposite reaction. When the boy exerts a force on the basketball, the basketball exerts an equal and opposite force on the boy's hand. This reaction force allows the boy to feel the feedback of throwing the basketball.

Friction

If the boy is standing on a surface, there might be some friction between his feet and the ground. This friction provides the necessary grip to generate the force required to throw the basketball effectively.

2. Why do you move forwards and a boat moves backwards when you jump from a boat to a dock? Explain in detail.

Answer:

Phenomena during jumping from a boat to a dock

When we jump from a boat to a dock, we move forward and the boat moves backwards due to the following phenomenon.

- When we jump from the boat, we exert a forward force on the boat. As a result, the boat experiences a backward force, causing it to move backwards.
- According to Newton's third law of motion, for every action, there is an equal and opposite reaction. When we push off the boat, we exert a force in one direction (forward) on the boat. As a result, the boat exerts an equal and opposite force on us, causing us to move in the opposite direction (backward).
- Energy is also involved in this scenario. When we jump from the boat, our potential energy is converted into kinetic energy as we move toward the dock. Meanwhile, the boat experiences a decrease in its kinetic energy due to the backward motion caused by our jump.

3. A bus covers a distance of 350 km in 2.5 hours and then it slows down and covers a distance of 275 km in 3.8 hours. Calculate the average speed of the bus.

Answer:

Given data

Distance = d_1= 350 km

Time = t_1=2.5 hours

Distance = d_2= 275 km

Time = t_2=3.8 hours

To find

Average speed = V_{av} =?

Solution

Average speed is calculated by dividing the total distance covered by an object by the total time taken.

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

Total distance covered by the bus = $d_1 + d_2$

Total distance covered by the bus = 350 km + 275 km

Total distance covered by the bus = 625 km

Total time taken by the bus = $t_1 + t_2$

Total time taken by the bus = 2.5 hours + 3.8 hours

Total time taken by the bus = 6.3 hours

By putting values in the formula.

$$\text{Average speed} = \frac{625\ \text{km}}{6.3\ hrs}$$

Average speed ≈ 99.21 km/h

Therefore, the average speed of the bus is approximately 99.21 kilometres per hour.

Term 3 Periodic Unit 1

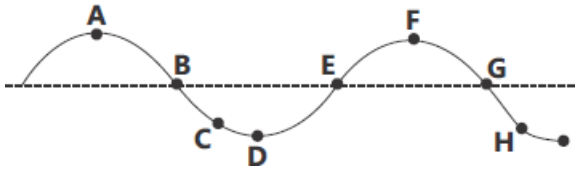
Unit 9: Waves

A. Choose the correct option.

1. Electromagnetic waves are:
   a. longitudinal waves
   b. transverse waves
   c. mechanical waves
   d. stationary waves

   The correct answer is b.
2. The distance between A and F is the:
   a. frequency
   b. period
   c. amplitude
   d. wavelength

   The correct answer is d.



3. By counting the number of crests that pass in a given amount of time, a person can calculate the:
   a. wavelength
   b. amplitude
   c. speed
   d. frequency

   The correct answer is d.
4. Which one is not a characteristic of a wave?
   a. amplitude
   b. period
   c. mass
   d. velocity

   The correct answer is c.
5. If the time period of a sound wave is increased, the sound made by this wave:
   a. would have a lower pitch
   b. would get softer
   a. would have a higher pitch
   b. would get louder

   The correct answer is a.
6. Waves carry:

a. energy
b. matter
a. both energy and matter
b. nothing

The correct answer is c.

7. Sound waves are:
   a. plane waves
   b. transverse waves
   a. longitudinal waves
   b. electromagnetic waves

   The correct answer is b.
8. Electromagnetic waves are:
   a. transverse only
   b. longitudinal only
   a. both transverse and longitudinal
   b. plane

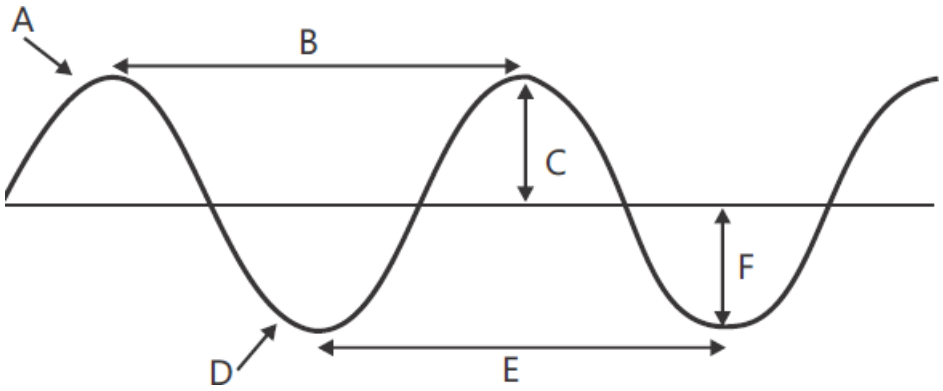
   The correct answer is a.
9. Distance between two consecutive crests is called:
   a. wavelength
   b. frequency
   c. pitch
   d. amplitude

   The correct answer is a.
10. Pitch is directly proportional to:
    a. frequency
    b. wavelength
    c. speed
    d. time period

    The correct answer is a.

B. Constructive response questions.

Label the different parts of the wave.



Answer:

A. Crest
B. Wavelength
C. Amplitude
D. Trough
E. Wavelength
F. Amplitude

C. Answer the following questions briefly.

1. An electromagnetic wave, such as light, does not require a medium. Can you think of an example that would support this claim?

   Answer:

   An example that supports the claim that electromagnetic waves like light do not require a medium for propagation is the transmission of light from the Sun to Earth through the vacuum of space. In space, matter is absent, and yet, sunlight, which is a form of electromagnetic radiation, travels through the vacuum to reach Earth.

2. If you were to shake the end of a spring up and down 10 times a second, what would be the frequency and the period of the wave produced on the spring?

   Answer:

   If we shake the end of a spring up and down 10 times a second, the frequency of the wave produced on the spring would be 10 hertz (Hz).

The period of the wave can be calculated by using the following formula:
Period (T) = 1 / Frequency (f)
T = 1 / 10 Hz
T = 0.1 seconds
So, the period of the wave would be 0.1 seconds.

3. Define the terms:
   a) wavelength b) frequency c) amplitude d) period, as applied to waves.
   Answer:
   a) Wavelength
   In transverse waves, the distance between two adjacent crests or two adjacent troughs is its wavelength.
   In longitudinal waves, the distance between two adjacent compressions or rarefactions is the wavelength.
   Wavelength is measured in metres (m).
   b) Frequency
   Frequency is the number of waves being sent out in one second.
   The unit of frequency is Hertz (Hz).
   c) Amplitude
   Amplitude is the characteristic of sound that tells us how loud a sound is. It refers to the size of the wave or the height of the wave.
   d) Period
   The time required to produce one complete wave is called the time period of the wave.
   The time period is measured in seconds (s).

4. Speakers and microphones are made on one of the characteristics of sound. Can you name the characteristic? How does it apply to these devices?
   Answer:
   The characteristic used in speakers and microphones is vibrations.
   In speakers: An electrical signal is converted into sound waves by causing a diaphragm to vibrate, producing audible sound.
   In microphones: Sound waves from the environment cause a diaphragm to vibrate, which is then converted into an electrical signal.
   Both devices rely on the conversion of vibrations into electrical or mechanical signals.

