WKS
Solubility Curves & Gas Solubility

Name Key
Period _____

Part 1: Solubility Curves of Solids

1) What is solubility? List at least two factors that affect solubility.
Solubility refers to the maximum amount of solute that can dissolve in a given amount of solvent at a particular temperature. Surface area, temperature, and pressure affect solubility.

2) What type of solution contains the maximum amount of solid dissolved in it? A saturated solution.

3) What type of solution can still have more solid dissolved in it? An unsaturated solution.

4) What type of solution has *more* solid than ordinarily possible dissolved in it? A supersaturated solution.

Refer to the solubility curves in Chart H of your reference pack to answer the following questions. Show any calculations used.

5) When the temperature increases, the solubility of most solids **(increases, decreases)**

6) How many grams of **$NaNO_3$** must be dissolved in 100 g of water to form a saturated solution at 40°C?
105 g $NaNO_3$

7) At what temperature can one dissolve a maximum of **60g** of **NH_4Cl** in 100g of water. 68°C

8) If **130 g of KNO_3** are added to 100 g of water at **40°C**, ...
   a) How many grams dissolve? 65 g
   b) How many grams stay undissolved? 130 g – 65 g = 65 g

9) If one dissolves **90 g of KNO_3** in 100 g H_2O **at 60°C**, what type of solution is formed? Unsaturated

10) How many grams of NaCl could dissolve in **200 g H_2O** at 70°C?

$$\frac{x}{200\text{ g H}_2\text{O}} = \frac{40\text{ g NaCl}}{100\text{ g H}_2\text{O}} \Rightarrow x = 200\text{ g H}_2\text{O} \times \frac{40\text{ g NaCl}}{100\text{ g H}_2\text{O}} = 80\text{ g NaCl}$$

11) Describe the steps needed to make a **supersaturated** solution that contains 130g of KNO_3 all dissolved in 100 g of water at 40°C.
Dissolve 130 g KNO_3 in 100 g H_2O at T≥68°C, then slowly cool solution to 40°C, taking care not to disturb it.

   a) List a few ways one could disturb this supersaturated solution and cause the "extra" solid to crystallize.
   Add a seed crystal, "scratch" the beaker, tap the beaker, send a shock through the solution.

   b) What kind of solution remains after the crystallization occurs?
   The resulting solution has undissolved solute, so it is saturated.

Part 2: Solubility of Gases

12) When the temperature increases, the solubility of gases **(increases, decreases)**. *(Think of a soda can.)*

13) When the pressure increases, the solubility of gases **(increases, decreases)**. *(Think of a soda can.)*

Refer to the solubility curve in Chart G of your reference pack to answer the following questions:

14) How many grams of **SO_2** can be dissolved in 100 g of water at 40°C? 6 g SO_2 / 100 g H_2O

15) At what temperature can one dissolve a maximum of **60g** of **HCl** in 100g of water? 46°C

16) If **50 g of NH_3** are added to 100 g of water at **20°C**, ...

a) Is the solution saturated or unsaturated? Unsaturated since the solubility is 56 g NH_3 / 100 g H_2O.

b) If the temperature is raised to 70°C, how many grams of NH_3 will bubble out of solution?
At 70°C the solubility of NH_3 is 18 g NH_3 / 100 g H_2O, so 50 g – 18 g = 32 g NH_3 will bubble out.

Use Henry's Law to answer the following questions.

17) What is the relationship between the solubility of a gas (*S*) at a given temperature and the partial pressure of the gas (*P*) above the solution?
The solubility of a gas increases as the pressure increases—this is a direct relationship.

18) If 0.55 g of a gas dissolves in 1.0 L of water at a pressure of 20.0 kPa, how much will dissolve at 110.0 kPa?

$$\frac{S_1}{P_1} = \frac{S_2}{P_2}; \frac{0.55\ g/L}{20.0\ kPa} = \frac{S_2}{110.0\ kPa}; S_2 = \frac{(0.55\ g/L)(110.0\ kPa)}{20.0\ kPa} = \boxed{3.0\ g/L}$$

19) A gas has a solubility of 0.66 g/L at 10.0 atm. What is the pressure on a 1.0-L sample that contains 1.5 g of gas?

$$\frac{S_1}{P_1} = \frac{S_2}{P_2}; \frac{0.66\ g/L}{10.0\ atm} = \frac{1.5\ g/L}{P_2}; P_2 = \frac{(1.5\ g/L)(10.0\ atm)}{0.66\ g/L} = \boxed{23\ atm}$$