CHAPTER 2

Is Matter Around Us Pure?

EXAM DRILL

ANSWERS

1. Particle size

2. It is due to collision between particles of dispersed phase and dispersion medium.

3(i) On heating, iron sulphide (FeS) *i.e.*, a compound is formed.

3(ii) Air is a homogeneous mixture.

3(iii) Caesium

3(iv) Ice.

4(i) The temperature at which a liquid boils and turns to vapour.

4(ii) Gas *R* with the highest boiling point will be the one to liquefy first.

4(iii) (a) The gases will distill out according to increasing boiling point, lowest boiling point first and highest boiling point last, *i.e.*, *P*, *Q*, and *R*.

4(iv) (a)

5. (b) : Mixture of methyl alcohol and acetone can be separated by fractional distillation as there is only small difference between boiling points of methyl alcohol and acetone.

OR

(a) The properties of a compound are entirely different from the properties of its constituents.

6. (a) : The zig-zag motion of colloidal particles is called Brownian movement.

7. (a)

8. (d) : When Iodine dissolved in alcohol is known as tincture of iodine and has antiseptic properties.

OR

(c) : No. of moles of NaOH

$$= \frac{M \times V}{1000} = \frac{0.5 \times 250}{1000} = 0.125$$

Mass of NaOH = $40 \times 0.125 = 5$ g

9. (a) : Iodized common salt is a homogeneous mixture since the composition of iodine and salt is fixed throughout the iodized salt and there are no visible boundaries.

10. (d) : Brass is a mixture of approximately 30% zinc and 70% copper.

OR

(c) When a beam of light is passed through a colloidal solution, it gets scattered.

11. (a) : A mixture of two immiscible liquids can be separated by using a separating funnel.

A mixture of alcohol and water can be separated by fractional distillation.

12. (a) : Gel is a colloid in which liquid phase is dispersed in solid dispersion medium *e.g.* jelly, cheese, butter, etc.

13. (a) : Light is scattered by colloidal particles, making the path of the beam visible.

14. (b) : Chromatography can be used to separate constituents of any coloured mixture.

15. (a) Blood is a negatively charged colloid. On applying ferric chloride, these negatively charged colloidal particles of blood neutralize their charge on reacting with Fe^{3+} ions furnished by ferric chloride and thus, get coagulated. Hence, bleeding stops due to the formation of a clot.

(b) A colloidal solution is a heterogeneous mixture and consists of two phases, *i.e.*, dispersed phase (colloidal particles) and dispersion medium in which colloidal particles are suspended. The size of the colloidal particles lies between 1 to 100 nm. For example, colloidal solution of sulphur or starch, milk, etc.

16. (a) Clay particles present in muddy water are negatively charged, On adding alum, positively charged Al^{3+} ions of alum neutralize the negative charge of clay particles. Hence, clay particles get precipitated and settle down at the bottom. These precipitates then can be removed by filtration to get clear water.

(b) Separating funnel separates two immiscible liquids which separate out in layers depending on their densities. Oil and water are immiscible liquids in which oil forms the upper layer as oil is lighter than water.

OR

(a) In colloidal solution the particles are bigger enough to scatter light hence, they show Tyndall effect. In true solution, the particle size is too small and hence, they cannot scatter light. Therefore, true solutions do not show Tyndall effect.

(b) A pure substance is one which is made up of only one kind of atoms or molecules. *e.g.* water is made up of only one kind of particles. So, water is a pure substance.

17. (a) Paints are colloidal solutions, hence on keeping for a long time the particles of paint tend to settle down. On stirring thoroughly the particles come to the colloidal state again.

(b) First shake the mixture with carbon disulphide, sulphur powder dissolves leaving behind common salt and sand. The mixture is filtered. Evaporation of carbon disulphide from the filtrate gives sulphur powder. The residue left on the filter paper consists of common salt and sand. Shake this mixture well with water when common salt dissolves leaving behind sand. The mixture is filtered. Evaporation of water from the filtrate gives common salt.

18. (a) Element

(b) Mixture (heterogeneous mixture)

(c) Mixture (homogeneous mixture)

(d) Element

(e) Compound ($CaCO_3$)

(f) Element

OR

(a) Quick lime is calcium oxide, CaO. The elements present in it are : Calcium (Ca) and Oxygen (O).

