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ACADEMY OF EXCELLENCE

Chapter – 2 Is Matter Around Us Pure

Multiple Choice Questions

Q1. Which of the following statements are true for pure substances?

i) Pure substances contain 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: i) Pure substances contain one kind of particles.

iii) Pure substances have the same composition throughout.

A pure substance is made up of one kind of atoms or molecules with same composition.

Q2. 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: c) Corrosion and it is a chemical change.

Rusting of iron is called corrosion. It is a chemical change because rusting is a chemical compound. For example, Hydrated iron oxide, $Fe_2O_3 . xH_2O$.

Reaction is $4Fe + 3O_2 + xH_2O \rightarrow \underbrace{Fe_2O_3 . xH_2O}_{rust}$

Q3. 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: a) Heterogeneous and shows Tyndall effect

A mixture of sulphur and carbon disulphide is a heterogeneous colloid with Tyndall effect which shows that in colloidal solution, the particles are bigger in size, so they scatter light.

Q4. 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: d) Iodine in alcohol

Tincture of iodine is prepared by dissolving iodine in alcohol.

Q5. 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: c) i) Ice and iv) Air

Air and Ice are homogeneous as the particles are not visible. The homogeneous mixture has a uniform composition in its mass whereas heterogeneous mixture do not have a uniform composition in its mass.

Q6. Which of the following are physical changes?

i) Melting of iron metal
ii) Rusting of iron
iii) Bending of an iron metal
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)**

Answer: c) i) Melting of iron metal

iii) Bending of an iron metal

iv) Drawing a wire of iron metal

Melting, bending of an iron rod and drawing a wire of iron metal are examples of physical changes as iron is changing its form and not the chemical composition, but in rusting of iron the chemical composition changes.

Q7. 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)**

Answer: a) i) Decaying of wood

ii)Burning of wood

Decaying and burning of wood are examples of chemical changes because the chemical composition of wood changes and a new substance is formed which cannot be converted to their original form again.

Q8. Two substances, A and B were made to react to form a third substance, A_2B according to the following reaction $2A + B \rightarrow A_2B$. Which of the following statements concerning this reaction are incorrect?

i) **The product A_2B shows the properties of substance 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)**

Answer: c) i), iii) and iv)

A_2B is a compound made of two elements A and B in a fixed ratio. The properties of a compound are different from its constituent elements, A and B.

Q9. Two chemical species X and Y combine together to form a product P which contains both X and Y, $X + Y \rightarrow P$, X and Y cannot be broken down into simpler substance 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 are elements
iv) P has a fixed composition

(a) (1), (ii) and (iii),

(b) (i), (ii) and (iv)

(c) (ii), (iii) and (iv)

(d) (i), (iii) and (iv)

Answer: (d) (i) P is a compound

(iii) X and Y are elements

(iv) P has a fixed composition

$X + Y \rightarrow P$

X and Y are elements so cannot be broken into simpler substances. P is a compound with fixed composition.

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Short Answer Type Questions

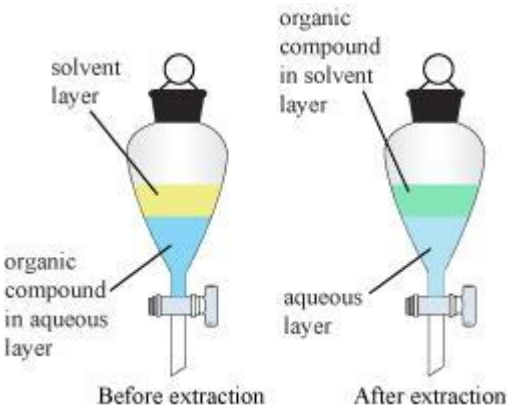
Q10. Suggest separation technique(s) one would need to employ to separate the following mixtures.

a) Mercury and water
b) Potassium chloride and ammonium chloride
c) Common salt, water and sand
d) Kerosene oil, water and salt

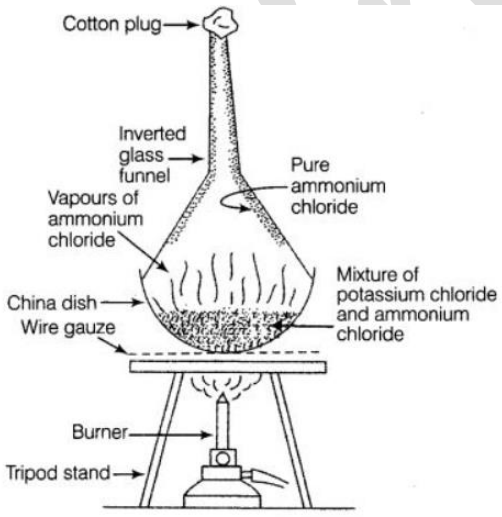
Answer:

a) Mercury and water separate by decantation with the help of separating funnel for the separation of two immiscible liquids as they have difference in their densities.

