Ch. 8
Solutions, Acids, & Bases

I. How Solutions Form

- Definitions
- Types of Solutions
- Dissolving
- Rate of Dissolving

A. Definitions

- **Solution** – a mixture that has the same composition throughout the mixture; a homogeneous mixture

Solute - substance being dissolved *(in lesser quantity)*

Solvent – what the solute is dissolved in *(in greater quantity)*

A. Definitions

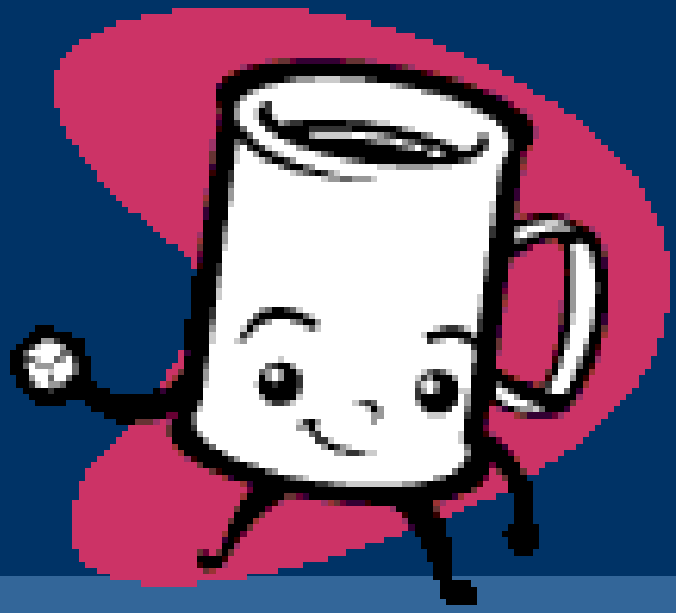
Solute - $KMnO_4$ **Solvent** - H_2O

Solutions

- Solution – a mixture that has the same composition throughout the mix.
- Remember the difference between a mixture and a compound.
  - Compounds have a fixed composition throughout.
  - Mixtures can have a variable composition throughout.

A. Definitions

- **Solubility** – The **maximum** amount of solute that can be dissolved in the solvent at a given **temperature.**

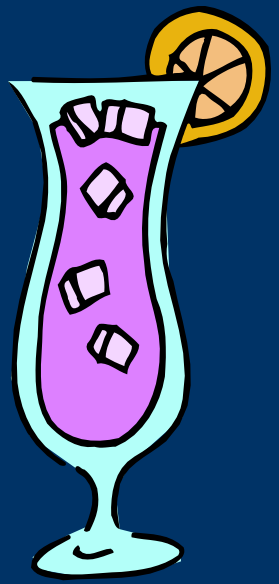


B. Types of Solutions

- **Saturated solutions** – ***maximum*** amount of solute at a given temperature.

- **Unsaturated solutions** – *less than* the maximum amount of solute at a given temperature.

- **<u>Supersaturated solutions</u>** – *more than* the maximum amount of solute at a given temperature; unstable.

