12. SEPARATION OF SOLID- LIQUID MIXTURES

SOLUTIONS

TEACHING TASK

JEE MAINS LEVEL QUESTIONS

1. The process of carefully pouring out a clear liquid after the solid has settled is called: **(FA & SA- 2 Marks)**

   A) Sedimentation B) Decantation C) Filtration D) Evaporation

Answer:B

Solution:The process of carefully pouring out a clear liquid after the solid has settled is called decantation.

2. The conversion of a liquid into vapor at a temperature below its boiling point is termed:

   A) Filtration B) Evaporation C) Distillation D) Sublimation

Answer:B

Solution:. The conversion of a liquid into vapor at a temperature below its boiling point is called evaporation.

3. To obtain pure water from seawater on a large scale, which method is most effective?

   A) Filtration B) Evaporation C) Centrifugation D) Distillation

Answer:D

Solution:Distillation is used on a large scale to obtain pure water from seawater because it effectively separates the solute (salt) from the solvent (water) by vaporizing and condensing the water.

4. A mixture of sand and water is filtered. What is collected as the residue?

   A) Water B) Sand

   C) Both sand and water D) Neither

Answer:B

Solution:Residue = sand (retained on filter paper).

5. Evaporation is used to separate a _____ solid from its _____. **(FA & SA- 3 Marks / 4 Marks)**

   A) Volatile; solute B) Insoluble; solution

   C) Non-volatile; solvent D) Sublimable; filtrate

Answer:C

Solution:Evaporation is used for a non-volatile solid from its solvent.

6. A mixture of sulfur (insoluble) in carbon disulfide (volatile liquid) can be separated by:

A) Filtration B) Evaporation
C) Distillation D) Sedimentation and decantation

Answer:B

Solution:Since carbon disulfide is volatile, it can be evaporated, leaving sulfur behind.

7. Naphthalene (sublimes) and ethanol (volatile liquid) are separated by distillation because:
A) Ethanol is non-volatile B) Naphthalene is non-volatile
C) Both are volatile D) Naphthalene dissolves in ethanol

Answer:B

Solution:Distillation is a separation technique that relies on differences in volatility (boiling points). It works by selectively boiling a more volatile liquid and then condensing its vapor. In this case, ethanol is a volatile liquid and will vaporize readily when heated, while naphthalene, despite being a sublimable solid, has a much higher boiling point and can be considered essentially non-volatile relative to the ethanol in the liquid mixture. Therefore, the ethanol can be distilled off, leaving the solid naphthalene behind.

8. A mixture contains ammonium chloride (sublimes), common salt, and water. The correct sequence for separation is: **(FA & SA- 5 Marks / 8 Marks)**
A) Filtration → Distillation
B) Sublimation → Filtration → Evaporation
C) Sedimentation →Decantation → Sublimation
D) Distillation → Filtration

Answer:B

Solution:First, sublimation removes ammonium chloride; then filtration separates insoluble salt from water; finally, evaporation recovers salt from the water.

9. Which of the following can be separated by filtration?
A) Glucose in water B) Alcohol in water
C) Rice grains in water D) Acetic acid in water

Answer:C

Solution:Glucose in water: Glucose dissolves → Cannot be filtered
Alcohol in water: Alcohol mixes completely → Cannot be filtered
Rice grains in water: Rice grains are insoluble solids → Can be filtered
Acetic acid in water: Acetic acid dissolves → Cannot be filtered

10. Which mixture is separable using filter paper?
A) Lemon juice B) Sugar solution C) Muddy water D) Salt solution

Answer:C

Solution:Filtration separates insoluble solids from liquids.
Lemon juice: Mostly a solution →cannot be filtered
Sugar solution: Sugar dissolves → cannot be filtered
Muddy water: Contains insoluble particles → can be filtered
Salt solution: Salt dissolves → cannot be filtered

JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type:

11. A mixture contains sand, salt, and water. Which of the following steps are required to obtain all components separately?
A) Filtration B) Evaporation C) Sublimation D) Distillation

Answer:A,B,D

Solution:Filtration (A) :Sand is insoluble in water.
Filtration separates sand from the salt solution (salt + water).
Evaporation (B):The filtrate contains salt dissolved in water.
Evaporation removes water, leaving salt behind.
If we want pure water too, evaporation alone won't help — we'd lose water as vapor.
Distillation (D):To recover both salt and water separately, distillation is required.
Water is distilled off, leaving salt behind.
Sublimation (C):Sublimation is used for solids like naphthalene, camphor, iodine.
Salt does not sublime, so this step is irrelevant here.

