Matter in Our Surroundings

Periodic Test

Q.1. What do you mean by fluidity?

Answer: The ability of a substance to flow is called fluidity. The substances which show fluidity are called fluids. Liquid and gas are examples of fluids. The particles of liquid and gas are able to move freely because there is a large space between them.

Q.2. What is evaporation?

Answer: Evaporation is the phenomenon in which a liquid is converted into gas at a temperature below its boiling point at atmospheric pressure. Drying of clothes and cooling of hot tea/milk kept open in a glass are due to evaporation.

Q.3. Why does a gas exert pressure?

Answer: The particles present in the gas move randomly at high speed. As a result, the gas particles hit the walls of the container in which it is kept, at high speeds. The particles can also hit each other. The pressure exerted by the gas is because of the force exerted by the particles per unit area of the container.

Pressure = Force/Area

Q.4. What determines the state of a substance, whether it will be solid, liquid or gas?

Answer: The state of a substance is determined by the inter-molecular forces present in it. If the inter-molecular forces are so strong that the substance is rigid and has fixed shape and volume, then the state of the substance is solid. The state of a substance is liquid if the inter-molecular forces hold the particles in such a way that the substance has no fixed shape but fixed volume. The state of a substance is gas if the inter-molecular forces among the particles are weak. Gases do not have a fixed shape or volume.

Q.5. Define specific heat of a substance.

Answer: The amount of heat energy for a substance of unit mass (for example 1 kg) required to raise its temperature by one unit (1°C or 1 K) is called specific heat of the substance.

Q.6. Give Reasons for the Following:

Why are we able to sip hot tea or milk faster from a saucer rather than a cup?

Answer: The surface area of a saucer is greater than that of a cup. It is to be noted that the rate of evaporation increases with an increase in surface area. This is because, as the surface area is increased, more particles in the surface are exposed to the surroundings and hence more particles would get converted into a vapour phase by acquiring energy from surroundings.

Q.7. Give Reasons for the Following:

A gas fills completely the vessel in which it is kept?

Answer: Gas does not have a fixed shape or volume. The inter-molecular forces among the particles of a gas are the weakest. So, they are able to move freely within the vessel.

Q.8. Give Reasons for the Following:

Why do we see water droplets on the outer surface of a glass containing ice-cold water?

Answer: The water vapour present in the air comes in contact with the glass containing ice-cold water. The vapour loses its energy to the cold water and gets converted to water droplets which we see on the outer surface of the glass. This process is called condensation.

Q.9. Give Reasons for the Following:

Why should we wear cotton clothes in summer?

Answer: We perspire more in summer. Sweat present in the surface of our body absorbs the energy equal to the latent heat of vapourisation and gets converted to vapour. This gives a cooling effect to our body. This is called evaporative cooling. Cotton is a good absorber of water. Hence, cotton clothes absorb the sweat and expose it to the surroundings for easy evaporation.

Q.10. Give Reasons for the Following:

Why does a desert cooler cool better on a hot dry day?

Answer: The humidity (amount of water vapour present in the air) is low on a dry day. Being a hot dry day, the temperature is high and the humidity is low. The rate of evaporation increases with

i. increase in temperature

ii. decrease in humidity

Therefore, the rate of evaporation and hence the cooling effect due to evaporation is high on a hot dry day. Thus, desert cooler cools better on a hot dry day.

Q.11. Differentiate between solids, liquids and gases with respect to: (a) fluidity (b) kinetic energy (c) density (d) shape (e) rigidity (f) compressibility.

Answer: (a) The ability of a substance to flow is called fluidity. Fluidity is only possible if there is enough space among the particles of the substance and the inter-molecular forces must not be very strong.

Solids have very strong inter-molecular forces of attraction among the particles forming it. They tend to maintain shape and have fixed volume.

Liquids and gases have weak inter-molecular forces of attraction when compared to solids. Hence, they have a tendency to obtain the shape of the container in which they are kept.

