ANSWER KEY & MARKING SCHEME · CBSE CLASS 9

Is Matter Around Us Pure?

Science · Chapter 2 · Use this with the Board Paper · Companion to Quick Drill

HOW TO USE

Attempt the Board Paper first (closed-book, full time). Then come here. For 2-mark+ questions, compare your answer to the model. For 3-4 mark questions, also consult the **Topper Templates** below — these show the exact step-by-step structure that scores full marks per CBSE marking-scheme conventions.

MODEL ANSWERS · BOARD PAPER

Section A — MCQ

Q1. Which of these has the smallest particle size: solution, colloid, suspension? [1 mark]

Ans: Solution (particles < 1 nm).

Q2. Name the property by which colloid particles scatter light. [1 mark]

Ans: Tyndall effect.

Q3. Which is NOT a pure substance: distilled water, gold, air, oxygen? [1 mark]

Ans: Air (it is a homogeneous mixture of gases).

Q4. State whether melting of ice is a physical or chemical change. [1 mark]

Ans: Physical change — no new substance is formed and it is reversible.

Q5. Name the technique used to separate cream from milk. [1 mark]

Ans: Centrifugation.

Section B — Short Answer-I (2 marks)

Q6. Calculate the mass percentage of solute when 10 g of NaCl is dissolved in 90 g of water. [2 marks]

Ans: Mass of solution = 10 + 90 = 100 g. Mass % = (10/100) × 100 = 10%.

Q7. Give one example each of an aerosol, a foam, a gel and an emulsion. [2 marks]

Ans: Aerosol — fog/smoke. Foam — whipped cream / shaving foam. Gel — jelly / cheese. Emulsion — milk / mayonnaise.

Q8. What is the difference between a saturated and an unsaturated solution? Give one example each. [2 marks]

Ans: A saturated solution has dissolved the maximum solute possible at the given temperature (e.g. sugar water until no more sugar dissolves). An unsaturated solution can still dissolve more solute (e.g. weak sugar water with sugar still able to dissolve).

Q9. Why is fractional distillation used to separate ethanol from water, and not simple distillation? [2 marks]

Ans: Boiling points of ethanol (78°C) and water (100°C) differ by only 22°C — less than 25°C. Simple distillation cannot separate them effectively because both vapours rise together. A fractionating column provides multiple condensation-evaporation cycles for clean separation.

Section C — Short Answer-II (3 marks)

Q10. Tabulate the differences between a true solution, a colloid and a suspension on the basis of (a) particle size (b) Tyndall effect (c) filterability. [3 marks]

Ans: True solution: <1 nm; no Tyndall; cannot be filtered. Colloid: 1-100 nm; shows Tyndall; not by paper but by centrifuge. Suspension: >100 nm; shows Tyndall; filterable by paper. (Award 1 mark per correctly-filled row in tabular form.)

Q11. Define Tyndall effect. Give two real-life situations in which you can observe it. [3 marks]

Ans: Tyndall effect is the scattering of a beam of light by colloidal particles, making the path of light visible. Examples: (i) Sunbeams entering a dark room through a small hole — dust + air (an aerosol) scatters the light. (ii) Car headlights passing through fog or mist on a winter morning — water droplets in air scatter the light.

Q12. Distinguish between elements and compounds using TWO points. Give one example of each. [3 marks]

Ans: (i) An element has only one type of atom (e.g. iron, oxygen); a compound has two or more elements chemically combined in a fixed ratio (e.g. water H_2O, salt NaCl). (ii) An element cannot be broken down by chemical means; a compound CAN be broken down by chemical methods (electrolysis, decomposition). (iii) Properties of a compound differ entirely from its constituent elements; an element has its own constant properties.

Section D — Long Answer (5 marks)

Q13. Describe with a labelled diagram the process of fractional distillation. State its principle and give two industrial applications. [5 marks]

Ans: Definition (1 mark): Fractional distillation is used to separate two or more miscible liquids whose boiling points differ by LESS than 25°C. Principle (1 mark): Liquids with different boiling points vaporise at different temperatures; a fractionating column packed with glass beads provides repeated condensation-revaporisation cycles, so the vapour reaching the top is progressively enriched in the lower-boiling component. Diagram (1 mark): Round-bottom flask with mixture + fractionating column with glass beads + thermometer at top + Liebig condenser + receiver flask (all labelled). Procedure (1 mark): Heat the mixture; lower-BP liquid vaporises first; vapour rises through the column, condenses and re-evaporates several times along the column; finally pure vapour enters the condenser, condenses to liquid and is collected. Industrial applications (1 mark): (i) Separation of gases from liquid air (oxygen, nitrogen, argon) at low temperatures. (ii) Separation of crude petroleum into fractions — petrol, diesel, kerosene, lubricating oil — at refineries.

Q14. How would you obtain pure copper sulfate from a sample contaminated with insoluble sand and soluble impurities? Describe the full process and explain why crystallisation gives a purer product than simple evaporation. (3+0+0 split actually internal: 1 for filtration + 2 for crystallisation steps) [3 marks]

Ans: Step 1 (filtration): Add minimum water to the impure sample in a beaker, heat gently and stir to dissolve the soluble copper sulfate and soluble impurities. Filter the hot solution to remove the insoluble sand — the filtrate is a hot saturated solution of $CuSO_4$ with soluble impurities. Step 2 (crystallisation): Cover the filtrate and allow it to cool slowly and undisturbed. As the solution cools, $CuSO_4 \cdot 5H_2O$ forms large blue crystals while the soluble impurities remain dissolved in the mother liquor. Filter and dry the crystals. Why purer than evaporation: Evaporation drives off the water and leaves ALL dissolved impurities along with the solid. Crystallisation lets only the desired solid form crystals while impurities remain in the mother liquor — giving much higher purity.

