CHEMISTRY -- p. 511 - 519 Review worksheet

Use figures 15-16 and 15-17 along with the pages above to answer each of the following questions. Be sure to read the captions and labels with each graph.

1. Define solubility in your own words.

– grams solute / 100g solvent

2. Complete the following table which compares the factors which affect solubility of gaseous vs. solid solutes.

Factor	Gaseous solute	Solid solute
Temperature	↑ temp. ↓ sol	↑ temp ↑ sol.
Pressure	↑ press ↑ sol	no affect
Surface Area	no affect ~~↑ surf area ↑ sol.~~	no ↑ S.A ↑ sol.
Agitation	↑ agitation ↓ sol.	↑ agit. ↑ sol

3. In figure 15-16 describe the slope of the lines for these solubility curves of gaseous solutes. downward slope

4. Why do these curves follow this pattern? b/c ↑ temp causes ↓ sol.

5. Why might it be harmful to plant and animal life if a factory were to dump the water they use to cool machinery into a river while it is still hot (Hint: there are no impurities in the water)?

high temps cause decr. sol. of gases like CO_2 & O_2

6. Describe the three following solutions:

a. Saturated - contains all poss. solute for given temp.

b. Supersaturated - contains more solute than poss. for given temp.

c. Unsaturated - does not contain as much solute as poss. for given temp.

Each of the following questions pertain to figure 15-17:

7. Classify each of the solutes as solids or gases.

sol $KI, NaNO_3, KNO_3, NH_4Cl, KCl$ gas SO_2, NH_3, HCl
$NaCl, KClO_3$

8. How many grams of KI would be needed to make a saturated solution at 25°C?

~150 g

9. If the temperature of water to be used as a solvent is 45°C, what amount of HCl must be added to make a saturated solution?

60 g

10. A solution labeled as containing 30.0 g of $KClO_3$/100 g of H_2O is found at 70°C what type of solution is it?

supersat unsat

11. Explain what you would need to do to make a supersaturated solution of KNO_3?

heat dissol to sat. cool

12. A solution containing 100.0 g of dissolved $NaNO_3$/100 g of H_2O is found at 30°C. Is this a stable solution, why or why not?

unstable b/c supersat.

13. Which substance is most soluble at 10°C?

KI

14. Which substance is least soluble at 65°C?

SO_2

15. Which substance shows the least change in solubility as temperature rises?

NaCl

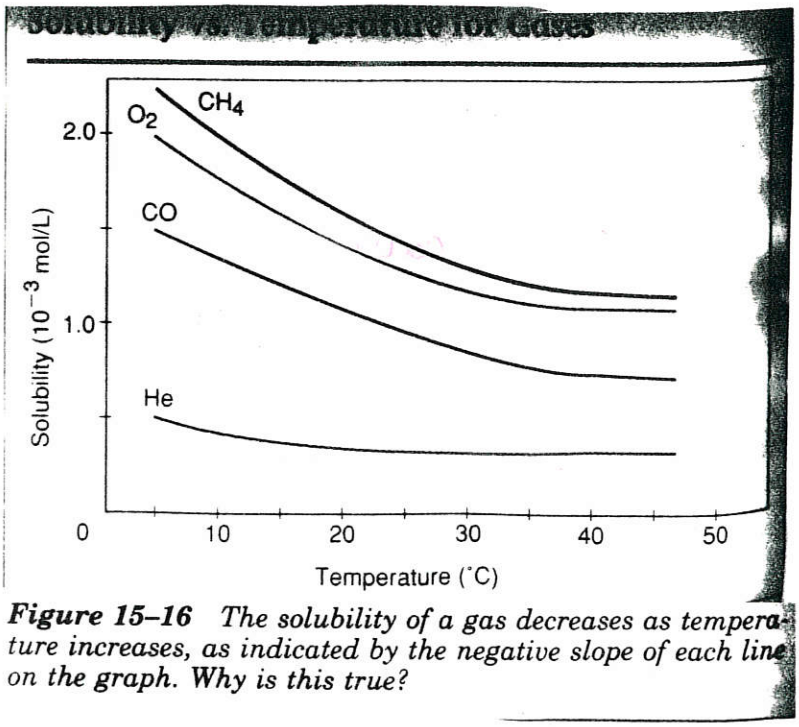

Figure 15–16 *The solubility of a gas decreases as temperature increases, as indicated by the negative slope of each line on the graph. Why is this true?*

