IS MATTER AROUND US PURE?

CBSE CLASS 9 SCIENCE (CHEMISTRY) • CHAPTER 2 • HIGH-YIELD QUESTION BANK & NOTES

Chapter Overview & Analytical Index

Aspect	Details
Weightage	8–10% in Annual CBSE Physical Science Examinations
Key Concepts	Pure Chemical Entities, Homogeneous vs Heterogeneous States, Solution Dynamics, Colloid Matrixes, Industrial Separation Frameworks
Exam Map	High Probability: Separation layouts (Fractional distillation/Crystallisation), Concentration calculations, Tyndall Effect mechanics.

Core Chapter Lexicon

Term	Strict Chemical Definition
Pure Substance	A material comprising only a single distinct species of particle throughout (atoms or molecules) with a fixed chemical profile.
Mixture	A physical aggregation of two or more independent chemical substances that retain their distinct chemical characteristics.
True Solution	A perfectly homogeneous molecular dispersion with an identical concentration distribution at any section. Particle diameters are < 1 nm.
Colloid System	A heterogeneous matrix featuring intermediate particle dimensions ($1 ext{ nm}$ to $100 ext{ nm}$) where the solute does not precipitate out.
Tyndall Effect	The visible scattering of a light beam path as it interacts with intermediate colloidal particle phases.

SECTION A: Top 50 Most Important Questions with Answers

A. Very Short Answer Questions (1 Mark)

Q1. What is a pure substance?

> A substance consisting of only one type of constituent particles (atoms or molecules) possessing uniform properties throughout.

Q2. Name the two types of pure substances.

> Elements and compounds.

Q3. What is a mixture?

> A configuration containing two or more pure substances physically mixed together in any variable proportion.

Q4. Give one example of a homogeneous mixture.

> A thoroughly stirred aqueous sugar solution.

Q5. What is the Tyndall effect?

> The scattering of an incident beam of light by suspended colloidal particles, making the path of light visible.

Q6. Name the technique used to separate cream from milk.

> Centrifugation.

Q7. What is the particle size range in a colloidal solution?

> $1 ext{ nm}$ to $100 ext{ nm}$ ($10^{-9} ext{ m}$ to $10^{-7} ext{ m}$).

Q8. Define saturated solution.

> A solution in which no additional amount of solute can be dissolved at that specific constant temperature.

Q9. Which type of mixture shows the Tyndall effect?

> Colloidal solutions (and certain fine suspensions before settling).

Q10. Name the method used to separate two immiscible liquids.

> Separation via a separating funnel based on density differentials.

Q11. What is the solvent in tincture of iodine?

> Alcohol (Ethanol). The solute is Iodine.

Q12. Is air a mixture or a compound?

> Air is a homogeneous mixture of various distinct gases.

Q13. What is the formula for mass percentage of a solution?

> $$ ext{Mass Percentage} = rac{ ext{Mass of Solute}}{ ext{Mass of Solution}} imes 100$$

Q14. Name a metal that is liquid at room temperature.

> Mercury ($ ext{Hg}$).

Q15. What is crystallisation?

> A purification process that separates a pure solid substance from a hot, saturated solution in the form of crystals upon slow cooling.

B. Short Answer Questions (2–3 Marks)

Q1. Differentiate between a pure substance and a mixture based on core behaviors.

Feature	Pure Substance	Mixture
Composition	Fixed composition throughout; components are chemically bonded.	Variable composition; constituents are merely physically blended.
Properties	Exhibits fixed, unique physical and chemical criteria.	Reflects the mixed traits of its various underlying ingredients.

Q2. What is a solution? Name its components with examples.

> A solution is a stable, homogeneous mixture of two or more substances. Its components are:
> 1. **Solute:** The chemical dissolved, usually present in smaller quantities (e.g., Iodine crystals, Salt).
> 2. **Solvent:** The medium doing the dissolving, usually present in larger quantities (e.g., Water, Alcohol).

