Is Matter Around Us Pure

Periodic Test

Q.1. What is meant by a pure substance?

Answer: A pure substance is a type of substance which contains a single type of constituent particles which are the same in their chemical nature.

Elements (Iron, copper etc.) and compounds (water, carbon dioxide, etc.) are examples of pure substances.

Q.2. What type of mixtures are separated by the technique of crystallization?

Answer: Crystallisation is a process that separates a pure solid in the form of its crystals from a solution. This process is used to obtain pure crystals of a substance from an impure mixture sample.

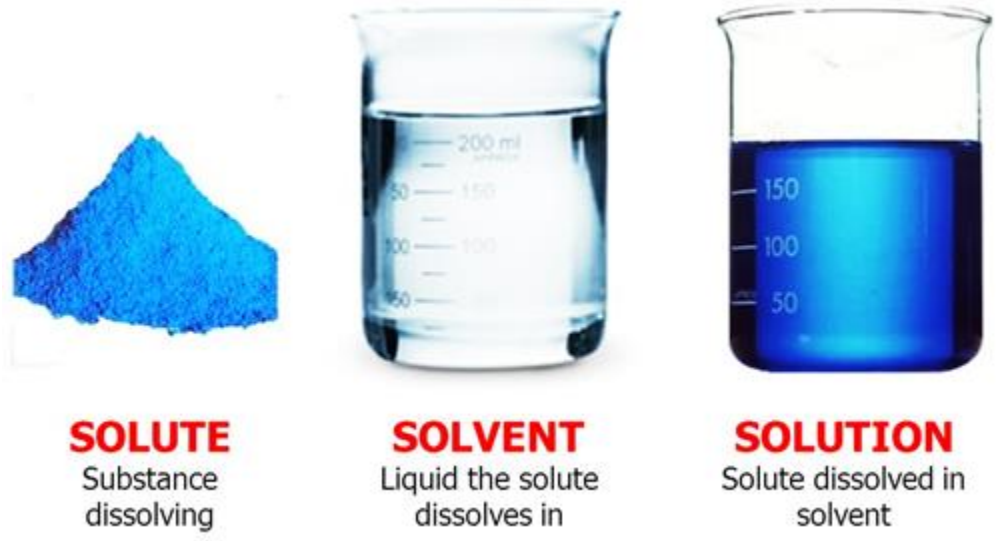
Example: Separation of pure crystals of copper sulphate from an impure mixture of copper sulphate solution is done using crystallisation.

Q.3. Define (a) solute (b) solvent.

Answer: (a) The solute is the component which gets dissolved in a solvent to form a solution. It is present in a smaller amount when compared to the solvent.

(b) The solvent is the component which dissolves a solute to form a solution. The solvent is present in larger amount when compared to the solute.

Example:



Q. 4. Why alloy is considered as a mixture?

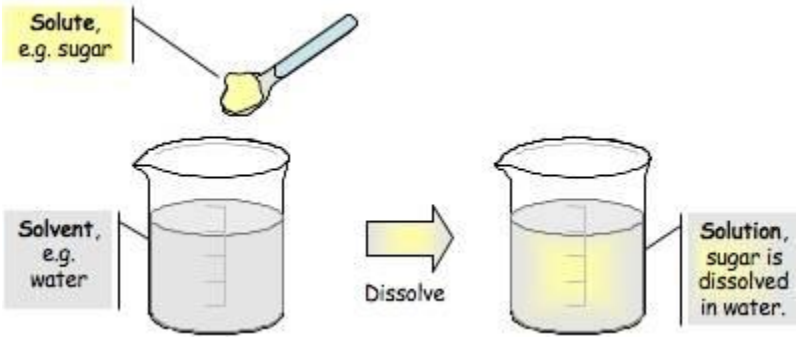
Answer: Alloy consists of metals mixed in a particular proportion. They exhibit the properties of the constituents. No new chemical properties are shown once the metals are mixed. Hence an alloy is considered as a mixture.

