Unit 2

Matter

Chemistry Assignments and Objectives

EQ: Why does Mrs. Dempsey's sweet tea make you cry tears of joy?

Lesson 1 – Learning Targets

1. Contrast mixtures and substances.
2. Classify mixtures as homogenous or heterogeneous.

Lesson 1 – Homework Problems

1. List three examples of substances. Explain why each is a substance.

NaCl compound Ne atom (element) CO_2 compound

They are represented with a symbol or ratio of symbols.

2. Explain the difference between a homogeneous mixture and a heterogeneous mixture. Give an example of each.

Kool-aid → Homogeneous mixture – looks like one substance

Salt/pepper → Heterogeneous mixture – different substances are visible

Lesson 2- Learning Targets

1. Distinguish between the terms saturated solution, unsaturated solution and supersaturated solution.
2. Identify the factors that affect solubility (temperature and pressure.)
3. Solve problems using a solubility graph.
4. Understand the impact of solution concentration on its physical properties. (Colligative properties.)

Lesson 2 – Homework Problems

How to Read the Solubility Chart:

1) The curve shows the # of grams of solute in a saturated solution containing 100 mL or 100 g of water (density of water = 1.00 g/mL) at a certain temperature.

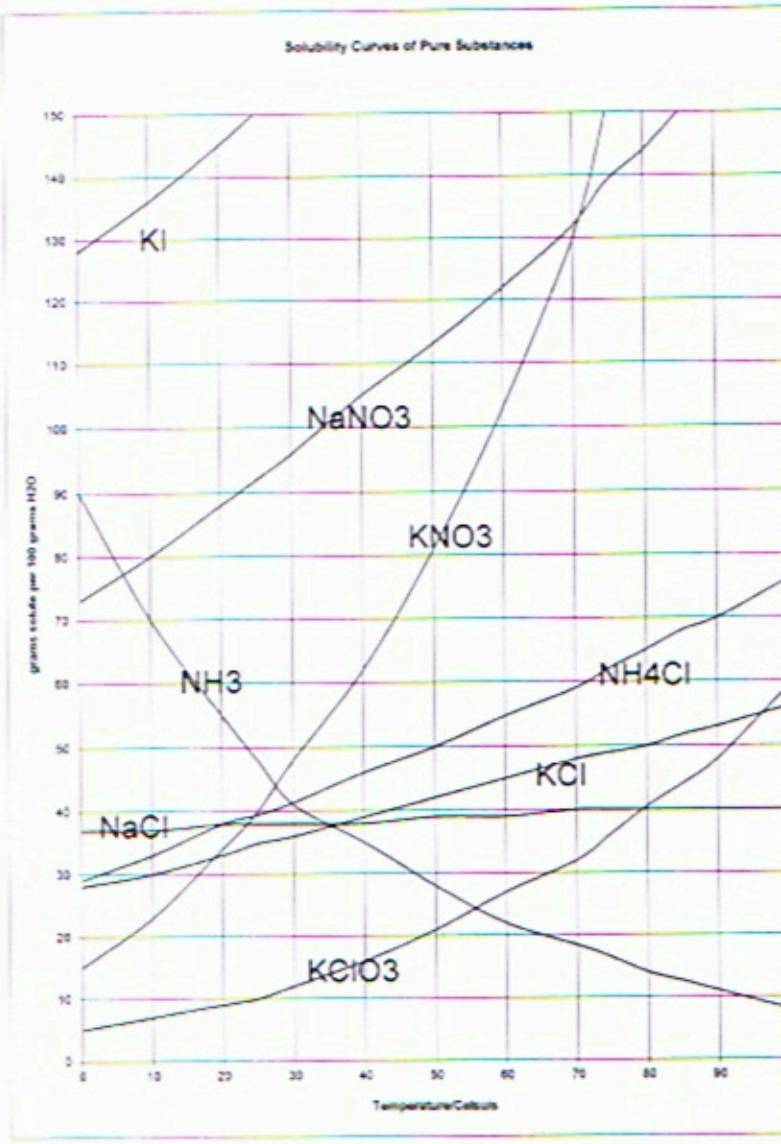
2) Any amount of solute below the line indicates the solution is unsaturated at a certain temperature

3) Any amount of solute above the line in which all of the solute has dissolved shows the solution is supersaturated.

4) If the amount of solute is above the line but has not all dissolved, the solution is saturated and the # grams of solute settled on the bottom of the container = total # g in solution – # g of a saturated solution at that temperature. (according to the curve)

5) Solutes whose curves move upward with increased temperature are typically solids because the solubility of solids increases with increased temperature.

6) Solutes whose curves move downward with increased temperature are typically gases because the solubility of gases decreases with increased temperature.



Solubility Problems to solve

1. Which of the substances shown on the graph is the most soluble in water at 10°C? KI

2. At what temperature is 90g of Na NO_3 a saturated solution in 100grams of water? 23°C

3. At 20°C, a saturated solution of $KClO_3$ is created in water. How many grams of potassium chlorate must be added to saturate the solution at 50°C? 12g

4. How many grams of NH_3 are required to saturate 250 grams of water at 70°C?
18 × 2.5 45g

5. At what temperature do saturated solutions of KNO_3 and $NaNO_3$ contain the same weight of solute per 100 mL of water? 71°C

6. What two substances have the same degree of solubility at approximately 19°C?
KCl + KNO_3

7. A saturated solution of KNO_3 is prepared at 60°C using 100.mL of water. How many grams of solute will precipitate out of solution if the temperature is suddenly cooled to 30°C? 55g

8. Thirty grams of KCl are dissolved in 100 mL of water at 45°C. How many additional grams of KCl are needed to make the solution saturated at 80°C? 20g

9. What is the lowest temperature at which 30. grams of KCl can be dissolved in 100 mL of water?
10°C

10. Are the following solutions saturated, unsaturated or supersaturated (assume that all three could form supersaturated solutions)
    a. 40. g of KCl in 100 mL of water at 80°C unsaturated
    b. 120. g of KNO_3 in 100 mL of water at 60°C supersaturated
    c. 80. g of $NaNO_3$ in 100 mL of water at 10°C Saturated

Lesson 3 – Learning Targets

1. Define molarity of a solution as moles of solute per liter of solution.
2. Solve problems using molarity.
3. Use $M_1V_1 = M_2V_2$ to calculate a new volume when diluting solutions.
4. Use molarities of solutions to understand colligative properties.

