MATTER IN OUR SURROUNDINGS

§§ INTRODUCTION :-

Early Indian philosophers and ancient Greek philosophers classified matter in the form of five basic elements "Panch Tatva" – air, earth, fire, sky and water. All living an non living things are made of these five basic elements.

In our surroundings, we see a large variety of things with different shapes, size and textures. Everything in this universe is made up of material which scientists have named "Matter", for example air, food,stones, clouds, stars, plants and animals, even a small drop of water or a sand particle are matter.The perception of joy, love, hate, thought, cold, hot, pain does not constitute matter while we perceive.

§§ DEFINITION :-

Material :– The term used to describe a particular kind of matter, is called material e.g. – wood,water and marble.

Type of material :–

Homogeneous material	Heterogeneous material
Which has same composition and same properties is called. Homogeneous material.	Which has different composition and different properties in material called hetrogeneous material.

Matter :– Anything which occupies space and has mass is called matter, so everything in the universe is "matter".

Some examples of matter are , water, air, metals, plants, animals etc. The matter can be classified into different categories depending upon its physical or chemical nature

(a) Matter is categorized as a gas, a liquid and a solid on the basis of physical state. For e.g. – Air , water and the earth.

Changes of state are also matters of everyday experience for example, ice melts and water freezes, water changes into steam on heating and steam condenses to liquid water on cooling.

(b) On the basis of chemical nature matter is classified as an element compound or mixture. Elements and compounds are pure substances whereas a mixture contains two or more pure substances.

The three physical states of matter (i.e solid, liquid or gaseous) arise due to variation in the characteristics of the particles of matter.

§§ SOLID STATE :

Matter in solid state has a definite shape and definite volume.

Examples: Silver, copper, sand, sugar, gold, ice, wood, stone, book, needle, pencil, piece of thread, etc.

¶¶ Properties of Solids :

(a) Solids have a definite shape and distinct boundaries: The solids have a fixed shape and distinct boundaries due to small inter particle distances and strong forces of attraction. e.g. when a pen is put in different containers, it does not change its shape.

However, when sugar and salt, are placed in different containers, they take up the shape of the containers, yet they (sugar & salt) are solids. This is because, the shape of individual sugar or salt crystal remains fixed whether we take it in our hand, or put in a jar or in plate.

The highly ordered arrangement of constituent particles of a solid is called a lattice. This gives rise to a regular geometrical shape to the crystals.

(b) Solids possess rigidity: The solids have the tendency to maintain shape, when some outside force is applied (known as rigidity). They may break when dropped or hammered.

However some solids like rubber band, changes its shape when stretched under influence of force, but it regains its original position, when force is withdrawn. However, if excessive force is applied, rubber band breaks.

(c) Solids have a definite volume : Solids have a definite volume as they can not be compressed due to small inter particle distances.

However some solids like sponge can be easily compressed. This is because sponge has minute holes in which air is trapped so that when we press it, air is expelled and the sponge is compressed.

(d) Solids do not possess the property of diffusion :- The solids do not have the property of diffusion into other solids (i.e. the particles of two solids do not intermix). This is because the particles of solid do not move much from their positions due to small inter particle distances and strong forces of attraction.

However particles of some solids like chalk have diffused into other solids like blackboard. i.e. if we write something on blackboard with the chalk and leave it uncleaned for sometime, we will find that it becomes difficult to clean the board. This is because of diffusion of chalk particles in between the particles of blackboard and hence it becomes difficult to rub them off.

§§ LIQUID STATE :

The matter in liquid state have a definite volume and no definite shape.

Examples : Water, blood, benzene, alcohol, milk, petrol, cooking oil, juice, cold drink etc.

¶¶ Properties of Liquids

(a) Liquid do not have fixed shape but have a fixed volume : The liquids have a fixed volume due to strong inter particle forces of attraction in them which are strong to keep the particles together.

But these forces are not strong enough to keep the particles in fixed position, therefore, liquids do not have a fixed shape, they take up the shape of vessel in which they are placed.

(b) Liquids are not rigid but have a property to flow : Liquids can flow and change shape due to larger inter particle distances and weaker forces of attraction in them, than solids. Thus liquids are not rigid but they possess fluidity (i.e. they have property to flow).

Relative fluidity of liquids differ from one liquid to other. e.g. water flows faster than honey.

(c) Liquids possess the property of Diffusion : Due to larger inter particle distances in liquids than in solids, the particles of a liquid have more freedom of motion than solids. Thus solids, liquids and gases all can diffuse into liquids as discussed below:

(i) Diffusion of solids into liquids: When a crystal of copper sulphate or potassium permanganate (solid) is added to water (liquid), the particles of $CuSO_4$ or $KMnO_4$ quickly diffuse in between the particles of water to form a solution.

(ii) Diffusion of liquids into liquids: When water is added to alcohol or vice-versa, the two liquids quickly diffuse into each other to form a solution.

(iii) Diffusion of gases into liquids: Some gases especially O_2 and CO_2 diffuse into water i.e. dissolve in water. So that aquatic animals can breathe under water due to presence of dissolved oxygen in water.

Thus solids, liquids & gases – all can diffuse into liquids. However, the rate of diffusion of liquids is much higher than that of solids.

♠ **Rate of diffusion of different liquids :-** Different liquids have different rates of diffusion. For example a drop of blue or red ink diffuses faster than a drop of honey into water.

♠ **Rate of diffusion increase with rise in temperature :-** Rate of diffusion increases with rise in temperature, hence sugar dissolves much more quickly in hot water than in cold water.

§§ GASEOUS STATE :

The matter in gaseous state has neither definite volume nor shape.

Examples : Air, oxygen, nitrogen, hydrogen, ammonia, carbon dioxide, compressed natural gas (CNG) etc.

¶¶ Properties of Gases

(a) Gases neither have a definite shape nor a definite volume : Gases do not have a definite shape, but they acquire the shape of the vessel in which they are placed.

Similarly, gases do not have a definite volume, but attain the volume of container to which they are transferred.

(b) Gases have maximum fluidity and least rigidity : The gases have high fluidity (property to flow) and least rigidity (tendency to maintain shape) due to large inter particle space and weak inter particle forces of attraction in them.

(c) Gases are highly compressible : The gases are highly compressible due to large inter particle spaces in them. Due to high compressibility, large volume of a gas can be compressed into a small cylinder and transported easily. e.g. L.P.G. gas & O_2 supplied to hospitals in cylinders is compressed gas. Similarly these days, compressed natural gas (CNG) is used as a fuel in vehicles.

Gases are highly compressible while liquids are almost incompressible, while solids are completely incompressible.

(d) Gases have low density : Gases have low density as compared to solids and liquids due to large inter molecular spaces in them. i.e. mass per unit volume of a gas is small and hence gases have low density.

(e) The Kinetic energy of particles in the gaseous state is quite high :- Due to large inter particle distances and weak forces of attraction, the particles of a gas can move freely & thus have large rotational, translational and vibrational motion and due to large translational motion, their kinetic energy is quite high which can be further increased by increasing the temperature of gas.

(f) Gases exert pressure : Due to larger inter particle distances and weaker inter particle forces of attractions, particles of a gas are moving continuously in different directions with different velocities. Due to this random motion, the particles of gas collide with each other and also with the walls of the containing vessel. Due to these collisions, the particles of the gas exert a force on the walls of the container. This force per unit area exerted by the particles of the gas on the walls of containing vessel is called the **pressure of the gas**.

Random motion means motion in different directions with different velocities. The random motion of particles of a gas is due to larger inter particle distances and weaker inter particle forces of attraction between them, unlike liquids & solids.

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Differences in the characteristics of states of matter (solids, liquids & gases) :

S.No.	Property	Solid	Liquid	Gas
1.	Packing	The particles are most closely packed.	The particles are less closely packed than solids.	Particles are at sufficient distances from each other.
2.	Shape	Solids have definite shape.	Liquids do not have definite shape. They assume the shape of container.	Gases do not have a definite shape. They assume the shape of container.
3.	Volume	Solids have definite volume.	Liquids have definite volume.	Gases do not have definite volume. They assume the volume of container.
4.	Density	Solids have high density.	Liquids have less density than solids but more than gases.	Gases have the least density.
5.	Diffusion	Solids have no tendency to diffuse.	Liquids have a tendency to diffuse slowly.	Gases diffuse rapidly.
6.	Rigidity	Rigid.	Fluid.	Fluid.
7.	Compressibility	Negligible.	Very low.	High.
8.	Inter-molecular forces of attraction	Maximum.	Less than solids.	Negligible.
9.	Kinetic energy of molecules	Least.	More than solids.	Very high.

§§ **Fourth state of matter (Plasma):**

The fourth state of matter is plasma.

Plasma is an ionized gas, a gas into which sufficient energy is provided to free electrons from atoms or molecules and to allow both species, ions and electrons,to coexist.

Plasma occurs naturally and makes up the stuff of our sun, the core of stars and occurs in quasars, x-ray beam emitting pulsars, and supernovas.

On earth, plasma is naturally occurring in flames, lightning and the auroras.

Most space plasmas have a very low density, for example the Solar Wind which averages only 10 particles per cubic-cm. Inter-particle collisions are unlikely - hence these plasmas are termed collision less.

§§ **Fifth state of matter (Bose - Einstein condensate):**

The collapse of the atoms into a single quantum state is known as Bose condensation or Bose-Einstein condensate is 5th state of matter.

The Bose-Einstein condensate occurs at ultra-low temperature, close to the point that the atoms are not moving at all.

A Bose-Einstein condensate is a gaseous superfluid phase formed by atoms cooled to temperatures very near to absolute zero.(0 K or -273^{0}C)

The first condensate was produced by Eric Cornell and Carl Wieman in 1995 at the University of Colorado at Boulder, using a gas of rubidium atoms cooled to 170 nanokelvins (nK). —Under such conditions, a large fraction of the atoms collapse into the lowest quantum state, producing a superfluid.

This phenomenon was predicted in the 1920s by Satyendra Nath Bose and Albert Einstein, based on Bose's work on the statistical mechanics of photons, which was then formalized and generalized by Einstein.

Ex :liquid Helium

§§ **Latent heat:**

The amount of heat required to change the state of matter from one state to another without rise in temperature is known as latent heat of that substance.

Latent heat is of two types:

(i) Latent heat of fusion: The amount of heat required to change the state of matter from solid state to liquid state without rise in temperature is known as latent heat of fusion.

(ii) Latent heat of vaporisation: The amount of heat required to change the state of matter from liquid state to gaseous state without rise in temperature is known as latent heat of vaporisation.

Some substances may exist in all the three states of matter in different conditions, for example, water can exist in three states of matter:

(i) in solid state as ice.

(ii) in liquid state as water.

(iii) in gaseous state as water vapours or steam.

This inter conversion of matter can be achieved by the following two ways :

(a) by changing the temperature.

(b) by changing the pressure.

Therefore the phenomenon of change of matter from one state to another state and back to original state, by altering the conditions of temperature and pressure etc., is called as iinterconversion of matter.

Common Unit of Temperature and SI Unit of Temperature :

Common unit of measuring temperature is degree Celsius (°C).

The SI unit of measuring temperature is Kelvin which is denoted by the symbol K.

The Kelvin scale and Celsius scale of temperature are interconvertible and the relation can be written as :Temperature in Kelvin (K) scale = Temperature in Celsius (°C) scale + 273.

§§ **EFFECT OF INCREASE IN TEMPERATURE**

(i) Change of state from solid to liquid (fusion): When heat is supplied to a solid (ice), the kinetic energy of solid particles increases due to increase in temperature. As a result, solid particles start vibrating with high speed. On further increasing temperature, the heat energy overcomes the forces of attraction between solid particles. At this temperature, the particles leave their fixed positions, start flowing and thus solid melts to form a liquid.

