Chapter - 2
Is Matter around Us pure

Multiple Choice Questions

1. 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)

Soln

Answer is b) (i) and (iii)

2. 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

Soln:

Answer is c corrosion and it is a chemical change.

Explanation :

Rusting of iron is corrosion and it's a chemical change because rust is a chemical compound called hydrate iron oxide $Fe_2O_3 . nH_2O$, iron(III) which is different from elemental iron.
Physical changes are those changes in which substance identity is not changed and it can get back to its original form ex: water freezing to ice can be melted back to water. Whereas chemical changes are those in which original substance identity is changed and they cannot be restored to their original form.

On adding solid solute is to the solvent, some solute dissolves and its concentration increases in solution. This process is known as dissolution.

Crystallization is a process in which Solute particles in solution collide with the solid solute particles to get separated out of solution.

3. 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

Soln:

A mixture of sulphur and carbon disulphide is a heterogeneous colloid and shows Tyndall effect. In a colloidal solution, the particles are big enough to scatter light. The scattering of light by colloidal particles is known as Tyndall effect. Colloids are actually heterogeneous in nature though they appear to be homogeneous.
Answer is a) heterogeneous and shows Tyndall effect.

Explanation:

A mixture of sulphur and carbon disulphide is heterogeneous and shows Tyndall effect because in a colloidal solution the particles are big enough to scatter light.

4. Tincture of iodine has antiseptic properties. This solution is made by dissolving

(a) iodine in potassium iodide
(b) iodine in vaseline
(c) iodine in water
(d) iodine in alcohol

Soln:

Answer is (d) iodine in alcohol

Explanation:

Tincture is prepared by using 2-7% elemental iodine and either of potassium iodide or sodium dissolved in alcohol. Since alcohol is a good solvent and iodine does not dissolve in water answer should be alcohol.

5. Which of the following are homogeneous in nature?
(i) ice
(ii) wood
(iii) soil
(iv) air

(i) and (iii)
(ii) and (iv)
(i) and (iv)
(iii) and (iv)

Soln:

Answer is a) (i) and (iii)

Explanation

Air and ice are homogeneous mixture because its elements are not visible and cannot be distinguished from one another.

6. Which of the following are physical changes?

(i) Melting of iron metal
(ii) Rusting of iron
(iii) Bending of an iron rod
(iv) Drawing a wire of iron metal

(a) (i), (ii) and (iii)
(b) (i), (ii) and (iv)
(c) (i), (iii) and (iv)
(d) (ii), (iii) and (iv)

Soln:

Answer is (c) (i), (iii) and (iv)

Explanation

Rusting of iron is a chemical process where iron reacts with water and oxygen to produce iron oxide whereas others given processes are physical changes.

7. Which of the following are chemical changes?

(i) Decaying of wood
(ii) Burning of wood
(iii) Sawing of wood
(iv) Hammering of a nail into a piece of wood

(a) (i) and (ii)
(b) (ii) and (iii)
(c) (iii) and (iv)
(d) (i) and (iv)

Soln:

Answer is (a) (i) and (ii)

Explanation

Decaying of wood and burning of wood because there will be change of chemical composition and wood cannot be restored to its original form.
Sawing of wood and hammering of nail into a piece of wood are physical process where compounds chemical composition is not changed.

8. Two substances, A and B were made to react to form a third substance, A2B according to the following reaction 2 A + B → A2 B which of the following statements concerning this reaction are incorrect?

(i) The product A2B shows the properties of substances A and B
(ii) The product will always have a fixed composition
(iii) The product so formed cannot be classified as a compound
(iv) The product so formed is an element

(a) (i), (ii) and (iii),
(b) (ii), (iii) and (iv)
(c) (i), (iii) and (iv)
(d) (ii), (iii) and (iv)

Soln:

Answer is (c) (i), (iii) and (iv)

Explanation:

A_2B is a compound made up of two elements A and B in a fixed ratio. The properties of a compound (e.g., A2B) are entirely different from those of its constituent elements (ie.g A and B). The composition of a compound is fixed.

9. Two chemical species X and Y combine together to form a product P which contains both X and Y X + Y → P X and Y cannot be broken down into simpler substances by simple chemical reactions. Which of the following concerning the species X, Y and P are correct?