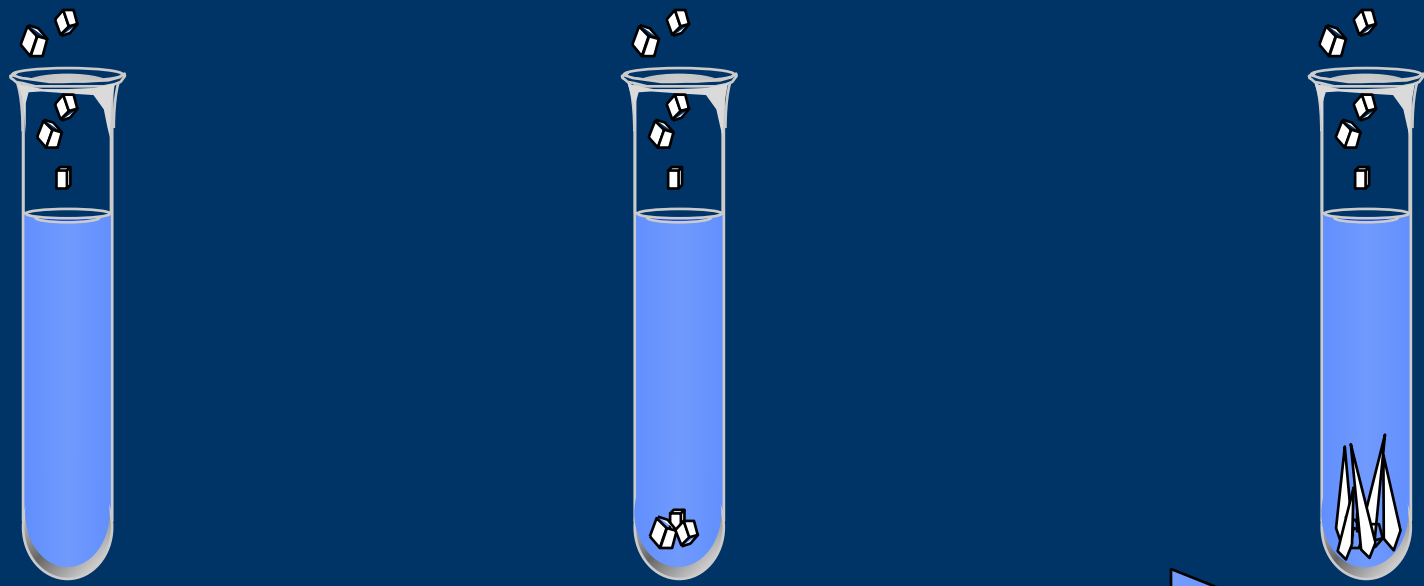


B. Types of Solutions

UNSATURATED SOLUTION
more solute dissolves

SATURATED SOLUTION
no more solute dissolves

SUPERSATURATED SOLUTION
becomes unstable, crystals form



C. Dissolving

- **Solvation**
  - occurs at the surface of the solute
  - solvent particles surround solute particles (+/- attraction)
  - solute particles are pulled into solution

D. Rate of Dissolving

- **Solids dissolve faster...**
  - more stirring
  - small particle size (increased surface area)
  - high temperature

Rate of Dissolving

To increase rate of dissolving of SOLIDS:

- Heat it

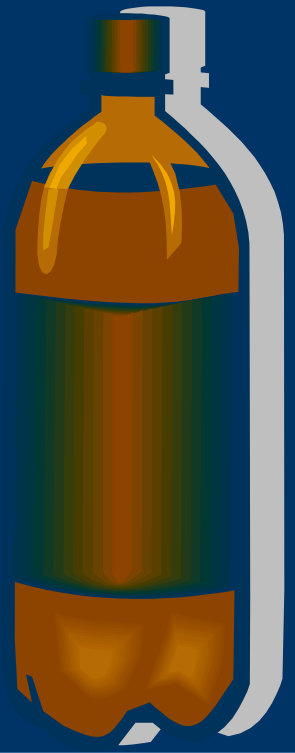
- Crush it

- Stir it

D. Rate of Dissolving

- **Gases dissolve faster...**
  - no shaking or stirring
  - high pressure
  - low temperature

- To make a gas dissolve more quickly in a liquid:
  - Cool it
  - Increase the pressure of the gas



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II. Concentration & Solubility

A. Concentration

- **% by Volume**
  - usually liquid in liquid
  - Ex: 10% juice = 10mL juice + 90mL water

- **% by Mass**
  - usually solid in liquid
  - Ex: 20% NaCl = 20g NaCl + 80g water

A. Concentration

- **Concentrated solution**
  - large amount of solute
- **Dilute solution**
  - small amount of solute

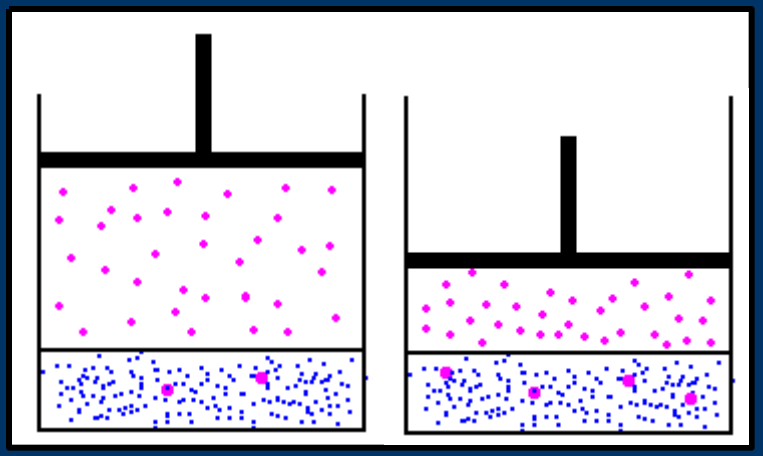
B. Solubility

- **Solubility**
  - **maximum** grams of solute that will dissolve in 100 g of solvent at a given temperature
  - varies with temperature
  - based on a saturated solution

B. Solubility

- **Solids are more soluble at...**
  - high temperatures

- **Gases are more soluble at...**
  - low temperatures
  - high pressures (Henry's Law)



C. Solubility Charts

Reading Solubility Charts

- If the number **in the problem** is EQUAL to the value on the chart the solution is considered SATURATED
- If the number **in the problem** is LESS than the value on the chart the solution is considered UNSATURATED
- If the number **in the problem** is MORE than the value on the chart the solution is considered SUPER SATURATED