The temperature at which a solid melts to become a liquid at atmospheric pressure is called its '**melting point'**. This process of change of solid state into liquid state is also called **'Fusion'**.

$$\text{Solid} \xrightarrow{\text{Heat}} \text{Liquid}$$

The melting point of ice is O^0C or 273 K ($O^0C = 273 + 0 = 273K$). This temperature (i.e. O^0C) remains constant till all the ice has melted even though we continue to supply the heat. This is because, the heat energy supplied is absorbed by the particles of ice to overcome the forces of attraction between them to change them from solid to liquid state without showing any rise in temperature. Therefore, it is considered that this heat gets hidden within the particles and is thus called latent heat (latent means hidden).

(ii) Change of state from liquid to gas (vaporisation) : When heat is further supplied to the liquid, kinetic energy of liquid particles increase further, as a result of this, inter-particle distance increase (app. 100 times). Hence, the magnitude of forces of attraction holding the liquid particles becomes so less that, the liquid particles break apart from the liquid state and change to gaseous or vapour state.

The pressure of air in atmosphere is called **atmospheric pressure.**

$$\text{Liquid} \xrightarrow{\text{Heat}} \text{Gas}$$

At which temperature liquid turns to gas is called as ***boiling point***. Each pure liquid has a fixed boiling point. The boiling point of pure water is 100^0C or 373 K ($100^0C = 273 + 100 = 373K$) This temperature (i.e. 100^0C) again becomes constant till all the liquid has vaporized. This is again because that heat energy supplied is absorbed by the liquid water particles to overcome the forces of attraction between them to change from liquid water to steam, without showing any rise in temperature. In other words, heat gets hidden within the particles and is therefore, called latent heat.

¶¶ **On decreasing temperature by cooling**

(i) Change of state from liquid to solid (solidification): When water is cooled (by lowering its temperature) it gets changed into solid 'ice'. The process of changing a liquid into a solid by cooling is called "freezing". When the temperature is lowered particles of the matter lose energy due to which they move slowly. If we continue to lower the temperature then the particles of substance stops moving and vibrates around their fixed position. At this point the liquid freezes and gets converted into solid.

$$\text{Liquid} \xrightarrow{\text{Cool}} \text{Solid}$$

Freezing is the reverse of melting. So the freezing point of a liquid is the same as the melting point of its solid form.

The amount of heat energy that is required to change 1kg of solid into liquid at atmospheric pressure at its boiling point is called, **latent heat of vaporization.**

(ii) Change of state from gas to liquid (condensation): When the temperature of gaseous state of matter is lowered, it is converted into liquid state. So, the process of changing a gas (or vapour) to a liquid by cooling, is called **condensation.** At which temperature a gas turns to liquid state is called as **condensation point.**

For example, when temperature of water vapour is lowered it gets converted into liquid water.

Explanation: when the temperature is lowered then the particle of gaseous state lose energy and their movement slow down, because of this they move closer together until they start being attracted to each other and form a liquid.

$$\text{Gas} \xrightarrow{\text{Cool}} \text{Liquid}$$

Condensation is the reverse of vaporization.

Conclusion: From the above discussion, we led to conclude that one state of matter can be changed into another or vice-versa by changing the temperature.

$$\text{Solid State} \underset{\text{Cool}}{\overset{\text{Heat}}{\rightleftharpoons}} \text{Liquid State} \underset{\text{Cool}}{\overset{\text{Heat}}{\rightleftharpoons}} \text{Gaseous State}$$

Imp Note: Melting point of ice is same as the freezing point of water. It is O^0C or 273K under one atmospheric pressure. In other words, at O^0C both ice and water exist together. But particles in water have more energy as compared to particles in ice at same temperature i.e. at 0^0C. This is because during the change of state from ice to water, heat energy equal to latent heat of fusion has been absorbed.

The particles of steam have higher energy than the particles of liquid water at same temperature i.e. at 100^0C. This is again because, during change of state from liquid water to steam or vapours, heat energy equal to latent heat of vaporization has been absorbed.

§§ SUBLIMATION

Sublimation is the process of conversion of a solid directly into a gas or vice-versa without changing into liquid state.

$$\text{Solid} \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} \text{Vapour (or gas)}$$

§§ By altering the pressure :

When pressure is lowered, boiling point of a liquid is lowered. Because when pressure is lowered the distance between the molecules increases and reaches the gaseous state easily.

Interconversion of states of matter :

The terms involved	Process of change of state at a particular temperature
• **Melting**	Solid state changes to liquid state
• **Vaporization**	liquid state changes to Gaseous state
• **Liquefaction**	Gaseous state changes to liquid state
• **Solidification**	liquid state changes to solid state
• **Sublimation**	Solid state changes to Gaseous state

The terms involved	Temperature at which....
• **Melting Point**	Solid state converts to liquid state
• **Boiling Point**	liquid state converts to Gaseous state
• **Liquefaction Point**	Gaseous state converts to liquid state
• **Freezing Point**	liquid state converts to solid state

Comparision of Different states of matter

Melting	Vaporization
The process of conversion of matter from solid to liquid is known as Melting	The process of conversion of matter from Liquid to Gas is known as Vaporization
On heating solids – temperature rises	On heating liquids- temperature rises
particles gain energy.	Particles gain energy
Intermolecular attractions decreases	Intermolecular attractions decreases
intermolecular space between molecules of solid increases	intermolecular space between molecules of liquid increases

Liquefaction	Solidification
The process of conversion of gas to liquid is known as Liquefaction	The process of conversion of liquid to solid is known as Solidification
On cooling gases: temperature falls	On cooling liquids: temperature falls
Attraction between molecules (intermolecular attraction) increases	Attraction between molecules (intermolecular attraction) increases
space between (intermolecular space) molecules of gases decreases	space between (intermolecular space) molecules of gases decreases
particles lose energy	particles lose energy
at liquefaction point, particles slow down, come close and convert into a liquid	At solidification [freezing] point, particles slow down and convert into a solid.

§§ EVAPORATION

"The process of a liquid changing into vapour (or gas) even below its boiling point is called evaporation".

Factors Affecting Evaporation

There are five factors which affects the rate of evaporation:–

(i) Nature of liquid :–

Different liquids have different rates of evaporation. A liquid having weaker interparticle attractive forces evaporates at faster rate because less energy is required to overcome the attractive forces.

Example – Acetone evaporates faster than water.

(ii) Surface area of the liquid :–

The evaporation depends upon the surface area. If the surface area is increased, the rate of evaporation increases because the high energy particles from liquid can go into gas phase only through surface.

Ex :–(a) The rate of evaporation increases when we put kerosene or petrol in an open china dish than in a test tube.

(b) Clothes dry faster when they are well spread because the surface area for evaporation increases.

(iii) Temperature:–

Rate of evaporation increases with increase in temperature. This is because with the increase in temperature more number of particles get enough kinetic energy to go into the vapour state (or gaseous state) **Example –** Clothes dry faster in summers than in winters.

(iv) Humidity in the air:– The air around us contains water vapour or moisture. The amount of water present in the air is referred to as humidity. The air cannot hold more than a definite amount of water vapour at a given temperature. If the humidity is more, the rate of vaporization decreases. The rate of evaporation is more if the air is dry.

Ex:– Clothes do not dry easily during rainy season because the rate of evaporation is less due to high moisture content (humidity) in the air.

(v) Wind speed :–

The rate of evaporation also increases with increase in speed of the wind. This is because with increase in speed of wind, the particles of water vapour move away with wind resulting decrease in the amount of vapour in the atmosphere.

Difference between Evaporation and Boiling

	Evaporation	Boiling
1	Evaporation process takes place	Boiling takes place only at definite
2	Evaporation takes place only at the	Boiling takes place even below the
3	It always causes cooling	No cooling

TEACHING TASK

SINGLE ANSWER TYPE:

1. A drop of ink can diffuse faster as compared to a drop of honey because

A) The attractive forces among the particles in blue ink are less compared to honey

B) The attractive forces among the particles in blue ink is more as compared to honey

C) There are no atlractive forces among the particles in blue ink

D) There are no attractive forces among the particles of honey

2. You know boiling point of water is 100^0C. You are applying more pressure on water when you are heating. Change observed in the boiling point of water is

A) Less than 100^0C B) equal to 100^0C

C) no boiling point D) Greater than 100^0C

3. Inter convertion involved in usage of "odonil" in wash room is

A) Sublimation B)Deposition C)Melting D)Freezing

4. Interconversion of matter involves change of matter from one state to another and back to its original state. It is affected by changes in conditions such as

A) Only temperature. B) Only pressure.

C) Both temperature and pressure. D) Neither pressure nor temperature

5. $\text{Water} \underset{B}{\overset{A}{\rightleftharpoons}} \text{Water vapour}$

A) A : solidification, B : vaporisation

B) A : vaporisation, B : condensation

C) A : melting, B : solidification

D) A : condensation, B : melting

6. The fundamental property of matter by virtue of which body resists to change its original position is called

A) Elasticity B) Buoyancy C) Continuity D) Inertia

7. $\text{Solid} \underset{B}{\overset{A}{\rightleftharpoons}} \text{Liquid}$ .Select the right option

A) A : vaporisation, B : condensation

B) A : condensation, B : vaporisation

C) A : sublimation, B : liquefaction

D) A : melting, B : solidification

8. The glow of stars is due to the presence of ..... in it

A)metane B) plasma C) nitrogen D) oxygen

9. Which of the following is gaseous form of the solid

A)Slaked lime B) Graphite C)solid CO_2 D)quick lime

10. $\underset{(\text{Solid})}{\text{Ice}} \underset{B}{\overset{A}{\rightleftharpoons}} \underset{\text{liquid}}{\text{Water}} \underset{B}{\overset{A}{\rightleftharpoons}} \underset{\text{gas}}{\text{Water vapour}}$ Identify A, B

	(A)	*(B)*
A)	Heating	Heating
B)	Cooling	Heating
C)	Heating	Cooling
D)	Cooling	Cooling

KEY

ΦΦ TEACHING TASK :

1. A 2.B 3.A 4.C 5.A 6.A 7.D 8. B 9.C 10.C

LEARNER'S TASK

BEGINNERS (Level - I)

1. The presence of impurities generally ----the melting point of substance

A) Increase B) Reduce C) Both A&B D) None of these

2. If melting points ice is 0^0c then freezing point of water is ------

A) 100^0c B) 15^0c C) 75^0c D) 0^0c

3. At which temperature solid turns to liquids is called as ------ points

A) Melting pointsB) Boiling points C) Freezing points D) none of these

4. The Solid state formed from the gaseous state on cooing is called as

A) Sublimate B) Condensation C) Melting points D) Boiling Points

5. At which tempereature a gas turns to liquid state is called

A) Condensation point B) Freezing point

C) Melting Point D) Boling Point

6. 0^0c temerature= --------kelvin

A) 273k B) 100k C) 173 k D)200k

7. Which process only we are getting oxygen purely in a hospitals for artificial respiration

A) Liquefaction B) Solidification C) Vapoursation D) Subllimation

8. In solids inter mollecular spaces are very ..... &inter mollecular attraction is.....

A)Less& High B)High&Less C)Both A&B D)None

9. The process of conversion of liquid slowly into gas at a temperature far below their boilingpoint is called.

A)Condensation B)Sublimatation C)Melting D)Evaporation.

10. The condensation point of water is

A)100°C B)101k C)150k D)2k

ACHIEVERS (Level - II)

Give reasons :

1. A gas fills completely the vessel, in which it is kept.

2. A gas exerts pressure on the walls of the container.

3. We can easily move our hand in the air but to do the same through a solid block of wood we need a karate expert.

4. The diver is able to cut through water in a swimming pool.

EXPLORERS (Level - III)

One or more than one answer type :

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

1. Which of the following statements is wrong

A. Air, water, chair, table and smell are examples of matter.
B. Gases have highest rate of diffustoin among all the three states of matter.
C. Evaporation causes heating.

2. Which of the following statements is correct

A. Camphor changes to gaseous state without changing into liquid.
B. Water has boiling point equal to 100°C.
C. Evaporation is a bulk phenomenon.

3. Which of the following statements is correct

A. Intermolecular forces are maximum in solids and minimum in gases.
B. Condensing is opposite to evaporating and freezing is opposite to melting.
C. The large volumes of gases can be put into small volumes of cylinders because of their property known as compressibility.

Matrix Match Type:

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

  *If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

1.