(b) Kinetic energy is the energy associated with the motion of particles. In solids, the particles do not move much due to strong inter-molecular forces of attraction. Therefore, the kinetic energy of the particles of solid is very low.

In liquids, particles can move, but there still is a force of attraction among them. The kinetic energy of particles of liquid is greater than that of solids.

In gases, there are weak inter-molecular forces of attraction among the particles. They are able to move very freely within the container in which it is kept. Therefore, the kinetic energy of particles is high in gases.

The order of increase in kinetic energy of the particles of the matter is:

Solid<Liquid<Gas

(c) Density refers to the amount of matter present in a given volume. Density increases with increase in the inter-molecular forces of attraction among the particles forming the matter which leads to more number of particles within the given space.

Since the order of strength of inter-molecular forces of attraction is:

Gases<Liquids<Solids

The increase in order of density for different states of matter is given by:

Gases<Liquids<Solids

(d) The shape of a substance is determined by the packing of particles which is due to the strength of inter-molecular forces of attraction among them.

In solids, particles are tightly packed as there are strong forces of attraction of particles. Hence solids have a fixed shape.

In liquids, particles are loosely packed. As a result, liquids do not have a fixed shape, but they take the shape of the container in which it is kept.

Gas particles are more loosely packed when compared to liquids due to weak forces of attraction. Therefore, gases too do not have a fixed shape.

(e) Rigidity is the property of a substance to retain shape. Solids tend to maintain a fixed shape when subjected to external forces. Liquids have a tendency to obtain the shape of the container in which they are kept as the particles are loosely packed.

The particles of a gas are linked by weak forces of attraction. Thus, gases do not have a fixed shape.

The increase in the order of rigidity is as follows:

Gases<Liquids<Solids

(f) A substance is compressible only if there is enough space between particles of the substance.

In solids, the particles are tightly packed and hence there is very little empty space inside the substance. Therefore, solids are very difficult to be compressed.

In liquids, there is some space between the particles and is compressible, but it requires a high amount of pressure to compress them.

In gases, there is a large space between the particles and hence is highly compressible.

Q.12. How evaporation differs from boiling?

Answer:

Evaporation	Boiling
The liquid is converted into vapour state at a temperature below the boiling point at atmospheric pressure.	The liquid is converted into a gaseous state at boiling point at atmospheric pressure.
Evaporation is a surface phenomenon	Boiling is a bulk phenomenon

Q.13. Differentiate between gas and vapour.

Answer:

Gas	Vapour
State of matter	A substance which coexists with liquid or solid at room temperature.
Gas in its natural state is gas at room temperature.	Vapour in its natural state is liquid or solid.
Appears at temperatures ≥ boiling point	May occur at temperatures below boiling point.
Example: Helium, Neon	Example: water vapour

Q.14. What are the characteristics of the particles of matter?

Answer: The characteristics of the particles of matter are:

(1) Particles of matter have space between them:

All matter consists of particles which have space between them. Hence when two different substances are mixed, the particles of one substance get into the spaces between particles of the other. The intermixing of particles of two different types of matter on their own is called diffusion.

(2) Particles of matter attract each other:

The particles of matter are held together by forces of attraction. These inter-molecular forces of attraction are responsible for the physical and chemical nature of the substance.

The strength of the force of attraction between particles of matter increase in the order:

Gases<Liquids<Solids

Q.15. Give Reasons Only:

A. Water at room temperature is a liquid.

B. Naphthalene balls disappear with time without leaving any solid.

C. We can get smell of perfume several metres away.

Answer: A. At room temperature, the energy present in the water molecules is sufficient to overcome the inter-molecular forces of attraction that would be present in ice (solid phase), but not enough to get converted into the gaseous phase. Thus, water exists as a liquid at room temperature.

B. Naphthalene balls undergo sublimation process in which the naphthalene balls (solid) are converted into their vapour state directly. Therefore, they disappear without leaving any solid behind. Naphthalene balls are commonly used to store clothes. They prevent the attack of moths or molds on the clothes or other materials.

