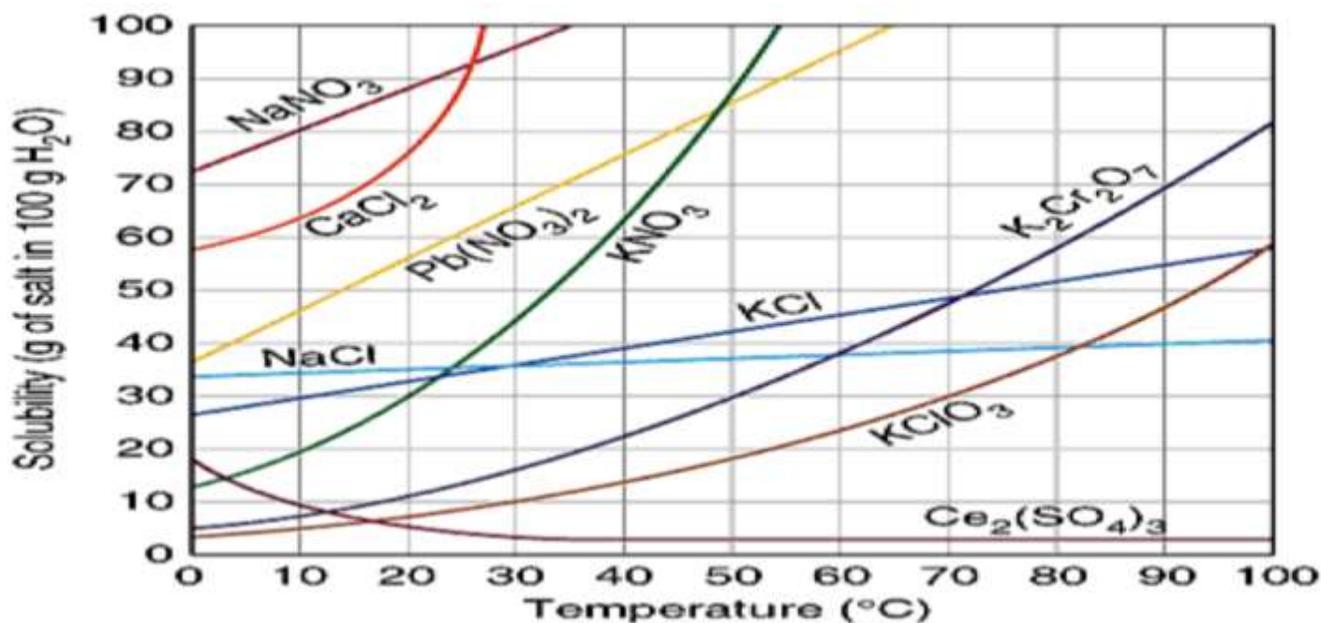


**Unit 9 Academic Chemistry Study Guide****Goals & Standards**

- I can determine the solubility of different substances.
- I can read a solubility curve and set up proportions to solve problems.
- I can perform a serial dilution.
- I can apply LeChatlier's principle when determining which direction the equilibrium shifts.
- I can write an equilibrium expression and determine if the reaction favors reactants or products.
- I can describe factors that affect reaction rates.

**Practice Problems**

1) Use the solubility curve to help your answer the following questions.



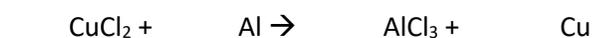
- What is the solubility of potassium chlorate at 70°C?
  - If I dissolved 50 grams NaCl in 100 grams of H<sub>2</sub>O at 10°C, is my solution saturated, unsaturated, or supersaturated? How did you know?
  - How many grams of NaNO<sub>3</sub> can I dissolve in 300 grams of water at 10°C to create a saturated solution?
- 2) How does increasing the temperature affect the solubility of solids? gases?
- 3) Describe the procedure to make a supersaturated solution.

4) If you have 3.00 g of LiOH dissolved in enough water to make a 45 mL solution, what is the molarity?

5) What mass of solute is needed to prepare 50 mL of a 0.15 M solution of H<sub>2</sub>SO<sub>4</sub>?

6) If 35 mL of 1.5 M solution is diluted to 100 mL, what is the concentration of the dilute solution?

7) If 25 mL of 0.33 M CuCl<sub>2</sub> solution reacts with excess aluminum, what is the mass of copper that will form?



8) Use the equation to answer the questions.  $3 \text{Fe(s)} + 4 \text{H}_2\text{O (g)} \rightleftharpoons \text{Fe}_3\text{O}_4 \text{(s)} + 4 \text{H}_2 \text{(g)} + \text{Heat}$

a) Predict the shift (left or right) if the amount of water is increased. \_\_\_\_\_

b) Predict the shift (left or right) if H<sub>2</sub> is removed as it is formed. \_\_\_\_\_

c) Predict the shift (left or right) if temperature is increased. \_\_\_\_\_

d) Write the equilibrium constant expression:

9) Use the equation to answer the questions.  $2 \text{H}_2\text{S(g)} + \text{Heat} \rightleftharpoons 2 \text{H}_2\text{(g)} + \text{S}_2\text{(g)}$

a) Predict the shift (left or right) if pressure is increased. \_\_\_\_\_

b) Predict the shift (left or right) if H<sub>2</sub> is added. \_\_\_\_\_

c) Predict the shift (left or right) if temperature is increased. \_\_\_\_\_

d) Predict the shift (left or right) if volume is increased. \_\_\_\_\_

e) Predict the shift (left or right) if S<sub>2</sub> is removed. \_\_\_\_\_

f) Write the equilibrium constant expression:

10) How can you tell if a reaction favors reactants or products?

