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PRACTICE

SCIENCE 9

Updated Answer Key

DNA education
New Delhi- 110002

Chapter 01 MATTER IN OUR SURROUNDINGS

WORKSHEET 1

Physical Nature of Matter

Q A. Multiple Choice Questions:

1. (a) 2. (c) 3. (a) 4. (c) 5. (b)

Q B. Give reasons for the following:

1. A diver is able to swim through water but not through the wood because of availability of space between the particles in water. Also, the forces of attraction between the liquid particles are not very strong.

2. The level of water in a glass remains same after dissolving sugar in it because the sugar particles gets into the spaces between water molecules.

3. It is easier to break a chalk piece than an iron bar because strength of force of attraction is lesser in chalk.

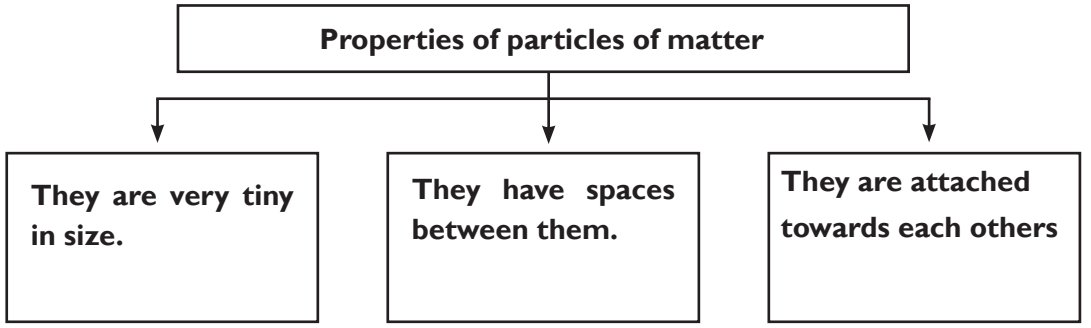
4. We can smell a hot dish from a distance but not a cold dish because hot food particles have high kinetic energy due to which they move faster as compared to cold food particles.

5. We can smell a lighted incense stick from a distance because gas particles have high kinetic energy,so they can travel a longer distance quickly.

Q C. State whether the following statements are true or false:

1. False 2. True 3. True 4. False 5. False

Q D. Complete the given flowchart:



Q E. Very Short Answer Questions:

1. A solid will have more density as the particles are closely packed and the inter-particle forces are strong enough to hold the particles together as compared to a liquid.

2. The particles of water are held together by forces of attraction. But these forces of attraction are not very strong. Therefore, by applying greater force, a diver can cut though water in a swimming pool by overcoming the weaker force of attraction present among the particles of water. Also, there are spaces between the particles of water. This observation shows that particles of matter attract each other and have space between them.

3. If a substance has no mass, it cannot be considered as a matter because a substance must have some mass to be called a matter.

4. LPG and oxygen are the two gases which are supplied in compressed form in homes and hospitals, respectively.

5. If the food is being cooked in the kitchen, its smell spreads and reaches us by the process called diffusion.

Q F. Short Answer Questions(Type I):

1. The intermixing of particles of two different types of matter on their own is called diffusion.

In diffusion, particles of matter intermix on their own with each other. They do so by getting into the spaces between the particles.

2. The intermolecular space between the gas particles is very large as compared to the intermolecular space between the liquid particles. Therefore, the gases are more compressible.

3. Physical nature of matter

(a) Matter is made up for particles

(b) Particles of matter have space between them

(c) Particles of matter are continuosly moving

(d) Particles of matter attract each other

(e) Matter around us exists in three different states– solid, liquid and gas.

Q G. Short Answer Questions(Type II):

1. Two factors which determine the rate of diffusion of a liquid into another liquid are –

(i) Temperature : It affects the rate of diffusion, as the temperature rises, the rate of diffusion increases.

(ii) Density : If any liquid has more density, the rate of diffusion will be lesser. In other words, rate of diffusion of liquids is inversely proportional to their density.

2. Activity:

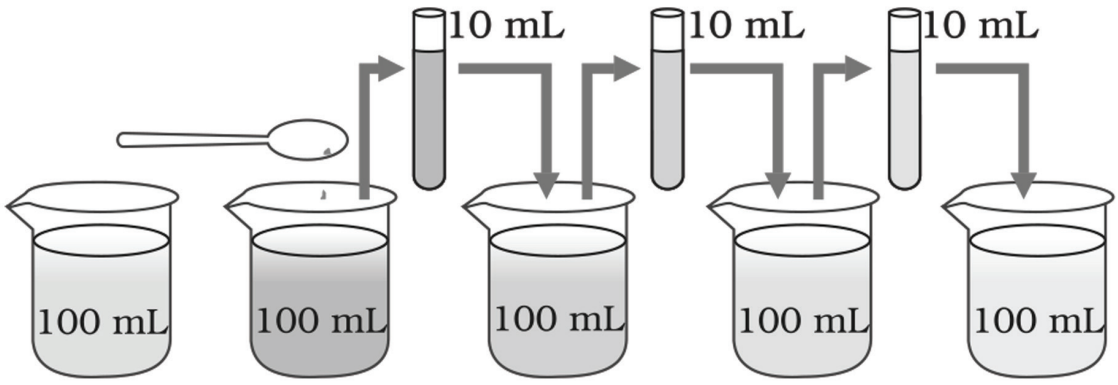
(a) Take 2-3 crystals of potassium permanganate and dissolve them in 100 mL of water.

(b) Take out approximately 10 mL of this solution and put it into 90 mL of clear water.

(c) Take out 10 mL of this solution and put it into another 90 mL of clear water.

(d) Keep diluting the solution like this 5 to 8 times.

(e) Is the water still coloured ?



This experiment shows that just a few crystals of potassium permanganate can colour a large volume of water (about 1000 L).

Conclusion: We conclude that there must be millions of tiny particles in just one crystal of potassium permanganate, which keep on dividing themselves into smaller and smaller particles.

3. If we put an unlit incense stick in a corner of a room. We have to go near to get its smell. Now, if we light the incense stick. We can get the smell sitting at a distance. This shows that the kinetic energy of the particles of matter increases with temperature.

Q H. Long Answer Questions:

1. (a) Three characteristics of particles of matter:

(i) Particles of matter have space between them.

(ii) Particles of matter are continuously moving and the movement of particles of matter depends on their kinetic energy. The solids have the least kinetic energy in their particles.

(iii) Particles of matter attract each other. Particles of matter have a force acting between them. This force keeps the particles together.

When we add some sugar or salt in a beaker containing water, after sometime it gets dissolved and form a homogeneous mixture or solution.

We also observe that there is not detectable rise in the level of water. This shows that spaces are present in between the particles of water. These are called interparticle spaces or wide.

2.

Property	Solid	Liquid	Gas
a. Density	They have high density.	They have density lower than solids but more than gases.	They have generally very low density.
b. Diffusion	Generally, they do not show the diffusion although some rare examples are known.	They show the property of diffusion.	They diffuse very rapidly.
c. Fluidity	They do not possess fluidity as they are rigid.	They possess fluidity that is why they can flow.	They have the highest fluidity.
d. Interparticle force of attraction	Interparticle force of attraction are the strongest.	Interparticle forces of attraction are weaker than the solids but stronger than those of gases.	Interparticle forces of attraction are the weakest.
e. Kinetic energy of particles	These particles have the least kinetic energy.	These have kinetic energy less than the gases and more than the solids.	They have the highest kinetic energy.

WORKSHEET 2

States of Matter

Q A. Multiple Choice Questions:

1. (a) 2. (d) 3. (b) 4. (b) 5. (c)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. Sublimation 2. Melting Point 3. Increases 4. Plasma 5. Iodine

Q C. Define the following terms.

1. Sublimation: A change of state directly from solid to gas without changing into liquid state is called sublimation.

2. Vaporisation: A change of state from liquid to a gas is called vaporisation.

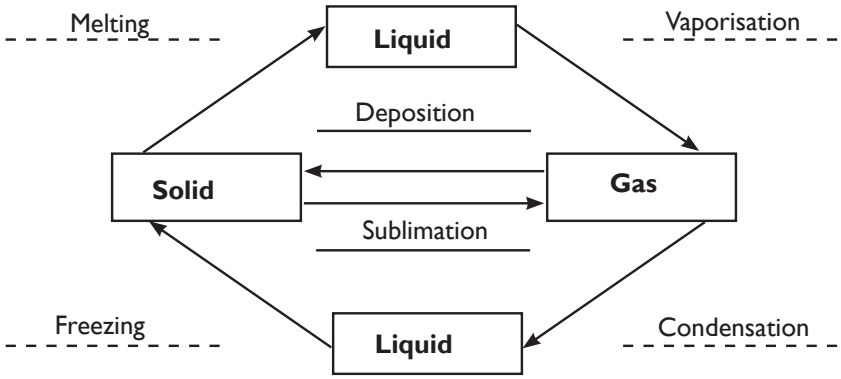
3. **Melting point:** The minimum temperature at which a solid melts to become a liquid at the atmospheric pressure is called its melting point.

4. **Latent heat:** Energy absorbed or released by a substance during a change in its physical state that occurs without changing its temperature is called its latent heat.

5. **Boiling point:** The temperature at which a liquid starts boiling at the atmospheric pressure is known as its boiling point.

Q D. Complete the flow chart given below:

Quantity **Units**



Q E. Very Short Answer Questions:

1. 373.15 K
2. (a) liquid (b) gaseous
3. (a) 26.85 celsius (b)299.85 celsius
4. Following two methods can be applied to convert a gas into a liquid.
   (i) By increasing the pressure or by compressing the gas.
   (ii) By lowering the temperature or by cooling the gas.
5. Solid carbon dioxide is known as dry ice.

Q F. Short Answer Questions (Type I):

1. At 273 K, ice absorbs more heat than water from the substance to overcome the latent heat of fusion and thus providing a more effective cooling effect. Therefore, ice at 273 k is more effective than water at the same temperature.
2. Sugar melts upon heating whereas ammonium chloride sublimes upon heating without leaving behind any residue.
3. (a) 233.15K (b) 373.15K

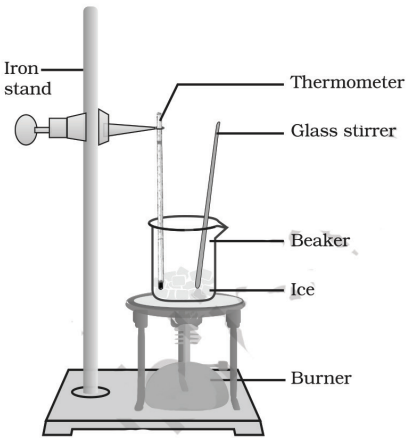
Q G. Short Answer Questions (Type II):

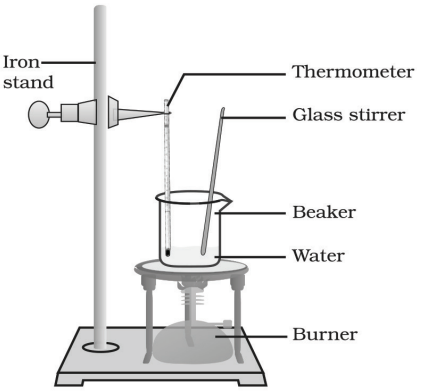
1. (a) Latent heat of fusion is the amount of heat energy required to change 1 kg of solid into liquid at its melting point.
   (b) Latent heat of vaporisation is the heat energy required to change 1 kg of a liquid to gas at atmospheric pressure at its boiling point.
2. This activity shows the compressibility of different state of matter.
   In first test tube, solid chalk powder is used which is incompressible.
   In second test tube, liquid water is used which is also incompressible.
   In third test tube, gaseous air is available which is highly compressible.

3. When ice (solid state) is heated, it melts and changes to water (liquid state). When water is boiled, it is converted to steam (gaseous state). The process can be reversed upon cooling. This justifies that these are the states of the same substance.

Q H. Long Answer Questions:

1.





Activity:

(a) Take about 150 g of ice in a beaker and suspend a laboratory thermometer so that its bulb is in contact with the ice, as in Figure.
(b) Start heating the beaker on a low flame.
(c) Note the temperature when the ice starts melting.
(d) Note the temperature when all the ice has converted into water.
(e) Record your observations for this conversion of solid to liquid state.
(f) Now, put a glass rod in the beaker and heat while stirring till the water starts boiling.
(g) Keep a careful eye on the thermometer reading till most of the water has vaporised.
(h) Record your observations for the conversion of water in the liquid state to the gaseous state.

On increasing the temperature of solids, the kinetic energy of the particles increases. Due to the increase in kinetic energy, the particles start vibrating with greater speed. The energy supplied by heat overcomes the forces of attraction between the particles. The particles leave their fixed positions and start moving more freely. A stage is reached when the solid melts and is converted to a liquid. The minimum temperature at which a solid melts to become a liquid at the atmospheric pressure is called its melting point.

The melting point of ice is 273.15 K. When we supply heat energy to water, particles start moving even faster. At a certain temperature, a point is reached when the particles have enough energy to break free from the forces of attraction of each other. At this temperature the liquid starts changing into gas. The temperature at which a liquid starts boiling at the atmospheric pressure is known as its boiling point. For water this temperature is 373 K.

2 .

Property	Solid	Liquid	Gas
a. Density	They have high density.	They have density lower than solids but more than gases.	They have generally very low density.
b. Diffusion	Generally, they do not show the diffusion although some rare examples are known.	They show the property of diffusion.	They diffuse very rapidly.

c. Fluidity	They do not possess fluidity as they are rigid.	They possess fluidity that is why they can flow.	They have the highest fluidity.
d. Interparticle force of attraction	Interparticle force of attraction are the strongest.	Interparticle forces of attraction are weaker than the solids but stronger than those of gases.	Interparticle forces of attraction are the weakest.
e. Kinetic energy of particles	These particles have the least kinetic energy.	These have kinetic energy less than the gases and more than the solids.	They have the highest kinetic energy.

WORKSHEET 3

Evaporation

Q A. Multiple Choice Questions:

1. (d) 2. (d) 3. (a) 4. (b) 5. (b)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. Cooling 2. Evaporation 3. Humidity 4. Cotton 5. Surface

Q C. Fill in the blanks using the suitable words given in the brackets:

1. True 2. True 3. True 4. False 5. True

Q D. Give reasons for the following:

1. Evaporation occurs below boiling point of water because evaporation takes place at all temperatures. But on reaching the boiling point, the vaporisation process takes place rapidly.
2. On a hot and humid day, the sweat from our body does not evaporate easily, making us feel very uncomfortable.
3. We should wear cotton clothes in summer because cotton is a strong water absorber that helps to absorb the sweat and introduce to the environment of evaporation.
4. The water vapour present in the air comes in contact with the glass containing ice-cold water. The vapour loses its energy in the cold water and gets converted to water droplets which we can see on the outer surface of the glass. This process is known as Condensation.
5. Acetone has a very low boiling temperature and evaporates very fast. When we put some acetone on our palm the particles of it gain energy from our palm and evaporate quickly which causes cooling.

Q E. Very short Answer Questions:

1. Wet clothes do not dry easily on a rainy day because the air has a lot of water vapour on it and it cannot accommodate the water vapour created by the wet clothes so the water remains in the clothes for a longer time.
2. We sweat after morning exercise. The sweat is then evaporated by blowing wind and it carries away latent energy from our skin making us feel cool.
3. The phenomenon of change of a liquid into vapours at any temperature below its boiling point is called evaporation.
4. The particles of liquid absorb energy from the surroundings to change into vapour by the process of evaporation.
5. When body temperature rises on a hot summer day, the sweat gland starts its secretion to keep our body temperature stable. So, we perspire more in summer.

Q F. Short Answer Questions (Type I):

1. The rate of evaporation increases as the temperature increases.
2. People sprinkle water on the roof on a hot day because water has a high latent heat of vaporisation so it will absorb more heat and make the roof cool.

3. A desert cooler gives cool air on a hot sunny day because the amount of water vapour present in the air is less on a hot sunny day.

Q G. Short Answer Questions (Type II):

1.

Boiling	Evaporation
a. Boiling takes place at a particular temperature when the liquid is heated.	a. Evaporation occurs on its own at all temperatures.
b. Boiling is a bulk phenomenon. It involves the formation of bubbles of the vapours form bulk (whole) of the liquid.	b. Evaporation is a surface phenomenon. It takes place only from the surface of the liquid.
c. No cooling is caused during boiling.	c. Evaporation always causes cooling.

2. During summer, we perspire more because of the mechanism of our body which keeps us cool. Cotton, being a good absorber of water helps in absorbing the sweat and exposing it to the atmosphere for easy evaporation. So, we should wear cotton clothes in summer.

3. Humidity is the amount of water vapour present in the air. As humidity increases the rate of evaporation decreases.

Q H. Long Answer Questions (Type II):

1. Factors that affect the rate of evaporation are

   (a) **Surface area exposed to the atmosphere:** If the surface area is increased, the rate of evaporation increases.

   (b) **Humidity:** The air around us cannot hold more than a definite amount of water vapour at a given temperature. If the amount of water vapours increases, the rate of evaporation decreases.

   (c) **Temperature:** With the increase in temperature, more number of particles get enough kinetic energy to go into the vapour state. So, evaporation rate also increases.

   (d) **Wind speed:** With the increase in wind speed, the particles of water vapour move away with the wind, decreasing the amount of water vapour in the surrounding.

2. The particles of liquid absorb energy from the surrounding to regain the energy lost during evaporation. This absorption of energy from the surroundings make the surroundings cold causing cooling effect.

   Examples:

   (a) When we pour some acetone (nail polish remover) on your palm, the particles gain energy from your palm or surroundings and evaporate causing the palm to feel cool.

   (b) After a hot sunny day, people sprinkle water on the roof or open ground because the large latent heat of vaporisation of water helps to cool the hot surface.

WORKSHEET 4

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (b) 2. (c) 3. (b) 4. (b) 5. (c) 6. (c) 7. (c)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. Fluidity 2. Gases 3. Rigidity 4. Humidity 5. Condensation

Q C. Match the following:

Quantity	Units
1. Temperature	(d) K
2. Length	(c) m
3. Mass	(b) kg

4. Density (e) kg/m3

5. Pressure (a) pascal

Q D. Differentiate between the following:

1.

	Solid	Liquid
a. Kinetic energy of particles	These particles have the least kinetic energy.	These have kinetic energy less than the gases and more than the solids.
b. Diffusion	Generally, they do not show the diffusion although some rare examples are known.	They show the property of diffusion.
c. Fluidity	They do not possess fluidity as they are rigid.	They possess fluidity that is why they can flow.

2. Fusion: The process of melting, that is, change of solid state into liquid state is also known as fusion. Condensation: Condensation is the change of the state of matter from the gas phase into the liquid phase. It is the reverse of vaporization.

3. Sublimation: The conversion of a substance from solid to the gaseous state without its becoming liquid is known as sublimation.

Q E. Very Short Answer Question:

1. Iodine and naphthalene can sublime.

2. (a) gaseous state (b) solid state

3. Liquids like acetone are kept in cool places to minimise the loss due to evaporation because they are highly volatile.

4. Kelvin temperature is 270K. Celsius scale temperature is 270 - 273 = -3C.

5. The answer is liquid A. Higher the vapour pressure lower will be the boiling point. So, liquid A will have lower boiling point.

6. The boiling point of water is 100°C. The temperature of boiling water does not rise instead of continuous supply of heat, as the extra heat is supplied to the water is used to turn water into steam. Hence, steam has a lot of latent heat which can cause severe burns. So, Alka felt intense heat from the puff of steam gushing out of the spout of the kettle.

7. 1 kg ice at o° celsius has strongest intermolecular forces.

Q F. Short Answer Question(Type I):

1. (a) The gas is liquefied petroleum gas.

(b) Change in pressure or reduction in pressure causes this change in state.

2. The boiling point of pure water is 100° C at normal pressure. The freezing point of pure water is 0 C. The sample of water under study boils at 102º C at normal pressure. So, the sample is not pure water. Since the sample of water is not pure, it will not freeze at 0° C. It will freeze at a temperature below 0° C.

3. Applying pressure makes the molecules of gas come closer and thus they are converted into liquid phase. The two liquefied gases used are CNG (Compressed Natural Gas) LPG (Liquefied Petroleum Gas)

4. (a) Liquid state (b) Solid state (c) Gaseous state (d) Liquid state

5. Figure (d) represents the result correctly. Justification: Initially temperature of the content of beaker does not rise, because of latent heat of fusion. When all ice melts and, the temperature of content starts rising, hence, figure (d) represents the result correctly.

Q G. Short Answer Question(Type II):

1. (a) Camphor is a volatile solid. It undergoes sublimation slowly at the room temperature. As a result, solid camphor gets converted into vapours which become a part of the air around us. Therefore, camphor disappears without leaving any solid remains.

(b) Wet clothes do not dry easily on a rainy day because of the high humidity in the air. The water vapours present in the air slows down the rate of evaporation from the clothes.

(c) We sweat more on a humid day. In hot and humid weather, the air around us already has a high percentage of water vapours, therefore, the sweat does not evaporate easily and gives us a sticking an uncomfortable feeling.

2. The boiling point of a liquid is the temperature at which its vapour pressure becomes equal to the atmospheric pressure. Since the atmospheric pressure is lower on mountains (Shimla) than on plains (Delhi), therefore, the vapour pressure of water becomes equal to the atmospheric pressure at a lower temperature between particles in Shimla than in Delhi. As a result, boiling point of water is lower in Shimla than in Delhi.

3. (a) Due to the presence of much smaller spaces amongst the particles of solids and liquids as compared to those in gases, the solid and the liquid states are collectively called the condensed phase of matter.

(b) Two states of matter other than solid, liquid and gas are

(i) Plasma

(ii) Bose Einstein Condensate

Plasma: The state consists of super energetic and super excited particles. These particles are in the form of ionised gases. The fluorescent tube and neon sign bulbs consist of plasma.

Bose-Einstein Condensate: In 1920, Indian physicist Satyendra Nath Bose had done some calculations for a fifth state of matter. Building on his calculations, Albert Einstein predicted a new state of matter – the Bose-Einstein Condensate (BEC). The BEC is formed by cooling a gas of extremely low density, about one-hundred-thousandth the density of normal air, to super low temperatures.

4. **Melting point:** The temperature at which a solid melts to become a liquid at atmospheric pressure is called its melting point. Each pure solid has a fixed melting point which is a measure of the strength of the force of attraction between its constituent particles. Higher the melting point, stronger are the forces of attraction.

(b) The common substances which undergo sublimation are:

(i) Naphthalene (ii) Ammonium chloride (iii) Camphor (iv) Anthracene

5. (a) The gas jar containing air also becomes completely reddish-brown. It is due to the movement of reddish brown vapours of gaseous particles of bromine from one vessel into another as they possess kinetic energy. It is because the gaseous particles have least or almost no forces of attraction between them. That's why this happened.

(b) The process involved here is called diffusion. It is the intermixing of the particles of different substances of matter on their own.

Q H. Long Answer Question:

1. The diagram shows that solids have very little inter particular space and particles are arranged in an orderly fashion. This allows very little movement of particles. Hence solids have only vibratory motion in their particles.

Liquids have inter particular spaces and are randomly arranged. This allows their particles to move and hence they are fluids.

Gases have large inter particle spaces and particles are arranged randomly. Hence, these particles can move randomly in different directions and can occupy as much space as available. They have high fluidity.

2. (a) Ice is being converted into water. Melting is going on over A to B.

(b) From B to C, temperature of water is being raised while its state remains the same.

(c) A = 0°C, B = 0°C, C = 100°C, D = 100°C.

From C to D, water is being converted into steam, i.e., vaporisation is occurring while the temperature remains the same.

Q I. Assertion-Reason Question:

1. (b) 2. (a) 3. (d)

Q J. Case-based Question:

1. (a) 2. (b) 3. (b) 4. (a) 5. (b)

Chapter 02 IS MATTER AROUND US PURE?

WORKSHEET 1

Mixture-Solutions, Suspension and Colloid

Q A. Multiple Choice Questions:

1. (a) 2. (d) 3. (c) 4. (d) 5. (c)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. compound 2. any 3. compound 4. homogeneous 5. evaporation

Q C. Give one word for the following :

1. Solution 2. Alloy 3. Aerosol 4. Compound 5. Tynder effect

Q D. Classify the following as homogeneous or heterogeneous mixtures:

Homogeneous mixtures = gasoline, vinegar, aerosol spray, air, steel, alcohol, iron nail

Heterogeneous mixtures = dirt, smog

* Sea water can be classified as homogeneous as well as hetrogeneous mixture.

Q E. Very Short Answer Questions:

1. Water and carbon dioxide gas.

2. (i) Sugar and sand (ii) Sand and water

3. Ethyl alcohol = solute, water = solvent

4. A colloidal solution is a heterogeneous mixture.

5. An aerosol is a suspension of fine solid particles or liquid droplets in air or another gas.

Examples - clouds, smoke, etc.

Q F. Short Answer Question(Type I)

1. Volume of solution = Volume of solute + Volume of solvent
= 50 + 150
= 200 mL

Concentration of solution $= \frac{\text{Volume of solute} \times 100}{\text{Volume of solution}} = \frac{50 \times 100}{200} = 25\%$

2. (a) Sunlight entering a dark room from a hole in window or door.

(b) Light falling on ground from the canopy of trees in a forest or garden.

3. Mass of solute = 2.5 g
Mass of solvent = 50 g

$$\text{Concentration (w/w)} = \frac{\text{Mass of solute} \times 100}{\text{Total mass of solution}} = \frac{2.5 \times 100}{52.5} = 4.76\%$$

Q G. Short Answer Questions (Type II).

1. Only colloidal solutions show the Tyndall effect as the practical size is large enough to scatter the particles of light. Solution of sodium chloride (salt water) is a true solution, so it does not show the Tyndall effect. However, the mixture of water and milk in water is a colloidal solution which shows the effect.

2. Total mass of solution = mass of solute + mass of solvent

= 36 + 100

= 136 g

$$\text{Concentration} = \frac{\text{Mass of solute} \times 100}{\text{Mass of solution}}$$

$$= \frac{36 \times 100}{136}$$

= 26.47 %

3. Three properties of colloids

(a) A colloid is a heterogeneous mixture.

(b) The size of particles of a colloid is too small to be individually seen by naked eyes.

(c) Colloids are big enough to scatter a beam of light passing through it and make its path visible.

Q H. Long Answer Type Questions:

1. (a) **Solution:** A solution is a homogeneous mixture of two or more substance. The major component of the solution is called the solvent and the minor component is called the solute. The particle size is less than 1 nm.

(b) **Suspension:** A suspension is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium. The particle size is more than 100 nm.

(c) **Colloid:** The particles of a colloid are uniformly spread throughout the solution. Due to the relatively smaller size of particles, as compared to that of a suspension, the mixture appears to be homogeneous. But actually, a colloidal solution is a heterogeneous mixture. The components of a colloidal solution are the dispersed phase and the dispersion medium.

2 a. A solution is a homogeneous mixture of two or more substances.

Properties of a solution

(i) A solution is a homogeneous mixture.

(ii) The particles of a solution are smaller than 1 nanometer in diameter. So, they cannot be seen by naked eyes.

(iii) Because of very small particle size, they do not scatter a beam of light passing through the solution. So, the path of light is not visible in a solution.

(iv) The solute particles cannot be separated from the mixture by the process of filtration. The solute particles do not settle down when left undisturbed, that is, a solution is stable.

b. Solution of iodine in alcohol known as 'tincture of iodine', has iodine (solid) as the solute and alcohol (liquid) as the solvent.

WORKSHEET 2

Separating the Components of a Mixture

Q A. Multiple Choice Questions:

1. (d) 2. (b) 3. (b) 4. (b) 5. (c)

Q B. State whether the following statements are true or false:

1. True 2. False 3. False 4. True 5. True

Q C. Differentiate between the following.

1. **Distillation:** Distillation involves the conversion of a liquid into vapours by heating followed by condensation of the vapours. It is used for the separation of components of a mixture containing two miscible liquids which have sufficient difference in their boiling points (greater than 25 K).

Fractional Distillation: If the boiling point of two miscible liquid differ by less then 25 K, they can be separated by the technique of fractional distillation. Here, a fractionating column is used which condenses the component with lower boiling point and hence the component with higher boiling point is separated first.

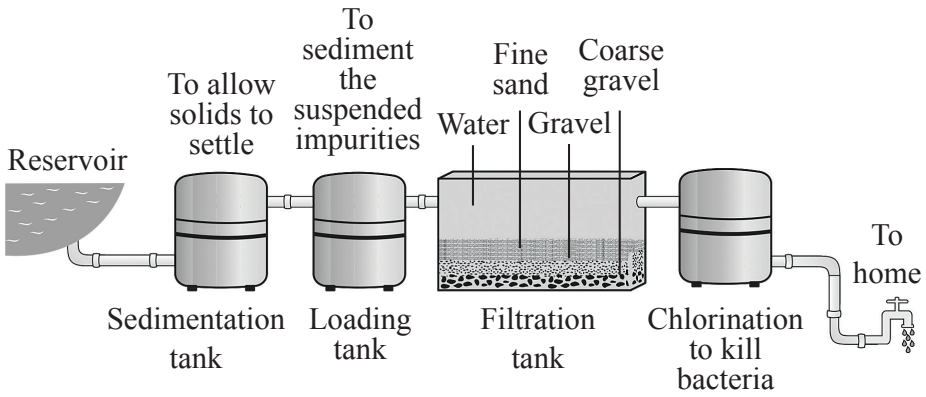
2. **Crystallisation:** The crystallisation method is used to purify solids. For example, the salt we get from sea water can have many impurities in it. To remove these impurities, the process of crystallisation is used. Crystallisation is a process that separates a pure solid in the form of its crystals from a solution. Crystallisation technique is better than simple evaporation.

   Evaporation: The evaporation method is used to separate the volatile component (solvent) from its non-volatile solute.

3. **Separating funnel:** A separating funnel is also known as separation funnel, separatory funnel, or colloquially sep funnel is a piece of laboratory glassware used in liquid-liquid extractions to separate the components of a mixture into two immiscible solvent phases of different densities. For examples, oil, and water. They are always separate out, and this can be removed easily.

   Chromatography: It is base on the principle of solubility of different components of a mixture in a given solvent. The more soluble component travels a larger distance on the stationary phase while the less soluble one travels less distance . In this way, components get separated from their mixture.

Q D.



Water purification system in water works

Q E. Very Short Answer Question:

1. Yes, naphthalene has a property of sublimation, i.e., solid converting directly into vapour. Thus, naphthalene having lower sublimation temperature than camphor, disappears with time first, leaving behind camphor.

2. It indicates that the ink drop consisted of a mixture of three different coloured dyes and is not just a single dye. Hence, ink is a mixture and not a pure substance.

3. It can also be obtained by the process of crystallisation.

4. Oxygen

5. Simple distillation is used for the separation of components of a mixture containing two miscible liquids which boil without decomposition and have sufficient difference in their boiling points. Whereas fractional distillation is used to separate many different components from the mixture even if the difference in their boiling points is less.

For example - crude oil in petroleum industry is separated into various fractions such as gasoline, kerosene oil, diesel oil, lubricating oil, etc., by fractional distillation.

Q F. Short Answer Questions:

1. Place the liquid container above a gas burner. Evaporate the liquid water. In the container, there will be nothing left if it's pure water. If it's salt water then salt will be left. It will be non sticky crystal white powder. If it is sugar solution then as water evaporates the remains will be sticky and it will turn brown and then black.

2. A separating funnel can be used to separate oil from water. Oil and water are two immiscible liquids and forms two different layers in separating funnel.

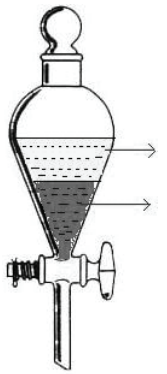
The principle is that immiscible liquids separate out in layers depending on their densities.

3. Take the given mixture in a distillation flask. Heat the mixture slowly keeping a close watch at the thermometer. At a certain point, temperature becomes constant. Petrol vaporises first as it has the lower boiling point. It condenses in the condenser and is collected from the condenser outlet. Stop heating when the temperature further starts rising. Kerosene is left behind in the distillation flask. Hence, a mixture of kerosene and petrol can be separated using distillation process.

Q G. Short Answer Questions (Type II)

1. First of all we put a magnet in the mixture of iron filings, sulphur powder and sugar. Now we observe that iron particles are attracted by the magnet and get separated from the mixture. After that, remaining mixture is dissolved in water. During this activity, we can observe sugar soluble in water while sulphur does not. On filtration, sulphur can be obtained on the filter paper, while sugar is recovered from the filtrate by distillation or evaporation.

2. When two liquids do not mix, they form two separate layers and are known as immiscible liquids. These two liquids can be separated by using a separating funnel.



Experiment: A separating funnel is a special type of glass funnel, which has a stopcock in its stem to regulate the flow of liquid. It will separate the immiscible liquids into two distinct layers depending on their densities. The heavier liquid (water) forms the lower layer while the lighter one (kerosene) forms the upper layer. Remove the stopper and open the tap to run the lower layer into a beaker. You will be left behind with just the upper layer in the funnel. Collect this liquid into another beaker. For example, kerosene and water mixture is separated by using separating funnel method. This method is also used to extract iron form its ore.

3. Chromatography is a separation technique used to separate different components from a mixture depending upon their solubility in a given solvent. It is widely used in the separation of amino acids and also in the the separation of different coloured dyes from a mixture.

Q H. Long Answer Questions:

1. (a) **Filtration:** It is based on the principle of particle size of different components. When mixture is allowed to pass through filter paper, the component with larger particle size will remain on the filter paper while that with smaller particle size will pass through the pores of filter paper and get collected as filtrate.

