4.SEPARATION TECHNIQUES
SOLUTIONS

TEACHING TASK

JEE MAIN LEVEL QUESTIONS

1. During the heating process, which component transitions directly from solid to gas without becoming liquid?
A) Sodium carbonate B) Ammonium chloride C) Table salt D) Calcium chloride
Answer:B
Solution:Ammonium chloride undergoes sublimation (direct solid $\rightarrow$ gas transition) when heated.
2. Which technique is demonstrated when a liquid part of a solution is removed by heating?
A) Chromatography B) Filtration C) Evaporation D) Crystallization
Answer:C
Solution:Evaporation removes solvent (liquid) by heating, leaving dissolved solids behind.
3. What remains on the surface after the liquid part of ink is removed through heat?
A) Water droplets B) Salt crystals C) Dye residue D) Oil film
Answer:C
Solution:Ink = Solvent (liquid) + Dye (solute). Heating evaporates the solvent, leaving dye particles.
4. What is the purpose of placing a shallow dish above a container of boiling water?
A) To absorb moisture B) To concentrate vapors
C) To gently heat another substance D) To cool down the mixture
Answer:C
Solution:This method is called indirect heating (or heating in a water bath) and is used to gently heat substances without direct flame.
5. Which part of the setup ensures that the substance on the dish is heated indirectly?
A) The burner B) The beaker of water C) The ink itself D) The tripod stand
Answer:B
Solution:Water in the beaker acts as a heat buffer, transferring heat gently to the dish above.
6. When you mix cooking oil with water in a glass, what happens?
A) They form one clear layer B) They react and change color
C) Oil floats on water D) Water floats on oil
Answer:C
Solution:Oil is less dense than water and does not mix with it (immiscible), so it floats.
7. Which of these is an example of a pair of immiscible liquids?

A) Milk and tea B) Lemon juice and water
C) Alcohol and water D) Kerosene and water
Answer:D
Solution:Kerosene and water do not mix (immiscible) and form separate layers.
8. Which characteristic best describes miscible liquids?
A) They evaporate easily B) They settle into layers
C) They always form bubbles D) They mix without separation
Answer:D
Solution:Miscible liquids dissolve into each other completely to form a uniform mixture.
9. What happens when two miscible liquids are combined?
A) They form separate layers B) They produce bubbles
C) They form a uniform mixture D) They turn into a solid
Answer:C
Solution:Miscible liquids (e.g., acetone-water) create homogeneous solutions at molecular level.
10. What type of solution do miscible liquids form?
A) Heterogeneous B) Cloudy C) Oily D) Homogeneous
Answer:D
Solution:Miscible liquids produce homogeneous solutions (uniform composition throughout).

JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type:

1. Which of the following pairs are examples of liquids that blend completely without forming layers?
A) Water and ethanol B) Oil and water C) Vinegar and water D) Milk and oil
Answer:A,C
Solution:Miscible liquids (mix completely):
Water + Ethanol (A): Polar molecules form hydrogen bonds $\rightarrow$ uniform mixture.
Vinegar (acetic acid) + Water (C): Both polar $\rightarrow$ homogeneous solution.
Immiscible liquids (form layers):
Oil + Water (B): Non-polar oil doesn't dissolve in polar water.
Milk + Oil (D): Milk is mostly water $\rightarrow$ oil separates out.
2. Which statements correctly describe pairs of liquids that do not mix well?
A) They stay in separate layers after mixing
B) One liquid always floats above the other
C) They form a single clear solution
D) Stirring does not make them blend permanently
Answer:A,B,D
Solution:Immiscible liquids exhibit:
A) Layering: Due to density differences (e.g., oil floats on water).
B) Floating: Less dense liquid rises (e.g., petrol on water).
D) Temporary mixing: Stirring disperses but doesn't dissolve (re-separates).

Incorrect option:

C) Single clear solution: Characteristic of miscible liquids (e.g., alcohol + water).

Statement Type:

A) Both Statements are true, Statement II is the correct explanation of Statement I.
B) Both Statements are true, Statement II is not correct explanation of Statement I.
C) Statement I is true, Statement II is false.
D) Statement I is false, Statement II is true.

3. Statement I : Water and alcohol mix completely with each other.
Statement II : Water and alcohol are examples of immiscible liquids.

Answer:C

Solution:Statement I is TRUE: Water (polar) and alcohol (polar, e.g., ethanol) are miscible—they form a homogeneous solution due to hydrogen bonding.
Statement II is FALSE: Water and alcohol are miscible, not immiscible. Immiscible liquids (e.g., oil-water) form separate layers.

4. Statement I : Oil and water do not mix and form two separate layers.
Statement II : Oil and water are examples of miscible liquids.