(b) Hydrogen bromide is HBr. The elements present in it are : Hydrogen (H) and Bromine (Br).

(c) Baking soda is sodium hydrogen carbonate, $NaHCO_3$. The elements present in it are : Sodium (Na), Hydrogen (H), Carbon (C) and Oxygen (O).

19. Solution : It is a homogeneous mixture of two or more substances. These solutions are also called true solutions because the particles of solutions have very small size (1 nm or 10^{-7} cm).

Suspension : It is a heterogeneous mixture which contains small insoluble particles of solute spread throughout the solvent without dissolving in it. The particle size of the solute particles is greater than 10^{-7} m or 10^{-5} cm (or 100 nm). These particles may or may not be visible to naked eye but are visible under microscope.

Colloids : A colloid is a heterogeneous mixture whose particles are not as small as solution but they are so small that cannot be seen by naked eyes.

OR

(i) The pair of liquids which do not mix with each other are called immiscible liquids. A mixture of two immiscible liquids can be separated by using a separating funnel. The separation of two immiscible liquids by a separating funnel depends on the difference in their densities. For example, kerosene oil and water being insoluble, form two separate layers, kerosene oil being lighter than water forms the upper layer while water forms the lower layer.

(ii) The separation of the two miscible liquids is based on the difference in their boiling points; the more volatile (low boiling) component distils over first while the less volatile component distills over afterwards. It is done by following method:

Simple distillation is used for separation of components of a mixture containing two miscible liquids which boil without decomposition and have sufficient difference (30-50 K) in their boiling points. For example, acetone and water can be separated by this method.

If however, the boiling points of two miscible liquids differ by less than 25 K they can be separated by fractional distillation. For example, fractional distillation of crude petroleum, fractional distillation of air, etc.

20. (a) The mixture of acetone and salt solution in water can be separated by distillation since a difference in their boiling points is more than 25°C. Acetone will evaporate and get condensed first leaving behind the salt solution.

(b) A fractionating column obstructs the upwards movement of the vapours of the liquids. As a result, the energy (latent heat of fusion) which is released by the high boiling liquid is taken by the low boiling liquid. It remains in the vapour state. The high boiling liquid by releasing energy condenses and falls back in the distillation flask. Thus, fractionating column helps in the separation of the components from a mixture.

21. (a) Alloys are homogeneous mixtures because they have uniform composition throughout.

(b) No, a solution can be solid (alloys) or gaseous (air) also.

(c) No, a true solution is a homogeneous mixture.

22. (a) Ordinary filter paper has a larger pore size through which colloidal particles can pass hence they cannot be separated by ordinary filter paper. However a special filter paper with the smaller pore size through which colloidal particles cannot pass is used to separate colloidal particles.

(b) (i) Evaporation

(ii) Separating funnel

(iii) Centrifugation

(iv) Chromatography

23. Mass of solute = 30 g

Mass of solvent = 470 g

Mass of solution = 30 + 470 = 500 g

Concentration of solution

$$= \frac{\text{mass of solute}}{\text{mass of solution}} \times 100 = \frac{30}{500} \times 100 = 6\%$$

24. By definition, 50% mass by volume percent solution means 50 grams of a solute dissolved in 100 mL of solution. Therefore, student '*C*' made the desired solution.

Student '*A*' dissolved 50 g of NaOH in 100 mL of water, so the solution is diluted and it is not a desired solution. By definition, 50% mass by mass percent solution means 50 grams of a solute dissolved in 100 grams of solution.

Student '*B*' dissolved 50 g of NaOH in 150 g of solution so, it is not the desired solution.

'*C*' has made the desired solution by dissolving 50 g NaOH in water to make the volume of the solution 100 mL.

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

$$= \frac{50}{100} \times 100 = 50\% \text{ mass by volume}$$

25. (a) **Iodine and sand :** Sublimation process can be used. Iodine will sublime on heating while sand will remain unaffected.

(b) **Kerosene oil, water and salt :** Separating funnel will separate kerosene oil and salt solution. Evaporation of salt solution will separate salt and water.

(c) **Sugar and sulphur :** The mixture is dissolved in carbon disulphide in a beaker by stirring with a glass rod. Sulphur dissolves while sugar remains as such. On filtering, sugar separates as the residue. The filtrate upon concentration and cooling gives crystals of sulphur.