Example, steel is an alloy of iron and carbon as it is a mixture of these two elements where the larger proportion is of metal (iron) and smaller proportion of non-metal (carbon)

Q. 5. Define solution.

Answer: A solution is a homogenous mixture of 2 or more substances. The substance present in the larger amount (solvent) dissolves the substance present in the smaller amount (solute).

Example,



Q.6. Give Reasons for the Following:

Why air is considered as a mixture?

Answer: The constituent particles of air are evenly distributed. This means that a sample of air taken from any place would contain the constituent particles in the same proportion/composition. Air is constituted by more than one kind of substance and shows the properties of its constituent particles. Therefore, air is considered a mixture.

Q.7. Give Reasons for the Following:

Why is it said that solubility of any solute changes with a change in temperature?

Answer: Solvent dissolves solute particles by overcoming the intermolecular forces between the solute (or one can call it the solute-solute interaction). So, to dissolve a solute, the solute-solute interaction must be broken by the solvent particles.

When the temperature increases, the kinetic energy of the solvent particles increases, causing to break the solute-solute interactions more effectively. This allows the addition of more solute particles, as there is space to accommodate more solute particles. So the solubility increases with increase in temperature. Lowering the temperature does the opposite. It decreases the solubility of the solute.

Q.8. Give Reasons for the Following:

Why Tyndall effect is not observed when light passes through a true solution or suspension?

Answer: The phenomenon where the path of the light beam is visible as a result of scattering of light by colloidal particles is called Tyndall effect. The size of the particle should be such that it should scatter light. Particles which are very small (in the case of true solutions) or very large (in the case of suspensions) do not scatter light. So, the Tyndall effect is not observed in true solutions or suspensions.

This is the general case. In certain special cases, if the particle size of suspension is small enough to scatter light, then suspensions also show Tyndall effect.

Q.9. Give Reasons for the Following:

Why cream separates from milk on churning?

Answer: Cream and milk differ in their density. Cream is denser than milk. When milk is churned (shaking or spinning of container containing milk by applying a rotating force) the denser particles (cream) tend to remain at the bottom, whereas the lighter particles (milk) stay at the top, along with the direction of spin. This process is called centrifugation.

Q.10. Give Reasons for the Following:

Why different colours present in the ink rise to different levels during paper chromatography?

Answer: Chromatography is the process of separation of solutes that dissolve in the same solvent.

Ink is a mixture of 2 or more colours (dye) dissolved in water. Different colours present in ink have different solubility in water. The component which is more soluble rises faster in the strip of filter paper. The component which is less soluble travels less distance in the filter paper. This is why different colours present in the ink rise to different levels during paper chromatography.

Q.11. Differentiate between true solution, colloidal solution and suspension.

Answer:

True Solution	Suspension	Colloidal Solution
Homogenous mixture	Heterogeneous mixture	Heterogeneous mixture
Appearance: Transparent	Appearance: Opaque	Appearance: Translucent
Particle size: very small, cannot be seen by naked eye	Particle size: large, cannot be seen by naked eye	Particle size: between true solution and suspension, cannot be seen by naked eye
Solute particles do not settle down when left undisturbed	Solute particles settle down when left undisturbed	Solute particles do not settle down when left undisturbed
Filtration separation – not possible	Filtration separation – possible	Filtration separation – not possible
Eg: salt solution	Eg: sand in water	Eg: Milk

Q.12. List the points of differences between homogeneous and heterogeneous mixtures.

Answer:

Homogenous mixtures	Heterogeneous mixtures
Uniform composition	Non-uniform composition
Constituent particles are not visible to naked eye	Constituent particles may be visible to naked eye
Components cannot be separated by simple filtration	Components may be separated by simple filtration
Do not scatter a beam of light	Scatter a beam of light (Tyndall effect)
Particle size is very small	Particle size is larger than that of homogenous mixtures
Eg: Sugar solution, alloys	Eg: Mud in water, Ink

Q.13. Differentiate between saturated and unsaturated solution.