Answer:C

Solution:Statement I is TRUE: Oil (nonpolar) and water (polar) are immiscible—they separate into layers due to polarity differences.
Statement II is FALSE: Oil and water are immiscible, not miscible. Miscible liquids (e.g., water-ethanol) mix uniformly.

Comprehension Type:

A mixture of two white powders—common salt and ammonium chloride—can be separated using a method called sublimation. In this process, both powders are mixed in a china dish. The dish is placed on a stand and covered with an inverted glass funnel. A small piece of cotton is placed at the top of the funnel to stop the gases from escaping. When the mixture is gently heated, ammonium chloride changes into vapor and rises. It then cools down and turns back into solid*on the inside wall of the funnel. Meanwhile, salt stays behind in the dish, because it doesn't turn into vapor. This way, the two powders are separated.

5. What method is used to separate ammonium chloride from salt?
A) Filtration B) Evaporation C) Sublimation D) Distillation

Answer:C

Solution:The passage explicitly describes sublimation as the method used.

6. What happens to ammonium chloride when it is heated?
A) It melts B) It dissolves in water C) It turns into vapor D) It burns

Answer:C

Solution:NH_4Cl undergoes sublimation (direct solid-to-vapor transition) when heated.

7. Why is cotton used at the mouth of the funnel?
A) To cool the vapors B) To stop vapors from escaping
C) To clean the funnel D) To mix the powder

Answer:B

Solution:The cotton plug acts as a barrier to prevent NH_4Cl vapors from escaping,

ensuring they condense back into solid on the funnel walls.
8. Which substance remains in the china dish after heating?
A) Water B) Ammonium chloride C) Sugar D) Salt
Answer:D
Solution:Salt (NaCl) has a very high melting point (~800°C) and does not sublime at the temperatures used. It remains in the dish.

Matrix Matching Type:

9. Column A Column B
A. Nitrogen 1. Last gas to evaporate from liquid air
B. Oxygen 2. Gas that boils off first due to lowest boiling point
C. Argon 3. Process of separating gases based on different boilingpoints
D. Fractional distillation 4. Has a boiling point between nitrogen and oxygen
E. Compression and cooling 5. Turns air into liquid form
Answer:A-2,B-1,C-4,D-3,E-5
Solution:
A. Nitrogen 2. Gas that boils off first due to lowest boiling point
B. Oxygen 1. Last gas to evaporate from liquid air
C. Argon 4. Has a boiling point between nitrogen and oxygen
D. Fractional distillation 3. Process of separating gases based on different boilingpoints
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LEARNERS TASK

JEE MAINS LEVEL QUESTIONS

1. Which of the following techniques relies on a moving liquid to distinguish blended hues in a substance?
A) Sedimentation B) Filtration
C) Capillary tracing D) Solvent migration analysis
Answer:D
Solution:This describes chromatography, where a solvent (mobile phase) separates mixtures based on differential migration of components.
Key terms: "Moving liquid" = solvent, "blended hues" = separated dyes.
2. Which of the following pairs will completely combine into one uniform solution?
A) Oil and water B) Vinegar and water C) Sand and water D) Oil and alcohol
Answer:B
Solution:Miscible pairs form homogeneous solutions:
Vinegar (acetic acid) + water = polar-polar mixing.
3. What term is used for liquids that do not form separate layers when mixed?
A) Immiscible B) Insoluble C) Miscible D) Dilutable
Answer:C
Solution:Miscible liquids (e.g., ethanol-water) mix uniformly.
4. Is water able to dissolve completely in alcohol?
A) Yes, they form one clear mixture B) No, alcohol floats on top
C) Only if heated D) Only in small amounts

Answer:A

Solution:Water (polar) + alcohol (polar, e.g., ethanol) are miscible in all proportions due to hydrogen bonding.

5. Which of the following pairs are miscible?

A) Water and oil B) Ethanol and water C) Kerosene and water D) Vinegar and oil

Answer:B

Solution:Miscible: Ethanol (polar) + water (polar).

6. When mixing miscible liquids in any amount, what can be observed?

A) They float one over the other B) A color change

C) A single clear layer D) Bubbles that separate the liquids

Answer:C

Solution:Miscible liquids form homogeneous solutions (e.g., acetone-water).

7. Which substance changes into gas form first when the mixture is gently warmed?

A) The one that turns to vapor at a higher reading

B) The one that stays behind till the end

C) The one with the lower heat point

D) The one with the heavier particles

Answer:C

Solution:Lower boiling point = volatile = vaporizes first (e.g., NH_4Cl sublimes before NaCl).

JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type:

1. What are the characteristics of liquids that form a uniform mixture when combined?

A) They do not separate into layers

B) They form a clear, single-phase solution

C) They require shaking to stay mixed

D) They are considered miscible

Answer:A,B,D

Solution:Miscible liquids exhibit:

A) No layer separation (homogeneous mixing).

B) Single-phase clarity (e.g., ethanol-water).