Q3. Why is a true solution considered a homogeneous mixture?

> Because the solute particles dissolve uniformly down to the molecular level. This uniform distribution ensures that any section of the solution has identical chemical properties. The particles are extremely tiny (< 1 nm) and do not settle over time.

Q4. Distinguish clearly between a saturated and an unsaturated solution.

Saturated Solution	Unsaturated Solution
Cannot dissolve any more solute at that specific constant temperature.	Can dissolve additional amounts of solute at that current temperature.
Holds the maximum possible amount of solute in its matrix.	Contains less than the maximum possible capacity of solute.

Q5. What is a suspension? Give two properties.

> A suspension is a heterogeneous mixture containing large solute particles that do not dissolve, but remain suspended throughout the bulk of the solvent.
> **Properties:** (i) The particles are larger than $100 ext{ nm}$ and can be seen with the naked eye. (ii) The particles are unstable and settle down at the bottom when left undisturbed.

Q6. What is a colloidal solution? Give two properties.

> A colloid is a heterogeneous system where one substance is dispersed as fine particles ($1 ext{ nm}$ to $100 ext{ nm}$) inside another substance.
> **Properties:** (i) The particles are small enough to stay suspended without settling, making the system stable. (ii) They easily scatter a beam of light, demonstrating the Tyndall effect.

Q7. Write three differences between a solution and a suspension.

Feature	True Solution	Suspension
Particle Size	Finer than $1 ext{ nm}$.	Larger than $100 ext{ nm}$.
Stability	Completely stable; no settling.	Unstable; particles settle out.
Filtration	Passes cleanly through filter paper.	Particles can be filtered out as residue.

Q8. What is the Tyndall effect? Why is it not observed in true solutions?

> The Tyndall effect is the visible scattering of light by particles suspended in a mixture. True solutions do not show this effect because their dissolved solute particles are incredibly tiny (< 1 nm). These particles are too small to block or scatter incoming light waves, allowing the light to pass straight through.

Q9. How will you separate a mixture of sand and water? Explain.

> A mixture of sand and water can be separated using **filtration**. The heterogeneous mixture is poured through a funnel lined with filter paper. The large, insoluble sand particles cannot pass through the pores of the paper and are caught as **residue**, while the clean water passes through into the flask below as the **filtrate**.

Q10. How is cream separated from milk? Name the principle.

> Cream is separated from milk using the **Centrifugation** technique. When milk is spun rapidly in a centrifuge, the lighter cream particles feel a smaller outward force and stay near the center, while the denser milk particles are forced outward toward the bottom. This allows the low-density cream to be skimmed off the top.

Q11. You are given a mixture of salt and water. How will you obtain pure salt?

> While simple evaporation works, the best approach is **crystallisation**. The salt solution is heated to evaporate some water, creating a hot, concentrated solution. When this solution is left to cool slowly, the salt particles join together to form pure solid crystals, while any dissolved impurities remain behind in the remaining liquid.

Q12. Distinguish clearly between elements and compounds.

Criteria	Element	Compound
Basic Structure	A pure substance composed of only one type of atom.	A substance made of two or more elements chemically bonded in a fixed ratio.
Decomposition	Cannot be broken down into simpler substances by chemical means.	Can be broken down into its original elements using chemical reactions or electrolysis.

Q13. Give three differences between a physical change and a chemical change.

Physical Change	Chemical Change
No new chemical substances are formed.	A brand new substance with different properties is formed.
The change is usually temporary and easily reversible.	The change is permanent and generally irreversible.
Only physical traits like shape or state are altered.	The fundamental chemical composition is completely changed.

Q14. What is a separating funnel? Which type of mixture is separated using it?

A separating funnel is an elongated glass apparatus fitted with a stopcock at its base. It is used to separate mixtures of **immiscible liquids** (liquids that do not mix, like oil and water). When left to sit, the liquids separate into distinct layers based on their densities. Opening the stopcock allows the denser bottom layer to be drained out completely, leaving the lighter layer behind in the funnel.

