3 Solutions, concentration, and separation – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	**Write it 3 times** (English)		
solution			
solute			
solvent			
molarity			
chromatography			
Solubility			

Recall

You have made and used solutions many times:

- Salt dissolves in water to make salt water.
- You have separated mixtures by filtering.
- Some things dissolve in water and some do not.

This sheet makes "how much is dissolved" exact, and lines up the ways to separate mixtures. Each idea has a worked example.

New ideas

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1 Solutions and concentration

A **solution** is a **solute** dissolved in a **solvent**. Its concentration is measured as **molarity**:

$$M = \frac{\text{moles of solute}}{\text{litres of solution}}.$$

Worked example. Dissolving 0.50 mol of salt in 2.0 L of water gives $M = \dfrac{0.50}{2.0} = 0.25$ M.

2 Dilution

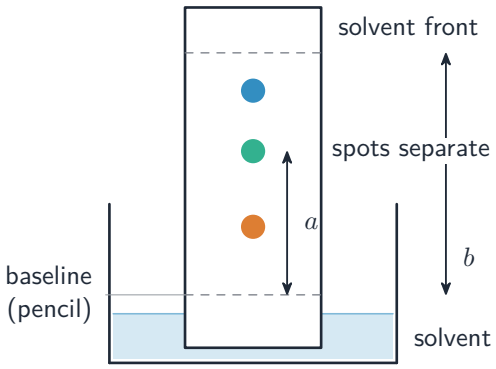
Adding solvent spreads the same moles through more volume, so the concentration drops. Because the moles do not change,

$$M_1V_1 = M_2V_2.$$

Worked example. To dilute 50 mL of 6.0 M acid to 2.0 M: $V_2 = \dfrac{M_1V_1}{M_2} = \dfrac{6.0 \times 50}{2.0} = 150$ mL, so you add $150 - 50 = 100$ mL of water.

3 Separating mixtures

Because a mixture's parts keep their own properties, physical methods separate them:



$$R_f = \frac{a}{b} = \frac{\text{spot}}{\text{solvent}}$$

- **filtration** – by particle size,
- **distillation** – by boiling point,
- **chromatography** – by how strongly each part sticks versus moves with a solvent.

4 What dissolves in what

Solubility follows the rule "**like dissolves like**": polar and ionic solutes dissolve in polar solvents (like water); non-polar solutes dissolve in non-polar solvents (like oil).

> **Watch out:** in a dilution the number of **moles of solute stays the same** – only the volume (and so the concentration) changes. That is exactly why $M_1V_1 = M_2V_2$ works.

Practice

Try these in order. The methods are all above.

2.1 Find the molarity of a solution with 0.20 mol of solute in 0.50 L of solution. [2]

2.2 You dilute 100 mL of 3.0 M solution to 1.0 M. Find the final volume. [3]

2.3 Name the separation method best suited to separating (a) sand from water, (b) two liquids with different boiling points. [2]

2.4 Explain, using "like dissolves like", why oil does not dissolve in water. [2]

2.5 State what stays constant during a dilution. [1]