(b) **Sublimation:** It is a process in which solid directly changes to gaseous state without passing through the intermediate liquid state. Sublimation can be used to separate volatile component from the non-volatile component of a mixture.

(c) Chromatography: It is based on the principle of solubility of different components of a mixture in a given solvent. The more soluble component travels a larger distance on the stationary phase while the less soluble one travels less distance . In this way, components get separated from their mixture.

(d) **Distillation:** Distillation involves the conversion of a liquid into vapours by heating followed by condensation of the vapours. It is used for the separation of components of a mixture containing two miscible liquids which have sufficient difference in their boiling points (greater than 25 K).

(e) Fractional Distillation: If the boiling point of two miscible liquid differ by less then 25 K, they can be separated by the technique of fractional distillation. Here, a fractionating column is used which condenses the component with lower boiling point and hence the component with higher boiling point is separated first.

2. (a) Magnetic Separation
(b) Reverse osmosis
(c) Evaporation
(d) Sedimentation
(e) Sublimation
(f) Filtration
(g) Chromatography

WORKSHEET 3

Pure Substances - Elements and Compounds

Q A. Multiple Choice Questions:

1. (c) 2. (d) 3. (c) 4. (c) 5. (c)

Q B. Match the following.

1. (e) 2. (b) 3. (d) 4. (c) 5. (a)

Q C. Define the following terms:

1. **Element:** An element is a form of matter that cannot be broken down by chemical reactions into simpler substances.

2. **Compound:** A compound is a substance composed of two or more elements, chemically combined with one another in a fixed proportion.

3. **Ductility:** Ductility is the ability of a material to be drawn or plastically deformed without fracture.

4. **Malleability:** Malleability is a property of a material by which it can be beaten to form thin sheets.

5. **Metalloid:** Some elements have intermediate properties between those of metals and non-metals, they are called metalloids. For example: boron, silicon, germanium etc.

Q D. Complete the following table:

Change	Physical / Chemical
Burning of magnesium ribbon in air	Chemical
Electrolysis of water	Chemical
Preparation of sugar solution	Physical
Conversion of milk into curd	Chemical
Evaporation of alcohol	Physical

Q E. Very Short Answer Questions:

1. Mercury

2. Brass is a homogenous mixture of two metals Copper and Zinc. Copper and Zinc are physically bound not chemically. So,brass is a mixture not a compound.

3. In a physical change no new substance is formed. in this case when the wool is knitted into a sweater only the appearance is changed, no new substance is formed. we can get back the wool from the sweater and thus it is a physical change .

4. Pure substances have definite composition and definite physical and chemical properties. Impure substances are made up of two or more pure substances mixed together in any proportion.

5. We will get a homogeneous mixture.

Q F. Short Answer Questions(Type I):

1. Air is a homogeneous mixture of number of gases such as oxygen, nitrogen, carbon dioxide, inert gases (mainly argon), water vapour. This is because all these gases in the air exist independently and their concentration may vary from-place to place. In a compound, composition is constant and substance does not exhibit properties of its constitutes which is not the case in air. Hence, it is not a compound.

2. Yes, both physical and chemical changes can happen at the same time. For e.g. - burning a candle.

3. Non-metals usually show some or all of the following properties:

(a) They display a variety of colours.

(b) They are poor conductors of heat and electricity.

(c) They are not lustrous, sonorous or malleable.

Q G. Short Answer Questions(Type II):

1. Three prominent properties of metals which are generally not shown by non-metals are

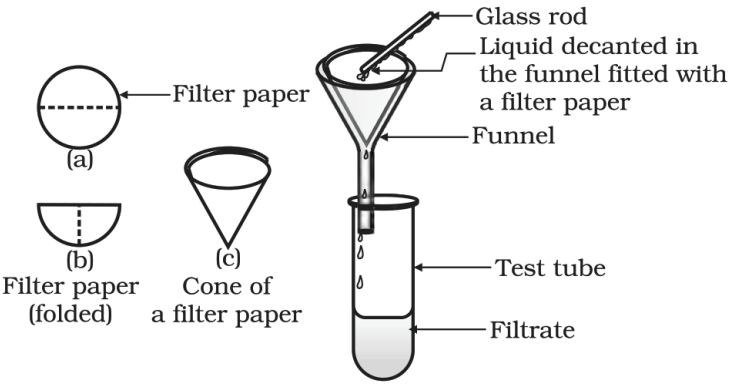
*Metals are lustrous.

*They conduct electricity.

*They are ductile and malleable.

2.

Mixtures	Compounds
1. Elements or compounds just mix together to form a mixture and no new compound is formed. 2. A mixture has a variable composition. 3. A mixture shows the properties of the constituent substances. 4. The constituents can be seperated fairly easily by physical methods.	1. Elements react to form new compounds. 2. The composition of each new substance is always fixed. 3. The new substance has totally different properties. 4. The constituents can be separated only by chemical or electrochemical reactions.



3. (a) Rigidity, fluidity, density, melting point

(b) Pick matter from paper

Q H. Long Answer Questions (Type II):

1. In 'A', a compound FeS is formed by the reaction between iron filings and sulphur. When dilute HCl is added to it, FeS will react with dilute HCl to form H2S gas which has smell of rotten eggs and will turn lead acetate

paper black. 'B' is not heated, so B is a mixture of iron fillings and sulphur powder. When dilute HCl is added to it, iron filings react with dilute HCl to form H2 gas which burns with a 'pop' sound if a burning matchstick is brought near it.

2. **Physical change:** The interconversion of states is called a physical change because these changes occur without a change in composition and no change in the chemical nature of the substance. For example; ice, water and water vapour all look different and display different physical properties, they are chemically the same.

Chemical change: A process in which one substance reacts with another to undergo a change in chemical composition is called chemical change. It brings change in the chemical properties of matter and we get new substances. A chemical change is also called a chemical reaction. For example; burning is a chemical change.

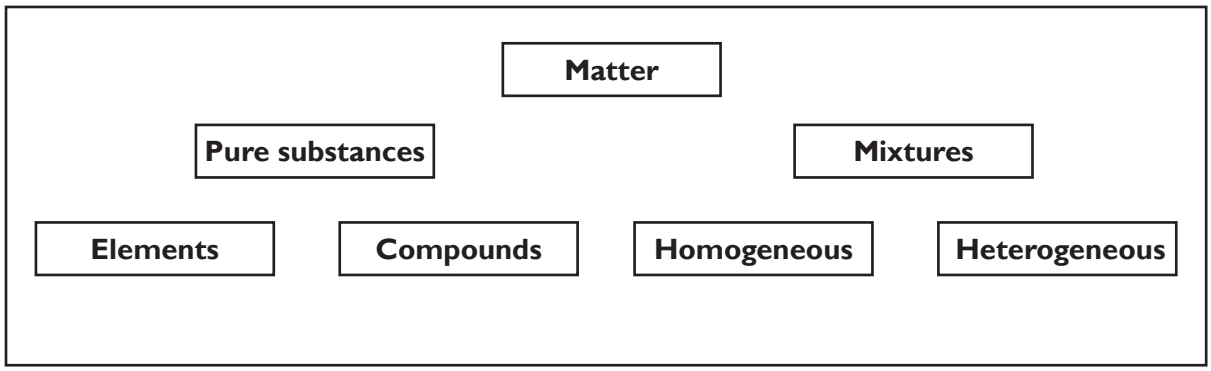
WORKSHEET 4

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (a) 2. (b) 3. (d) 4. (d) 5. (a) 6. (c) 7. (c)

Q B. Complete the given flow chart.



Q C. Give reason for the following:

1. A colloid is a heterogeneous mixture in which the dispersed particles are intermediate in size between those of a solution and a suspension. Because the dispersed particles of a colloid are not as large as those of a suspension, they do not settle out upon standing.

2. A true solutions does not show tyndall effect because the particle are not large enough to scatter the light incident on it.

3. In alloy the metals and non-metals do not chemically react with each other and there is just a physical mixture of different element and to have a compound it is necessary to form chemical bonds. Therefore, alloy is a mixture and not compounds.

4. Components of a colloid cannot be separated by filtration because the components of the colloid solution are very small and can easily pass through filter paper.

5. Crystallisation technique is better than simple evaporation technique as –

(a) some solids decompose or some, like sugar, may get charred on heating to dryness.

(b) some impurities may remain dissolved in the solution even after filtration. On evaporation these contaminate the solid.

Q D. Complete the given table:

Dispersed Phase	Dispersing Medium	Type of Sol	Examples
Liquid	Gas	Aerosol	Fog, clouds, mist
Solid	Gas	Aerosol	Smoke, automobile exhaust
Gas	Liquid	Foam	Shaving cream
Liquid	Liquid	Emulsion	Milk, face cream
Solid	Liquid	Sol	Milk of magnesia, mud
Gas	Solid	Foam	Sponge, pumice
Liquid	Solid	Gel	Jelly, cheese, butter
Solid	Solid	Solid sol	Coloured gemstone, milky glass

Q E. Very Short Answer Questions:

1. (i) salt dissolved in water
(ii) sugar dissolved in water

2. Metals: gold, silver Non-metals: oxygen, iodine

3. silicon, germanium

4. Gel is a liquid dispersed in solid. Examples include cheese, butter, jellies etc.

5. less than 1 nanometer

6. Distillation can be used for this purpose. As the boiling point of acetone is much less than that of water, it will evaporate and get collected in the separate beaker earlier, leaving behind the solution of water and salt.

7. No, since alcohol and water are miscible liquids, they cannot be separated using separating funnel as they would not form two distinct layers. Instead, they can be separated using distillation.

Q F Short Answer Questions(Type I):

1. A fractionating column is a tube packed with glass beads. The beads provide surface for the vapours to cool and condense repeatedly. It is used in distillation of liquid mixtures so as to separate the mixture into its component parts, or fractions, based on the differences in volatilities.

2. The scattering of a beam of light is called the Tyndall effect For example, Tyndall effect can be observed when sunlight passes through the canopy of a dense forest. In the forest, mist contains tiny droplets of water, which act as particles of colloid dispersed in air.

3. The size of colloidal particles is smaller. They continue to move in a zig-zag pattern, avoiding the force of gravity and do not settle down. However, because the particles in suspension are larger, they settle down under gravity's influence.

4. Colloids: pond water, fog, paint True solutions: vinegar, glucose solution

5. It will be a mixture as it contains two different types of particles, i.e., of sugar and beetroot.

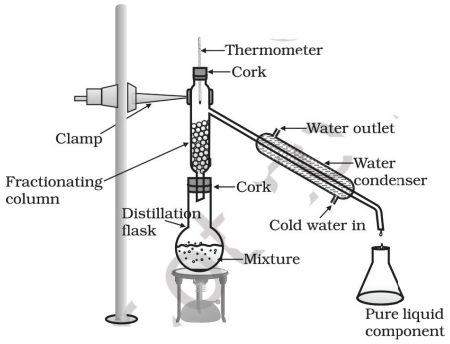
Q G. Short Answer Questions(Type II):

1. Distillation process involve the conversion of a liquid into vapour that is subsequently condensed back to liquid form. It is used to separate liquids from nonvolatile solids.

2. (a) Dispersed phase = liquid
Dispersing medium = gas
(b) Dispersed phase = liquid
Dispersing medium = solid
c) Dispersed phase = solid
Dispersing medium = solid

3. (a) C is true solution as the entire mixture passes through the filter paper.
(b) B is suspension as residue is left behind in the filter paper.
(c) A is colloid solution as a translucent filtrate is obtained.

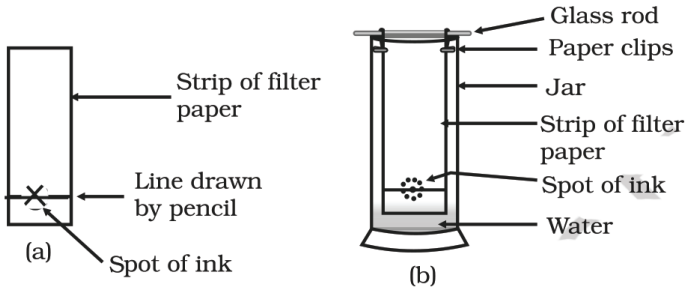
4. The principle of fractional distillation is that different liquids boil at different temperature. The miscible liquids boil at different temperature and evaporate at different temperature. When the mixture is heated, the liquid with lower boiling point boils and turns into vapours.



5. On adding more of substance X in the solution at that temperature, if it dissolves then the solution is unsaturated and if it does not dissolve then solution is saturated. When a saturated solution is cooled down, the solubility decreases and substance Separates from the solution in the form of crystals.

Q H. Long Answer Questions

1. The process of separation of components of a mixture is known as chromatography. It is the technique used for separation of those solutes that dissolve in the same solvent. Given diagram show the separation of dyes in black ink using chromatography.



2. **(a) Sugar:** For a solute to be soluble in a solvent, both the components should have similar kind of intermolecular attraction. The oxygen-hydrogen bonds in sugar are slightly polar in nature, and the polar water molecules attract these charged areas of sugar to dissolve it, forming a clear solution.

(b) Iodine: Since iodine is a non-polar molecule, it is not very easily dissolved in water. Alcohol is less polar so iodine is more soluble in it. Even chloroform is a non-polar solvent which dissolves iodine.

(c) Chalk: It is insoluble in all the three solvents because of very low solubility in these solvent.

Q I. Assertion-Reason Questions:

1. (a) 2. (c) 3. (b)

Q J. Case-based Questions:

1. (a) 2. (d) 3. (d) 4. (c) 5. (d)

Chapter

3 ATOMS AND MOLECULES

WORKSHEET-1

Laws of Chemical Combination

Q A. Multiple Choice Questions:

1. (a) 2. (c) 3. (d) 4. (c) 5. (b)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. masses 2. fixed 3. element 4. compounds 5. 14 : 3

Q C. Give reasons for the following:

1. The total mass of reactants is always equal to the total mass of product in a reaction because atoms are rearranged and not created or destroyed, the number of atoms of each different element must be the same on each side of the equation.
2. Water from all sources has hydrogen and oxygen in the ratio 1 : 8 by mass because of law of constant proportion.
3. Atoms of a given element are identical in mass because atoms of the same element consist of the same atomic number.
4. The number of electrons is equal to the number of protons, which makes atoms electrically neutral. The number of protons in an atom is the defining feature of an atom. This makes one element different from another.
5. Democritus named the smallest piece of matter atoms which means indivisible.

Q D. Match the following:

1. (d) 2. (e) 3. (b) 4. (c) 5. (a)

Q E. Very Short Answer Questions:

1. Law of Definite Proportion
2. The postulate of Dalton's atomic theory resulting from the law of conservation of mass is 'The relative number and kinds of atoms are constant in a given compound. Atoms cannot be created nor destroyed in a chemical reaction'.
3. Antoine Lavoisier and Joseph L. Proust
4. Democritus
5. Atoms

Q F. Short Answer Questions (Type I):

1. Law of conservation of mass states that mass can neither be created nor destroyed in a chemical reaction. It was proposed by Lavoisier.
2. Maharishi Kanad, postulated that if we go on dividing matter (padarth), we shall get smaller and smaller particles. Ultimately, a stage will come when we shall come across the smallest particles beyond which further division will not be possible. He named these particles 'Parmanu'.
3. Law of conservation of mass and law of constant proportions.

Q G. Short Answer Questions (Type II):

1. The postulates of Dalton's atomic theory may be stated as follows:
   (i) All matter is made of very tiny particles called atoms, which participate in chemical reactions.
   (ii) Atoms are indivisible particles, which cannot be created or destroyed in a chemical reaction.
   (iii) Atoms of a given element are identical in mass and chemical properties.
   (iv) Atoms of different elements have different masses and chemical properties.
   (v) Atoms combine in the ratio of small whole numbers to form compounds.
   (vi) The relative number and kinds of atoms are constant in a given compound.
2. Law of constant proportions: "In a chemical substance the elements are always present in definite proportions by mass". For example,
   (a) In a compound such as water, the ratio of the mass of hydrogen to the mass of oxygen is always 1:8, whatever the source of water. Thus, if 9 g of water is decomposed, 1 g of hydrogen and 8 g of oxygen are always obtained.
   (b) Similarly in ammonia, nitrogen and hydrogen are always present in the ratio 14:3 by mass, whatever the method or the source from which it is obtained.
3. The composition of CO_2 in both the cases would be same, i.e., the carbon and oxygen will combine in the same ratio 1:2. The law associated is law of constant proportion.

Q H. Long Answer Questions:

1. This activity shows the law of conservation of mass. Here, solutions of barium chloride and sodium sulphate were weighed separately before reaction. After mixing the solutions, the total weight of the mixture is found to be equal to that of the individual solutions before reaction.
2. Sample 1: Mass of chloride = mass of NaCl - Mass of Na = 14.75 - 5.80 = 8.95 g
   Sample II: Mass of Na = Mass of NaCl - Mass of Cl = 11.32 - 6.87 = 4.45
   Sample III: Mass of chloride = mass of NaCl - Mass of Na = 7.45 - 2.93 = 4.52 g
   Now, in sample I, ratio of Na:Cl is 5.80: 8.95 = 0.648
   In sample II, ratio of Na:Cl is 4.45: 6.87 = 0.648
   In sample III, ratio of Na:Cl is 2.93: 4.52 = 0.648
   Since the ratio of sodium and chloride ions in all samples is same, the law of constant proportions is verified.

WORKSHEET-2

Atoms, Molecules and Ions

Q A. Multiple Choice Questions:

1. (b) 2. (a) 3. (b) 4. (c) 5. (a)

Q B. Complete the following table:

Element	Symbol
Aluminium	Al
Copper	Cu
Nitrogen	N
Potassium	K
Iodine	I
Sliver	Ag

Calcium	Ca
Lead	Pb
Fluorine	F
Sodium	Na

Q C. State whether the following statements are true or false:

1. True 2. False 3. False 4. True 5. True

Q D. Give the chemical formula of a following compounds:

Compound	Chemical Formula
Aluminium sulphate	$Al_2(SO_4)_3$
Potassium nitrate	KNO_3
Calcium carbonate	$CaCO_3$
Aluminium oxide	Al_2O_3
Lead bromide	$PbBr_2$
Magnesium chloride	$MgCl_2$
Ferrous sulphate	$FeSO_4$
Cupric carbonate	$CuCO_3$
Ammonium hydroxide	NH_4OH
Calcium phosphate	$Ca_3(PO_4)_2$

Q E. Very Short Answer Questions:

1. The number of atoms constituting a molecule is known as its atomicity.
2. The chemical formula of a compound is a symbolic representation of its composition.
3. The atom which has excess or deficit of electrons is called an ion.
4. Clusters of atoms that act as an ion are called polyatomic ions.
5. O_3 (ozone)

Q F. Short Answer Questions (Type I):

1. A_3B_2
2. The atomic mass of an element is numerically equal to the mass of 1 mole of its atoms.

   1 mole of atoms = 6.022×10^{23} atoms.

   Now, 1 atom of element X has mass = 2.65×10^{-23}g.

   So, 6.022×10^{23} atoms of element X have mass = $2.65 \times 10^{-23} \times 6.022 \times 10^{23}$=16u. This is oxygen.
3. Sodium atom is defined as the smallest particle of an element which may or may not be capable of free existence. However, it is the smallest particle that takes part in a chemical reaction. Sodium ion carry positive charge after losing one electron from the outermost shell.

Q G. Short Answer Questions (Type II):

1. The rules to write a chemical formula are as follows:

   (a) the valencies or charges on the ion must balance.

(b) when a compound consists of a metal and a non-metal, the name or symbol of the metal is written first.

(c) in compounds formed with polyatomic ions, the number of ions present in the compound is indicated by enclosing the formula of ion in a bracket and writing the number of ions outside the bracket.

2. For magnesium chloride, we write the symbol of cation (Mg^{2+}) first followed by the symbol of anion (Cl^-). Then their charges are criss-crossed to get the formula. Formula of magnesium chloride is $MgCl_2$. Thus, in magnesium chloride, there are two chloride ions (Cl^-) for each magnesium ion (Mg^{2+}). The positive and negative charges must balance each other and the overall structure must be neutral.

3. (a) The relative atomic mass of the atom of an element is defined as the average mass of the atom, as compared to $1/12^{th}$ the mass of one carbon-12 atom.

(b) One atomic mass unit is a mass unit equal to exactly one-twelfth ($1/12^{th}$) the mass of one atom of carbon-12.

(c) (i) 12.011 u
(ii) 15.999 u

Q H. Long Answer Questions:

1. (a) $NaNO_3$
(b) $Al(OH)_3$
(c) $(NH_4)_2SO_4$
(d) Na_2S
(e) $MgCO_3$

2. An ion can be negatively or positively charged. A negatively charged ion is called an 'anion' and the positively charged ion, a 'cation'. Take, for example, sodium chloride (NaCl). Its constituent particles are positively charged sodium ions (Na^+) and negatively charged chloride ions (Cl^-).

WORKSHEET-3

Molecular Mass and Mole Concept

Q A. Multiple Choice Questions:

1. (b) 2. (d) 3. (a) 4. (d) 5. (b)

Q B. State whether the following statements are true or false:

1. True 2. True 3. False 4. True 5. False

Q C. Differentiate between the following:

1. Molecular mass	Formula unit mass
(a) Molecular mass is a term for average relative mass of a single molecule.	(a) Formula mass is a term used for the sum of the atomic mass of constituents atoms.
(b) Molecular mass is for Covalent compounds.	(b) Formula mass is for ionic compounds.

2. Molar mass	Molecular mass
(a) It refer to the mass of a mole of a substance.	(a) It refer to the mass of molecule
(b) It is measured in g / mol.	(b) It is measured in amu.
(c) Less accurate than Molecular mass.	(c) Accurate to use in higher calculations.
3. Mole	**Gram**
(a) A mole is a certain number of molecules, atoms, ions etc.	(a) Gram signifies mass.
(b) In this system, the mole has above $6.022X10^{23}$ baseless.	(b) It is measused in amu. (Atomic mass unit)

Q D. Fill in the blanks using the suitable words given in the brackets:

1. mole 2. molar 3. 44 gram 4. 6.022×10^{23} 5. 6.022×10^{23}

Q E. Very Short Answer Questions:

1. The mole is the amount of substance of a system that contains $6.02214076 \times 10^{23}$ specified elementary entities.
2. Atomic mass of oxygen = 16 gram

   Molar mass of oxygen = (16×2)gram =32 gram

   Mass of 1 mole of any molecule is equal to its molar mass. Thus, mass of 1 mole of oxygen is 32 gram.
3. Avogadro's constant multiplied by the number of moles of the atom equals the number of atoms in the element.
4. Given mass = 0.5 g

   Atomic mass = 23 u

   Now, atomic mass is numerically equal to molar mass but there is a difference of unit.

   So, Molar Mass = 23 g

   Number of Moles = Given Mass / Molar Mass = 0.5 / 23

   = 0.0217 moles
5. H_2S molecule has 1 sulphur and 2 hydrogen atoms. So, a total of 3 atoms.

Q F. Short Answer Questions (Type I):

1. Molecular mass of $CaCO_3$ (40+12+3x16 = 100)

   100g of $CaCO_3$ has molecules = 6.022×10^{23}

   50g of $CaCO_3$ have molecule = $\frac{6.022 \times 10^{23} \times 50}{100}$ = 3.011×10^{23} molecules

2. (a) Atomic mass of nitrogen = 14 u

Mass of 1 mole of nitrogen = 14x1 = 14 g

(b) Atomic mass of aluminium = 27 u

Mass of 4 moles of aluminium =27x4 = 108 g

3. $M(OH)_2$, M_3N_2

Q G. Short Answer Questions (Type II):

1. (a) 32 g of O_2 =1 mole

12 g of O_2 = 1/32 x 12 = 0.37 moles

(b) 18 g of water = 1 mole

20 g of water = 1/18 x 20 = 1.1 moles

(c) 44 g of CO_2 = 1 mole

22 g of CO_2 = 1/44 x 22 = 0.5 moles

2. (a) Glucose = $C_6H_{12}O_6$ = 6×12+12×1+6×16 = 72+12+96 = 180 g

(b) Sulphuric acid = H_2SO_4 = 2×1+32+4×16 = 98 g

(c) Hydrochloric acid = HCl = 1+ 35.3 = 36.3g

3. The mass percent of an element = (Atomic mass of element/Molecular mass of compound)X100

Atomic mass of sodium and chlorine = 23 + 35.5 = 58.5

Now to calculate mass percent of sodium, (23/58.5)X100=39.32%

Now to calculate mass percent of chlorine, (35.5/58.5)X100=60.62%

Q H. Long Answer Questions:

1. (a) Moles = $\frac{\text{Mass}}{\text{Atomic mass}}$

Number of atoms = Moles × Avogadro's number = $\frac{0.08}{1} \times 6.022\times10^{23} = 0.48\times10^{23}$ atoms

(b) Number of atoms = Moles × Avogadro's number = $\frac{0.8}{56} \times 6.022\times10^{23} = 0.086\times10^{23}$ atoms

(c) Number of atoms = Moles × Avogadro's number = $\frac{0.008}{32} \times 6.022\times10^{23} = 0.0015\times10^{23}$ atoms

(d) Number of atoms = Moles × Avogadro's number = $0.5 \times 6.022\times10^{23} = 3.011\times10^{23}$ atoms

(e) Number of atoms = Moles × Avogadro's number = $2/23 \times 6.022\times10^{23} = 0.523\times10^{23}$ atoms

2. (a) Molar mass Al_2O_3 = (2X27 +3X16) =102 g / Mol

Moles of Al_2O_3 = 0.056 / 102 = 0.000549

Moles of Al^{3+} = 0.000549 x 2 = 0.00110

Number of Al^{3+} ions = 0.00110 x 6.02 x10^{23} = 6.6 x 10^{20}

(b) 1 mole of calcium chloride=111 g

Therefore 222 g of $CaCl_2$ is equivalent to 2 moles of $CaCl_2$. Since 1 formula unit $CaCl_2$ gives 3 ions,therefore,1 mole of $CaCl_2$ gives 3 moles of ions.

2 moles of $CaCl_2$ would give 3x2=6 moles of ions.

Number of ions=Number of moles of ions X Avogadro number

=6x6.022x10^{23}

=36.132x10^{23}

=3.6132x10^{24} ions

WORKSHEET-4

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (a) 2. (a) 3. (c) 4. (c) 5. (a)
6. (d) 7. (a)

Q B. Complete the following table:

Compound	Chemical Formula	Combining Elements	Ratio by mass
Water	H_2O	H:O	1:8
Calcium oxide	CaO	Ca:O	5:2
Carbon dioxide	CO_2	C:O	3:8
Magnesium sulphate	$MgSO_4$	Mg: S: O	0.2: 0.26: 0.53
Ammonia	NH_3	N:H	14:3
Sodium chloride	NaCl	Na:Cl	23: 35.5

Q C. Give one word for the following:

1. Polyatomic ions 2. Simple ions 3. Atomicity
4. Ionic compounds 5. Mole

Q D. Complete the following table:

Name of ion	Symbol
Ammonium	NH_4^+
Sulphide	S^{2-}
Cupric	Cu^{2+}
Carbonate	CO_3^{2-}
Sulfite	SO_3^{2-}
Magnesium	Mg^{2+}
Nitride	N^{3-}
Sulfate	SO_4^{2-}
Phosphate	PO_4^{3-}
Ferrous	Fe^{2+}
Hydroxide	OH^-

Q E. Very Short Answer Questions:

1. X_2O_3
2. H_2O, HCl
3. Mole = Mass/Atomic Mass

   Mass = mole x atomic mass = 0.2×16 = 3.2 g
4. Ammonium ion or NH_4^+
5. $Al_2(SO_4)_3$
6. On heating the compounds, sugar will turn brownish while salt will remain white. Also, the solution of salt in water conducts electricity while that of sugar does not.
7. 23 u. It is sodium.

Q F. Short Answer Questions (Type I):

1. Number of moles of ammonia $= \frac{3}{17}$

   $=0.1764$mol

   Molecular mass SO_3=1x32u+3x16u

   = 80u

   1 mole of SO_3 weights 80g

   0.1764 moles Weigh = 80x0.1764

   = 14.11g

   Thus, 14.11g sulphur trioxide contains the same number of molecules in 3g of ammonia.
2. Molar mass of H_2O (2 + 16) = 18g

   $$\text{Molecules in } H_2O = \frac{\text{Mass of } H_2O \times \text{Avogadro's number}}{\text{Molecular mass}}$$

   $$= \frac{0.9 \times 6.022 \times 10^{23}}{18} = 0.3 \times 10^{23}$$

3. (a) Anion – CH_3COO^- and Cation – Na^+

   (b) Anion – Cl^- and Cation – Na^+

   (c) No Ions

   (d) Anion – NO_3^- and Cation – NH_4^+
4. (a) Rahul

   (b) Both containers have equal number of atoms.
5. Molar mass of Methane = 16g

   Carbon = 75% of 16 = 12g

   Hydrogen = 25% of 16 = 4g

   12 g of carbon contains 1 carbon atom and 4g of Hydrogen contains 4 hydrogen atoms.

   ∵ Simplest formula of methane is CH_4.

Q G. Short Answer Questions (Type II):

1. Mass percentage of carbon = $\frac{\text{Mass of Carbon x 100}}{\text{Total mass of } CO_2} = \frac{12 \times 100}{44} = 27.27\%$

   Mass percentage of oxygen = $\frac{\text{Mass of Oxygen X 100}}{\text{Total mass of } CO_2} = \frac{16 \times 2 \times 100}{44} = 72.72\%$

2. Number of moles of water molecules=0.5 mol
   Number of moles of hydrogen atoms= 0.5×2=1
   Number of hydrogen molecules=6.022×10^{23} atoms.
   Number of moles of oxygen atom =0.5×1=0.5
   Number of molecules of oxygen atom= 3.011×10^{23} atoms.
3. 1mol water contain 6.023×10^{23} molecules of water.
   (a) 0.5 mol water contain $0.5 \times 6.023 \times 10^{23}$ molecules of water
   $= 3.011 \times 10^{23}$ molecules of water
   1 molecule of water contain 2 atoms of hydrogen and 1 atom of oxygen
   (b) Number of hydrogen atom= $2 \times 3.011 \times 10^{23} = 6.023 \times 10^{23}$
   (c) Number of oxygen atom=3.011×10^{23}
4. (a) Number of moles=46/23=2
   Number of particles= Number of moles of particles × Avogadro number
   $=2 \times 6.02 \times 10^{23}$
   $=12.04 \times 10^{23}$
   (b) Number of moles= 8/32=1/4
   number of particles=$1/4 \times 6.02 \times 10^{23}$
   $= 1.505 \times 10^{23}$
   (c) Number of moles= 0.1 (given)
   number of particles= $0.1 \times 6.02 \times 10^{23}$
   $= 0.602 \times 10^{23}$
5. The law which governs this is the Law of definite proportion which states that a chemical compound always contains exactly the same proportion of elements by mass.

Q H. Long Answer Questions:

1. (a) A sodium atom and ion, differ by one electron. For 100 moles each of sodium atoms and ions there would be a difference of 100 moles of electrons.
   Mass of 100 moles of electrons= 5.48002 g
   Mass of 1 mole of electron = 5.48002 /100 g
   Mass of one electron = $\frac{5.48002}{100 \text{ X } 6.022 \text{ X } 10^{23}} = 9.1 \times 10^{-28}\text{ g} = 9.1 \times 10^{-31}$ kg

   (b) Mass of silver = m gram
   Mass of gold = m/100 gram
   Number of atoms of Ag = m/ (108 x N_A)
   (Atomic Weight of Ag =108)

Number of atoms of Au = m/ (100x 197 x N_A)

Required ratio = m/ (100x 197 x N_A) : m/ (108 x N_A)

= 108 : 100×197

= 108 : 19700

2. Molar mass of glucose = 180 g

Hence, 180 g of glucose requires 108 g of water.

18 of glucose requires = 108/180 x 18 = 10.8 g water.

Also, density = mass/volume

Volume of water = 10.8/1 = 10.8 cm^3

Q I. Assertion-Reason Questions:

1. (d) 2. (c) 3. (c)

Q J. Case-based Question:

1. (d) 2. (c) 3. (b) 4. (c) 5. (a)

Chapter

4 STRUCTURE OF THE ATOM

WORKSHEET-1

Atomic Models and Sub-atomic Particles

Q A. Multiple Choice Questions:

1. (b) 2. (b) 3. (a) 4. (a) 5. (b)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. Helium 2. Energy 3. Nucleons 4. Helium 5. Without

Q C. Give one word for the following:

1. Electron 2. Canal Rays 3. Rutherford 4. Nucleus 5. Neutron

Q D. Match the following:

1. (d) 2. (e) 3. (b) 4. (a) 5. (c)

Q E. Very Short Answer Questions:

1. Proton
2. -1.6×10^{-19} C
3. Chadwick
4. A proton has about 1836 times the mass of an electron.
5. Neutrons and protons

Q F. Short Answer Questions (Type I):

1. (i) Rutherford"s model cannot explain the stability of an atom.

(ii) It cannot explain the distribution of electrons around the nucleus or their energies.

2. The main difference between Thomson and Rutherford model of atom is that Thomson model does not give details about the atomic nucleus whereas Rutherford model explains about the nucleus.

3. A neutron is a subatomic particle found in the nucleus of every atom except that of simple hydrogen. The particle derives its name from the fact that it has no electrical charge; it is neutral. Neutrons are extremely dense.