Q15. Explain chromatography. Give one application.

Chromatography is an advanced separation technique used to separate various solutes that dissolve in the same solvent. It works because different components move across a stationary phase (like chromatography paper) at different speeds based on their individual solubilities.
Application: Separating and identifying the individual colored dyes found in commercial ink.

Q16. Why is crystallisation better than evaporation to obtain pure salt from seawater?

Crystallisation is preferred because: (i) Simple evaporation can cause delicate, heat-sensitive solids to decompose or char when heated to dryness. (ii) Soluble impurities that do not turn into vapor would remain mixed with the solid during evaporation, whereas crystallisation leaves them dissolved in the liquid, producing a pure crystalline solid.

Q17. Classify the following as homogeneous or heterogeneous: (a) Air, (b) Soil, (c) Sugar solution, (d) Milk.

(a) Air – Homogeneous Mixture; (b) Soil – Heterogeneous Mixture; (c) Sugar solution – Homogeneous Mixture; (d) Milk – Heterogeneous Mixture (on a microscopic level as a colloid).

Q18. Why is milk called a colloid? Name the dispersed phase and dispersion medium in milk.

> Milk is classified as a colloid because its internal particles ($1 ext{ nm}$ to $100 ext{ nm}$) are small enough to look uniform to the naked eye, but large enough to scatter light and show the Tyndall effect.
> • **Dispersed Phase:** Liquid fats/lipids.
> • **Dispersion Medium:** Aqueous water phase.

Q19. Calculate the mass percentage of a solution containing 20 g of salt in 80 g of water.

> $$ ext{Mass of Solute (salt)} = 20 ext{ g}$$ $$ ext{Mass of Solvent (water)} = 80 ext{ g}$$ $$ ext{Total Mass of Solution} = 20 ext{ g} + 80 ext{ g} = 100 ext{ g}$$ $$ ext{Mass Percentage} = \left(rac{20 ext{ g}}{100 ext{ g}} ight) imes 100 = 20\%$$

Q20. What is the fundamental operational difference between a colloid and a suspension?

> The key difference is particle stability and size. Colloid particles ($1 ext{--}100 ext{ nm}$) are light enough that molecular collisions keep them permanently suspended, so they never settle. Suspension particles are much larger (> 100 nm), meaning gravity pulls them down over time, causing them to settle at the bottom of the container.

C. Long Answer Questions (5 Marks)

Q1. Explain how matter is classified into pure substances and mixtures. Draw a detailed classification chart.

> Matter is divided into two primary categories based on its chemical purity: **Pure Substances** and **Mixtures**.
>
> [Image of classification of matter chart splitting into pure substances and mixtures then elements compounds homogeneous and heterogeneous]
>
> **1. Pure Substances:** These consist of only one type of particle and have a fixed chemical composition throughout. They are further divided into:
>
> - *Elements:* The simplest form of chemical matter, made of only one type of atom. They cannot be broken down into simpler components by ordinary chemical reactions (e.g., Copper, Gold).
> - *Compounds:* Substances formed when two or more different elements chemically combine in a fixed mass ratio. They can be broken down into their individual elements only through chemical changes or electrolysis (e.g., Pure Water, Sodium Chloride).
>
> **2. Mixtures:** These are physical combinations of two or more pure substances mixed in any variable proportion, where each component keeps its own chemical properties. They are divided into:
>
> - *Homogeneous Mixtures:* Mixtures with a perfectly uniform composition throughout their bulk (e.g., saline solutions).
> - *Heterogeneous Mixtures:* Mixtures with a non-uniform composition and visible boundaries between components (e.g., oil-and-water or muddy water).

Q2. Differentiate thoroughly between homogeneous and heterogeneous mixtures with two examples each.