Answer:

Saturated Solution	Unsaturated Solution
At given temperature, no more solute can be dissolved	At given temperature, more solute can be dissolved
The concentration of solution is maximum (at a given temperature)	The concentration of solution is lower than the maximum (at a given temperature)

Q.14. What is the difference between aqueous and non-aqueous solution?

Answer:

Aqueous solution	Non-aqueous solution
The solution in which the solvent used is water	The solvent used is not water
Water is a polar solvent.	Solvent maybe polar or non-polar.
Liquid solution	Maybe solid, liquid or gaseous solution
Eg: Salt solution (salt + water)	Eg: Tincture of iodine (Iodine + alcohol). Alcohol is the solvent

Q.15. Explain the following giving examples:

(a) Saturated solution

(b) Unsaturated solution

(c) Suspension.

Answer: (a) A solution in which at a given temperature, no more solute can be dissolved by the solvent is called a saturated solution. The concentration of such solutions is the maximum at a given temperature.

To illustrate this, take a glass or a beaker and add some common salt to it. Fill the beaker with water and stir it well. One now gets a salt solution. Continue adding salt slowly to the beaker along with stirring. At some point of time, the solution reaches a state where even though salt is added and stirred, some of the salt stays undissolved. Then one can say that the solution has reached its saturation level at that temperature.

(b) A solution in which at a given temperature, more solute can be dissolved by the solvent is called an unsaturated solution. Unsaturated solutions can be made saturated by adding more solute to it. In the activity mentioned in (a), the solution obtained in the beginning is an unsaturated solution.

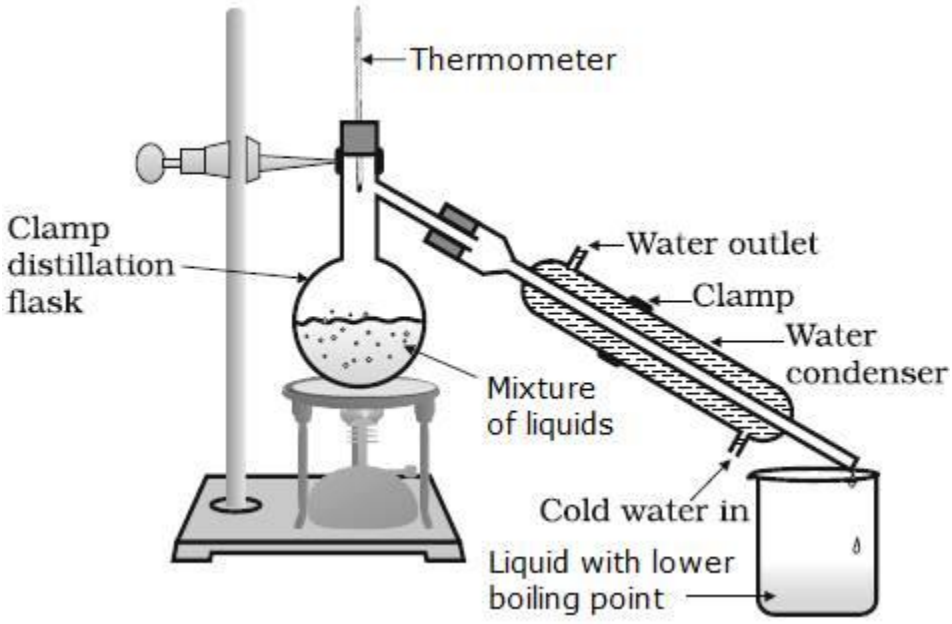
(c) The suspension is a heterogeneous mixture of 2 or more components. The particles forming the suspension are visible to the naked eye. In this mixture, the solute particles do not dissolve in the solvent, instead, they remain suspended in the solvent medium.

When left undisturbed, the solute particles tend to settle down at the bottom of the container.