## NCFE Multiple Choice Practice

1) The equation represents a chemical reaction at equilibrium.  $\text{HCl} (aq) + \text{Mg} (s) \rightarrow \text{MgCl}_2 (aq) + \text{H}_2 (g) + \text{heat}$

What happens to the system when the temperature is decreased?

- The reaction shifts toward the right, and the amount of hydrogen gas increases.
- The reaction shifts toward the right, and the amount of hydrogen gas decreases.
- The reaction shifts toward the left, and the amount of hydrogen gas increases.
- The reaction shifts toward the left, and the amount of hydrogen gas decreases.

2) This equation represents a chemical reaction at equilibrium:  $2\text{SO}_2(g) + \text{O}_2(g) \rightarrow 2\text{SO}_3(g)$

What will happen when the concentration of  $\text{SO}_3$  is increased?

- The reaction shifts to the right, and concentrations of  $\text{SO}_2 (g)$  and  $\text{O}_2 (g)$  decrease.
- The reaction shifts to the right, and concentrations of  $\text{SO}_2 (g)$  and  $\text{O}_2 (g)$  increase.
- The reaction shifts to the left, and concentrations of  $\text{SO}_2 (g)$  and  $\text{O}_2 (g)$  decrease.
- The reaction shifts to the left, and concentrations of  $\text{SO}_2 (g)$  and  $\text{O}_2 (g)$  increase.

3) Why is potassium chloride able to dissolve in water?

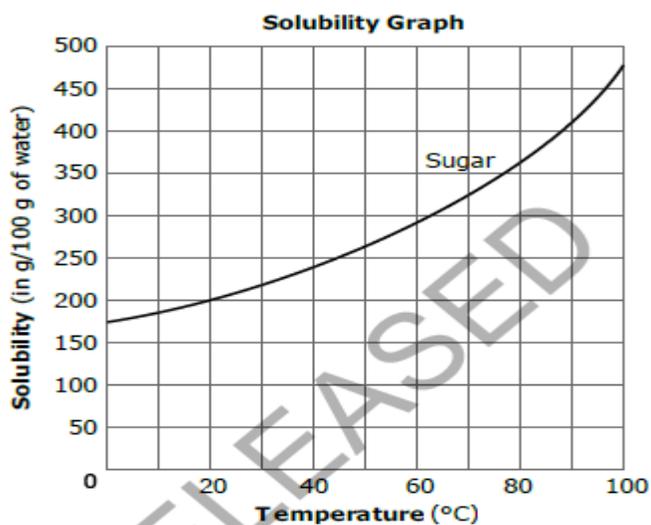
- because potassium ions are attracted to the partial negative charge of hydrogen
- because potassium ions are attracted to the partial positive charge of hydrogen
- because potassium ions are attracted to the partial negative charge of oxygen
- because potassium ions are attracted to the partial positive charge of oxygen

4) Which *best* describes electrolytic and nonelectrolyte solutions?

- Electrolytic solutions produce ions in solution, while nonelectrolytes do not produce ions in solution.
- Electrolytic solutions include alcohols and sugars, while nonelectrolytes include acids and bases.
- Electrolytic solutions are not able to conduct electricity, while nonelectrolytes are able to conduct electricity.
- Electrolytic solutions are composed of polar covalent substances, while nonelectrolytes are composed of ionic compounds.

5) The diagram to the right shows the solubility of sugar in water. A student dissolves 300 g of sugar in 100 g of water at  $80^\circ\text{C}$ . The solution is then allowed to cool to  $40^\circ\text{C}$ . The appearance of the solution does not change during the cooling. Which term accurately describes the solution at  $40^\circ\text{C}$ ?

- Suspension
- Colloid
- Supersaturated
- Unsaturated



6) The equation below represents the reaction between nitrogen gas and hydrogen gas to form ammonia.

The reaction occurs within a closed container and comes to equilibrium:  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

What expression represents the equilibrium expression for this reaction?

(answer choices are on the right)

A  $K_{eq} = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$

B  $K_{eq} = \frac{[\text{N}_2][\text{H}_2]^3}{[\text{NH}_3]^2}$

C  $K_{eq} = \frac{[\text{N}_2][\text{H}_2]}{[\text{NH}_3]}$

D  $K_{eq} = \frac{[\text{N}_2]^2[\text{H}_2]^2}{[\text{NH}_3]^3}$