12. Centrifugation is applied to separate:
A) Fat globules from skimmed milk
B) Pollen grains suspended in water
C) Sugar from sugarcane juice
D) Blood components like plasma and RBCs

Answer:A,B,D

Solution: Centrifugation uses centrifugal force to separate components of a mixture based on density differences. Heavier/denser components settle at the bottom.
A) Fat globules from skimmed milk: Correct. This is the process used to make skimmed milk, where less dense fat globules are separated.
B) Pollen grains suspended in water: Correct. The solid pollen grains are heavier than water and can be forced to the bottom of the tube.
D) Blood components like plasma and RBCs: Correct. This is a classic application. RBCs are denser than plasma and separate into distinct layers in a centrifuge.
C) Sugar from sugarcane juice: Incorrect. Sugar is dissolved in the juice, forming a solution. Centrifugation cannot separate dissolved solids; evaporation or crystallization is used.

Statement Type:

A)Both statement I and II are correct and statement II is correct explanation of statement I.
B) Both statement I and II are correct and statement II is not correct explanation
of statement I.
C)Statement I is correct and statement II is incorrect.
D) Statement I is incorrect and statement II is correct.

13. **Statement I** : Sublimation can be used to separate naphthalene from salt.
Statement II : Sublimation is the process in which a solid directly changes into vapor without passing through liquid

Answer:A

Solution:Statement II is the correct definition of sublimation. Naphthalene is a volatile solid that sublimes upon heating, while common salt (sodium chloride) does not. Therefore, when a mixture of naphthalene and salt is heated, naphthalene changes directly into vapor, which can then be cooled and collected separately, leaving the salt behind. Statement II correctly explains why the separation described in Statement I is possible.

14. **Statement I** : Filtration can be used to separate salt dissolved in water.
Statement II : Filtration is a process in which insoluble solids are separated from a liquid using a filter medium

Answer:D

Solution:

Statement I is incorrect: Salt dissolves in water to form a true solution. The salt particles are too small to be trapped by a filter paper. Filtration cannot separate a dissolved solid from a liquid. To separate salt from water, processes like evaporation or distillation are used.

Statement II is correct: It accurately defines the filtration process, which is designed to separate an insoluble solid (the residue) from a liquid (the filtrate).

Comprehension Type:

Comprehension - I

The process of separation of insoluble solid constituents of a mixture from its liquid constituents, by passing the suspension through a suitable porous material, is called filtration.

The clear liquid obtained from the suspension of an insoluble solid and a liquid by the process of filtration, is called filtrate.

The insoluble solid constituents left on the filtering material (such as strainer, muslin cloth or filter paper), when a suspension is filtered, is called residue or precipitate.

15. The process of separating insoluble solid constituents from liquid by passing the suspension through a porous material is called:
A) Sedimentation B) Decantation C) Filtration D) Evaporation

Answer:C

Solution: Filtration separates insoluble solids from liquids using a filter (porous material)

16. The clear liquid that passes through the filter paper during filtration is known as:
A) Solute B) Filtrate C) Residue D) Distillate

Answer:B

Solution:Filtrate is the clean liquid that passes through the filter paper.

17. The insoluble solid left behind on the filter paper after filtration is called:
A) Distillate B) Filtrate C) Residue D) Solvent

Answer:C

Solution:Residue is the solid left on the filter paper after filtration.

18. Which of the following can serve as a filtering material?
A) Strainer B) Muslin cloth C) Filter paper D) All of the above

Answer:D

Solution: Strainer, muslin cloth, and filter paper can all be used for filtration.

Comprehension - II

When a liquid changes into gaseous state on gentle heating, such that liquid does not boil, the process is called evaporation. The process of evaporation is employed to remove soluble solids from their solution in water. For example, if there is a common salt solution, then solid common salt can be separated by the process of evaporation.

19. When a liquid changes into the gaseous state on gentle heating without boiling, the process is called:
A) Distillation B) Sublimation C) Evaporation D) Filtration

Answer:C

Solution:Evaporation occurs slowly at any temperature below boiling point.

20. Evaporation is used to separate:
A) Insoluble solids from liquids
B) Soluble solids from their aqueous solutions
C) Two immiscible liquids
D) Volatile solids from non-volatile solid

Answer:B

Solution:Evaporation removes the liquid (solvent), leaving behind the soluble solid (solute), like salt from saltwater.

Matrix Matching Type:

21.

Column–I	Column–II
A) Filtration	1) Muddy water
B) Distillation	2) Separation of butter from curd
C) Evaporation	3) Sugar from sugar solution
D) Centrifugation	4) Pure alcohol from alcohol–water mixture

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

Solution:

A) Filtration	1) Muddy water
B) Distillation	4) Pure alcohol from alcohol–water mixture
C) Evaporation	3) Sugar from sugar solution
D) Centrifugation	2) Separation of butter from curd

22.