(i) P is a compound
(ii) X and Y are compounds
(iii) X and Y
(iv) P has a fixed composition

(a) (i), (ii) and (iii),
(b) (i), (ii) and (iv)
(c) (ii), (iii) and (iv)
(d) (i), (iii) and (iv)

Soln:

Here X and Y cannot be further broken down into simpler substance. Hence X and Y are elements and P can be broken down to its elements hence P is a compound.

Short Answer Questions

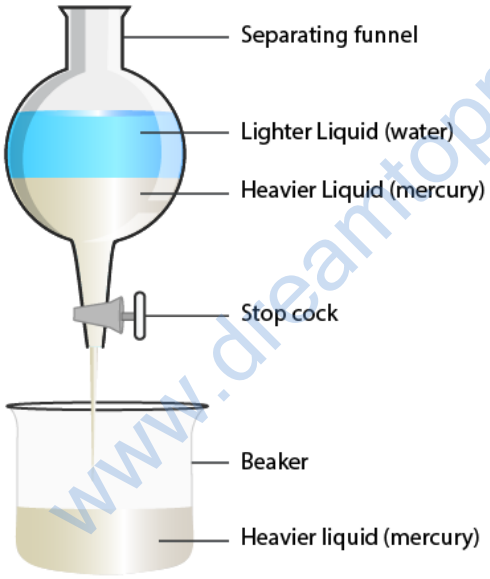
10. Suggest separation technique(s) one would need to employ to separate the following mixtures.
(a) Mercury and water
(b) Potassium chloride and ammonium chloride
(c) Common salt, water and sand
(d) Kerosene oil, water and salt

Soln:

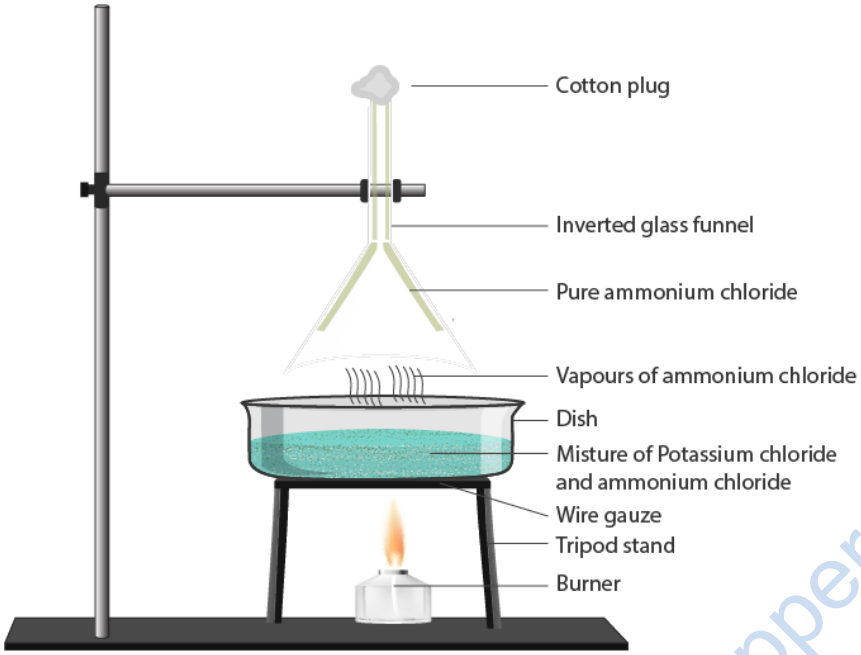
Answers are a) decantation b) Sublimation c) Filtration and evaporation d) decantation