Property	Homogeneous Mixtures	Heterogeneous Mixtures
Uniformity	The composition is completely uniform throughout the entire volume.	The composition varies from one region to another within the mixture.
Phase Boundary	No visible boundaries of separation can be seen between the combined components.	Clear, distinct boundaries of separation exist between the different components.
Separation Limit	The individual components are completely invisible, even under a powerful microscope.	The different phases or components can often be seen with the naked eye or a standard microscope.
Key Examples	1. Clear saltwater solutions. 2. Clean atmospheric air.	1. A mixture of sand and iron filings. 2. An emulsion of oil and water.

Q3. Explain the properties of a true solution, suspension, and colloid in a unified comparative matrix.

Property Criteria	True Solution	Colloidal System	Suspension Phase
1. Nature	Homogeneous matrix.	Heterogeneous matrix (appears uniform).	Heterogeneous matrix.
2. Particle Size	Finer than $1 ext{ nm}$ ($<10^{-9} ext{ m}$).	$1 ext{ nm}$ to $100 ext{ nm}$.	Larger than $100 ext{ nm}$ ($>10^{-7} ext{ m}$).
3. Optical Scattering	Does not show Tyndall effect.	Shows strong Tyndall scattering.	May scatter light before particles settle.
4. Stability	Completely stable; no precipitation.	Stable; does not settle.	Unstable; particles precipitate out.
5. Filter Ability	Passes completely through filter paper.	Passes through standard filter paper.	Particles are caught on filter paper.

Q4. What is concentration of a solution? Explain the two primary mathematical methods to express concentration with formulas and a numerical sample.

The **concentration of a solution** is a measure of the amount of solute dissolved in a given quantity of the solution (or solvent). It is typically calculated using one of two methods:

Method A: Mass by Mass Percentage ($\% ext{ w/w}$):

$$ ext{Mass Percentage} = rac{ ext{Mass of Solute}}{ ext{Total Mass of Solution}} imes 100$$

$$ ext{Where: Total Mass of Solution} = ext{Mass of Solute} + ext{Mass of Solvent}$$

Method B: Mass by Volume Percentage ($\% ext{ w/v}$):

$$ ext{Mass by Volume Percentage} = rac{ ext{Mass of Solute}}{ ext{Total Volume of Solution}} imes 100$$

Numerical Example: Suppose $10 ext{ g}$ of pure table sugar is completely dissolved in $90 ext{ g}$ of water. The concentration is calculated as follows:

$$ ext{Total Mass of Solution} = 10 ext{ g} \ (ext{solute}) + 90 ext{ g} \ (ext{solvent}) = 100 ext{ g}$$ $$ ext{Mass Percentage} = \left(rac{10 ext{ g}}{100 ext{ g}} ight) imes 100 = 10\%$$

Q5. How will you separate the components of a complex solid mixture containing sand, salt, and iron filings? Explain step by step.

> This three-part mixture can be separated step-by-step by utilizing the unique physical properties of each component:
>
> **Step 1: Magnetic Separation (Isolating Iron Filings):** Spread the dry mixture across a flat container. Pass a strong permanent horseshoe magnet closely over the surface. The ferromagnetic iron filings will be attracted to the magnet and lift away, leaving only sand and salt behind in the dish.
>
> **Step 2: Dissolution and Filtration (Isolating Sand):** Add water to the remaining sand and salt mixture and stir thoroughly. The salt dissolves completely into the water, while the sand remains insoluble. Pour this mixture through a funnel lined with filter paper. The insoluble sand is caught on the paper as **residue**. Wash it slightly and leave it to dry. The clear saltwater passes through as the **filtrate**.
>
> **Step 3: Crystallisation (Isolating Pure Salt):** Pour the saltwater filtrate into a clean evaporating dish. Heat the solution until most of the water evaporates, leaving behind a highly concentrated, saturated salt solution. Stop heating and let it cool down slowly. As it cools, pure salt crystals will form in the dish, which can then be dried for use.