Q G. Short Answer Questions (Type II):

1. The salient features of Rutherford's gold foil experiment are

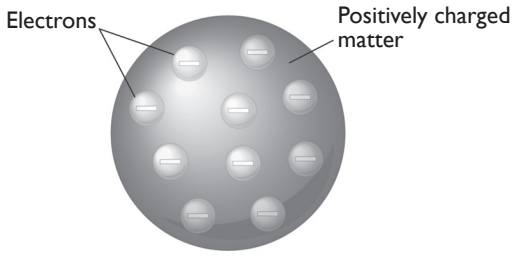
(i) The atom contains a central part called nucleus which is surrounded by electrons.

(ii) The nucleus of an atom is positively charged.

2.

Electrons	Protons	Neutrons
Negatively charged	Positively charged	No charge
Present outside the nucleus	Present inside the nucleus	Present inside the nucleus of an atom
Negligible mass	1 a.m.u	1 a.m.u
Get attracted towards positive charge	Get attracted towards negative charge	Do not get attracted to any charged particle

3. According to J.J Thomson, an atom is a sphere of positive charge in which the negative charges are embedded just like the seeds are embedded in a watermelon. The negative and positive charges are equal and hence the atom is electrically neutral.



Q H. Long Answer Questions:

1. (a) Rutherford's model

Characteristic features:

(i) There is a positively charged centre in an atom called the nucleus. Nearly all the mass of an atom resides in the nucleus.

(ii) The electrons revolve around the nucleus in circular paths.

(b) Neils Bohr's model

Characteristic features:

(i) Only certain special orbits known as discrete orbits of electrons, are allowed inside the atom.

(ii) While revolving in discrete orbits the electrons do not radiate energy.

(c) J.J. Thomson's model

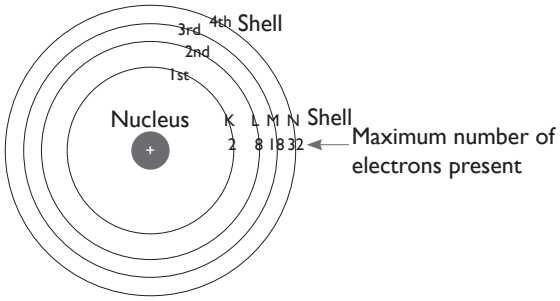
Characteristic features:

(i) An atom consists of a positively charged sphere and the electrons are embedded in it.

(ii) The negative and positive charges are equal in magnitude. So, the atom as a whole is electrically neutral.

2. (i) The maximum number of electrons that can be present in the n^{th} shell is equal to $2n^2$. Thus, we have

Shell	Maximum number of electrons present
1st shell or K-shell (n=1)	$2x1^2 = 2$
2nd shell or L-shell (n=2)	$2x2^2 = 8$



Maximum number of electrons present in different shells

3rd shell or M-shell (n=3)	$2x3^2 = 18$
4th shell or N-shell (n=4)	$2x4^2 = 32$

(ii) The outermost shell cannot have more than 8 electrons even if the first rule is violated. For example 3rd shell (M-shell) can accommodate up to 18 electrons but as soon as it has acquired 8 electrons, the filler of the 4th shell (N-shell) starts. Thus, for the first 18 elements, rule(iii), as given below, can be applied.

(iii) Electrons can not enter into a new shell unless the inner shells are completely filled. In other words, the shells are filled in a step-wise manner.

WORKSHEET-2

Electron Distribution in Atoms and Valency

Q A. Multiple Choice Questions:

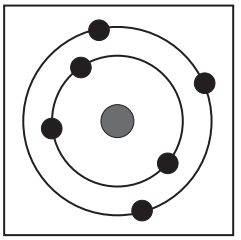
1. (c) 2. (a) 3. (d) 4. (b) 5. (a)

Q B. Define the following terms:

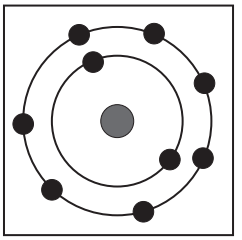
1. Valency is the combining capacity of an atom.
2. The electrons present in the outermost shell of an atom are known as the valence electrons.
3. The outermost orbital shell of an atom is called its valence shell.
4. A positively charged ion is called cation.
5. A negatively charged ion is called anion.

Q C. From the given electronic configurations, identify and name the respective elements.

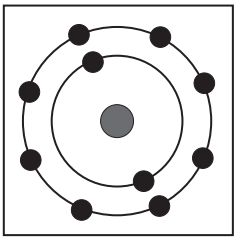
Carbon	Fluorine
Neon	Oxygen
Magnesium	Chlorine
Sodium	Argon
Aluminium	Phosphorus



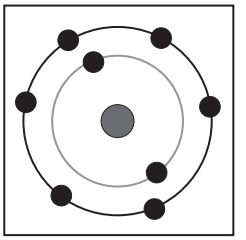
Carbon



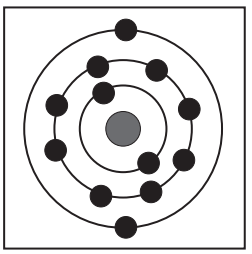
Fluorine



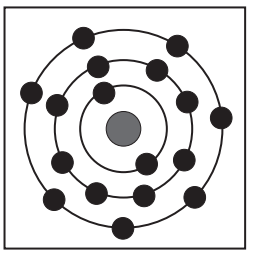
Neon



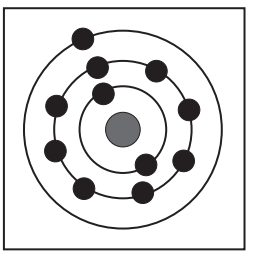
Oxygen



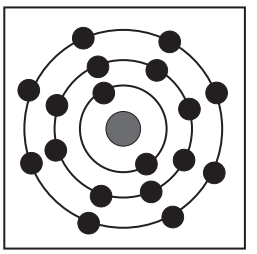
Magnesium



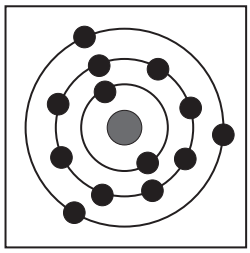
Chlorine



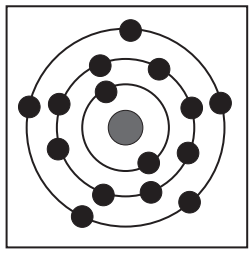
Sodium



Argon



Aluminium



Phosphorus

Q D. Complete the following table:

S. No.	Ion	Electronic Configuration
1.	N^{3-}	2, 8
2.	S^{2-}	2,8, 8
3.	Mg^{2+}	2, 8
4.	Al^{3+}	2, 8
5.	O^{2-}	2, 8

Q E. Very Short Answer Questions:

1. For S^{2-} atomic configuration K= 2 L= 8 M= 8 since it has two extra electrons, the actual atomic number is 18 -2 = 16.
2. The electronic configuration of potassium is 2,8,8,1.
3. (a) 2 (b) 1
4. 2+8 = 10
5. -1

Q F. Short Answer Questions (Type I):

1. 10 and 18
2. (a) 3 (b) 2 (c) 4 (d) 1
3. Helium has 2 electrons in its outermost shell thereby completing duplet configuration, as a result, valency is zero.

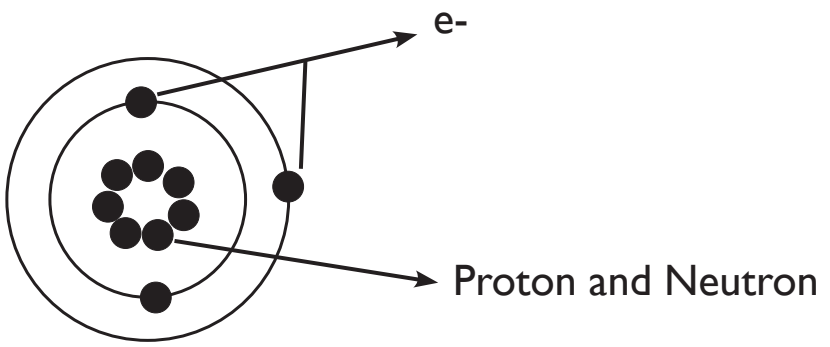
Q G. Short Answer Questions (Type II):

1. Electronic configuration of element having atomic number 16 is 2, 8, 6 So, electron distribution in K, L, M are 2, 8, 6 respectively. Electro valency of atomic number of 16 will be 2.
2. (a) Since the atomic number (Z) of chlorine is 17, the electronic configuration of chlorine will be 2, 8, 7. There are eight electrons in the L shell (second shell).

   (b) Electrons in the outermost shell of the atom are responsible for bond formation
3. Helium (He), neon (Ne) and argon (Ar) have completely filled outermost shell. They have stable electronic configuration. They neither lose electrons nor gain electrons. Hence, their valency is zero.

Q H. Long Answer Questions:

1. (a) These compounds are formed when the element Z reacts together with non metals. In this form, it will have an oxidation number of 3. The metal Z is an electropositive metal that reacts with the non-metals. So, valency of element Z found in the given compounds is 3.
   (b) Z is a metal because it is electropositive and reacting with non-metals.
   (c) The charge on the ion so formed will be 3.
   Formula of compound formed is Na_3Z.
2. (a) Atomic number =16 X is non-metal.
   (b) Mass Number = no. of protons + no. of neutrons
   Atomic no. = no. of protons
   3 = 3
   So no. of proton = 3
   Neutron = mass no. – no. of protons
   = 7-3 = 4.



WORKSHEET-3

Atomic Number, Mass Number, Isotopes and Isobars

Q A. Multiple Choice Questions:

1. (a) 2. (b) 3. (a) 4. (b) 5. (c)

Q B. Give reasons for the following:

1. Protons and neutrons are present in the nucleus of an atom. Hence, they are also called nucleons.
2. Isotopes have similar chemical properties they have the same number of electrons as an atom of that element. Chemical properties based on number of electrons and not neutrons.
3. Mass number determines the physical properties. Isotopes have different number of neutrons which affects the mass number. Hence, they have different physical properties.
4. Chlorine always exists as two isotopes .These are Cl-35 and Cl-37 isotopes and are present in the ratio of 3:1. The atomic mass of the element is considered in fractional form as 35.5 and is regarded as the relative atomic mass.
5. Argon and calcium are isobar because both the elements have same atomic mass equal to 40 but different atomic numbers, i.e. argon has atomic number equal to 18 and calcium has atomic number equal to 20.

Q C. State whether the following statements are true or false:

1. False 2. True 3. True 4. False 5. False

Q D. Differentiate between the following:

1.

Atomic number	Mass number
Atomic number is usually the number of protons present in an element's nucleus.	Mass number is associated with the number of neutrons and protons that are present in a particular nucleus of an element.
It is the total number of protons in the atom's nucleus.	It is the average weight of an element.
The letter Z is used to represent an atomic number.	Mass number is denoted by A.

2.

Isotopes	Isobars
Isotopes are atoms of the same element.	Isobars are atoms of different elements.
They have the same atomic number but different mass number.	They have different atomic numbers but same mass numbers.
Number of protons and electrons in isotopes are the same	Number of protons and electrons in isobars is different.

3.

Protium	Deuterium
Protium is an isotope of hydrogen which contains one proton and one electron.	Deuterium is an isotope of hydrogen having a proton. a neutron and an electron.
Its atomic mass is 1.	Its atomic mass is 2.
It is used as a component in common compounds such as water, hydrocarbon, etc.	It is used as a component in heavy water, as a component in solvents used for NMR spectroscopy, etc.

Q E. Very Short Answer Questions:

1. Atomic number = 8, Mass number =16, Element = Oxygen
2. $^{31}X_{15}$
3. Hydrogen, Deuterium

4. The mass number is defined as the sum of the total number of protons and neutrons present in the nucleus of an atom.
5. Both oxygen atoms have different number of neutrons so the atomic mass of both are different. This also shows that they are isotopes of each other.

Q F. Short Answer Questions (Type I):

1. Isotopes of an element differ in the number of neutrons in the nuclei so they have a different mass number as the mass number is the sum of a number of protons and neutrons in the nucleus.
2. If Z = 3, i.e., atomic number is 3. Its electronic configuration is 2, 1. Hence, the valency of the element is 1 since the outermost shell has only one electron.
3. Helium atom has two neutrons. The mass of an atom is the sum of the masses of protons and neutrons present in its nucleus. Since helium atom has two protons, mass contributed by the two protons is (2×1)u=2u. Then, the remaining mass (4 - 2) u = 2 u is contributed by 2 neutrons.

Q G. Short Answer Questions (Type II):

1. Atomic mass number = 23

   Number of neutron = 12

   So, number of electrons = Atomic number =23 - 12 = 11

   Symbol of the element = $_{11}Na^{23}$
2. The atomic mass of two isotopic atoms are 35(75%) and 37(25%).

   Thus, average mass = $\frac{35 \times 75}{100} + \frac{37 \times 25}{100}$ = 26.25 + 9.25 = 35.5 u
3. Number of protons = 5

   Number of neutrons = 6

   So, atomic mass number = Number of protons + Number of neutrons

   = 5 + 6 = 11

   Atomic number will be = 5

   So, number of electrons = 5

   Electronic configuration = 2, 3

   So, valence electron is 3.

Q H. Long Answer Questions:

1. The hydrogen element has three isotopes: hydrogen, deuterium, and tritium. We each have a single proton (Z = 1), but the number of their neutrons is different. There is no neutron in hydrogen, one in deuterium, and two neutrons in tritium.
2. (a) Properties of isotopes:
   (i) Each isotope of an element is a pure substance.
   (ii) The chemical properties of isotopes are similar.
   (iii) Their physical properties such as mass, melting or boiling point, density, and freezing point are different.

   (b) Three applications of isotopes
   (i) An isotope of uranium is used as a fuel in nuclear reactors.
   (ii) An isotope of cobalt is used in the treatment of cancer.
   (iii) An isotope of iodine is used in the treatment of goitre.

WORKSHEET-4

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (b) 2. (a) 3. (c) 4. (d) 5. (c)
6. (c) 7. (c)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. Hydrogen 2. 2 3. same 4. nucleus 5. neutron

Q C. State whether the following statements are true or false:

1. False 2. False 3. True 4. True 5. False

Q D. Complete the following table:

Element	Atomic number	Number of electrons	Number of neutrons	Number of protons	Valency
Carbon	6	6	6	6	4
Oxygen	8	8	8	8	2
Fluorine	9	9	10	9	1
Sodium	11	11	12	11	1
Silicon	14	14	14	14	4
Phosphorus	15	15	16	15	3
Chlorine	17	17	18	17	1

Q E. Very Short Answer Questions:

1. Iso- electronic species are elements or ions that have the equal number of electrons. Example: O^{2-},F^{-},Mg^{2+} have 10 electrons.
2. An electron is a negatively charged particle, whereas a proton is a positively charged particle. The magnitude of their charges is equal. Therefore, an atom containing one electron and one proton will not carry any charge. Thus, it will be a neutral atom.
3. If the electron move from K to L shell of an element, energy will be absorbed.
4. 18
5. Protons are collectively present in the nucleus at the centre while electrons revolve rapidly round the nucleus in fixed circular orbits called energy levels.
6. The statement is incorrect as the number of protons is never greater than the number of neutrons. Number of neutrons can be equal to or greater than the number of protons because mass number is equal to double the atomic number or greater than double the atomic number.
7. Electrical discharge in gases

Q F. Short Answer Questions(Type I):

1. Electronic configuration of element having atomic number 12 is 2, 8,2.
2. (a) $CuBr_2$ (b) $Al(NO_3)_3$ (c) $Ca_3(PO_4)_2$ (d) Fe_2S_3
3. (a) MgS (b) $Cu(OH)_2$
4. (a) The valency is calculated by finding the number of electrons required to get an octet in its valence shell.

(b) (i) Chlorine has a valency of (18 –17=) 1.

(ii) The valency of sulphur is (18 –16 =) 2.

5. % of α -particles deflected more than 50° = 1% of α -particles.

   % of α -particles deflected less than 50° =100α1=99%

   Number of α -particles bombarded =1 mole =6.022×10^{23} particles

   Number of particles that deflected at an angle less than 50°

   = 99/100 × 6.022×10^{23}

   = 596.178 × 10^{23}

Q G. Short Answer Questions (Type II):

1. (a) Electrons

   (b) Total number of electron in NO_3- ion = 7+3 x 8+1 = 7+24+1 = 32

2. Isotopes are atoms of the same element that differ only inMake Q G. (1.) of WS -4 the number of neutrons in the nucleus. Since chemical properties are determined by the atom's electronic configuration and that relates to number of protons, not neutrons, the chemical properties are the same.

3. (a) Number of electrons in Rn= 86

   Number of protons in Rn=86

   Number of neutrons in Rn= 222 - 86 = 136

   (b) He, Ne and Ar are noble gas atoms, i.e., they have complete valence shell due to which they show zero valency.

4. The number of neutrons in an element M has atomic mass 24 and atomic number 12 is 24-12=12. The electron distribution in K, L and M shells is 2, 8, 2 respectively.

5. Let the percentage of $\frac{16}{8}X$ be A%. Then the percentage of $\frac{18}{8}X$ be (100 – A)%

   $\therefore\ 16\times\frac{A}{100}+18\times\frac{100-A}{100}=16.2$

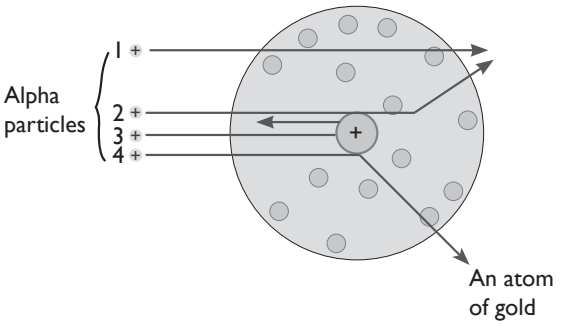
   $\Rightarrow 1800-2A=1620$

   $\Rightarrow A=90$

   So the answer is 90% $\frac{16}{8}X$ and $\frac{18}{8}X$.

Q H. Long Answer Questions:

1. Ernest Rutherford discovered the nucleus within an atom in his alpha-ray scattering experiment. The arrangement of the alpha-particle scattering experiment is as follows:



Rutherford produced a narrow beam of particles from a radioactive source (e.g., radium or polonium), which was allowed to strike an extremely thin gold foil. Rutherford proposed that if the spherical model proposed earlier which made for a uniform distribution of positive and negative particles was correct then the alpha particle striking the gold atoms would be uniformly deflected. However, the observations were:

(a) Most of the alpha particles passed straight through the gold foil without suffering any deflection from their original path

(b) A few of them were deflected through small angles, while a very few deflected to a large extent.

(c) A very small percentage (1 in 100000) was deflected through 180°(turned back)

Conclusions

(a) The atom of an element consists of a small positively charged nucleus which is situated at the centre of the atom and which carries almost the entire mass of the atom.

(b) The electrons are distributed in the empty space of the atom and are revolving around the nucleus at high speed.

(c) The number of electrons in an orbit is equal to the number of positive charges (protons) in the nucleus. Hence, the atom is electrically neutral.

(d) The volume of the nucleus is negligibly small as compared to the volume of the atom.

(e) Most of the space in the atom is empty.

(f) The arrangement of electrons in an atom is just like a solar system.

Drawbacks of Rutherford's model of an atom:

The orbital revolution of the electron is not expected to be stable. Any particle in a circular orbit would undergo acceleration and the charged particles would radiate energy. Thus, the revolving electron would lose energy and finally fall into the nucleus. If this were so, atom should be highly unstable and hence, matter would not exist in the form that we know.

2. (a) Cathode rays.

(b) Cathode rays carry negative charge, are made up of material particle sand travel in starlight line.

Q I. Assertion-Reason Questions:

1. (b) 2. (d) 3. (d)

Q J. Case-based Question:

1. (c) 2. (a) 3. (a) 4. (c) 5. (c)

Chapter 5 THE FUNDAMENTAL UNIT OF LIFE

WORKSHEET-1

Structural Organisation of Living Organisms

Q A. Multiple Choice Questions:

1. (b) 2. (b) 3. (c) 4. (c) 5. (c)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. Cell theory 2. Cork 3. Cells 4. Amoeba 5. Multicellular

Q C. Give one word for the following:

1. Multicellular organism 2. Protoplasm 3. Egg cell 4. Cell 5. Nerve cell

Q D. Define the following terms:

1. The smallest unit that can live on its own and that makes up all living organisms and the tissues of the body is called cell.
2. An organism made up of only one cell is called unicellular.
3. An organism made up of many cells is called multicellular.
4. Cork is a substance which comes from the bark of a tree.
5. A microscope is an instrument that makes an enlarged image of a small object, thus revealing details too small to be seen by the unaided eye.

Q E. Very Short Answer Questions:

1. Cells were first discovered by Robert Hooke in 1665.
2. Cell is a Latin word for 'a little room'.
3. Paramoecium and bacteria
4. Plants, animals
5. Schleiden and Schwann

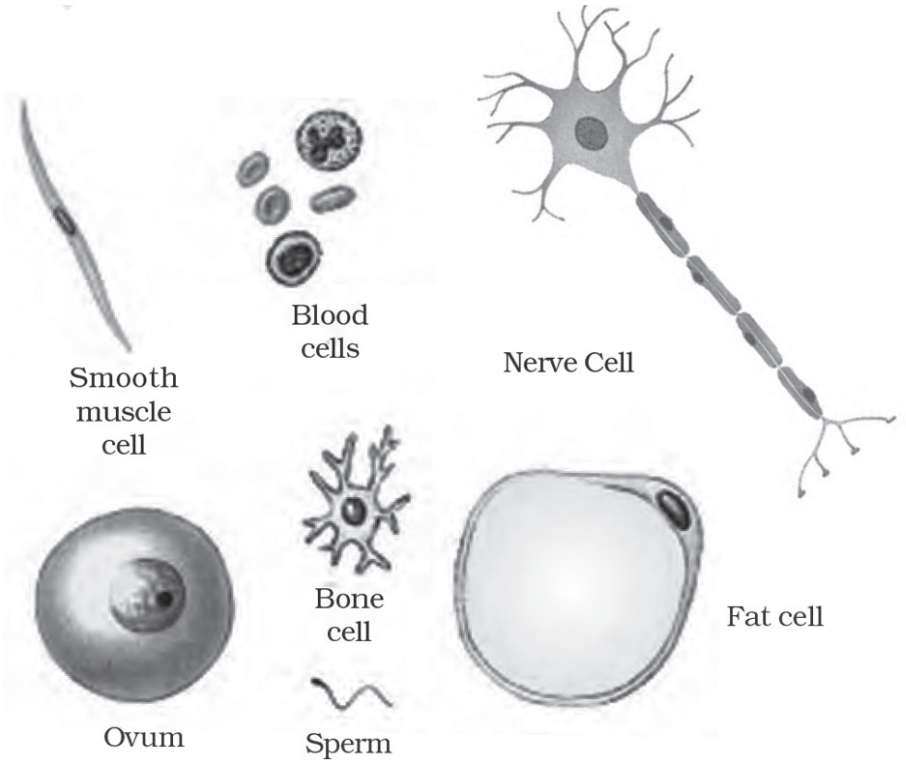
Q F. Short Answer Questions (Type I):

1. Through the process of endocytosis, an amoeba obtains its food. As its cell membrane is flexible enough, food particles are engulfed forming a food vacuole girdling it which is assisted by the pseudopodia.
2. Virchow suggested that all cells arise from pre-existing cells.
3. Cells are called building blocks of life because they are basic structural and functional units of our life. In the different levels of organization in an organism, the cell acts as the basic unit. This means cells form the tissues, organs and organ systems in the different organisms.

Q G. Short Answer Questions (Type II):

1. Robert Hooke observed a piece of cork. He noticed that the cork was made of small structures that reminded him of individual rooms. He called these "rooms" cells. Because the cork Hooke was observing was dead, the cells he observed were also non functioning.

2.



3. Postulates of Cell theory are:-
   (i) All living organisms are made up of cells. Hence cells are structural and functional units of living organisms.
   (ii) All cells are similar in their structure and function but they are not identical.
   (iii) New cells are formed through division in the pre-existing cells.

Q H. Long Answer Questions:

1. Division of labour means that different parts perform different functions. For example; a multi-cellular organism like the human, body has a heart to pump blood, a stomach to digest food and so on. Similarly, division of labour is also seen within a single cell. In fact, each cell has got certain specific components within it known as cell organelles. Each kind of cell organelle performs a special function, such as making new material in the cell, clearing up the waste material from the cell and so on.
2. The shape and size of a cell is indeed related to its function. For example, the nerve cells are elongated in shape and are thin and dainty. This helps in transmitting the signals easily. Furthermore, the dendrites at the ends help transmit the messages to more than one other nerve cell so the message can reach either the brain or the spinal cord faster. The thin shape also helps keep the message on a straight path and keeps the message from getting confused or mixed up with other messages being transmitted so as to insure the direct and immediate receiving of all the messages. We can also take the exampla of a simple animal cell. An animal cell does not have a cell wall. This

makes it easy for it to move around the body. The red blood cells are also good examples of such a cell. It is round in shape so that it holds larger amounts of haemoglobin (which contains oxygen) for transportation all around the body.

WORKSHEET-2

Structural Organization of a Cell

Q A. Multiple Choice Questions:

1. (a) 2. (d) 3. (b) 4. (d) 5. (d)

Q B. Match the following:

Column A	Column B
1. Chromosome	(a) Nucleus
2. Cell wall	(d) Plants
3. Cell membrane	(e) Selectively permeable
4. Eukaryotic	(c) Nucleolus
5. Prokaryotic	(b) DNA

Q C. Fill in the blanks using the suitable words given in the brackets:

1. high, low 2. organelles 3. cells 4. microscopes 5. single

Q D. Differentiate between the following:

1. Nucleus and nucleolus

Nucleus	Nucleolus
a. Controls the structure and working of cells	a. It synthesises informal nutrients
b. Covered by a two membrane envelope	b. Does not have a covering membrane

2. Cell membrane and nuclear membrane

Cell membrane	Nuclear membrane
a. It encloses the cytoplasm.	a. It encloses the nucleus.
b. It is a lipid bilayer.	b. It is a double lipid bilayer.

3. Exosmosis and Endosmosis

Exosmosis	Endosmosis
a. It occurs when cell is placed in hypotonic solution.	a. It occurs when cell is placed in hypertonic solution.
b. Concentration of water is high inside the cell.	b. Concentration of water is high outside the cell.

Q E. Very Short Answer Questions:

1. Cell wall
2. Nucleus
3. Cellulose fibers
4. They will shrink due to osmosis.
5. Genes

Q F. Short Answer Questions (Type I):

1. Animal cells do not have cell walls, because cell walls make cells rigid, reduce the flexibility of cells, and that would affect animals from moving. Cell walls reduce the locomotive ability of organisms.
2. Prokaryotic cell. Evidence supports the idea that eukaryotic cells are actually the descendents of separate prokaryotic cells that joined together to form a symbiotic union.
3. Plasma membrane is the outermost covering of the cell that separates the contents of the cell from its external environment. It is also called cell membrane.

Functions of plasma membrane

(i) It protects cell from its surrounding.

(ii) They help in regulate the movement of substance in and out of the cell.

(iii) They also covered in places with cholesterol molecules and proteins.

Q G. Short Answer Questions (Type II):

1. Chromatin is entangled mass of thread- like structure. Chromatin material gets organised into chromosome. The chromosome contains DNA and protein. Two arms of chromosome are called chromatids. Thus, chromosome is made of chromatid and chromatid is made of chromatin.
2. Plasma membrane is called selectively permeable membrane because it allows only certain/ selective materials to enter and exit the cell layer. Molecules like oxygen and water move in and out of cell by the process of diffusion and osmosis respectively.
3. (a) The cell will shrink as the water inside the cell will move out from higher potential to lower potential.
   (b) The cell will swell up as the water from surrounding medium will move inside the cell from higher potential to lower potential.
   (c) The cell shall remain as it is without any net movement of water.

Q H. Long Answer Questions:

1. (a) The cell wall is a protective layer around the plant cell. It mostly consists of cellulose, which provides rigidity and strength to the plant cell, helping it to stand upright.
   (b) The cell walls of plant cells help maintain turgor pressure, which is the pressure pressing the cell wall. The cell wall efficiently holds water so that the cell does not burst.
   (c) Plant cell
   (d) If animal cell is provided with cell wall, the animal would become stiff and rigid and would not able to do all the necessary things it needs to do like to survive, run, eat, etc.
2. (a) The cell will shrink due to exosmosis.
   (b) Cell membrane, because it allows movement of only those substances that are required by the cell to maintain its vitality.
   (c) Exosmosis occured here. The water surrounding the cell has lowr water concentration that inside the cell. Hence, water from the cell moves out from the cell and the cell shrinks.

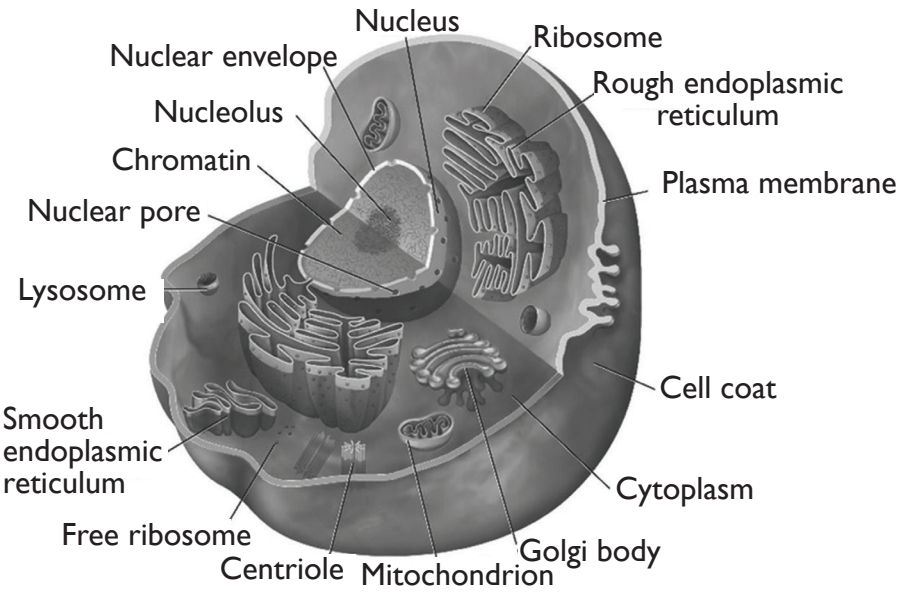
WORKSHEET-3

Cell Organelles and Cell Division

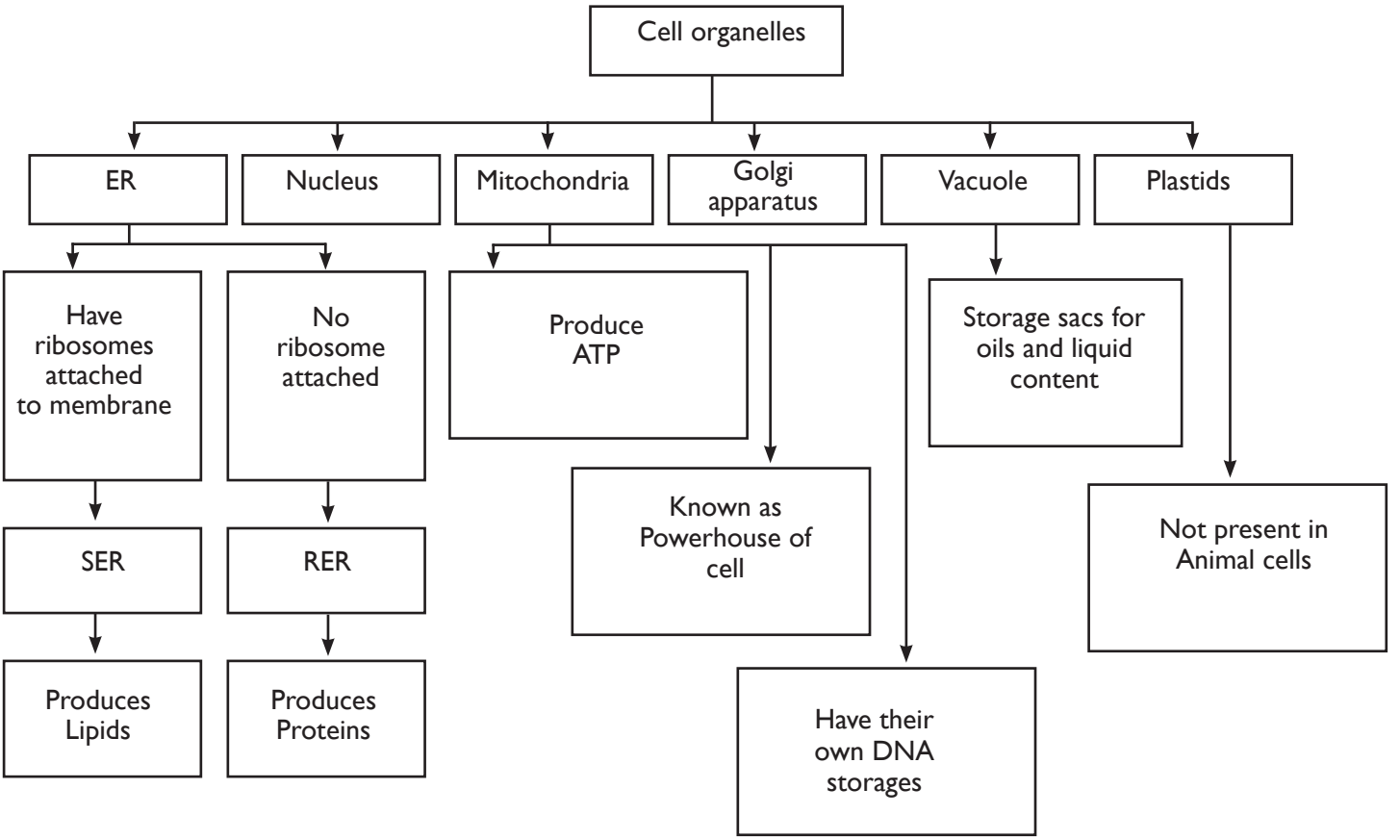
Q A. Multiple Choice Questions:

1. (a) 2. (a) 3. (a) 4. (c) 5. (c)

Q B. Label the different parts of a cell shown below:



Q C. Complete the flow chart shown below:



Q D. Name the following:

1. Chloroplasts
2. Golgi apparatus
3. (a) RER (b) SER
4. Nucleus
5. Ribosome

Q E. Very Short Answer Questions:

1. No
2. Ribosomes
3. Chloroplasts
4. Meiosis
5. Adenosine triphosphate

Q F. Short Answer Questions (Type I):

1. The folding of the inner membrane increases the surface area inside the organelle. Since, many of the chemical reactions happen on the inner membrane, the increased surface area creates more space for reactions to occur.
2. There are two types of plastids – chromoplasts (coloured plastids) and leucoplasts (white or colourless plastids). Chromoplasts containing the pigment chlorophyll are known as chloroplasts. Chloroplasts are important for photosynthesis in plants. Chloroplasts also contain various yellow or orange pigments in addition to chlorophyll. Leucoplasts are primarily organelles in which materials such as starch, oils and protein granules are stored.
3. There are two types of ER– rough endoplasmic reticulum (RER) and smooth endoplasmic reticulum (SER).