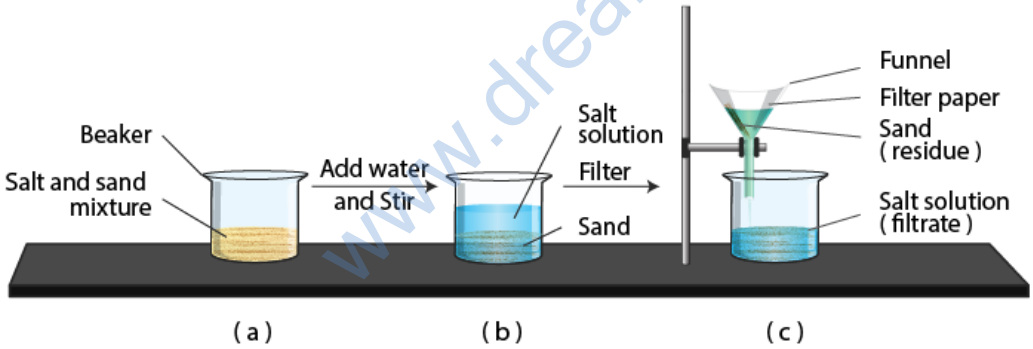
Explanation

a) Decantation method is used to separate the mixture of Mercury and water. Here Mercury is heavier than water hence it forms a separate layer which can be easily separated in separating funnel.



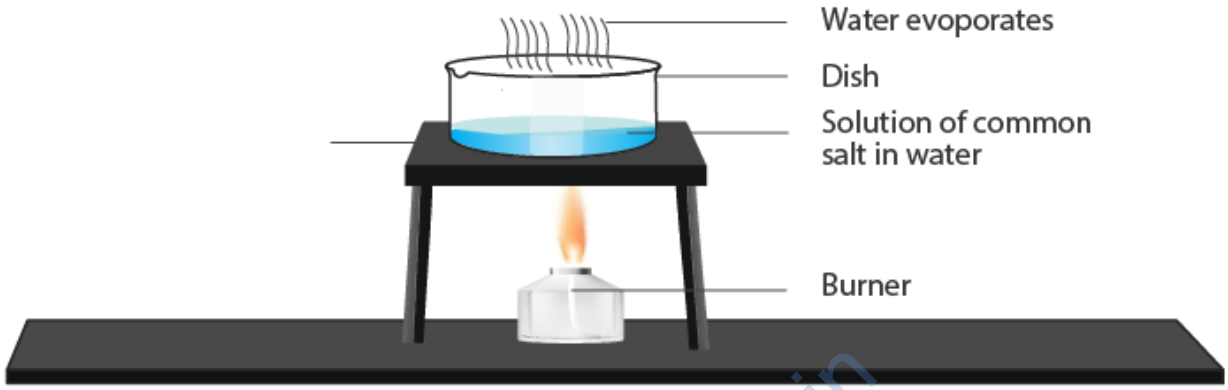
a) Potassium chloride and ammonium chloride are separated by sublimation method because ammonium chloride being a sublimate, sublimes leaving behind the potassium chloride.





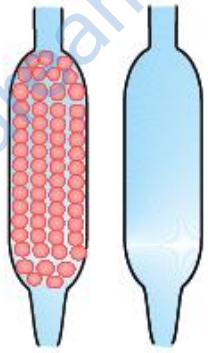
Seperation of salt and sand mixture

b) Common salt, water and sand are separated by filtration and evaporation processes. Common salt, water and sand are filtrated to separate the sand from salt solution. Then salt solution is heated to evaporate the water leaving behind salt.



Seperation of common salt dissolved in water by evoporation

11. Which of the tubes in Fig. 2.1
(a) and (b) will be more effective as a condenser in the distillation apparatus?



Soln:
Answer is tube a

Explanation
Marbles in tube A increases the surface area that comes in contact with vapours. This gives more time for condensation of vapours hence tube A is an effective condenser than tube B.

12. Salt can be recovered from its solution by evaporation. Suggest some other technique for the same?

Soln:

Answer is crystallization

Explanation:

Salt can be recovered from its solution by crystallization. Crystallization is a more efficient process as it removes soluble impurities which cannot be done by evaporation.

13. The 'sea-water' can be classified as a homogeneous as well as heterogeneous mixture. Comment.
Soln

If we consider the sea water on the surface it comprises water and salts hence it is homogenous mixture. If we consider the sea water from deep sea it consists of salts, water, mud, decayed plants etc which will be heterogeneous mixture.

14. While diluting a solution of salt in water, a student by mistake added acetone (boiling point 56°C). What technique can be employed to get back the acetone? Justify your choice.

Soln:
Distillation can be used to separate acetone from the mixture of salt and water.