Column-I		**Column-II**
a)	Liquifaction	1) Solid state to direct gaseous state
b)	Melting point	2) Liquid changes into solid
c)	Freezing point	3) Solid changes into liquid
d)	Sublimation	4) Gaseous states to liquid state
		5) Liquid to gaseous state

A) a - 4, b - 1, c - 2, d - 3
B) a - 4, b - 3, c - 2, d - 1
C) a - 2, b - 3, c - 1, d - 4
D) a -3, b -2, c - 4, d - 1

2.

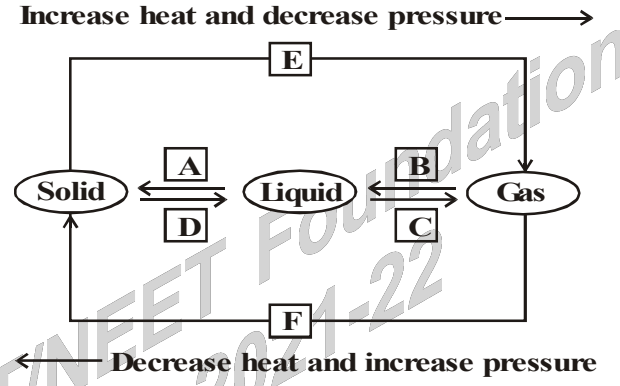
Column-I	**Column-II**
a) The molecules are made up of smaller particles	1) Molecules
b) Matter is made up of	2) Liquefaction point
c) The constant temperature at which gas changes into liquid	3) Atoms

A) a - 3, b - 1, c - 2, B) a - 1, b - 3, c - 2,

C) a - 2, b - 3, c - 1, D) a -3, b -2, c - 1,

IV) Comprehension type

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which* ***ONLY ONE i****s correct. Choose the correct option.*



1. Which of the following statements are correct

A) If the melting point of a substance is above the room temperature at the atmospheric pressure, it is called solid.

B) If the boiling point of a substance is above room temperature under atmospheric pressure, it is classified as liquid.

C) If the boiling point of the substance is below the room temperature at the atmospheric pressure it is called gas.

D) All the above

2. A, B, D, and F in the above diagram

A) A : Fusion, B : Vaporizations, D : Solidification, F : Sublimation

B) A : Sublimation , B : Vaporizations, D : Solidification, F : Fusion

C) A : Fusion, B : Solidification, D : Vaporizations, F : Sublimation

D) A : Sublimation , B : Vaporizations, D :Fusion, F : Solidification

KEY

ΦΦ LEARNER'S TASK :

☐ **BEGINNERS :**

I. 1. B 2. D 3.A 4.A 5.A 6.A 7.A 8. A 9. D 10.A

☐ **EXPLORERS :**

One or more than one correct answer: 1. A,B,C 2. A,B 3. A,B,C

Match the following: 1) B 2) A

Comprehension type: 1. A 2. D

The chemical classification of matter :

The chemical classification of matter is into two types

1) Pure substances 2) Mixtures

A) Pure substances

It is a homogeneous material which contains particles of only one kind. All these particles will have a definite set of properties. Therefore all elements are pure substance & all compounds are also pure substances.

But there are some substances which appear as pure substances but are not pure substances. For example tap water, milk, honey, medicines & fruit juice.

1) A clear tap water is not a pure substance. It contains some dissolved salts and air. Due to the presence of dissolved salts water has taste.

2) Milk is not a pure substance because it contains fats, carbohydrates salts, vitamins, proteins and water in different proportions.

3)Honey is not a pure substance because it contains a number of chemical molecules of other substances in addition to sugar. Fruit juice is not a pure substance as it contains sugar, mineral salts and a number of organic compounds.

✦ **Pure substances are further divided into elements and compounds.**

§§ **Elements**

Definition: Substances, which cannot be broken further into any other substances by any physical or chemical means, are called **'Elements'.**

Example : Hydrogen, oxygen, nitrogen, copper, zinc, tin, lead, mercury, etc. are all elements as they cannot be subdivided into simpler parts by any **chemical means.** A substance made up of the atoms with same atomic number is called an **element.**

§§ **Characteristics of an element:**

i) ***Nature:*** An element is a pure and homogeneous substance.

ii) ***Melting and Boiling points:*** It has characteristic melting and boiling points.

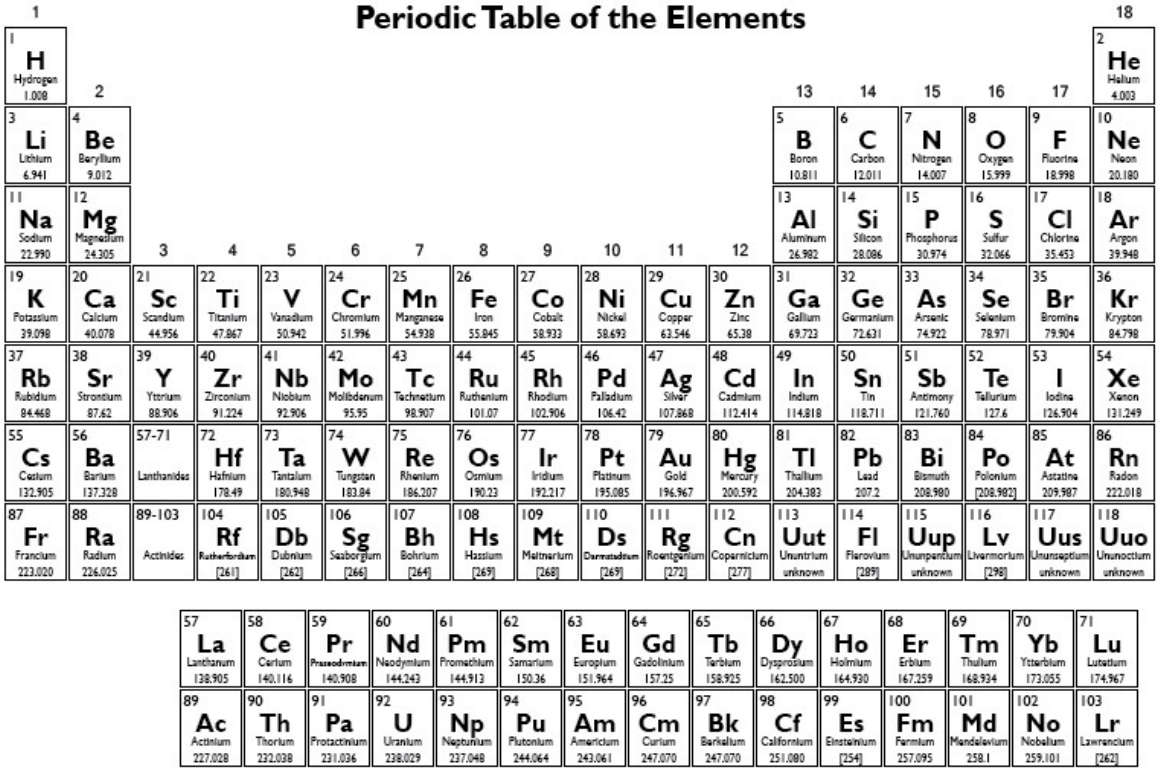
iii) ***Separation of components:*** An element cannot be broken down into simpler substances, by any physical or chemical means.

iv) ***Nature of Atoms:*** An element is made up of same kind of atoms. Different elements are made up of different kinds of atoms.

v) ***Chemical Reaction:*** An element may chemically react with other element(s), to form compound(s). For example, hydrogen combines with oxygen, to form water, and with chlorine to form hydrogen chloride.

Elements are represented by symbols. Symbols are used for convenience and for easy learning. Short hand notation of an element is called **symbol**

PERIODIC TABLE OF ELEMENTS WITH SYMBOLS



Elements are further classified broadly into metals and non-metals.

§§ **Metals**

If an element is a metal, it should have the following characteristics:

(i) It should have lustre, i.e., it should have metallic glow.

(ii) It should be a good conductor of heat and electricity.

(iii) It should be ductile, i.e., it should be drawn into wires.

(iv) It should be malleable, i.e., it should be beaten into sheets.

(v) It should be a solid at room temperature.

(vi) It should produce a sonorous sound on being hit.

Exceptions:

Mercury and Gallium are liquid metals at 30^0C.

Zinc is not malleable and ductile at room temperature.

§§ **Non-metals**

An element is a non-metal, if it has the following characteristics:

(i) It has no lustre, i.e., it cannot be polished.

(ii) It is a bad conductor of heat and electricity.

(iii) It is not ductile, i.e., it cannot be drawn into wires.

(iv) It is not malleable, i.e., it cannot be beaten into sheets.

(v) It is a gas or a brittle solid at room temperature.

(vi) It does not produce a sonorous sound on being hit.

Exceptions:

Graphite (form of carbon) has a lustre and is a good conductor of heat and electricity.

Bromine is a liquid non-metal.

§§ **Differences between Metals and Non-Metals**

	Properties of metals :	Properties of non-metals :
1	They have generally silver grey colour, However some metal or their alloys have golden yellow colour. **Excepltion is copper, which is reddish in colour**.	They exist in solid, liquid and gaseous state.
2	Metals have a lusture, the freshly cut surface has a shine on it.	They display variety of colour.
3	They easily conduct heat and electricity.	They are generally neither malleable nor ductile.
4	They are malleable i.e. they can be beaten into sheets.	They are poor conductors of heat and electricity.
5	They are sonorous. eg. Gold, silver, copper, iron, sodium, potassium etc. Mercury is the only metal that is liquid at room temperature.	They are not sonorous. eg. Hydrogen, oxygen, iodine, carbon etc.

§§ **Metalloids :** Some element have intermediate properties of the metals and non-metals. The elements which exhibit the properties of metals as well as non-metals, are called metalloids.

Example : Boron, Silicon, Germanium etc.

§§ **COMPOUND:**A compound is a pure substance formed from two or more elements combined together in a definite proportion by weight.

¶¶ **Properties of compounds:**

i) A compund cannot be separated into its constituent elements by mechanical or physical methods.

EX: Iron sulphide is a compund of iron and sulphur.Put a magnet close to a sample of iron sulphide, the iron present in the iron sulphide does not get attracted towards the magnet bcoz iron has no identity in iron sulphide. Also, sulphur dissolves in carbon disulphide. But if we add carbon disulphide to iron suphide, the sulphur present in iron sulphide does not dissolve in it,

because sulphur has no individual property in iron sulphide.These clearly show that the constituents(Fe and S) present in iron sulphide cannot be separated by physical methods.

ii) The properties of a compound differ entirely from those of its constituent elements.

EX: water is a compound made up of hydrogen and oxygen. But, the properties of water are different from those of hydrogen and oxygen. Water is a liquid, while hydrogen and oxygen are gases.

iii) When a compound is formed , energy is usually released or absorbed(in the form of heat or light) during the chemical reaction.

EX: The constituent elements of water are hydrogen and oxygen- both are gases and do not react with each other unless an electric spark is provided ,i.e., energy is supplied.

iv) In a compound, the constituent elements are present in a definite proportion by weight.

In water, hydrogen and oxygen are present in a fixed ratio of 1:8 by weight.

v) A compound has a fixed melting point, a fixed boiling point, etc.

EX: Ice always melts at 0^{o} c.

vi) A compound is a homogenous substance, ie., a compound is such a substance which is same through out in its properties and composition.

EX: Iron sulphide is a compound of iron and sulphur. if we see iron sulphide through a microscope , particles of iron or sulphur cannot be separately identified.

Since compunds are formed by chemical combination of elements, they are also called **chemical compounds.**

¶¶ **Differences between elements and compounds**

ELEMENTS	COMPOUNDS
An element is a substance whichcannot be split into two two or more different substances.	A compound can be split into 2 or more different substances.
An element is formed from atoms of the same kind	A compound is formed from atoms of different kinds.

§§ **MIXTURES:** A mixture is a material containing 2 or more elements or compounds that are in close contact and mixed together in any proportion. The components of a mixture can be separated by simple mechanical means.

EX: i) Air is a mixture if N, O, CO_2 , watervapour and a small amount of ther substances.

ii) Gun powder is a mixture of nitre(KNO_3) sulphur and coal.