Eg: Mixture of sand and water forms a suspension.

Q.16. How will you separate a mixture containing benzene and diesel (difference in their boiling points is more than 50°C), which are miscible with each other?

Answer: A mixture of 2 miscible liquids whose boiling points differ by more than 50°C can be separated using a technique called distillation. The liquids must not decompose upon boiling.



The mixture of liquids is taken in a round bottom flask and is heated. The liquid component with a lower boiling point starts to escape from the mixture and the gas is passed through a condenser. The cold water helps to condense the gas into its liquid form and is collected in a beaker.

In the given mixture, at around 80°C, benzene gets converted into a gaseous state and is sent through the condenser to get benzene back in the liquid state.

Finally, diesel remains in the round bottom flask and benzene in the beaker.

Q.17. Describe the method of tea making by using the terminology of:

(a) soluble (b) solvent

(c) solute (d) solution

(e) insoluble (f) filtrate

(g) residue (h) dissolve

Answer: Take a kettle or a teapot. Add water to it. Boil the water and add tea powder/tea leaves to it based on your choice. The more tea you add, the stronger the liquid becomes. Note that tea is the solute and water is the solvent. Also, the tea powder insoluble in water, but the essence is absorbed by the liquid. Once the tea+mixture starts to boil, dissolve sugar (another solute) in it. You may add sugar as long it is soluble in it for maximum sweetness. To this solution, add milk if you need milk tea. Once it is boiled, remove it from the heat source and filter the solution for tea powder. You can see that the residue you get is tea powder, and the filtrate (the liquid after filtration) is black/milk tea.

Q. 18. What is meant by the concentration of a solution? Explain by giving an example.

Answer: The concentration of a solution is the amount of solute present in a given amount of solution or solvent. This can be mathematically written as:

The concentration of solution = $\frac{\text{Amount of solute}}{\text{Amount of solution}}$

Or

The concentration of solution = $\frac{\text{Amount of solute}}{\text{Amount of solvent}}$

Mainly one expresses concentration in 2 ways:

(a) Mass by mass percentage:

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

(b) Mass by volume percentage:

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

Eg:

Consider 30g of sugar (solute) dissolved in 150g of water (solvent).

Then the mass of solute = 30g

Mass of solvent = 150g

Mass of solution = Mass of solute + mass of solvent

= 30+150

= 180g

Therefore, the concentration of solute expressed using mass by mass percentage is:

Mass by mass percentage of solution = (Mass of solute/Mass of solution) x 100

$$= \left(\frac{30}{180}\right) \times 100$$

$$= \left(\frac{1}{6}\right) \times 100$$

= 16.6%

Q.19. Give two characteristics each of:

(a) Pure substances.

(b) Mixtures.

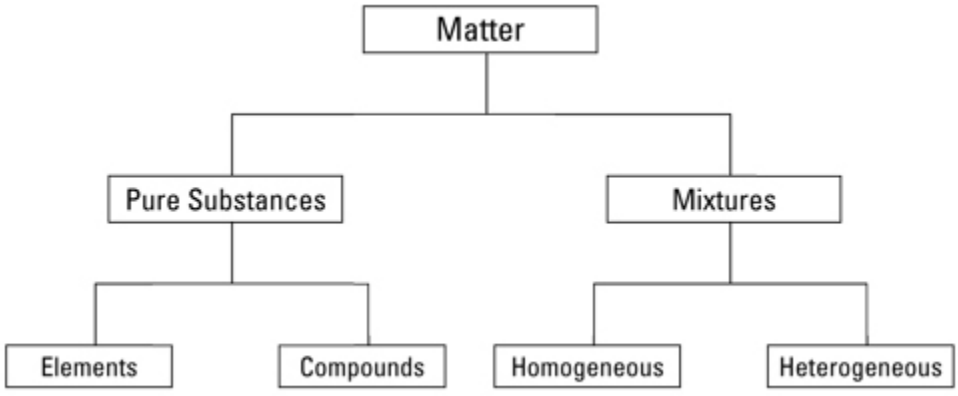
Answer: (a) A pure substance is a type of matter which is formed by a single type of particles. The constituent particles are identical in their chemical nature. The constituent particles of a particular pure substance will always be found in a fixed composition and cannot be separated using physical methods.