(d) **Common salt, camphor and iron filings :** With the help of a magnet, iron filings will be separated from the mixture. Sublimation method will be applied to the remaining mixture of common salt and camphor. Camphor will sublime while common salt will remain left as residue.

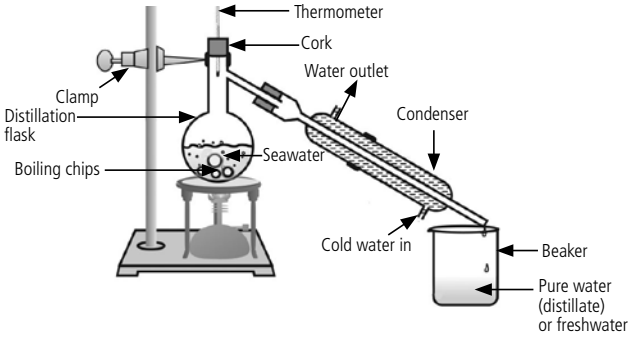
(e) **Potassium chloride and ammonium chloride :** Potassium chloride and ammonium chloride can be separated by sublimation. Ammonium chloride being volatile will be converted into vapours. Potassium chloride does not sublime.

26. These are of eight types :

S. No.	Dispersed Phase	Dispersion Medium	Type or name of colloidal solution	Examples
1.	Solid	Solid	Solid sol	Some coloured glasses
2.	Liquid	Solid	Gel	Cheese, butter
3.	Gas	Solid	Solid foam	Sponge, rubber foam
4.	Solid	Liquid	Sol	Mud, milk of magnesia
5.	Liquid	Liquid	Emulsion	Milk, hair cream
6.	Gas	Liquid	Foam	Froth, whipped cream
7.	Solid	Gas	Solid aerosol	Smoke
8.	Liquid	Gas	Liquid aerosol	Fog, mist

OR

(a) In order to obtain freshwater from seawater, simple distillation is used.

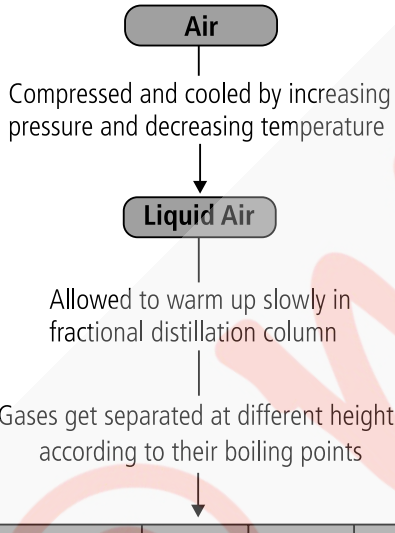


(b) (i) To purify a sample of flammable liquid containing a small amount of dissolved solid, the apparatus should be modified as no direct heating can be done. So, the distillation flask should be kept in water bath to prevent the direct contact of fire with the liquid.

(ii) To separate the fractions of a sample of crude oil, fractional distillation is used as the difference in boiling points of different fractions is very less. A column, called the fractionating column, is attached to the distillation flask and the condenser. Many glass beads in the fractionating column provide a large surface area for vapour to condense.

27. (a) Small crystals (blue in colour) start forming.
(b) All crystals are blue and look alike, but differ in size.
(c) Yes, crystals differ in size.
(d) Crystals are separated from the liquid by decantation.
(e) The liquid left behind after crystallisation is called mother liquor.

28. Air is a homogeneous mixture of many gases which can be separated by fractional distillation. Air is cooled and compressed by applying pressure and decreasing temperature. Air is compressed to form liquid air called liquefied air. Liquid air is subjected to fractional distillation and different gases are separated according to their boiling points.



	Oxygen	Argon	Nitrogen
Boiling Point (°C)	–183	–186	–196
% in Air by Volume	20.9	0.9	78.1

Two main components of air are oxygen and nitrogen for which percentage in air by volume is given in the table above. Oxygen gets liquefied first because its boiling point is higher than that of the other components.

29. (a) A saturated solution can be made unsaturated in the following two ways :

(i) By increasing the temperature of the solution. When a saturated solution is heated, solubility of the solute increases and hence the solution becomes unsaturated.

(ii) By adding more solvent or by diluting, a saturated solution is made unsaturated.

(b) (i) and (iv) are physical changes and (ii) and (iii) are chemical changes.