C. The particles of perfume (gaseous state) mix with the air quickly. This process of intermixing on their own is called diffusion. The diffused particles move with high speeds due to weak inter-molecular forces of attraction and travel long distances (several metres). Hence, we can smell the perfume from several meters away.

Q.16. What are the factors which affect the rate of evaporation? Explain.

Answer: The factors which affect the rate of evaporation are:

(1) Surface area:

Evaporation is a surface phenomenon. As the surface area increases, more particles present in the liquid surface are exposed to the surroundings, and the rate of evaporation also increases.

(2) Temperature:

With the increase in temperature, more particles are provided with kinetic energy to escape into the vapour state. Hence the rate of evaporation increases.

(3) Humidity:

Humidity is the amount of water vapour present in the air. For a given temperature, the air can only hold a particular amount of water vapour. So, if the humidity is high, the amount of water vapour is high and hence the further conversion of a liquid into a vapour state is difficult or not favourable. Hence the rate of evaporation decreases.

(4) Wind Speed:

Increase in wind speed results in more moving away from water vapour particles with the wind, decreasing the amount of water vapour present in the air in that area. So, the rate of evaporation increases with the wind speed.

Q.17. A. What produces more severe burns, boiling water or steam?

B. For any substance, why does the temperature remain constant during the change of state?

Answer: A. At a given temperature, particles of steam are at higher kinetic energy than that of boiling water. Therefore, steam would produce more severe burns than boiling water.

B. During the change of state, the heat energy supplied to the substance is completely used to overcome the forces of attraction between the particles of the substance. So, there is no change in the temperature of the substance during its change of state. The energy supplied at that time is called latent heat.

Q.18. A. Give two characteristic properties of a liquid.

B. Why does our palm feel cold when we put alcohol or perfume on it?

C. Give two factors which determine the rate of diffusion of a liquid in another liquid.

Answer: A. The particles of liquid have the ability to flow. The particles are loosely packed and can move from one place to another. This property is called fluidity.

Liquids have the ability to acquire the shape of the container in which it is kept in. This is possible because of the fluidity of liquids.

B. When alcohol or perfume is put on our palm, the particles of alcohol/perfume gain energy from our palm or surroundings and evaporate. This produces a cooling effect to the palm. The principle behind this is evaporative cooling.

C. The rate of diffusion of a liquid in another liquid is affected by:

(1) Viscosity and chemical nature:

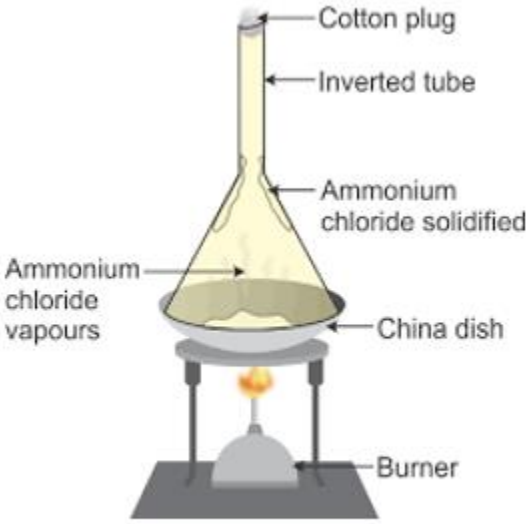
Viscosity is the resistance offered to the flow of liquids, or simply it is the thickness of the liquid. The rate of diffusion also depends upon the chemical nature of the liquids.

(2) Temperature:

An increase in temperature would increase the kinetic energy of the liquid particles which increases the rate of diffusion between them.

Q.19. Draw a labelled diagram to show the sublimation of Ammonium chloride.