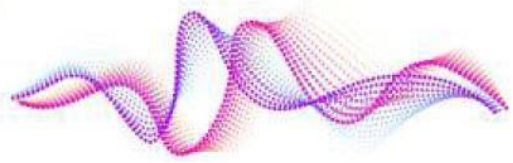
5. Differentiate between transverse waves and longitudinal waves.
   Answer:
   Differences between transverse waves and longitudinal waves are:

Transverse Waves	Longitudinal Waves
In transverse waves, the oscillations of particles are perpendicular (at an angle of 90°) to the direction of wave propagation.	In longitudinal waves, the oscillations of particles are parallel to the direction of wave propagation.
Waves produced due to the up-and-down movement of particles are transverse waves.	In longitudinal waves, particles move back and forth along the same line as the wave travels.
Examples: Light waves and waves on a string.	**Examples:** Sound waves and seismic waves.

D. Investigating questions.

1. Throw a stone in water and analyse the type of waves formed in it. What type of waves are produced in water?
   Answer:
   Type of Waves Formed When a Stone is Thrown into Water:
   When a stone is thrown into the water, it creates a specific type of mechanical wave known as water waves. These waves are a combination of both transverse and longitudinal waves.
   Transverse waves: Water waves exhibit a transverse motion at the surface. The particles at the surface of water move in an up-and-down motion as the wave passes. This creates the characteristic ripple pattern seen on the surface of water.
   Longitudinal Component: Water waves also have a longitudinal wave. The energy from the stone's impact travels horizontally across the surface of the water.
   These waves are an excellent example of mechanical waves as they require a medium (water) for propagation. The stone's impact introduces energy into the water, causing the particles at the surface to oscillate and generate these waves.

2. Analyse the following waveforms. How have the characteristics of the sounds changed? What do you infer about sound production?

a) 

b) 

Answer:

Analysis of Waveforms and Sound Characteristics:

To analyze the characteristics of sound waves, you would need specific waveforms to examine. Sound wave characteristics include amplitude, frequency, wavelength and pitch.

Characteristics of the sound waves

The characteristics of sound wave ‘a’ and sound wave ‘b’ are:

Pitch: Pitch is the quality of sound that distinguishes between high-pitched and low-pitched sounds.

The pitch of the given waves is influenced by various factors, including frequency, wavelength, and amplitude.

Frequency: The number of cycles (compressions and rarefactions) per second in the waveform determines the frequency. It directly relates to the perceived pitch of the sound.

- **Sound wave 'a':** This waveform exhibits a low frequency, resulting in a deep sound. Lower frequencies produce lower-pitched sounds.
- **Sound wave 'b':** In contrast, this waveform has a high frequency, leading to a shrill sound. Higher frequencies produce higher-pitched sounds.

Wavelength: The distance between two adjacent compressions or rarefactions are the wavelength.

- **Sound wave 'a':** This wave has a longer wavelength, contributing to its lower-pitched characteristics.
- **Sound wave 'b':** Conversely, this wave has a shorter wavelength, contributing to its higher-pitched characteristics.

Amplitude: The height of the waveform represents the amplitude, which corresponds to the loudness of the sound. Larger amplitudes indicate louder sounds.

- **Sound wave 'a':** This waveform has a smaller amplitude, suggesting a softer sound.

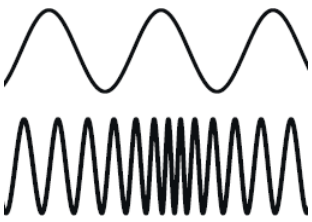
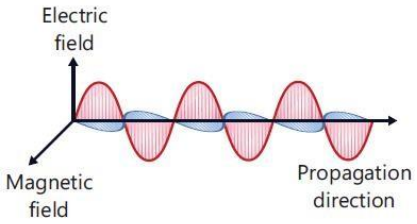
- **Sound wave 'b':** In contrast, this waveform displays a large amplitude, indicating a louder sound.

E. Answer the following questions in detail.

1. How do sound waves differ from light waves? Describe in detail.

Answer:

Differences between sound waves and light waves are:

Properties	Sound Waves	Light Waves
Definition	Sound waves require a material medium to travel through.	Light waves do not require a material medium to propagate.
Type of wave	Sound waves are mechanical waves.	Light waves are electromagnetic waves.
In vacuum	They cannot propagate through a vacuum.	They can travel through a vacuum, such as space.
Propagation	Sound waves propagate through the compression and rarefaction of particles in the medium.	Light waves consist of oscillating electric and magnetic fields that are perpendicular to each other and the direction of wave propagation.
Speed	Mechanical waves are far slower.	Electromagnetic waves travel at the speed of light.
Formation	These waves are formed due to the vibration of particles of the medium.	These waves are formed due to varying electric and magnetic fields.
Nature	Sound waves can be longitudinal or transverse waves.	Light waves are transverse waves.
Shape		

2. Discuss the relation between frequency, pitch and time period. Explain it graphically.

Answer:

Frequency

The number of waves being sent out in one second is called the frequency of the wave. The unit of frequency is Hertz (Hz). The frequency of a wave can be calculated by:

Frequency = number of waves/time

$f = n/t$

Time period

The time required to produce one complete wave is called the time period of the wave. The time period is measured in units of time such as second(s).

The time period is the reciprocal of the frequency,

Time period = 1 / frequency

$T = 1/f$

Pitch

The characteristic of a sound that helps us to differentiate between a shrill and grave sound is called pitch.

The pitch of a sound depends upon the frequency of waves produced in 1 second. Hence, pitch depends on the frequency of the sound.

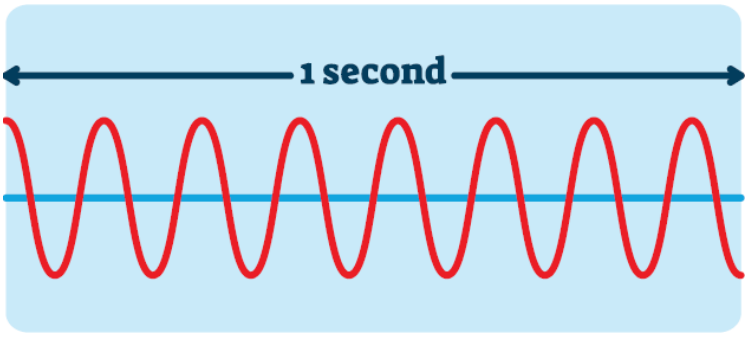
Relationship between frequency, time period and pitch

- As the frequency of waves increases, more waves are produced. As the frequency of a wave decreases, fewer waves are produced.
- If the frequency of the wave increases, its time period will decrease. If the frequency of the wave decreases, its time period will increase.
- The higher the frequency of a sound is, the higher its pitch and it produces a shrill sound. The lower the frequency, the lower its pitch and it produces a deep sound.

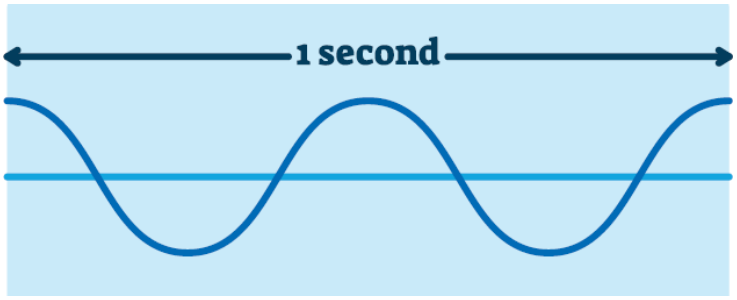
Graphical Explanation

In a graphical representation, you can depict the relationship between frequency (f), pitch, and time period (T) as follows:

- Higher frequency (f) corresponds to a shorter time period (T) and it has higher-pitched sounds.



- Lower frequency (f) corresponds to a longer time period (T) and it has lower-pitched sounds.



3. Compare the types of waves with examples from everyday life.

Answer:

Waves

Waves are a pattern of motion that transfer energy from one place to another without transferring matter. Waves are produced by vibration.