§§ **PROPERTIES OF MIXTURES:**

1. A mixture homogenous or heterogenous.

A homogenous mixture has uniform composition throughout its mass.

EX: Sugar solution is a mixture of sugar in water. Any portion of this solution contains the same proportion of sugar and water.

A heterogenous mixture of does not have a uniform composition throughout its mass.

EX: a mixture of sand and common salt. The composition of different parts of this mixture have different proportions of sand and common salt.

2. The constuents of mixture can be separated by physical methods such as filtration, evaporation ,sublimation and magnetic separation.

EX: When a magnet is put in the mixture of iron filings and sulphur, the iron particles get attracted to the magnet. When we add carbon disulphide to the mixture, sulphur dissolves in it but iron particles remain unaffected. On filtration, iron can be obtained as aresidue.

3. In the preparation of a mixture , energy is usually neither given out nor absorbed.

EX: when sugar and sand is mixed together, there is no energy change, i.e., enrgy is neither released nor absorbed.

4.The composition of a mixture is not fixed.

EX: Composition of a mixture varies from one part to another. The constituents of the mixture may be present in any proportion by weight.

5. A mixture has no definite melting and boiling point etc.

6. In the formation of a mixture, no chemical reaction occure.

The constituents of a mixture do not undergo any change in composition.

¶¶ **Types of mixtures:** Mixtures can be categorised into various types, depending on the physical states of the constituents. Some of these types are.

i) Solid-solid mixture, ex: sugar and sand

ii) Solid-liquid, ex: mixture of iodine and ethanol(tincture of iodine)

iii) Solid-gas ,ex: air trapped in pores of soil particles .

iv) Liquid-gas, ex: all gases are partially miscible with liquids.

v) Gas-gas, ex: air is a mixture of several gases.

vi) Liquid-liquid, ex: water-alcohol, water-oil mixture.

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

§§ **Solutions :–**

A homogeneous mixture of two or more substances is called a solution. In a solution there is homogeneity at the particle level. Usually we think of a solution as a liquid that contains either a solid or a liquid or a gas dissolved in it. However, this is not true. We can have a solid solution as in the case of Alloys.

e.g. Air is a mixture of gas in gas. Air is a homogeneous mixture of a number of gases. It's two main constituents of gases are oxygen (21%) and Nitrogen (78%)

§§ **Alloys :–**Alloys are homogeneous mixtures of metals and cannot be separated into their components by physical methods. But still, an alloy is considered as a mixture, because it shows

the properties of it's constituents and can have variable composition. For example, brass is a mixture of 30% zinc and 70% copper.

§§ **Components of a solutoin :–**

The substances present in a homogeneous solution, are called components of the solution. A solution basically has two components i.e. a solvent and a solute.

(a) Solvent :– The component of a solution which dissolves the other component in it self, is called solvent. A solvent is the larger component of the solution. e.g. a solution of sugar in water is a solid in liquid solution. In this solution, sugar is the solute and water is the solvent.

(b) Solute :–The component of the solution which dissolves in the solvent, is called solute. Solute is the smaller component of the solution e.g. solution of iodine in alcohol known as 'tincture of iodine', iodine is the solute.

- Similarly, in carbonated drinks (Soda water), carbon dioxide gas is the solute.

¶¶ **Characteristics of a solution :–**

- Solution is a homogeneous mixtures.
- The size of solute particles in a solution is extremely small. It is less than 1 nm in diamter.
- The particles of a solution cannot be seen even with a microscope.
- The particles of a solution pass through the filter paper. So, a solution cannot be separated by filtration.
- The solutions are very stable. The particles of solute present in a solution do not separate out on keeping.
- A true solution does not scatter light (because its particles are very small).

§§ **Concentration of a solution :–** The concentration of a solution is the amount of solute present in a given quantity of the solution. In other words the mass of the solute in grams, which is present in 100 g of a solution.

In a solution the relative proportion of the solute and solvent can be varied. Depending upon the amount of solute present in a solution, it can be called a dilute, concentrated or a saturated solution. Different substances in a given solvent have different solubilities at the same temperature.

The most common method for expressing the concentration of a solution, is called percentage method.

The concentration of solution refers to the percentage of solute present in the solution. The percentage of solute can be expressed in terms of -

(i) Concentration of a solution in terms of mass of solute :– If the solution is of a 'solid solute' dissolved in a liquid, then we consider the 'mass percentage of solute' in calculating the concentration of soluton. So, in the case of a solid solute dissolved in a liquid solvent.

$$\text{Mass by mass percentage of a solution} = \frac{\text{Mass of solute (in grams)}}{\text{Mass of solution (in grams)}} \times 100$$

The mass of solution = mass of solute + mass of solvent

EX: A solution contains 80 g of common salt in 640 g of water. Calculate the concentration in terms of mass by mass percentage of the solution.

(ii) Concentration by mass by volume percentage of a soluiton.

$$\text{Mass by volume percentage of a solute in - Solution} = \frac{\text{Mass of solute}}{\text{Volume of solution}} \times 100$$

Depending upon the unit of the mass and volume, the mass by volume percentage of a solute in solution, can have following units.

(a) gram/ml (b) gram/litre

A solution contains 40g of acetic acid and 500 ml of aq. solution. What is the concentration of acetic acid solution?

§§ **Saturated solution :–**

A solution which at a given temperature dissolves as much solute as it is capable of dissolving, is said to be a saturated solution.

Ex. At 30°C, 55 g of common salt dissolves in 100g of water. However, if more of common salt is added to the above solution, it just does not dissolve. In such a situation, the solution of common salt containing 55 gm of salt in 100 gm of water, is a saturated solution at 30°C.

If a saturated solution at some particular temperature is heated, the solution becomes unsaturated, because of the increase in solubility.

If a saturated solution at some higher temperature is cooled, it remains saturated. The excess solute comes out of the solution and deposits it self in the form of crystals.

§§ **Unsaturated solution :–**

When the amount of solute contained in a solution is less than the saturation level, the solution is said to be an unsaturated solution.

Ex. At 30°C, if 45 g of common salt is dissolved in 100 g of water, such solution so formed is capable of dissolving more of the common salt, then such a solution is called unsaturated solution.

§§ **Super saturated solution :–**

A solution which contains more of the solute than required to make a saturated solution, is called a super saturated solution.

§§ **Solubility of a solute :–** The amount of solute (in gram), which dissolve in 100 g of water (solvent), at a given temperature, is called solubility of the solute at that temperature.

Substance (or Solute)	Solubility in water (at 20°C)
Copper sulphate	21 g
Potassium nitrate	32 g
Potassium chloride	34 g
Sodium chloride	36 g
Ammonium chloride	37 g
Sugar	204 g

§§ **Suspensions :–**

A suspension is a heterogeneous mixture in which the small particles of a solid are spread throughout a liquid without dissolving in it. The particles have a tendency to settle down at the bottom of solvent and can be filtered out, because their size is bigger than the size of the pores of filter paper.

eg. (1) Chalk-water mixture is a suspension of fine chalk particles in water.

(2) Muddy water is a suspension of soil particles in water.

¶¶ **Properties of a suspension :**

1. A suspension is a heterogeneous mixture.
2. The size of solute particles in a suspension is quite large. It is larger than 100nm in diameter.

3. The particles of a suspension can be seen easily.

4. A suspension scatters a beam of light passing through it, because it's particles are quite large.

5. The particles of suspension settle down, when the suspension is kept undisturbed.

6. The process of setting of suspended particles under the action of gravity is called sedimentation. So suspensions are unstable.

§§ Colloidal solution or Colloids :

A heterogeneous solution in which the particle size is in between 10^{-7}cm to 10^{-5}cm such that the solute particles neither dissolve nor settle down in a solvent, is called colloidal solution. The components of a colloidal solutions are the dispersed phase and the dispersion medium. The solute-like component or the dispersed particles in a colloidal form of the dispersed phase, and the component in which the dispersed phase is suspended is known as the dispersing medium.

¶¶ Properties of colloids :

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

2. They do not settle down when left undisturbed, that is colloid is quite stable.

3. They can not be separated from the mixture by the process of filteration. But, special technique of separation known as centrifugation can be used to separate the colloidal particles.

4. Colloidal solutions are not transparent, but translucent in nature.

5. The particles of a colloidal solution scatter light i.e. when strong beam of light is passed through the colloidal solution, the path of beam becomes visible.

Dispersed phase :- It is the component which is present in small proportion and consists of particles of colloidal dimensions (10^{-9} m to 10^{-7} m).

Dispersion medium :- It is the component which is present in excess and acts as a medium in which colloidal particles are dispersed.

COMMON EXAMPLES OF COLLOIDS

Dispersed Phase	Dispersing Medium	Type	Example
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	Foam, rubber, sponge, pumice
Solid	Solid	Solid Sol	Coloured gemstone, milky glass

§§ Brownian movement of colloids :-

The colloidal particles are moving at random in a zigzag motion in all directions. This type of zig-zag motion of colloidal particles is called Brownian movement. The brownian movement is caused by

the collision (hitting) of the colloidal particle with the molecules of the dispersion medium.

§§ **Tyndall effect :**

The phenomenon due to which the path of light becomes visible, due to scattering of light by the colloidal particle is called Tyndall effect.

Example :

Tyndall effect can also be observed when a fine beam of light enters a room through a small hole. This happens due to the scattering of light by the particles of dust and smoke in the air.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 colloids dispersed in air.

DIFFERENCE BETWEEN TRUE SOLUTIONS AND COLLOIDAL SOLUTIONS

True Solutions	Colloidal Solutions
The particle size is less than 10–7cm	The particles size is in between 10–7cm to 10–5cm
The particles are not visible under powerful microscope	The particles are visible under microscope.
The particle of a true solution can be recovered by evaporation and crystallisation	The particle of a true solution cannot be recovered by evaporation and crystallisation
The particles of a true solution do not scatter light	The particles of a colloidal solution scatter light.
True solutions are clear and transparent	Colloidal solutions are translucent.

DIFFERENCE BETWEEN COLLOIDAL SOLUTIONS AND SUSPENSIONS

Colloidal Soluitons	Suspension
The size of particles of solute is in between 10–7cm to 10–5cm.	The size of particles of solute is more than 10–5cm
The particles of solute do not settle down	The particles of suspension settle down
The particles of solute cannot be filtered out	The particles of suspension can easily be filtered

TEACHING TASK

1. Milk is a _____ solution while vinegar is a _____ solution.

(A) Suspension, colloidal (B) Colloidal, suspension

(C) True, colloidal (D) Colloidal, true

2. A liquid and a solid together consisting a single phase is known as :

(A) Solution (B) Solute (C) Solvent (D) Emulsion

3. Which of the following is a homogeneous system ?

(A) Muddy water (B) Bread (C) Concrete (D) A solution of sugar in water

4. The zig-zag movement of dispersed phase particle in a colloidal system is known as :

(A) Transitional motion (B) Circular motion

(C) Linear motion (D) Brownian motion

5. An emulsion is a colloidal system of :

(A) Solid dispersed in solid (B) Liquid dispersed in liquid

(C) Gas dispersed in liquid (D) Brownian motion

6. Milk is :

(A) Fat dispersed in water (B) Fat dispersed in milk

(C) Fat dispersed in fat (D) Water dispersed in milk

7. Scattering of light takes place in :

(A) Electrolytic solutions (B) Colloidal solutions

(C) Electrodialysis (D) Electroplating

8. Foam is a colloidal solution of :

(A) Gaseous particles dispersed in gas (B) Gaseous particles dispersed in liquid

(C) Solid particles dispersed in liquid (D) Solid particles dispersed in gas

9. Which of the following forms a colloidal solution in water ?

(A) Salt (B) Glucose (C) Starch (D) Barium nitrate

10. Movement of colloidal particles under the influence of electrical field is called :

(A) Electrophoresis (B) Dialysis (C) Ionisation (D) Electrodialysis

11. Gelatin is also called as :

(A) Protective colloid (B) Hydrophilic colloid (C) Emulsion (D) None of these

12. The sky looks blue due to :

(A) Dispersion effect (B) Reflection (C) Scattering (D) Transmission

13. In colloidal state, particle size ranges from :

(A) 1 to 10 A° (B) 20 to 50 A° (C) 10 to 100 A° (D) 1 to 280 A°

14. Tyndall effect is observed in :

(A) Solution (B) Precipitate (C) Sol (D) Vapour

15. Brownian movement is due to :

(A) Temperature fluctuations within the liquid phase

(B) Attraction and repulsion between the charges on the colloidal particles

(C) Impact of molecules of the dispersion medium on the colloidal particles

(D) Convention currents

16. Difference between a crystalloid and a colloid is in :

(A) Particle size (B) The nature of solute

(C) Diffusion through a membrane (D) All of the above

17. Blood is _____ charged sol.

(A) Negatively (B) Positively (C) Neutral (D) None of these

18. Ice cream is an example of :

(A) True solution (B) Emulsion (C) Colloid (D) Suspension

19. Water loving colloids are called :

(A) Hydrophobic colloids (B) Reversible colloids

(C) Irreversible colloids (D) Hydrophilic colloids

20. The technique used in ultra-microscope is :

(A) Adsorption (B) Coagulation (C) Tyndall effect (D) Electrophoresis

KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13
Ans.	D	A	D	D	B	A	B	B	C	A	A	C	C
Que.	14	15	16	17	18	19	20						
Ans.	C	C	D	A	B	D	C						