Answer:



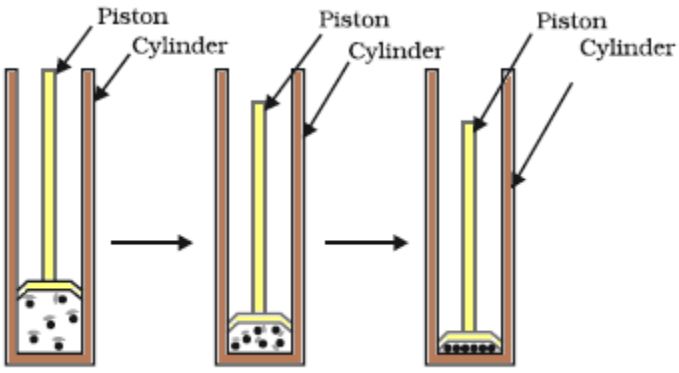
Sublimation of ammonium chloride

Ammonium chloride (NH_4Cl) is taken on a china dish. It is covered by placing an inverted funnel. The neck of the funnel is plugged using cotton. This is heated with the help of a burner as shown in the figure.

One can see that ammonium chloride starts to sublime (to convert into gaseous phase without entering liquid phase). The ammonium chloride vapours try to escape, but the funnel is completely sealed. Therefore, the ammonium chloride vapours after rising up lose energy and get solidified along the walls of the funnel. This process from vapour to solid state is also called sublimation.

Q.20. How will you show that, by applying pressure, particles of matter can be brought close together?

Answer: Consider a cylinder containing a certain amount of gas. To apply pressure, the piston is lowered towards the gas particles as shown in the figure.

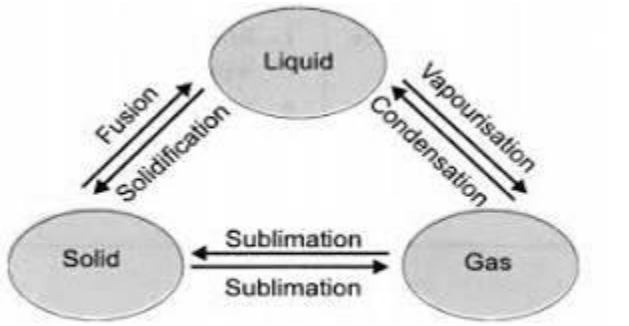


Compression of gas

One can observe that as the applied pressure increases, the gas particles are forced to come closer and closer. As a result, there is an increase in the inter-molecular forces of attraction. Further increase in pressure would result in the liquefying of gas.

Q.21. Show diagrammatically, the interconversion of the three states of matter.

Answer: The interconversion of the three states of matter – solid, liquid, gas is illustrated by the following figure.



Interconversion of the three states of matter

From the figure, one can summarise that:

Starting state of matter	*Ending state of matter*	*Name of the process*
Solid	Liquid	Fusion
Solid	Gas	Sublimation
Liquid	Solid	Solidification (Freezing)
Liquid	Gas	Vapourisation
Gas	Solid	Sublimation
Gas	Liquid	Condensation

Q.22. Ice melts by absorbing heat. When it melts, its temperature remains the same. Where does the heat energy go?

Answer: When ice reaches its melting point, the energy supplied to the system (ice) is used to overcome the force of attraction between the solid particles and converts the solid into a liquid state. At this point, there is no rise in temperature. The energy is completely used in the change of state from solid to liquid (or also called melting). This heat energy used in the conversion is called the latent heat of fusion. It is called “latent” or hidden because the supplied heat energy is not used to raise the temperature of ice.

Q.23. 2 ml of Dettol is added to a beaker containing 500 mL of water and stirred. State four observations that you can make.

Answer: When 2 ml of dettol is added to a beaker containing water, one can see that:

(a) Dettol completely mixes with water. After mixing, one cannot distinguish the dettol content from water.

(b) The smell of dettol could be identified after stirring.

(c) A slight colour change can also be observed while stirring. The mixture becomes slightly white in colour.