Example

When a stone is thrown in still water, it causes vibrations in the water. The energy of the stone transfers into the water and forms waves.

Types of waves

Waves are divided into two main types.

1. Electromagnetic waves
2. Mechanical waves

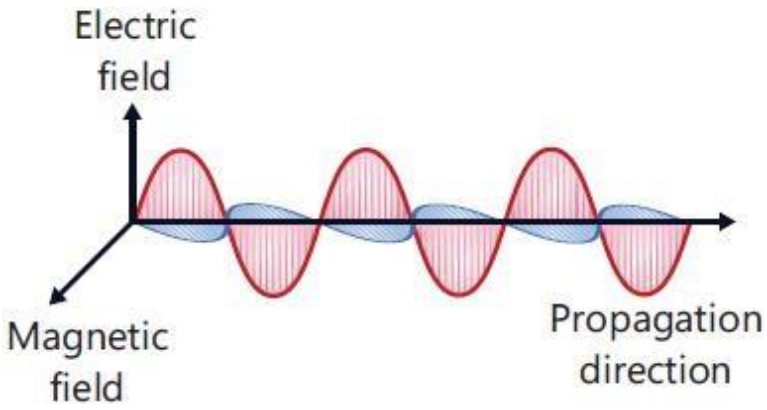
Electromagnetic waves

Electromagnetic waves consist of disturbances that can travel without a medium. The light from the Sun is an electromagnetic wave that travels through the vacuum of space. These waves are formed due to varying

electric and magnetic fields. Electromagnetic waves travel at the speed of light. They are transverse in nature.

Example

Light waves are an example of electromagnetic waves.



Mechanical waves

Mechanical waves consist of disturbances that can only travel through a medium (solid, liquid or gas). These waves are formed due to the vibration of particles of the medium. They are far slower. They can be transverse and longitudinal.

Example

Sound waves and water waves are mechanical waves, as they require a medium to travel.

Types of mechanical waves

Mechanical waves are classified further based on the motion of the direction of particles. Types of mechanical waves are:

1. Transverse waves
2. Longitudinal waves

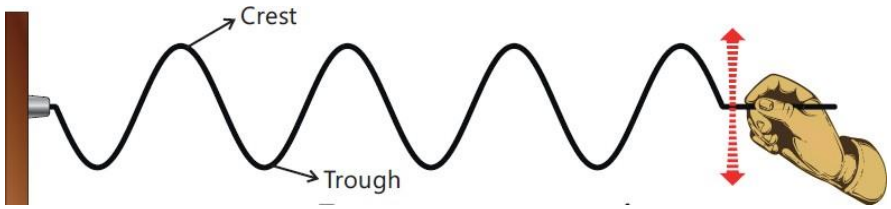
Transverse waves

In a transverse wave, the direction in which the wave travels is perpendicular (at an angle of 90°) to the direction of the disturbance. In simple words, waves produced due to the up-and-down movement of particles are transverse waves.

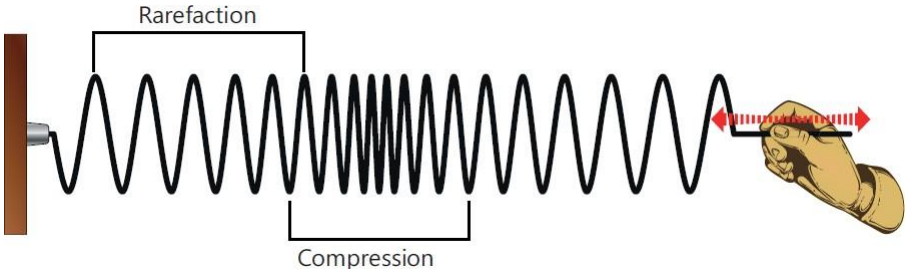
Specific points of a transverse wave

There are two specific points of a transverse wave including crest and trough.

Crest: The crest is the portion of the wave above the mean position.
Trough: The trough is the portion of the wave below the mean position.
Example
Water waves are examples of transverse waves.
We can observe transverse waves by shaking a rope. When a rope moves up and down, waves are generated.



Longitudinal waves
A longitudinal wave travels in the same direction as the disturbance that formed it. The direction in which the wave travels is parallel to the direction of the disturbance. In simple words: Waves produced due to the back-and-forth movement of particles are called longitudinal waves.
Example
Sound waves are examples of longitudinal waves.
To observe a longitudinal wave, take a spring and stretch out one end, then leave it and observe. A wave will pass from the stretched end to the other end of the spring. It is a longitudinal wave.
Components of a longitudinal wave
When a longitudinal wave is travelling through a spring, two components can be seen, including compression and rarefaction.
Compression: The part where the particles of the medium are compressed is known as compression.
Rarefaction: The part where the particles spread out is known as rarefaction.



Term 3 Periodic Unit 1
Unit 10: Heat and Temperature

A. Choose the correct option.

1. The cooking of food in a microwave oven occurs through:
   a. conduction
   b. convection
   c. radiation
   d. evaporation
   The correct answer is c.
2. Heat transfer occurs in:
   a. 2 ways
   b. 3 ways
   c. 4 ways
   d. 5 ways
   The correct answer is b.
3. A good conductor of heat is:
   a. air
   b. plastic
   c. silver
   d. glass
   The correct answer is c.
4. Convection can take place through:
   a. air
   b. plastic
   c. bricks
   d. wood
   The correct answer is a.
5. Home water heaters work on the principle of:
   a. conduction
   b. convection
   c. radiation
   d. evaporation
   The correct answer is b.
6. The device used to measure temperature is a:
   a. Pico meter

b. barometer
c. manometer
d. thermometer

The correct answer is d.

7. The normal temperature of a healthy person is:
   a. 37°C
   b. 37°F
   c. 37 K
   d. 40°F

   The correct answer is a.
8. The Sun's heat reaches us by:
   a. conduction
   b. convection
   c. radiation
   d. conduction, convection and radiation

   The correct answer is c.
9. A liquid matter used in a thermometer is:
   a. Silver
   b. Sulphur
   c. Mercury
   d. Bromine

   The correct answer is c.
10. Metals are good conductors because they have:
    a. free electrons
    b. particles
    c. free protons
    d. no free electrons

    The correct answer is a.

B. Answer the following questions briefly.

1. Differentiate between heat and temperature.

Answer:

Differences between heat and temperature are:

Heat	Temperature
Heat is a form of energy transfer that occurs due to a temperature difference between two objects.	Temperature is a measure of the average kinetic energy of the particles in an object.
It flows from a region of higher temperature to a region of lower temperature.	It indicates how hot or cold an object is.
Heat is measured in units like joules or calories.	Temperature is measured in units such as degrees Celsius (°C), degrees Fahrenheit (°F) or kelvin (K).

2. List down some applications of convection.

Answer:

Application of convection

There are many applications of convection in our everyday life.

- Birds such as kites, hawks, vultures and gulls glide on air currents through the convection process. They save a lot of energy by doing so.
- A radiator puts warm air out at the top and draws in cooler air at the bottom.
- The steam coming out from a cup of hot tea indicates that heat is being transferred into the air through convection.
- Ice melts because heat moves to the ice from the air.
- The air which we breathe out is warmer and lighter. It rises and moves out through a household ventilator.
- In a domestic water heater, water is heated in the boiler by a gas burner or heating coil.
- An air conditioner also uses convection currents to cool a room.

3. When we touch a metal spoon, it feels cold. Why?
   Answer:
   The metal is a good conductor of heat, it carries heat away quickly. Heat flows from our hand into the metal spoon and then is conducted rapidly away into the surroundings, leaving its surface and your skin surface relatively cool. That is why a metal spoon feels cool.

