Overview of Chapter 14

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

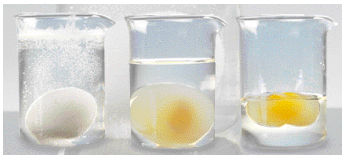
Today's questions to consider:

- 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

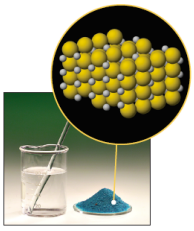
- Solutions
- Calculating concentrations
  - Molarity
  - Molality
  - Mole fraction

Solutions

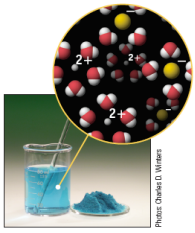


Why does a raw egg swell or shrink when placed in different solutions?

Some Definitions



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



Photos: Charles D. Winters

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

Definitions

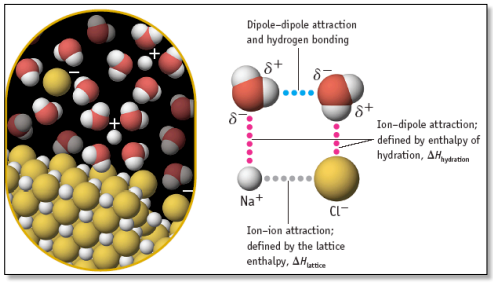
Solutions can be classified as saturated or unsaturated.

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

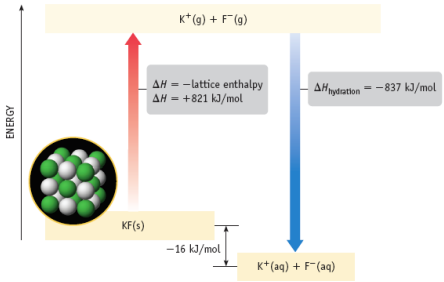
Definitions

SUPERSATURATED SOLUTIONS
contain more than is possible and are unstable.

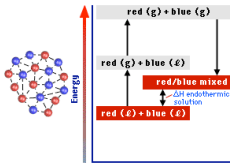
Dissolving An Ionic Solid



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.

$NaCH_3CO_2$ (s) + heat ----> Na^+(aq) + $CH_3CO_2^-$(aq)

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

Na^+(aq) + $CH_3CO_2^-$(aq) ---> $NaCH_3CO_2$ (s) + heat

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

Concentration Units

Molarity, M

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

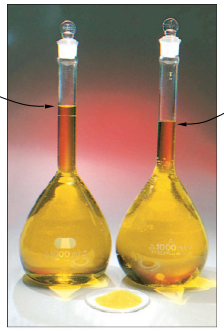
Molality, m

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

Concentration Units

Molality (m):
0.100 m K_2CrO_4 =

19.4g K_2CrO_4
+
1.00 kg H_2O



Molarity (M):
0.100 M K_2CrO_4 =

19.4g K_2CrO_4
in
1.00 L total volume

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