OR

(a) A solution in which more quantity of solute can be dissolved without raising its temperature, is called an unsaturated solution. For example, if in an aqueous solution of salt, more of salt can be dissolved without raising its temperature, then this salt solution will be an unsaturated solution.

A solution in which no more solute can be dissolved at that temperature, is called a saturated solution. For example, if in an aqueous salt solution, no more salt can be dissolved at that temperature, then that salt solution will be a saturated solution.

In order to test whether a given solution is saturated or not, we should add some more solute to this solution and try to dissolved it by stirring (keeping the temperature constant). If more solute does not dissolve in the given solution, then it will be a saturated solution; but if more solute gets dissolved, then it will be an unsaturated solution.

(b) To prepare a saturated solution of a substance, say sodium chloride, we take some water in a beaker and heat it slowly with the help of a burner. Now, we start adding sodium chloride salt to the hot water with a spoon and stir it with a glass rod continuously so that sodium chloride goes on dissolving in water. We take the temperature of water up to 25°C and then keeping this temperature constant, go on adding sodium chloride till no more sodium chloride dissolves in it and some sodium chloride is also left undissolved at the bottom of the beaker. The contents of the beaker are now filtered through a filter paper arranged in a funnel. The clear solution obtained in the form of "filtrate" is the saturated solution of sodium chloride at 25°C.

If a saturated solution of sodium chloride is allowed to cool, then the crystals of solid sodium chloride will reappear in the solution.

30. (a) The solubility of a solute at a particular temperature is the maximum amount of solute in grams that will saturate 100 g of the solvent at that temperature.

Thus, solubility of a solute (at t °C) =

$$\frac{\text{Weight of solute (g)}}{\text{Weight of solvent (g)}} \times 100$$

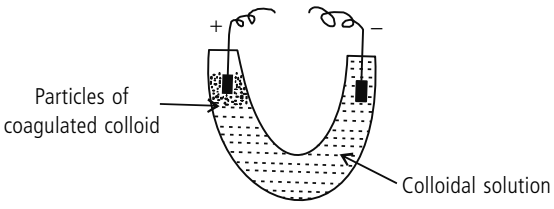
(b) It means that a maximum of 20.7 g of copper sulphate can be dissolved in 100 g of water at a temperature of 20°C.

(c) The solubility of solids in liquids usually increases on increasing the temperature and decreases on decreasing the temperature.

(d) Mixtures in which one component is soluble in a given solvent while other is not soluble are separated by crystallisation.

OR

(a) The colloidal solutions contain either positively or negatively charged particles and therefore when an electric field is applied on them, the particles move towards the oppositely charged particles. This migration of colloidal particles under the influence of an electric field is known as electrophoresis.



(b) The surface of fractionating column is colder than the vapours which reach there. Therefore, the vapours are condensed and run down as liquid. As the process goes on, the fractionating column warms up by the heat released by the condensed vapours. This released heat evaporates the liquid which passes to the next higher colder part of the fractionating column. Here again the vapours are condensed.

This liquid is heated once again by the other hot vapours and the liquid moves up in the form of vapours. The process of evaporation and condensation thus continues throughout the fractionating column. Ultimately the more volatile liquid passes through the condenser and is collected as distillate. The less volatile liquid runs down in the round bottom flask.

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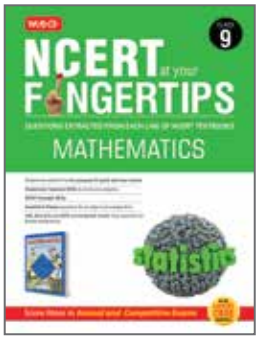

