Chapter 14/15 Chemistry Test

Multiple Choice: Select the best answer

1. Consider the reaction:

$$CaCl_2(s) + 2H_2O(g) \rightleftharpoons CaCl_2 \cdot 2H_2O(s)$$
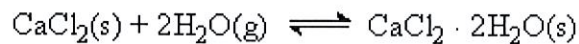
The equilibrium constant for the reaction as written is

A) $K = \dfrac{[CaCl_2 \cdot 2H_2O]}{[CaCl_2][H_2O]^2}$

B) $K = \dfrac{1}{[H_2O]^2}$

C) $K = \dfrac{1}{2[H_2O]}$

D) $K = [H_2O]2$

E) $K = \dfrac{[CaCl_2 \cdot 2H_2O]}{[H_2O]^2}$

2. Consider the following equilibrium:

$$H_2(g) + I_2(s) \rightleftharpoons 2HI(g) \quad \Delta H = +68.0 \text{ kJ/mol}$$
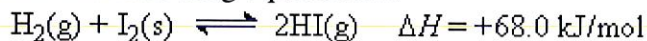
The proper K_{eq} expression is:

A) $\dfrac{[H_2][I_2]}{[HI]}$ **B)** $\dfrac{\sqrt{([H_2][I_2])}}{[HI]^2}$ **C)** $\dfrac{[HI]}{\sqrt{([H_2])}}$ **D)** $\dfrac{[HI]^2}{[H_2][I_2]}$ **E)** $\dfrac{[HI]^2}{[H_2]}$

3. Which of the following is true for a system whose equilibrium constant is relatively small?
   A) It will take a short time to reach equilibrium.
   B) It will take a long time to reach equilibrium.
   C) The equilibrium lies to the left.
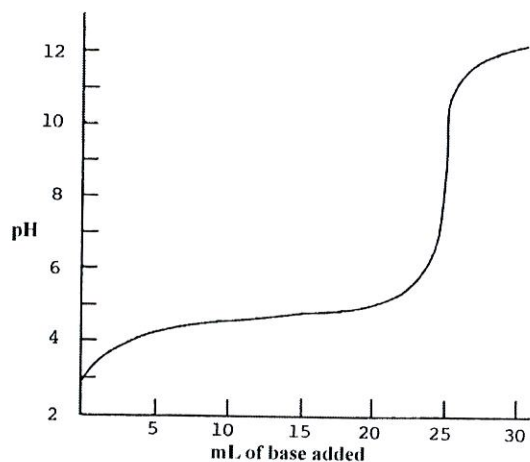   D) The equilibrium lies to the right.
   E) Two of these.

4. Equilibrium is reached in chemical reactions when:
   A) the rates of the forward and reverse reactions become equal.
   B) the concentrations of reactants and products become equal.
   C) the temperature shows a sharp rise.
   D) all chemical reactions stop.
   E) the forward reaction stops.

5. Which of the following is a conjugate acid/base pair?

    A) HCl/OCl–   **D)** OH– / H_3O+

    B) $H_2SO_4/SO_4{}^{2+}$ **E)** none of these

    C) $NH_4{}^+/NH_3$

6. The equilibrium constants (K_a) for HCN and HF in H_2O at 25°C are 6.2×10^{-10} and 7.2×10^{-4}, respectively. The relative order of **strengths** is:

    A) HF > H_2O > HCN   **D)** HF > HCN > H_2O

    B) H_2O > HF > HCN   **E)** none of these

    C) HCN> HF > H_2O

7. Calculate the [H+] in a solution that has a pH of 11.70.

    A) 2.3 M   **D)** 2.0×10^{-12} M

    B) 11.7 M   **E)** none of these

    C) 5.0×10^{-3} M

8. The pH of a solution at 25°C in which [OH–] = 3.4×10–5 M is:

A)4.5   **B)** 10.5   **C)** 9.5   **D)** 6.3   **E)** none of these

9. Which of the following is **not true** for a solution at 25°C that has a hydroxide concentration of 2.5×10^{-6} M?

    A) $K_w = 1 \times 10^{-14}$

    B) The solution is acidic.

    C) The solution is basic.

    D) The [H] is 4×10^{-9} M.

    E) The K_w is independent of what the solution contains.

10. The pH of a 0.100 M solution of an aqueous weak acid (HA) is 3.20. The K_a for the weak acid is:

A)6.3×10^{-4} **B)** 7.2×10^{-5} **C)** 4.0×10^{-6} **D)** 3.2   **E)** none of these

12. A 0.400-g sample of NaOH(s) is added to enough water to make 250.0 mL of solution. The pH of this solution is:

A) 12.000 **B)** 1.398 **C)** 2.000 **D)** 12.602 **E)** none of these

13. The dihydrogenphosphate ion, $H_2PO_4^-$, is amphoteric its conjugate acid and conjugate base would look like what, respectively:

A) H_3PO_4, PO_4^{3-}

B) H_3PO_4, HPO_4^{2-}

C) $H_2PO_4^-$, HPO_4^{2-}

D) HPO_4^{2-}, PO_4^{3-}

E) HPO_4^{2-}, H_3PO_4

Essays: Show all work and circle answer when applicable

14.

a. Calculate the pH of a 0.15 M solution of HF given the $K_a = 5.6 \times 10^{-10}$

b. What is the percent ionization of HF above?

c. Using the K value given above. Graph the equilibrium for the reaction. Label your axis and your product and reactants.

15. Circle the Lewis Acids and Box the Lewis Bases

PF_3 BF_3 NH_3 SO_2

16. Write a reaction for Sulfuric acid reacting with water. Label the **acid, base, conjugate acid, and conjugate base.**

17. Answer the questions using the titration curve.

a.　　　　Place a dot (•) on the curve at the equivalence point.

b.　　　　The pH at the equivalence point is _____

c. Based on the curve above how would you set up this experiment? Circle the correct choices in diagram below accordingly.

Burette contents: (circle one of each)

STRONG / WEAK

ACID / BASE

Flask contents: (circle one of each)

STRONG / WEAK

ACID / BASE