LEARNER'S TASK

BEGINNERS (Level - I)

Single correct answer

1. Coagulation occurs due to :

(A) The scattering of light (B) The presence of charges

(C) The neutralization of charges (D) Unequal bombardment by solvent molecules

2. Sol is :

(A) Solid dispersed in liquid (B) Liquid dispersed in gas

(C) Gas dispersed in liquid (D) Gas dispersed in solid

3. The separation of colloidal particles from those of molecular dimensions is called :

(A) Dialysis (B) Pyrolysis

(C) Peptization (D) Photolysis

4. Liquid dispersed in gas is called :

(A) Aerosol (B) Solid sol (C) Sol (D) Solid foam

5. Drinking soda is an example of a solution of :

(A) Gas in liquid (B) Liquid in gas (C) Gas in gas (D) Solid in liquid

6. Amalgam is a solution of :

(A) Solid in solid (B) Solid in liquid (C) Liquid in solid (D) Liquid in liquid

7. Which of the following is a true solution ?

(A) NaCl in sulphur dioxide (B) Copper in silver

(C) Salt in petrol (D) Mud in water

8. Which of the following statements is correct ?

(A) Compounds can be sepearated into constituents by physical processes

(B) The boiling points and melting points of compounds are not fixed

(C) The composition of compounds are not fixed

(D) The properties of compounds are entirely different from those of its constituents

9. Water is :

(A) A compound (B) A mixture (C) True solution (D) All of these

10. Milk of Magnesia is an example of :

(A) Emulsion (B) True solution (C) Colloid (D) Suspension

11. Solid foam is

(A) Solid dispersed in solid (B) Liquid dispersed in solid

(C) Gas dispersed in solid (D) Solid dispersed in liquid

12. What is the property used in sewage disposal ?

(A) Coagulation (B) Adsorption (C) Electrophoresis (D) Tyndall effect

13. The size of a colloidal particle is :

(A) 10^{-1} to 10^{-3} cm (B) 10^{-5} to 10^{-7} cm (C) 10^{-8} to 10^{-5} cm (D) 10^{-6} to 10^{-8} cm

14. Which of the following is not a compound ?

(A) Sugar (B) Common salt (C) Diamond (D) Plaster of Paris

15. Which of the following is an example of a mixture ?

(A) Sugar (B) Brass (C) CO_2 (D) NO_2

16. The most abundant metal in the earth's crust is :

(A) Fe (B) Cu (C) Al (D) Au

17. The most abundant element in the earth's crust is :

(A) Si (B) C (C) O (D) Ca

18. Which of the following gives a true solution in water-

(A) Starch (B) Sugar (C) Chalk powder (D) Egg albumin

19. Which of the following statements is not correct-

(A) A compound is a pure substance

(B) Compound is homogeneous in nature

(C) Compound always contains two or more elements

(D) Compound can be separated into constituent elements by some physical process.

20. Which of the following statements is not true -

(A) True solutions are homogeneous in nature

(B) Suspensions are heterogeneous in nature

(C) Solute particles in a colloidal solution can be separated by filtration

(D) True solutions are transparent to light

21. Which of the following is the second most abundant metal in the earth's crust ?

(A) Copper (B) Aluminium (C) Iron (D) Zinc

22. Which of the following will show Tyndall effect-

(A) Starch solution (B) Sodium chloride solution

(C) Copper sulphate solution (D) Sugar solution

23. When a beam of light is passed through a true solution, it gets-

(A) Reflected (B) Absorbed (C) Scattered (D) Path of light does not visible

ACHIEVERS (Level - II)

ANSWER THE FOLLOWING:

1. Define element, compound and mixture. Give two examples of each.

2. Give differences between compounds and mixtures

3. Write a brief notes on :

(i) Tyndall effect (ii) Solubility

4. How would you confirm that a colourless liquid given to you is pure water ?

5. Classify each of the following as a homogeneous or heterogenous mixture. Soda water, wood, air, vinegar, Filtered tea.

EXPLORERS (Level - III)

I) One or more than one answer type

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

1. Which of the following statement is incorrect

A. Steam is a compound.

B. Mercury is a liquid non-metal.

C. Mass percentage of a solution containing 10 g of solute in 100g of water is 10%.

2. Which of the following statement is correct

A. Mixture of salt and ammonium chloride can be separated by cyrstallisaion process.

B. Constituents of a mixture can be separated by physical methods.

C. Milk, coffee and brass are example of mixtures.

3. Which of the following statement is correct

A. Digestion of food is a physical change.

B. Solutions cannot be separated by the process of filtration.

C. Fog is an example of liquid dispersed in gas.

II) Comprehension type

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*

The colloidal particles are moving at random in a zigzag motion in all directions. This type of zig-zag motion of colloidal particles is called Brownian movement. The brownian movement is caused by the collision (hitting) of the colloidal particle with the molecules of the dispersion medium.The phenomenon due to which the path of light becomes visible, due to scattering of light by the colloidal particle is called Tyndall effect.

1. This type of zig-zag motion of colloidal particles is called Brownian movement

A) Brownian movement B) Tyndall effect C) Both D) None

2. Scattering of light by the colloidal particle

A) Brownian movement B) Tyndall effect C) Both D) None

III) Matrix Matching type

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

Column - A	**Column - B**
a) Liquid in Gas	1) Shaving cream
b) Solid in Liquid	2) Milk of magnesia
c) Liquid in Liquid	3) Mist
d) Gas in Liquid	4) Emulsion

KEY

ΦΦ LEARNER'S TASK :

☐ **BEGINNERS :**

Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ans.	C	A	A	A	A	C	B	D	A	D
Que.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.	C	A	B	C	B	C	C	B	D	C
Que.	21	22	23							
Ans.	C	A	D							

☐ **EXPLORERS :**

I. One or more than one answer type

Que.	1	2	3
Ans.	A,B,C	B,C	B,C

II. Comprehension type

Que.	1	2
Ans.	A	C

III. Matrix Matching type : a-3, b-2, c-4, d-1

§§ CHANGES AROUND US

Introduction:

In our daily life, we observe many changes a round us everything in this universe undergoes a change. These changes may be observed by us at school, home, play ground, garden or any other place.The changes can bring about different kinds of alterations in things around us. Some of the alterations brought about are permanent in Nature and other are temporary in Nature are permanent in Nature and other are **temporary in Nature.**

§§ ***Classification of changes:*** The changes taking place around us can be classified as under

1) Slow and fast changes
2) Reversible and irreversible changes
3) Desirable and undesirable changes
4) Periodic and non periodic changes
5) Physical and chemical changes.

§§ **Slow and fast changes:**

i) Fast change:

Some changes are very fast. These changes occur with in seconds (or) minutes.

Examples:burning of a match stick, bursting of a cracker, spinning of a top etc are examples of fast changes.

ii) Slow change:

Some changes take place very slowly. These changes may take hours, days, months (or) years to complete.

Eg:Rusting of an iron.

The water changes into ice in a fridge in a few hours.

√ **ILLUSTRATION**

Classify the following in to slow and fast changes.

a) Spinning of top b) Formation of day and night

c)Formation of curd from milk d) Change of season.

e) Making curd from milk by adding lemon juice.

Solution:

a)fast change b)Slow change c)Slow change

d)Slow change e)fast change

§§ ***Reversible change:***

A Change which can be reversed is called a reversible change. In this change, the products formed can be converted back into their original forms.

Examples: Water can be changed into ice by placing it in the freezing chamber of the fridge. The ice so formed can be converted back into water by placing the ice outside the fridge.

§§ ***Irreversible change:***

A change which cannot be reversed is called an irreversible change. In this change, the products cannot be converted back into their original form.

Examples: When a paper is burnt, it changes to ash and smoke. From ash and smoke, we cannot get back paper. Thus, the change is irreversible

√ **ILLUSTRATION**

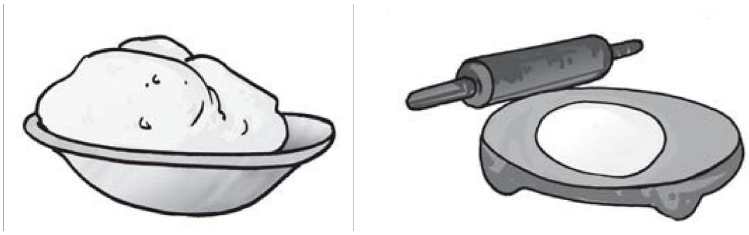
How does curd being set? Is this change reversible?

Solution:

A small quantity of curd is added to warm milk. The milk is stirred and is set a side undisturbed for a few hours at a warm place. In a few hours, the milk changes in to curd. Curd formed from milk can not be changed in to milk again. So this is an irreversible change.

Activity

Take some dough and make a ball. Try to roll out a roti May be you are not happy with its shape and wish to change it back into a ball of dough again.



A ball of dough and a rolled out roti

Now, think about the three changes you observed .. What do they have in common? Was it possible to get the balloon back to its original shape and size? Was the size of the paper same as before and after making an aeroplane? Was it possible to get back the ball of dough again? What do you conclude? In each of the three activities, is it possible to get back to the material with which we started our activity? If the answer is yes, it means that the changes occurring in these activities can be reversed. Now, let us repeat the same activities with a difference.

ACTIVITY

S.NO	CHANGE	CAN BE REVERSED
1	Raw egg to boiled egg	Yes/No
2	Batter to idli	
3	Wet clothes to dry clothes	
4	Woollen yarn to knitted sweater	
5	Grain to its flour	
6	Cold milk to hot milk	
7	Straight string to coil String	
8	Bud to flower	
9	Solid ice cream to molten ice cream	
10	Stretched rubber band to its normal size	

§§ ***Desirable and undesirable changes :***

A change brought about by a person (or) the nature, which is useful, is called a desirable change.

Examples:

1) Formation of curd from milk is a desirable change. It is because curd is more easily digestible as compared to milk.

2) Melting of snow on the mountains.

3) Change of weather from winter to summer is a desirable change.

§§ ***Undesirable change:*** A change brought about by a person (or) the nature, such that it has harmful effects is called an undesirable change.

Examples:

1)Food turning bad in summer is an undesirable change.

2) Breaking of glass ware/glass article is an undesirable change.

3) Rusting of articles of iron is an undesirable change.

§§ ***Periodic Changes:*** The changes which occur again and again, after fixed intervals of time, are called periodic changes.

Examples:

1) Swinging of a clock pendulum is a periodic change.

2) Phases of moon is a periodic changes

3) Change of seasons is a periodic change.

4) High and low tides at sea is a periodic change.

5) Beating of heart is a periodic change.

§§ ***Non Periodic changes:*** The changes which do not repeat themselves at regular intervals of time, are called non periodic changes.

Examples:

1) Earth quakes are non periodic changes.