Elements and compounds are examples of pure substances.

(b) Mixtures are a type of matter formed by more than one pure substance. The constituent particles just mix together in different proportions to give different mixtures. The properties exhibited by the mixture are the same as the properties exhibited by the individual constituent particles. These constituents can be fairly separated using physical techniques.

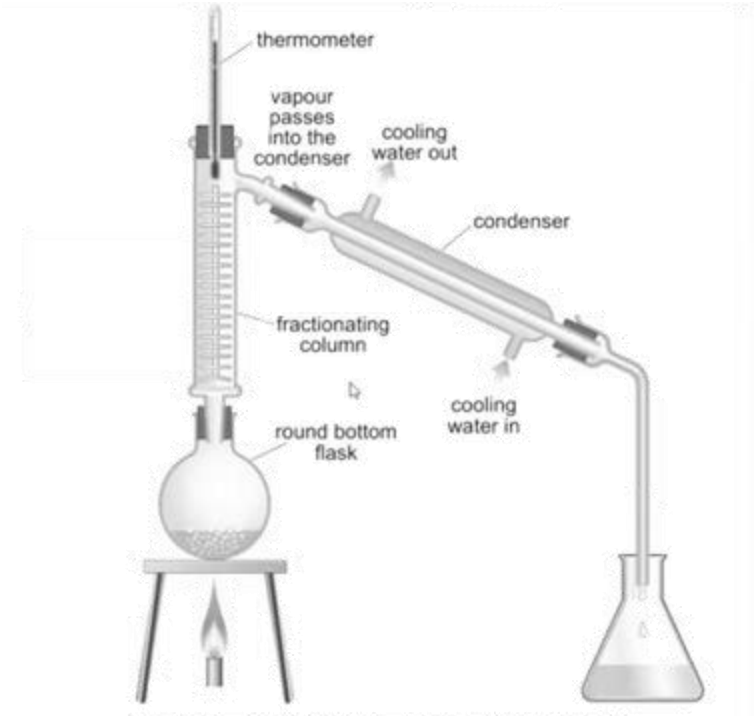
Sugar solution, milk, air are examples of mixtures.

Note: The sub-division of matter is shown as:



Q.20. Draw a labelled diagram showing fractional distillation.

Answer:



Fractional distillation is the process used to separate a mixture of miscible liquids whose boiling points differ by less than 25°C. The experimental setup is similar to that of distillation except for a fractionating column which is filled with glass beads.

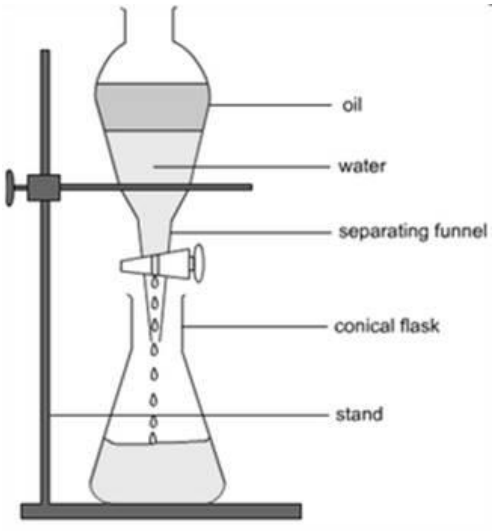
In this method, the mixture is heated using a burner, and both the liquids most likely enter the vapour state. The vapours hit the glass beads in the column and tend to condense. Out of the two vapours, the vapour component which is less volatile cools faster than the other and returns to liquid state. Gradually, the more volatile component reaches the top of the column and is passed through the condenser as shown in the figure and gets liquefied.

