Name _____ Date _____ Class _____

CHAPTER 18 STUDY GUIDE FOR CONTENT MASTERY

Section 18.2 Factors Affecting Chemical Equilibrium

In your textbook, read about Le Châtelier's Principle.

Answer the following questions.

1. What does Le Châtelier's Principle say?
   If a stress is applied to a system at equilibrium, the system shifts in the direction that relieves the stress.

2. What are three kinds of stresses that can be placed on a system?
   Answers may vary, but should include changes in concentration, volume, and temperature. Some students may list pressure in place of volume.

For each reaction below, state the direction, left or right, in which the equilibrium will shift when the indicated substance is added. Identify one other way in which the reaction could be shifted in the same direction you indicated. (Hint: There may be more than one way to do this.)

3. Reaction: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$; NH_3 added
   left; remove N_2 or H_2

4. Reaction: $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$; H_2 added
   right; add I_2 or remove HI

5. Reaction: $CO(g) + H_2O \rightleftharpoons CO_2(g) + H_2(g)$; H_2O added
   right; add CO or remove CO_2 or H_2

6. Reaction: $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$; SO_3 added
   left; remove SO_2 or O_2

7. Reaction: $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$; SO_2 added
   right; remove SO_3

8. Reaction: $2NCl_3(g) \rightleftharpoons N_2(g) + 3Cl_2(g)$; NCl_3 added
   right; remove N_2 or Cl_2

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CHAPTER 18 STUDY GUIDE FOR CONTENT MASTERY

Section 18.2 *continued*

In your textbook, read about factors affecting chemical equilibrium.

Use each of the terms below just once to complete the passage.

right	exothermic	increase	stress	catalyst	energy
smallest	change	reverse	constant	forward	

When you decrease the volume of a reaction vessel, you **(9)** increase the pressure. This causes a reaction at equilibrium to shift to the side with the **(10)** smallest number of moles. If the reaction has an equal number of moles of reactants and products, changing the volume of the reaction vessel causes no **(11)** change in the equilibrium.

Changing the temperature of a reaction at equilibrium alters both the equilibrium **(12)** constant and the equilibrium position. When a reaction is **(13)** exothermic, which means it releases energy, lowering the temperature shifts the equilibrium to the **(14)** right because the forward reaction liberates heat and removes the **(15)** stress.

A **(16)** catalyst speeds up a reaction by lowering the **(17)** energy requirements for the reaction, but it does so equally in both the **(18)** forward and the **(19)** reverse directions. The reaction will reach equilibrium more quickly, but with no change in the amount of product formed.

For each reaction below, indicate in which direction the equilibrium shifts when the stated stress is applied to the system. Write *R* if the reaction shifts to the right, *L* if it shifts to the left, or *NC* if there is no change.

	Reaction	Stress
L	**20.** $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g) + \text{heat}$	temperature increase
NC	**21.** $CO(g) + Fe_3O_4(s) \rightleftharpoons CO_2(g) + 3FeO(s)$	volume increase
R	**22.** $C_2H_2(g) + H_2O(g) \rightleftharpoons CH_3CHO(g) + \text{heat}$	temperature decrease
R	**23.** $2NO(g) + H_2(g) \rightleftharpoons N_2O(g) + H_2O(g) + \text{heat}$	volume decrease
L	**24.** $\text{Heat} + H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$	temperature decrease
NC	**25.** $H_2(g) + Cl_2(g) \rightleftharpoons 2HCl(g) + \text{heat}$	volume decrease