

CLASS 9 SCIENCE — CHAPTER 5

NCERT SOLUTIONS

Exploring Mixtures and Their Separation

New NCERT *Exploration* Textbook | 2026–27

The chapter-end “Revise, Reflect, Refine” section contains **15 questions**.

Q1. Classification of Mixtures

Question:

Which option correctly classifies the following mixtures as homogeneous (Hm) and heterogeneous (Ht)?

Options:

- (i) Air — Hm, Milk — Ht, Sugar solution — Hm, Smoke — Hm
- (ii) Brass — Ht, Fog — Ht, Vinegar — Ht, Muddy water — Hm
- (iii) Copper sulfate solution — Hm, Salt solution — Hm, Milk — Hm, Bronze — Hm
- (iv) Muddy water — Ht, Milk — Ht, Blood — Ht, Brass — Hm

 **Answer: (iv)**

Explanation:

Mixture	Type	Reason
Air	Homogeneous	Gases are uniformly mixed
Milk	Heterogeneous	It is a colloid
Sugar solution	Homogeneous	Uniform throughout

Smoke	Heterogeneous	Solid particles dispersed in gas
Muddy water	Heterogeneous	Mud particles are suspended
Blood	Heterogeneous	It is a colloid
Brass	Homogeneous	Alloy with uniform composition

Therefore:

✅ **Option (iv) is correct.**



Q2. Tyndall Effect

Question:

Which mixtures show the Tyndall effect?

- (a) Air and dust particles
- (b) Copper sulfate and water
- (c) Starch and water
- (d) Acetone and water

Options:

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

✅ **Answer: (iii) a and c**



Explanation:

The Tyndall effect is the **scattering of light by dispersed particles**.



Air + dust → particles scatter light.



Starch + water → colloidal particles scatter light.

But:

🧪 Copper sulfate solution → true solution → no Tyndall effect.

💧 Acetone + water → true solution → no Tyndall effect.

★ **Answer:**

(iii) a and c



Q3. Solution, Suspension and Colloid

Complete the table using the words given in the textbook.



Solution

Properties:

- Small-sized particles
- Particles remain evenly distributed
- Does not settle down
- Cannot be separated by filtration
- Transparent

Examples:



Salt solution



Brass



Suspension

Properties:

- Large-sized particles
- Particles settle when left undisturbed
- Scatters light
- Separates by filtration

- Heterogeneous mixture

Examples:

 Sand in water

 Mud

** Colloid****Properties:**

- Moderate-sized particles
- Particle size = 1–1000 nm
- Does not settle down
- Scatters light
- Cannot be separated by ordinary filtration

Examples:

 Milk

 Smoke

 Butter

** Q4. Concentration of Components****(i) Cake mixture****Question:**

A cake recipe uses:

Sugar = 75 g

All-purpose flour = 420 g

Sodium hydrogencarbonate = 5 g

Express the concentration of each component using an appropriate method.

Step 1: Total mass

Total mass:

$$75 + 420 + 5$$

$$= 500 \text{ g}$$

Sugar:

Percentage:

$$\text{Mass \%} = (\text{Mass of component} / \text{Total mass}) \times 100$$

$$= (75 / 500) \times 100$$

$$= 15\%$$

Flour:

$$= (420 / 500) \times 100$$

$$= 84\%$$

Sodium hydrogencarbonate:

$$= (5 / 500) \times 100$$

$$= 1\%$$

✅ Answer:

🍬 Sugar = **15% m/m**

🌾 Flour = **84% m/m**

🧪 Sodium hydrogencarbonate = **1% m/m**

Check:

$$15 + 84 + 1 = 100\%$$



Q4(ii). Brass Alloy

Question:

A brass alloy contains **70% copper by mass**. Calculate the quantities of copper and zinc present in **120 g of brass**.

Copper:

Copper = 70% of 120 g

$$= (70/100) \times 120$$

$$= 84 \text{ g}$$

Zinc:

$$\text{Zinc} = 120 - 84$$

$$= 36 \text{ g}$$



Answer:

● Copper = 84 g

● Zinc = 36 g



Q5. Cooking Oil and Water

Question:

One litre of cooking oil has a mass of 910 g. If this oil is mixed with water:

- (i) Will it form a separate layer?
- (ii) Which substance will be on top?
- (iii) How will you separate the two layers?