The less volatile component remains in the round bottom flask.

The process is repeatedly done to completely separate the two liquids.

Q.21. Show diagrammatically, how will you separate two immiscible liquids?

Answer:

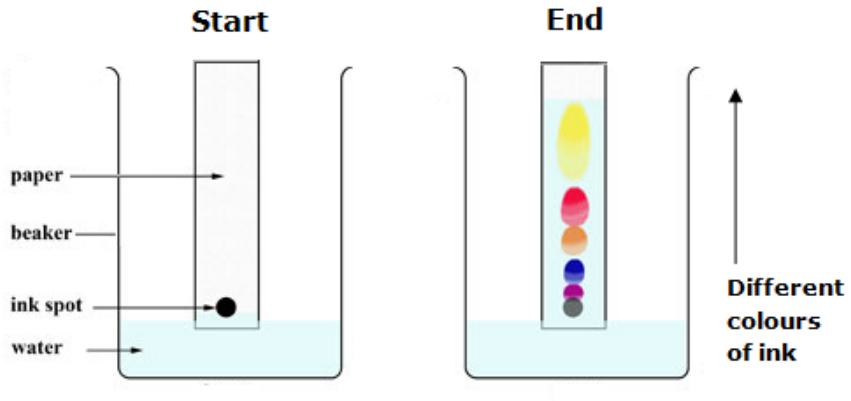


Separation of 2 immiscible liquids is done using a separating funnel. The above figure shows a separating funnel clamped to a stand. In this case the mixture to be separated contains oil and water.

Immiscible liquids do not mix well and have different densities. When the mixture is left undisturbed, the denser liquid comes to the bottom of the funnel, and the lighter liquid stays on top of it. Now by operating a stopcock carefully, one can transfer the denser liquid (here, water) to the conical flask. The stopcock is closed when water is completely transferred from the funnel. The separation is done multiple times to ensure complete separation of the two components. Oil remains in the funnel and water is in a conical flask.

Q.22. Draw a labelled diagram to show separation of dyes in black ink using a chromatography method.

Answer:



Chromatography is a technique used to separate components which dissolve in the same solvent. Different components present in the ink have different solubility in the solvent. The component which is more soluble in the solvent travels more distance with

the solvent. Likewise, the component with less solubility travels less distance with the solvent.

Paper chromatography is illustrated in the above figure. An ink spot is marked in a thin strip of filter paper. The bottom of the paper is immersed in a beaker containing water. As the water rises up, it takes along the different components present in the ink to different heights according to their solubility. As a result, colours (individual components of the ink) are seen along the height of the strip.

This way, the individual components are separated out using chromatography.

Q.23. Crystallisation method is used to get salt from sea water. Why is it so?

Answer: The salt present in sea water may contain impurities in dissolved form. Simple evaporation causes the water to evaporate, leaving the impurities with the salt. In crystallisation, pure solid is obtained in the form of crystals from a solution. So, crystallisation ensures the purity of the product obtained.

Q.24. Fractional distillation method is used for the separation of different gases from air. Why is it so?

Answer: To separate the different gases from air, they are to be liquefied first to implement fractional distillation. The air is cooled and compressed to obtain liquid air. One can see that the boiling points (b.p.) of various constituents differ by less than 25°C.

For instance, the b.p. of oxygen is -183°C whereas the b.p. of nitrogen is -196°C. So simple distillation would convert both into gaseous state, and one would fail to separate them. Due to this reason, fractional distillation is used.

In this case, both liquids get converted into vapour state and passes through the fractionating column. The less volatile component gets condensed and becomes a liquid again. The more volatile component suffers less condensation. As a result, the more volatile component tends to reach the top of the fractionating column. This vapour at the top is condensed and collected in a beaker.

For the separation to be effective, this process is done multiple times.

Q.25. Separating funnel is used to separate two immiscible liquids and not the miscible liquids. Why is it so?

