CHEM. 111
Spring 2006   NAME_____ _____
100 points   last   first
                                    EXAM 4
Significant Figures must be correct. All set-ups must be shown or no credit will be given.
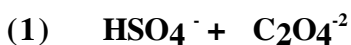**1.** (4 points) **Write the conjugate acid for each of the following:**

a. HCO_3^{1-} _____ b. H_2O _____

2. (4points) **Write the conjugate base for each of the following:**

a. HPO_4^{-2} _____ b. H_2O _____

3. (4points) **a) Write Bronsted acid-base equilibrium equations for the following:**

          b) Show the acid-base conjugated species, labeling all species

    (1) $HSO_4^- + C_2O_4^{-2}$

    (2) $HPO_4^{-2} + NH_4^+$

4.   (8 points)   **Calculate the pH of the following solutions**

    a. a solution with a $[H_3O^+] = 5.9 \times 10^{-9}$ _____
    setup:

      Is this solution acidic or basic?_____

    b. a solution with a $[OH^-] = 3.8 \times 10^{-3}$ _____
    setup:

      Is this solution acidic or basic?_____

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5. (6points)   **Calculate the hydronium ion concentration of the following solutions**

    a.   **a solution with a [OH⁻] = 9.8 X 10⁻⁹** _____
    setup:

    b.   **a solution with a pOH = 9.35** _____
    setup:

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6. (3 points)   **Is the following a Lewis acid or Lewis base or neither?**

    a.   **BBr₃** _____

    Explain
    briefly:_____

    _____

7. (12 points)   **Consider the reaction at equilibrium:**
        $H_2{}_{(g)}$ + $CO2_{(g)}$ Δ $H_2O_{(g)}$ + $CO_{(g)}$ $\Delta H = + 41$ KJ
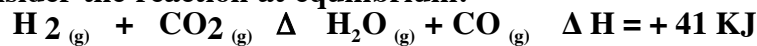
    Predict the effect of the following changes. Would the changes cause the net reaction to go to
    the right, left, or no effect?

    a)   Adding carbon dioxide gas_____

    b)   Decreasing the volume of the container_____
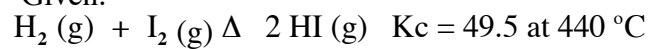
    c)   Increasing the temperature_____

    d)   Removing some CO _____

    e)   Adding a catalyst_____

    f)   Increasing the pressure _____

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8. (14 points)   Given:

$$H_2 (g) + I_2 (g) \rightleftharpoons 2\ HI (g) \quad K_c = 49.5 \text{ at } 440\ ^\circ C$$

0.200 moles each of hydrogen and iodine gas were added to a 5.00 liter container. Calculate the equilibrium concentrations.

ANSWER_____

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9. (12 points)   The decomposition of $COCl_2$ is:

$$COCl_2 \text{ (g)} \quad \Delta \quad CO \text{ (g)} + Cl_2 \text{ (g)}$$

If 3.00 moles of $COCL_2$ are placed in a 2.00 L container and 45.0 % is decomposed before equilibrium is esatblished at 20 °C

a) Calculate the equilibrium constant, K_c

ANSWER_____
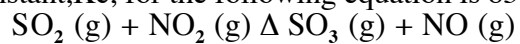
b) Calculate the equilibrium constant, K_p

ANSWER_____

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10. (10 points) Calculate the pH of 0.260 M pyridine, $C_6H_5NH_2$, given: $K_b = 3.8 \times 10^{-10}$

Answer_____

/10

11. (16 points) The equilibrium constant, Kc, for the following equation is 85.0 at 460 °C:

$$SO_2 (g) + NO_2 (g) \Delta SO_3 (g) + NO (g)$$

If .250 moles of SO_2, 0.250 moles of NO_2, 0.150 moles of SO_3 and 0.150 moles NO are placed in a 0.500 - Liter container:

a. Will be the net-reaction be to the right or left to obtain equilibrium. Show calculation.

ANSWER_____

b. What will be the concentration of each species at equilibrium?

ANSWER_____
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12. (10 points)A .012 M solution of nicotinic acid (niacin) $HC_6H_4NO_2$ has a pH of 3.39. What is the Ka for nicotinic acid?

Answer_____

What is the percent ionization for the above solution of Nicotinic acid?

Answer_____

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