(i) Will separate layers form?

✓ **Yes.**

Oil and water are **immiscible liquids**.

They do not mix and form separate layers.

(ii) Which will be on top?

Oil has a lower density than water.

Therefore:

🛢️ **Oil → Upper layer**

💧 **Water → Lower layer**

(iii) Method of separation:

Use a:

Separating funnel

The lower water layer is drained first through the stopcock, followed by the oil layer.

★ **Answer:**

Oil and water form separate layers. Oil is on top and they can be separated using a separating funnel.

The textbook describes this method for immiscible liquids.



Q6. Assertion and Reason

Assertion:

Solutions do not exhibit the Tyndall effect.

Reason:

The particles in solutions are larger than 100 nm, so they cannot scatter light.

✅ **Answer: (iii)**

Assertion is true, but Reason is false.

Explanation:

Solutions do not show the Tyndall effect because their particles are extremely small.

Solution particles are:

Less than 1 nm

They are not larger than 100 nm.

Therefore:

✓ Assertion = True

✗ Reason = False



Q7. Methods of Separation

Fill in the table with the appropriate method and reason.

Mixture	Method	Reason
 Mud from muddy water	Filtration / sedimentation + filtration	Mud particles are insoluble and can be separated
 Plasma from blood	Centrifugation	Components have different densities
 Naphthalene and sand	Sublimation	Naphthalene sublimates; sand does not
 Chalk powder and common salt	Dissolution + filtration + evaporation/crystallization	Salt dissolves in water but chalk does not
 Common salt and water	Evaporation / crystallization	Water evaporates, leaving salt



Oil from water

Separating funnel

Oil and water are immiscible and have different densities



Pigments of a flower

Paper chromatography

Pigments move at different rates on paper



Q8. Two Miscible Liquids

Question:

Two miscible liquids A and B have boiling points:

A = 60°C

B = 90°C

Suggest a method to separate them.

Given difference:

$90 - 60$

= 30°C

The difference is greater than about 25°C .

Therefore, the appropriate method is:

Simple distillation



How it works:

1. Heat the mixture.
2. Liquid A has the lower boiling point.
3. A vaporises first.
4. Vapour passes into the condenser.
5. It cools and becomes liquid.
6. The liquid is collected separately.



Answer:

The two liquids can be separated by distillation because their boiling points differ by 30°C.

Q9. Evaporation, Crystallization and Distillation

Compare the three methods.

Evaporation	Crystallization	Distillation
Solvent is removed by evaporation	Pure crystals are formed from a saturated solution	Liquid is vaporised and then condensed
Solvent is generally not recovered	Gives a relatively pure solid	Allows recovery of liquid
Useful for obtaining salt from salt water	Useful for purification of solids	Useful for separating liquids or recovering solvent
Example: salt from seawater	Copper sulfate crystals	Acetone + water

When to use evaporation?

When we only need the dissolved solid and do not need the solvent.

When to use crystallization?

When we want **pure crystals** of a dissolved solid.

When to use distillation?

When we want to recover the solvent or separate liquids with sufficiently different boiling points.

The textbook distinguishes these methods based on their purpose and properties.

Q10. Blood as a Colloid

Question:

Blood is an example of a colloidal mixture.

- (i) What would happen if blood behaved like a true suspension inside the body?
- (ii) Identify the dispersed phase and dispersion medium.

(i) Answer:

If blood behaved like a true suspension, its particles would settle under gravity.

This could cause:

- ✗ Uneven distribution of blood components
- ✗ Difficulty in transporting substances
- ✗ Problems with circulation
- ✗ Blockage or accumulation of cells in certain regions

The colloidal nature of blood helps its components remain dispersed.

(ii) Answer:

Dispersed phase:

- 🔴 Blood cells and other suspended cellular components

Dispersion medium:

- 💧 Plasma

★ Answer:

Dispersed phase → Blood cells

Dispersion medium → Plasma

The textbook explains that blood is neither a true solution nor a true suspension; it is a colloid.