   The main function of the RER is to make protein. The function of the SER is to synthesize lipids and help detoxify the cell.

Q G. Short Answer Questions (Type II):

1. **Similarities**

   (i) Plastid and mitochondria are cell organelles present in the eukaryotic cells.

   (ii) Both are semi autonomous cell organelles.

   (iii) They both have their own DNA for protein synthesis.

   Difference

   Mitochondria are the site of cellular respiration. Plastid is the site of photosynthesis.

2. Lysosomes are membrane-bound sacs filled with digestive enzymes.

   Functions:

   These help to keep the cell clean by digesting any foreign material as well as worn-out cell organelles. When the cell gets damaged, lysosomes may burst and the enzymes digest their own cell. Therefore, lysosomes are also known as the 'suicide bags' of a cell.

3. (a) Differences in the vacuoles found in plant cell and animal cell

Plant cell	Animal cell
a. Contains a single large vacuole.	a. Contains several small vacuole.
b. Generally occur in the centre of the plant cell.	b. Can be distributed all over the animal cell
c. Important in maintaining the turgor pressure.	c. Important in exocytosis and endocytosis.

(b) (i) It is involved in sysnthesis of cell wall, plasma membrane and lysosome.

(ii) It produces vacuoles or secretory vesicles which contain cellular nutrients.

Q H. Long Answer Questions:

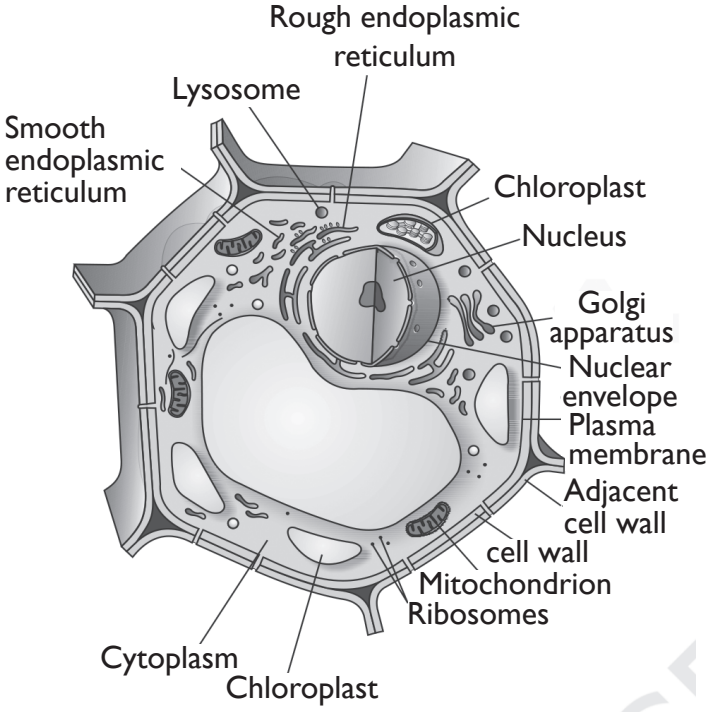
1. (a)There are two main types of cell division: mitosis and meiosis The process of cell division by which most of the cells divide for growth is called mitosis. In this process, each cell called mother cell divides to form two identical daughter cells. The daughter cells have the same number of chromosomes as mother cell.

   Meiosis is a type of cell division in sexually reproducing organisms that reduces the number of chromosomes in gametes (the sex cells, or egg and sperm). It involves two consecutive divisions. When a cell divides by meiosis it produces four new cells instead of just two. The new cells only have half the number of chromosomes than that of the mother cells.

   (b) Mitosis: It helps in growth and repair of tissues in organisms.

   Meiosis: It makes the cells needed for sexual reproduction to occur.

2. (a)



(b)

Plant cell	Animal Cell
It consists of a cellulose cell wall outside the cell membrane.	It does not have a cell wall.
Are square or rectangular in shape.	Are irregular or round in shape.
Centrosomes and centrioles are absent.	Centrosomes and centrioles are present.
Plastids are present.	Plastids are absent
Vacuoles are few large or single and centrally positioned vacuole.	Vacuoles are usually small and sometimes they are absent.
Cilia is absent	Cilia is present in most animal cells.

WORKSHEET-4

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (c) 2. (d) 3. (d) 4. (d) 5. (b)
6. (b) 7. (a)

Q B. Differentiate between the following:

1. Plant cell is rectangular in shape, has a cell wall and chloroplasts. Animal cells are rounded in shape, lack cell wall and chloroplasts.
2. SER are smooth and helps in formation of lipids while RER are rough and helps in protein synthesis.
3. Prokaryotic cell does not have a well-defined nucleus and membrane-bound organelles while eukaryotic cell has well-defined nucleus and membrane bund organelles.

Q C. Give reason for the following:

1. Both chloroplasts (plastids) and mitochondria possess their own DNA, RNA, and 70S ribosomes which helps them synthesise some of their proteins and enzymes. Due to this functional independence, they are semi-autonomous.
2. Mitochondria are commonly known as power house of the cell because they contain enzymes necessary for the total oxidation of food and for release of high amount of energy in the form of ATP. The body uses energy stored in ATP for synthesis of new chemical compounds and for mechanical work.
3. Nucleus is called the brain of the cell because it controls all the metabolic activities of the cell.
4. The ribosomes help in the synthesis of proteins in the cell. Hence, they are known as the protein factories of the cell.
5. Nuclear membrane is a double-layered covering which has pores that allow the transfer of material from inside the nucleus to its outside. These pores have complex structures that selectively allow passage of substances. Therefore, nuclear membrane is selectively permeable.

Q D. State whether the following statements are true or false:

1.True 2.True 3.True 4.True 5.True

Q E. Very Short Answer Questions:

1. Due to consuming salt, the body cells undergo exosmosis and release water resulting in vomiting.
2. Cell wall is considered dead due to the presence of cellulose.
3. Cytoplasm
4. (i) DNA - Deoxyribo Nucleic Acid
   (ii) RNA - Ribo Nucleic Acid.
5. Nucleus, cell membrane, and cytoplasm
6. Small vesicles associated with the plasma membrane are present in bacteria. These vesicles have pigment which can trap sunlight to carry photosynthesis.
7. The salt solution is more concentrated than the cytoplasm, so exosmosis occurs. Due to the water loss cytoplasm of the cell shrinks away from the cell wall making the cell plasmolyzed. Between the cell and cytoplasm, the solution gets filled. This process is known as plasmolysis and is reversible.

Q F. Short Answer Questions (Type I):

1. The nucleus controls most of the activities of the cell because it contains the genetic material or DNA.
2. Cell wall is found in plant cells outside the plasma membrane. It is a rigid covering made up of cellulose which a complex substance is providing structural support to the plants.
3. Because it helps in transporting protein within or outside the cell.
4. The digested products absorbed by the blood and supplied to all parts of the body are called absorption. This process involves the following mechanisms:

   Simple diffusion: The movement of solute from higher concentration to lower concentration through the membrane. For example glucose, amino acids diffuse into blood.

   Active Transport: The movement of solute from lower concentration to higher concentration through the external energy. For example: Sodium ions are absorbed by active transport.

   Facilitated transport: The movement of the solute with the help of carrier proteins through a biological membrane. For example digested amino acids are absorbed in this manner.

   Passive transport: The movement of the solute through the cell membrane without the help of external energy. The simple food products are absorbed by the process of passive transport.
5. Both the cells will swell. RBC will burst easily while cells of onion peel will resist the bursting to some extent.

Q G. Short Answer Questions (Type II):

1. A cell consists of three parts: the cell membrane, the nucleus, and, between the two, the cytoplasm. Within the cytoplasm lie intricate arrangements of fine fibers and hundreds or even thousands of miniscule but distinct structures called organelle.
2. Nucleus controls the heredity characteristics of an organism. It main cellular metabolism through controlling synthesis of particular enzymes. It is responsible for protein synthesis, cell division, growth and differentiation. It stores heredity material in the form of deoxy-ribonucleic acid (DNA) strands.

3. Diffusion can occur in any medium, whether it is liquid, solid, or gas. Osmosis occurs only in a liquid medium.

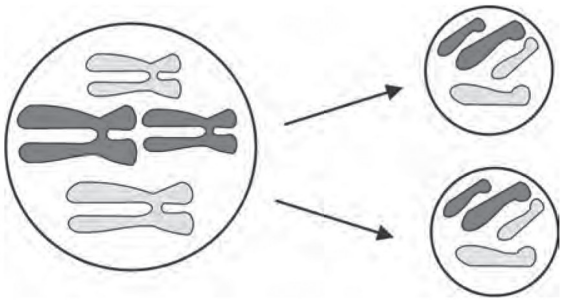
   Diffusion does not require a semipermeable membrane. Osmosis requires a semipermeable membrane.

4. The endoplasmic reticulum (ER) is an important organalle in eukaryotic cell. It is a network of tubules and flattened sacs that serve a variety of functions in plant and animals. It plays a major role in the production, processing, and transport of proteins and lipids. The ER produces transmembrane proteins and lipids for its membrane and for many other cell components including lysosome, secretory vesicles, the golgi apparatus, the cell membrane, and plant cell vacuole.
5. Viruses can be considered to be alive as they depend upon hosts to replicate their DNA from RNA. They are much smaller than the cells. But cell theory states that "all living cells are made of cells that are fundamental unit of life". So, a virus is not made up of cells. But, it is considered to be living. Therefore, it is an exception to the theory.

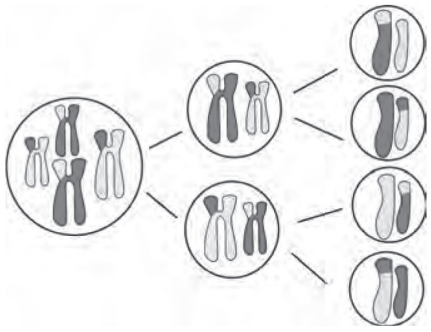
Q H. Long Answer Questions:

1. (a)

   - Mitosis consists of one stage whereas meiosis consists of two stages.
   - Mitosis produces diploid cells (46 chromosomes) whereas meiosis produces haploid cells (23 chromosomes).
   - Mitosis produces two identical daughter cells whereas meiosis produces four genetically different daughter cells.
   - Mitosis helps in growth and repair of tissues in organisms whereas meiosis makes the cells needed for sexual reproduction to occur.



Mitosis



Meiosis

2. (a) A - Plant cell B - Animal cell

   (b) It will gain water by the process of osmosis. The cell wall swell up because the concentration of water is high in the hypotonic solution.

   (c) It will loose water by the process of osmosis. The cell wall shrink and gets plasmolysed because the concentration of water is low in the hypertonic solution.

Q I. Assertion-Reason Questions:

1. (b) 2. (b) 3. (a)

Q J. Case-based Questions:

1. (c) 2. (d) 3. (b) 4. (b) 5. None of the above

Chapter

6 TISSUES

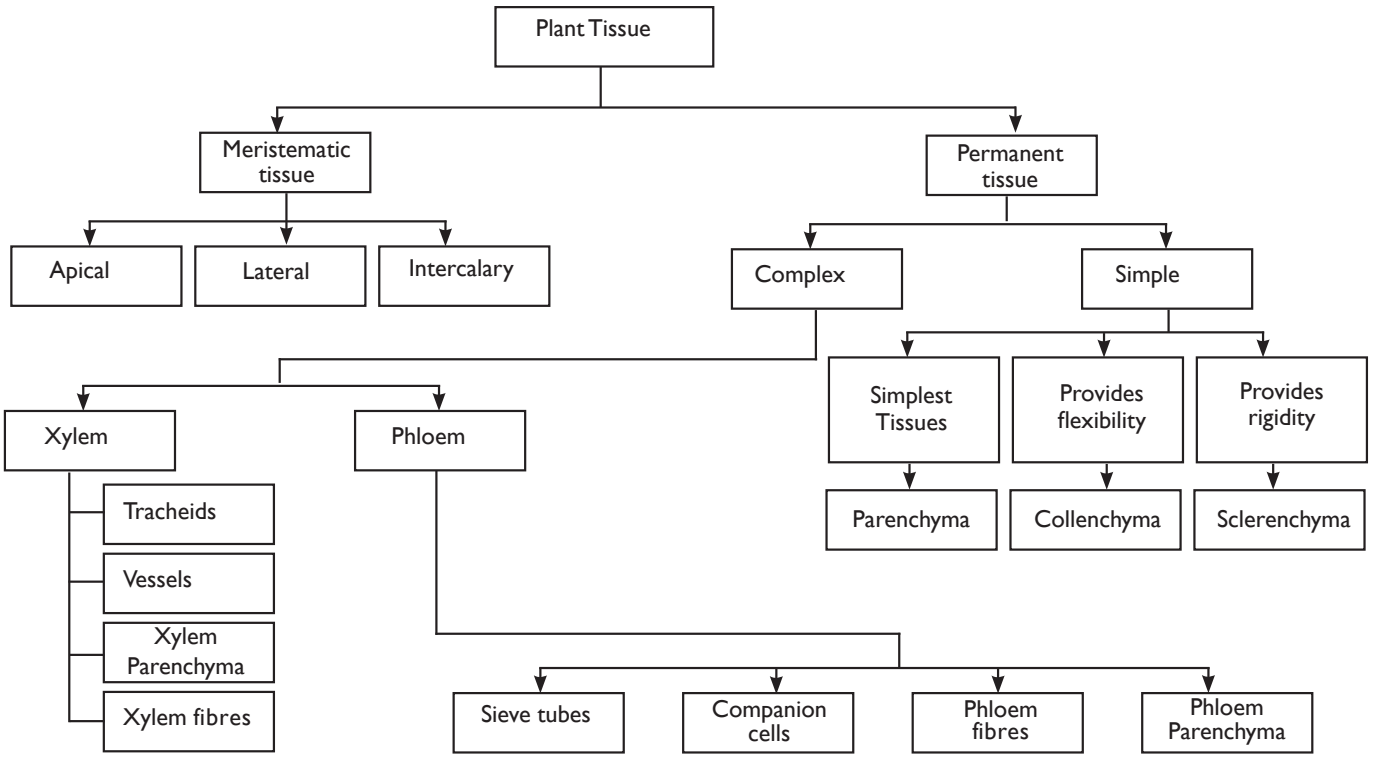
WORKSHEET-1

Plant Tissues

Q A. Multiple Choice Questions:

1. (d) 2. (b) 3. (c) 4. (d) 5. (c)

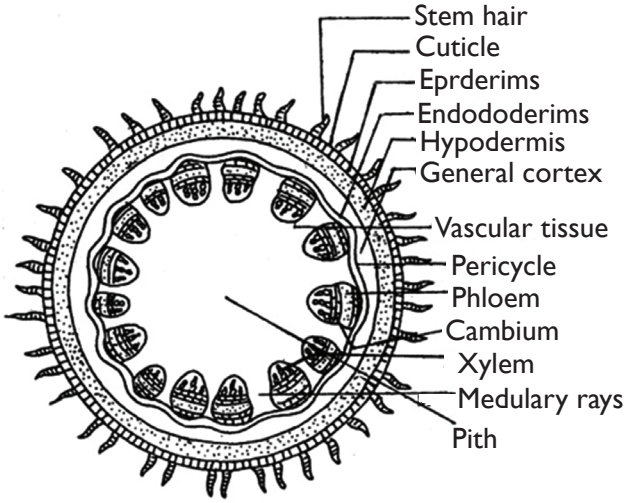
Q.B Complete the flowchart given below:



Q C. Match the followings:

Column A	Column B
1. Intercalary meristem	(c) Base of Internode
2. Thick walled cells	(e) Sclerenchyma
3. Sieve tube	(a) Phloem
4. Vessels	(d) Xylem
5. Chlorenchyma	(b) Photosynthesis

Q. D Label the diagram of the section of stem shown below:



Q E. Very Short Answer Questions:

1. Cork cambium and vascular cambium.
2. Meristematic tissue and epithelial tissue.
3. The dead elements present in the phloem is phloem fibre.
4. The different components of xylem tissue are tracheids, vessels, xylem parenchyma and xylem fibres.
5. Sclerechyma is the tissue found in the husk of coconut.

Q F. Short Answer Questions (Type I):

1. This happens due to transpiration.
2. (a) Epidermis protects the plant body against invasion of parasites.
   (b) Epidermis is very important for plant. It is the outermost protecting layer of plant. It protectes against loss of water, mechanical injury and invasion of parasitic fungi.
3. The main difference between sieve tubes and companion cells is that sieve tubes are the long, narrow, pointed tubes present in the phloem of angiosperms whereas companion cells are attached to the sieve tubes, regulating the activity of sieve tubes.

Q G. Short Answer Questions (Type II):

1. The elements of phloem tissues are:

   Sieve tubes: These are tubular cells with perforated walls.

   Companion cells: These are small elongated cells.

   Phloem fibres: They provide mechanical strength to the tissue.

   Phloem parenchyma: They help in storage and lateral conduction of food.

2. (a) Cells of cork are dead and compactly arranged without intercellular spaces. These cells have a chemical substance called suberin in their walls.
   (b) It is formed by secondary lateral meristem called cork cambium. Cork cambium gives rise to new cells on it's both side, thus, forming cork on the outer side.
   (c) Cork is protective in function. Cork cells prevent infection and mechanical injury.

3. Simple tissues and Complex tissues

Simple tissues	Complex tissues
a. Simple tissue consists of one same type of cells.	a. Complex tissue has different type of cells.
b. Simple tissue consists of parenchyma, collenchyma and scerenchyma.	b. Complex tissue consists of xylem and phloem.
c. Simple tissue occurs in all parts of plants.	c. Complex tissue only occurs in vascular region.

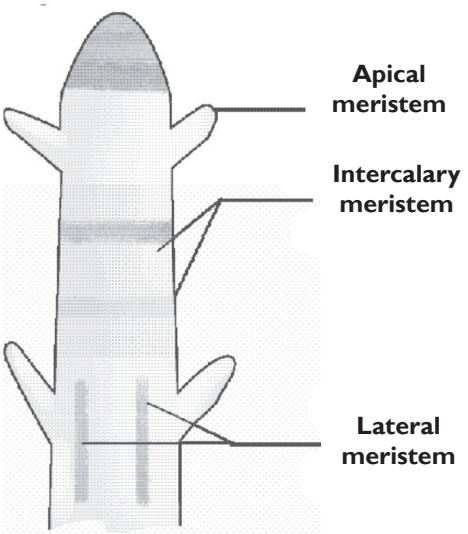
Q.H Long Answer Questions:

1. (a) Meristematic tissues are simple tisssues composed of a group of similar and immature cells that can divide and form new cells.

(b) The main characteristics of meristematic cells are:

(i) Isodiametric, rounded polygonal cells
(ii) Absence of intercellular spaces,
(iii) Dense cytoplasm and conspicuous nucleus
(iv) Absence of intercellular spaces
(v) Ability to divide and grow

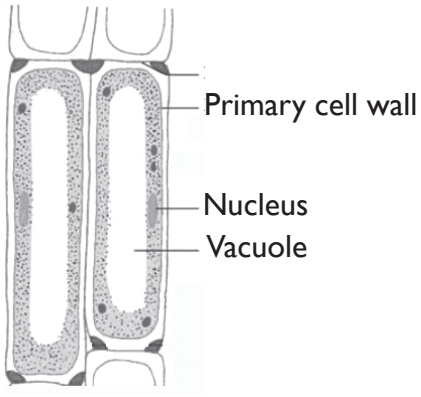
(c)



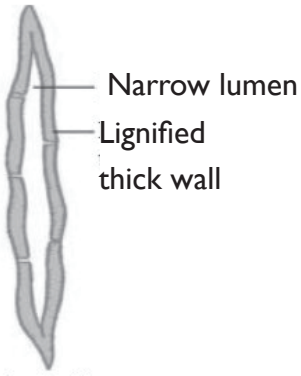
(d) The function of meristematic cells are mainly the increase in length and girth of plant. It is also responsible for secondary growth and thickness of plant. Due to presence of meristems the plant growth continues throughout the life of a plant.

2. Collenchyma and Sclerenchyma

Collenchyma	Sclerenchyma
a. The cells of collenchyma are living and have the cytoplasm and the nucleus.	a. The cells are dead. They do not have the cytoplasm and the nucleus.
b. They provide mechanical support and elasticity to the plant organ.	b. They mainly provide mechanical support to plant and rigidity to the plant.
c. Collenchyma cells may contain chlorophyll and can also help in the manufacture of starch.	c. They do not contain chlorophyll in any condition as they are dead cells.



Collenchyma



Sclerenchyma

WORKSHEET-2

Animal Tissues

Q A. Multiple Choice Questions:

1. (d) 2. (c) 3. (b) 4. (c) 5. (a)

Q B. Give one word for the following:

1. Connective Tissue
2. Eepithelial Tissue
3. Blood Plasma
4. Neurons
5. Ligament

Q C. Give reasons for the following statements:

1. it is essential because they act as a starter for the cell to function properly.
2. 99% calcium in the body is present in the mineral phase in bones. Hence the hard matrix of bones is made of calcium.
3. Actin and myosin are the contractile proteins present in muscles, which bring about the contraction and relaxation of muscles.
4. Nerve cells as are usually long and thin because of the need to transmit information between various parts of the body. It is the key unit of the nervous tissue and also helps in carrying stimulus from the body.
5. Smooth muscle are called unstriated muscles because these types of muscles do not show light and dark bands or striations when stained as shown by striated muscles. Smooth muscle are also called involuntary muscles.

Q D. Define the following:

1. Tendons are fibrous tissue with great strength but limited flexibility.
2. Cartilage is the main type of connective tissue seen throughout the body.
3. The term "epithelium" refers to layers of cells that line hollow organs and glands.
4. Neurons (or nerve cells) are specialised cells that transmit and receive electrical signals in the body.

5. Blood is a type of connective tissue. It has a liquid matrix called plasma, in which the red blood cells (RBCs), white blood cells (WBCs) and platelets are suspended. The plasma contains proteins, salts and hormones.

Q E. Very Short Answer Questions:

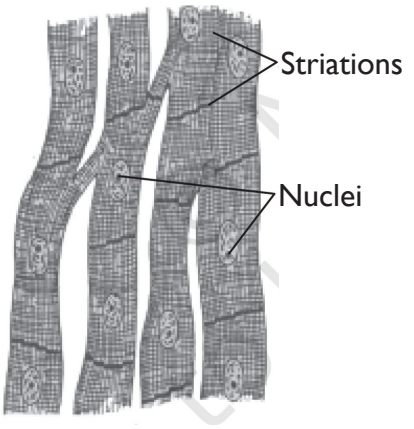
1. Cardiac muscles
2. The bone matrix contains bone minerals which consists of mainly calcium and phosphorus with trace amounts of sodium, magnesium, and bicarbonate.
3. Bone and cartilage
4. Red blood cells, white blood cells, and platelets
5. (a) Skeletal muscle fibre
   (b) Smooth muscle fibre

Q F. Short Answer Questions (Type I):

1. Fluid connective tissue is a connective tiisue in which the matrix is liquid. Examples of this tissue are blood and lymph.
2. (a) Squamous epithelium - It is located in the skin.
   (b) Cuboidal epithelium - It is located in kidney tubules and in salivary glands.
   (c) Columnar epithelium - It is found in inner lining of stomach and intestine.
   (d) Stratified epithelium - It is located in outer skin.
3. The ligaments connect the bone to bone at the union of the joint. They are elastic in nature, ligaments allow for the controlled movement of joints.

Q G. Short Answer Questions (Type II):

1. Functions of various components of blood are:
   (a) Red Blood Cell(RBC)-They carry protein hemoglobin, which transports oxygen from lungs to rest of the body.
   (b) White Blood Cell (WBC)-They are primarily for protecting body from infection
   (c) Platelets-They help in blood clotting process.
   (d) Plasma-It is a liquid component of blood and transports blood cells throughout the body.
2. The specific function of the cardiac muscle is to control the contraction and relaxation of the heart.



3. Epithelial tissue is a simplest tissue. An epithelial tissue is composed of one or more layers of cells covering the external surface of the body and internal organs.

Functions:

(i) Protects from injury, drying and microbial infection.

(ii) Absorption of water and nutrients.

(iii) Elimination of waste products.

(iv) Secrets sweat,saliva,mucus and enzymes.

(v) Lining of mouth and alimentary canal and give protection to organs.

Q H. Long Answer Questions:

1. (a) Neuron

   (b) A-Dendrite, B-Cyton, C-Nucleus, D-Axon, E-Nerve ending

   (c) Neurons have the ability to receive stimuli from within or outside the body and conduct impulses to different part of the body. The impulses travel from one neuron to another neuron and finally to the brain or spinal cord.

2. (a) (i) Cardiac muscles, (ii) Smooth muscles, (iii) Skeletal muscles

   (b)

Character	Striated	Unstriated	Cardiac
Structure	Cells are long, cylindrical, non tapering and are unbranched.	Cells are long with tapering ends and are unbranched.	Cells are non-tapering, cylinderical and are branched.
Location	In hands, leg and skeletal muscles	The wall of stomach, intestine, ureter	In the heart

WORKSHEET-3

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (c) 2. (d) 3. (a) 4. (c) 5. (b)
6. (d) 7. (a)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. epithelial 2. Sclerenchyma 3. heart 4. axon 5. Collenchyma

Q C. Differentiate between the following:

1. Striated muscles: It is a form of striated muscle tissues and is mainly found attached to bones by the tendons. They are involuntary muscles. Cells are cylindrical.

   Unstriated muscles: These muscles are found inside of organs like the blood vessels, stomach, and intestines. They are voluntary muscles. Cells are long.

2. Cardiac muscles: Cardiac muscles are only found in the heart wall of vertebrates. These muscles are shorter in size. These muscles help in the pumping of blood from the heart.

   Skeletal muscles: Skeletal muscles are attached to the bones and are voluntary in nature. Skeletal muscles are longer, compared to cardiac muscles. These muscles help in the movement and functioning of the body.

3. Plant tissue: Cells of plant tissue have cell wall. Growth is restricted to the tips of stem and roots. Some tissues are dead and some are living.

   Animal tissue: Cell wall is not present. For animal tissue, growth is uniform all over the body. All tissues are living.

Q D. Complete the table given below

Location / Organ	Type of Epithelial Tissue
Lining of blood vessels	Simple squamous epithelium
Lung alveoli	Thin squamous epithelium
Skin	Stratified squamous epithelium
Inner lining of intestine	Columnar epithelium
Respiratory tract	Ciliated pseudostratified columnar epithelium
Lining of kidney tubules	Simple cuboidal epithelium

Q E. Very Short Answer Questions:

1. Suberin
2. The term tissue was coined by Marie Francois Xavier Bichat in the year 1792.
3. Cutin is that chemical substance.
4. A complex organic polymer deposited in the cell walls of many plants, making them rigid and woody.
5. Sclerenchyma
6. This is because increase in length occurs at nodes by intercalary meristem.
7. Because fats act as an insulator and prevent the escape of heat from their body.

Q F. Short Answer Questions (Type I):

1. This is because it contains air sacs that provide buoyancy.
2. The tracheid and vessels are the basic cells in the xylem, that is all plants have tracheids, but not the more highly evolved vessel elements. Tracheids are generally spindle shaped, very elongate, and have tapered ends.
3. In multicellular organisms, several cells are grouped to form tissues. These tissues perform particular function at a definite place in the body. for e.g. - nerve cells.
4. Animals have all living cells because they need to locomote from one place to another. The cells of plant tissue possess cell wall whereas cell wall is absent in animal cells.
5. (a) Athlete feels tired because the muscles did not get enough oxygen and lactic acid starts accumulating in them.
   (b) He was asked to take rest so that the muscles get enough oxygen, are relieved and the person can then feel rejuvinated.

Q G. Short Answer Questions (Type II):

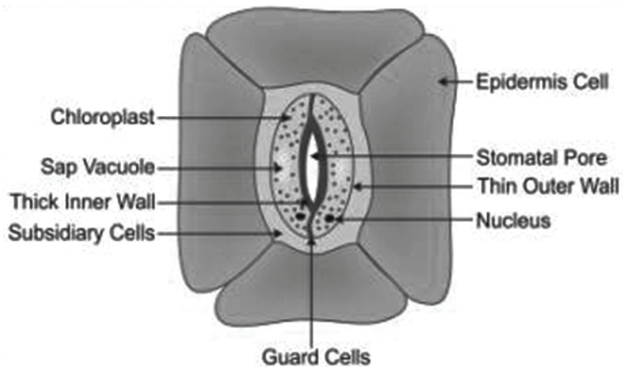
1. Types of Simple tissue –
   (i) Parenchyma-They are living cells and walled, soft in nature due to the presence of thin-walled cells.
   (ii) Collenchyma-These are characterised by uneven thick-walled living cells. This unevenness in the thickening of the cell walls imparts partially hard giving mechanical support derived essentially from the elongated cells of the ground meristems, procambium sometimes.
   (iii) Sclerenchyma-They have cells with thickened lignified walls, providing them strength and making them waterproof.

2. Trachieds and vessels are called tracheary elements. Tracheids are found in all vascular plants, but vessel elements are unique to angiosperms. Both kinds of cells die at maturity, but their lignified cell walls remain as the conduits through which water is carried in the xylem.
3. Parenchyma: The cells parenchyma have thin cell wall. They are loosely packed; with lot of inter-cellular spaces between them. Parenchyma makes the largest portion of a plant body. Parenchyma mainly works are packing material in plant parts. The main function of parenchyma is to provide support and store food.

   In some plant parts, parenchyma has chlorophyll as well. In that case, parenchyma carries out photosynthesis and is then termed as chlorenchyma.

   In aquatic plants, large air cavities are present in parenchyma. This provides buoyancy to the plant ,and then the parenchyma is known as aerenchyma.
4. The stomata consist of minute pores called stoma surrounded by a pair of guard cells. Stomata, open and close according to the turgidity of guard cells. The cell wall surrounding the pore is tough and flexible.

   The gas exchange that occurs when stomata are open facilitates photosynthesis. Photosynthesis is the process by which plants convert sunlight into usable energy. During photosynthesis, carbon dioxide is taken in from the atmosphere through the stomata and oxygen is released as a waste product.



5. (a) Collenchyma
   (b) It provides flexibilty to plant tissues that helps in bending without breaking
   (c) Amyloplasts in collenchyma stores starch.

Q H. Long Answer Questions:

1. (a) Squamous epithelium is made up of large flat cells whose edges are fit together like tiles in a floor. Due to their tile like appearance, they are also known as pavement epithelium.
   (b) Because the produce lactic acid due to lack of oxygen during exercise.
   (c) It helps them in floating.
   (d) Because they help in movement and locomotion.
   (e) This is a place where chemical transmission of impulses occur from one neuron to another.
2. (a) On the basis of absence of nucleus.
   (b) B-Neutrophil, C-Eosinophil, D-Basophil
   (c) E is monocyte and helps to form more new cells while F are lymphocytes and provide immunity.
   (d) These platelets help in blood clotting. They lack nucleus and are cellular fragments.

Q I. Assertion-Reason Questions:

1. (a) 2. (a) 3. (c)

Q J. Case-based Questions:

1. (c) 2. (a) 3. (b) 4. (d) 5. (d)

Chapter

7 Motion

WORKSHEET-1

Describing Motion, Velocity and Acceleration

Q A. Multiple Choice Questions:

1. (a) 2. (c) 3. (a) 4. (d) 5. (a)

Q B. A particle is moving in a circle of diameter 20m. Complete the following table for the motion of this particle:

S.No.	Rounds	Displacement (m)	Distance (m)
1.	1	0	(22/7)x20
2.	1.5	20	(1.5)x(22/7)×20
3.	2	0	(2)x(22/7)×20
4.	2.5	20	(2.5)(22/7)×20

Q C. Differentiate between the following:

1. Distance	Displacement
Distance travelled by an object is the length of actual path.	Displacement travelled by an object is the shortest distance between the initial to final position.
It is scalar quantity.	It is vector quantity.
Its value can never be zero or negative.	Its value can be zero or negative.
2. Velocity	**Acceleration**
Velocity is the rate of change of displacement.	Acceleration is the rate of change of velocity.
Velocity implies the speed of an object, in the given direction.	Acceleration implies any change in the velocity of the object with respect to time.
SI unit is m/s or ms^{-1}.	SI unit is m/s^2 or ms^{-2}.