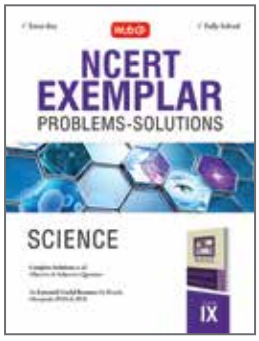

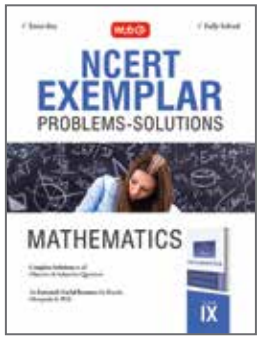

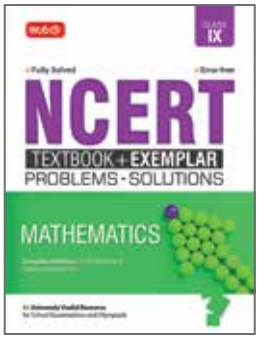

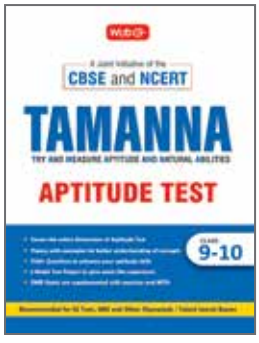

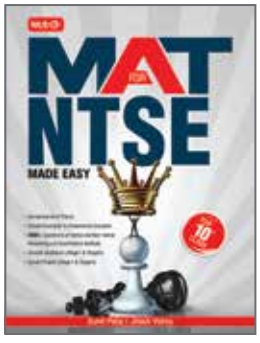

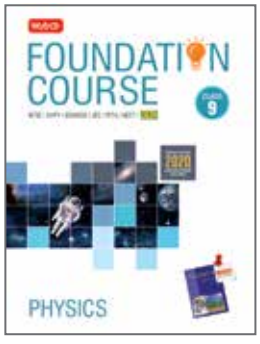

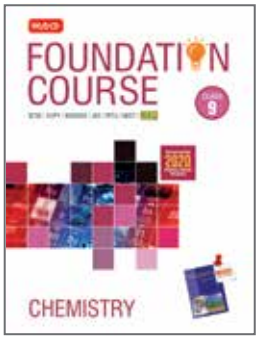

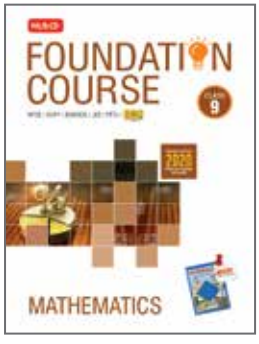

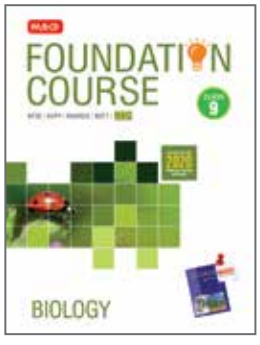

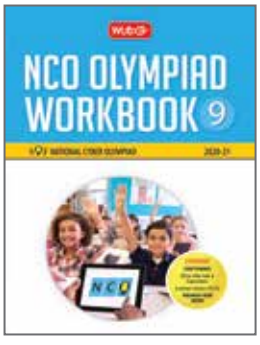

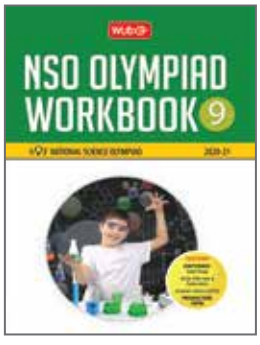

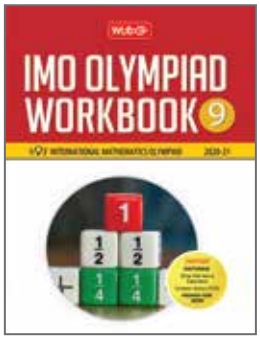

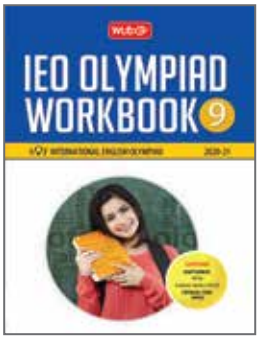

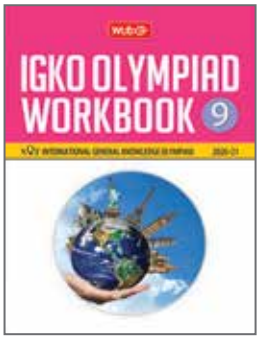

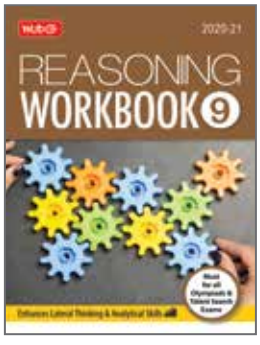

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