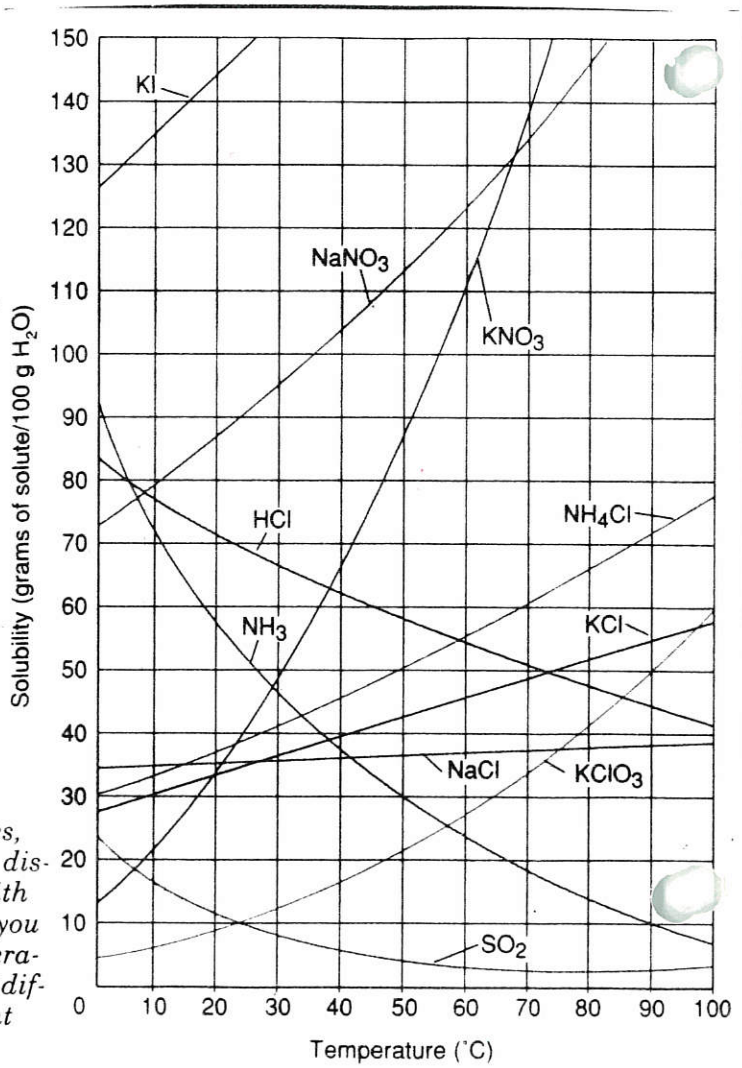

Figure 15–17 *Unlike gases, the solubility of most solids dissolved in water increases with increasing temperature. As you can see in this graph, temperature affects the solubility of different substances in different ways.*

16. What is the boiling point elevation when 311.4 g of magnesium iodide is dissolved in 200. g of water? K_b for water is 0.52 C°/m.

$311.4\text{ g } MgI_2 \times \frac{1\text{ mol}}{278.1\text{ g}} = 1.11\text{ mol}$

$200.\text{ g } H_2O = 0.200\text{ kg}$

$m = \frac{1.11}{0.2} = 5.6\text{ m}$

$\Delta T = 0.52 \times 5.6$

$\Delta T = 2.9\,^{\circ}C$

17. If 67.7 g of urea (CH_4N_2O) is dissolved in 833 g of chloroform, what is the elevation in the boiling point? K_b for chloroform is 3.85 C°/m.

$67.7\text{ g } CH_4N_2O \times \frac{1\text{ mol}}{60.0\text{ g}} = 1.13\text{ mol}$

$833\text{ g} \times \frac{1\text{ kg}}{1000\text{ g}} = 0.833\text{ kg}$

$m = \frac{1.13}{0.833} = 1.35\text{ m}$

$\Delta T = (3.85)(1.35)$

$\Delta T = 5.21\,^{\circ}C$

18. How much will the freezing point of 1050 g of benzene be lowered if 31.1 g of orcinol ($C_7H_8O_2$) is dissolved in the benzene? K_f for benzene is 5.12 C°/m.

$31.1\text{ g } C_7H_8O_2 \times \frac{1\text{ mol}}{124\text{ g}} = 0.25\text{ mol}$

$1050\text{ g} \times \frac{1\text{ kg}}{1000\text{ g}} = 1.050\text{ kg}$

$m = \frac{0.25}{1.050} = 0.24\text{ m}$

$\Delta T = (5.12)(0.24)$

$\Delta T = 1.22\,^{\circ}C$

19. What is the freezing point depression when 85.3 g of Li_2O is dissolved in 1500 g of water? K_f for water is 1.86 C°/m.

$85.3\text{ g } Li_2O \times \frac{1\text{ mol}}{29.8\text{ g}} = 2.86\text{ mol}$

$1500\text{ g} \times \frac{1\text{ mol}}{1000\text{ g}} = 1.5\text{ kg}$

$m = \frac{2.86}{1.5\text{ kg}} = 1.91\text{ m}$

$\Delta T = (1.86)(1.91)$

$\Delta T = 3.55\,^{\circ}C$