

Overview of Chapter 14

- Solutions
- Concentrations:
 - Molarity
 - Molality
 - Mole fraction
- Colligative Properties
 - Freezing point depression
 - Boiling point elevation
- Osmosis

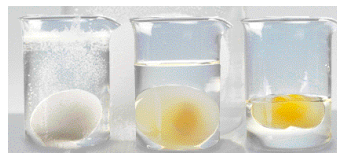
Today's questions to consider:

- What is the difference between solute and solvent?
- What is the difference between molarity and molality?
- How do you calculate mole fraction?

Today's Topics

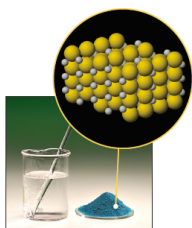
- Solutions
- Calculating concentrations
 - Molarity
 - Molality
 - Mole fraction

Solutions

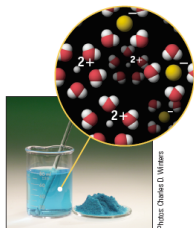


Why does a raw egg swell or shrink when placed in different solutions?

Some Definitions



A solution is a **HOMOGENEOUS** mixture of 2 or more substances in a single phase.



One constituent is usually regarded as the **SOLVENT** and the others as **SOLUTES**.

Definitions

Solutions can be classified as **saturated** or **unsaturated**.

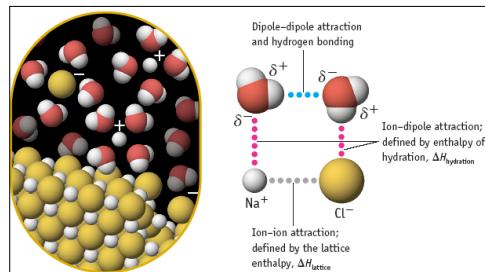
A saturated solution contains the maximum quantity of solute that dissolves at that temperature.



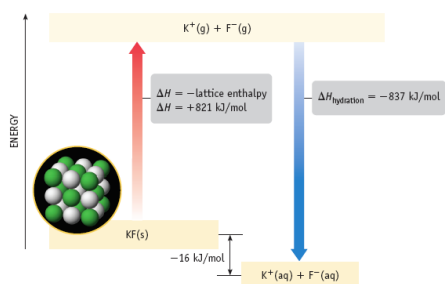
Definitions

SUPERSATURATED SOLUTIONS contain more than is possible and are unstable.

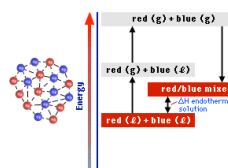
Dissolving An Ionic Solid



Energetics of the Solution Process



Energetics of the Solution Process



If the enthalpy of formation of the solution is more negative than that of the solvent and solute:
the enthalpy of solution is negative, and the solution process will be **exothermic**!

Supersaturated Sodium Acetate

Sodium acetate has an **ENDOTHERMIC** heat of solution.
 $\text{NaCH}_3\text{CO}_2(\text{s}) + \text{heat} \rightarrow \text{Na}^+(\text{aq}) + \text{CH}_3\text{CO}_2^-(\text{aq})$

Therefore, formation of solid sodium acetate from its ions is **EXOTHERMIC**.

$\text{Na}^+(\text{aq}) + \text{CH}_3\text{CO}_2^-(\text{aq}) \rightarrow \text{NaCH}_3\text{CO}_2(\text{s}) + \text{heat}$

Supersaturated sodium acetate produces heat when the ions come out of solution and form a solid.

Concentration Units

Molarity, M

$$M \text{ of solute} = \frac{\text{mol solute}}{1 \text{ L solution (total volume)}}$$

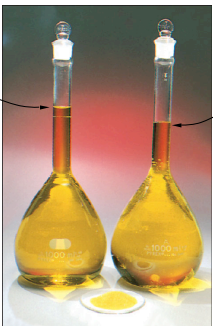
Molality, m

$$m \text{ of solute} = \frac{\text{mol solute}}{1 \text{ kg solvent}}$$

Concentration Units

Molality (m):
 $0.100\text{ m K}_2\text{CrO}_4 =$
 $19.4\text{ g K}_2\text{CrO}_4$
 $+$
 $1.00\text{ kg H}_2\text{O}$

Molarity (M):
 $0.100\text{ M K}_2\text{CrO}_4 =$
 $19.4\text{ g K}_2\text{CrO}_4$
 in
 $1.00\text{ L total volume}$



The image shows two identical volumetric flasks, each containing a yellow liquid. The flask on the left is labeled for molality, and the flask on the right is labeled for molarity. Both flasks have a small amount of yellow solid at the bottom, representing the 19.4g of K₂CrO₄. The molality flask is filled with water to the 1.00 kg mark, while the molarity flask is filled to the 1.00 L mark. The difference in liquid levels between the two flasks illustrates that the total volume of the solution is greater than the volume of the solvent alone.

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