Q11. Sand + Salt + Naphthalene

Question:

A mixture contains:



Sand



Common salt



Naphthalene

Identify the correct sequence of separation techniques shown in the textbook.



Correct sequence:

1 Sublimation

Heat the mixture.

Naphthalene sublimates and separates from:



Sand +



Salt

2 Dissolution + Filtration

Add water.



Salt dissolves.



Sand does not.

Filter the mixture.



Sand remains as residue.



Salt solution passes through.

3 Evaporation / Crystallization

Heat the salt solution.

Water is removed.

 Salt is obtained.

★ **Final sequence:**

Sublimation → Dissolution + Filtration → Evaporation/Crystallization

Q12. Water and Acetone

Question:

Why is distillation an effective method for separating water and acetone?

Given:

Acetone boiling point $\approx 56^{\circ}\text{C}$

Water boiling point = 100°C

Difference:

$100 - 56$

= 44°C

The boiling points differ sufficiently.

When heated:

 Acetone vaporises first.



 Vapour enters condenser.



 Vapour cools and becomes liquid.



 Acetone is collected separately.

 **Answer:**

Distillation is effective because acetone and water have sufficiently different boiling points.

The textbook specifically gives approximately **56°C for acetone and 100°C for water.**



Q13. Solubility Data

The textbook provides the following data:

Salt	10°C	20°C	30°C	40°C	60°C	80°C
Potassium nitrate	21	32	45	62	106	167
Sodium chloride	36	36	36.3	36.5	37	37
Potassium chloride	35	35	37.4	40	46	54
Ammonium chloride	24	37	41	41	55	66

Values are in **g per 100 g water.**



Q13(i)

Question:

What mass of potassium nitrate is needed to prepare a saturated solution in **50 g water at 40°C?**

At 40°C:

Potassium nitrate solubility = **62 g per 100 g water**

For 50 g water:

Required mass = $62 \times 50 / 100$

= 31 g

✓ **Answer:**

31 g of potassium nitrate



Q13(ii)

Question:

A saturated solution of potassium chloride is prepared at 80°C and cooled to 25°C. What will happen?

At 80°C:

Solubility = **54 g per 100 g water**

At 25°C, the solubility is between the values at 20°C and 30°C:

Approximately:

36–37 g per 100 g water

Therefore, as the solution cools:

↓ Solubility decreases



Excess potassium chloride separates out



💎 Crystals form

✓ **Answer:**

Potassium chloride crystals will separate out as the solution cools because its solubility decreases with temperature.

Q13(iii). Effect of Temperature on Solubility

Answer:

For all four salts, solubility generally increases as temperature increases.

But the increase is different.

Potassium nitrate

Shows the **largest increase**:

21 → 167 g

Ammonium chloride

24 → 66 g

Potassium chloride

35 → 54 g

Sodium chloride

36 → 37 g

Shows only a **very small increase**.

★ Order of increase:

Potassium nitrate > Ammonium chloride > Potassium chloride > Sodium chloride

Q14. Sugar Solutions

Three students prepare sugar solutions:

Student A:

20 g sugar + 80 g water

Student B:

20 g sugar + 100 g water

Student C:

30 g sugar + 80 g water

Q14(i). Calculate mass percentage

Formula:

Mass percentage = (Mass of solute / Mass of solution) × 100

 **Student A**

Mass of solution:

$$20 + 80 = \mathbf{100\text{ g}}$$

Percentage:

$$(20 / 100) \times 100$$

$$= \mathbf{20\%}$$

 **Student B**

Mass of solution:

$$20 + 100 = \mathbf{120\text{ g}}$$

Percentage:

$$(20 / 120) \times 100$$

$$= \mathbf{16.67\%}$$

 Student C

Mass of solution:

$$30 + 80 = \mathbf{110\text{ g}}$$

Percentage:

$$(30 / 110) \times 100$$

$$= \mathbf{27.27\%}$$

 Answer:

Student	Sugar concentration
A	20%
B	16.67%
C	27.27%

Q14(ii). Which is most concentrated?