D) By definition, "miscible" means capable of mixing in all proportions.

Incorrect option:

C) Miscible liquids do not require shaking to stay mixed (they remain uniform naturally).

2. Which of the following are examples of pairs that completely mix without forming layers?

A) Water and alcohol B) Oil and water

C) Vinegar and water D) Kerosene and water

Answer:A,C

Solution:Miscible pairs (polar-polar):

A) Water (H_2O) + Alcohol (e.g., ethanol, CH_3CH_2OH): Both polar $\rightarrow$ hydrogen bonding $\rightarrow$ uniform mixture.

C) Vinegar (aqueous acetic acid, CH_3COOH) + Water: Polar-polar $\rightarrow$ homogeneous solution.
Immiscible pairs (polar-nonpolar):
B) Oil (nonpolar) + Water (polar): Form separate layers.
D) Kerosene (nonpolar) + Water (polar): Immiscible.

Statement Type:

A) Both Statements are true, Statement II is the correct explanation of Statement I.
B) Both Statements are true, Statement II is not correct explanation of Statement I.
C) Statement I is true, Statement II is false.
D) Statement I is false, Statement II is true.

3. Statement I : Miscible liquids form a homogeneous solution.
Statement II : Immiscible liquids always mix completely.

Answer:C

Solution:Statement I is TRUE: Miscible liquids (e.g., ethanol-water) form homogeneous solutions (uniform composition throughout).
Statement II is FALSE: Immiscible liquids (e.g., oil-water) do not mix and form separate layers.

4. Statement I : Vinegar and water mix completely in all proportions.
Statement II : Vinegar and water are immiscible liquids.

Answer:C

Solution:Statement I is TRUE: Vinegar (aqueous acetic acid) and water are both polar $\rightarrow$ miscible in all ratios.
Statement II is FALSE: They are miscible, not immiscible.

Comprehension Type:

When two liquids that do not mix are combined, they form two separate layers. A common example is kerosene and water. Kerosene is lighter and stays on top, while water is heavier and settles at the bottom. To separate them, we use a separating funnel.
In the experiment, the mixture of kerosene and water is poured into the funnel and allowed to stand. After a while, the two liquids clearly form layers. By slowly opening the stopcock (a small valve), the bottom liquid (water) is allowed to flow out first into a beaker. The stopcock is then closed before the top liquid (kerosene) starts coming out. After that, kerosene is poured into another beaker.
This method works well because the two liquids do not mix and have different densities.

5. What tool is used to separate kerosene and water?
A) Measuring cylinder B) Test tube C) Separating funnel D) Evaporating dish

Answer:C

Solution:The passage explicitly mentions using a separating funnel to separate immiscible liquids like kerosene and water.

6. Why do kerosene and water form separate layers?
A) They have the same color
B) They dissolve in each other

C) They have different densities and don't mix
D) They boil at the same temperature

Answer:C

Solution:Immiscibility: Kerosene (nonpolar) and water (polar) do not mix due to polarity differences.
Density difference: Kerosene (less dense, ~0.8 g/cm^3) floats on water (1 g/cm^3).

7. Which liquid comes out first from the separating funnel?
A) Kerosene B) Oil C) Alcohol D) Water

Answer:D

Solution:Water is denser and forms the bottom layer ? flows out first when the stopcock is opened.
Kerosene (A) is the top layer and is collected later.

8. Where does kerosene stay in the separating funnel?
A) At the bottom B) In the stopcock C) In the middle D) At the top

Answer:D

Solution:Kerosene is less dense than water $\rightarrow$ floats as the top layer.

Matrix Matching Type:

9. Column A Column B

A. Filter paper	1. Used to attach paper strip to the pencil
B. Water	2. Shows separation of ink into different colors
C. Cello tape	3. The liquid that helps carry the ink upward
D. Capillary action	4. Absorbent surface that helps separateink components
E. Colored bands on paper	5. Movement of water through the tiny spaces in thepaper

Answer:A-4,B-3,C-1,D-5,E-2

Solution:

A. Filter paper	4. Absorbent surface that helps separate ink components
B. Water	3. The liquid that helps carry the ink upward
C. Cello tape	1. Used to attach paper strip to the pencil
D. Capillary action	5. Movement of water through the tiny spaces in thepaper
E. Colored bands on paper	2. Shows separation of ink into different colors

KEY

			TEACHING TASK						
			JEE MAIN LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
B	C	C	C	B	C	D	D	C	D
			JEE ADVANCED LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	
A,C	A,B,D	C	C	C	C	B	D	A-2,B-1,C-4,D-3,E-5	
			LEARNERS TASK						
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7			
D	B	C	A	B	C	C			
			JEE ADVANCED LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	
A,B,D	A,C	C	C	C	C	D	D	A-4,B-3,C-1,D-5,E-2	