4. Give two examples of thermal radiation from your surroundings.
   Answer:
   Two examples of thermal radiation from our surroundings are given below.
   - A microwave oven uses thermal radiation to cook food.
   - When we sit beside a fire, the heat of the fire reaches us by radiation.

5. What purpose are insulating boards used for?
   Answer:
   Insulating boards are used as lining of interior walls as well as for partition walls. The purpose of using Insulating boards is either to conserve heat or to block sound transmission within a building.

C. Constructive response questions.

i. Define kinetic energy.
   Answer:
   Kinetic energy
   Kinetic energy is the energy an object possesses due to its motion. It is a form of mechanical energy and depends on both an object's mass and its velocity.
   The formula for kinetic energy
   Mathematically, kinetic energy (KE) is calculated using the following formula.
   K.E. = ½ mv^2
   Where m is the mass of the object in kilograms (kg) and v is the velocity (speed) of the object in meters per second (m/s).
   The faster an object moves and the heavier it is, the more kinetic energy it possesses.
   Unit for kinetic energy
   Kinetic energy is measured in joules (J).

ii. Why do animals living in the Antarctic have thick fur on their bodies?

Answer:

Animals in the Antarctic, such as penguins and seals, have thick for several reasons:

Insulation: The thick fur acts as insulation to prevent heat loss from their bodies. In the extreme cold of the Antarctic, maintaining body heat is essential for survival. Thick fur helps these animals retain the warmth generated by their bodies.

Cold-Weather Adaptation: Thick fur is adapted to the harsh Antarctic environment. It helps the animals of Antarctica to survive in freezing temperatures, where other animals would struggle to maintain their body temperature.

iii. Convert 450K to °C.

Answer:

Given data

K = 459K

To find

°C = ?

Solution

To convert from kelvin (K) to degrees Celsius (°C), we can use the following formula.

°C = K - 273.15

°C = 450K - 273.15

°C = 176.85

So, 450K is equal to 176.85°C.

iv. Convert 87°F to °C.

Answer:

Given data

°F = 87°F

To find

°C = ?

Solution

To convert from degrees Fahrenheit (°F) to degrees Celsius (°C), we can use the following formula.

°C = (°F - 32) × 5/9

°C = (87°F - 32) × 5/9 (rounded to two decimal places)
°C = 30.56°C
So, 87°F is equal to 30.56°C.

v. Write 'conductor' on 'insulator' in the table for the diagrams given below.

Answer:

Conductor	
Insulator	
Conductor	
Insulator	

D. Investigating questions.

1. What will happen if buildings are not insulated?

Answer:

If buildings are not insulated, several adverse effects can occur.

Increased Energy Consumption

During hot weather, buildings become excessively warm, requiring more energy for air conditioning. Conversely, in cold weather, buildings become excessively cold, demanding more energy for heating.

Structural Damage

Temperature variations can cause materials within the building structure to expand and contract. Over time, this can lead to structural damage, such as cracks in walls and ceilings, as well as warped or damaged building components.

Condensation and Mold

Inadequate insulation can lead to condensation on interior surfaces. Excess moisture and humidity can create an environment favourable to fungus growth. Fungus not only damages buildings but can also pose health risks to occupants.

Environmental Impact

Increased energy consumption to compensate for poor insulation contributes to higher greenhouse gas emissions. This harms the environment and causes climate change.

Financial Costs

Building owners may incur higher maintenance costs due to structural repairs, increased energy bills, and potential health-related expenses resulting from poor indoor air quality.

2. Investigate and give the reason why some animals sit in groups during winter.

Answer:

Many animals exhibit group behaviour during the winter months, which can take various forms like huddling, roosting, or migrating. These behaviours serve several important purposes.

Thermoregulation

One of the primary reasons animals huddle together is to conserve body heat. In a group, animals can share body warmth, reducing heat loss to the

environment. This behaviour helps them survive in cold temperatures, maintain their metabolic functions and conserve energy.

Protection from Predators

Grouping can protect from predators. Larger groups can collectively defend against potential threats, making it harder for predators to single out and capture individual prey.

Energy Conservation

During winter, food sources may become scarce and foraging can be challenging. By conserving energy through reduced physical activity and sharing body heat, animals can survive on limited food resources until conditions improve.

Migratory Strategies

Some animals migrate to warmer regions during winter to escape the cold entirely. Migration allows them to find food and maintain their preferred temperature range.

Breeding and Reproduction

Some animals gather in groups during winter for mating and reproduction. This ensures that offspring are born when conditions are favourable and food is more abundant.

E. Answer the following questions in detail.

1. Describe applications of conduction in everyday life.

Answer:

Thermal conduction

Thermal conduction is the mechanism of the transfer of heat between two adjacent parts of a body because of their temperature difference. Heat is transferred from a hot region to a cold region.

Examples

1. A blacksmith heating a sword in hot coal and the heat transferring up through the metal.
2. The heat from a stove top is transferred into a metal pot of water.

Application of heat conduction

- **Cold cast iron skillet**

  A cold cast iron skillet is placed onto a stovetop. When the stove is turned on, the skillet becomes very hot due to the conduction of heat from the burner to the skillet. If we try to touch the handle of the

skillet, it does not feel too hot. This is because some insulated material such as wood is used to make the handle.

- **The engine of a car**
  When the engine of a car is turned on, the bonnet becomes warm due to the conduction of heat from the engine to the bonnet of the car.

2. Define thermal expansion and contraction. Explain their effects in everyday life.

Answer:

Thermal expansion

Thermal expansion occurs when a material is heated and it gains more internal energy because the atoms within the material move around faster, and the material expands.

Examples

Following are some examples of thermal expansion in our everyday lives.

- Sags in electrical power lines.
- Metal-framed waves need rubber spacers to avoid thermal expansion.
- Expansion joints (like joints of two railway tracks).

Thermal contraction

Thermal contraction occurs when you cool the material down, and the atoms do not have that much energy.

Examples

Following are some examples of thermal expansion in our everyday lives.

- Snapping of taut power lines during winter.
- Deflation of a balloon when placed in ice-cold water.
- Breakage of an initially hot glass placed under cold running water.

Effect of thermal expansion and contraction

Thermal expansion or contraction changes the size or volume of a substance by changing the spaces between the particles.

Effects of thermal expansion and contraction in everyday life are:

The stuck lid of a jar

Running hot water on the jar for a couple of minutes when the lid of the jar stuck. It will open easily because the metallic lid will expand on heating.

Clinical thermometer

Liquid expands on heating. This phenomenon is used in a thermometer. The mercury or alcohol present in a thermometer expands on high body temperature to indicate fever.

Railway lines

There are spaces in train tracks. It is because, during summers when the metal tracks expand, they prevent them from buckling.

Electricity pylons

The wires that hang between electricity pylons have some slack. This is because during winter when wires contract, they do not break by becoming too tight.

3. Compare the three scales of temperature in detail.

Answer:

Temperature scales

There are three types of temperature scales.

1. Celsius scale (°C)
2. Kelvin scale (K)
3. Fahrenheit scale (°F)

Celsius scale (°C)

The Celsius scale is also known as the centigrade scale. It comprises 100 divisions (0- 100).

Division of scale

The melting point of water is 0°C and the boiling point of water is 100°C. 0°C represents the cold end and 100°C represents the hotter end of the range in temperature distributed on the scale.

Formula

It can be converted into Kelvin using the following formula.

T(°C) = T(K) – 273

Kelvin scale (K)

Kelvin is the SI unit of temperature. The Kelvin scale is named after a scientist, Lord Kelvin. It is also called the absolute temperature scale.

Division of scale

It is divided into 100 divisions starting from 273 to 373 Kelvin. 0 Kelvin is the lowest temperature and is equal to -273 °C.

Formula

It can be converted into Celsius using the following formula:

T(K) = T(°C) + 273

Fahrenheit scale (°F)

The Fahrenheit temperature scale was developed by the scientist Daniel Fahrenheit.