3. Scalar quantity	Vector quantity
A scalar quantity has only magnitude, but no direction.	Vector quantity has both magnitude and direction.
Every scalar quantity is one-dimensional.	Vector quantity can be one, two or three-dimensional.
It changes with the change in their magnitude.	It changes with the change in their direction or magnitude or both.

Q D. Give one word for the following:

1. Liner Motion
2. Deceleration
3. Angular acceleration
4. Curvilinear Motion
5. Speed

Q E Very Short Answer Questions:

1. Initial velocity (u) = 80 km h^{-1} = 80 x $\frac{5}{18}$ ms^{-1} = 22.22 ms^{-1}

   Final velocity (v) = 60 km h^{-1} = 60 x $\frac{5}{18}$ ms^{-1} = 16.67 ms^{-1}

   Time (t) = 5s

   Acceleration (a) = ?

   using, $a = \frac{v - u}{t}$

   $= \frac{(16.67 - 22.22)\ ms^{-1}}{5s}$

   $= \frac{-5.55\ ms^{-1}}{5s}$

   $= -1.11\ ms^{-2}$

2. (a) Speedometer in a car measures its instantaneous speed.
   (b) Odometer in a car measures its actual distance travelled by it.
3. When an object moves along a straight line on the same direction.
4. (a) m/s = velocity of an object
   (b) m/s^2 = acceleration of an object
5. If the direction component of the object's velocity is constant.

Q F. Short Answer Questions (Type I):

1. Radius of orbit (r) = 42,250 km

   Distance travelled by satellite to complete one orbit = circumference of orbit

   $= 2\pi r$

   $= 2x \frac{22}{7} x\ 42{,}500$ km

   = 267142.84 km

   Time = 24 hr

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

$= \frac{267142.84 \text{ km}}{24 \text{ h}}$

$= 11130.95 \text{ km h}^{-1}$

$= \frac{11130.95 \text{ km}}{3600 \text{ s}}$

$= 3.09 \text{ kms}^{-1}$

2. Because the train may be in motion for the person who is outside the train but for passengers inside the train may be at rest as motion and rest are relative terms.
3. Zero

Q G. Short Answer Questions (Type II):

1. Speeds in increasing order are:

   (b) A bicycle moving with a speed of 200 m/min. i.e. $\frac{200 \text{ m}}{60 \text{ s}} = 3.3 \text{ ms}^{-1}$

   (c) A scooter moving with a speed of 30 km/h. i.e. $\frac{30 \times 1000 \text{ m}}{60 \times 60 \text{ s}} = 8.3 \text{ ms}^{-1}$

   (a) An athlete running with a speed of 10 m/s. i.e. 10 ms^{-1}

2. (a) Yes, a particle can be accelerated when it is moving with constant speed.

   (b) No

3. As average velocity depends on displacement and displacement can be zero if the object returns to initial position. Where as displacements is zero as source and destination is same. Hence, a body can have zero average velocity but not average speed.

   v = displacement/time

   s = distance/time

Q H. Long Answer Questions:

1. (a) Motion is a change in position of an object over time.

   (b) Acceleration is the rate of change of the velocity of the object.

   (c) Displacement is defined as the change in position of an object.

   (d) Speed is defined as the total distance travelled by the object in the time interval during which the motion takes place.

   (e) Velocity is defined as the distance traveled in a given direction by a moving object in a given time or speed in a given direction.

2. (a) Let the length of the line segment AB be x m.

   The time taken is given as t = distance covered/speed

   Total time = $t_1 + t_2 = \frac{x}{30} + \frac{x}{20} = \frac{5x}{60}$ h

   Average speed = Total distance/Total time = $\frac{2x}{5x/60} = 24$ km/h

   (b) (i) The radius of the circular path (r) is 70m.

   As the body travels half of the circumference, the distance covered by the body d is (22/7) x 70 = 220m

Displacement of the body = 2d = 2 x 70 = 140 sm.

Hence, the average velocity = vel $_{av}$ = s/t

= 140/20 = 7.

So, the average velocity is 7m/s.

(ii) Distance covered by the body = 220m.

Time taken = t = 20

Average speed = 220/20 = 11.

So, the average speed is calculated as 11m/s.

WORKSHEET-2

Graphical Representation and Equations of Motion

Q A. Multiple Choice Questions:

1. (c) 2. (c) 3. (c) 4. (b) 5. (c)

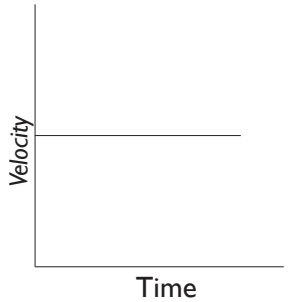
Q B. Give reasons for the following:

1. Because rate of change of distance gives speed.
2. Because body is at the same distance at different interval of time.
3. Because rate of change of velocity gives acceleration.
4. Because velocity is decreasing with time.
5. Because distance can never be negative.

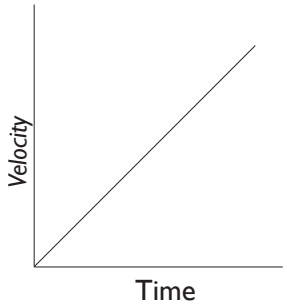
Q C. Match the following:

Column A	Column B
1. Slope of v-t graph	(c) Acceleration
2. Straight line s-t graph	(a) Uniform Motion
3. Area under v-t graph	(b) Distance
4. Slope of s-t graph	(d) Speed
5. Curved line s-t graph	(e) Non-uniform motion

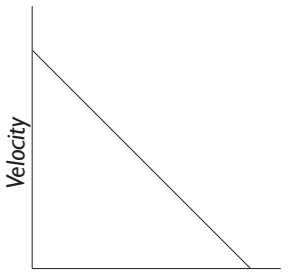
Q D. Write the type of acceleration shown by the following graphs:



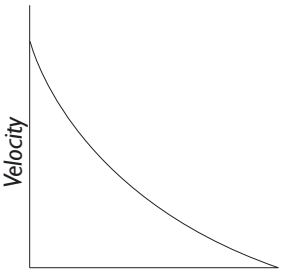
Zero



Uniformly increasing



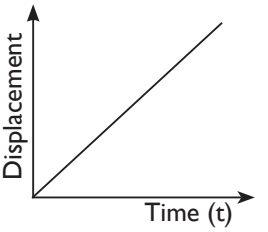
Uniformly decreasing



Non-uniformly decreasing

Q E. Very Short Answer Questions:

1. **Conclusion:** v-t graph is not a straight line. This shows that the object is under non- uniform accelerated motion.
2. It means the object is moving with uniform motion.
3. The object is stationary and is not moving.
4. The distance is measured by the area occupied below the velocity-time graph.
5. The tangent of the graph gives us velocity of the object in motion.
   Tan θ = P/B
   Tan θ = Displacement/time.



Q F. Short Answer Questions (Type I):

1. Initial velocity (u) = 20 m/s

   acceleration (a) = 0.5 m/s^2 or, $\frac{1}{2}$ m/s^2

   time (t) = 30s

   distance (s) = ?

   using, $s = ut + \frac{1}{2}(at)\,t$

   $= 20 \times 30 + \frac{1}{2}(0.5 \times 30)30$

   $= 600 + \frac{1}{2}(450)$

   $= 600 + 225$

   $= 825m$

2. (a) Constant (b) Zero
3. Initial velocity of motorcycle (u) = 0 m/s

   Final velocity of motorcycle (v) = 28 m/s

   Time, (t) = 4s

   (a) Its average acceleration (a) = ?

   using, $v = u + at$

   $28 = 0 + (4)a$

   $(4)\,a = 28$

   $a = 7m/s^2$

(b) Displacement, (s)

using, $v^2 = u^2 + 2as$

$(28)^2 = (0)^2 + 2 \times (7)(s)$

$784 = 14 \times s$

$s = \frac{784}{14}$

$s = 56$ m

Q G. Short Answer Questions (Type II):

1. Initial velocity (u) = 8 m/s

acceleration (a) = 1 m/s^2

Distance (s) = 18m

Final velocity (v) = ?

using, $v^2 - u^2 = 2as$

$v^2 = \sqrt{2as + u^2}$

$v^2 = \sqrt{2 \times 1 \times 18 + (8)^2}$

$v^2 = \sqrt{(36 + 64)}$

$v = \sqrt{100}$

$v = 10$ m/s

2. In the first case:

Initial velocity (u) = 0 m/s

final velocity (v) = 10 m/s

time velocity (t) = 25 s

acceleration (a) = $\frac{v - u}{t}$

$= \frac{(10 - 0) \text{ m/s}}{25\text{s}}$

$= 0.4 \text{ m/s}^2$

In the second case:

Initial velocity (u) = 10 m/s

final velocity (v) = 0 m/s

time (t) = 50 s

acceleration (a) = $\frac{v - u}{t}$

$= \frac{(0 - 10) \text{ m/s}}{50\text{s}}$

$= - 0.2 \text{ m/s}^2$

Thus, the acceleration of the bicycle in the first case is 0.4 ms^{-2} and in the second case is - 0.2 ms^{-2}.

Distance travelled in first case:

$2aS_1 = v^2 - u^2$

$2(0.4)\ S_1 = (10)^2$

$S_1 = 125$ m

Distance travelled in 2nd case:

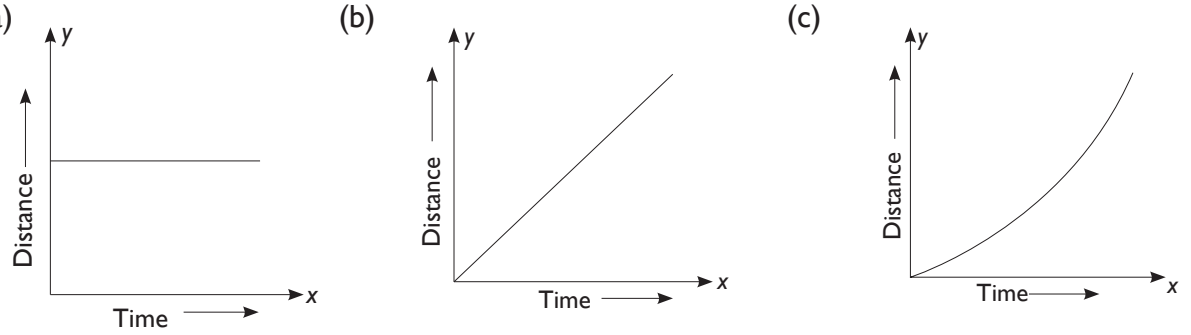
$2aS_2 = v^2 - u^2$

$2(0.2)\ S_2 = (10)^2$

$S_2 = 250$ m

Total distance = $S_1 + S_2$ = 125 m + 250 m = 375 m

3. (a) (b) (c)



Q H. Long Answer Questions :

1. (a) The initial speed of the car = 10 km/h

   (b) The maximum speed attained by the car = 35 km/h

   (c) Part of the graph shows zero acceleration $\Rightarrow$ t = 3h to t = 8h.

   (d) The part of the graph shows varying retardation, t = 8h to t = 10h.

   (e) Distance travelled in first 8 hours.

   = area of trapezium + Area of rectangle

   = [$\frac{1}{2}$× Sum of perpendicular lines × h] + (l×b)

   = $\frac{1}{2}$× [(10+35) × 3] + (5×35)

   = $\frac{1}{2}$ [(45) × 3] + 175

   = 242.5 km

2. (a) Initial velocity of an aeroplane (u) = 0 m/s

   Final velocity of an aeroplane (v) = ?

   Acceleration of an aeroplane (a) = 3m/s^2

   Time of an aeroplane (t) = 35s

   Displacement of an aeroplane (s) = ?

   For displacement using, $s = ut + \frac{1}{2}at^2$

   $s = [0 + \frac{1}{2} \times 3 \times (35)^2]$m

   s = 1837.5 m

   For velocity using, v = u + at

   = (0 + 3 × 35)m/s

   = 105 m/s

   (b) The figure (graph) (B) is possible.

   This distance-time graph shows when the body is at rest,the position of the body does not change with time. Its distance from the origin continues to be same at the instants of time.

WORKSHEET-3

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (a) 2. (a) and (b) 3. (c) 4. (b) 5. (c)
6. (c) 7. (b)

Q B. A car moves in a straight line from rest at t = 0 and accelerates at $2m/s^2$. On the basis of this information, complete the following table:

Time	Displacement	Velocity
2 s	4 m	4 m/s
5 s	25 m	10 m/s
5s	25 m	10 m/s
10 min	360000 m	1200 m/s

Q C. State whether the following statements are true or false:

1. True 2. False 3. False 4. True 5. True

Q D. Fill in the blanks using the suitable words given in the brackets:

1. position 2. uniform 3. average speed 4. acceleration 5. speed

Q E. Very Short Answer Questions:

1. The direction of velocity of an object moving along a circular path is along the tangent to the circle at every point.
2. Magnitude of average velocity = Average speed.

   So, numerical ratio of average velocity to average speed is 'One'.
3. The path may be a straight line.
4. (a) The total distance travelled = h + h = 2h

   (b) The displacement is zero, because the initial and final position coincide.
5. Velocity- m/s or ms^{-1}, acceleration- m/s^2 or ms^{-2}.
6. Accelerated motion
7. Initial difference in height = (150 – 100) m = 50 m

   We know that, by second equation of kinematics, $s = ut + \frac{1}{2}at^2$ considering g = 10 m/s

   Distance travelled by first body in 2s = $h_1 = 0 + \left(\frac{1}{2}\right) g\,(2)^2 = 2g = 2 \times 10 = 20$ m

   Distance travelled by another body in 2s = $h_2 = 0 + \left(\frac{1}{2}\right) g\,(2)^2 = 2g = 2 \times 10 = 20$ m

   After 2s, height at which the first body will be = h_1 = 150 – 20 = 130 m

   After 2s, height at which the second body will be = h_2 = 100 – 20 = 80 m

   Thus, after 2s, difference in height = (130 – 80) = 50 m = initial difference in height

   Thus, difference in height does not vary with time. So, the answer is zero.

Q F. Short Answer Questions (Type I):

1. Given : Initial velocity (u) = 5×10^4 ms^{-1}

   Final velocity (v) = $2 \times 5 \times 10^4$ ms^{-1}

   acceleration (a) = 10^4 ms^{-2}

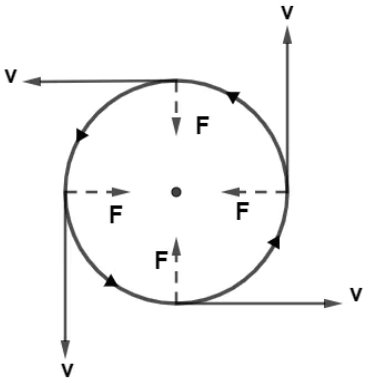
   Using $v = u + at$

   $2 \times 5 \times 10^4 = 5 \times 10^4 + 10^4 \times t$

   $10 = 5 + t$

   $t = 5$ s

2. The direction of acceleration acting on the body is from the body to the centre of the circle.



An object moving in uniform circular motion

   Here, "F" show direction of acceleration.

3. $Speed_1$ (s_1) = 10 kmh^{-1} , $speed_2$ (s_2) = 15 kmh^{-1}

   $time_1$ (t_1) = 2 h , $time_2$ (t_2) = 3 h

   $Distance_1$ $(d_1) = s_1 \times t_1$, $Distance_2$ $(d_2) = s_2 \times t_2$

   $= (10 \times 2)$ km $= (15 \times 3)$ km

   = 20 km = 45 km

   $\therefore$ Total distance moved by her = $D = d_1 + d_2$

   $D = (20 + 45)$ km = 65 km

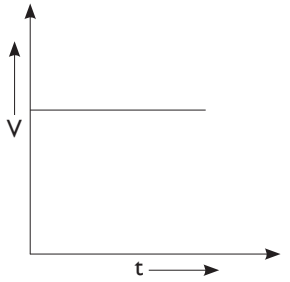
   Hence, Average speed = $\frac{\text{Total distance}}{\text{Total time}}$

   $= \frac{65 \text{ km}}{(2 + 3)\text{h}}$

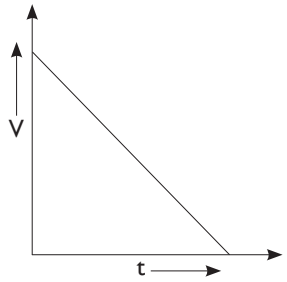
   $= \frac{65 \text{ km}}{5 \text{ h}}$

   = 13 kmh^{-1}

4. (a) When the object is in uniform motion.



(b) When the object is thrown vertically upwards.



5. Initial velocity of Shatabdi (u) = 0

final velocity of Shatabdi (v) = 108 km/h = $108 \times \frac{5}{18}$ m/s = 30m/s

Time (t) = 2 min = 120 sec

(a) acceleration (a) = ?

using, $v = u + at$

$30 = 0 + a(120)$

$a = \frac{30m/s}{120s}$

$a = 0.25m/s^2$

(b) Distance travelled by the train, s = ?

using, $s = ut + 0.5at^2$

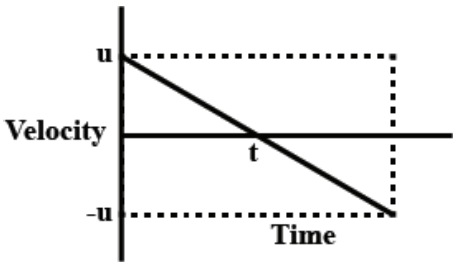
$s = 0 + (0.5)\ (0.25)\ (120)^2$

s = 1,800m

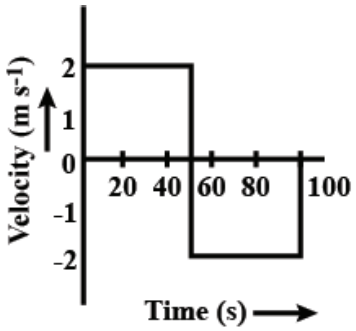
Q G. Short Answer Questions (Type II):

1. $a = (58 - 56)/1 = 2\ km/s^2$

2. (a)



(b) For the initial 50 second, velocity is 2 m/s. After that, velocity drops of zero, as shown by vertical line in graph. For the next 50 second, velocity is taken in negative because displacement is becoming zero.



3. (a) Negative acceleration means that the rate of change of velocity is negative or velocity decreases.

Examples:

- When we apply brakes in a moving car, then negative acceleration acts on it and the car stops.
- When we throw a ball upwards, then also negative acceleration acts on it. Thus, when the ball reaches the highest point, the velocity of the ball becomes zero.

(b) Four examples of uniform circular motion are as below:

- Motion of hand tips of a clock is uniform circular motion
- Motian of a satellite around the earth is an example of uniform circular motion
- Motion of electrons around the nucleus.
- Motion of a car moving along a circular path

4. We know,

From the equation of motions

$s = u\,t + \frac{1}{2} at^2$

Now we can find

Distance travelled in 5 s

Putting all the values

$s_5 = u \times 5 + \frac{1}{2} a \times 5^2$

or $s_5 = 5\,u + \frac{25}{2} a$....(i)

Similarly, distance travelled in 4s,

$s_4 = 4u + \frac{16}{2} a$ ....(ii)

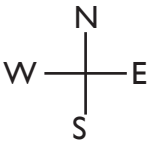
Finding the relation

Distance travelled in the interval between 4th and 5th second is the difference between the distance travelled in 5 sec and 4 sec.

$s_5 - s_5 = (u + \frac{9}{2} a)$m.

Hence, the relation is as stated above.

5. (a) Distance covered = total length of the path covered



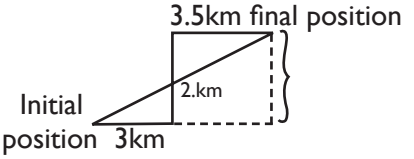
It is a scalar quantity (scalar quantities are the ones which only have magnitude like time) So, the distance covered by the person = 3 km + 2 km + 3.5 km = 8.5km

(b) Displacement is the length of the shortest path between the initial and the final position object.It is a vector quantity. So, Displacement of this motion

$(D)^2 = 2^2 + (6.5)^2$

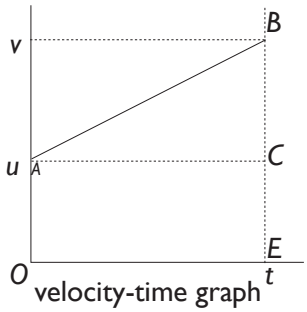
$= \sqrt{4 + 42.25} = \sqrt{46.25}$

Displacement = 6.8 km (approx)



Q H. Long Answer Questions:

1. An object starts linear motion with a velocity 'u' and under acceleration 'a'. It acquires a velocity 'v' in time 't'.



velocity-time graph

(a) As a result of the acceleration, its velocity from u to v (final velocity) in time t. Since the slope of the v-t graph gives the acceleration of the moving object = acceleration = Slope of AB = $\frac{BC}{CA}$

$$a = \frac{v - u}{t}$$

$$v - u = at$$

$$v = u + at$$

It is velocity time equation.

(b) Third equation of motion.

As we know that the distance travelled 's' in time 't' is given by the area enclosed by the velocity-time graph and the time axis.

Therefore, distance travelled (s) = area of the trapezium ABEO

$$= \frac{u + v}{2} \times t \qquad \text{..... (i)}$$

we know, $(v - u) = at$

$$t = \frac{v - u}{a}$$

Substituting the value of t in equation (i), we get

$$s = \frac{u + v}{2} \times \frac{v - u}{a}$$

$$2as = (v + u)(v - u)$$

$$2as = v^2 - u^2$$

$$v^2 = u^2 + 2as$$

It is position-velocity relation.

2. (a) (i) The speed of car is constant but the direction of motion of the car is changing continuously.
   (ii) The length of each side of a circular path tends to be zero. So, the athlete has to change his direction of motion at each point.
   (iii) The wheels of the car are in uniform circular motion.
   (b) It actually moves in straight line but due to gravity its path is curved and it appears to be moving around the earth. So, because the satellite is falling freely under the influence of gravity, hence the motion is accelerated.

Q I Assertion-Reason Questions:

1. (a) 2. (c) 3. (c)

Q J. Case-based Question:

1. (d) 2. (d) 3. (c) 4. (d) 5. (a)

Chapter 8 FORCE AND LAWS OF MOTION

WORKSHEET-1

Forces, First law of Motion and its Applications

Q A. Multiple Choice Questions:

1. (a) 2. (b) 3. (c) 4. (d) 5. (c)

Q B Match the following:

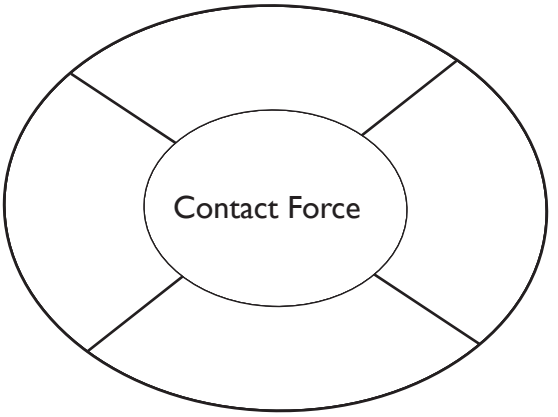
Column A	Column B
1. Contact force	(b) Air resistance
2. Friction	(e) Opposes motion
3. Action and reaction forces	(a) Newtion's 3rd law
4. Pull or push	(c) Force
5. Balanced forces	(d) Zero resultant

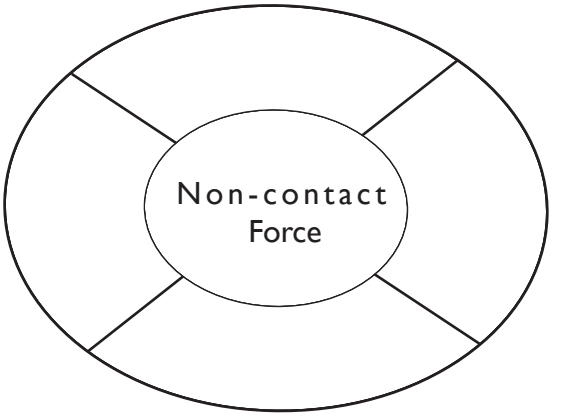
Q C. Fill in the blanks using the suitable words given in the brackets:

1. opposite 2. unbalanced 3. Galileo 4. opposes 5. inertia

Q D. Classify the following as contact and non-contact forces:

Gravitational force, frictional force, magnetic force, mechanical force, muscular force, electromagnetic force, normal reaction force, nuclear force





Contact forces: Frictional force, mechanical force, muscular force, normal reaction force

Non-contact forces: Gravitational force, magnetic force, electromagnetic force, nuclear force

Q E. Very Short Answer Questions:

1. Tendency of a body to resist changes in position of rest, motion or direction.
2. Loaded one will require larger force to stop because it has more mass; ($F \propto P$) more momentum.
3. External unbalanced force.
4. Zero
5. Force of friction

Q F. Short Answer Questions (Type I):

1.

Balanced force	Unbalanced force
Forces equal in magnitude and opposite in direction.	Force unequal in magnitude, can be in same or opposite direction.
It does not produce acceleration in an object, it acts upon.	It produces acceleration in the object, it acts upon.
Example; fruit hanging from a tree.	Example; an object sinking in water.

2. The force of friction depends upon the following factors:
   - The force of friction depends upon the nature of the surface which is in the contact. For example, while walking on a rough surface, the force of friction is more, while climbing the mountain the friction is increased by wearing special types of shoes to increase friction.
   - The force of friction is directly proportional to the mass of the object. For example, when a heavy vehicle is moving on a road, it has more force of friction than light vehicles.
3. The difference between mass and inertia is that mass is the quantity of the matter in a body irrespective of its volume. Whereas inertia is the tendency of an object to continue its state of either rest or motion.

Q G. Short Answer Questions (Type II):

1. (a) Unbalanced external retarding force (air resistance, force gravity).
   (b) Unbalanced external accelerating force.
   (c) Balanced force (object has same/uniform velocity at each interval of time).
2. Three effects of force are:
   - Change of magnitude of speed of a moving object, e.g. cricket ball hit by batsman.
   - It causes motion in a stationary body, e.g. - a book on table moves when pushed.
   - It can stop a moving body. e.g. a moving ball stopped by force on our hand.
3. (a) Change of shape till the time the force is applied.
   (b) Change of speed and direction of ball.
   (c) Change of (shape and size) configuration of spring.

Q H. Long Answer Questions:

1. (a) Coin falls down to the glass due to inertia of rest to resist the change of position.
   (b) Inertia defined in 1st law of motion i.e. when no unbalanced external force acts on an object it continues to be in its state of rest or motion in a straight line path.
   (c) It will be same even heavier coin will have more inertia hence tendency of being at rest will be more to stay at rest.
2. (a) Newton's first law of motion states that:

   An object remains in the state of rest or of uniform motion in a straight line unless compelled to change that state by an applied unbalanced force.

   All objects resist a change in their state of motion. The tendency of undisturbed objects to stay at rest or to keep moving with the same velocity is called inertia. This is why, the first law of motion is also known as the law of inertia.

Example: A ball at rest on the ground continues to be at rest unless someone kicks it or any external force acts on it.

(b) Inertia is directly proportional to the mass of the object.

Example: When we throw 2 ball (one plastic and the other tennis) with equal speed, the tennis ball with higher mass will have higher inertia.

WORKSHEET-2

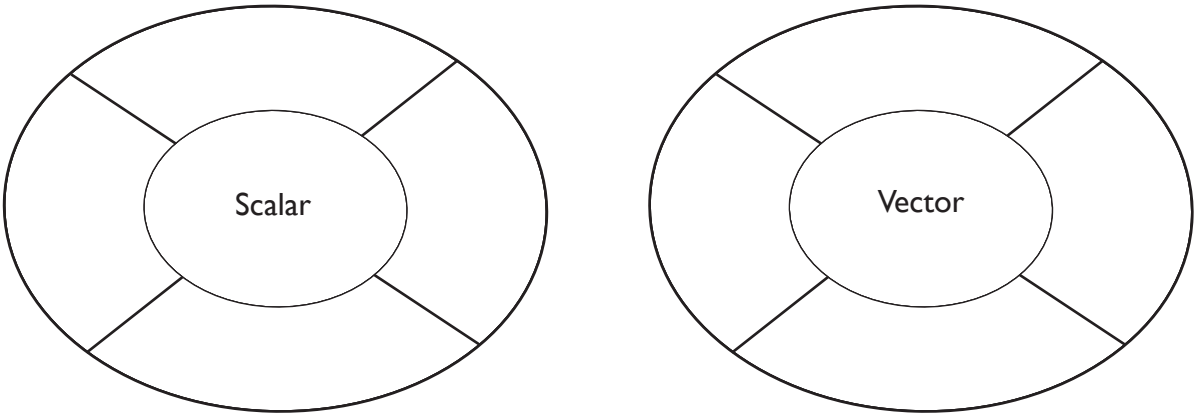
Second Law of Motion and its Applications

Q A. Multiple Choice Questions:

1. (d) 2. (c) 3. (c) 4. (c) 5. (b)

Q B. Classify the following as scalar or vector quantities:

Mass, momentum, velocity, force, speed, acceleration, time, inertia



Scalar: Mass, speed, time, inertia

Vector: Momentum, velocity, force, acceleration

Q C. Fill in the blanks using the suitable words given in the brackets:

1. vector 2. unbalanced 3. kg ms^{-1} 4. decreases 5. momentum

Q D. Give one word for the following:

1. Acceleration 2. Momentum 3. Impulse 4. kg m/s 5. Force

Q E. Very Short Answer Questions:

1. The momentum, p of an object is defined as the product of its mass, m and velocity, v.
   That is, $p = mv$
   The SI unit of momentum is kilogram-metre per second (kg m s^{-1}).
2. No. Momentum is directly proportional to the velocity of the body. Since the body's velocity is changing with a constant rate, its momentum will also increase.
3. He might injure his hand because of greater momentum imparted by the fast moving ball, because effect of force will be larger for short time.
4. SI unit of force is Newton. One newton is that force which produces an acceleration of 1 m/s^2 in a body of mass 1 kg. 1 newton = 1kg x 1 m/s^2 or 1N = 1kg m/s^2. Thus, force is measured using the second law of motion.
5. Car has more momentum because it has more mass.

Q. F Short Answer Questions (Type I):

1. A 3kg mass at 4 m/s^2 as; F = ma

   So, $F_1 = m_1 \times a_1 = 3 \times 4 = 12$ N

   where as $F_2 = m_2 \times a_2, = 5 \times 2 = 10$ N

   so, $F_1 > F_2$.

2. When a person falls from a certain height on a hard concrete floor than on a sandy surface he/ she is prone to more serious injuries as when he falls on the hard floor, he/ she comes to rest almost instantaneously so the floor exerts a large force on the person and gets injured. But if he/ she falls on sand or carpet, the time duration in which he/she comes to rest increases and so the carpet or sand exerts a less force on the person and he is not injured.

3. Given: $m_A = m_B = M$

   $v_A = v$; $v_B = 3v$

   $p_A = m_A \times v_A = Mv$

   $p_B = m_B \times v_B = M(3v) = 3Mv$

   $p_B > p_A$

   $3mv > mv$

   B has 3 times more momentum than A.

Q G. Short Answer Questions (Type II):

1. F = ma; Given F = 50 N; m = 20 kg; u = 15 m/s

   so, a = F/m = 2.5 ms^{-2}

   Now, v = u + at

   0 = 15 - 2.5 t

   $\Rightarrow$ t = 15/2.5

   t = 6 s

2. (a) This decreases that rate change of momentum of the ball by increasing time so that the force exerted by the ball on the hand reduces.

   (b) This is to increase the time of the athlete's fall to stop after making the jump. This decreases the rate of change of momentum and hence, the force.

   (c) When a car suddenly starts, the person moves backward due to inertia of rest. Similarly when the car suddenly stops, the person moved forward. Hence, the driver and person need a seat belt for their safety to prevent any injury.

3. According to Newton's Second law,

   F = ma

   F = m (v-u) t

   F = m (v-u) t

   If, F = 0

   Then, v = u

   i.e. the object continues to move with uniform velocity if no force is applied.

   If, F = 0 and u = 0, then, v is also 0 i.e. the object will stay at rest.

   According to Newton's First law of motion, an object at rest or uniform motion tends to remain at rest or in uniform motion unless an unbalanced force acts on it.

   Hence proved.

Q H. Long Answer Questions:

1. (a) Rate of change of momentum of an object is directly proportional to the applied force in the direction of force.

i.e. Consider an object of mass m having initial and final velocity applying force for some time 't'. Initial momentum P_i = mu and P_f = mv

change of momentum $p_f - p_i = m(v - u)$

Now according to 2nd law of motion, F $\propto$ rate of change of momentum,

$\Rightarrow F \propto \frac{m(v - u)}{t} \Rightarrow F \propto ma \Rightarrow F = ma$, If proportionality constant = 1.

(b) Given: m = 500 g = 0.5 kg; v = 0 m/s; u = 50 m/s ; t = 0.01s;

$F = \frac{m(v - u)}{t}$

$\Rightarrow F = \frac{0.5(50 - 0)}{0.01} = 0.5 \times 50 \times 100 = 2500$ N

F = 2500 N

2. (a) We know, F = ma

So, $m_1 = \frac{F}{a_1} = \frac{5}{8}$ Kg

$m_2 = \frac{F}{a_2} = \frac{5}{24}$ Kg

Total mass = $m_1 + m_2$

$M = \frac{5}{8}$ Kg + $\frac{5}{24}$ Kg = $\frac{5}{6}$ Kg

Acceleration produced = $\frac{F}{M} = \frac{5}{\frac{5}{6}} = 6\ ms^{-2}$

(b) Force acting on the ball = F = ?