2) Land slides during rainy season are non-periodic changes.

3) Falling of leaves from a tree is a non - periodic change.

4) Rusting of iron articles is non periodic changes.

√ **ILLUSTRATION**

Classify the following into periodic, non periodic, desirable & undesirable changes?

a) Sneezing,Coughing

b) Sun rise, Sun set

c) Ripening of fruit

d) Bees changing nectar into honey

e) The running of a batsman between the wickets

f) Motion of the earth around the sun

g) Fruit Rotting

h) Volcanic eruptions

SOLUTION:

a) Non periodic b) Periodic c) Desirable d) Desirable

e) Non periodic f) Periodic g) Undesirable h) Undesirable

§§ ***Physical and chemical changes:***

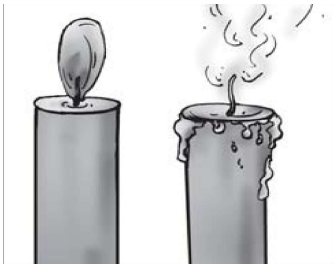
All substances around us undergo changes. In some cases, the changes are small and difficult to defect. In other cases, the changes are observed and easy to defect.These changes generally get accerelated if we heat the substances.

Most of these changes can be classified under two headings.

a) Physical change b) Chemical Change

a) Physical changes are generally temporary in nature and no new substances are formed.

b) Chemical changes are generally permanant in and new substances are which have entirely new properties.



§§ ***Def of Physical Change:*** A physical change is one that changes the shape ,size, physical state,and appearance of a substance, but not its chemical composition

√ **ILLUSTRATION:**

Zinc oxide is a white powder.place about 2 g of Zinc oxide in a dry test tube.Heat the test tube strongly.What do you notice after 2 minutes of heating?

SOLUTION:

The Zinc oxide changes to yellow colour .cool the test tube .In a few minutes ,the colour of zinc oxide changes to white colour.Thus, we can say that the change in zinc oxide was temporary in nature

Characteristics of physical change :

1) No new substances are formed during physical change.

2) Physical change is temporary and can be easily reversible

3) There is no change in weight during physical change.

4) Only a little heat is absorbed (or) given off during a physical change.

5)There is usually no loss or gain of energy during a physical change

Every day examples of physical changes:

Some of the very common examples of physical changes

1) Melting of ice (or) wax (or) butter (or) ghee.

2) Freezing of water to ice (or) solidification of liquid wax to solid wax.

3)sublimation of iodine or camphor

4) magnetisation of iron

5) breaking of a glass

6) Crystallisation of salts or sugar from their solutions

7) Changes of colour due to heat as in case of Zinc oxide (Zno) (or) lead monoxide.

§§ ***Chemical Change:*** .

Definition:A change which alters the specific properties of a substance by bringing about a change in its molecular composition, followed by a change in its state is called chemical change.

√ **ILLUSTRATION:**

fix a candle on the table and light it .What do you observe after 10 minutes?

SOLUTION:

1) The candle burns to give heat and light energy.

2)The candle does not regain its original size when put off.

Thus ,the burnig of a candle is a pemanent change which can not be reversed.

Actually, the candle burns to form new products,i.e carbon dioxide gas and water vapour.

Characteristics of a chemical change:

1) When a chemical change occurs new substances, with entirely new properties are formed.

2) Chemical change is permanant change,i.e it cannot be easily reversed
3) There is usually a change in weight or mass during chemical reaction
4) Lot of heat is usually given off (or) absorbed during a chemical changes.

Every day examples of chemical changes.

1) Cooking of food
2) Food turning bad after a few days.
3) Curdling of milk
4) Germination of seeds
5) Digestion of food with in our bodies
6) Fermentation of sugar solution to alcohol.
7) Rusting of Iron.

¶ ***Differences between physical change and chemical change.***

	Physical Change	**Chemical Change**
1.	The Change takes place only in in state, color, texture However, composition remains the same	1. The Change takes place color, texture etc., along with the change in composition.
2.	Specific properties of the substance donot change	2. Specific properties of substancechange completely.
3.	No new substances are produced.	3. New substances, with new properties are produced.
4.	There is no net absorption (or) release of energy.	4. There is always net Release of energy.
5.	It is a temporary change and can be reversed.	5. It is a permanent change and cannot be reversed.

TEACHING TASK

I) MCQS with `Single answer is correct :

1. Burning of a match stick is a .
a)slow change b)fast change c)reversible change d)none

2. A baby grows into an adult is a .
a)slow change b)fast change c)irreversible change d)none

3. Rusting of an iron is a.
a)slow change b)chemical change c)both a & b d)periodic change

4. The change of seasons from summer to winter is a
a)slow change b)reversible change c)desirable change d)both a & d

5. A change which can be reversed is called.
a)irreversible change b)reversible change c)desirable change d)none

6. When a paper is burnt it changes to ash and smoke it is a.
a)irreversible change b)reversible change c)desirable change d)none

7. A candle on burning forms carbondioxide gas and water vapour.
a)reversible change b)irreversible change
c)periodic change d)desirable change

8. Falling of leaves from a tree is a .

a)slow change b)irreversible change c)nonperiodic change d)both b & c

9. A change which cannot be reversed is called.

a)slow change b)irreversible change c)nonperiodic change d)both b & c

10. Curdling of a milk is a.

a)irreversible change ***b)***periodic change ***c)****slow change* *d)both a & c*

11. The orginal substance can not be obtained in a .

a)Physical change b) Chemical change c)slow change d)desirable change

12. ZnO when heated becomes .

a)yellow b)blue c)red d)green

13. At room temperature lead monoxide has .....colour.

a)yellow b)blue c)red d)greenish yellow

14. Zinc oxide is yellow when hot and white when cold This is an example of :

a)Physical change b)chemical change c)fast change d)none

15. The gas evolved on heating $NaNO_3$ is

a) O_2 b)NH_3 c) N_2 d)Cl_2

16. During the white wash lime reacts with .....in the air.

a) O_2 b) N_2 c)NH_3 d)CO_2

17. Which process involved in the formation of the drops

a)Evaporation b)Condensation c)Filtration d)decantation

18. Physical change is a.

a)temperory change b)permanent change c) both a & b d)none

19. Evoparation of water by the heat of sun .

a)Physical change b)chemical change c)fast change d)none

20. Melting of ice is a.

a)reversible change b)Physical change c)chemical change d)both a & b

21. Beating of metals into sheets or drawing metals into wires.

a)temperory change b)reversible change c)Physical change d)all

II) ***<u>MCQS with more than one answer is correct :</u>***

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which* ***ONE or MORE*** *is correct. Choose the correct options*

22. These are the products of milk

a)butter b)ghee c)sweets d)none

23. The changes in seasons due to

a) revolution of earth b)rotaion of earth c)position of sun d)none

24. Examples of permanent changes are

a)souring of curd b)cooking food c)ripening of oranges d)none

III) ***Odd one out and give your reason :***

25. Ice, Zinc oxide, wax, Ghee.

26. Seasons, heart beat, clock pendulum, earth quakes

IV) Correct the sentence if it is wrong otherwise rewrite the sentence :

27. Boiled egg is temporary change

28. Drying of clothes in the presence of sun light is a permanent change

29. human growth is a parmanent change.

30. Rusting of iron is a chemical change.

V) Match the following :

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

  *If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

31.

	Group-A		***Group-B***
a)	Natural change	1)	Natural gas
b)	Man made change	2)	Seasons
c)	Chemical change	3)	Milk in curd
d)	Physical change	4)	Rusting of iron
e)	Fossil fuels	5)	ice to water

A) a - 3, b - 2, c - 4, d - 1,e-5 B) a - 4, b - 2, c - 3, d - 5,e-1

C) a - 2, b -3, c -4, d - 5, e-1 D) a - 3, b - 1, c - 4, d - 2,e-5

VI. Statement type questions:

- *This section contains certain number of questions. Each question contains Statement – 1 (Assertion) and Statement – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct Choose the correct option.*

A) Both statement Iand II correct. *B) Both statement I and II in correct*

C) Statement I is corect and statement II is incorrect.

D) Statement I is incorrect and statement II is correct

32. **Statement I :** Agening of human beings are irreversible change.

Statement II : A change whivch cannot be reversed is called an irreversible change.

33. **Statement I :** A change which can be reversed is called a reversible change.

Statement II : Falling of leaves from a tree reverseble change.

VII) Comprrehension type questions :

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*

A change which is desirible at one time, may be un desirable at some other time, a change may be desirble for more people and undesirble for other.

34. The farmers spray chemicals on vegetables & fruits to kill insects. This is example of

A) Desirable change B) Irreversible change

C) Periodic change` D) Physical change

35. Flooding of rivers in rainy season is an :

A) Reversible change B) Undersirable change

C) Desirable change D) Physical change

KEY

ΦΦ TEACHING TASK :

1-b 2-c 3-c 4-c 5-b 6-a 7-b 8-d 9-b

10-d 11-b 12-a 13-a 14-c 15-a 16-d 17-c 18-a 19-a 20-d
21-d 22-a,b,c 23-a,b,c 24-a,b,c 25-ZnO 26-earth quakes 27-F
28-T 29-T 30-T 31-C 32-A 33-C 34-A 35-B

LEARNER'S TASK

BEGINNERS (Level - I)

I) MCQ with single correct answer:

1. Food turning bad in summer is a .

a)undesirable change b)desirable change

c)periodic change d)physical change

2. Rusting of iron is a .

a)slow change b)undesirable change c)chemical change d)all

3. Melting of snow on the mountains in summer is a .

a)desirable change b)physical change

c)periodic change d)none

4. The heat produced by the burning of petrol in the engines of cause is a .

a)desirable change b)undesirable change c)both a & b d)physical change

5. Beating of heart is a .

a)periodic change b)physical change

c)undesirable change d)desirable change

6. Earth quakes are a .

a)nonperiodic change b)irrverible change c)periodic change d)physical change

7. The changes which occurs again and again after fixed intervels of time are called.

a)chemical change b)physical change c)periodic change d)none

8. Flooding of riverse in rainy seasons is an .

a)undesirable change b)physical change c)chemical change d)none

9. High and low tides at sea is a .

a)periodic change b)physical change c)chemical change d)nonperiodic change

10. Change of seasons is a .

a)periodic change b)desirable change c)slow change d)all

11. A chemical change involves .

a)change of state only b)change of colour only

c)change of state as well as composition d)none

12. An example of chemical change is .

a)melting of sulphur b)formation of snow c)earth quakes d)burning of coal

13. Fermentation of sugar solutions to alcohol is a .

a)chemical change b)irreversible change c)permanent change d)all

14. Curdling of milk .

a)chemical change b)irreversible change c)slow change d)all

15. The plants make their food through the process of.

a)phothosynthesis b)respiration c)glycolysis d)none

16. During physical and chemical changes .

a) energy is always absorbed.

b) energy is always released

c) no energy is absorbed or released

d) energy is either absorbed or released

17. When sugar is on heating into .

a)sugar b)char coal c)steam d) b & c

18. Burning of coal is a .

a)chemical change b)physical change c)fast change d)non periodic change

19. Action of heat on paraffinwax is .

a)chemical change b)permenent change

c)physical change d)desirable change

20. We changes which occur with in seconds are minutes is called

a) Slow change b) Fast change

c) Intermediate change d) intra molecular change

21. Bursting of a ballon is an example of

a) Slow change b) Fast change

c) Intermediate change d) intra molecular change

22. Formation of ash from burnt paper is exmaple of

a) Periodic change b) Non periodic change

c) Irreversible change d) reversible change

23. Hammering or heating of iron is

a) Periodic change b) Fast change

c) Irreversible change d) reversible change

ACHIEVERS (Level - II)

Descriptive Type Question:

1. Explane the reversible and irreversible of changes?

2. Define periodic chenge and non periodic chenge examples ?

3. Explan the classification of chenges and give two examples to each?

EXPLORERS (Level - III)

II. MCQS with more than one answer is correct :

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

1. In thermal power stations, heat, smoke, heat energy is produced from burning of coal; this involves

A) Chemical change B) Undesirable change

C) Desirable change D) Non periodic change

2. Which of the following statements are correct

A) a chemical equation consist of formulae of reactants connected by a (+) plus sign

