Exploring Mixtures and their Separation

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. Sulphur is:

(a) a compound **(b)** an element
(c) a heterogeneous mixture **(d)** a homogeneous mixture

2. Soda water is:

(a) a solution **(b)** a colloid
(c) a suspension **(d)** a pure substance

3. A solution is:

(a) a heterogeneous mixture
(b) a pure compound
(c) a homogeneous mixture of two or more substances
(d) an element

4. Which method is used to separate the gases in air?

(a) fractional distillation **(b)** distillation
(c) filtration **(d)** fractional distillation of liquid air

5. Which of these is a physical change?

(a) Cutting a tree into logs **(b)** Making curd from milk
(c) Cooking of food **(d)** Souring of milk

6. Butter is a colloid of the type:

(a) aerosol **(b)** emulsion **(c)** gel **(d)** sol

7. 50 g of sugar is dissolved in 775 g of water. The concentration (mass by mass percentage) is:

(a) 0.06% **(b)** 6.45% **(c)** 6.06% **(d)** 93.94%

8. Assertion (A): A solution of 60 g of salt in 775 g of water has a concentration of 7.74% by mass.
Reason (R): Mass by mass percentage = mass of solute ÷ mass of solution × 100.

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. 17.5 g of urea is dissolved in 290 g of water. Find the mass of the solution and its concentration (mass by mass percentage).

10. How much potassium nitrate and how much water are needed to make 850 g of a 4% (by mass) solution?

11. How would you separate iron filings from sulphur powder? Name the method and the property it uses.

12. What is the difference between a mixture and a compound?

13. Classify each as an element, a compound or a mixture (homogeneous or heterogeneous): sand and salt; vinegar; salt solution; methane.

14. Name the dispersed phase and the dispersing medium in pumice stone, and the type of colloid.

15. Classify as physical or chemical changes: breaking a glass; souring of milk; digestion of food; boiling of water.

16. Is fine sand stirred in water a solution, a colloid or a suspension? Will it show the Tyndall effect?

Section C — Word problems — 4 × 4 = 16 marks

17. Compare a true solution, a colloid and a suspension in terms of particle size, stability, filtration and the Tyndall effect.

18. Solution P has 20 g of sugar in 125 g of water; solution Q has 50 g of sugar in 175 g of water. (a) Find the concentration of each (mass by mass). (b) Which is more concentrated? (c) If they are mixed, what is the concentration of the mixture?

19. Describe, in order, how you would separate a mixture of chalk powder, ammonium chloride, iron filings. Name each method.

20. NCERT data: ammonium chloride dissolves to 24 g at 283 K, 37 g at 293 K, 41 g at 313 K, 55 g at 333 K, 66 g at 353 K in 100 g of water. (a) What mass is needed to make a saturated solution in 200 g of water at 353 K? (b) If this solution is cooled to 313 K, what mass of crystals separates? (c) What does this show about solubility and temperature?

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Answer key

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Q	Answer	Working
1	**(b) an element**	—
2	**(a) a solution**	it is a homogeneous mixture
3	**(c) a homogeneous mixture of two or more substances**	—
4	**(d) fractional distillation of liquid air**	—
5	**(a) Cutting a tree into logs**	no new substance is formed
6	**(c) gel**	liquid dispersed in a solid
7	**(c) 6.06%**	50 ÷ (50 + 775) × 100
8	**(d) A is false, but R is true.**	A is false: 60 ÷ 835 × 100 = 7.19% (7.74% divides by the water only). R is true.
9	**307.5 g; 5.69%**	solution = solute + solvent
10	**34 g of solute and 816 g of water**	4% of 850 g
11	**A magnet: iron is attracted by a magnet; sulphur is not.**	—
12	**In a mixture the components keep their own properties, can be in any proportion and can be separated physically. In a compound the elements are combined chemically in a fixed proportion and have new properties; they can be separated only by chemical means.**	—
13	**sand and salt: heterogeneous mixture; vinegar: homogeneous mixture; salt solution: homogeneous mixture; methane: compound**	—
14	**Dispersed phase: gas; dispersing medium: solid; solid foam**	—
15	**breaking a glass: physical; souring of milk: chemical; digestion of food: chemical; boiling of water: physical**	—
16	**A suspension; yes, its large particles scatter light (until they settle)**	—
17	**Solution: particles smaller than 1 nm, stable, pass through filter paper, no Tyndall effect. Colloid: particles about 1–100 nm, stable, pass through filter paper, show the Tyndall effect. Suspension: particles larger than 100**	—

Q	Answer	Working
	nm, unstable (settle), are left on filter paper, scatter light.	
18	**(a) P: 13.79%, Q: 22.22%. (b) Q. (c) 18.92%**	mixture: (20 + 50) ÷ (145 + 225) × 100
19	**(1) Move a magnet over the mixture to remove the iron filings; (2) Heat the mixture so that the ammonium chloride sublimes and collects on a cool funnel; (3) The chalk powder is left behind.**	—
20	**(a) 132 g. (b) 50 g. (c) The solubility of ammonium chloride decreases as the temperature falls (it increases with temperature).**	66 × 200 ÷ 100; (66 − 41) × 200 ÷ 100

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