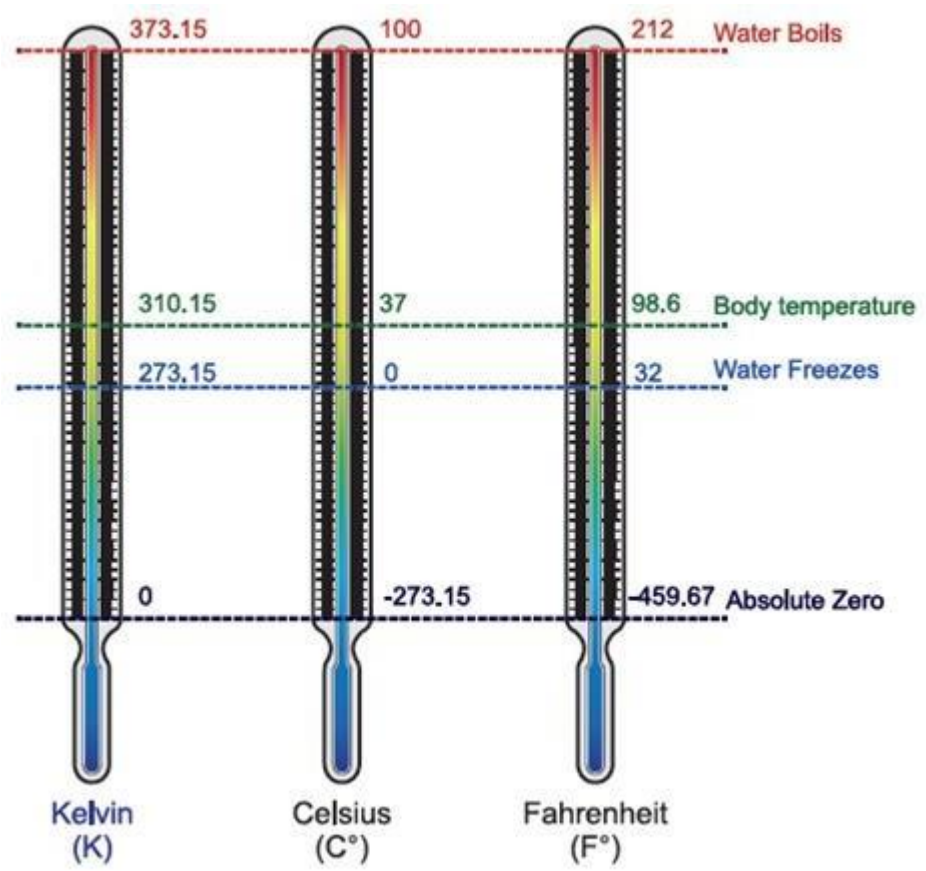
Division of scale

There are 180 divisions in this scale starting from 32 to 212 with the former being the melting point of water and the latter being the boiling point of water.

Formula

The Fahrenheit scale can be converted into the Celsius scale using the following formula.

T(°F) = 1.8 T(°C) + 32



Temperature scales

Term 3 Periodic Unit 2
Unit 11: Technology in Everyday Life

A. Choose the correct option.

1. An advanced method of food preservation includes:
   a. drying
   b. freezing
   c. adding chemicals
   d. fermentation
   The correct answer is d.
2. Drip irrigation is useful because:
   a. it irrigates a wide area
   b. it saves water
   c. pipes are used for irrigation
   d. no maintenance is required
   The correct answer is b.
3. A stethoscope is a/an _____instrument.
   a. medical
   b. agricultural
   c. industrial
   d. educational
   The correct answer is a.
4. A sanitizer is not a:
   a. liquid
   b. solid
   c. foam
   d. gel
   The correct answer is b.
5. The picture given below shows:
   a. sprinkler irrigation
   b. drip irrigation
   c. manual irrigation
   d. surface irrigation
   The correct answer is a.



6. A sanitizer is used to:
   a. kill germs

b. give a cooling effect on hands
c. give a pleasant smell
d. moist skin

The correct answer is a.

7. The incorrect statement about preservation is:
   a. wash the fruits before preservation.
   b. sterilization is not necessary.
   c. seal the food in airtight jars.
   d. use clean utensils

   The correct answer is b.

B. Answer the following questions briefly.

1. Search the internet and explain the different techniques used for the preservation of food.

   Answer:

   The methods used in the past to preserve food included freezing and drying. Currently, canning, tinning, pasteurization, freezing, dehydration, sterilization, addition of chemicals, etc. are some methods used to preserve food.

   Freezing: Storing food at very low temperatures to preserve it for an extended period.

   Canning: Sealing food in airtight containers and heating them to kill bacteria.

   Drying: Removing moisture from food to inhibit microbial growth.

   Pickling: Immersing food in a solution of vinegar or brine to extend its shelf life.

   Pasteurization: Heating food to a specific temperature to kill pathogens while retaining flavour.

2. You have a very small lawn in your house. Which method will you use for irrigation?

   Answer:

   The drip irrigation method is used for the irrigation of our small lawn.
   In drip irrigation, water is dripped directly on the soil surrounding the plant at a very slow rate. Drip irrigation is effective because it minimises water waste, prevents soil erosion and is simple to install. It provides a small amount of water to a limited area.

3. Can you preserve all types of food using the same method? Explain.
   Answer:
   No, we cannot preserve all types of food using the same method. The choice of method depends on the food's characteristics. For example:
   - The refrigeration and freezing method is ideal for meat, dairy and fresh food.
   - Canning is suitable for preserving fruits, vegetables and sauces.
   - The drying method works well for herbs, fruits and meats.
   - Pickling is a commonly used method of preservation for vegetables.

4. A farmer wants to irrigate his wheat field. Which method will you suggest for him and why?
   Answer:
   For a wheat field, a farmer would typically use large-scale irrigation methods such as drip irrigation and sprinkler irrigation. Drip irrigation is efficient as it delivers water directly to the root zone, conserving water and maximizing the yield of wheat crops.

5. Check the heartbeat of your friend using a stethoscope and tell how many times his/her heart beats in 30 seconds.
   Answer:
   To check the heartbeat of my friend, I will follow these steps:
   - Place the stethoscope's chest piece on my friend's chest.
   - Listen for the lub-dub sounds(one complete heartbeat) of the heart.
   - Count the number of heartbeats in 30 seconds.
   - Multiply this count by 2 to find the heart rate in beats per minute.

C. Investigating questions.

1. Design your own model of a drip irrigation system and demonstrate how it is used to conserve water.
   Answer:
   To design a model of drip irrigation following materials are used.
   Materials
   - Cardboard
   - Glue gun
   - Coloured paper

- Switch
- Battery
- DC water pump
- Plastic containers
- Plastic tray
- Plastic tube
- Paper cups
- Artificial plant
- Paint
- Scissors

Procedure

- Take the plastic container and put it on the cardboard.
- Cut the cardboard into the size of the plastic container.
- Make holes in the cardboard the size of a paper cup.
- Glue the cardboard on the plastic container and paint it green.
- Pour soil into the paper cups and put artificial plants in the cups.
- Put these cups in the holes of the container.
- Make a stand with the help of cardboard and coloured paper.
- Take the plastic container and make a hole in its bottom.
- Fix the plastic tube in it with glue and the container on the stand.
- Put the plastic tube on the plants in such a way that it passes through all of the plants.
- Make small holes in the tube for water dripping.
- Take the other container and cover it with paper to make a well.
- Fix the DC motor pump with the pipe and attach it to the battery and switch.
- Put the pipe in the well and glue the switch and battery on the well.
- Pour water into the well.
- Switch ON to see water dripping on the plants.