B) a chemical equation consist of formulae of reactants connected by a (-) minus sign

C) the substances which take part in a chemical reaction are called reactants

D) the substance formed,as a result of chemical change, are called products

3. Water cycle involves

A) Evaporation B) Sublimation C) Condensation D) freezing

4. Changing of iron wire into a magnet involves

A) Chemical change B) Permanent change

C) Temporary change D) Physical change

III. Odd one out and give your reason :

5. Burning of wood; melting of wax; burning petrol; burning of coal

6. Spinning of a top; curdling of milk; rusting of iron; burning of a match stick.

IV. Correct the sentence if it is wrong otherwise rewrite the sentence :

7. A physical change cannot be reversed.

8. Formation of day and night is a fast change.

9. Switching of electric bulb is an irreversible change.

10. Heat is not given off during a chemical change.

11. Burning candle doesnot give heat and light energy.

V. Match the following:

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

12.

a)	Growth of a child to an adult	1)	Photosynthesis
b)	Plants making their food in sunshine	2)	Physical change
c)	Falling of leaves from a tree	3)	Slow change
d)	Crushing of an icecube	4)	Nonperiodic change

A) a - 3, b - 2, c - 4, d - 1 B) a - 4, b - 2, c - 3, d - 1

C) a - 1, b - 2, c - 3, d - 4 D) a - 3, b - 1, c - 4, d - 2

13.

a)	Change of seasons	1) Desirable change
b)	Bursting of balloon	2) Irreversible change
c)	Formation of manure	3) Periodic change
d)	Burning of sparkle (or) fire-crackers	4) Fast change

A) a - 2, b - 1, c - 4, d - 3 B) a - 3, b - 4, c - 1, d - 2

C) a - 2, b - 3, c - 4, d - 1 D) a - 3, b - 1, c - 4, d - 2

VI. Comprehention type:

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*

Change is the law of nature. Changes may occur in shape, position, colour, temperature etc. Every change takes place due to some specific reasons. The changes may be caused due to heating or by mixing or by applying force and pressure. Heating or cooling causes change in physical state of a substance.

14. When water freezes and changes into ice, it

a) expand b)compress c)freez d)none

15. When a candle is burnt, its size reduces. This change is a/an

a) physical change b)chemical change c)reversible d)periodic change

VII. Statement type questions:

- *This section contains certain number of questions. Each question contains Statement – 1 (Assertion) and Statement – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct Choose the correct option.*

A. Both statement I and II correct.

B. Both statement I and II in correct

C. Statement I is corect and statement II is incorrect.

D. Statement I is incorrect and statement II is correct

16. **Statement I :**change of seasan is a periodic change.
Statement II: the change which occure again and again ,after fixed intreval of time ,are called periodic change.

17. **Statement I :** " Melting of butter this change is temporary in nature and no new substance are formed
Statement II : Physical changes are generally is temporary in nature and no new substance are formed

KEY

ΦΦ LEARNER'S TASK :

☐ **BEGINNERS :**

1-a	2-d	3-a	4-a	5-a	6-a	7-c	8-a	9-a	10-d	11-c	
12-d	13-d	14-d	15-a	16-d	17-d	18-a	19-c	20-b	21-b	22-c	23-d

☐ **EXPLORERS :** 1-a,c 2-a,c,d 3-a,b,c 4-c,d 5-melting of wax

6-spinning of top 7-F 8-F 9-F 10-F 11-F 12-d 13-b

14-b 15-b 16-1 17-1

§§ ***Chemical Equation:***

Definition: The chemical equation is a statement that describes a chemical change in terms of symbols and formulae.

$$2H_2O + O_2 \rightarrow 2H_2O$$

1. **a) Reactants:** The substances which take part in a chemical reation are called reactants. The reactants are always written on the left hand side of a chemical equation.

(b) Products: The substances formed, as a result of chemical change are called products. The products are always written on the right hand side of a chemical equation.

2. A chemical equation consists of formulae of reactants connected by a (+) plus sign and an arrow $(\rightarrow)$, followed by the formulae of products connected by (+) plus sign.

√ **ILLUSTRATION:**

$C + O_2 \rightarrow CO_2$ **+ Energy** What is the significance of this reaction?

SOLUTION:

The imporatance of this reaction, Energy is released when from the reaction when carbon is burnt in the presence of air.So this is called Exothermic reaction. This is also an example for the combination reaction. As carbon is burnt in the presence of oxygen thus it is also called as combustion reaction.

§§ **Information convayed by eqation:**

1.It shows the reactants which enter into a reaction and the products which are formed by the reaction.

2.The amounts of each substance used and substants produced.

¶¶ **Two important principles to remember:**

1. Every chemical compound has a formula which cannot be altered

2. A chemical reaction must account for evary atom that is used .This is an application of the law of conservation of Matter which state that in a chemical reaction atoms are neither created nor destroyed

¶¶ **Some things to remember about writing eqations:**

1. The di atomic molecules are always written $H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2$

2. The sign$(\rightarrow)$ means "yeilds" and shows the direction of the reaction .

3. A small delta($\triangle$) , above the arrow shows that heat has been added.

4. A double arrow , shows that the reaction is reversible and can go in both directions.

§§ ***Explanation of Chemical equation :***

Like symbols and formulae, chemical equation conveys both qualitative and quantitative meanings.

1. The equation below can be interpreted qualitatively, by saying that hydrogen reacts with oxygen to form water.

$$2H_2 + O_2 \rightarrow 2H_2O$$

Hydrogen oxygen Water.

2. Quantitatively, the equation has number of meanings

(a) Two molecules of hydrogen react with one molecule of oxygen to form two molecules of water.

(b) It states that two volumes of hydrogen will completely react with one volume of oxygen to form two volumes of water.

√ **ILLUSTRATION**

What is a balanced chemical equation ?

SOLUTION

An equation in which the number of each atom of an element on reactants side is equal to the number of each atom of an element on product side, is called balanced equation.

(a) Sodium nitrate decomposes on heating and forms sodium nitrite and oxygen. Writing the symbols and formulae of reactants and products, the equation can be represented as shown below.

$$NaNO_3 \rightarrow NaNO_2 + O_2$$

sodium nitrate sodium nitrite oxygen

However, the given equation is not a correct equation, because the total number of oxygen atoms on the reaction side is 3, where as on the products side is 4. Such type of equation is called unbalanced equation.

However, if we write the above equation as shown below, the number of atoms on each side i.e, reactants and products is same.

$$2NaNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2$$

In the above equation, there are 2 sodium atoms, 2 nitrogen atoms and 6oxygen atoms on each side. Such equation is called abalanced equation.

§§ ***Balanced equation :*** An equation in which the number of each atom of an element on reactants side is equal to the number of each atom of an element on product side, is called balanced equation.

Following points necessary before one starts writing a balanced equation.

1.Whether (or) not reaction takes place between two (or) more reactants.

2. One must know all the products formed during the chemical reaction

3. One must know the correct symbols and formulae of the reactants and products.

How to balance a chemical equation

Example: Ferric hydroxide reacts with dilute sulphuric acid to form ferric sulphate. And water.This reaction can be written in the form of word equation as

Ferric hydroxide + Sulphuric acid(dil)----------> Ferric sulphate + water

counting the number of various atoms in reactants and products.

	Iron atoms	sulphur atoms	Hydrogen atoms	oxygenatoms
in reactants	1	1	5	7
in products	2	3	2	13

§§ ***Balancing iron atoms :*** As the number of atoms of iron on the products side is 2, therefore, in order to make equal number of iron, we will multiply $Fe(OH)_3$ with numeral 2.

$$2Fe(OH)_3 + H_2SO_4(dil) \rightarrow Fe_2(SO_4)_3 + H_2O$$

§§ ***Balancing sulphur atoms :*** Sulphur atoms are 3 towards the products side and one towards the reactants side Thus, in order to equalise sulphur atoms, we will multiply H_2SO_4 with numeral 3.

$$2\ Fe(OH)_3 + 3H_2SO_4 \rightarrow Fe_2(SO_4)_3 + H_2O$$

§§ ***Balancing hydrogen atoms:*** Hydrogen atoms towards reactants side are 12 (6 in $2Fe(OH)_3$ and 6 in $3H_2SO_4$). However, hydrogen atoms towards the products side are 2 in H_2O. Thus, in order to equalise hydrogen atoms, the H_2O on the products side should be multiplied by numeral 6.

$$2\ Fe(OH)_3 + 3H_2SO_4 \rightarrow Fe_2(SO_4) + 6H_2O$$

§§ ***Balancing oxygen atoms :*** Oxygen atoms towards the side of reactants are 18 (6 in 2 $Fe(OH)_3$ and 12 in H_2SO_4).Oxygen atoms towards the products side are 18 (12 in $Fe_2(SO_4)_3$ and 6 in $6H_2O$). Thus, oxygen atoms are equal on the sides of reactants and products.The whole balanced equation can be written as

$$2Fe(OH)_3 + 3H_2SO_4 \rightarrow Fe_2(SO_4)_3 + 6H_2O\,.$$

TEACHING TASK

I. MCQS with single answer is correct :

1. In a chemical reaction the atoms are neither created nor .....

A) invented B) destroyed C) both A & B D) None

2. The substance which take part in a chemical reaction are called

A) reactants B) products C) formula D) compound

3. The no. of places at which an element appears in a chemical reaction is called

A) repetition B) periodicity C) frequency D) regularity

4. In a metal and non metal have same frequency then the element i.e. balanced first is

A) non metal B) metal

C) metal if its atomic mass more D)non metal if its atomic number more

5. $CH_4 + O_2$ ———> $CO_2 + H_2O$; *Balanced Equation*

6. $Cu_2O + Cu_2S$ ———> $Cu + SO_2$

Balanced Equation

. .....

7. $Fe + O_2$ ----------> FeO

Balance the equation

.....

8. $CaOCl_2 + NH_3$ ----------> $CaCl_2 + H_2O + N_2$

Balence this equation.

---

9. $Al_2O_3 + C$ ----------> $Al_4C_3 + CO$

Balence this equation.

---

10. $HCl + Na$ ----------> $NaCl + H_2$

Balence this equation.

II. MCQS with more than one answer is correct :

- *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options*

11. Chemical reactions are takes place in

A) Respiration process B) Photosynthesis

C) Preparation of drugs D) solar system

12. when carbon and oxygen reacts ,the possible products are

A) CO B) CO2 C) C2O3 D) C2O

13. Reacion between iron and oxygen gives

A) Haematite B) Magnatite C) Dolomite D) Salt

III. TRUE OR FALSE

14. The sign of an arrow -------> is read yield

15. Potassium nitrate decomposes on heating to form potassium nitrite and oxygen

16. Respiration process is the reverse of photosynthesis

17. When metals reacts with water produce hydrogen gas.

IV. ODD ONE OUT

18. Respiration , photosynthesis , heating of mercuric oxide, decomposition of potassiumnitrate

19. Reactents,Products,Chemical reaction,Heating.

V. Matrix Match Type:

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*
  *If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

20.

Column-I	Column-II
a) $2 N_2 + O_2$	1) $2Fe_2O_3 + 4 SO_2$
b) H_2O_2	2) $2N_2O$
c) $4 FeS + 7O_2$	3) $H_2 + O_2$

d) $4\ FeS_2 + 11\ O_2$ 4) $2Fe_2O_3 + 8SO_2$

A)a-2,b-3,c-1,d-4 B)a-1,b-3,c-2,d-4

C)a-4,b-3,c-2,d-1 D)a-1,b-2,c-3,d-4

21.