Mercury has more density than water so, the lower layer is mercury and upper layer is water.



b) Potassium and ammonium chloride separate by sublimation as ammonium chloride sublime leaving behind potassium chloride.

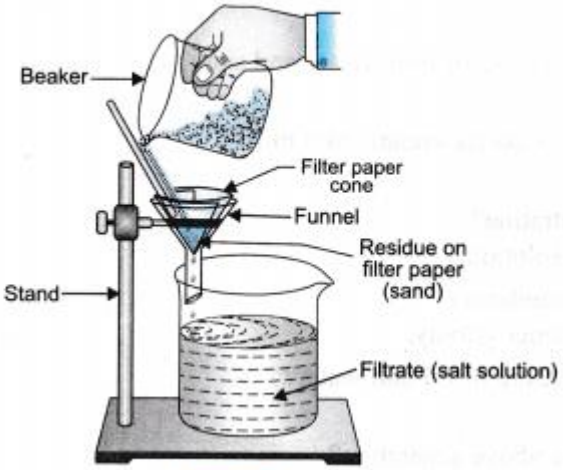


Separation of potassium chloride and ammonium chloride by sublimation

c) Common salt, water and sand is separated by

i) Decantation or filtration is used to separate sand from common salt in water as common salt is soluble in water and sand is insoluble in water. Filtration separate residue and filtrate from common salt solution.

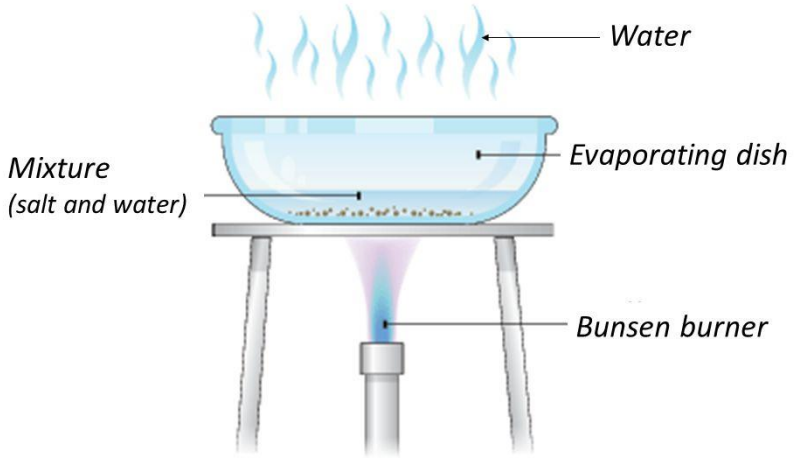
• **Filtration of Sand & Salt Solution**



Filtration

ii) In evaporation water evaporates and common salt remains as residue.

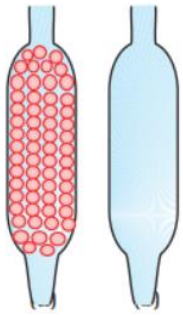
Separating Mixtures: Evaporation



d) For separating kerosene oil from salt and water solution, the methods are: -

i) Filtration.
ii) Evaporation.

Q11. Which of the tubes in Figure a) and b) will be more effective as a condenser in the distillation apparatus?



Answer:

Condenser shown in figure first is more effective in the distillation apparatus due to more surface area provided by beads for cooling vapours passing through it.

Q12. Salt can be recovered from its solution by evaporation. Suggest some other technique for the same?

Answer:

Salt can be separated from its solution by crystallization. It is a process to remove soluble impurities, which cannot be removed in the evaporation.

Q13. The 'sea-water' can be classified as a homogeneous as well as heterogenous mixture. Comment.

Answer:

'Sea-water' has dissolved salts so, it is homogeneous. It is also heterogeneous as it also contains various insoluble substances like sand, microbes, shells made of calcium carbonate etc.