2. Check the heartbeat of your classmates using the stethoscope you made.

Answer:

The procedure to make a stethoscope is given below.

Materials

- Plastic tubes
- Galvanized Iron (GI) wire

- Balloon
- Earbud
- Plastic ball
- Tape
- Scissors

Procedure

- Cut the plastic tube into two halves.
- Cut the plastic ball in half.
- Make a hole in the centre of the ball and join one end of the tube in the centre of the ball. Wrap it with tape.
- Cut the balloon and wrap it in the ball.
- Seal it around the pipe with the rubber band. Secure it with tape.
- Take the wire and bend its ends inwards.
- Now add the connector and fix the plastic tubes on the wire.
- Fix earbuds at the other ends of the tubes.
- Join the other end of the tube with the ball using the connector.
- Wrap the joint with tape.
- The stethoscope is ready to use.

Checking Classmates' Heartbeats:

To check the heartbeat of my classmates with my design stethoscope, I will follow the given steps.

- Ask the classmates to sit down comfortably on the chair.
- Place the stethoscope's chest piece on their chest.
- Listen for the lub-dub sounds(one complete heartbeat) of the heart.
- Count the number of heartbeats in 1 minute.

D. Answer the following questions in detail.

1. Demonstrate the method of preserving mango juice.

Answer:

The method of preserving mango juice is given below.

Materials

- Pan
- Sugar
- Oranges
- Preservative

- Container

Procedure

- Take sugar according to your taste in a pan and add a glass of water.
- Put it on the stove and stir continuously.
- Check the consistency of the sugar syrup. It should be a single thread.
- Switch off the stove and let it cool.
- Squeeze juice from the oranges.
- Mix orange juice with the sugar syrup slowly.
- Add the preservative Potassium Meta B1- sulphate and mix it.
- Pour it into an airtight container and store it in the refrigerator.

2. How will you preserve mango pickles? Demonstrate.

Answer:

A simplified demonstration of making mango pickles is given below.

Materials

- Raw green mangoes
- Mixing bowl
- Glass jar with an air-tight lid
- Vinegar
- Turmeric
- Salt
- Cloth
- Red chilli powder
- Mustard seeds
- Fenugreek seeds
- Mustard oil

Procedure

- Wash and cut the mangoes into small pieces.
- Let the mango pieces dry in the Sun for a few hours. This removes excess moisture.
- Add salt, red chilli powder, mustard seeds, turmeric and fenugreek seeds in a mixing bowl.
- Add the dried mango pieces to the spice mixture and mix thoroughly, ensuring the pieces are coated evenly.
- Take a jar and pour mustard oil in it.

- Pack the mango pieces tightly into the jars.
- Place the sealed jars in a cool, dry place.

3. Demonstrate how to make a hand sanitizer.

Answer:

To make a hand sanitizer the procedure is given below.

Materials

- Aloe vera gel
- Ethanol
- Whisk
- Spoon
- Body Oil
- Spray bottle

Procedure

- Wash hands properly before making the sanitizer.
- Make sure all items are clean before using them.
- Pour aloe vera gel into a bowl and whisk it well.
- Add ethanol carefully and mix well.
- Add body oil to the mixture and mix it well.
- Pour it into a spray bottle and apply it to the hands.

Term 3 Periodic Unit 2
Unit 12: Earth and Space

A. Choose the correct option.

1. What causes the Earth to rotate around the Sun?
   a. orbits
   b. the Moon
   c. gravitational Force
   d. dwarf Planets
   The correct answer is c.
2. The Moon is a natural _____of the Earth.
   a. satellite
   b. planet
   c. orbit
   d. comet
   The correct answer is a.
3. The tilt in the Earth's axis causes _____.
   a. a year
   b. days and nights
   c. tides
   d. seasons
   The correct answer is d.
4. Tides are caused by the gravitational pull of:
   a. the Moon
   b. the Sun
   c. the Earth
   d. Both the Moon and the Sun
   The correct answer is d.
5. Earth has _____Moons.
   a. 3
   b. 4
   c. 2
   d. 1
   The correct answer is d.
6. The Earth completes its orbit around the Sun in:
   a. 365 days

b. 364 days
c. 365 ¼ days
d. 364 ¼ days

The correct answer is c.

7. The Earth is the _____largest planet.
   a. 1st
   b. 5th
   c. 3rd
   d. 4th

   The correct answer is b.
8. The unit of weight is:
   a. kg
   b. g
   c. N
   d. m

   The correct answer is c.
9. The mass of an object is 2 kg. Its weight is:
   a. 9.8 N
   b. 19.6 N
   c. 2 N
   d. 20 N

   The correct answer is b.
10. The path in which a planet moves is called a/an:
    a. circle
    b. equator
    c. axis
    d. orbit

    The correct answer is d.

B. Constructive response questions.

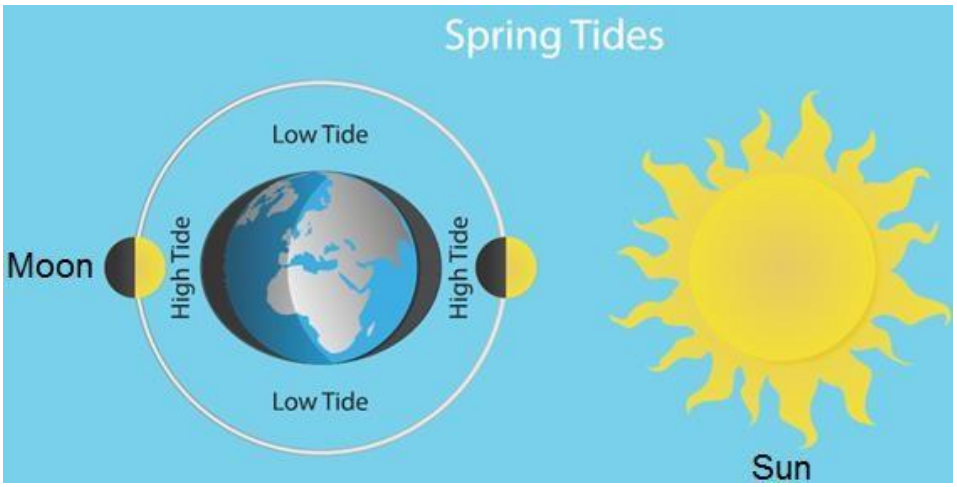
i. How can you change neap tides into spring tides? Explain with an illustration.

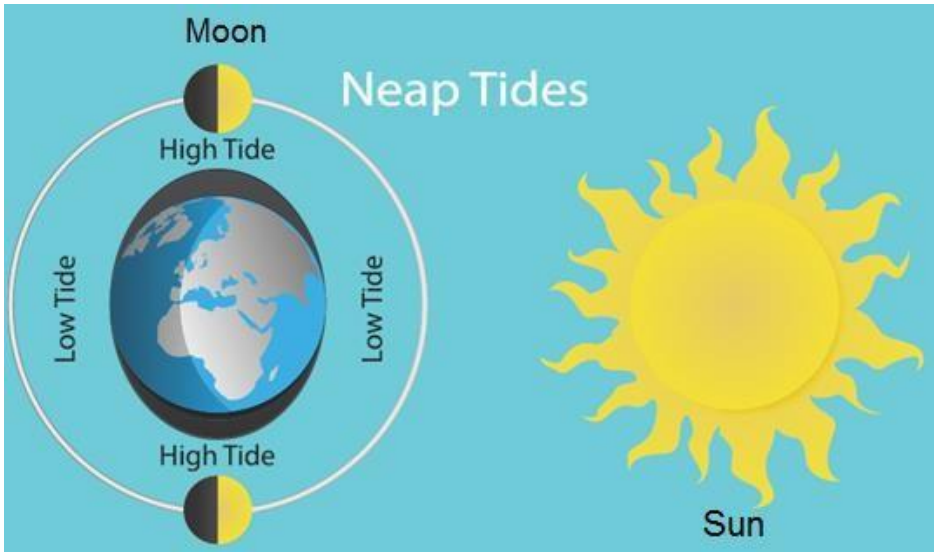
Answer:

As the Moon orbits the Earth, the bulge follows the position causing neap and spring tides.