Column–I	Column–II
a) Residue	1) The process where a liquid changes into vapor below its boiling point
b) Filtrate	2) Potassium nitrate (from aqueous solution)
c) Non-volatile solute	3)Solid left on filter paper
d) Evaporation is	4) A transparent liquid obtained after filtration

Answer:a-3,b-4,c-2,d-1

Solution:

a) Residue	3)Solid left on filter paper
b) Filtrate	4) A transparent liquid obtained after filtration
c) Non-volatile solute	2) Potassium nitrate (from aqueous solution)
d) Evaporation is	1) The process where a liquid changes into vapor below its boiling point

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LEARNERS TASK

CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ's)

1. The process in which heavier insoluble solids settle down from a suspension is called:

   A) Evaporation B) Distillation C) Sedimentation D) Decantation

Answer:C

Solution:Sedimentation → heavier particles settle at the bottom

2. Large-scale preparation of magnesium sulfate crystals from seawater is done by:

   A) Sedimentation B) Decantation C) Filtration D) Evaporation

Answer:D

Solution:Evaporation of water → crystals remain

3. Coffee grounds are separated from brewed coffee by:

   A) Sedimentation B) Decantation C) Evaporation D) Filtration

Answer:D

Solution:Filtration → separates solid coffee grounds from liquid coffee

4. Pure water from river water containing dissolved salts is obtained by:

   A) Filtration B) Distillation C) Centrifugation D) Evaporation

Answer:B

Solution:Distillation → separates water from dissolved salts

5. Separation of plasma from blood is carried out using:

   A) Centrifugation B) Distillation C) Evaporation D) Filtration

Answer:A

Solution:Centrifugation → separates plasma from blood cell

6. Pouring off a clear liquid from a mixture without disturbing insoluble solids is

called:

A) Sedimentation B) Decantation C) Filtration D) Evaporation

Answer:B

Solution:Pouring off a clear liquid from a mixture without disturbing insoluble solids is called Decantation.

7. In a filtration process, the solid remaining on the filter paper is called:

A) Residue B) Sediment C) Filtrate D) Supernatant liquid

Answer:A

Solution:In a filtration process, the solid remaining on the filter paper is called Residue.

8. Fine particles of powdered chalk suspended in water can be separated by whirling the mixture at high speed. This process is called:

A) Sedimentation B) Filtration C) Centrifugation D) Decantation

Answer:C

Solution:Fine particles of powdered chalk suspended in water can be separated by whirling the mixture at high speed. This process is called Centrifugation.

9. The device used to separate cream from milk or plasma from blood is called:

A) Filter paper B) Residue C) Sieve D) Centrifuge

Answer:D

Solution:The device used to separate cream from milk or plasma from blood is called Centrifuge.

10. To recover potassium chloride from its aqueous solution, the suitable method is:

A) Boiling B) Evaporation C) Filtration D) Decantation

Answer:B

Solution:Evaporation $\rightarrow$ water evaporates, KCl crystals remain

JEE MAINS LEVEL QUESTIONS

1. _____ is the process of separating very fine insoluble solid particles present in a liquid quickly and effectively.

A) Sedimentation B) Decantation C) Filtration D) Centrifugation

Answer:D

Solution:Centrifugation uses high-speed spinning to separate fine particles more efficiently than filtration.

2. Which method would you use to separate chalk powder and water?

A) Distillation B) Sublimation C) Filtration D) Crystallization

Answer:C

Solution:Chalk powder is insoluble in water, so filtration works best.

3. The insoluble solid particles left on the filter paper are called:

(FA & SA- 2Marks)

A) Residue B) Filtrate C) Precipitate D) Sediment

Answer:A
Solution:In filtration, the solid trapped by the filter paper is called the residue.

4. The process of separating insoluble solid constituents from a liquid by passing the mixture through a porous material is called:
A) Evaporation B) Crystallization C) Filtration D) Decantation
Answer:C
Solution:The process of separating insoluble solid constituents from a liquid by passing the mixture through a porous material is called Filtration.

5. Choose the incorrect statement:
A) Naphthalene is a volatile solid
B) Potassium chloride is a non-volatile solid
C) Ethanol is a volatile liquid
D) Sugar is a volatile solid
Answer:D
Solution:Sugar is non-volatile and does not vaporize on heating—it decomposes.