Column-I	**Column-II**
a) The substance which take part in chemical reaction	1) Products
b) The substance formed as a result of chemical reaction	2) Balanced equation
c) A chemical equation in which number of atoms of each element is same on the side of reactants and products	3) $CaCl_2 + H_2O$
d) $Ca(OH)_2 + 2HCl$	4) Reactants
	5) $CaCl_2 + H_2O + CO_2$

A) a-2,b-1,c-4,d-3 B) a-1,b-2,c-4,d-3

C) a-4,b-1,c-2,d-3 D) a-1,b-2,c-3,d-4

VI. ***Statement type questions:***

- *This section contains certain number of questions. Each question contains Statement – 1 (Assertion) and Statement – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct Choose the correct option.*

1. Both statement Iand II correct.

2. Both statement I and II in correct

3. Statement I is corect and statement II is incorrect.

4. Statement I is incorrect and statement II is correct

22. **Statement I :** 10g of sold wax at melting will form 10 gm molten wax.

Statement II : Molecules of eyes, water or stream always conatain two atoms of hydrogen and one atom of xoygen.

23. **Statement I :** Water changes to absorbing a certain amount of energy.

Statement II : The heat energy supplied during the above change is utilised to change the composition of the molecules of a substance.

VII. Comprehension type questions

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*

The color change in a banana peel is caused by chemical changes that are taking place in the cells of the bababa. A chemical changge occurs when a substnace reacts and form one or more new substances.

24. Which of the following is chemical change ?

A) Burning of fuels B) Burning of crackers

C) A strong heating of mercuric oxide D) All

25. When zinc hydroxide is heated, it decomposes to form zinc oxide. This is example of :

A) Physical change B) Periodic change

C) Chemical change ` `D) All

LEARNER'S TASK

BEGINNERS (Level - I)

I. MCQS with single answer is correct

1. The substances taking part in a chemical reactions are known as.
A)reactants B)products C)both a & b D)none

2. Thechemical equation is a statement that describes a chemical change in terms of.
A)symbols B)reactants C)formulae D)both a & c

3. $Fe + N_2O$ ———> $N_2 + Fe_3O_4$ Balanced Equation
. .....

4. $Sn + HCl + NO$ ———>$SnCl_2 + NH_2OH$
Balanced Equation
. .....

5. $FeSO_4 + H_2SO_4 + HNO_3$ ———>$Fe_2(SO_4)_3 + NO + H_2O$
Balanced Equation
. .....

6. $Cu_2O + Cu_2S$ ———> $Cu + SO_2$
Balanced Equation
.....

7. ..... may be defined as an atom or group of atoms which behaves as a single unit in chemical change.
A) compound B) Molecule C) Ion D) None

8. In a balanced equation
A) The number of molecules of both sides are equal.
B) The number of atoms on both sides are same
C) The diatomic molecules present on both sides are equal
D) Reactants and products are same side

9. A formula has
A) qualitative significance only B) quantitative significance only
C) Both A & B D) None

10. In a chemical reaction the atoms are neither created nor .....
A) invented B) destroyed C) both A & B D) None

11. The new substance is formed in a chemical reaction are called
A) reactants B) products C) formula D) compound

12. The no. of places at which an element appears in a chemical reaction is called
A) repetition B) periodicity C) frequency D) regularity

13. In a metal and non metal have same frequency then the element i.e. balanced first is
A) non metal B) metal
C) metal if its atomic mass more D) non metal if its atomic number more

14. Change which is desirable at one time , may not be -------- of some of the time
A) Desirible change B) Un Desirible change
C) Periodic change D)Chemical change

15. $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$ after balancing the equation find out the number of moles of CO_2

A) 1 B)2 C)3 D)4

16. $CaCo_3 \rightarrow Cao + CO_2$ in this equation find out the reactant

A) $CaCo_3$ B) $CaCo_3$ C) CO_2 D) $Cao + CO_2$

17. Find out the diatomic molecule

A) P_4 B) S_8 ` C) Co_2 D) H_2

18. Rust formula is a -------

A) Fe_2O_3 B) Fe_2O_3 x H_20 C) a,b D) None

ACHIEVERS (Level - II)

Descriptive Type Question:

1. Define balencing chemical equation equation?and give two examples.

2. N_2 + H_2 ----------> NH_3

H_2 + O_2 ----------> H_2O Balence the following equations.

3. Define reactants and products?

4. Ferric hydroxide + Sulphuric acid(dil)----------> Ferric sulphate + water

Balance the equation.

EXPLORERS (Level - III)

I. Multi Correct Choice Type:

*This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D), out of which **ONE or MORE** is correct. Choose the correct options.*

1. Which is the wrong statement

A) The number of molecules of both sides are equal.

B) The number of atoms on both sides are same

C) The diatomic molecules present on both sides are equal

D) Reactants and products are same side.

2. $N_2 + 3H_2 \rightarrow 2NH_3$ The above reaction is a balanced one with corrected limitations. Identify the corrected limitations.

A) Physical states of reactants B) Number of atoms and molecules

C) Symbols and formulae of all the substances.

D) Physical conditions of a reaction on the arrow.

3. The trivalent ion or radical among the following

A) O B) B C) N D) P

4. The bivalent ion or radical among the following

A) Sulphate B) carbonate C) phosphate D)Sulphide

5. A formula has

A) qualitative significance only B) quantitative significance only

C) Colour property D) None

6. Identify the balanced equation of the following

A) $H_2 + C\ell_2 \rightarrow 2HC\ell$ B) $2Mg + O_2 \rightarrow 2MgO$

C) $2CO + O_2 \rightarrow 2CO_2$ D) $Fe + S \rightarrow FeS$

III. Odd one out and give your reason :

7. Balenced equation,Stoichiomatric equation,equal no of reactants&products,catelyst

8. N_2 ,H_2, NH_3, CO_2.

9. H_2O, CO, H_2, O_2.

IV. Correct the sentence if it is wrong otherwise rewrite the sentence :

10. The no of reactants and products are equal in the balencing chemical equation.

11. Balanced chemical equation may sometimes contain more reactant atoms.

12. Balanced chemical equation may sometimes contain more products atoms.

13. The balancing equation containg reactants and products are exite in any state also.

V. Match the following:

- *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

  *If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

14.

Column-I	Column-II
a) $Mg + 2HC\ell$	1) $MgO + C$
b) $2Mg + CO_2$	2) $CaC\ell_2 + H_2O$
c) $Ca(OH)_2 + 2HC\ell$	3) $CaC\ell_2 + H_2O + CO_2$
d) $CaCO_3 + 2HC\ell$	4) $MgC\ell_2 + H_2$
	5) MgO + HCl

A)a-2,b-3,c-5,d-4 B)a-1,b-3,c-2,d-4

C)a-4,b-1,c-2,d-3 D)a-1,b-2,c-5,d-4

15.

Column–I	Column–II
a) $xH_2 + yO_2 \rightarrow 2H_2O$	1) 1, 1
b) $xC + yO_2 \rightarrow CO_2$	2) 1, 2
c) $xCH_4 + yO_2 \rightarrow CO_2 + 2H_2O$	3) 2, 1
d) $xAl + yO_2 \rightarrow 2Al_2O_3$	4) 4, 3

A) a - 1, b - 4, c - 2, d - 3 B) a - 3, b - 1, c - 2, d- 4

C) a - 1, b - 2, c - 3, d - 4 D) a - 4, b - 3, c - 2, d - 1

VI. Comprehension Type:

- *This section contains paragraph. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (A) , (B) ,(C) and (D) out of which **ONLY ONE i**s correct. Choose the correct option.*

A chemical equation in which number of atoms of each element is same on the side of reactants and products is called "balanced equation".

Example: $2KNO_3 \rightarrow 2KNO_2 + O_2$

16. Which of the following is not true for a balanced chemical equation?

A) A balanced chemical equation gives information about physical states of all reacting substances.

B) A balanced equation gives information about the number of atoms of all substances involved in the reaction.

C) Both 1 and 2. D) None of these.

17. $N_2 + 3H_2 \rightarrow 2NH_3$

Which of the following statements is not true?

A) One molecule of nitrogen and three molecules of hydrogen combine to form two molecules of ammonia at same conditions of temperature and pressure.

B) 28 grams of nitrogen and 6 grams of hydrogen combine to form 34 gramsof ammonia.

C) One gram of nitrogen and three grams of hydrogen combine to form two grams of ammonia.

D) Both 1 and 2.

18. $2Mg + O_2 \longrightarrow 2MgO$ Which of the following statements is not true?

A) One molecule of magnesium and two molecules of oxygen combine to form two molecules of magnesium oxide.

B) 28 grams of magnesium and 6 grams of oxygen combine to form 34 grams of magnesium oxide.

C) 48 grams of magnesium and 32 grams of oxygen combine to form 80 grams of magnesium oxide

D) All of these

VII. Statement type questions:

- *This section contains certain number of questions. Each question contains Statement – 1 (Assertion) and Statement – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct Choose the correct option.*

A. Both statement Iand II correct.

B. Both statement I and II in correct

C. Statement I is corect and statement II is incorrect.

D. Statement I is incorrect and statement II is correct magnesium oxide.

19. **Statement I :** on strong heating mercuric oxide decomposes to form mercury and oxygen.

Statement II :strong heating mercuric oxide is a permanent change ,which cannot be reversed.

20. **Statement I :** during the heating of sugar ,the weight of black residue is less than the actual weight of the sugar.

Statement II : the total weight of the substance taking part in a chemical change remain the same.

RESEARCHERS (Level - IV)

I) ANSWER THE FOLLOWING :

1. Some changes can be reversed, some cannot be reversed. (**CBSE2001**)

2. If we sharp a pencil its length decreases. Can this change be reversed? (**BHU98**)

3. After baking a roti on tawa, it is not possible to get back the ball of dough again.What type of change is this?

4. Raw egg is boiled. We can reverse this change. (TRUE/FALSE) (**CBSE2004**)

5. A copper wire is folded to form a loop. Can this change be reversed?

6. Digestion of food is a/an----------

II) Additional Bits

1. Milk is converted to curd ----------

a) Physical change b) chemical change c) both a,b d) None

2. Example of physical change

a) Melting of ice b) Butter c) Ghee d) All

3. Artificial ripening of fruits is

a) Natural Change b) Undesirable change

c) Periodic change d) Physical change

4. Change which is desirable at one time , may not be -------- of some of the time

a) Desirible change b) Un Desirible change c) Periodic change d)Chemical change

5. Rusting makes the articles of Iron ----------

a) Strong b) Weak c) House d) All of these

6. The sulphuric acid formula is ---------

a) H_2So_4 b) HSo c) HSo_2 d) All

7. Ferric acid formula is

a) Fe_2O_3 b) Fe_3O_4 c) Fe_2O d) All

KEY

ΦΦ TEACHING TASK :

1-b 2-a 3-b 4-b

5. $CH_4 + 2\ O_2 \longrightarrow CO_2 + 2H_2O$

6. $2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$

7. $2Fe + O_2 \longrightarrow 2FeO$

8. $3CaOCl_2 + 2NH_3 \longrightarrow 3CaCl_2 + 3H_2O + N_2$

9. $2Al_2O_3 + 9\ C \longrightarrow Al_4C_3 + 6\ CO$

10. $2HCl + 2Na \longrightarrow 2\ NaCl + H_2$

11-a,b,c,d 12-a,b 13-a,b 14-T 15-T 16-T 17-T

18-respiration 19-heating 20-a 21-c 22 -1 23-3

24-D 25-C.

ΦΦ LEARNER'S TASK :

☐ **BEGINNERS :** 1-A 2-D

3. $3Fe + 4N_2O \longrightarrow 2N_2 + Fe_3O_4$
4. $3Sn + 6HCl + 2NO \longrightarrow 3SnCl_2 + 2NH_2OH$
5. $6FeSO_4 + 3H_2SO_4 + 2HNO_3 \longrightarrow 3Fe_2(SO_4)_3 + 2NO + 4H_2O$
6. $2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$

7-B 8-B 9-C 10-B 11-B 12-B 13-B 14-A 15-D 16-A 17-D 18-C

☐ **EXPLORERS :**

1-a,c,d 2-a,d 3-b,c,d 4-a,b,c 5-a,b,c 6-a,b,c,d
7-catalyst 8-NH_3 9-CO 10-T 11-T 12-T 13-T 14-C 15-B
16-C 17-D 18-D 19-A, 20-C

☐ **RESEARCHERS: II)** 1- b 2-d 3-a 4-A 5-a 6-a 7-a