(d) The concentration of dettol is reduced. The effects (for example the ability to kill germs) shown by the mixture of dettol+water is less than that of 2 ml of dettol alone.

Q.24. Water is kept in an earthen pot (matka) during summer. Why is it so?

Answer: An earthen pot contains tiny holes. The particles present in the water surface acquire energy from the surroundings and get converted into vapour (The process involved is evaporation). The vapours escape through these tiny holes producing a cooling effect to the water inside the pot.

Comprehensive Exercises (MCQ)

Q.1. In which state of matter, the process of diffusion is fastest:

Answer: The process of intermixing of particles of two different types of matter on their own is called diffusion. In gases, the molecules move freely at high speeds. There is a larger space between the gas molecules when compared to the spaces between molecules in solids and liquids. This is why the process of diffusion is the fastest in gases.

Q.2. Evaporation is called as:

Answer: Evaporation is the phenomenon of change of a liquid into vapour phase at temperatures below its boiling point. A small fraction of the particles present in the liquid surface having higher kinetic energy breaks away from the force of attraction between other liquid particles to become vapour. Since surface particles contribute to evaporation, evaporation is a surface phenomenon.

Q.3. During the evaporation process, the heat is:

Answer: Evaporation takes place when the particles present in the liquid surface acquire more kinetic energy by absorbing heat from the surroundings. These particles escape from the force of attraction of other particles and get converted into the vapour phase.

Q.4. Boiling process is a:

Answer: Boiling is the process of conversion of a liquid into the vapour state. This happens when the particles of the bulk of the liquid gain enough energy to break the force of attraction between the particles of liquid.

Q.5. The state of matter which is found to be more stable at lower temperature:

Answer: At low temperatures, there is less kinetic energy associated with the particles of matter. Therefore, the particles only vibrate in their positions. Since the energy from surroundings is not able to break the bond or force of attraction between the particles, the particles tend to be in a solid state with distinct boundaries and fixed volume.

Q.6. The gas can be liquefied by:

Answer: By lowering temperature, the energy of surroundings become less than that of the gaseous particles. Then there is a transfer of energy from gas to the surroundings. Thus, the gas molecules lose energy and get converted to a liquid state.

By raising pressure, the particles of gas come closer and closer and get converted to a liquid state.

Q.7. Intermolecular forces of attraction are least effective in:

Answer: In gases, there is a large space between the gaseous particles and the particles move at high speeds. This is because of the weak intermolecular forces of attraction. The intermolecular forces of attraction are higher in solids, liquids, and plasma.

Q.8. Evaporation of a liquid takes place at:

Answer: Evaporation is the phenomenon in which a liquid is converted into vapour state at any temperature below the boiling point of the liquid.

Q.9. When water gets solidified into ice, then heat is:

Answer: The molecules of water have more energy than that of ice. When solidified, the water molecules must lose energy to the surroundings to form ice. So, heat is evolved in the conversion of water to ice.

Q.10. Boiling of a liquid takes place at

Answer: A liquid starts to boil at the boiling point. Boiling point is the temperature at which the liquid starts changing to gas at atmospheric pressure. So, the conditions for boiling are fixed temperature and normal atmospheric pressure.

Q.11. Arrange the following in the increasing order of 'forces of attraction':

Answer: The increasing order of forces of attraction for the three states of matter (solid, liquid, gas) is as follows:

Gas>Liquid>Solid

Here, water → liquid, air → gas, sugar → solid, oxygen → gas, salt →solid, oil → liquid, juice → liquid.

The option which obeys the above order is (C)

Q.12. Which condition out of the following increase the evaporation of water.

Answer: When the temperature is increased, more number of particles get enough kinetic energy to go into the vapour state, increasing the rate of evaporation.

Q.13. The property to flow is unique to fluids. Which one of the following statements is correct?

Answer: States of matter which have the ability to flow are called fluids. Flow refers to the movement of particles of matter. One can find that the particles of liquid and gas are able to flow as there is enough space between the particles constituting liquid and gas. In the case of solids, there is a restriction in movement of particles as there are strong forces of attraction between them.