Explanation

There is considerable differences in the boiling points of acetone (56°C) and water (100°C). When the solution is heated acetone evaporates first which can be collected to obtain acetone.

15. What would you observe when

(a) a saturated solution of potassium chloride prepared at 60°C is allowed to cool to room temperature.
(b) an aqueous sugar solution is heated to dryness.
(c) a mixture of iron filings and sulphur powder is heated strongly.

Soln:

a) Sodium potassium chloride will separate out from the saturated solution when the temperature of the solution reduced from 60°C to room temperature. Solubility of the solid state is affected by the changed temperature.
b) When aqueous sugar solution is heated forst water gets evaporated upto some extent then sugar gets charred.
c) Iron combines with sulphur and forms iron sulphide (FES).

16. Explain why particles of a colloidal solution do not settle down when left undisturbed, while in the case of a suspension they do.

Soln:

Size of the particles in suspension is relatively larger than size of the particles in a solution. Moreover in suspension molecular interaction is weaker to keep the molecules in suspended form. Hence the particles settle down. Similarly in colloidal solution molecular interaction is strong hence they remain in suspended form.

17. Smoke and fog both are aerosols. In what way are they different?

Soln:

Both smoke and fog have gas as the dispersion medium (continuous phase). But the difference lies in dispersed phase .Dispersed phase in fog is liquid whereas in smoke it is solid (particulate matter).

18. Classify the following as physical or chemical properties
(a) The composition of a sample of steel is: 98% iron, 1.5% carbon and 0.5% other elements.
(b) Zinc dissolves in hydrochloric acid with the evolution of hydrogen gas.
(c) Metallic sodium is soft enough to be cut with a knife.
(d) Most metal oxides form alkalis on interacting with water.

Soln:

Ans: Physical properties are a) and c). Chemical properties are b) and d)

Explanation

a) Composition of a sample of steel is: 98% iron, 1.5% carbon and 0.5% other elements. It is a chemical property because no new compound is formed as the steel is an alloy and alloy and is a homogeneous mixture of two or more metals or of metallic elements with non-metallic elements.
b) It is chemical property because zinc reacts with HCL to give out zinc chloride and Hydrogen gas.
c) Cutting knife will not involve any chemicals reaction and did not form new compound hence it is a physical property.
d) It is chemical property as new compound is form by the interaction of metal oxides with alkalis.

19. The teacher instructed three students 'A', 'B' and 'C' respectively to prepare a 50% (mass by volume) solution of sodium hydroxide (NaOH). 'A' dissolved 50g of NaOH in 100 mL of water, 'B' dissolved 50g of NaOH in 100g of water while 'C' dissolved 50g of NaOH in water to make 100 mL of solution. Which one of them has made the desired solution and why?

Soln:

Answer is student C because both B and A has made the solution of 150ml whereas student C prepared required quantity.

Explanation
Student A and B prepare 150 ml solution, so student c make desire solution because he add water to make 100 ml solution. and from calculation,

$$\%w/v = \frac{100 \times \text{weight of sub (solute)}}{\text{volume of solution}}$$

$$\therefore \%50 = \frac{100 \times \text{weight of sub}}{100 \text{ ml}}$$

$$\text{weight of sub} = \frac{50 \times 100 \text{ ml}}{100}$$

$$\therefore \text{ weight of sub} = 50 \text{ g}$$

Here the 50g NaOH requred for 50% w/v 100ml solution of NaOH

20. Name the process associated with the following
(a) Dry ice is kept at room temperature and at one atmospheric pressure.
(b) A drop of ink placed on the surface of water contained in a glass spreads throughout the water.
(c) A potassium permanganate crystal is in a beaker and water is poured into the beaker with stirring.
(d) A acetone bottle is left open and the bottle becomes empty.
(e) Milk is churned to separate cream from it.
(f) Settling of sand when a mixture of sand and water is left undisturbed for some time.
(g) Fine beam of light entering through a small hole in a dark room, illuminates the particles in its paths

Soln:

Answers a) sublimation
b) Diffusion
c) Dissolution/ diffusion
d) Evaporation
e) Centrifugation
f) Sedimentation
g) Tyndall effect (Scattering of light)

21. You are given two samples of water labelled as 'A' and 'B'. Sample 'A' boils at 100°C and sample 'B' boils at 102°C. Which sample of water will not freeze at 0°C? Comment.

