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**POST-LAB REPORT #4**

**EQUILIBRIUM AND LA CHATELIER’S PRINCIPLE**

**PART A: Study of the Weak-Acid Equilibrium:**

(aq) + (l) ⇌ (aq) + (aq)

**yellow/orange               red**

1. When adding sodium sulfate solution, how did the color of the equilibrium mixture change? **red to yellow/orange**

a. The color change indicated a shift in the point of equilibrium. In which direction did the equilibrium shift? (L) left     (R) right       (N) no change

b. Explain your answer to question 1a. You should indicate which ion was added to or removed from the equilibrium mixture.

When adding , equilibrium will shift left due to the excess of ions added. It is necessary to reduce the excess and form new ions to re-establish equilibrium.

2. When adding sodium hydrogen sulfate crystals, how did the color of the equilibrium mixture change? **yellow to red**

a. The color change indicated a shift in the point of equilibrium. In which direction did the equilibrium shift? (L) left      (R) right       (N) no change

b. Explain your answer to question 2a. You should indicate which ion was added to or removed from the equilibrium mixture.

When adding , equilibrium will shift right due to the excess of ions added, which will react with water to establish equilibrium.

3. Upon heating in which direction is the equilibrium shifting?

(L) left      (R) right      (N) no shift

4. Upon cooling in which direction is the equilibrium shifting?

(L) left       (R) right      (N) no shift

5. Is the forward reaction A. endothermic B. exothermic C. insufficient info

6. Explain your answers to questions 3, 4, and 5.

Heat is added into products, hence generating energy to create more reactants. This indicates that equilibrium shifts to the left. Per cooling, the system is being forced to release energy which means a right-shift to re-establish equilibrium.

**PART B: Study of Equilibrium on Solubility:**

(s) ⇌ (aq) + 2 (aq)

**cloudy               clear (pink)**

7. When adding concentrated hydrochloric acid, how did the appearance of the equilibrium mixture change? **cloudy to clear pink**

a. The change in appearance indicated a shift in the point of equilibrium. In which direction did the equilibrium shift?

(L) left     (R) right      (N) no shift

b. Explain your answer to question 7a. You should indicate which ion was added to or removed from the equilibrium mixture.

As HCl is added, the ions and are added which help to form water molecules with . Because some substances in the product are consumed, equilibrium is re-established by shifting to the right.

8. When adding EDTA, how did the appearance of the equilibrium mixture change? **cloudy to clear pink**

a. The change in appearance indicated a shift in the point of equilibrium. In which direction did the equilibrium shift? (L) left      (R) right      (N) no shift

b. Explain your answer to question 8a. You should indicate which ion was added to or removed from the equilibrium mixture.

As EDTA binds with to create a Mg-EDTA complex, some substances in the product are consumed. Equilibrium needs to shift to the right.

9. Upon heating in which direction is the equilibrium shifting?

(L) left      (R) right      (N) no shift

10. Upon cooling in which direction is the equilibrium shifting?

(L) left      (R) right      (N) no shift

11. Is the forward reaction A. endothermic  B. exothermic   C. insufficient info

12. Explain your answers to questions 9, 10, and 11.

After heated, it is observed that more solids in the mixture are generated, hence indicating more reactants formed. This means that equilibrium has shifted to the left. Exothermic reaction is favored when the temperature drops, releasing heat into the surrounding. Since heat is produced on the products side of the reaction, the system has released energy, which means the forward reaction is exothermic.

**PART C: Study of Equilibrium of Two Complex Ions:**

(aq) + 6 (l) ⇌ (aq) + 4 (aq)

**blue                                        pink**

13. When adding silver nitrate solution, how did the color of the equilibrium mixture change? **blue to pink**

a. The color change indicated a shift in the point of equilibrium, in which direction did the equilibrium shift?

(L) left      (R) right      (N) no shift

b. Explain your answer to question 13a. You should indicate which ion was added to or removed from the equilibrium mixture.