Answer: Two immiscible liquids are separated by the difference in their densities. When left undisturbed, the denser liquid tends to stay at the bottom of the separating funnel, and the lighter liquid stays at the top. Then the denser liquid is extracted out by carefully operating the stopcock.

In the case of miscible liquids, the densities of the constituent liquids are relatively the same and the mixture is homogenous. When left undisturbed, one will not obtain the

liquids in layer as there is not much difference in their densities.

Comprehensive Exercises (MCQ)

Q.1. Which of the following will show “Tyndall effect”?

A. Salt solution

B. Sugar solution

C. Soap solution

D. Copper sulphate solution

Answer: Tyndall effect is the phenomenon in which the path of the light beam becomes visible when a light beam enters a colloidal solution. The path becomes visible due to the scattering of light by the colloidal particles. Soap solution is an example of a colloidal solution and hence shows Tyndall effect. Salt solution, sugar solution and copper sulphate are examples of true solutions and do not show Tyndall effect.

Q.2. What happens when a saturated solution is cooled?

A. It becomes unsaturated

B. It remains unaffected

C. It becomes supersaturated

D. It becomes transparent

Answer: A solution in which no more solute can be dissolved at a given temperature is called saturated solution, and the amount of solute present in a saturated solution at a given temperature is called solubility. Solubility is directly proportional to temperature. So, when temperature decreases (i.e., when the saturated solution is cooled), solubility also decreases. Therefore, the solution becomes supersaturated.

Q.3. Which of the following is a compound?

A. Air

B. Water

C. Soda water

D. Pond water

Answer: Water is a compound formed by the element’s hydrogen and oxygen. Air, pond water, soda water are examples of mixtures.

Q.4. Which of the following is an element?

A. Oxygen gas

B. Carbon dioxide gas

C. Sulphur dioxide gas

D. Nitrogen dioxide gas

Answer: Elements are pure substances which cannot be further broken down into simpler substances. Carbon dioxide gas, sulphur dioxide gas, nitrogen dioxide gas are examples of compounds and they can be further broken down into elements by chemical reactions.

Q.5. Which of the following is a homogeneous mixture?

A. Soda water

B. Copper sulphate solution

C. Starch solution

D. Sodium chloride solution

Answer: Homogeneous mixtures are mixtures in which the constituent substances are mixed well and have a uniform composition throughout.

Options (a), (b) & (d) are homogeneous mixtures.

Starch Solution is heterogenous mixture. The starch solution is a suspension and not a solution.

Q.6. Which of the following materials fall in the category of a "pure substance"?

A. Ice, milk and iron

B. CaO, CO2 and NaCl

C. Brick, mercury and wood

D. Iron, CaO and air

Answer: Pure substances are those in which all the constituent particles present in them are the same in their chemical nature.

Elements and compounds are examples of pure substances. CaO, CO2, NaCl are examples of compounds. Air, milk, brick and wood fall under impure substances.

Q.7. Which of the following is an aqueous solution?

A. Sulphur in carbon disulphide

B. Iodine in carbon disulphide

C. Sodium chloride in water

D. Iodine in alcohol

Answer: Aqueous solution is a solution in which the solvent is water.

Q.8. The substances that sublime can be made to liquefy by:

A. Heating them under pressure

B. Heating them at low pressure

C. Cooling them under pressure

D. Cooling them at low pressure

Answer: Sublimation is the process of conversion of a substance from solid state to gaseous state without entering the liquid state. When more pressure is applied, the gaseous particles would come closer and closer (because of compression) and tend to form liquids. The heat energy supplied under pressure will then force the solid to convert into liquid state, as now it cannot sublime due to the pressure applied over it.

Q.9. The substances that sublime easily are:

A. Petrol, acetone, camphor, iodine and solid CO2

B. Iodine, Solid CO2, ammonium chloride, kerosene and diesel

C. Iodine, camphor, ammonium chloride, anthracene and naphthalene D. Iodine, acetone, camphor, petrol and naphthalene

Answer: Sublimation is the process of conversion of a substance from solid state to gaseous state without entering the liquid state. The substances which are sublimable are highly volatile in nature.