Soln:

Answer is sample B
Explanation

Sample B may consists of impurities. At 1 atm boiling point of water is 100°C and freezing point is 0°C. Hence sample B which will not boil at 102°C will not freeze at 0°C.

22. What are the favourable qualities given to gold when it is alloyed with copper or silver for the purpose of making ornaments?

Soln:

Pure gold (24) karat) is soft and does not have strength. In order to give strength to gold silver and copper is alloyed to gold. An alloy that has 20 parts of gold and 4 parts of silver is known as 24 karat gold.

23. An element is sonorous and highly ductile. Under which category would you classify this element? What other characteristics do you expect the element to possess?

Soln:

An element which is sonorous and highly ductile can be classified as metal. Other characterised than can be expected are lustre, malleability, heat and electrical conductivity.

24. Give an example each for the mixture having the following characteristics. Suggest a suitable method to separate the components of these mixtures
(a) A volatile and a non-volatile component.
(b) Two volatile components with appreciable difference in boiling points.
(c) Two immiscible liquids.
(d) One of the components changes directly from solid to gaseous state.
(e) Two or more coloured constituents soluble in some solvent.

Soln:

It will be a pure substance because chemical structure of the sugar remains same despite of change in source of their extraction.

25. Fill in the blanks
(a) A colloid is a ——— mixture and its components can be separated by the technique known as ———.
(b) Ice, water and water vapour look different and display different —— properties but they are ——— the same.

(c) A mixture of chloroform and water taken in a separating funnel is mixed and left undisturbed for some time. The upper layer in the separating funnel will be of——— and the lower layer will be that of ———.
(d) A mixture of two or more miscible liquids, for which the difference in the boiling points is less than 25 K can be separated by the process called———.
(e) When light is passed through water containing a few drops of milk, it shows a bluish tinge. This is due to the ——— of light by milk and the phenomenon is called ——— . This indicates that milk is a ——— solution.

Soln:

Answers
a) Heterogeneous
b) Physical

c) Water, Chloroform

d) Distillation
e) Scattering, Tyndall effect, colloidal

26. Sucrose (sugar) crystals obtained from sugarcane and beetroot are mixed together. Will it be a pure substance or a mixture? Give reasons for the same.

Soln:

It will be a pure substance because chemical structure of the sugar remains same despite of change in source of their extraction.

27. Give some examples of Tyndall effect observed in your surroundings?

Soln

1. The beam of light passing on screen in a theatre.
2. When light passes through a dark room.

28. Can we separate alcohol dissolved in water by using a separating funnel? If yes, then describe the procedure. If not, explain.

Soln:

We cannot separate alcohol dissolved in water by separating funnel as they both are miscible solvents.

29. On heating calcium carbonate gets converted into calcium oxide and carbon dioxide.
(a) Is this a physical or a chemical change?
(b) Can you prepare one acidic and one basic solution by using the products formed in the above process? If so, write the chemical equation involved

Soln:
Answers:

a) It is a chemical change

$CaCO_3 + H_2O \rightarrow CaO + CO_2$

b) Acidic and basic solutions can be prepared by dissolving the products of the above process in water
$CaO + H_2O \rightarrow Ca(OH)_2$ (basic solution) $CO_2 + H_2O \rightarrow H_2CO_3$ (acidic solution)

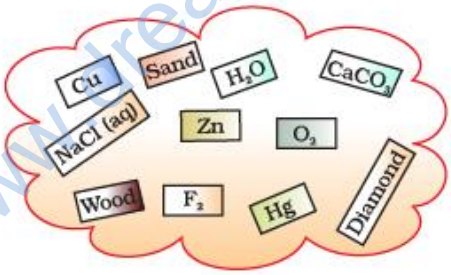
30. Non metals are usually poor conductors of heat and electricity. They are non-lustrous, non-sonorous, non-malleable and are coloured.
(a) Name a lustrous non-metal.
(b) Name a non-metal which exists as a liquid at room temperature.
(c) The allotropic form of a non-metal is a good conductor of electricity. Name the allotrope.
(d) Name a non-metal which is known to form the largest number of compounds.
(e) Name a non-metal other than carbon which shows allotropy.
(f) Name a non-metal which is required for combustion.