Q6. Explain the scientific principle and operational process of centrifugation. List two industrial applications.

> **The Governing Principle:** Centrifugation separates components of a liquid mixture based on differences in their densities. When the mixture is spun rapidly in a circle, the denser particles experience a stronger outward force and are pushed to the very bottom of the tube, while the lighter, less dense particles remain near the top.
>
> [Image of laboratory centrifuge machine spinning tubes to separate dense particles at the bottom]
>
> **The Process:** Fill specialized centrifuge tubes with the liquid mixture (like raw milk or blood). Place the tubes into the rotor pockets of a centrifuge machine, making sure the rotor is perfectly balanced. Close the lid securely and spin the machine at high speed for several minutes. Once stopped, you will find a clear separation: the heavy solid particles form a compact pellet at the bottom, while the lighter liquid stays on top.
>
> **Industrial Applications:**
>
> - *Clinical Diagnostics:* Separating red and white blood cells from liquid blood plasma in diagnostic laboratories.
> - *Dairy Industry:* Spinning raw milk at high speeds to separate the lighter cream/fat layers from the denser skim milk.

Q7. What is chromatography? Explain how paper chromatography separates the different colored pigments found in standard ink.

> **Chromatography** is a powerful separation technique used to separate various dissolved solutes that travel through a stationary phase at different speeds. This speed difference depends on each solute's individual solubility in a moving solvent phase.
>
> **Operational Process for Ink:** Cut a long, narrow strip of Whatman filter paper. Draw a straight line with a graphite pencil about $3 ext{ cm}$ up from the bottom edge. Place a single concentrated drop of black ink right on the center of this line and let it dry completely. Suspend the paper strip inside a glass cylinder containing a small layer of water at the bottom, making sure the bottom edge of the paper touches the water but the ink spot stays safely above the water level.
>
> **Result and Mechanics:** As water rises up the filter paper via capillary action, it dissolves the components of the ink spot. The different colored pigments in the ink travel upward along with the water. Because each pigment has a different solubility and bonds differently to the paper fibers, the more soluble components move up faster and farther. This separates the ink into distinct, colored bands along the paper strip.

Q8. Why is crystallisation considered a significantly better purification technique than simple thermal evaporation? Explain with examples.

> Crystallisation is a much gentler and more effective purification method than simple evaporation for the following reasons:
>
> - *Thermal Protection:* Heating a solution to dryness during evaporation can cause delicate, heat-sensitive organic substances (like sugar) to decompose, char, or burn. Crystallisation uses lower temperatures and slow cooling, keeping these substances safe.
> - *Removal of Residual Solubles:* Simple evaporation drives off the liquid solvent, leaving behind all dissolved solids—including any unwanted soluble impurities. Crystallisation forces the target substance to form pure solid structures, leaving the impurities dissolved in the remaining liquid to be poured away.
> - *Crystalline Structure:* It produces large, high-purity crystals with a well-defined shape, whereas evaporation leaves behind a fine, impure powder. For example, obtaining pure copper sulfate ($ ext{CuSO}_4$) from an impure sample using crystallisation removes all impurities, leaving behind clear, deep-blue crystals.

Q9. Distinguish clearly between elements, compounds, and mixtures using a comprehensive comparative matrix.

Property	Element	Compound	Mixture
Composition	Consists of only a single type of atom.	Made of two or more elements chemically bonded in a fixed ratio.	Made of two or more substances physically mixed in any ratio.
Separation Limit	Cannot be broken down into simpler substances.	Can be broken down only via chemical reactions or electrolysis.	Can be easily separated using physical methods (filtration, distillation).
Identity	Retains its fundamental elemental properties.	Loses the original traits of its elements; forms entirely new properties.	Each component retains its individual chemical properties.
Energy Change	No energy change is involved in its existence.	Heat or light is usually absorbed or released during formation.	No heat or chemical energy change occurs during physical mixing.
Examples	Pure Copper ($ ext{Cu}$), Oxygen gas ($ ext{O}_2$).	Pure Water ($ ext{H}_2 ext{O}$), Table Salt ($ ext{NaCl}$).	Crude Oil, Brass alloy, Air.