As the Earth rotates on its axis, the areas directly in line with the Moon experience spring tides. On the other hand, neap tides occur when the gravitational forces of the Moon and the Sun are at right angles to each other concerning Earth.

The alignment of the Moon, the Earth, and the Sun change neap tides into spring tide due to the gravitational forces of the Moon and the Sun.





ii. Why are neap tides moderate tides?

Answer:

Neap tides are considered moderate tides because the gravitational forces of the Moon and Sun act at right angles to each other concerning the Earth.

- During neap tides, the gravitational pull of the Moon partially cancels out the gravitational pull of the Sun. When the Moon is at a right angle to the Sun concerning the Earth, it exerts a gravitational force that creates a high tide on one side of the Earth (the side facing the Moon) and a low tide on the opposite side (the side away from the Moon).
- At the same time, the gravitational force of the Sun also creates a high tide on one side of Earth (the side facing the Sun) and a low tide on the opposite side (the side away from the Sun).

Since the tidal effects of the Moon and the Sun are partially offsetting each other during neap tides, the result is a smaller difference in water levels. This smaller tidal range makes neap tides appear moderate in comparison to spring tides, which have a larger tidal range with higher high tides and lower low tides.

C. Answer the following questions briefly.

1. What will happen if the gravitational force of the Earth diminishes?

Answer:

The gravitational force tries to pull objects together and never pushes back. If the gravitational force of the Earth were to diminish significantly, several consequences would occur:

- Objects on Earth's surface would weigh less, making them feel lighter.
- Human and animal locomotion would be affected, as it would require less effort to move.
- Earth experiences some atmospheric effects, such as changes in air pressure and density, which could impact weather patterns.
- The orbits of satellites and the Moon around the Earth would be altered.

2. If the Southern Hemisphere is facing the Sun, what season will it have?

Answer:

When the Southern Hemisphere of the Earth points towards the Sun, it has the summer season.

3. Differentiate between mass and weight. Write their SI units.

Answer:

Differences between contact and non-contact force are:

Mass (m)	Weight (w)
Mass is the quantity of matter in an object.	Weight is the force with which the Earth attracts an object towards its centre.
It is denoted by 'm'.	It is denoted by 'w'.
It is measured in kilograms (kg).	It is measured in Newton (N).

4. Describe tides and their types.

Answer:

Tides are the regular rising and falling of the Earth's surface water in response to the gravitational attraction of the Moon and the Sun.

Types of tides

There are two main types of tides including high tides and low tides.

High Tide: When water levels rise to their highest point, creating a high tide.

Low Tide: When water levels fall to their lowest point, creating a low tide.

Additionally, there are two special types of tides including neap tides and spring tides.

Spring Tides: The highest high tides and lowest low tides produced spring tides. They occur during the full moon and new moon when the gravitational forces of the Moon and the Sun align in a straight line.

Neap Tides: The moderate tides with less difference between high and low tides produce neap tides. They occur during the first and third quarters of the moon when the gravitational forces of the Moon and the Sun are at right angles.

5. If the Earth stops spinning around its own axis, what will happen?

Answer:

If the Earth were to suddenly stop spinning on its axis, several significant consequences would occur.

- One side would face continuous daylight, while the other side would be in constant darkness, resulting in extreme temperature variations.
- The lack of rotation would disrupt the atmosphere's circulation, leading to severe weather events.
- The distribution of mass on Earth would change, affecting gravitational forces leading to geologic and oceanic shifts.
- Plant and animal life would face extreme challenges in adapting to the new and harsh environmental conditions.

D. Investigating questions.

1. Prove the force of gravity by doing an experiment. Explain its importance in our lives.

Answer:

Gravity is the force that holds the planets in their orbits around the Sun and keeps the Moon in its orbit around the Earth. Every object in the universe whether small or large, exerts a force on every other object.

Proving the Force of Gravity Experimentally

The procedure of an experiment to demonstrate the force of gravity is given below.

Materials

- A small ball (e.g., a tennis ball)
- A ruler
- A table or flat surface

Procedure

- Place the ruler vertically on the edge of the table.
- Place the small ball at the top of the ruler.
- Carefully push the ball off the ruler to fall freely to the ground.
- Observe the motion of the ball as it falls.

Explanation

When the ball is released from the ruler, it falls straight down due to the force of gravity. Gravity is the force that pulls objects with mass toward one another. In this case, the Earth's gravity is pulling the ball downward. The ball accelerates as it falls, which is why it gains speed as it moves towards the ground.

Importance of Gravity in Our Lives

Some importance of gravity in our lives is given.

- It keeps us and everything on Earth grounded, preventing us from floating into space.
- Gravity is responsible for the weight of objects. Without gravity, objects would have no weight, and we wouldn't be able to measure or quantify mass.
- It influences many natural phenomena, including the tides, the orbits and the motion of celestial bodies.

2. What causes high tides? Explain the phenomenon with the help of a diagram.

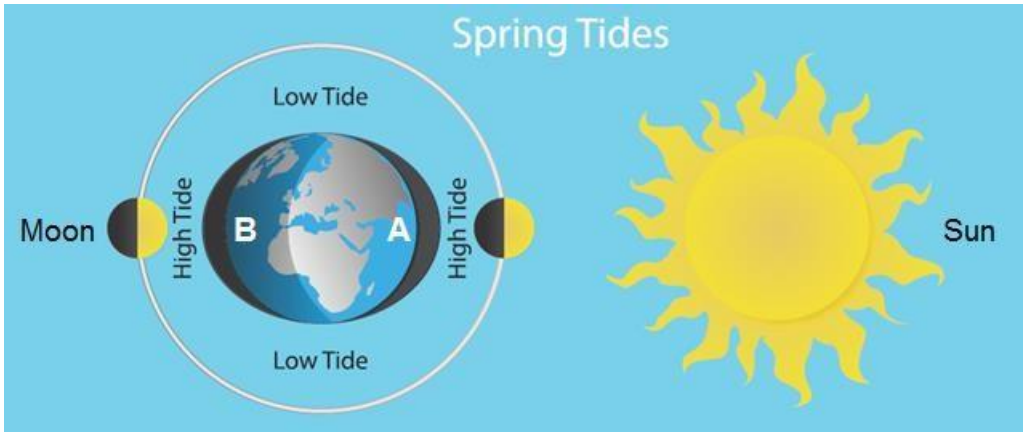
Answer:

High tides are primarily caused by the gravitational pull of the Moon and the Sun on Earth's oceans.

Causes of High Tides

Here is an explanation with the help of a diagram. The diagram illustrates two key positions in the Earth-Moon system, A and B.

- At position A, the gravitational pull of the Moon is stronger on the side of Earth facing the Moon, creating a "bulge" of water in that region. This results in a high tide known as the "high tide bulge."
- At position B, on the opposite side of the Earth, there is another high tide bulge caused by the centrifugal force due to the rotation of the Earth-Moon system.
- In between these two high tide bulges, there are areas with lower water levels, known as "low tides."



3. Calculate the weight of an object having a mass of 4 kg on Earth and the Moon.

Answer:

Given data:

Mass of an object = 4 kg

Acceleration due to gravity (g) on Earth = 9.81 m/s^2

Acceleration due to gravity (g) on Moon = 1.625 m/s^2

To find:

Weight on Earth =?

Weight on Moon =?