Soln:

Answers

a) **Iodine** is a lustrous non-metal.
b) **Bromine** is liquid at room temperature
c) **Graphite** is allotropic form of Carbon (non-metal) which is a good conductor of electricity.
d) **Carbon** is a non-metal which can form the largest number of compounds.
e) **Sulphur and Phosphorous** are the non-metals which shows allotropy.
f) **Oxygen** is a non-metal which is required for combustion.

31. Classify the substances given in Fig. 2.2 into elements and compounds



Soln:
Answer
Elements-Copper(Cu), Zinc(Zn), Oxygen(O2), Fluoride(F2), Mercury(Hg), Diamond
Compounds-NACL(Aq), Wood, Sand, H2O, CaCO3

32. Which of the following are not compounds?
(a) Chlorine gas
(b) Potassium chloride
(c) Iron
(d) Iron sulphide
(e) Aluminium
(f) Iodine
(g) Carbon

(h) Carbon monoxide
(i) Sulphur powder

Soln:

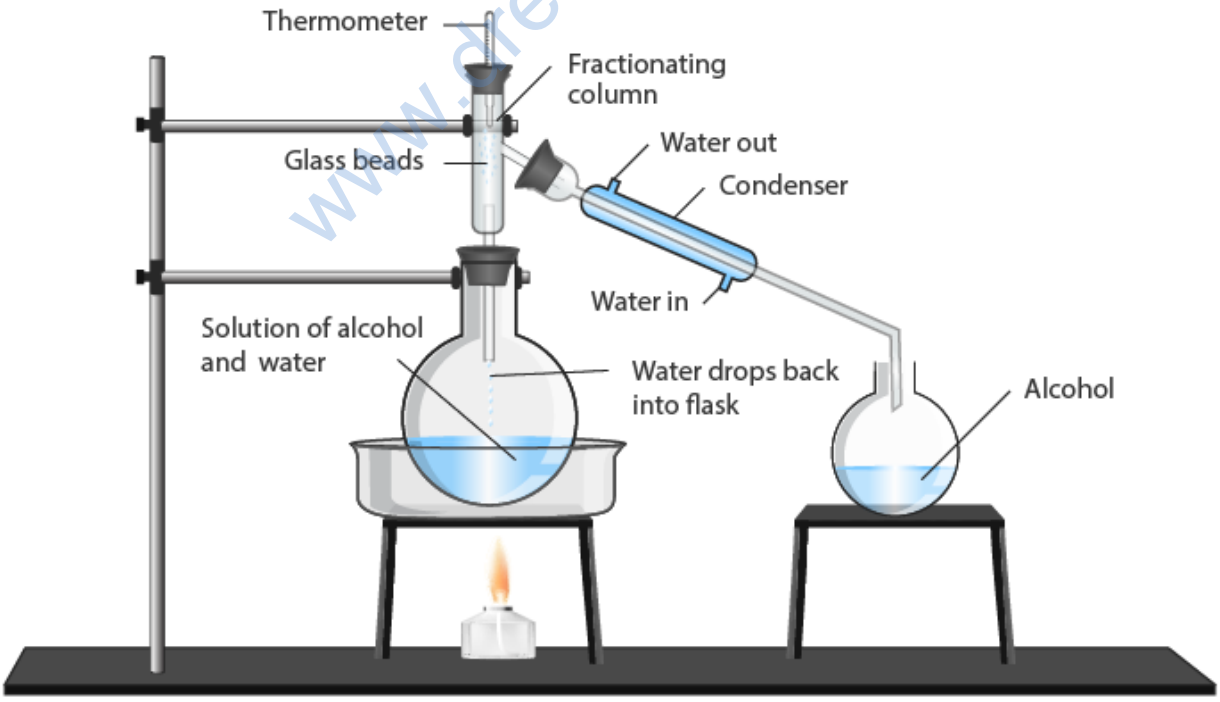
Answers
a.Chlorine gas
c.Iron
e. Aluminium
f. Iodine
g.Carbon
i.Sulphur powder

Long Answer Questions

33. Fractional distillation is suitable for separation of miscible liquids with a boiling point difference of about 25 K or less. What part of fractional distillation apparatus makes it efficient and possess an advantage over a simple distillation process. Explain using a diagram.