Q10. Provide five distinct differences between physical and chemical changes with clear everyday examples.

Criteria	Physical Change	Chemical Change
1. Substance Formation	No new substance is formed; molecules remain identical.	Entirely new chemical substances are formed.
2. Reversibility	The change is temporary and can be easily reversed.	The change is permanent and cannot be easily reversed.
3. Energy Flow	Very little thermal or radiant energy is absorbed or released.	Large amounts of heat, light, or sound energy are exchanged.
4. Mass Properties	The total mass of the specific underlying material stays the same.	The mass of individual reacting substances changes as they form new products.
5. Core Examples	Melting of wax, tearing of paper, freezing water.	Rusting of iron, burning wood, cooking an egg.

Q13. How will you separate a mixture of two miscible liquids like alcohol and water? Explain the distillation process with a detailed description.

> A mixture of two miscible liquids with a significant difference in their boiling points (at least $25^\circ ext{C}$) can be separated using **fractional distillation**. For alcohol (ethanol, boiling point $78^\circ ext{C}$) and water (boiling point $100^\circ ext{C}$), the process works as follows:
>
> [Image of fractional distillation apparatus setup showing flask burner fractionating column condenser and receiving flask]
>
> **The Setup and Process:** Pour the alcohol-and-water mixture into a round-bottom distillation flask. Fit the flask with a fractionating column and a thermometer, then connect it to a water-cooled Liebig condenser. Heat the flask gently over a burner while monitoring the temperature closely.
>
> **The Separation Mechanics:** As the mixture heats up, the more volatile liquid—alcohol, which has a lower boiling point ($78^\circ ext{C}$)—turns into vapor first. These vapors rise up into the fractionating column and pass into the Liebig condenser. The cold water circulating around the condenser cools the vapors, turning them back into a liquid. This pure liquid alcohol drips into a receiving flask at the other end. The water, having a higher boiling point ($100^\circ ext{C}$), remains behind in the original distillation flask.

SECTION B: NCERT Activity-Based Questions

Activity 2.1: Heating Iron Filings and Sulphur Powder

Mix iron filings and sulphur powder. Divide the mixture into two parts. Keep Part 1 as a cold physical mix, and heat Part 2 intensely over a burner until it turns into a dark solid.
Observation & Core Deduction: Passing a magnet over Part 1 easily pulls out the iron filings, and adding carbon disulfide ($ ext{CS}_2$) dissolves the yellow sulfur. For Part 2, the magnet catches nothing and the sulfur will not dissolve. This proves that heating caused a chemical reaction that formed a completely new compound, Iron Sulfide ($ ext{FeS}$), which has its own unique properties.

Activity 2.2: Tyndall Effect Analysis Across Mixtures

Shine a focused laser pointer through three separate beakers containing: (a) a clear aqueous copper sulfate solution, (b) a fresh sample of milk, and (c) a mixture of chalk powder stirred in water.
Observation & Core Deduction: The laser beam passes through the copper sulfate solution without scattering, leaving its path invisible. However, the path of light shines clearly inside the milk and the chalk water. This shows that the larger particles in colloids (milk) and suspensions (chalk water) scatter light waves, demonstrating the Tyndall effect, whereas the tiny particles in true solutions cannot.

Activity 2.4: Separating Funnel Mechanics with Immiscible Liquids

Pour a mixture of kerosene oil and water into a separating funnel, shake gently, and let it sit undisturbed for several minutes.
Observation & Core Deduction: The two liquids separate into two distinct layers. Water, having a higher density, settles at the very bottom, while the lighter kerosene oil floats on top. Opening the bottom stopcock allows you to drain the water layer out completely into a beaker, shutting it off just as the oil layer reaches the valve. This shows how density differences can be used to separate immiscible liquids.