Q14. While diluting a solution of salt in water, as student by mistake added acetone (boiling point 56^oC). What technique can be employed to get back the acetone? Justify your choice.

Answer:

Acetone is soluble in water and form homogeneous mixture. So, it cannot be separated by separating funnel. Acetone can be separated by distillation process as difference in the boiling points of acetone and water is greater than 25^oC.

The boiling point of –

Acetone - 56^oC

Water - 100^oC

In distillation, acetone boil at 56^oC , change into vapours and is collected in flask by condensation.

Q16. Explain why particles of a colloidal solution do not settle down when left undisturbed, while in the case of a suspension they do?

Answer:

The particles of colloid are smaller, and are in a state of zig-zag motion which is called Brownian movement. It provides stability to colloidal sols against force of gravity so, particles of colloid repel each other which do not allow them to settle down.

Q17. Smoke and fog both are aerosols. In what way are they different?

Answer:

Air is Dispersion medium in smoke and fog, but they differ in dispersed phase. In smog, solid carbon particles are dispersed in air and in fog, liquid water particles are dispersed in air.

Q18. 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 from alkalis on interacting with water.**

Answer:

a) It is a physical property as no new compound is formed as steel is an alloy i.e a homogeneous mixture of two or more metals or of metal with non-metal.
b) It is a chemical property as zinc react with hydrochloric acid and hydrogen gas is evolved and zinc chloride is formed.
c) It is a physical property as cutting with knife do not form new substance.
d) It is a chemical property as new compound is formed metal oxide reacts with water.

Q19. The teacher instructed three students 'A', 'B' and 'C' respectively to prepare a 50% (mass by volume) solution hydroxide (NaOH). 'A' dissolved 50 g of NaOH in 100 mL of water. 'B' dissolved 50 g of NaOH in 100 g of water while 'C' dissolved 50 g of NaOH in water to make 100 mL of solution. Which one of them has made the desired solution and why?

Answer:

Student 'C' has made desired solution as 50% of mass means 50 gms of solute dissolved in 100 ml of solution and not in 100 ml of solvent.

$$\frac{mass}{volume} per\ cent = \frac{mass\ of\ solute\ (gms)}{volume\ of\ solution\ (mL)} \times 100$$

$$= \frac{50}{100} \times 100 = 50\%$$

Student 'A' dissolved 50 gms of NaOH in 100 ml of water which is incorrect.

Student 'B' dissolved 50 gms of NaOH in 100 g of water which is incorrect.

Q20. 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.**

Answer:

a) Sublimation, because when the dry ice is kept at room temperature and one atmospheric pressure, it sublimes with no residue.
b) Diffusion, because on mixing ink into water, a uniform mixture is formed.
c) Diffusion, as potassium permanganate crystal dissolves in water.
d) Evaporation, as acetone evaporates when kept in open bottle.
e) Centrifugation, because when milk in closed container is rotated in big centrifuge machine at a very high speed, milk separates into cream and skimmed milk.
f) Sedimentation, as sand do not dissolve in water and forms suspension and settles down at the bottom.
g) Tyndall effect is a process of scattering of light by colloidal solution, dust particles are suspended in air which scatter light entering from small holes in a dark room.

Q21. You are given samples of water labelled as 'A' and 'B'. Sample 'A' boils at 100^oC and sample 'B' boils at 102^oC. Which sample of water will not freeze at 0^oC? Comment.

Answer:

Sample 'B' will not freeze at 0^oC, as it is impure water, and it boils at 102^oC while the boiling point of pure water is 100^oC, which shows sample contains impurities. As, pure substance has sharp melting point.

Q22. What are the favourable qualities given to gold when it is alloyed with copper or silver for the purpose of making ornaments?

Answer:

Gold is a soft metal and change its shape with a little force. So, it cannot be moulded into ornaments.

When gold is mixed with alloy, copper or silver, the gold becomes hard, strong but its brittleness decreases. So, it can be used to make ornaments.

Q23. 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?

Answer:

Given element is a sonorous and ductile so, it is a metal.

The characteristics of metals are:

1) It has metallic lustre and can be polished.
2) It is good conductor of heat and electricity.
3) It is ductile.
4) It is malleable.
5) It has high tensile strength.
6) It has high densities, melting point and boiling point.
7) It is hard.
8) It is solid at room temperature.

The characteristics of non-metals are;

1) It is neither malleable nor ductile and do not conduct electricity.
2) Metalloids properties of metals as well as of non-metals.