C. Solubility Charts

Solubility of Compounds in g/100g of Water at various Temperatures

Compound	0° C	20° C	60° C	100° C
Ammonium chloride	29.4	37.2	55.3	77.3
Copper(II) sulfate	23.1	32.0	61.8	114
Lead(II)chloride	0.67	1.0	1.94	3.2
Potassium bromide	53.6	65.3	85.5	104
Sodium chlorate	79.6	95.9	137	204

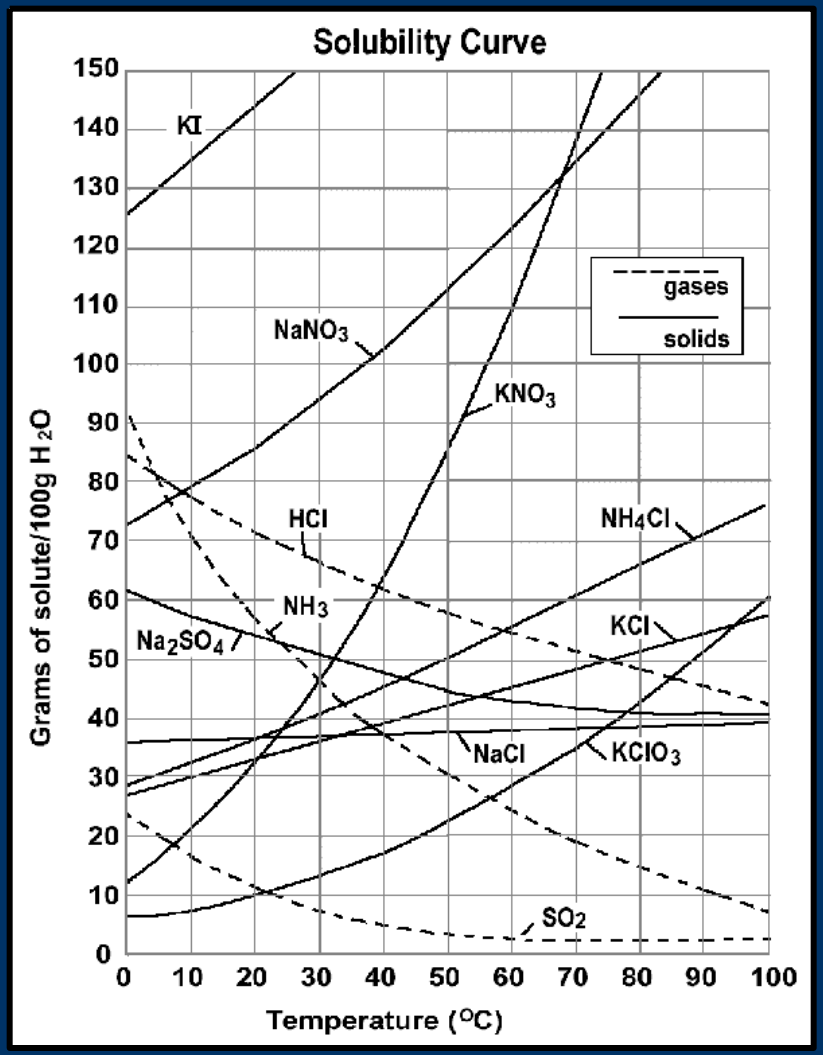
Answer Questions on your paper

- Chart

1) How would you classify a solution of 65.3g of potassium bromide at 20ºC? **Saturated**
2) How would you classify a solution of 65.3g of potassium bromide at 60ºC? **Unsaturated**
3) How would you classify a solution of 65.3g of potassium bromide at 0ºC? **Supersaturated**
4) How would you classify a solution of 37g of ammonium chloride at 20ºC? **Unsaturated**
5) How would you classify a solution of 2.5 g of lead (II) chloride at 20ºC? **Supersaturated**

D. Solubility Graphs

- **Solubility Curve**
  - shows the dependence of solubility on temperature



Graph

6) How would you classify a solution of 80g of HCl at 20ºC? **Supersaturated**
7) How would you classify a solution of 30g of KNO_3 at 20ºC? **Unsaturated**
8) How would you classify a solution of 39g of NaCl at 100ºC? **Saturated**
9) How would you classify a solution of 80g of $NaNO_3$ at 30ºC? **Unsaturated**
10) How would you classify a solution of 40g of $KClO_3$ at 80ºC? **Unsaturated**

11) How many grams of solute would you need to form a saturated solution of NH_4Cl at 50ºC? **50 g**

12) How would you classify a solution of 20g of SO_2 at 0ºC? **Unsaturated**

13) How much KI would you need to form a saturated solution at 10ºC? **135 g**

14) Which solid decreases in solubility as the temperature increases? **Na_2SO_4**