## **Study Guide**

## **DEFINE**

- 1. reversible reaction
- 2. chemical equilibrium
- 3. reaction to the right
- 4. reaction to the left
- 5. LeChatelier's Principle
- 6. common ion effect

## SHORT ANSWER

7. Given the fact that the *concentrations* of reactants and products are not changing, why is the word "dynamic" used for describing chemical equilibriums?

8. How do you indicate a reversible chemical reaction?

9. Why does a numerically large K<sub>eq</sub> mean that the products are favored in an equilibrium system?

10. An equilibrium system contains small and unchanging amounts of products and large amounts of reactants. What can you say about the size of  $K_{eq}$  for such an equilibrium?

11. What is meant by a stress on a reaction that is at equilibrium?

12. How does LeChatlier's Principle describe an equilbrium's response to a stress?

13. How is  $K_{eq}$  changed when heat is added to an equilibrium in which the forward reaction is exothermic?

14. How is the equilibrium disturbed when heat is added to a reversible reaction in which the forward reaction is exothermic?

15. When an equilibrium shifts to the right, what happens to the following?

- (A) the concentration of the reactants?
- (B) the concentration of the products?

16. How would each of the following affect the equilibrium of the following reaction? CO (g) +  $2H_2$  (g) <--> CH<sub>3</sub>OH (g) + heat

- (A) adding CO
- (B) cooling the system
- (C) adding a catalyst
- (D) removing CH<sub>3</sub>OH
- (E) decreasing the volume of the system
- 17. Are the relative amounts of reactant and product in a system at equilibrium 50-50? Explain.

18. Do the following describe a reaction where the reactants are favored, products are favored, or neither are favored?

- (A) K<sub>eq</sub> = .0257
- -(B) K<sub>eq</sub> = 1.0
  - (C) K<sub>eq</sub> = 2.34
- 19. At equilibrium, the rate of the forward reaction is \_\_\_\_\_\_ the rate of the reverse reaction.
- 20. List the ways to disturb a chemical equilibrium:

21. Why do chemists disturb reactions that are at equilibrium?

- 22. Describe 3 situations in which reactions go to completion:
- 23. What would happen if
  - (A) HCI was added to a solution of NaCl? Why?
  - (B) NaCl was added to a solution of K<sub>3</sub>PO<sub>4</sub>? Why?
- 24. How does the value of K<sub>eq</sub> show that a reaction reaches equilibrium very quickly?
- 25. Under suitable conditions, roughly what proportions of all chemical reactions are reversible?
- 26. The value of the K<sub>eq</sub> changes with \_\_\_\_\_ only.
- 27. How is the value of K<sub>eq</sub> determined?

## PROBLEMS

28. Calculate  $K_{eq}$  for the following equilibrium when  $[SO_3] = .016 \text{ n/L}$ ,  $[SO_2] = .0056 \text{ n/L}$ ,  $[O_2] = .0021 \text{ n/L}$ .

 $2SO_{3}(g) \iff 2SO_{2}(g) + O_{2}(g)$ 

29. Calculate the concentration of hydrogen when  $[CO_2] = .32 \text{ n/L}$ ,  $[H_2O] = .24 \text{ n/L}$ , [CO] = .28 n/L, and the K<sub>eq</sub> is 1.6 at 933K for the following reaction.

 $H_{2}(g) + CO_{2}(g) \iff H_{2}O(g) + CO(g)$ 

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