Q.10. Chromatography is the technique which is used for separation of those solutes that:

A. Dissolve in the same solvent

B. Get adsorbed to different extremes

C. Get absorbed at the same speed

D. Are soluble in aqueous medium

Answer: Chromatography is a technique used in the separation of a mixture into individual components. The different components dissolved by the same solvent travel with different speeds based on the solubility of the components and get separated.

Q.11. Which of the following statements are true for pure substances?

(i). Pure substances contain only one kind of particles

(ii). Pure substances may be compounds or mixtures

(iii). Pure substances have the same composition throughout

(iv). Pure substances can be exemplified by all elements other than nickel

A. (i) and (ii)

B. (i) and (iii)

C. (iii) and (iv)

D. (ii) and (iii)

Answer: Pure substances contain only one kind of particles and have the same composition throughout. Elements and compounds fall under pure substances, not mixtures. All elements including nickel are examples of nickel.

Q.12. Rusting of an article made-up of iron is called:

A. Corrosion and it is a physical as well as chemical change

B. Dissolution and it is a physical change

C. Corrosion and it is a chemical change

D. Dissolution and it is a chemical change

Answer: Corrosion is the process of degradation of a material as a result of chemical reactions with the environment. The material gets converted into its oxide, sulphide or another compound. Rusting of iron is an example of corrosion where iron is converted into iron oxide when exposed to air and moisture. Since there is a change in the material (formation of a new compound), corrosion is a chemical change.

Q.13. A mixture of sulphur and carbon disulphide is:

A. Heterogeneous and shows Tyndall effect

B. Homogeneous and shows Tyndall effect

C. Heterogeneous and does not show Tyndall effect

D. Homogeneous and does not show Tyndall effect

Answer: Mixture of sulphur and carbon disulphide is an example of a true solution. True solutions are homogenous and do not Tyndall effect.

Q.14. Tincture of iodine has antiseptic properties. This solution is made by dissolving:

A. Iodine in potassium iodine

B. Iodine in Vaseline

C. Iodine in water

D. Iodine in alcohol

Answer: Tincture of iodine is made by dissolving iodine in alcohol. It is used as medicine.

Q.15. Which of the following are homogeneous in nature?

(i) Ice (ii) Wood

(iii) Soil (iv) Air

A. (i) and (iii)

B. (ii) and (iv)

C. (i) and (iv)

D. (iii) and (iv)

Answer: Homogenous nature implies that the composition is uniform throughout. If you take different samples of the same substance, the components present in it will be in same composition. Ice is a pure substance whereas air is a mixture, but both are homogenous in nature as there is uniform composition of constituents.

Comprehensive Exercises (T/F)

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

The properties that can be observed and specified are called physical properties.

Answer: True

Properties such as density, boiling point, melting point are physical properties and they can be observed or measured directly.

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

During burning of a candle only chemical change takes place.

Answer: False

Both physical and chemical changes occur during burning of a candle. There is a change in the state of wax from solid state to liquid state and from liquid state to vapour state. Change in state of the matter is a physical change.

Burning involves the process of combustion. The candle is basically a carbon containing material which combines with oxygen to give out carbon dioxide. This process is a chemical change.

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

Non-metals are lustrous and good conductors of heat and electricity.

Answer: False

Metals are lustrous and are good conductors of heat and electricity.

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

Metals are malleable, ductile, sonorous and lustrous.

Answer: True

Metals can be bet to form thin sheets (malleable), drawn to form thin wires (ductile). They produce a ringing sound when they are hit (sonorous) and have a shiny appearance (lustre).

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

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

Answer: True

Compounds are pure substances composed of 2 or more elements chemically combined with one another in a fixed proportion. Water, carbon dioxide are examples of compounds.