Q24. Give an example 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.

Answer:

a) Example: - Mixture of water and acetone.
Method: - Distillation separate volatile and non-volatile components.

b) Example: - Mixture of petrol and kerosene

Method: - Distillation separate two volatile components with difference in boiling points.

c) Example: - Mixture of water and mustard oil.
Method: - Separating funnel is used to separate mixture of immiscible liquids.

d) Example: - Mixture of ammonium chloride and common salt.
Method: - Sublimation is used to separate the mixture as one component changes from solid to gas.

e) Example: - Mixture of different pigments from an extract of flower petals.
Method: - Chromatography is used to separate two different substances present in the solution.

Q25. Fill in the blanks.

a) A colloid is a ……. Mixture and its components can be separated by the techniques 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 blush tinge. This is due to …….. of light by milk and the phenomenon is called ……. this indicates that milk a ……. Solution.

Answer:

a) **heterogeneous**, **centrifugation**.
b) **physical**, **chemically**.
c) **water**, **chloroform**.
d) **fractional distillation**.
e) **scattering**, **Tyndall effect**, **colloidal**.

Q26. Sucrose (sugar) crystals obtained from sugarcane and beetroot are mixed together. Will it be a pure substance or a mixture? Give reason for the same.

Answer:

The law of direct proportions or constant proportions states that irrespective of the source a chemical compound, it is made of the same elements combined together in the same fixed proportion by mass.

So, it will be a pure substance, as sugar obtained by different sources like sugarcane and beetroot have same compositions.

Q27. Give some examples of Tyndall effect observed in your surroundings?

Answer:

Examples of the Tyndall effect are: -

a) Sunlight scattered through the canopy of a dense forest.
b) Beam of light scatters in a dark room through a small hole.

Q28. Can we separate alcohol dissolved in water by using a separating funnel? If yes, then describe the procedure. If not, explain.

Answer:

No, alcohol cannot be separated from the water by using a separating funnel as, alcohol is completely soluble in water.

Q29. 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.

Answer:

a) It is a chemical change as composition of product formed is different from the substance taken. The reaction is:

$$\underset{\text{Calcium carbonate}}{CaCO_3} \rightarrow \underset{\text{Calcium oxide}}{CaO} + \underset{\text{Carbon dioxide}}{CO_2}$$

b) Yes,

1) When CaO dissolves in water it forms calcium hydroxide, a basic solution.

$$CaO\ (s) + H_2O\ (l) \rightarrow \underset{Calcium\ hydroxide}{Ca(OH)_2\ (aq)}$$

2) When $CO_2\ (g)$ dissolves in water it forms carbonic acid, an acidic solution.

$$CO_2\ (g) \quad + \quad H_2O\ (l) \rightarrow \quad \underset{Carbonic\ acid}{H_2CO_3\ (aq)}$$

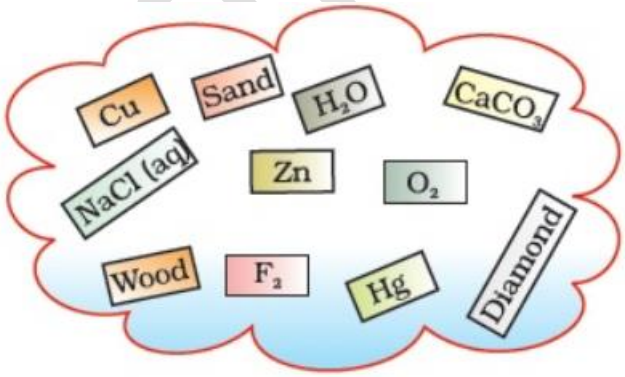
Q30. Non-metals are usually poor conductors of heat and electricity. They are non-lustrous, non-sonorous, non-malleable and are coloured.

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.

Answer:

a) Iodine is lustrous non-metal.
b) Bromine is non-metal and a liquid at a room temperature.
c) Graphite is the allotropic form of carbon which is a good conductor of electricity.
d) Phosphorous is a non-metal other and shows allotropy.
e) Oxygen is a non-metal and helps in combustion.

Q31. Classify the substance given in figure into elements and compounds.



Answer:

Elements	Compounds
Cu	$Sand$
O_2	H_2O
Zn	$CaCO_3$
F_2	$NaCl\ (aq)$
Hg	
$Diamond\ (Carbon)$	

Wood is neither an element nor compound. It is a mixture.