As AgN is added, the ions and are added. The silver ion will react with in the products to create a solid. Since is removed from the product side, equilibrium shifts right.

14. When adding hydrochloric acid, how did the color of the equilibrium mixture change? **pink to blue**

a. If a color change indicated a shift in the point of equilibrium. In which direction is the equilibrium shifting?

(L) left      (R) right      (N) no shift

b. Explain your answer to question 14a. You should indicate which ion was added to or removed from the equilibrium mixture.

As HCl is added, the ions and are added, thus adding excess of in the product. As the concentration of product increases, equilibrium needs to shift left to maintain the concentration.

15. When adding deionized water, how did the color of the equilibrium mixture change? Explain this observation.

**blue to pink** - Water is added into the reactant; therefore, equilibrium will shift to the product side, hence observing a color change to pink.

16. Upon heating in which direction is the equilibrium shifting?

(L) left      (R) right      (N) no shift

17. Upon cooling in which direction is the equilibrium shifting?

(L) left      (R) right      (N) no shift

18. Is the forward reaction A. endothermic  B. exothermic  C. insufficient info

19. Explain your answers to questions 16, 17, and 18.

Upon heating, it is observed that the mixture went from the color of pink rose to blue-ish at the bottom. This indicates that equilibrium has shifted to the left. Heat added comes from the product side which means that the system released heat, making this an exothermic reaction. Upon cooling, it changes from blue-ish color back to pink rose, making equilibrium shifting to the right.

**PART D: Study of the Equilibrium:**

(aq) + (aq) ⇌ (aq)

**pale yellow                       red**

20. Which reagent(s) did you use to enhance the formation of  (aq)? Why?

The reactant in the form of KSCN was added on the product side; therefore, producing more products means a left-shift for equilibrium.

21. Indicate which ion was added to or removed from the equilibrium mixture, based on the reagent(s) you chose in question 20.

was added.

22. Which reagent(s) did you use to enhance the formation of  (aq)? Why?

As EDTA was added, Fe-EDTA complex will be formed and thus consuming some reactants. Since there is less reactant now, the reaction will shift to the left, thus enhancing the formation of .

23. Indicate which ion was added to or removed from the equilibrium mixture, based on the reagent(s) you chose in question 22.

was removed and EDTA was added.

24. Upon heating in which direction is the equilibrium shifting?

(L) left      (R) right      (N) no shift

25. Upon cooling in which direction is the equilibrium shifting?

(L) left      (R) right      (N) no shift

26. Is the forward reaction A. endothermic  B. exothermic  C. insufficient info

27. Explain your answers to questions 24, 25, and 26.

As additional reactants are created as a result of heating that raises the temperature, the equilibrium shifts to the left. As the temperature drops, the equilibrium shifts to the right as fewer products form. In the forward reaction, is formed with energy is released so this reaction is exothermic.

Consider the following reaction and situations 1 through 10. In the spaces provided, clearly indicate the best response to each situation.

**A. increase        C. no change        E. shift right**

**B. decrease       D. shift left            F. cannot be determined**

**C (s) + (g) ⇌ CO (g) + (g)  ΔH > 0**

1. What will be the effect upon the equilibrium if the pressure on the system is increased? **D**

2. What will be the effect upon the concentration of CO if the concentration of  is decreased? **A**

3. What will be the effect upon the equilibrium if the concentration of H2 is decreased? **E**

4. What will be the effect upon the concentration of  if the concentration of H2 is increased? **A**

5. What will be the effect upon the equilibrium if  is removed and more C is added? **E**

6. What will be the effect upon the concentration of  if the amount of C is increased? **A**

7. What will be the effect upon the equilibrium if the temperature and the concentration of  increases? **F**

8. What will be the effect upon the concentration of CO if the temperature is increased? **A**

9. What will be the effect upon the equilibrium if the concentration of  is decreased and CO is increased? **D**

10. What will be the effect upon the equilibrium if a catalyst is added? **C**