★ TOPPER ANSWER TEMPLATES

5 TEMPLATES · MEMORISE THE FORMAT

★ TOPPER TEMPLATE — Differentiate true solution, colloid and suspension

A perennial 3-mark question in CBSE Class 9 'Is Matter Around Us Pure?'.

Step 1 [1 mark]	**True solution**	Homogeneous; particle size <1 nm; transparent, no Tyndall effect; not separable by filtration or centrifugation; stable — e.g. salt in water.
Step 2 [1 mark]	**Colloid**	Appears homogeneous but is heterogeneous; particle size 1–100 nm; shows Tyndall effect; not filterable but separable by centrifugation — e.g. milk, blood.
Step 3 [1 mark]	**Suspension**	Heterogeneous; particle size >100 nm; settles on standing; separable by filtration; shows Tyndall effect — e.g. chalk in water.

COMMON LOSS OF MARKS:

- Writing only definitions without comparison points
- Forgetting to mention particle size in nanometres
- Missing the centrifuge vs filter paper distinction for colloids

★ TOPPER TEMPLATE — Define the Tyndall effect with daily-life examples

A frequent 3-mark question in CBSE Class 9 chemistry of mixtures.

Step 1 [1 mark]	**Definition**	Tyndall effect is the scattering of a beam of light by colloidal particles, making the path of light visible.
Step 2 [1 mark]	**Why it occurs**	Dispersed-phase particles (1–100 nm) are just large enough to scatter visible-light wavelengths; true solutions cannot.
Step 3 [1 mark]	**Two examples**	(i) Sunlight entering a dark room through a small hole is made visible by dust; (ii) car headlights become visible in fog due to suspended water droplets.

COMMON LOSS OF MARKS:

- Saying 'all mixtures' show Tyndall (only colloids do)
- Confusing scattering with reflection
- Giving only one example when two are asked

★ TOPPER TEMPLATE — Explain fractional distillation with diagram, principle and use

A high-value 5-mark question in CBSE Class 9 separation techniques.

Step 1 [1 mark]	**Definition + criterion**	Used to separate two or more miscible liquids whose boiling points differ by LESS than 25 °C, where simple distillation fails.
Step 2 [1 mark]	**Principle**	Liquids vaporise at different temperatures; the fractionating column gives repeated evaporation–condensation cycles so vapour at the top is enriched in the more volatile component.
Step 3 [2 marks]	**Labelled diagram + procedure**	Heat the mixture in a round-bottom flask fitted with a fractionating column packed with glass beads, a thermometer at the top, and a condenser leading to a receiver; label flask, column, beads, thermometer, condenser, receiver.
Step 4 [1 mark]	**Industrial use**	Separation of different gases from air, or fractions of petroleum in a refinery.

COMMON LOSS OF MARKS:

- Forgetting the <25°C boiling-point-difference criterion
- Not labelling the fractionating column or glass beads in the diagram
- Giving simple-distillation use (water purification) instead of a true fractional use

★ TOPPER TEMPLATE — Calculate mass percentage of a solution

A standard 2-mark numerical in CBSE Class 9 concentration problems.

Step 1 [1 mark]	**Formula + mass of solution**	Mass of solution = solute + solvent = 50 g + 450 g = 500 g. Mass % = (mass of solute / mass of solution) × 100.
Step 2 [1 mark]	**Substitute & final answer**	= (50/500) × 100 = 10%. State the answer with the % sign: mass percentage = 10%.

COMMON LOSS OF MARKS:

- Using 450 g instead of 500 g as denominator (forgetting solvent + solute)
- Missing the % sign in the final answer
- Not writing the formula explicitly before substituting

★ TOPPER TEMPLATE — Distinguish elements and compounds with examples

A recurring 3-mark question in CBSE Class 9 pure substances.

Step 1 [1 mark]	**Element + 2 examples**	An element is a pure substance of only one kind of atom, not breakable by chemical means — e.g. iron (Fe), oxygen (O_2).
Step 2 [1 mark]	**Compound + 2 examples**	A compound is formed when two or more elements combine chemically in a FIXED ratio by mass — e.g. water (H_2O), carbon dioxide (CO_2).
Step 3 [1 mark]	**Two distinguishing properties**	A compound has properties different from its elements and can only be split chemically (not physically); an element cannot be decomposed at all.

COMMON LOSS OF MARKS:

- Giving mixtures (air, brass) as compound examples
- Saying compounds can be separated by physical means (they CANNOT)
- Missing the 'fixed ratio by mass' phrase in the compound definition

MARKING SCHEME — GENERAL NOTES

- Tabular comparison questions: award marks per correctly filled row, not per cell — students who write only definitions without tabular form lose 0.5 mark.
- All diagrams must carry at least 4 labels for full marks; an unlabelled diagram earns 0 marks even if drawn correctly.
- Numerical problems: formula (0.5 mark) + correct substitution (1 mark) + final answer with units/% sign (0.5 mark).
- For 3-mark conceptual questions, award 1 mark per distinct concept or example. Mere reproduction of NCERT lines without explanation gets at most 1.5 marks.

- For the 5-mark fractional distillation question, the labelled diagram MUST include flask, fractionating column, glass beads, thermometer, condenser and receiver — missing any two costs 0.5 mark.
- Spelling of technical terms (Tyndall, colloid, suspension, miscible, sublimation) — penalise only if the spelling completely changes the meaning.