Soln:

Fractional column is the most important of fractional distillation apparatus. It is provided with glass beads in it. This column helps to obstruct the upward movement of the vapours of the two liquids. The vapours of high boiling liquid gets condensed earlier at lower level. Latent heat released helps to take the vapours of low boiling liquid to a height in the fractionating column.



Separation of miscible liquids

The advantages are as
given below

1. This method can separate the liquids with a boiling point difference about or less than 25 K,
2. During the process, both evaporation and condensation take place simultaneously.

3. A mixture (like petroleum) can also be separated by fractional distillation process which contains several components.

34.
(a)Under which category of mixtures will you classify alloys and why?
(b) A solution is always a liquid. Comment.
(c) Can a solution be heterogeneous?

Soln:

a) An alloy is a homogenous mixture of two or more elements. Elements can be two metals or a metal with a non-metal.

An alloy is classified as a homogenous mixture because it shows properties of two or more elements it is made of. It constituents are in varied composition. Ex: Brass is an alloy which shows characteristics of copper and Zinc and their composition varies from 20 to 35 %.

b) No the solution cannot be always liquid

35. Iron filings and sulphur were mixed together and divided into two parts, 'A' and 'B'. Part 'A' was heated strongly while Part 'B' was not heated. Dilute hydrochloric acid was added to both the Parts and evolution of gas was seen in both the cases. How will you identify the gases evolved?

Soln:

When iron fillings and sulphur is heated it will give following reaction
$Fe(s)+S(s) \longrightarrow FeS$
When HCl is added to this mixture ferric chloride is produces and Hydrogen Sulphide gas is produced. Foul rotten egg smell of Hydrogen sulphide is the indicator of H2S production.
When dilute HCL is added to setup B Hydrogen gas is evolved and sulphur does not take part in the reaction.
When a burning match stick is brought near the evolved gas, matchstick burns with a pop. This is the indication of production of Hydrogen gas.

36. A child wanted to separate the mixture of dyes constituting a sample of ink. He marked a line by the ink on the filter paper and placed the filter paper in a glass containing water as shown in Fig.2.3. The filter paper was removed when the water moved near the top of the filter paper.
(i) What would you expect to see, if the ink contains three different coloured components?
(ii) Name the technique used by the child.
(iii) Suggest one more application of this technique.

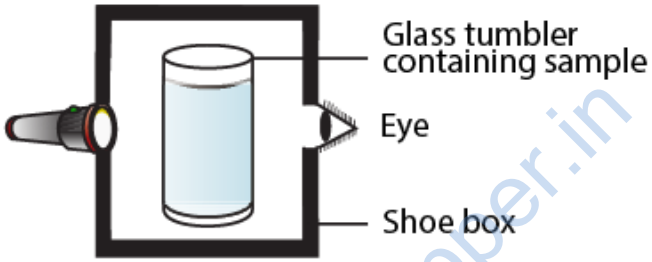
Soln:

(i) If the ink contains three different coloured components then you can observe three different bands on the paper

(ii) Child uses the technique of paper chromatography

(iii) Paper chromatography is used to separate different pigments present in the chlorophyll.

37. A group of students took an old shoe box and covered it with a black paper from all sides. They fixed a source of light (a torch) at one end of the box by making a hole in it and made another hole on the other side to view the light. They placed a milk sample contained in a beaker/tumbler in the box as shown in the Fig.2.4. They were amazed to see that milk taken in the tumbler was illuminated. They tried the same activity by taking a salt solution but found that light simply passed through it?



(a) Explain why the milk sample was illuminated. Name the phenomenon involved.
(b) Same results were not observed with a salt solution. Explain.
(c) Can you suggest two more solutions which would show the same effect as shown by the milk solution?

Soln:

(a) Milk is a colloidal substance. Particulate matter present in the milk make the light scatter which results in Tyndall effect. Because of Tyndall effect the milk got illuminated.