Q.14. What will be the correct sequence of temperature when 25°C, 46°C and 99°C are converted to the Kelvin scale?

Answer: One can obtain the temperature in Kelvin scale using the following relation:

x°C = (x+273) K

∴ 25°C = (25+273) K = 298 K

46°C = (46+273) K = 319 K

99°C = (99+273) K = 372 K

Q.15. Which is the correct statement?

Answer: Sublimation could be one of the following:

(1) Conversion of solid into vapour without passing through liquid state

(2) Conversion of vapour into solid without passing through liquid state

Freezing is the conversion from liquid to solid, and vaporisation is the conversion from liquid to gas.

Comprehensive Exercises (T/F)

Q.1. Write true or false for the following statements:

The movement of tiny particles in a gas or liquid is called Tyndall effect.

Answer: False

The movement of a tiny particle in a gas or liquid is called the flow of particles. The property can be also called as “fluidity”

Tyndall effect is the phenomenon of light scattering by particles in a colloid.

Q.2. Write true or false for the following statements:

The force of attraction between the constituent particles in any form of matter is known as inter-molecular force.

Answer: True

Inter-molecular forces are present in all states of matter. They are the highest in solids and lowest in gases. Inter-molecular forces determine the structure of the substance.

Q.3. Write true or false for the following statements:

Solids are very rigid and cannot flow from one place to another.

Answer: True

The inter-molecular forces in solids are very strong. This restricts the movement of the particles in the solid. Therefore, solids have a rigid structure and fixed volume.

Q.4. Write true or false for the following statements:

The diffusion in liquids depends upon the thickness (viscosity) as well as on the chemical nature of the diffusing liquids.

Answer: True

Viscosity is the property of resistance offered to the flow of a fluid (liquid or gas). It is informally referred to as “thickness”

Diffusion is the process of intermixing of two different states of matter on their own. Not all substances diffuse well, as it depends upon the chemical nature and viscosity of the diffusing liquids.

Q.5. Write true or false for the following statements:

The Celsius scale is an absolute temperature scale.

Answer: False

Kelvin scale is an absolute temperature scale. The conversion of ° celsius to kelvin is:

x°C = (x+273.16) K

The lowest possible temperature is 0 K (=-273.16°C) which is also referred to as absolute zero.

Q.6. Write true or false for the following statements:

0°C = -273 K

Answer: False

The relation between Celsius scale and Kelvin scale is:

x°C = (x+273) K

When x = 0,

0°C = (0+273) K = 273 K

Q.7. Write true or false for the following statements:

-273°C = 0 K

Answer: True

The relation between Celsius scale and Kelvin scale is:

x°C = (x+273) K

When x = -273,

-273°C = (-273+273) K = 0 K

Q.8. Write true or false for the following statements:

The term vapour describes the gaseous state of a substance that normally exists as a liquid or solid.

Answer: True

Consider the case of water. In room temperature, it exists in liquid state. When heated to 100°C, water gets converted into water vapour.

That is the natural state of vapour is solid or liquid in room temperature, but for gases, the natural state of gas is gas itself in room temperature.

Q.9. Write true or false for the following statements:

Latent heat means the heat which can be seen easily.

Answer: False

The word “latent” means hidden. Latent heat refers to the amount of heat energy required to convert 1 kg of a particular state of matter into another at a constant temperature (and atmospheric pressure).

For example, latent heat of fusion refers to the amount of heat energy required to convert 1 kg of a solid into liquid at atmospheric pressure at its melting point.

Q.10. Write true or false for the following statements:

Gases can be liquefied easily by applying pressure and reducing temperature.

Answer: True

When pressure is applied to gases (or when gases are compressed) the gaseous particles are forced to come closer and get liquefied. When the temperature is reduced, the energy of gaseous particles is higher than the surroundings. As a result, the gaseous particles lose energy and become liquids.