Solution:

To calculate the weight of an object on Earth, use the given formula:

Weight (W) = mass (m) x acceleration due to Gravity (g)

Weight on Earth

W = 4 kg x 9.81 m/s^2

W = 39.24 N

Weight on the Moon

W = 4 kg x 1.625 m/s^2

W = 6.5 N

Therefore, the object would weigh approximately 39.24 newtons on Earth and 6.5 newtons on the Moon.

E. Answer the following questions in detail.

1. Describe the movement of the Earth.

Answer:

Earth

Earth is the fifth largest planet in the solar system and the third nearest planet to the Sun. The Earth is home to countless living things, including us.

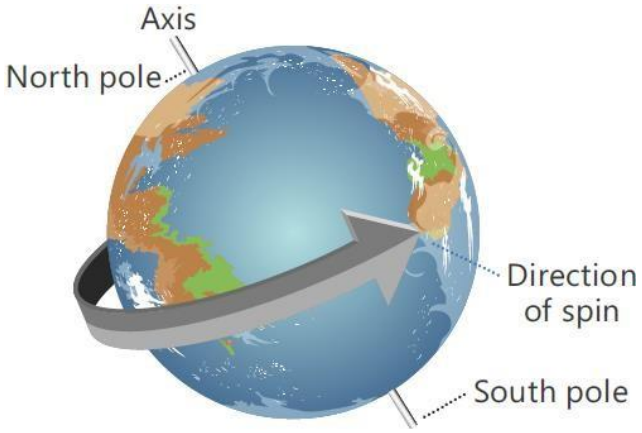
Movement of the Earth

The movement of the Earth involves the rotation, revolution and tilting of the Earth.

Earth's rotation

The Earth spins on its axis and is tilted 23.5° to the plane of its orbit. This axial tilt remains steady throughout the year. The Earth's axis is the imaginary vertical line around which the Earth spins. The poles are located

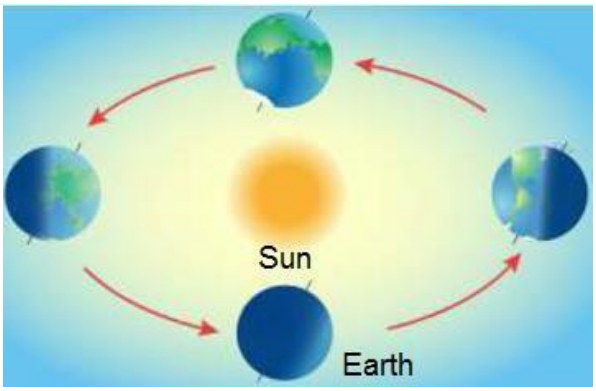
at the north and south ends of the axis. The spinning of the Earth around its axis is called rotation.



Earth's revolution

The Earth revolves around the Sun with many other planets and dwarf planets in fixed paths called orbits.

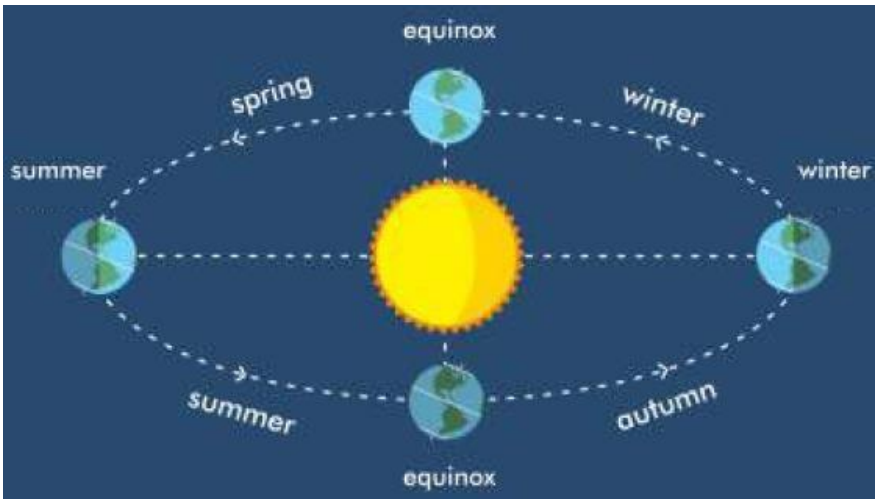
The Earth orbits around the Sun at an average distance of 149.60 million km in an anticlockwise pattern. One complete orbit takes 365 and one-quarter days a year around the Sun. The orbit of the Earth is an elliptical, elongated closed curve. If the orbit of the Earth had been a circle, the distance of the Earth from the Sun would have been the same all around, but that is not the case; the distance between the Earth and the Sun changes during a year along the orbit of the Earth. The Earth comes nearest to the Sun around January and goes farthest around July. The rotation of the Earth causes day and night while the revolution of the Earth around the Sun causes different seasons.



Axial Tilt

Earth's axis is not perpendicular to its orbital plane but tilted at an angle of approximately 23.5 degrees. This tilt is responsible for the changing seasons as different parts of the Earth receive varying amounts of sunlight during the year.

When the axis of the Earth points towards the Sun, it is called the summer season for that hemisphere. On the other hand, when the axis of the Earth points away from the Sun, it is the winter season for that hemisphere. The seasons of spring and autumn form between these two times when the axis of the Earth points 90 degrees away from the Sun.



2. What is the moon? Describe the Earth's moon and its rotation and revolution.

Answer:

Moon

Our Moon was formed after a huge crash that happened billions of years ago. A huge space rock smashed into the young Earth and caused loose pieces of rock that float into space. They combined to form our Moon.

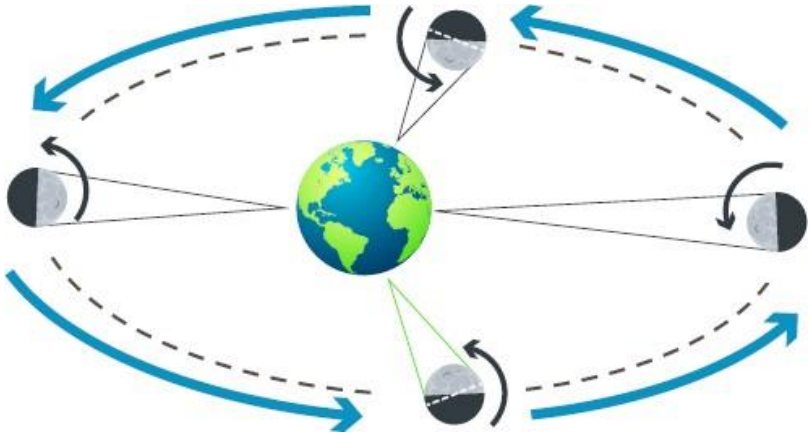
Moon – the Earth's satellite

The Earth is called the satellite of the Sun while the Moon is called the satellite of the Earth.

Rotation and revolution of Moon

The Moon rotates around its axis and revolves around the Earth. The Earth is the only planet that has one moon. It is the brightest object in our night sky. The Moon's revolution is responsible for the changes in its appearance.

The rotation of the Moon cannot be seen because its rotation takes 27.3 days; the same time it takes to revolve around the Earth. Therefore, the same side of the Moon always faces the Earth.



3. Differentiate between mass and weight with examples.

Answer:

Differences between mass and weight

Differences between mass and weight are given below in the table.

Mass (m)	Weight (w)
Mass is the quantity of matter in an object.	Weight is the force with which the Earth attracts an object towards its centre.
It is denoted by 'm'.	It is denoted by 'w'.
It is measured in kilograms (kg).	It is measured in Newton (N).
The mass will remain the same everywhere.	The weight may change at different places.
The mass will never be zero in space.	The weight may be zero in space.
It is measured by a physical balance.	It is measured by a spring balance.