6. The best method to separate iron filings from sand and water mixture is:
(FA & SA- 3 Marks / 4 Marks)
A) Sedimentation B) Decantation C) Filtration D) Magnetic separation
Answer:D
Solution:Magnetic separation can directly remove iron filings without needing to separate sand and water first

7. The non-volatile solid in sugar solution is:
A) Sugar B) Water C) Both A & B D) None
Answer:A
Solution:Sugar is non-volatile (does not evaporate), while water is volatile (evaporates easily).

8. The clear liquid above a settled suspension of mud in water is called:
A) Residue B) Supernatant liquid
C) Filtrate D) Sediment
Answer:B
Solution:After mud settles in water, the clear liquid above is the supernatant liquid.

9. The process by which water vapor changes into liquid is called:
(FA & SA- 5 Marks / 8 Marks)
A) Decantation B) Sublimation C) Condensation D) Evaporation
Answer:C
Solution:Condensation is the process where a gas or vapor changes into a liquid.

10. What kind of mixtures are bronze or brass?
A) Solid-Gas B) Liquid-Liquid C) Gas-Gas D) Solid-Solid
Answer:D

Solution:Bronze (copper and tin) and brass (copper and zinc) are solid solutions or alloys, which are solid-solid mixtures.

JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type:

11. Which of the following mixtures can be separated by filtration?
    A) Sand and water
    B) Sugar and water
    C) Chalk powder and water
    D) Muddy water

Answer:A,C,D

Solution:Filtration separates an insoluble solid from a liquid.
A) Sand and water: Correct. Sand is insoluble in water.
C) Chalk powder and water: Correct. Chalk powder is insoluble in water.
D) Muddy water: Correct. Mud consists of insoluble soil/silt particles.
B) Sugar and water: Incorrect. Sugar dissolves in water to form a true solution, so it passes through a filter.

12. Evaporation is suitable to separate:
    A) Salt from its aqueous solution
    B) Sugar from sugar solution
    C) Iodine from alcohol
    D) Sand from water

Answer:A,B

Solution:Evaporation is used to recover a non-volatile solute (solid) from its solution by removing the volatile solvent (liquid).
A) Salt from its aqueous solution: Correct. Salt is non-volatile and remains after the water evaporates.
B) Sugar from sugar solution: Correct. Sugar is non-volatile and remains after the water evaporates.
C) Iodine from alcohol: Incorrect. Iodine is volatile and would sublime upon heating. A better method is evaporation followed by sublimation or simply distillation to recover the alcohol.
D) Sand from water: Incorrect. Sand is insoluble, not dissolved. It is more effectively separated by filtration.

13. Decantation is used when:
    A) A heavier insoluble solid settles down
    B) You want to separate liquid from solid without filtration
    C) Two miscible liquids have different boiling points
    D) Separating fine suspended particles

Answer:A,B

Solution:Decantation relies on the settling of solids (sedimentation) and then pouring off the liquid.
A) A heavier insoluble solid settles down: Correct. This is the prerequisite for decantation (the process is sedimentation followed by decantation).
B) You want to separate liquid from solid without filtration: Correct. Decantation is a simple pouring method that doesn't require a filter.
C) Two miscible liquids have different boiling points: Incorrect. This describes the principle of distillation.
D) Separating fine suspended particles: Incorrect. Fine particles may not settle

easily, making decantation ineffective. Centrifugation or filtration would be used.

Statement Type:

A)Both statement I and II are correct and statement II is correct explanation of statement I.

B) Both statement I and II are correct and statement II is not correct explanation of statement I.

C)Statement I is correct and statement II is incorrect.

D) Statement I is incorrect and statement II is correct.

13. **Statement I** : Sublimation can be used to separate ammonium chloride from a mixture with common salt.
Statement II : Naphthalene can be separated from sand by the same process.

Answer:B

Solution:Statement I:Correct. Ammonium chloride sublimes on heating, common salt does not.

Statement II: Correct. Naphthalene also sublimes, sand does not.

Relationship: Statement II is not an explanation of Statement I; it's just another example of the same principle.

14. **Statement I** : Centrifugation can separate cream from milk.
Statement II : Sedimentation alone is sufficient to separate plasma from blood

Answer:C

Solution:Statement I: Correct. Cream is separated from milk by centrifugation in a dairy.

Statement II: Incorrect. Sedimentation by gravity is too slow and inefficient to separate plasma from blood because blood cells are colloidal in nature and don't settle quickly without high speed. In practice, a centrifuge is used.

Comprehension Type:

The process of separation of a liquid from a soluble salt solution by the evaporation of liquid and recondensation of its vapours in another vessel, is called distillation.

The pure liquid so collected from its salt solution by the combined process of distillation and condensation, is called distillate or distilled liquid.