SECTION C: Assertion & Reason Questions

Directions: Select **(A)** if both Assertion (A) and Reason (R) are true and R is the correct explanation of A; select **(B)** if both are true but R is not the correct explanation; select **(C)** if A is true but R is false; select **(D)** if A is false but R is true.

1. Assertion (A): Atmospheric air is classified as a homogeneous mixture rather than a compound.
Reason (R): The gases in air are physically blended together in proportions that can vary by location, and they can be separated using physical methods like fractional distillation.

> **Ans: (A)** Both statements are true, and the variable composition and physical blending explain why air is a mixture.

2. Assertion (A): Fresh milk displays a distinct, visible path when a beam of light passes through it.
Reason (R): Milk is a colloidal suspension containing intermediate-sized fat particles that scatter light waves.

> **Ans: (A)** Both statements are true, and the colloidal nature of milk directly explains the light scattering.

3. Assertion (A): Crystallisation is considered a much better purification method for isolating solids than simple thermal evaporation.
Reason (R): Crystallisation completely removes every type of soluble and insoluble impurity in a single step.

> **Ans: (C)** The Assertion is true, but the Reason is false. Crystallisation is the better method because it prevents heat-sensitive solids from burning and isolates pure crystal structures, not because it removes every single impurity at once.

4. Assertion (A): When a mixture of sand and salt water is poured through filter paper, the dissolved salt is left behind on the paper.
Reason (R): Dissolved salt particles break down to molecular sizes (< 1 nm) and pass easily through the pores of filter paper.

> **Ans: (D)** The Assertion is false, but the Reason is true. Dissolved salt passes straight through the filter paper along with the water; it is the large, insoluble sand particles that are caught as residue.

SECTION D: Case Study Questions

Case Study: Laser Analysis of Unknown Mixtures

An investigator prepares three unlabeled liquid samples in identical glass containers. Sample 1 is a clear salt solution; Sample 2 is a fresh starch solution; Sample 3 is muddy water from a river. The investigator shines a strong laser pointer through each sample to study how they interact with light, and leaves them sitting still for two hours to check their stability.

Q1. Which sample(s) will show a visible light path when the laser shines through them? Name the scientific effect responsible for this.

> **Ans:** Sample 2 (starch solution) and Sample 3 (muddy water) will show a visible light path. This occurs due to the **Tyndall effect**, where particles of intermediate or large sizes scatter the incoming light.

Q2. What changes will be visible in Sample 3 after sitting undisturbed for two hours? Classify this mixture phase.

> **Ans:** After two hours, the large, heavy soil particles in Sample 3 will settle out and accumulate at the bottom of the container, leaving clearer water on top. This behavior classifies Sample 3 as an unstable **suspension**.

Q3. Why does Sample 1 leave the laser beam completely invisible, and what is its typical particle size limit?

> **Ans:** Sample 1 is a true solution. Because its dissolved solute particles are incredibly tiny—finer than $1 ext{ nm}$ ($10^{-9} ext{ m}$)—they are too small to block or scatter light waves, leaving the laser beam invisible as it passes through.

SECTION E: High-Yield Exam Blueprint Matrix

Q.No.	Most Expected Core Examination Question Targets	Weightage
1	Draw a complete classification chart of matter, explaining the differences between elements, compounds, and mixtures.	5 Marks
2	Compare the properties of true solutions, colloids, and suspensions using a clear comparative table.	5 Marks
3	Explain the separation of two miscible liquids using fractional distillation, noting the required boiling point conditions.	3 Marks
4	Calculate the mass percentage concentration of a solution containing $15 ext{ g}$ of solute dissolved in $85 ext{ g}$ of water.	2 Marks
5	Why is crystallisation preferred over simple thermal evaporation for purifying heat-sensitive substances?	3 Marks