Q32. 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**

Answer:

Followings are not as compound: -

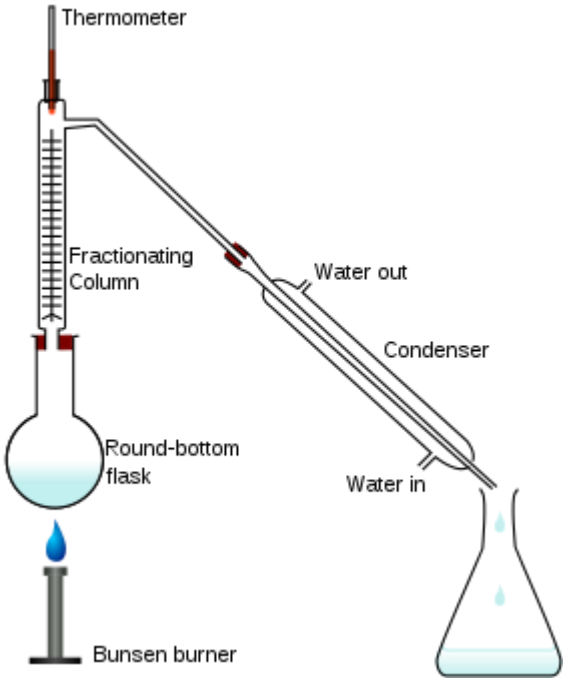
a) Chlorine gas
b) Iron
c) Aluminium
d) Iodine
e) Carbon
f) Sulphur powder

Long Answer Type Questions

Q33. 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.

Answer:

Fraction column is used in the fractional distillation apparatus. It helps in blocking the upward movement of the vapours of two liquids. Vapours of the high boiling liquid gets condensed. The latent heat, helps to take the vapours of the low boiling liquid to a height in the fractionating column. In this both evaporation and condensation take place. For example, petroleum.



Q34.

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?

Answer:

a) Alloys are homogeneous mixtures of metals, as

   1) It shows the properties of various components of the mixture.
   2) It has variable compositions, example, brass is a mixture as it has properties of copper and zinc.

b) A solution is not always a liquid. It involves solids and gases too, example; alloy is a solution of solid in solid. Air is a solution of gases in gases.

c) Colloidal solution is heterogeneous, but appear to be homogeneous mixture.

Q35. 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 cases. How will you identify the gases evolved?

Answer:

When part 'A' is heated, the compound FeS is formed by the reaction between iron fillings and sulphur.

As dilute HCl is mixed to part A, FeS will react with the dilute HCl to form H_2S gas.

$$Fe\ (s)\ + S\ (s) \rightarrow \quad FeS\ (s)$$

$$FeS\ (s) + 2\ HCl\ (dilute) \quad \rightarrow \quad FeCl_2\ (aq) + H_2S\ (g)$$

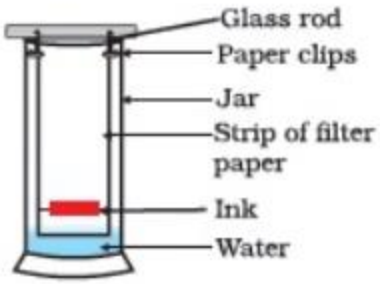
$$(CH_3COO)_2Pb\ (aq) + H_2S\ (g) \quad \rightarrow \quad PbS\ (s) + 2CH_3COOH$$

$$Lead\ acetate \qquad\qquad Black\ ppt \quad Acetic\ acid$$

Part 'B' is a mixture of iron fillings and sulphur powder, as it is not heated. On adding dilute HCl to the mixture, iron fillings react with dilute HCl to form $H_2\ (g)$ which burns with a pop sound on bringing burning match stick near it.

$$Fe\ (s)\ + \quad 2HCl\ (dilute)\ \rightarrow \quad FeCl_2\ (aq) + \quad H_2\ (g)$$

Q36. 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 figure. The filter paper was removed when the water moved near the top of the filter paper.

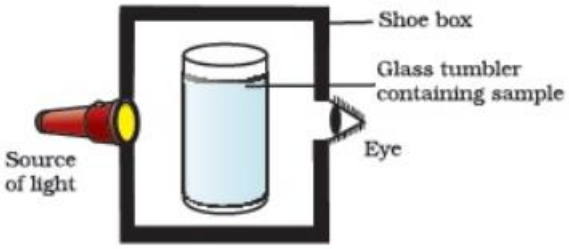


a) **What would you expect to see, if the ink contains three different coloured components?**
b) **Name the technique used by the child.**
c) **Suggest one more application of this technique.**

Answer:

a) Three different coloured spots are on the strip at different heights.
b) Chromatography technique is used.
c) To separate drug from the blood, the chromatography is used.