The process of distillation is useful in obtaining pure water from the water containing dissolved impurities.

In Gulf countries, the drinking water is obtained by the distillation of a sea water.

15. The process of separating a liquid from a soluble salt solution by evaporation and condensation of vapours is called:
A) Filtration B) Evaporation C) Distillation D) Sublimation

Answer:C

Solution:Distillation involves evaporation of the liquid and condensation of vapors to

obtain pure liquid.

16. The liquid obtained after distillation and condensation is called:
A) Residue B) Filtrate C) Distillate D) Supernatant liquid

Answer:C

Solution:The purified liquid that we collect after condensation in distillation is called distillate.

17. Distillation is particularly useful for obtaining:
A) Salt from seawater
B) Pure water from water containing dissolved impurities
C) Sand from water
D) Sugar from sugar solution

Answer:B

Solution:Distillation is used to separate soluble impurities from water, especially when we need pure water.

18. In Gulf countries, drinking water is obtained from seawater using:
A) Filtration B) Sedimentation C) Decantation D) Distillation

Answer:D

Solution:Seawater contains salt (soluble impurity). To get pure drinking water, distillation (desalination) is used.

Integer type:

19. Among sugar and water, sand and water, iron filings and water, seawater, how many are solid-liquid mixtures? _____

Answer:4

Solution:Sugar and water $\rightarrow$ solid dissolved in liquid $\rightarrow$ solid-liquid mixture
Sand and water $\rightarrow$ solid suspended in liquid $\rightarrow$ solid-liquid mixture
Iron filings and water $\rightarrow$ solid suspended in liquid $\rightarrow$ solid-liquid mixture
Seawater $\rightarrow$ solid (salt) dissolved in liquid $\rightarrow$ solid-liquid mixture
All 4 are solid-liquid mixtures.

20. Among salt, sugar, sand, iodine, water, how many are non-volatile solids? _____

Answer:3

Solution:Non-volatile solid $\rightarrow$ does not vaporize easily at room temperature.
Salt $\rightarrow$ non-volatile solid
Sugar $\rightarrow$ non-volatile solid
Sand $\rightarrow$ non-volatile solid
Iodine $\rightarrow$ sublimes at room temperature (volatile solid)
Water $\rightarrow$ liquid, not solid
So: salt, sugar, sand $\rightarrow$ 3.

21. The following methods can be used for separation of solid-liquid mixtures:
A) Evaporation B) Distillation C) Sedimentation D) Sublimation E) Filtration

How many of these five methods can actually separate a solid-liquid mixture effectively? _____

Answer:4

Solution:

A) Evaporation:Works when the liquid is volatile and the solid is non-volatile (e.g., salt solution → salt left behind after water evaporates).

B) Distillation : Separates liquid from dissolved solid by boiling and condensing the liquid (e.g., salt water → pure water collected, salt left behind).

C) Sedimentation:Effective when the solid is insoluble and heavier than the liquid (e.g., sand in water → sand settles at the bottom).

D) Sublimation:Used when a solid sublimes (like naphthalene, camphor, iodine). Not applicable for separating a general solid-liquid mixture.

E) Filtration:Works when the solid is insoluble in the liquid (e.g., chalk in water → chalk retained on filter paper).

Matrix Matching Type:

22.

Column–I	Column–II
A) Filtration	1) Salt from seawater
B) Evaporation	2) Coffee grounds from coffee
C) Decantation	3) Supernatant liquid from muddy water
D) Centrifugation	4) Cream from milk
E) Sublimation	5) Ammonium chloride from salt

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

Solution:

A) Filtration	2) Coffee grounds from coffee
B) Evaporation	1) Salt from seawater
C) Decantation	3) Supernatant liquid from muddy water
D) Centrifugation	4) Cream from milk
E) Sublimation	5) Ammonium chloride from salt

KEY

				TEACHING TASK					
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
B	B	D	B	C	B	B	B	C	C
			JEE ADVANCED LEVEL QUESTIONS						
11	12	13	14	15	16	17	18	19	20
A,B,D	A,B,D	A	D	C	B	C	D	C	B
21		22							
A-1,B-4,C-3,D-2		a-3,b-4,c-2,d-1							
				LEARNERS TASK					
			CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ's)						
1	2	3	4	5	6	7	8	9	10
C	D	D	B	A	B	A	C	D	B
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
D	C	A	C	D	D	A	B	C	D
			JEE ADVANCED LEVEL QUESTIONS						
11	12	13	13	14	15	16	17	18	19
A,C,D	A,B	A,B	B	C	C	C	B	D	4
20	21	22							
3	4	A-2, B-1, C-3, D-4, E-5							