Chemistry 20	Unit 3
Lesson 3 - Concentration as a Percent	84 mins

Solubility of Ionic Compounds

Solubility Table (Data Booklet)

Ammonium sulphite	$NH^{4+}\ SO_3^{2-}$	$(NH_4)_2SO_{3\,(aq)}^{-}$
Lithium fluoride	$Li^+\ F^-$	$LiF_{(s)}$
Sodium hydroxide	$Na^+\ OH^-$	$NaOH_{(aq)}$
Niobium (III) chloride	$Nb^{3+}\ Cl^-$	$NbCl_{3(aq)}$

Percentage Concentration

$$concentration = \frac{quantity\ of\ solute}{quantity\ of\ solution} \times 100\%$$

Types
- % v/v
  Percent by volume
- % w/w
  Percent by weight

Percent by Volume

$$C_{v/v} = \frac{V_{solute}}{V_{solution}} \times 100\%$$

2L of solution of 5% v/v acetic acid
- What would be the V_{solute}?

$$C_{CH_3COOH} = \frac{V_{solute}}{V_{solution}} \times 100\%$$

$$C_{CH_3COOH} \div 100\% = \frac{V_{solute}}{V_{solution}} \times 100\% \div 100\%$$

$$\frac{C_{CH_3COOH}}{100\%} \times V_{solute} = \frac{V_{solute}}{V_{solution}} \times V_{solution}$$

$$\frac{(C_{CH_3COOH})(V_{solution})}{100\%} = V_{solute}$$

$$V_{solute} = \frac{(5\%)(2L)}{100\%} = 0.1\ L$$

Percentage by Weight

$$C_{w/w} = \frac{m_{solute}}{m_{solution}} \times 100\%$$

Eg.

0.11% w/w of flouride

$$m_{solution} = 250\ g$$

$$m_{solute} = ?$$

$$m_{solute} = \frac{(C_{w/w})(m_{solution})}{100\%}$$

$$m_{solute} = \frac{(0.11\%)(250g)}{100\%} = 0.28g$$

Eg.

$$m_{solution} = 12.0g$$

$$0.103\ mol\ of\ Ag_{(s)}$$

$$C = ??$$

$$m_{Ag} = Mn = (107.87\ g)(0.103\ mol) = 11.1061\ g$$

$$C_{w/w} = \frac{m_{solute}}{m_{solution}} \times 100\%$$

$$C_{w/w} = \frac{(11.1061\ g)}{(12.0\ g)} \times 100\% = 92.6\%$$

Eg.

$$Sol'n\ of\ HCl = 500\ mL$$

$$d = 1.50\ g/mL$$

$$n = ?$$

$$m = dV = (1.50\ g/mL)(500\ mL) = 750\ g$$

$$n = \frac{m}{M} = \frac{750\ g}{36.46\ g/mol} = 20.6\ mol$$

Extra Examples

6) $C_{w/w}$ = 25.0% $m_{sol'n}$ = 60.0 kg m_{solute} = ?? $C_{w/w} = \frac{m_{solute}}{m_{solution}} \times 100\%$ $m_{solute} = \frac{(C_{w/w})(m_{solution})}{100\%}$ $m_{solute} = \frac{(25.0\%)(60.0\ kg)}{100\%}$ $m_{solute} = 15.0\ kg = 1.50 \times 10^4\ g$	$C_{v/v}$ = 70.0% $V_{sol'n}$ = 500 mL $V_{solute} = \frac{(C_{v/v})(V_{solution})}{100\%}$ $V_{solute} = \frac{(70.0\%)(500\ mL)}{100\%}$ $V_{solute} = 350\ mL$	

Chemistry 20 - Unit 2 - Concentration as a Percent

Name: _____

You may find the following formulas useful:

$C = \frac{n}{V}$ $m = Mn$ $d = \frac{m}{V}$	$C_{v/v} = \frac{V_{solute}}{V_{solution}} \times 100\%$ $C_{w/w} = \frac{m_{solute}}{m_{solution}} \times 100\%$

1. Write dissociation formulas for each of the following compounds. Following that, predict the solubility of each compound in water.

a. Barium chloride	f. Ammonium chlorate
b. Rubidium oxalate	g. Cesium perchlorate
c. Strontium sulfate	h. Vanadium (V) carbonate
d. Iron (III) hydroxide	i. Lithium phosphate
e. Copper (I) fluoride	j. Lead (II) sulfate

2. Rubbing alcohol, $C_3H_7OH_{(l)}$, is typically sold in many drugstores as 70.0% by volume.

a. What volume of pure $C_3H_7OH_{(l)}$ is present in a 500 mL solution?

b. Under standard conditions, the density of rubbing alcohol is 0.786 g/mL. How many grams of rubbing alcohol are in a typical bottle?

c. How many moles of rubbing alcohol are in a typical bottle?

3. Hydrogen peroxide is a common disinfectant. Calculate the mass of $H_2O_{2(aq)}$ needed to make 1000 bottles of rubbing alcohol if each bottle contains 250 g of solution and the concentration by weight is 3.0%.

4. A typical 355 mL can of Coca-Cola contains 39 g of sucrose, $C_{12}H_{22}O_{11(aq)}$.

a. What chemical amount of sucrose is in a case of 24 cans of Coca-Cola?

b. Under standard conditions, the density of sucrose is 1.59 g/mL. What is the percentage concentration by volume of sucrose in 1 can of Coca-Cola?

5. A solution of sodium hydroxide has a concentration of 15.0% by volume.

a. If a beaker contains 425 mL of this solution, what volume of sodium hydroxide is present?

6. A brine solution in a home water-softening system has a salt concentration of 25.0% by mass. In grams, what mass of salt is dissolved if the tank holds 60.0 kg of solution?

7. A 0.175 kg solution contains 0.470 moles of unknown metal with a 15.0% concentration by weight.

a. In grams, what mass of metal is dissolved in the solution?

b. What is the **most likely** identity of the unknown metal?