Q37. 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 figure. 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?**

Answer:

a) The milk sample was illuminated as it is a colloidal solution and the particles of colloidal solution scatter light, which is called Tyndall effect.

b) Salt solution is a true solution, as solute particle size is too small to scatter the light and do not show Tyndall effect.

b) Examples of colloid are: gold sol, arsenious sulphide sol, blood etc.

Q38. 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.**

Answer:

a) Physical change, as there is evaporation of water so there is no change in the composition of the substance.
b) Physical change, as it involves movement of air.
c) It is physical change, when kerosene vaporises. After burning, it is a chemical change as a new product is formed.
d) Physical change, as there is dissolution.
e) Physical change, as there is separation of components by centrifugation.

Q39. During an experiment the students were asked to prepare a 10% (mass/mass) solution of sugar in water. Ramesh dissolved 10 g of sugar in 100 g of water while Sarika prepared it by dissolving 10 g of sugar in water to make 100 g of the solution.

a) **Are the two solutions of the same concentration?**
b) **Compare the mass % of the two solutions.**

Answer:

a) No, the solutions do not have the same concentration.

b) Mass in percentage of solution by Ramesh $= \frac{mass\ of\ solute}{mass\ of\ solution} \times 100$

$$= \frac{mass\ of\ solute}{mass\ of\ solution} \times 100$$

$$= \frac{10\ g}{(10\ g + 100\ g)} \times 100$$

$$= \frac{100}{11}$$

$$= 9.09\%$$

Mass in percentage of solution by Sarika

$$= \frac{10}{100} \times 100 = 10\%$$

The solution of Ramesh has less percentage = 9.09% by mass than of Sarika = 10%.

Q40. You are provided with a mixture containing sand, iron filings, ammonium chloride and sodium chloride. Describe the procedure you would use to separate these constituents from the mixture?

Answer:

1) To remove iron fillings with the help of magnet

   Place the mixture of sand and iron fillings on a dish and move the magnet bar over the mixture, so iron fillings attract to the magnet and get separated.

2) To remove ammonium chloride from sand and sodium chloride by sublimation

   The mixture is transferred to china dish and undergoes sublimation. The ammonium chloride vaporises and on condensation it forms $NH_4Cl\ (s)$. Sand and sodium chloride will be left behind on the china dish.

3) To remove sand from sodium chloride by filtration. Sodium chloride dissolve and after filtration sand is collected as residue.

4) Evaporation or Crystallization is used to get the sodium chloride. So, filtrate evaporate to dryness to get sodium chloride back.

Q41. Arun has prepared 0.01% (by mass) solution of sodium chloride in water. Which of the following correctly represents the composition of the solution?

a) 1.00 g of NaCl + 100 g of water
b) 0.11 g of NaCl + 100 g of water
c) 0.01 g of NaCl + 99.99 g of water
d) 0.10 g of NaCl + 99.90 g of water

Answer:

c) Mass in percentage

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

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

$$= \frac{0.01 \times 100}{100.00}$$

$$= 0.01\%$$

So, correct option is c).

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

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

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

These percentage is not equal to the percentage of sodium chloride solution in water prepared by Arun. So, these options are incorrect.

Q42. Calculate the mass of sodium sulphate required to prepare its 20% (mass per cent) solution in 100 g of water?

Answer:

Mass in percent of sodium sulphate solution = 20%

Mass of the solvent = 100 g

the mass of solute (sodium sulphate) = xg

Using the formula,

$$Mass\ in\ \% = \frac{mass\ of\ solute}{mass\ of\ solution} \times 100$$

$$= \frac{mass\ of\ solute}{mass\ of\ solute + mass\ of\ solvent} \times 100$$

$$20 = \frac{xg}{(x + 100)g} \times 100$$

$$20\ (x + 100) = 100x$$

$$20x + 2000 = 100x$$

$$100x - 20x = 2000$$

$$80x = 2000$$

$$x = \frac{2000}{80}$$

$$x = 25\ g$$

So, the mass of sodium sulphate = 25 g