We know that, F = ma = $m\left(\frac{v-u}{t}\right)$ ...(i)

Substituting the given values in eq. (i) , we have

Force acting on the ball = F = ma = $\frac{50}{1000}\left(\frac{30-0}{6}\right) = \frac{1}{4}$

Therefore net force acting on the ball is 1/4 N.

WORKSHEET-3

Third Law of Motion and Conservation of Momentum

Q A. Multiple Choice Questions:

1. (a) 2. (b) 3. (b) 4. (c) 5. (a)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. different 2. constant 3. action, reaction 4. unbalanced 5. may

Q C. Define the following terms:

1. Whenever two bodies interact with each other, the force exerted by the first body on the second is called action.
2. The force exerted by the second body on the first body is called reaction.
3. Recoil of a gun is moving of the gun backward when the bullet is fired.

4. A collision is an event in which two or more objects exert forces on each other for a short interval of time.
5. Momentum of a body is defined as the product of the mass and the velocity of the body.

Q D. Give reasons for the following:

1. According to Newton's third law of motion, forces always act in equal but opposite pairs. This means that when you push on a wall, the wall pushes back on you with a force equal in strength to the force you exerted.
2. Walking on the road is possible only due to the reaction force. In order to walk, we push our foot against the road and thus exert action force in backward direction.
3. Apple falls towards the earth, but the earth does not move towards the apple because acceleration is inversely proportional to mass. Earth's mass being extremly large as compared to apple, it has negligible acceleration towards the apple.
4. When passengers alight from the boat they push the boat backward and this results that the boat tends to leave the shore due to action reaction law.
5. Action and reaction force pairs don't cancel because they act on different objects. Forces can cancel only if they act on the same object.

Q E. Very Short Answer Questions:

1. According to Newton's third law of motion, for every action, there is an equal and opposite reaction. When the boy jumps from a boat, he applies force on the boat due to which boat moves backward.
2. The recoil in a gun is caused due to the forward momentum of the bullet. The force with which the bullet is fired is balanced by the recoil of the gun. So the recoil follows Newton's third law of motion.
3. Third law of motion
4. Object thrown by Shubham is an action that has an equal and opposite reaction (3rd Law of Motion).
5. Zero

Q F. Short Answer Questions (Type I):

1. Light rifle, as it will gain more backward velocity.
2. Given: $m_B = 20\ g = 0.02\ kg$; $v_B = 150\ m/s$ and $m_p = 2\ kg$; $v_p = ?$

   As $m_B \times v_B = -m_P \times v_P \Rightarrow v_P = \dfrac{-m_B \times v_B}{M_P} = \dfrac{-0.02 \times 150}{2} = -1.5\ m/s$
3. Newton's Third Law really does say that if A pushes B, then B pushes A with an equal and opposite force. However, these force do not cancel because they influence the motion of different objects. The force that A exerts on B influences B's motion, and the force that B exerts on A influences A's motion. The force on B can cancel with other forces on B - but NOT with forces on A(and vice versa).

Q G. Short Answer Questions (Type II):

1. Law of conservation of momentum: It states that the total momentum of any system of objects remains constant in the absence of any external force.

   Examples: • A bullet fired from a gun.
   • Two balls colliding with each other.

2. Three examples are:
   - Pulling an elastic band
   - Swimming or rowing a boat
   - Static friction while pushing an object
3. The separation between them will increase. Initially, the momentum of both of them is zero as they are at rest. In order to conserve the momentum the one who throws the ball would move backward. The second will experience a net force after catching the ball and therefore will move backward that is in the direction of the force.

Q H. Long Answer Questions:

1. Let mass of object A and B be m_1 and m_2 respectively.

   Let their initial velocity be u_1 and u_2. Let their final velocity be v_1 and v_2.

   We know,

   $P = mv$

   Let their initial momentum be $m_1 u_1$ and $m_2 u_2$

   Let their final momentum be m_1v_1 and m_2v_2

   Total initial momentum = $(m_1u_1 + m_2u_2)$

   Total final momentum = $(m_1v_1 + m_2v_2)$

   If F_2 is the force that acts on object B,

   $F_2 = -F_1$

   $m_2 a_2 = -m_1a_1$

   $m_2 \times \frac{v_2 - u_2}{t} = -m_1 \times \frac{v_1 - u_1}{t} \left(\because a = \frac{(v-u)}{t}\right)$

   $m_2 (v_2 - u_2) = -m_1 (v_1 - u_1)$

   $m_2 v_2 - m_2u_2 = m_1u_1 - m_1v_1$

   $(m_2v_2 + m_1 v_1) = (m_2u_2 + m_1u_1)$

   i.e. Magnitude of total final momentum = Magnitude of total initial momentum

2. (a) Mass of bullet = 10 gm = 0.01 kg

   initial velocity (u) of bullet = 1000 m/s

   final velocity (v) = 0 m/s (because it has stopped after striking sand)

   displacement of bullet = s = 5 cm = 0.05 m

   (i) Using $2as = v^2 - u^2$

   $2(a)(0.05) = 0^2 - 1000^2$

   $2a(5/100) = -1000000$

   $2a(1/20) = -1000000$

   $a(1/10) = -1000000$

   $a = -10000000 = -10^7 m/s^2$

   Acceleration of bullet is $-10^7 m/s^2 = -10000000 m/s^2$

by using F = ma

F = 0.01 (-10000000)

F = (1/100)(-10000000)

F = -100000 N

Therefore resistive force of bullet = -100000 N.

(ii) By using, v = u + at

a = (v - u)/t

-10000000 = (0 - 1000)/t

-10000000 = - 1000/t

-1/10000 = t

or

t = 10^{-4} seconds.

(b) Mass of one part m_1 = 200 gm

Its velocity v_1 = 12 m/s towards east

So, mass of other part. (m_2) = 300 – 200 =100 gm

Let its velocity be v_2.

Applying conservation of linear momentum

$m_1 v_1 + m_2 v_2 = 0$

Or 200 X 12 + 100 X v_2 = 0

$\Rightarrow v_2 = -24$ m/s

So, the second part will fly off towards west with a velocity of 24 m/s.

WORKSHEET-4

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (a) 2. (c) 3. (c) 4. (d) 5. (c)
6. (b) 7. (d)

Q B. Give reasons for the following:

1. Because our body is in inertia, if car stops but our body is still in motion due to inertia and we should get hurt.
2. To minimise the time period for which his hand remains in contact with the slab of ice.
3. In order to prevent the luggage from falling, it is advised to tie the luggage with a rope.
4. By doing this, he increases the time in which the velocity of ball will become zero.
5. Because of inertia of rest of passenger.

Q C. Differentiate between the following:

1. Balanced force means the sum of all the forces(or net force) acting on a body is zero. Balanced force doesn't affect the state of motion of object.

   Unbalanced force means the sum of all the forces acting on a body is non-zero. Unbalanced force changes the state of motion.

2. Action is the cause while reaction is the effect due to the cause.
   Action is the act that you perform on something expecting something to happen while reaction is the response that is given back.
3. Force is an external cause, while momentum is an internal property of matter.
   A force exists for a stationary object, momentum is zero for a stationary object

Q D. State whether the following statements are true or false:

1. True 2. False 3. True 4. True 5. False

Q E Very Short Answer Questions:

1. As soon as water comes out of the nozzle of the sprinkler, it exerts an equal force on the nozzle in opposite direction and the sprinkler starts rotating force on the nozzle in opposite direction.
2. F = ma
3. Zero; as at the highest point $v = 0 \Rightarrow p = m \times v \Rightarrow p = m \times 0 \Rightarrow p = 0$
4. Force
5. Inertia of rest
6. They will move in forward direction. The iron ball will move slower.
7. Steel has the highest inertia.

Q F. Short Answer Questions (Type I):

1. Due to conservation of momentum and to 3rd law of motion (action/reaction).
2. kg m/s. Velocity needs to be varied if momentum of given mass to be changed.
3. He might injure his hand because of greater momentum imparted by the fast moving ball, because effect of force will be larger for short time.
4. v = 0
   u = 50 m/s
   a = ?
   s = 0.1 m
   $v^2 = u^2 + 2as$
   in this case the bullet is decelerating so
   $v^2 = u^2 - 2as$
   $0^2 = 50^2 - 2 \times a \times 0.1$
   $2500 = 0.2a$
   $a = -\frac{2500 \times 10}{2}$
   $a = -12500$ m/s^2 (Since decelerating)
   F = ma (bullet to wall)
   $F = -(4/1000) \times 12500 = -50$N
   Average resistance offered by wall to bullet = 50N
5. Here, initial velocity of sphere (u) = 0
   Distance travelled (s) = 10 m
   Acceleration of sphere (a) = 9.8 m/s^2
   Final velocity (v) = ?
   Final velocity of sphere when it just reaches the ground can be calculated using,
   $v^2 - u^2 = 2as$
   $\Rightarrow v^2 - 0 = 2 \times 9.8 \times 10$
   $= 196$ m/s

$\therefore$ v = $\sqrt{196}$ m/s = 14 m/s

Momentum of the sphere just before it touches the ground = mv

= 1 kg × 14 m/s

= 14 kg-m/s

On reaching the ground, the iron sphere comes to rest, so its final momentum is equal to zero.

According to the law of conservation of momentum, momentum transferred to the ground = momentum of the sphere just before it comes to rest = 14 kg-m/s

Q G. Short Answer Questions (Type II):

1. Common velocity means both trolley and boy moves with same velocity

   Initial momentum = (60 x 3) + (140 x 1.5) = 180 + 210 = 390 kg m/s.

   Final momentum = (60 + 140) v = 200v

   so, on equating 200 v = 390

   v = 390/200

   v = 1.95 m/s

2. Newton's Second law of motion :- The rate of change of momentum is directly proportional to the force applied on the system.

   Force applied is directly proportional to the product of mass and acceleration .

   Let p_i, p_f be the initial and final momentums respectively.

   According to newton's second law :-

   $(p_f - p_i) / t \propto F$

   We know that,

   Momentum (P) = mv.

   Let v be the final and u be the initial velocity.

   Now,

   $(mv - mu) / t \propto F$

   $F \propto m (v - u) /t$

   $F \propto ma.$

   F = kma.

   Here, K is the proportionality constant. It's value is 1.

   Units of force are given by the units of mass and acceleration. Units of force is K gm/s^2.

   In accordance to honour the contributions of Newton, 1 kg m/s^2 is termed as 1 Newton.

   Definition: 1 Newton is the force required to move or displace a 1 kg body with 1m/s^2 acceleration.

3. Given: m = 2kg; t =10s; u = 5 m/s; v = 10m/s

   we know, $\frac{v - u}{t} = a \Rightarrow a = \frac{(10 - 5)}{10} = \frac{1}{2}$ m/s^2

   Now, F = ma = 2 x $\frac{1}{2}$ =1

   Now, F = 1N; if applied force 15s

   then, $F = \frac{mv}{t} \Rightarrow v = \frac{1N \times 15s}{2kg} \Rightarrow$ v = 7.5 m/s

4. The total momentum = constant

$P = MV_o$

$M = 100\ g, V_o = 0$. So, $P = 0$.

and

After the explosion,

$P = m_1 \times V_1 + m_2 \times V_2$

where $m_1 = m_2 = M / 2$. Putting the value

$(M / 2) \times V_1 + (M / 2) \times V_2 = 0$

$V_1 + V_2 = 0$

$V_1 = -V_2$,

So, they fly in opposite directions.

5. (a) Net force = $F_1 - F_2 = 60 - 40 = 20$ N

(b) Direction will be towards F_2.

(c) It will be 20 N of frictional force that will act towards F_1 between the surface of block and force.

Q H. Long Answer Questions:

1. (a) First law of motion: The body continues in its state of rest or motion untill unless any external force is applied to it.

(b) Third Law: To every action there is an equal and opposite reaction.

(c) Second Law: Rate of change of momentum of an object is directly proportional to the applied force in the direction of force.

i.e. Consider an object of mass m having initial and final velocity applying force F for some time 't'. Initial momentum $p_i = mu$ and final momentum $p_f = mv$

change of momentum $p_f - p_i = m(v - u)$

Now according to 2nd law, $F \propto$ rate of change of momentum,

$\Rightarrow F \propto \frac{m(v - u)}{t} \Rightarrow F \propto ma \Rightarrow F = Rma \Rightarrow F = ma$, (If $R = 1$)

(d) Initial momentum = 30 x 48 = 1440 kg m/s

After exploding in 2 parts, 18 kg has zero velocity (rest) and other part (30 - 18 = 12 kg) has velocity v.

Final momentum = 18 x 0 + 12v

momentum before = momentum after

$\Rightarrow 1440 = 12\ v$

$\Rightarrow v = 120$ m/s

2. (a) The cork is blown away.

(b) In backward direction, opposite to the motion of cork.

(c) Cork will move with greater velocity due to lesser mass.

Q I. Assertion - Reason Questions:

1. (a) 2. (c) 3. None of these

Q J. Case-based Questions:

1. (c) 2. (c) 3. (b) 4. (a), (b) and (c) 5. (b)

Chapter

9 GRAVITATION

WORKSHEET-1

Gravitation and Free Fall

Q A. Multiple Choice Questions:

1. (b) 2. (c) 3. (d) 4. (d) 5. (a)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. centripetal
2. inversely
3. Henry Cavendish
4. earth
5. gravitation

Q C. State whether the following statements are true or false:

1. False 2. False 3. True 4. True 5. False

Q D. Define the following terms.

1. Gravitation is the attractive force existing between any two objects that have mass.
2. Centripetal force is the force that acts on the body to keep it moving in a curved path.
3. Free fall is defined as when a body is moving only under the influence of the earth's gravity.
4. The law applies to objects anywhere in the universe is said to be universal law.
5. The acceleration produced in a body due to the gravitational force of the earth is called the acceleration due to gravity.

Q E. Very Short Answer Questions:

1. Every body into the universe attracts every other body with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.
2. The falling of a body from a height towards the earth under the gravitational force of earth alone is called free fall.
3. Let the mass of the object = m.

   Distance between the earth's centre and object = Radius of the earth = R.

   Therefore, Gravitational Force = F = GMm/ R^2.
4. The acceleration produced in a body due to the gravitational force of the earth is called the acceleration due to gravity.
5. Gravitational force depends on:
   - The masses of the two bodies involved.
   - The distance between the two bodies.

Q F. Short Answer Questions (Type I):

1. Becomes four times
2. Both will reach the ground at the same time.
3. Here the ball is going up against the gravity so the value of acceleration due to gravity (g) is to be taken as negative (with a minus sign)

(a) Here, initial velocity of ball (u) = 49 m/s

Final velocity of ball (v) = 0 (The ball stops at top)

Acceleration due to gravity (g) = $-9.8 m/s^2$ (The ball goes up)

And Height (h) = ?

Now, putting all these values in the formula

$v^2 = u^2 + 2gh$

$(0)^2 = (49)^2 + 2 \times (-9.8) \times h$

$0 = 2401 - 19.6\ h$

$19.6\ h = 2401$

$h = \frac{2401}{19.6}$

$h = 122.5$ m

Thus, the maximum height to which the ball rises is 122.5 metres.

(b) We will first calculate the time taken by the ball to reach the highest point by using the formula :

$v = u + gt$

Here, final velocity v = 0 (the ball stops at top)

Initial velocity u = 49 m/s

Acceleration due to gravity $g = -98\ m/s^2$ (The ball goes up)

And so putting these value in the above formula ,we get

$0 = 49 + (-9.8) \times t$

$0 = 49 - 9.8\ t$

$9.8\ t = 49$

$t = \frac{49}{9.8}$

$t = 5$ s

Thus, the ball takes 5 seconds to reach the highest point of its upwards journey. Ball will take an equal time ,that ,is 5 seconds to reach return to the surface of the earth .In ohter words the ball will take a total time of 5 + 5 =10 seconds to return to the surface of the earth.

Q G. Short Answer Questions (Type II):

1. Given, v = 0 (at highest point)

time of reach at highest point = $\frac{6}{2}$ = 3s, $a = -9.8 ms^{-2}$

(a) $V = u + at$

$0 = u + 9.8 \times 3$

$u = 29.4 ms^{-1}$

(b) $2as = v^2 - u^2$

$s = \frac{v^2 - u^2}{2a}$

$= \frac{0 - 29.4 \times 29.4}{2 \times 9.8}$

$= 44.1$

(c) t = 4s. In 3s ball reaches top, in 1s it fall down so, u = 0

Distance covered in 1s from top

$$s = ut + \frac{1}{2} at^2$$

$$\Rightarrow s = 0 + \frac{1}{2} \times 9.8 \times 1$$

$$s = 4.9 \text{ m}$$

So, ball will be 4.9 m below the top of tower after 4 s.

2. (a) Given $m' = \frac{m_e}{2}$

and $r' = \frac{r_e}{2}$

for earth, $g = \frac{Gm_e}{r_e^2}$

for new planet,

$$g' = \frac{Gm'}{r'^2}$$

$$g' = \frac{Gm_e \times (2)^2}{2 \times r_e^2}$$

$$= \frac{4 G m_e}{2 \times r_e^2}$$

$$g' = 2g$$

$$= 2 \times 9.8$$

$$g' = 19.6 \text{ m/s}^2$$

(b) When an object is dropped freely under gravitational force of earth is called free fall and its velocity changes at a constant rate causing a uniform acceleration of 9.8 m/s^2.

3. As we know, $F \propto \frac{m_1 m_2}{r^2}$

(a) If $m_1 = 2m_1$

then $F \propto 2m_1 m_2$

force will be twice.

(b) $F \propto \frac{1}{r^2}$

if r = 3r

$$F \propto \frac{1}{(3r)^2}$$

$$F \propto \frac{1}{9r^2}$$

F will decrease by a factor of 9.

(c) both masses are doubled

i.e $m_1 = 2m_1$ and $m_2 = 2m_2$

$F \propto m_1 m_2$

$F \propto 2m_1 2m_2$

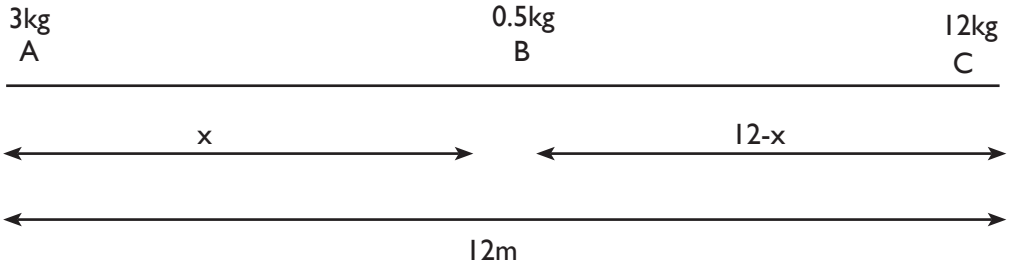
$F \propto 4m_1 m_2$

Force will be 4 times.

Q H. Long Answer Questions:

1. Given, m_1 = 3 kg and m_2 = 12 kg

Let the mass, m_3 = 0.5 kg be placed at a distance of x from m_1 as shown in figure.



Then, force acting on m_3 due to m_1 is equal and opposite to the force acting on m_3 due to m_2.

$\therefore F_{31} = F_{32}$

$$\frac{Gm_1m_3}{x^2} = \frac{Gm_3m_2}{(12-x)^2}$$

$$\Rightarrow \frac{3}{x^2} = \frac{12}{(12-x)^2}$$

$$\Rightarrow \left(\frac{12-x}{x}\right)^2 = \frac{12}{3} = 4$$

$$\Rightarrow \frac{12-x}{x} = 2$$

$$\Rightarrow 12 - x = 2x$$

$$\Rightarrow 12 = 3x$$

$$\Rightarrow x = 4 \text{ m}$$

The position of required point is at a distance 4 m from the mass 3 kg.

2. (a) Let us consider two bodies A and B of masses m_1 and m_2 which are separated by a distance r.

Then the force of gravitation (F) acting on the two bodies is given by

$F \alpha (m_1 \times m_2)$

and

$F \alpha \frac{1}{r^2}$

Combining both equations, we get

$F \alpha \frac{m_1 \times m_2}{r^2}$

$F = G \frac{m_1 \times m_2}{r^2}$

where G is constant, known as universal gravitational constant.

Here, if m_1 and m_2 of two bodies are of 1 kg and the distance (r) between them is 1 m , then

The force of gravitation = F = G

Thus, the gravitational constant G is numerically equal to the force of gravitation which exists between two bodies of unit masses kept at a unit distance from each other.

(b) Acceleration due to gravity = g

mass of planet = M

radius = R

according to universal law of gravitation

$f = GMm/r^2$ (i)

When a object fall vertically on towards the earth, then

$f = mg$ (ii)

using equation (i) and (ii), we get

$mg = GMm/r^2$

$g = GM/r^2$

WORKSHEET-2

Mass, Weight, Thrust and Pressure

Q A. Multiple Choice Question:

1. (b) 2. (c) 3. (d) 4. (c) 5. (b)

Q B. Fill in the blanks using the suitable words given in the brackets:

1. Larger 2. thrust 3. maximize 4. 6 5. weight

Q C. Given one word for the following:

1. Mass 2. Pressure 3. Weight 4. Newton 5. Volume

Q D. Differentiate between the following:

1. Mass: Mass is the measure of the amount of matter in a body. Mass is denoted using m or M. Weight: Weight is the measure of the amount of force acting on a mass due to the acceleration due to gravity. Weight usually is denoted by W.
2. Thrust: It is a force that acts normally on a surface. It is a vector quantity.

   Pressure: It is the thrust per unit area of surface. It is a scalar quantity.
3. Gravity of Earth: The earth's gravity is very precisely mapped. The earth gravity is strong enough to sustain and withstand an atmosphere on the earth.

   Gravity of Moon: The moon's gravity is very poorly mapped. There is no atmosphere present on the moon gravity.

Q E. Very Short Answer Questions

1. When mass of object (m) = 50 kg, g = 10 m/s^2

   So, weight = m×g = 50×10 = 500 N

   Weight of object on moon is $1/6^{th}$ of that on earth

   $$\Rightarrow \text{weight of moon} = \frac{1}{6} \times \text{weight of earth}$$

   $$= \frac{500}{6}$$

   $$= 83.33$$

   $$\frac{\text{weight on earth}}{\text{weight of moon}} = \frac{500}{83.33}$$

2. Thrust is the force acting on an object perpendicular to its surface.

   SI unit is Newton (N).
3. Weight on earth = 100 N

   weight on moon = $\frac{1}{6}$ x weight on earth

   $= \frac{1}{6} \times 100 = 16.66$ N
4. Zero
5. At the poles

Q F. Short Answer Questions (Type I):

1. Given, m = 30 kg on earth G = Universal gravitational constant

   weight = m×g = m × $\frac{GM}{R^2}$ M = Mass of earth

   R = Radius of earth

   Mass of the body remains same on surface of other planets.

   Gravity on a planet g' = $\frac{GM'}{R'^2}$

   and given $M' = \frac{M}{9}$ and $R' = \frac{R}{2}$

   $\Rightarrow g' = \frac{GM}{R^2 \times 9} \times 4$

   $g' = \frac{4}{9}\frac{GM}{R^2}$

   $= \frac{4}{9} \times g$

   weight on planet = $m \times g' = 30 \times (4/9) = \frac{40}{3} = 13.33N$

2. (a) w = 600 N, g = 10 m/s^2

   $w = mg \Rightarrow m = \frac{600}{10} = 60$ kg

   (b) The gravitational acceleration is lower on the moon than on the earth due to which a person experiences less gravitational force on the moon. This is the reason why one can jump higher on the surface of the moon than on the earth.

3. Pressure = force/area

   Area of base = 4 x 2 = 8 sq m

   We know that the thrust is the reaction force.

   and force = weight of the water

   weight of the water = mass of water x gravity

   mass of water = volume x density of water

   volume of water = 4 x 2 x 2 =16 cubic metre

   density of water = 1000 kg/m^3

   mass = volume x density

   mass of water = 16 x 1000 =16000 kg

   Force = thrust = weight of the water =16000 × 9.8 = 156800 N

Q G. Short Answer Questions (Type II):

1. Weight of a body of mass m on the earth.s surface , $W = mg = \frac{GMm}{R^2}$, where M and R are the mass and the radius of the earth.

   when mass remains constant and radius doubles, then weight $W_1 = \frac{GMm}{(2R)^2} = \frac{GMm}{4R^2}$

   $\therefore \frac{W_1}{W} = \frac{GMm}{4R^2} \times \frac{R^2}{GMm} = \frac{1}{4}$

   Hence, new weight would be $\frac{1}{4}$ the of the present weight.

2. (a) 1 pascal is the pressure exerted or experienced by a body or object when a thrust of 1N acts on an area of 1metre square.

   mass of boy = 40 kg

   weight of boy = 40 x g = 40 x 10 = 400 N

Area = 0.04 m^2

Pressure = $\frac{\text{Force}}{\text{Area}}$

$= \frac{400}{0.04}$

P = 10000 Pa

3. (a) Camels can walk easily in the desert because of their wide feet. Their wide feet allow the weight of their body to act on a larger surface of land reducing the pressure exerted on the land by the camel.

(b) This is because the area of a sharp pin is less and hence it exerts a greater pressure and pierces easily as compared to that of a blunt pin.

(c) A truck or motor bus has wider tyres so that the pressure acting on the road due to weight of the truck may be small.

Q H. Long Answer Questions:

1. We know that $g = \frac{GM}{R^2}$

Also, w = mg

$W = \frac{GMm}{R^2}$

Let the mass of an object be m. Let its weight on the moon be W_m. Let the mass of the moon be M_m and its radius be R_m By applying the universal law of gravitation, the weight of the object on the moon will be

$Wm = \frac{GM_m \times m}{R^2_m}$ (1)

Let the weight of the same object on the earth be W_e. The mass of earth is M and its radius is R.

$W_e = G \frac{Mxm}{R^2}$ (2)

Substituting the values in equations (1) and (2), we get

$W_m = G \frac{7.36x10^{22}xm}{(1.74x10^6m)^2}$

$W_m = 2.431 \times 10^{10} G \times m$ (3)

And $W_e = 1.474 \times 10^{11} G \times m$ (4)

Dividing equation (3) By (4)

$\frac{W_m}{W_e} = \frac{2.431 \times 10^{10}}{1.474 \times 10^{11}} = 0.165 = \frac{1}{6}$

$\frac{\text{Weight of the object on the moon}}{\text{Weight of the object on the earth}} = \frac{1}{6}$

Weight of the object on the moon = $\frac{1}{6}$ x its weight on earth

2. (a) Here, F = 20 N, W = 9.8 N, m = ?, a = ?

$m = \frac{W}{g} = \frac{9.8}{9.8} = 1kg$

$a = \frac{F}{m} = \frac{20}{1} = 20\ m/s^2$.

(b) Let present mass of earth = M

present radius of earth = R

present acceleration due to gravity = g

present weight = W

mass = m

$\therefore$ W = mg

and $g = \frac{GM}{R^2}$

Now M' = M + 10% of M = $M + \frac{M}{10} = \frac{11M}{10}$

$\therefore g' = \frac{GM'}{R^2} = \frac{G}{R^2} \times \frac{11M}{10}$

$= \frac{11GM}{10R^2}$

$\therefore \frac{g'}{g} = \frac{11GM}{10R^2} \times \frac{R^2}{GM} = \frac{11}{10}$

or $g' = \frac{11}{10} g$

Multiplying both sides by m, we get

$mg' = \frac{11}{10} mg$

or $W' = \frac{11}{10} W = 1.1 W$

Thus, our weight will become 1.1 times to our original weight.

(c) R' = 2R

$\therefore g' = \frac{GM}{(R')} = \frac{GM}{(2R)^2} = \frac{GM}{4R^2}$

or $g' = \frac{1}{4} g$

Multiplying both sides by m, we get

$mg' = \frac{1}{4} mg$

or $W' = \frac{1}{4} W$

Hence, weight will become one fourth of our original weight.

WORKSHEET-3

Buoyancy, Archimedes' Principle and Relative Density

Q A. Multiple Choice Questions:

1. (b) 2. (b) 3. (b) 4. (c) 5. (b)

Q B. State whether the following statements are true and false:

1. False 2. True 3. False 4. False 5. False

Q C. State the relation between buoyant force (F_B) and weight of the block (W) in each of the cases shown below:

1. $F_B = W$
2. $F_B > W$
3. $F_B = W$
4. $F_B < W$

Q D. Match the following:

Column A	Column B
1. Buoyant force	(c) Archimedes' principle
2. Relative density	(d) No unit
3. Density	(a) kg m^{-3}
4. Pressure	(e) Force per unit area
5. Lactometer	(b) Purity of milk

Q E. Very Short Answer Questions:

1. Relative Density = $\frac{\text{Density of substance}}{\text{Density of water}}$

$$7.8 = \frac{\text{Density of substance}}{1}$$

Density of substance = 7.8 g/cm^3

2. It is decreased and object appears lighter than actual.
3. To determine purity of milk.
4. Due to buoyant force acting on it.
5. No unit, it is dimensionless because it is given by same quantities division i.e

$$\textbf{Relative Density} = \frac{\text{Density of substance}}{\text{Density of water}};$$

which cancels out each other.

Q F. Short Answer Questions (Type I):

1. Liquid A
2. Mass of substance m = 50 g

Volume of substance v = 20 cm^3

Density of substance = $\frac{M}{V}$

$= \frac{50}{20}$

= 2.5 gcm^{-3}

As density of water is 1g/cm^3 and Density of substance is more than it.

Hence, it will sink.

3. Greater buoyant force will be experienced in salt water as density of salt solution will be more. Same holds good for reduced size of cube.

Q G. Short Answer Questions (Type II):

1. Density is defined as mass of substance per unit volume i.e. D = $\frac{M}{V}$

Relative density is the ratio of density of a substance to that of water.

$$\text{i.e. Relative Density of substance} = \frac{\text{Density of substance}}{\text{Density of water}}$$

Given:

Density of water = 1000 kg/m^3

Relative Density of substance = 19.3

Density of gold = Density of water × Relative Density of gold

= 1000 × 19.3

= 19300 kg/m^3

2. (a) According to Archimedes'principle, the upthrust exerted by a fluid on an object immersed in it is equal to the weight of the fluid displaced by that object.

   (b) Applications:

   - In determining relative density of a substance.
   - The lactometers used to determine purity of milk.

3. (a) Buoyancy is a tendency of water to exert an upward force on an object immersed in it.

   An object floats or sinks when placed on the surface of the water because of two reasons.

   * If its density is greater than that of water, an object sinks in water.

   * If its density is less than that of water, an object floats in water.

   (b) Water displaced =100 cc – 50 cc = 50 cc

   So, mass of water displaced = Volume of water displaced × density of water

   = (50 cc × 1 g/cc)= 50 g

Q H. Long Answer Questions:

1. (a) The object will float in a liquid if the weight of object is equal to the weight of liquid displaced by it.

   (b) Life jackets do not absorb water neither add to weight and are far less denser than water so it floats easily and when we wear, it reduces our relative density to water. The buoyancy life jacket provides, from being less denser than us and keeps us floating in any circumstance.

   (c) The volume of a 500 g sealed packet is 350 cm^3. The volume of sealed packet is greater than density of water so it will sink. Now, density of water is 1g/cm^3. Using Archimedes Principle,

   $$\text{The volume of water} = \frac{\text{Mass of water}}{\text{Density of water}}$$

   $$= \frac{350}{1}$$

   $$= 350\ cm^3$$

   $\therefore$ Weight of water displaced is 350 cm^3.

2. (a) (i) Life jackets do not absorb water neither add to weight and are far less denser than water so it floats easily and when we wear, it reduces our relative density to water. The buoyancy life jacket provides, from being less denser than us and keeps us floating in any circumstance.

   (ii) Sea water is more denser than river water, hence he/she tend to float higher because of much higher buoyant force acting on an body making it easier to swim.

   (b) A steel needle has more density than water and hence it sinks. While a ship made up of steel has a definite structure in which inner part is hollow and contain air in it which makes it less denser than density of water and hence it floats over.

   OR

   Ship displaces more water than needle as volume of ship is more than that of needle. Since upthrust depends upon volume of object. So, more the volume, more upthrust acts on it and object floats.

   (c) Upthrust depends on the volume of the submerged block and the density of the displaced liquid. So, the more the volume of the body submerged, the more the upthrust. Here, the liquid is the same but the volume of the wood is greater than that of the iron block. Hence, the upthrust on the wooden block will be more than that on the iron block of the same mass.

WORKSHEET-4

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (a) 2. (a) 3. (d) 4. (b) 5. (b)
6 (b) 7. (d)

Q B. Complete the table given below:

Quantity	SI Unit	Symbol of unit
Pressure	Pascal	Pa
Thrust	Newton	N
Universal Gravitational Constant	Nm^2kg^{-2}	Nm^2kg^{-2}
Acceleration due to Gravity	Metre per second square	$m\ s^{-2}$
Weight	Newton	N
Mass	Kilogram	kg

Q C. Fill in the blanks using the suitable words given in the brackets:

1. constant 2. Weight 3. N 4. decrease 5. more

Q D. Give reason for the following statements:

1. It is equal to the weight of the fluid displaces by the object.
2. Ice has lesser density than water due to cage-like structure.
3. Weight varies with the value of 'g' from place to place.
4. Because the value of 'g' near the erath's surface is nearly constant.
5. The radius of earth at equator is slighty greater than that at its poles.