Lesson 3 – Homework Problems

1. How many moles of $CaCl_2$ would be dissolved in 1.0 L of a 0.1 M solution of $CaCl_2$?

$L \cdot M = \frac{mol}{L} \times L$

$(1.0\,L)(0.1\,M) = 0.1\,mol$

2. What is the concentration of 25 mL of solution that has 0.05 moles of solute dissolved in it?

$$M = \frac{0.05\,mol}{0.025\,L} = 2\,M$$

one s.f.

3. How many liters of water need to be added to 0.5 moles of $CaCl_2$ to make a 0.20 M solution of $CaCl_2$?

$$\frac{L \cdot M}{M} = \frac{mol}{M} \qquad L = \frac{mol}{M} = \frac{0.5\,mol}{0.2\,mol/L} = 2.5\,L$$

$= 3\,L$

4. How many mL of a 5.0 M H_2SO_4 stock solution would you need to prepare 100.0 mL of 0.25 M H_2SO_4?

$$\frac{M_1V_1}{M_1} = \frac{M_2V_2}{M_1} = \frac{(0.25\,M)(100.0\,ml)}{5.0\,M} = 5.0\,mL$$

5. If 250 mL of 0.10 M lithium acetate solution is diluted to a volume of 750 mL, what will the concentration of this solution be?

$$\frac{M_1V_1}{V_2} = \frac{M_2V_2}{V_2} = \frac{(0.10M)(250\,ml)}{750\,ml} = .033M$$

6. If 750 mL of 0.50 M sodium chloride solution is left uncovered on a windowsill and 150 mL of the solvent evaporates, what will the new concentration of the sodium chloride solution be?

$$\frac{M_1V_1}{V_2} = \frac{M_2V_2}{V_2} = \frac{(0.50M)(750\,ml)}{600\,ml} = .63M$$

7. If the concentration of a solution is 0.05 M on one side of a semipermeable membrane and 0.06 M on the other side, which way will osmosis occur? Draw a picture to represent the movement.

0.05M | .06M

→

8. Why will a raw egg with its shell removed swell in pure water, but shrivel in a concentrated salt water solution? Water moves through the membrane to even out solute concentration

9. List the following sodium chloride solutions in order of decreasing freezing point.

a. 0.12 M b. 0.03 M c. 0.23 M d. 0.01 M

d, b, a, c

Unit 2 Review

1. Using the solubility graph, what mass of ammonium chloride (NH_4Cl) will produce a saturated solution in 100 g of water at 50°C? 50g

2. Using the solubility graph, what is the maximum amount of KI that can dissolve in 300 g of water at 15°C? 140 x 3 = 420g

3. A saturated solution of KCl is made with 200 g of water at 40°C. According to the graph, how much more KCl can be dissolved if the temperature of the solution is raised to 90°C?

39 -> 53 = 14g x 2 = 28g

4. What will usually makes a substance dissolve faster in a solvent?
stirring, crushing, heating

5. Compare the amount of solute and solvent in a concentrated solution and also in a dilute solution.
Concentrated solutions have more solute per unit volume of solution compared to dilute solution

6. How many moles of solute are in 200.0 mL of a 0.30 M solution?
$M = \frac{mol}{L}$ $mol = (.200\,L)(.30\,\frac{mol}{L}) = 0.060\,mol$

7. What is the molarity of a solution containing 2.5 moles of solute in 400 mL of solution?
$M = \frac{2.5\,mol}{.400\,L} = 6.25\,M$ or $6\,M$ (sig. fig.)

8. What is the molarity of a solution that contains 3.0 moles of solute in 2.0 liters of solution?
$M = \frac{3.0\,mol}{2.0\,L} = 1.5\,M$

9. To 335 mL of a 0.500 M solution of KCl, a student adds enough water to make 1.00 L of a more dilute KCl solution. What is the molarity of the new solution?
$\frac{M_1 V_1}{V_2} = M_2 = \frac{(0.500\,M)(.335\,L)}{1\,L} = .168\,M$

10. What is the volume of 6.00 M HNO_3 needed to make 333 mL of 2.30 M HNO_3 ?
$\frac{M_1 V_1}{M_1} = \frac{M_2 V_2}{M_1} = \frac{(2.30\,M)(333\,mL)}{6.00\,M} = 128\,mL$

11. Define and give an example:
A. Substance - compound or element $CaCO_3$
B. Homogenous mixture - 2 or more substances, but looks like one (salt water)
C. Heterogeneous mixture – 2 or more substances you can see (Chex Mix)

12. Which will freeze at a lower temperature, a sodium chloride solution with a concentration of 0.5 M or 0.8 M? Explain why. 0.8 M
more particles dissolved in water requires lower temp. to freeze

13. Which will boil at a lower temperature, a solution of sodium chloride with a concentration of 0.24 M or 0.36 M? Explain why.
0.24 M
Boiling point elevation effect increases with greater concentration of solute