(b) Salt is a homogenous solution. Small particles present in salt solution do not scatter light rays hence there will be no Tyndall effect. Since salt solution did not exhibit Tyndall effect light is not illuminated.

(c) Detergent solution and sulphur solution exhibit Tyndall effect.

38. Classify each of the following, as a physical or a chemical change. Give reasons.
(a) Drying of a shirt in the sun.
(b) Rising of hot air over a radiator.
(c) Burning of kerosene in a lantern.
(d) Change in the colour of black tea on adding lemon juice to it.
(e) Churning of milk cream to get butter.

Soln:

a) Drying of shirt in the sun is a physical phenomenon because there are no chemical reaction or any chemical changed involved in this process.

b) Rising of hot air over radiator is a physical change. Water in a radiator converts to vapours. Hot air becomes lighter and rises.

c) Burning of kerosene in a lantern is a chemical change because kerosene burns by using atmospheric oxygen and produces carbon dioxide.

d) Change in the
colour of black
tea on adding lemon juice to it is a chemical change. Lemon juice is a source of citric acid, ascorbic acid and malic acid. This acid reacts Flavin antioxidants present in black tea to change colour of the tea.

e) Churning of milk cream to get butter is a physical change as there is no involvement of chemical reaction. Here the principal is of centrifugation which turn the milk cream to butter.

39. During an experiment the students were asked to prepare a 10% (Mass/Mass) solution of sugar in water. Ramesh dissolved 10g of sugar in 100g of water while Sarika prepared it by dissolving 10g of sugar in water to make 100g of the solution. (a) Are the two solutions of the same concentration (b) Compare the mass % of the two solutions.

Soln:

Mass % = Mass of solute Mass of solute + Mass of solvent ×100

Solution made by Ramesh

Mass % = 10/ 100 +10 x 100 = 10 /110 x100 = 9.09%

Solution made by Sarika Mass % = 10 /100 ×100 = 10%

The solution prepared by Sarika has a higher mass % than that prepared by Ramesh.

40. You are provided with a mixture containing sand, iron filings, ammonium chloride and sodium chloride. Describe the procedures you would use to separate these constituents from the mixture?

Soln:

a) Using Magnet: Move magnet over the mixture which will result in the sticking of iron fillings to magnet. Like this iron fillings get separated from mixture.
b) Sublimation: Remaining mixture is heated in a china dish. Ammonium chloride is a sublimating substance and it will evaporate without passing through liquid phase. Ammonium chloride can be collecting an inverted funnel over china-dish.
c) Sedimentation, decantation, filtration: Remaining mixture is dissolved in water and allowed to settle down. Sand will settle at the bottom. Liquid should be decanted to another beaker. Then it is filtered to remove traces of sand.
d) Filtered solution is heated to evaporate the water. Once all the water gets evaporated salt remains in the beaker.

41. Arun has prepared 0.01% (by mass) solution of sodium chloride in water. Which of the following correctly represents the composition of the solutions?
(a) 1.00 g of NaCl + 100g of water
(b) 0.11g of NaCl + 100g of water
(c) 0.0l g of NaCl + 99.99g of water
(d) 0.10 g of NaCl + 99.90g of water

Soln:

Here,

$$\text{Mass\%} = \frac{\text{mass of solute} \times 100}{(\text{mass of solute} + \text{mass of solvent})}$$

$$= \frac{0.01\text{g} \times 100}{(0.01 + 99.99)\text{g}} = \frac{0.01 \times 100}{100.00} = 0.01\%$$

which is equal to the percentage of sodium chloride in water prepared by Arun. So, option (c) is correct.

In option (a), mass% = $\frac{1.00\text{g} \times 100}{(1.00 + 100)\text{g}} = \frac{1.00 \times 100}{101.00} = 0.99\%$

42. Calculate the mass of sodium sulphate required to prepare its 20% (mass percent) solution in 100g of water?
Soln:

In option (b), mass% = $\frac{0.11\text{g} \times 100}{(0.11 + 100)\text{g}} = \frac{11}{100.11} = 0.11\%$

In option (d), mass% = $\frac{0.1\text{g} \times 100}{(0.1 + 99.90)\text{g}} = \frac{10}{100} = 0.1\%$

Hence, other three representations are incorrect.