Q E. Very Short Answer Questions:

1. Because mercury is more dense than steel, and water is less dense than steel.
2. Archimedes' principle
3. The value of g changes with altitude while the value of G remains constant.
4. An upward buoyant force and a downward force of gravity.
5. Zero
6. Mass of an object
7. (i) when the volume of the both balls are equal.
   (ii) when their volume of water displaced is equal.

Q F. Short Answer Questions (Type I):

1. $m_1 = m_2 = 50$ kg, $r = 0.5$ m

$$F = \frac{Gm_1m_2}{r^2}$$

$$= \frac{6.67\times10^{-11}\times50\times50}{0.5\times0.5}$$

$F = 6.67\times10^{-7}$ N

2. The importance of universal law of gravitation is that it explains the motion of planets around the sun, the motion of moon around the earth, and the motion of artificial satellites around the earth. It also explains the phenomena of rainfall, snowfall, and flow of water in rivers on the earth.
3. A thin strap will have less or small area of contact which will exert more pressure on the shoulder of a person carrying it. Hence, it will be difficult to hold a bag with thin and strong string.
4. The factors on which buoyant force depends are:
   - Volume of the liquid displaced
   - Volume of the body submerged in liquid
   - Density of the liquid
   - Acceleration due to gravity
5. Given: (i) When the stone from the top of the tower is thrown,

   Initial velocity u = 0

   Distance travelled = x

   Time taken = t

   Therefore,

   $s = ut + \frac{1}{2} gt^2$

   $x = 0 + (1/2)\, gt^2$

   $x = 5\, t^2$ (1)

   When the stone is thrown upwards,

   Initial velocity u = 25 m/s

   Distance travelled = (100 – x)

   Time taken = t

   $s = ut + \frac{1}{2} gt^2$

   $(100 - x) = 25t + (1/2) \times 10 \times t^2$

   $x = 100 - 25\, t + 5t^2$ (2)

   From equations (1) and (2)

   $5t^2 = 100 - 25t + 5t^2$

   $t = (100/25) = 4$ sec

   After 4sec, two stones will meet

   From (1)

   $x = 5t^2 = 80$ m

   Putting the value of x in

   = (100 - 80) = 20 m.

   This means that after 4 sec, 2 stones meet a distance of 20 m from the ground.

Q G. Short Answer Questions (Type II):

1. Let the height of the tower be 'h'. Suppose it takes 'n' second to reach the ground. Thus, in nth second the body covers a height (16h/25).

   It starts from rest, thus,

$S_n = u + (a/2)(2n - 1)$ [this is the equation to find the distance travelled in nth second]

$(16h/25) = 0 + (9.8/2)(2n - 1)$

$16h/25 = 4.9(2n - 1)$ (1)

Again, the body reaches the ground in 'n' second. So, the distance travelled in 'n' second is,

$h = 0 + ½ gn^2$

$h = (9.8/2)n^2$

$h = 4.9n^2$ (2)

From (1) and (2), we have,

$16(4.9n^2)/25 = 4.9(2n - 1)$

$16n^2 = 25(2n - 1)$

$16n^2 - 50n + 25 = 0$

$n = 0.625$ or 2.5

Here, n = 0.625 s is not possible. So, the time in which the body hits the ground is 2.5 s.

Putting value of n in equation (2), we get

$h = 4.9n^2 = 4.9 \times 2.5 \times 2.5 = 30.625$ m.

This is the height of the tower.

2. Since the aeroplane is directly above a target at a height of 1000 m, the distance by which bomb will miss the target is equal to the horizontal distance covered by bomb during its fall

Horizontal distance (d) = Time of fall × Horizontal speed

$\Rightarrow d = t \times v$

$\Rightarrow d = \sqrt{\frac{2h}{g}} \times 500$ km/h

$\Rightarrow d = \sqrt{\frac{2 \times 1000}{10}} \times 500 \times (5/18)$ m/s

$\Rightarrow d = 1964.2$ m

3. First law: All planets revolve round the sun in eliptical orbits with sun at one of the foci.
Second law: A line joining any planet to the sun sweeps out equal areas in equal intervals of time.
Third law: The square of the period of any planet around the sun is proportional to the cube of the planet's mean distance from the sun.

4. Let mass of the first body be m_1.

Let mass of the second body be m_2.

Force on 1st body Force on 2nd body

$\frac{GMm_1}{R^2} = \frac{GMm_2}{R^2}$

G and G cancel, M and M cancel R^2 and R^2 cancel

This leaves $m_1 = m_2$

Hence proved.

5. The gravitational attraction between the planet and sun is the source of centripetal force.

This force depends upon mass of two objects between which it acts and the distance between them i.e.

$F \propto \frac{m_1 m_2}{r^2}$; m_1 = mass of one object

m_2 = mass of second object

r = distance between them

If this force will be zero then the planet will be moving into tangential path from the point on its rotational orbit.

Q H. Long Answer Questions:

1. (a) Universal law: If we drop a stone of mass m from a distance R from centre of earth of Mass M, then force exerted by earth on stone is

$$F = \frac{GM}{R^2} \qquad (1)$$

Second law: Now, gravitational force acting on stone

$$F = m \times g \qquad (2)$$

from (1) and (2)

$$\frac{GM}{R^2} = mxg$$

$$g = \frac{GmM}{R^2}$$

(b) u =10 m/s

v = 0 (top)

s =120 m

g =10 m/s^2

$$s = ut + \frac{1}{2}gt^2$$

$$120 = 10 \times t + \frac{1}{2}\ 10\ t^2$$

$$\Rightarrow 5t^2 + 10t - 120 = 0$$

$$\Rightarrow t^2 + 2t - 24 = 0$$

Using quadratic equation, we get

$$t = 4 \text{ sec}$$

Time taken to reach the ground

= 2 x time taken to reach top

= 2 x 4 = 8 s

$\therefore$ Time taken to reach ground is 8 s.

2. (a) The weight depends upon acceleration due to gravity for any certain place.

i.e. w = mg

g is found to be maximum at poles and minimum at equator.

Weight on equator will also be less than that at poles.

Mass is constant everywhere in the universe.

(b) The weight will be more at poles than at equator.

(c) At the centre.

(d) If there is no acceleration due to gravity then object may be falling but not under free fall and would not be attracted to the earth and everything will be floating in the air.

Q I. Assertion-Reason Questions:

1. (a) 2. (c) 3. (a)

Q J. Case-based Question:

1. (d) 2. (a) 3. (b) 4. (c) 5. (d)

Chapter 10 WORK AND ENERGY

WORKSHEET-1

Concept of Work and Rate of Doing Work

Q A. Multiple Choice Questions:

1. (d) 2. (c) 3. (d) 4. (c) 5. (c)

Q B. State whether the work done is positive, negative or zero in each of the following cases:

(a) Zero (b) Positive (c) Negative

Q C. State whether the following statements are true or false:

1. False 2. True 3. False 4. False 5. True

Q D. Give reasons for the following:

1. Because work has only a magnitude but no direction.
2. While holding a book, the force you exerted is upwards (to support its weight) so no work is done on the book.
3. Work done (W) = force x displacement.

   Hence, work is said to be done when there is displacement. In this case, the wall does not displace from its position even though the force is applied and since displacement is zero work done is said to be zero.
4. In the given case, the direction of force (vertically downward) and displacement (vertically upward) are opposite to each other. Hence, the sign of work done is negative.
5. Gravitational force is acting in vertically downward direction and displacement is in horizontal direction. Hence, work done by the labourer is zero.

Q E. Very Short Answer Questions:

1. When the force acting on the object is opposite to the force of gravity.
2. Force (F) = 10 N

   Distance (s) = 5 m

   Work done = Force x Distance

   = 10 x 5

   = 50 Nm = 50 J
3. Work is said to be done whenever a force acts on a body and the body moves in the direction of the force. SI unit of work is joule (J).
4. SI unit of power is watt (W). When a body does work at the rate of 1 joule per second, its power is 1 watt.
5. No. Because he has applied the force but the object has not displaced.

Q F. Short Answer Questions (Type I):

1. The work done by earth in moving around sun is zero. Because the centripetal force acting on the earth is perpendicular to the motion of earth.

2. Mass of lady (m) = 60 kg

Time (t) = 30 s

Total steps = 70

Height of each step = 15cm

Total height of all steps = 70 x 15 cm = 1050 cm

= 10.5 m

Work done = mgh = 60 x 10 x 10.5 = 6300 J

$$\text{Power} = \frac{w}{t} = \frac{6300}{30} = 210\,W$$

3. Power is inversely proportional to time, so the worker who completes the work in 3 hours has more power.

Q G. Short Answer Questions (Type II):

1. (a) The rate doing work is called power. SI unit of power is watt (W).

(b) Mass of boy (m_1) = 40kg

Mass of box (m_2) = 20kg

Height of building (h) = 15m

Time (t) = 25s

work done = mgh

$= (m_1 + m_2) \times 10 \times 15$

$= 60 \times 10 \times 15$

$= 9000\ J$

$$\text{Power} = \frac{w}{t} = \frac{9000\,J}{25\,s} = 360\,\text{watt}\,(W)$$

2. (a) Here, $\theta = 90^0$

Work done = F. S cos θ = F. S x cos 90^0 = 0

Hence, the work done is zero.

(b) Force (F) = 50 N

Distance (S) = 4 m

$\theta = 60^0$

Work done = F. S cos θ

$= 50 \times 4 \times \cos 60^0$

$= 100\ J$

3. Given : Final velocity (v) = 25 m/s, distance (s)= 20 m, mass (m) = 10 kg

According to the question:

$v^2 - u^2 = 2as$

$25^2 - 0^2 = 2 \times a \times 20$

$625 = 40\ a$

$625/40 = a$

Acceleration (a) = 15.625

Now, we shall find the force applied

F = ma

F = 10 × 15.625

F = 156.25 N

Work = F x s

Work = 156.25 x 20

Work = 3125 J

The work done in changing the velocity of the body here is 3125 J.

Q H. Long Answer Questions:

1. (a) Volume of water (V) = 30000 L = 30000×10^{-3} m^3 = 30 m^3

Density of water (ρ) =1000 kg/m^3

Mass of water (m) = ρ x V = 1000 x 30 = 30000 kg

Work done (W) = mgh = 30000 x 10 x 45 = 1.35×10^7 J

Time (t) =10 min = 10 x 60 = 600 s

Power (P) = $\frac{W}{t} = \frac{1.35 \times 10^7}{600} = 22500$ W

(b) (i) Force (F) = mass x acceleration = m x a

here, a = g = 10 ms^{-2}

F = 250 x 10

= 2500 N

distance (s) = 1 m

Workdone = force x distance = 2500 x 1Nm = 2500 J

(ii) Zero; as the box does not move at all, while holding it.

(iii) In order to hold the box, men are applying a force which is opposite and equal to the gravitational force acting on the box. While applying the force, muscular effort is involved. So, they feel tired.

2. Mass of car A (m_A) = mass of car B (m_B) = 1000 kg

initial velocity of car A (u_A) = 36 km/h = 10 m/s

initial velocity of car B (u_B) = 0 m/s

final velocity of car A (v_A) = 0 m/s

final velocity of car B (v_B) = ?

Applying law of conservation of momentum.

$m_A u_A + m_B u_B = m_A v_A + m_B v_B$

or, 1000 x 10 + 1000 x 0 = 1000 x 0 +1000 × v_B

v_B= 10 m/s = 36 km/h

The speed of car B after collision is 10 m/s = 36 km/h

WORKSHEET-2

Energy - Kinetic Energy and Potential Energy

Q A. Multiple Choice Questions:

1. (a) 2. (a) 3. (d) 4. (d) 5. (d)

Q B. Match the followings:

Column A	Column B
1. Chemical energy into mechanical energy	(a) Car engine
2. Heat energy into mechanical energy	(d) Steam engine
3. Mechanical energy into electrical energy	(a) Electric generator
4. Electrical energy to mechanical energy	(b) Electric motor
5. Light energy into electrical energy	(f) Solar cell
6. Electrical energy into Light energy	(e) Electric bulb

Q C. A body of mass 10 kg falls from the height of 10 m towards the earth. Complete the following table, given ($g = 10\ m/s^{2)}$):

Height from the earth (m)	Potential energy (J)	Kinetic energy (J)	Mechanical energy (J)
10 m	1000 J	0 J	1000 J
0 m	0 J	1000 J	1000 J
5 m	500 J	500 J	1000 J
2 m	200 J	800 J	1000 J

Q D. Fill in the blanks using the suitable words given in the brackets:

1. 3.6×10^6 J 2. potential 3. constant 4. kinetic 5. power

Q E. Very Short Answer Questions:

1. Power of electric oven (P) = 2500 W, time (t) = 4 hours
   Total energy consumed = P x t
   = 2500 x 4
   = 10 KWh
   = 10 unit
2. Potential energy of body A = $mgh_1 = mgh$
   Potential energy of body B = $mgh_2 = 2mgh$
   $$\text{Ratio} = \frac{mgh}{2mgh} = \frac{1}{2} = 1:2$$
3. K. E. = $\frac{1}{2}\ mv^2$
   Where v is the velocity of object
   $\Rightarrow$ K. E. $\propto v^2$
4. An electric fan converts electric energy to mechanical energy.
   During photosynthesis light energy is converted into chemical energy.
5. Gravitational potential energy (G. P. E.) = mgh

Q F. Short Answer Questions (Type I):

1. Mass of object (m) = 1kg
   Kinetic energy (K. E.) = 4 J
   $\frac{1}{2}\ m\ v^2 = 4$
   $\frac{1}{2} \times 1 \times v^2 = 4$
   $v^2 = 8$

$v = 2\sqrt{2}$ m/s

If velocity is increased by 50% new velocity, $v' = 3\sqrt{2}$

New kinetic energy

$= \frac{1}{2} m \times v'^2$

$= \frac{1}{2} \times 1 \times (3\sqrt{2})^2$

$= \frac{1}{2} \times 9 \times 2 = 9$ J

2. An object possesses gravitational potential energy if it is positioned of a height above the zero height. An object possesses elastic potential energy if it is of a position on energy medium other then the equilibrium position. Storing of water in the overhead tank is an example of gravitational potential energy while stretching of a rubber band is an example of elastic potential energy.
3. So that dam store the potential energy and the flow converts that energy into kinetic energy. More the height, greater the potential energy.

Q G. Short Answer Questions (Type II):

1. Kilowatt - hour (kwh) is the commercial unit of energy. One kilowatt-hour is defined as the amount of energy that is consumed by a machine in one hour working at a constant rate of one kilowatt.

   SI unit of energy is joule.

   Now,

   1 kWh = 1000 Wh

   Now, we know that 1 hour = 60 x 60 minutes = 3600 minutes

   So,

   1 kWh = 1000 W x 3600 s

   1 kWh = 3600000 Joules

   1 kWh = 3.6×10^6 Joules.

   Hence, the relation between commercial and unit of electric energy with S.I unit of energy is 1 kWh = 3.6×10^6 Joules.

   Power (P) = 500 W = $\frac{1}{2}$ kW

   Time (t) = 10 hours

   Energy consumed in one day = P x t

   $= \frac{1}{2} \times 10$

   = 5 kW h

   Energy consumed in month of April = 5 kWh x 30

   = 150 kWh

   = 150 units

2. Mass of ball (m) = 0.5 kg

   Initial speed (u) = 5 m/s

   Final speed (v) = 3 m/s

   Change in K. E. = Final K. E. - Initial K. E.

   $= \frac{1}{2} mv^2 - \frac{1}{2} mu^2$

   $= \frac{1}{2} m (v^2 - u^2)$

   $= \frac{1}{2} \times 0.5 (9 - 25)$

   = 4 J.

3. Consider a body with mass m, raised through a height h, from the ground.
   Force required to raised the object = Weight of object = mg
   Object grains energy equal to the work done on it.
   Work done on the object against gravity is W.
   W = Force x displacement
   = mg x h
   W = mgh
   P. E. = mgh

Q H. Long Answer Questions:

1. Let an object of mass m, starts from rest and attains a uniform velocity v, after a force F is applied on it.
   Let during this period the object be displaced by distance s.
   thus, work done on object (W) = F x s
   Let the acceleration produced after applying force on object be a.

   So, using third equation of motion, we have:

   $v^2 - u^2 = 2as$

   $s = \frac{v^2 - u^2}{2a}$

   Also, force, F = ma

   $W = ma \times \frac{v^2 - u^2}{2a}$

   $W = \frac{1}{2} m (v^2 - u^2)$

   $W = \frac{1}{2} mv^2$ (As, u = 0)

   $(K.E. = \frac{1}{2} mv^2)$

   Mass (m) = 70kg

   Height (h) = 10m

   PE = mgh = 70 x 10 x 10 = 7000 J = 7 KJ

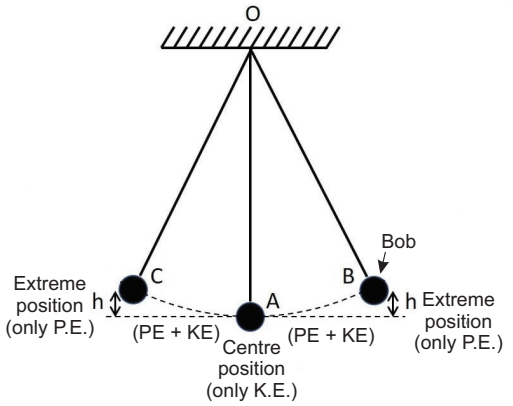
   At half way down, the potential energy of the object will be 1960/2 = 980 J.

   At this point, the object has on equal amount of potential energy and kinetic energy.

   Hence, kinetic energy = 980 J.

2. (a) Law of conservation of energy states that energy can neither be created nor destroyed, but it can be transformed from one form to another. The total energy before and after the transformation remains the constant.

   (b) In case of swinging pendulum, the bob moves in to and from motion and at mean position it has maximum K. E. This K. E. transforms into P. E. while going from mean to extreme position and this process repeats.



WORKSHEET-3

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (c) 2. (c) 3. (c) 4. (c) 5. (c) 6. (a) 7. (c)

Q B. Give one word for the following:

1. Kilowatt hour
2. Kinetic Energy
3. Free fall
4. Energy
5. Elastic potential energy

Q C. Differentiate between the following:

1. Work is the ability to supply force and a change in distance to an object. Work cannot be transformed from one form to the other.

   Energy is the ability to supply or create work. Energy can be transformed from one form to another.
2. A watt (W) is a unit of measurement of power. Watts therefore refer to the power of any device.

   A kilowatt hour (kWh) is a unit of measurement of energy. A kilowatt hour therefore refers to the consumption of any device.
3. Kinetic energy is the energy of motion. By the process of collision, kinetic energy can be easily transferred from one body to another.

   Potential energy is the energy of position. There is no way to transfer potential energy from one body to another.

Q D. Fill in the blanks using the suitable words given in the brackets:

1. decreases 2. conserved 3. velocity 4. kilowatt 5. scalar

Q E. Very Short Answer Questions:

1. Mass of horse (m_1) = 250 kg

   Mass of dog (m_2) = 25k g

   $v_1 = v_2 = v$

   Kinetic energy of horse = $\frac{1}{2}\ m_1 v_1^2 = \frac{1}{2} \times 250 \times v^2$

   Kinetic energy of dog = $\frac{1}{2} m_2 v_2^2 = \frac{1}{2} \times 25 \times v^2$

   So, horse possesses more kinetic energy.
2. If all the forces are balanced.
3. When the direction of force acting on an object is opposite to the direction of displacement, the work done by force is negative.
4. (a) Object A loses energy.

   (b) Object B gains energy.
5. No, because its potential and kinetic energy are zero. Any object cannot have momentum even if its mechanical energy is zero.
6. $V_1^2 / V_2^2 = 1/9$. Therefore, ratio is 1:9.
7. A has more potential energy.

Q F. Short Answer Questions (Type I):

1. When the object is displaced perpendicular to the force applied, the work done is zero.
2. Iron object. Because the iron object has more potential energy than wooden object.

3. Power (P) = 40 w

Time (t) = 6 h

Energy consumed by the tube in one day = Power x time

= 40 W x 6 h

= 240 Wh

= 0.24 kWh = 0.24 units

4. Initial velocity of car (u) = 30 km/h

Final velocity of car (v) = 60 km/h

mass of car = 1500 kg

Work done = change in kinetic energy

$= \frac{1}{2} m(v^2 - u^2)$

$= \frac{1}{2} \times 1500 (60^2 - 30^2)$

$= \frac{1}{2} \times 1500 \times 2700$

$= 150 \times 2200$

= 2025000 J = 2025 k J.

5. Mass = m kg

Let, weight of the man on earth = W_1

Weight of the man on planet A = W_2

Given : $W_2 = \frac{W_1}{2}$

or $mg' = \frac{mg}{2}$

or $g' = \frac{g}{2}$

potential energy used by him to jump height of 0.4 m on earth is 0.4 mg.

if he applies same potential energy on planet A with acceleration due to gravity g' he would move a height h'

so, mgh = mg'h'

since,

$\frac{g}{2} = g'$

$g \times 0.4 = \frac{g}{2} h'$

So, h' = 0.8 m

Hence, he can jump on the planet A up to height of 0.8 m.

Q G. Short Answer Questions (Type II):

1. (a) (i) Steam engine (ii) Generator.

   (b) Since the displacement of the pitcher is zero from the last 20 minutes, hence the work done by person is zero.

2. Kinetic energy of the object (K. E.) = 25 J

   Velocity (v) = 5 m/s

   As we know that,

   K. E. = $\frac{1}{2} mv^2$

$25 = \frac{1}{2} \times m \times 5^2$

$m = 2$ kg.

(a) When velocity is made two times, k. E. becomes four times

As, $v' = 2v$

$(K.E)' = \frac{1}{2} m v'^2$

$= 4 \left(\frac{1}{2} mv^2 \right) = 4$ K. E.

(b) When velocity is made three times, K. E. becomes 9 times.

$v' = 3v$

$(K.E.)' = \frac{1}{2} m v'^2$

$= \frac{1}{2} m (3v)^2$

$= 9 \left(\frac{1}{2} mv^2 \right)$

$= 9$ K. E.

3. When the ball is dropped from a certain height, it will have some stored gravitational energy. This energy can be shown by

G. P. E. $= m \times g \times h$

The potential energy of gravity is directly affected by the height. When the ball is dropped from a 10 m height, it loses of, 40% energy thus affecting the same percentage of height when it bounces back.

Now, 40% of the energy lost means 40% of the height also lost on bouncing back.

Given height is 10m and when there is a lose 40% of 10m, left will be 60% of 10 m.

The height of the bounce back is hence 60% of 10m which 6m.

4. Given: Mass of bullet (m) = 10 g = 0.01 kg

Speed (v) = 1000 m/s

Distance (s) = 5 cm = 0.05 m

(a) We know that $F = ma$

and $v^2 = u^2 - 2as$

or $a = (v^2 - u^2) / 2s$

Now $F = m [(v^2 - u^2) / 2s]$

$= 0.01 \times [(1000^2 - 0) / 2 \times 0.05]$

Resistive force will be $F = 10$ N

(b) Now time taken to come to rest will be

$S = \{(u + v) / 2\} t$

So $t = 2s / (u + v)$

$= 2 \times 0.05 / 1000$

$t = 10^{-4}$ s

5. Given: Total displacement travelled by the boy = 1500 m + {1.5 (2π r)} + 2000 m = 1500 m + 942 m + 2000 = 4442 m

Because, frictional force is non-conservative force (path dependent) so the total travelling displacement is equal to 4442 m.

Frictional force = 5 N

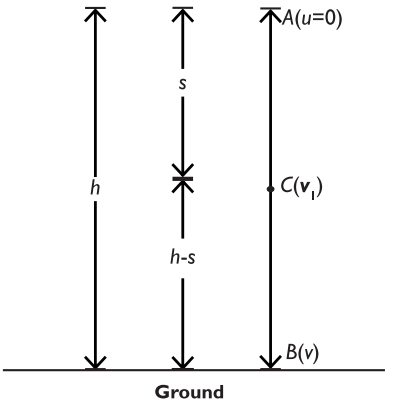
We know that,

Work done = Force × Displacement

Work done (W) = 5 × 4442

W = 22210 J = 22.21 KJ

Q H. Long Answer Questions:



1. Let us consider a body of mass placed at A.

Let,

h = AB = height of body diagram above the ground.

s = distance of any point c from A.

g = acceleration due to gravity at the place.

v_1 = velocity of the body at C.

v = velocity f the body at B, a point just above the ground.

The velocity at the point A is zero, i. e, u = 0.

(i) At the point A:

P. E. = mgh

K. E. = 0

Total mechanical energy at A = P. E + K. E.

= mgh + 0 = mgh

(ii) At the point C:

When the body moves from A to C, it covers a distance s. If v_1 is the velocity at C.

Then from, $v^2 - u^2 = 2as$ we get

$v_1^2 - 0 = 2gs$

$v_1^2 = 2gs$

K. E. at C = $\frac{1}{2} mv_1^2 = \frac{1}{2} m (2gs)$

= mgs

P. E. at C = mg (h-s)

Total mechanical energy at C = K. E. + P. E.

= mgs + mg (h-s)

= mgh

(iii) At the point B:

From, $v^2 - u^2 = 2as$

$v^2 - 0 = 2gh$

$v^2 = 2gh$

K. E. at B = 0

Total mechanical energy at B = K. E. + P. E. = 0 + mgh = mgh

Clearly, the total mechanical energy of the body at A, B and C is the same. Hence, the total mechanical energy of the body throughout the free fall is conserved and is equal to the sum of kinetic energy and potential energy.

2. (a) Let v be the velocity of dog and horse.

Mass of dog (m_1) = m

Mass of horse (m_2) = 10m

$$\text{Ratio of K. E} = \frac{\frac{1}{2}m_1v^2}{\frac{1}{2}m_2v^2}$$

$$KE_1 : KE_2 = \frac{m}{10m} = 1 : 10$$

(b) We know,

Power (P) = Force (F) x velocity (v);

Power deliver by Avinash = 10 × 8 = 80 W,

Power deliver by Kapil = 25 × 3 = 75 W

Hence, Avinash is more powerful because he delivers a power of 80 W, while Kapil delivers a power of 75 W.

Q I. Assertion-Reason Questions:

1. (b) 2. None of these 3. (c)

Q J. Case-based Question:

1. (a) 2. (c) 3. (a) 4. (c) 5. (c)

Chapter
11 SOUND

WORKSHEET-1

Production and Propagation of Sound

Q A. Multiple Choice Questions:

1. (c) 2. (d) 3. (c) 4. (c) 5. (a)

Q B. Match the following:

Column A	Column B
1. Maximum disturbance caused by a wave	(d) Amplitude
2. Distance travelled by a wave per second	(c) Velocity
3. Number of vibrations per second	(b) Frequency
4. Distance between two consecutive crests	(a) Wavelength
5. Time taken to complete one oscillation	(e) Time period

Q C. Differentiate between the following:

1. Pitch is independent of the energy received by the ear in unit time. It is dependent on the change in the frequency. As the frequency increases, the shrillness of the sound increases.

   Loudness is dependent on the energy received by the ear in unit time. It is independent of the change in frequency.

2. A compression is a region in a longitudinal wave where the particles are closest together. It is the region of high density.

   A rarefaction is a region in a longitudinal wave where the particles are furthest apart. It is the region of low density.

3. Longitudinal wave: The medium moves in the same direction of the wave. It is made of rarefactions and compressions.

   Transverse wave: The medium is moving perpendicular to the direction of wave. It is made of troughs and crests.

Q D. Define the following:

1. Vibration means a kind of rapid to and fro motion of an object.
2. The amount of sound energy passing each second through unit area is called the intensity of sound.
3. The magnitude of the maximum disturbance in the medium on either side of the mean value is called the amplitude of the wave.
4. The number of complete oscillations per unit time is called the frequency.
5. The distance between two consecutive compressions or two consecutive rarefactions is called the wavelength.

Q E. Very Short Answer Questions:

1. Amplitude determines loudness.
2. Frequency υ = 220 Hz

speed, v = 440 m/s

wavelength, $\lambda = \frac{\text{speed}}{\text{frequency}} = \frac{v}{\nu} = \frac{440\,m/s}{220\,Hz} = 2m$

3. Iron

4. Wavelength, $\lambda = \frac{\text{speed}}{\text{frequency}}$

5. Frequency, υ = 100 Hz

   Vibrations per minute = 100 × 60 = 6000

Q F. Short Answer Questions (Type I):

1. (a) Parallel to the direction of waves propagation.

   (b) perpendicular to the direction of wave motion.

2. Number of vibrations = 32

   Frequency tuning fork = 256 Hz

   Time to complete one vibration = $\frac{1}{256}$ s

   Time to complete 32 vibrations = $\frac{32}{256}s = \frac{1}{8}s = 0.125$ s

3. (a) Low pitched

   (b) High pitched

Q G. Short Answer Questions (Type II):

1. When a sound, producing source moves with a speed higher than that of sound, it produces shock waves in air. These shock waves carry a large amount of energy. The air pressure variation associated with this type of shock waves produces a very sharp and loud sound called the "sonic boom".

2. (a) Approximately 344 m/sec

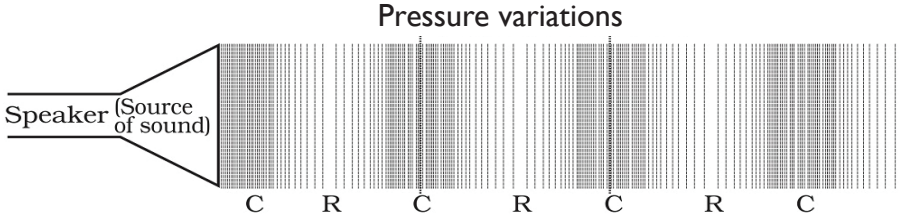
   (b) Two factors are:

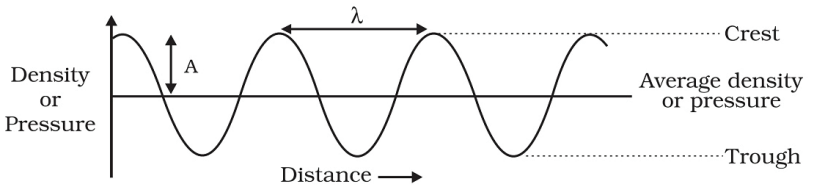
   - Density of the medium: When the medium is dense, the molecules are closely packed to each other and hence a lot of force is required by the molecules so as to produce sound wave. Also, the speed of sound decreases with increase in the density of the medium.
   - Temperature of the medium: Sound waves are directly proportional to the temperature of the medium. Therefore, as the temperature increases, the speed of sound increases and vice versa.

3. (a) Energy

   (b) Particle of the medium

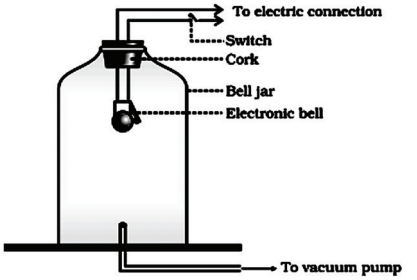
   (c) Sound Propagates as pressure variation is shown below:



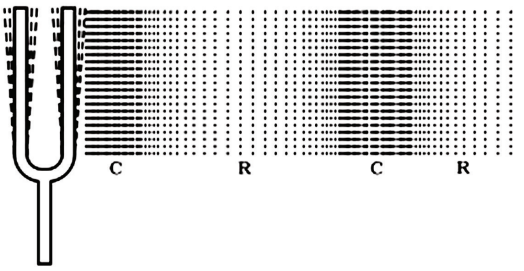


Graphical representation of density and pressure variations

Q H. Long Answer Questions:



1. Take an electrical bell and an air tight glass bell jar connected to a vacuum pump. Suspend the bell inside the jar, and press the switch of the bell. You will be able to hear the bell ring. Now pump out the air from the glass jar. The sound of the bell will become jointer and after some time, the sound will not be heard. This so because almost all air has been pumped out. This shows that sound needs a material medium to travel.
2. When a vibrating body moves forward it creates a region of high pressure in its vicinity region of high pressure is known as compressions. When it moves backwards, it creates a region of low pressure in its vicinity. This region is known as rarefaction. As the body continues to move forward and backwards, it produces a series of compressions and rarefactions. This is shown in figure below.



WORKSHEET-2

Reflection of Sound

Q A. Multiple Choice Questions:

1. (d) 2. (d) 3. (b) 4. (a) 5. (c)

Q B. Give one word for the following:

1. Reflection of sound
2. Reverberation
3. Stethoscope
4. Trumpets
5. Echoes

Q C. State whether the following statements are true or false:

1. False 2. True 3. True 4. False 5. False

Q D. Give reasons for the following:

1. It is due to echo.
2. So that speech can be easily heard even by the persons sitting at a considerable distance.

3. Due to successive or multiple reflections of sound.
4. To reduce reverberation
5. So that the sound after reflection from the curved surface reaches all corners of the hall evenly.

Q E. Very Short Answer Questions:

1. Reflection of sound
2. An echo is a sound caused by the reflection of sound waves from a surface back to the listener.
3. Reverberation is the phenomenon of overlapping of sound caused by multiple reflections.
4. Trumpets and shehanais
5. Due to multiple reflection of sound of lightening between the cloud and earth's surface.