Compare:

$$A = 20\%$$

$$B = 16.67\%$$

$$C = 27.27\%$$

Therefore:

 **Student C's solution is the most concentrated.**

Why?

It contains the greatest percentage of sugar in the total solution.



Q15. Separation Technique — Figure 5.26

Question:

Examine Fig. 5.26.

- (i) Identify technique S.
- (ii) Label apparatus A, B and C.
- (iii) Identify which mixtures can be separated using this technique.

The figure represents:

Fractional distillation

(i) Technique S:

Fractional distillation

It is used when liquids have relatively small differences in boiling points.

The textbook states that fractional distillation is used when boiling points differ by **less than about 25°C**.

(ii) Apparatus:

The diagram contains the standard fractional-distillation arrangement, including:

 **A** → Heating/distillation flask

 **B** → Fractionating column

 **C** → Condenser

(iii) Which mixtures can be separated?

The boiling points given are:

Substance	Boiling point
Water	100°C
Acetone	56°C
Alcohol	78°C
Chloroform	61°C
Benzene	80°C

We compare the differences.

(a) Water + acetone

Difference:

$$100 - 56 = 44^{\circ}\text{C}$$

✗ Not fractional distillation according to the given criterion.

(b) Water + salt

✗ Not two miscible liquids.

(c) Acetone + alcohol

$$78 - 56 = 22^{\circ}\text{C}$$

✓ Suitable.

(d) Sand + salt

✗ Solid mixture.

(e) Alcohol + chloroform

$$78 - 61 = 17^{\circ}\text{C}$$

✓ Suitable.

(f) Alcohol + benzene

$$80 - 78 = 2^{\circ}\text{C}$$

✓ Suitable.

★ **Answer:**

Mixtures that can be separated by fractional distillation are:

(c) Acetone + alcohol

(e) Alcohol + chloroform

(f) Alcohol + benzene

CHAPTER 5 — COMPLETE ANSWER KEY

Q	Answer
1	(iv)
2	(iii) a and c
3	Solution, suspension and colloid classification
4(i)	Sugar = 15% , Flour = 84% , Sodium hydrogencarbonate = 1%
4(ii)	Copper = 84 g , Zinc = 36 g
5	Oil forms upper layer; separating funnel
6	(iii)
7	Filtration, centrifugation, sublimation, dissolution/filtration, evaporation/crystallization, separating funnel, chromatography
8	Distillation
9	Evaporation vs crystallization vs distillation

- 10 Blood = colloid; dispersed phase = blood cells, medium = plasma
- 11 Sublimation → filtration → evaporation/crystallization
- 12 Distillation; boiling points 56°C and 100°C
- 13(i) 31 g KNO_3
- 13(ii) KCl crystals separate on cooling
- 13(iii) KNO_3 shows greatest increase
- 14(i) A = 20%, B = 16.67%, C = 27.27%
- 14(ii) Student C
- 15 Fractional distillation; (c), (e), (f)
-

CHAPTER 5 — IMPORTANT FORMULAS

Mass by mass percentage

Mass percentage = $(\text{Mass of solute} / \text{Mass of solution}) \times 100$

Mass by volume percentage

Mass by volume percentage = $(\text{Mass of solute} / \text{Volume of solution}) \times 100$

Volume by volume percentage

Volume by volume percentage = $(\text{Volume of solute} / \text{Volume of solution}) \times 100$

Solubility

Solubility = Maximum mass of solute that dissolves in 100 g of solvent at a given temperature

★ CHAPTER 5 — SEPARATION METHODS AT A GLANCE

Mixture	Method
 Salt + water	Evaporation / crystallization
 Water + acetone	Distillation
 Oil + water	Separating funnel
 Naphthalene + sand	Sublimation
 Blood components	Centrifugation
 Muddy water	Filtration / coagulation
 Flower pigments	Paper chromatography
 Miscible liquids with close boiling points	Fractional distillation

The chapter specifically identifies crystallization, distillation, chromatography, separating funnel, sublimation, centrifugation, coagulation and the Tyndall effect as the key ideas for separating and identifying components of mixtures.