Name Answer Key Hour ____

Chapter 17-18 Review

(Honors Chemistry)

1. Define all Key Terms
   - Rate
   - Collision Theory
   - Activation energy
   - Activated complex
   - Transition state
   - Catalyst
   - Inhibitor
   - Reversible Reaction
   - Chemical equilibrium
   - Equilibrium position
   - Le Chateliers Principle
   - Equilibrium Constant

2. What must happen in order for a reaction to occur according to the collision theory?

   1. Collisions
   2. Sufficient Energy
   3. Correct Orientation

3. What happens to a reaction when temperature is increased, and how does it actually affect the reaction?

   1. Particles move faster causing more collisions
   2. Kinetic Energy Increases

4. What increases the rate of a reaction? Give an example.

Increasing Temperature
Increasing Concentration
Decreasing Particle Size

5. How does a catalyst affect a reaction? Give an example. Lowers Activation Energy

Ex) Enzymes, Heat, Electricity

6. What happens to a catalyst during a reaction?

It remains unchanged

7. What does it mean when a reaction reaches a chemical equilibrium?

Rate (Forward Rxn) = Rate (Reverse Rxn)

8. What happens to the equilibrium when products are removed or added?

- Products Removed; Shifts toward product
- Product Added; Shifts toward Reactant

9. What happens to the equilibrium position when temperature is increased or decreased in an endothermic or exothermic reaction?

- Increase Temp + Shifts toward Endothermic Rxn
- Decrease Temp + Shifts toward Exothermic Rxn

10. In an equilibrium system how can you increase the yield of a product or a reactant?

Increase Product: Add Reactant, Remove Product
Increase Reactant: Add Product, Remove Reactant

11. How does an increase or decrease in volume affect the pressure in a container at equilibrium?

- Increasing Volume decreases pressure
- Decreasing Volume increases pressure

12. Given a reaction, what happens in every scenario?
    - Increase or decrease in concentration
    - Increase or decrease in temperature
    - Increase or decrease in pressure

13. Write the expression for the equilibrium constant for this reaction:

- $2N_2O_5\ (g) \Leftrightarrow 4NO_2\ (g) + O_2\ (g)$

$$\frac{[NO_2]^4 \times [O_2]}{[N_2O_5]^2}$$

- Calculate the equilibrium constant for the reaction if the concentrations are $[N_2O_5] = 0.50$ mol/L, $[NO_2] = 0.80$ mol/L, $[O_2] = 0.20$ mol/L

.33

- How would the equilibrium shift if oxygen was added to this reaction?

Left

- How would the equilibrium shift if pressure was decreased in this reaction?

Right

14. The equilibrium constant for the following reaction is 5.6. If a one liter container of N_2O_4 is 0.66- mol, what is the equilibrium concentration of NO_2? $2NO_2(g) \Leftrightarrow N_2O_4(g)$

$$[NO_2]^2 = \frac{[N_2O_4]}{5.6} = \frac{[.66]}{5.6} = .118$$

$\sqrt{.118} = .343\text{-M}$

15. Write the equilibrium expression for each of the following reactions.

a. $4NO_{(g)} + 2O_{2(g)} \Leftrightarrow 2N_2O_4\ (g)$

b. $2NO_{(g)} + Br_{2(g)} \Leftrightarrow 2NOBr\ (g)$

c. $CO_{(g)} + 2H_{2(g)} \Leftrightarrow CH_3OH\ (g)$

d. $SO_{2(g)} + NO_{2(g)} \Leftrightarrow SO_{3(g)} + NO\ (g)$

16. What effect would an increase in pressure have on the equilibrium position of each reaction?

- $4NO_{(g)} + 2O_{2(g)} \Leftrightarrow 2N_2O_4\ (g)$ Right
- $2NO_{(g)} + Br_{2(g)} \Leftrightarrow 2NOBr\ (g)$ Right
- $CO_{(g)} + 2H_{2(g)} \Leftrightarrow CH_3OH\ (g)$ Right
- $SO_{2(g)} + NO_{2(g)} \Leftrightarrow SO_{3(g)} + NO\ (g)$ NONE

17. Circle the K_{eq} value that is most favorable to product formation:

- $K_{eq} = 1 \times 10^{12}$ b. $K_{eq} = 1.5$ c. $K_{eq} = 5.6 \times 10^{-4}$ d. $K_{eq} = -21.2$

18. A liter of gas at equilibrium contains 0.18 mol H_2S, 0.014 mol H_2, and 0.035 mol S_2. Calculate the equilibrium constant for the reaction. $2H_2S_{(g)} \Leftrightarrow 2H_{2(g)} + S_{2\,(g)}$

$K_{eq} = \frac{[S_2] \times [H_2]^2}{[H_2S]^2} = \frac{[.035]^1 \times [.014]^2}{[.18]^2} =$ .000212 or 2.12×10^{-4} either is Fine

19. Write the expression for the equilibrium constant for this reaction. $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$

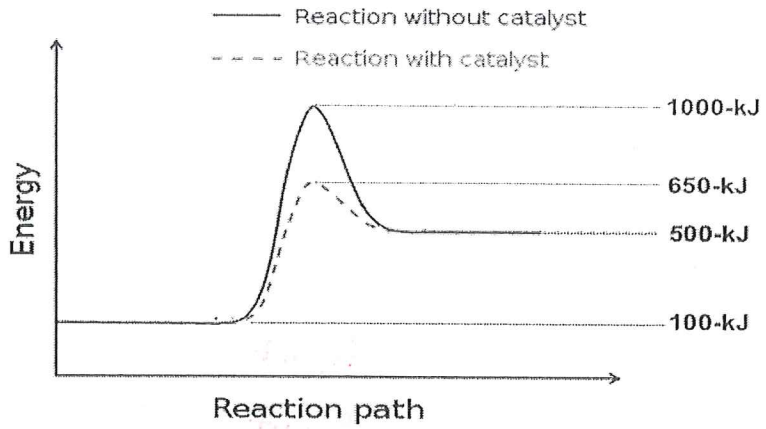
20. Calculate the equilibrium constant for the reaction at equilibrium if the concentrations are $[CO_2] = 0.552$ mol, $[H_2] = 0.552$ mol, $[CO] = 0.448$ mol, $[H_2O] = 0.448$ mol. $CO_{2(g)} + H_{2(g)} \Leftrightarrow CO_{(g)} + H_2O_{(g)}$

$\frac{[.448]^1 \times [.448]^1}{[.552]^1 \times [.552]^1}$ .66 Reactants Favored

21. Calculate the average reaction rate of the following reaction when the initial concentration of [O2]=7.4-M and the final concentration of [O2]=1.3-M. The initial time of the reaction was 5.0 seconds and the final time was 12.5 seconds. $CH_4(g) + O_2(g) \rightarrow H_2O\,(l) + CO_2(g)$

$\frac{7.4 - 1.3}{12.5 - 5.0} = \frac{6.1}{7.5} =$ .813 $\frac{mol}{L \cdot s}$

Use the graph below to answer question s 22 – 27.



22. What is the activation energy of the un-catalyzed reaction? 900 -KJ

23. What is the activation energy of the catalyzed reaction? 550 -KJ

24. How much energy is stored in the reactants? 100 -KJ

25. How much energy is stored in the products? 500 - KJ

26. What is the enthalpy change in the reaction? 400 - KJ

27. How much energy does the activated complex have during this reaction? 1000 -KJ