Q F. Short Answer Questions (Type I):

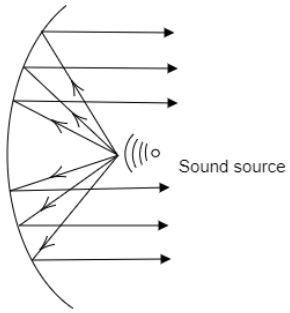
1. Laws of reflection of sound are:
   - The angle of reflection is always equal to the angle of incidence.
   - The reflected sound, the incident sound, and the normal sound belong in the same plane.
2. Speed of sound (v) = 342 ms^{-1}

   Echo returns in time (t) = 3 s

   Distance travelled by sound = v × t = 342 × 3 = 1026 m

   In the given interval of time, sound must travel a distance that is twice the distance of the reflecting surface and source.

   Therefore, the distance of the reflecting surface from the source =1026/2 = 513 m.
3. A soundboard is a concave board that is placed behind the speaker in large halls or auditoriums so that the speech can be easily heard even by the person sitting at a considerable distance. The soundboard works in the following manner as the speaker toward the audience and hence prevents the spreading of sound in various directions. Due to this, sound is distributed uniformly througout the hall and even the person sitting at the back of the hall can hear the speech easily.



Q G. Short Answer Questions (Type II):

1. The sensation of sound, which an observer hears, persists in the brain for about 0.1 s. Thus, for distinct echo formation, the time difference between the original sound and reflected sound must be at least 0.1 s or more. Now, the time of echo is t = 2d/v, where d is the distance between observer and the reflecting surface and v is the velocity of sound.

   Hence, d = vt/2

   Therefore, minimum distance (d) = v x 0.1/2 = v/20

   Thus, reflector surface must be situated at a minimum distance of v/20 in order to form a distinct echo.

   At room temperature of about 22°C speed of sound in air has a value of 344 m s^{-1}, hence value of minimum distance (d) = 344/20 = 17.2 m

   It means that in a room of length less than 17.2 m there will be no echo.
2. (a) The phenomenon of overlapping of sound caused by multiple reflections is called reverberation. This causes the overlapping of several echoes. The time gap between several echoes is so short that these cannot be distinguished. So we hear multiple noisy echoes. For example, when we shout in a cave, reverberation of sound occurs.

(b) Reverberation can be reduced by absorbing the sound using some materials as it reaches the wall and ceiling of the room and thus prevent the sound from getting reflected.

3. If the time gap between the original sound and reflected sound received by the listener is around 0.1 s, only then the echo can be heard.

The minimum distance travelled by the reflected sound wave for the distinctly listening the echo

= velocity of sound x time gap

= 344 x 0.1

= 34.4 m

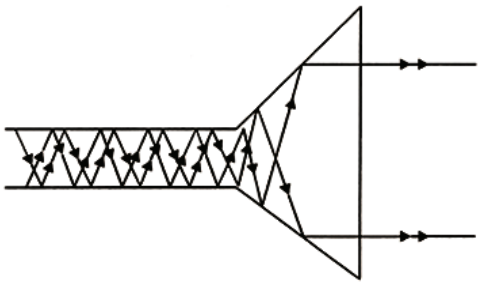
But in this case the distance travelled by the sound reflected from the building and then reaching to the girl will be (6+6)=12 m, which is much smaller than the required distance. Therefore, no echo can be heard.

Q H. Long Answer Questions:

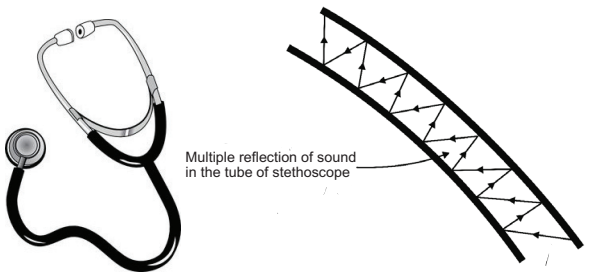
1. Multiple reflection of sound is the sound which is reflected more than once.

Uses of multiple reflections of sound are:

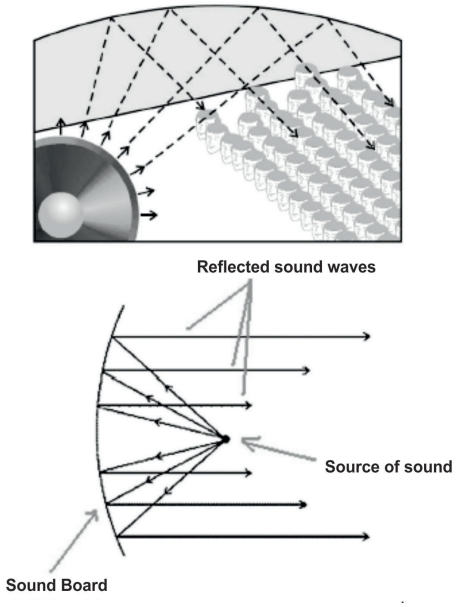
- Megaphones or Speaking tubes: Megaphones or loudhailers, horns, musical instruments are all designed to send sound in a particular direction without spreading it in all directions. In these instruments, a tube followed by a conical opening reflects sounds successively to guide most of the sound waves from the source in the forward direction.



- Stethoscope: Stethoscope is a medical instrument used for listening to sounds produced within the body, chiefly in the heart or lungs. In stethoscopes the sound of the patient's heartbeat reaches the doctor's ears by multiple reflection of sound, as shown in below figure.



- Design of concerts Halls, Cinema Halls and Conference Halls: The ceilings of these halls are curved. This enables the sound to reach all corners of the hall after reflection from the ceiling as shown in below left figure. A sound board, which is a curved sound reflecting surface, is placed behind the stage. The source is located at the focus of this reflecting surface. Sound waves coming from the source become parallel after reflection from the sound board and spread evenly throughout the width of the hall as shown in above right sided figure.



2. (a) Let the distance of hill be d.

Now, distance travelled by sound = 2d

time taken = 0.8 second

speed of sound = 340 m/s

So, 2d = 340×0.8

or, d = 340×0.4 = 136 m

So, the distance of the hill from the boy is 136 m.

(b) (i) Let the person be standing 640 metres away from Cliff A. It is given that the person shouted and he heard the echo after 4 seconds. When the person will shout, the sound waves will go from the person to Cliff A and return to him again. This means the sound waves travel a distance of 640 metres two times. Therefore the total distance travelled by the sound is

d = 640 × 2 = 1280 m.

This distance is travelled by sound in 4 seconds. So the speed of the sound is

$v = \frac{1280}{4} = 320$ m/s.

This speed of sound is constant.

(ii) Let the second echo strike the other cliff, say cliff B. The time taken by the echo to return to the person is 4 + 3 = 7 seconds.

Since the speed of sound is 320 m/s, the total distance travelled by the sound waves is

= 320 × 7 = 2240 m.

But this is the total distance travelled by the sound waves, which will be two times the actual distance between the cliff and the person.

Therefore, the distance between the cliff and the person will be 2240/2 = 1120 m. So, we obtain two equations —

Distance between the person and Cliff A = 640 m.

Distance between the person and cliff B = 1120 m.

Therefore the distance between the two cliffs will be 640+1120 = 1760 m.

WORKSHEET-3

Hearing Range, Ultrasound and Human Ear

Q A. Multiple Choice Questions:

1. (d) 2. (d) 3. (b) 4. (d) 5. (c)

Q B. Complete the following table:

S. No.	Sound Wave	Range (Hz)
1.	Audible	20 Hz - 20,000 Hz
2.	Infrasonic	Above 20,000 Hz
3.	Ultrasonic	Above 20 KHz

Q C. Fill in the blanks using the suitable words given in the brackets:

1. SONAR 2. below 3. ultrasound 4. outward 5. cochlea

Q D. State functions of each of the following:

1. Pinna collects sound waves and channels them into the ear canal (external auditory meatus), where the sound is amplified.
2. The two primary functions of the eardrum are auditory and protective.
3. The external auditory canal's function is to transmit sound from the pinna to the eardrum.
4. Cochlea converts the auditory signals to neural impulses.
5. The auditory nerve carries hearing information from the cochlea to the brain.

Q E. Very Short Answer Questions:

1. 20 Hz to 20,000 Hz
2. Dolphins and bats
3. Whales and elephants
4. Ultrasound
5. Sound navigation and ranging

Q F. Short Answer Questions (Type I):

1. **Given:** Time = 2.4 / 2 = 1.2 sec
   Speed of sound = 1513 m/s
   Depth = ?
   Speed = Distance / Time
   1513 = Distance / 1.2
   D = 1513 m/s × 1.2 s
   = 1260.83 m
2. Electrocardiography (ECG) is the process of recording the electrical activity of the heart over period of time.
3. Time = 1.02 s
   Speed of sound in water =1531m/s
   Distance = Speed × Time
   = 1531×1.02
   = 1561.62 m

So, the distance of the cliff from the substance = $\frac{1561.62\,m}{2} = 780.81\,m$

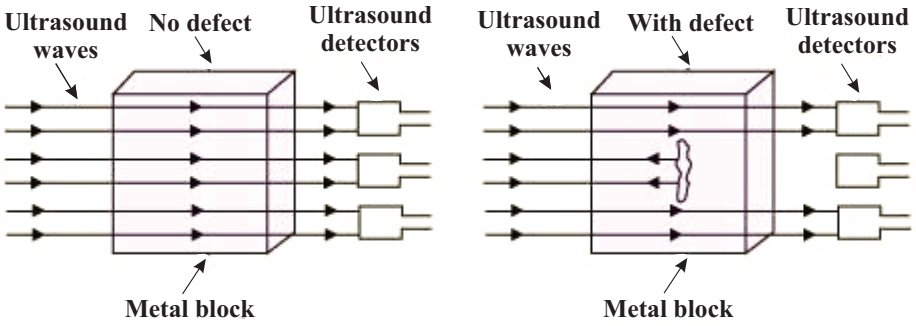
Q G. Short Answer Questions (Type II):

1. Ultrasonography uses high-frequency sound pulses that are emitted from a hand-held ultrasound transducer.

   This technique is used in x-ray, medical treatment etc.

2. Hearing aids work by amplifying sound through a three-part system: The microphone receives sound and converts it into a digital signal. The amplifier increases the strength of the digital signal. The speaker produces the amplified sound into the ear.

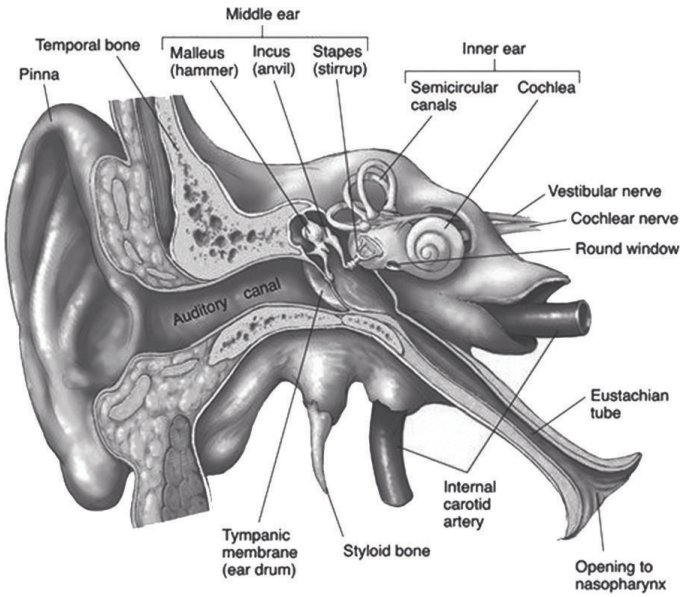
3. Ultrasounds can be used to detect cracks and flaws in metal blocks. Defects in metal blocks occur due to crack in them. Cracks have air in them. The speed of sound in metal is greater than that in air. Thus, air acts as a rarer medium for sound waves. Whenever ultrasound is transmitted through a metal block that has defects, these waves get reflected in encountering such cracks. Therefore, these waves are not detected at the detector placed on the other side of the block, opposite to that of the transmitter. This indicates that there is a defect in the block.



Q H. Long Answer Questions:

1. The sound waves passes through the ear canal to a thin membrane called eardrum. The eardrum vibrates.

   The vibrations are amplified by the three bones of the middle ear called hammer, anvil and stirrup. Middle ear transmits the sound waves to the inner ear. The brain then interprets the signals as sound.



2. (a) SONAR is an acronym for Sound Navigation And Ranging. It is an acoustic device used to measure the depth , direction, and speed of under-water objects such as submarines and ship wrecks with the help of ultrasounds. Is is also used to measure the depth of seas and oceans.

(b) A sonar device on a submarine sends out a signal and receives an echo 5 s later. Calculate the speed of sound in water if the distance of the object from the submarine is 3625 m.

Time is taken to hear the echo, t = 5 s

Distance of the object from the submarine, d = 3625 m

Total distance travelled by the sonar waves during the transmission and reception in water = 2d

The velocity of sound in water, v = 2d/t

= 2 x 3625/5

= 1450 m/s.

WORKSHEET-4

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (b) 2. (c) 3. (a) 4. (c) 5. (c) 6. (a) 7. (d)

Q B. Give reasons for the following:

1. This is because the speed of light is greater than the speed of sound.
2. Due to their different waveforms.
3. Sound is heard only if the body vibrates with a frequency of at least 20 Hz. Frequency of vibration of the pendulum is less than 20 Hz. Hence, no sound is heard when the pendulum vibrates or oscillates in air.
4. Those animals have audible range of ultrasonic sound so they can sense earthquakes before its effect.
5. Sound cannot travel through vacuum as there is no particles present for vibrations to take place.

Q C. Complete the table given below:

Sound Velocity	Frequency	Wavelength	Time period	Audible / Ultrasound / Infrasonic
330 m/s	550 Hz	0.6 m	0.0018 sec	Audible
34000 m/s	500 Hz	68 m	0.002 sec	Audible
343.4 m/s	20200 Hz	1.7 cm	4.95×10^{-5} sec	Ultrasonic

Q D. Fill in the blanks using the suitable words given in the brackets:

1. cannot 2. pressure 3. absorbers 4. more than 5. infrasonic

Q E. Very Short Answer Questions:

1. Speed of sound in air increases with increase in temperature.
2. The quality or timbre of sound.
3. Time-period, T = 0.02 seconds

$$\text{frequency} = \frac{1}{T} = \frac{1}{0.02} = 50\,\text{Hz}$$

4. Hertz

5. Frequency
6. This is because the particles in vulcanized rubber do not vibrate or oscillate as fast as in other solids or in air.
7. Higher pitch

Q F. Short Answer Questions (Type I):

1. The wave in which particles of the medium vibrate in a direction perpendicular to the direction of propagation of the wave is called tranverse wave.
2. A loud sound has higher energy because higher energy produces loud sound but soft sound produces soft sound.
3. Mechanical waves, e.g., sound waves.
4. Speed, v = 330 m/s

   Frequency, υ = 550 Hz

   wavelength, $\lambda = \frac{\text{speed}}{\text{frequency}} = \frac{v}{\upsilon} = \frac{330\,m/s}{550\,Hz} = \frac{3}{5} = 0.6\,m$

5. Sound is directly proportional to temperature. So,
   (a) Echo will be heard later
   (b) Echo will be heard sooner

Q G. Short Answer Questions (Type II):

1. Speed of sound wave, v = 339 m/s

   Wavelength, λ = 1.5 cm = 0.015 m/s

   Frequency, $\upsilon = \frac{v}{\lambda} = \frac{339}{0.015} = 2260\,Hz$

   Yes, it will be audible.

2. Height of tower, h = 500m

   g = 10 m/s^2

   Speed of sound, v = 340 m/s

   Initial velocity of the stone, u = 0

   According to the second equation of motion: $h = ut + \frac{1}{2} gt^2$

   $500 = 0 \times t + \frac{1}{2} \times 10 \times t^2$

   $\Rightarrow 100 = t^2$

   $\Rightarrow t = 10$ s

   Now, time taken by the sound to reach the top from the base of the tower = 500/340 = 1.475 s

   Therefore, the splash is heard at the top after time = 10 + 1.475 = 11.475 s

3. (a) X

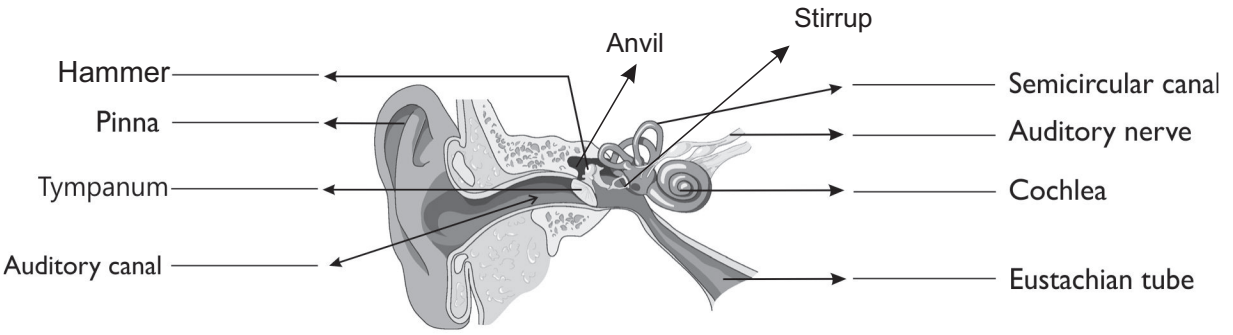
   (b) Y

   (c) Frequency = No. of oscillations/ time

   = 360 / (2 x 60)

   = 3 Hz

4.



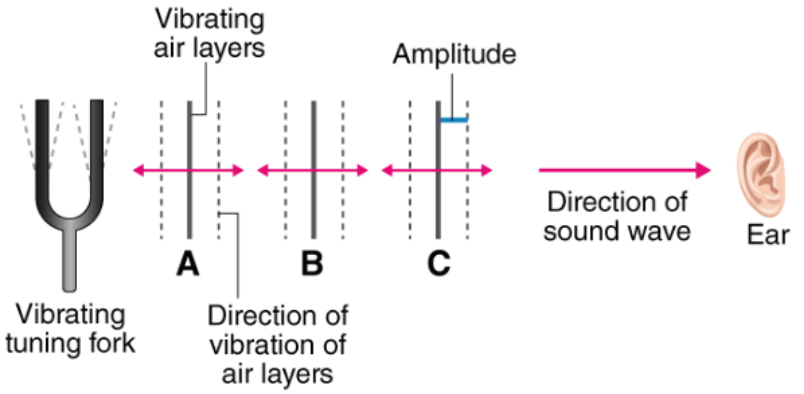
5. Time = 70s

Speed of sound in water = 1550 m/s

Distance of enemy submarine = $\frac{1}{2}$ x Speed x Time = $\frac{1}{2}$ x 1550 x 70 = 54250 m

Q H. Long Answer Questions:

1. The sound is produced through the vibration of parties of medium and it is transmitted through vibrations and passes through the ear canal to a thin membrane called eardrum. The eardrum vibrates. Sound waves cause the eardrum to vibrate.



2. (a) Sound travels fastest in solids and slowest in air. Water is in between. This is because the particles in solids are closer together than the particles in liquids or gases, and the particles in liquids are closer together than the particles in gases. The tighter particles are packed in a space, they collide more frequently. This allows sound, which is simply the combined collisions of particles, to travel fastest in solids. So, to reiterate, sound travels fastest in solids, then water, and slowest in air. In this case, the sound of an explosion on the surface of a lake is heard by a boat man 100 m away and by a diver 100 m below the point of explosion and the sound takes time t to reach the boat man. Here, the boat man is on the surface of the lake, that is, air and the diver is inside the lake of water. The diver hears the explosion first as the sound travels four times faster in water than in air.

(b) Hence, the time taken for the sound to reach the diver is t x 1/4 = 0.25t.

Q I. Assertion-Reason Questions:

1. (c) 2. (c) 3. (c)

Q J. Case-based Question:

1. (c) 2. None of these 3. (d) 4. (b) 5. (b)

Chapter 12 IMPROVEMENT IN FOOD RESOURCES

WORKSHEET-1

Improvement in Crop Yields

QA. Multiple Choice Questions:

1. (d) 2. (a) 3. (d) 4. (c) 5. (c)

QB. Match the following:

Column A	Column B
1. Kharif	(b) Rice
2. Rabi	(c) Wheat
3. Tilling	(e) Ploughing
4. Fertilizer	(d) Urea
5. Weed	(a) Amaranthus

QC. Give one word for the following:

1. Intercropping
2. Mixed Cropping
3. Organic Farming
4. Fungicide
5. Irrigation

Q D. Classify the following under suitable groups in the given table:

groundnut, grass, mustard, black pepper, rice, wheat, oat, pea, gram, sudan, chilly, maize

Category	Examples
Spices	black pepper, chilly
Oil seed crops	Groundnut, Mustard
Fodder crops	Oat, sudan, grass
Cereal crops	Wheat, maize, rice
Pulses	Pea, gram

Q E. Very Short Answer Questions:

1. FCI (Food Corporation of India) and CWC (Central Warehousing Corporation)
2. Below 15
3. (a) Nature of crop plants
   (b) Nature of soil of the crop fields
4. Rice is a crop that can tolerate water logging in the field while example of crops that cannot tolerate water logging are wheat and cotton.
5. Mulching the soil with weeds and using manure.

Q F. Short Answer Questions (Type I):

1. Photoperiod is the physiological reaction of organisms to the length of day or night. It occurs in plants and animals. Photoperiod in agriculture provides adequate light for flowering.
2. It is the farming in which no chemical fertilizers, pesticides or herbicides are used. But uses all organic matter for its growth like manure, neem leaves as pesticides and for grain storage.
3. In India, the different patterns of growing Crops are: Mixed cropping, inter cropping and crop rotation.

Q G. Short Answer Questions (Type II):

1. (a) Irrigation: The process of supplying water to crop plants through human efforts by means of canal, wells, reservoirs, tube-wells, etc.

   (b) It is essential, because it maintains moisture in the soil, for the growth of the roots of the crop plants, etc.

   (c) Three ill-effects of excessive irrigation are:
   - Increase in saline and alkaline elements in soil or increase in salinity.
   - Shallowness of roots
   - Reduction in temperature of roots.

2. (a) Advantages of crop rotation are:
   - It prevents soil depletion.
   - Increases soil fertility.
   - Reduces soil erosion.

   (b) The three main criteria, while selecting the crops for rotation are:
   - Soil and type of crop depending on duration
   - Livestock on the farm
   - Occurrence of pests and diseases

3. The factors responsible for losses of grains during storage are:
   - Abiotic factors like moisture, humidity and temperature.
   - Biotic factors like insects, rodents, birds, mites, bacteria and fungi.

   The various measures for safe storage of grain are:
   - Be sure that there is no moisture where you are storing grain.
   - Be sure that the place is free from pesticides, insecticides, etc.

Q H. Long Answer Questions:

1. (a)

Manure	Fertilizer
a. Increases soil fertility by enriching the soil with organic matter and nutrients as it is prepared by the decomposition of animal excreta and plant wastes.	a. Mostly inorganic compounds which provide specific nutrients like nitrogen, phosphorus and potassium.
b. Improves soil fertility. Do not lead to pollution.	b. Excessive use may destroy soil fertility and pollution.
c. e.g. - manure waste, yard compost, etc.	c. e.g. - synthetic chemicals, nutrients, etc.

(b) Advantages of using fertilizers are:

- It increases crop yield and improves poor quality land.
- Manure improves soil texture, recycles nitrogen and introduces essential bacteria.
- Pasture is improved so animals fatten up quicker.

Disadvantages of using fertilizers are:

- Crops grow better, but so do weeds. Therefore, herbicide sprays are required too.
- Better quality plants attract insects so pesticides may be needed.
- Excess nitrogen from fertilizers gets into water supply, causing fish to die.

2. Various sources of irrigation available in our country are:
   - Well irrigation is common is alluvial plains of the country.
   - Canals are second most important source of irrigation in India after wells and tube wells. The canals are irrigating those lands which have large plains, fertile soils and peremist rivers.
   - Tank irrigation is more in the rocky plateau area of the country, where the rainfall is uneven and highly seasonal.

WORKSHEET-2

Animal Husbandry

Q A. Multiple Choice Questions:

1. (b) 2. (a) 3. (c) 4. (b) 5. (a)

Q B. State whether the following statement are true or false:

1. True 2. False 3. True 4. False 5. False

Q C. Complete the following table:

S. No.	Disease	Causative organism	Animal affected	Signs / Symptoms
1.	Ranikhet	Virus	Poultry	Coughing, muscular tremors, depression
2.	Anthrax	Bacteria	Cattle	Fever, chills, headache
3.	Tuberculosis	Bacteria	Human	Infection of lungs
4.	Fowl typhoid	Bacteria	Poultry	Anorexia, weakness, diarrhoea
5.	Rabies	Virus	Dogs	Fever, headache

Q D. Define the following terms:

1. Apiaries: A collection of hives or colonies of bees kept for their honey.
2. Drought animals: The cattle that are used for doing labour in the fields such as irrigation, tilling, etc. are called draught animals. Example- Oxen, Bullock.
3. Aquaculture: Production of fish and other sea-food in fresh water or marine water resources is called aquaculture.
4. Layers: Layers are egg-laying poultry birds which are raised for the purpose of commercial egg production.
5. Broilers: Broilers are chicken that is bred and raised specifically for meat production.

Q E. Very Short Answer Questions:

1. Red sindhi and sahiwal
2. Apis Cerana Indica and Apis dorsata
3. He should grow good variety of flowers for nectar collection by bees.
4. Animal husbandry provides livestock production. It is an integral part of crop farming and contributes significantly to household nutritional security.
5. Aseel, Ghagns, Chattisgarh and Bursa.

Q F. Short Answer Questions (Type I):

1. The main elements of animal husbandry are
   - Proper feeding of animals.
   - Providing freshwater to animals.
   - Providing safe and hygienic shelter to animals.
   - Ensuring proper health of animals and protection against diseases.
   - Proper breeding of animals.
2. An increase in feed intake usually results in the production of a greater volume of milk.
3. Pox and rinderpest

Q G. Short Answer Questions (Type II):

1. (a) Fishes with different food habits are chosen so that they do not compete for food among themselves, Also, this ensures a complete utilize of food resources in the pond.

   (b) Fish culture is done with the combination of rice because in rice crops we have to put lot of water so, we can put fishes in to the water so it can eat up the insects which harm the crop and its manure is dissolved into the soil and become a nutrient to the plant.

   (c) Broiler chickens are fed with vitamin rich supplementary feed for good growth rate and better feed efficiency.
2. (a) Composite fish culture is a system in which five or six different species of fishes are grown together in a single fish pond. Fishes with different food habitats are chosen so that they don't compete for food among themselves.

   (b) Catla, rohu, mrigals, etc.

   (c) Catla : Surface feeders

   Rohu : Feed in the middle - zone

   Mrigals : Bottom feeders
3. (a) Broilers are kept in free run barns while layers are kept in bars.

   (b) Protein and fat-rich food should be provided to broiler chicken.

Q H. Long Answer Questions:

1. Capture fishing : In capture fishing , the fish catching is done from various natural resources, lakes, river, oceans, seas, etc.

   Capture fisheries is intended for catching fishes and also prawns, lobsters, crabs, sea-cucumbers, whales, pearl oysters, edible bivalve and copious other organisms of other than fishes etc.

   Inland fishing : Inland fishing captures freshwater fish species, such as trout.

   Examples of the inland fishery are Rohus, Grass Craos, Callas, Mrigals, etc.

Aquaculture : In aquaculture , culture of fishing is done using any water body which may contain salt water or fresh water.

Examples of aquaculture production include oysters, clams, mussels, shrimp, salmon, etc.

2. (a) Apis mellifera

(b) Because it is gentle in nature. Also, it has high honey collection capacity.

(c) For best results in honey production, first suitable location for keeping beehives should be selected, proper management of beehives during season needs to be done. Do not add more bees to another area that is about to spread. This retains good bees and raise queens from best colonies.

WORKSHEET-3

Based on Complete Chapter

Q A. Multiple Choice Questions:

1. (b) 2. (d) 3. (b) 4. (d) 5. (a) 6. (d) 7. (a)

Q B. Complete the following table:

1.	*Kharif* crops	-	Maize, Rice
2.	*Rabi* crops	-	Peas, Mustard
3.	Indian breeds of cows	-	Sahiwal, Gir
4.	Micronutrients	-	Calcium, Iron
5.	Macronutrients	-	Lipids, Proteins
6.	Weeds	-	Bull thistle, Xanthium
7.	Pests	-	Rodents, Weeds
8.	Fertilizers	-	Nitrogen, Phosphorus

Q C. Differentiate between the following:

1. Layers and Broilers

Layers	Broilers
a. The egg-laying poultry bird is called layer. The ration for broilers is protein-rich with adequate fat.	a. The poultry bird groomed for obtaining meat is called broiler.
b. The levels of vitamins A and K is kept high in the poultry feeds.	b. While broilers require protein rich diet or ration with adequate fat.

2. Apiculture and Mariculture

Apiculture	Mariculture
It is technique of growing or keeping bess in hives on large scale for the purpose of extraction of honey and wax.	Mariculture is a specialised branch of aquaculture involving the cultivation of marine organisms for food and other animal products in enclosed sections of the open ocean, fish farms built on littoral waters or in artificial tanks, ponds or raceways which are filled with seawater.

3. Intercropping and Crop rotation

Intercropping	Crop Rotation
It invovles growing two or more crops simultaneously on the same field in definite proportion or pattern.	The growing of different crops on a piece of land in a pre-planned succession is known as crop rotation.
e.g. - soyabean + maize, etc	e.g. - corn, mixed grass, etc.

Q D. Fill in the blanks using the suitable word given in brackets:

1. Fishes 2. nitrogenous 3. kharif 4. hybridisation 5. second

Q E. Very Short Answer Questions:

1. It provides an irrigation facility.
2. Hybridisation is the process of interbreeding between individuals of different species or genetically divergent individuals from the same species.

   Its types are:

   - Single cross hybrides
   - Double cross hybrides
   - Triple cross hybrides
   - Population hybrides
3. 12 months
4. Compost and Green manure
5. Manganese, Zinc, Nitrogen, Phosphorus
6. Fibres or roughage.
7. Manures and compost.

Q F. Short Answer Questions (Type I):

1. Rearing and management of honeybees for commercial production of honey and other products of the beehive is called apiculture.

   The products obtained from apiculture are:

   - Honey
   - Beeswax
2. Protein - Beans, Spirulina and Lentils

   Fats - Avocados, Olive oil, Seasame

   Carbohydrates - Sweet potatoes, Brown rice, Oatmeal.

   He should select disease resistant variety with higher production.
3. He should ensure proper sunlight and ventilation along with cleanliness in the shelter.
4. Useful effects:

   - There was moderate agricultural growth particularly in wheat production.
   - It raised the availability of food in the country.

Harmful effects:

- The loss of soil nutrients making it unproductive.
- Excessive use of pesticides increases the presence of its residues in foods and environment.

5. They should practice drip irrigation, sprinkler system of irrigation and rainwater harvesting.

Q G. Short Answer Questions (Type II):

1. (a) To kill the harmful pests and insects that can damage the crops.

   (b) Fungicides, herbicides, and insecticides. Examples of specific synthetic chemical pesticides are glyphosate, Acephate, Deet, Propoxur, Metaldehyde, Boric Acid, Diazinon, Dursban, DDT, Malathion, etc.

2. (a) Different parameters are used to check the success of artificial insemination in animal. By regular insemination of semen after collection and frequent checking on fertility.

   (b) Advantages of artificial insemination:

   - There is no need of maintenance of breeding bull for a herd.
   - It prevents the spread of certain diseases and sterility.

3. (a) Unfertilized eggs of honeybee grows into a drone bee and fertilized eggs will hatch into female worker bees.

   (b) Swarming benefit the bee colony by increasing space within a hive and expanding the range of these pollinators.

4. (a) Mixed cropping is the practice of growing two or more crops together on the same piece of land in one crop season.

   (b) Crops are selected carefully so that they do not compete with each other for light, nutrients and water. Seeds should be sown at approximate distance.

   (c) Advantages of mixed cropping:

   - It acts as an insurance against the possible total crop failure in poor rainfall areas.
   - It saves time and labour of farmer.

5. Maintenance of temperature is needed for better egg production by poultry birds. Therefore, larger size (increase in surface area of body) and no adaptability of summer may cause decline in egg production. To obtain the smaller size and higher summer adaptability, cross breeding of poultry birds are done. Small size is also needed for better housing and low feed.

Q H. Long Answer Questions:

1. (a) The process of farming of animal and keeping it as a pet or in any other form is called domestication.

   (b) Horse and sheep.

   (c) Milk and cheese.

   (d) Improving the animals cooling process through proper water, shedding and ventilation. Increasing the milking frequency during a 24-hour period.

   (e) The two types of animal feed are:

   - Roughage: These are rich in fibre; e.g., cowpea, berseem, etc.
   - Concentrates: These are nutrient-rich and low on fibres; e.g., oats, maize, etc.

2. (a) With addition of chemical fertilizers there is sudden increase in yield due to release of nutrients N, P, K, etc. in high quantity which are absorbed by the roots quickly. The gradual decline in the graph may be due to continuous use and high quantity of chemicals which kill microbes useful for replenishing the organic matter in the soil. This decreases the soil fertility.

(b) Because manures work slower than chemical fertilisers.

(c) The use of natural and chemical amendments is the cause.

(d) (i) Vermicompost: It is the compost prepared in the farm by the use of farm waste and earthworms.

(ii) Green manure: It is the manure made up of only organic kitchen and farm waste.

(iii) Biofertiliser: Biofertilisers are substances that contain microorganisms, which when added to the soil increase its fertility and promotes plant growth.

Q I. Assertion-Reason Question:

1. None of these 2. (a) 3. (c)

Q J. Case-based Question:

1. (c) 2. (a) 3. (d) 4. (b) 5. None of these