



**GENERAL CHEMISTRY 2  
SECOND EXAM**

**Name** \_\_\_\_\_

**Panthersoft ID** \_\_\_\_\_

**Signature** \_\_\_\_\_

**Part 1** \_\_\_\_\_ (20 points)

**Part 2** \_\_\_\_\_ (30 points)

**Part 3** \_\_\_\_\_ (30 points)

**TOTAL** \_\_\_\_\_ (80 points)

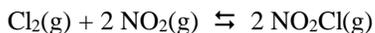
**Do all of the following problems. Show your work.**

**Part 1. Multiple choice.** Circle the letter corresponding to the correct answer. There is one and only one correct answer per problem. [4 points each]

1) Which of the following general classes of substances does not appear in the expression for the equilibrium constant for a reaction?

- a) pure solids
- b) solvents
- c) solutes
- d) both a and b
- e) both b and c

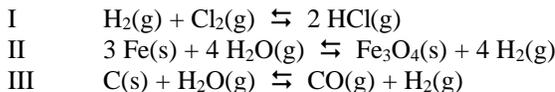
2) For the chemical reaction



$K_C = 1.8$  at a temperature  $T$ . For a particular set of starting conditions and the same temperature  $Q_C = 0.040$ . As the system approaches equilibrium, which of the following will occur?

- a) The moles of  $\text{NO}_2\text{Cl}(\text{g})$  will increase
- b) The moles of  $\text{Cl}_2(\text{g})$  will increase
- c) The moles of  $\text{NO}_2(\text{g})$  will increase
- d) Both b and c
- e) None of the above

3) Consider the following three reactions



For which of the above reactions will the numerical value for  $K_C$  and  $K_p$  be equal?

- a) Reaction I only.
- b) Reaction II only.
- c) Reaction III only.
- d) Both reaction I and reaction II
- e) Both reaction I and reaction III

4) Which of the following hydroxide compounds is a strong soluble base?

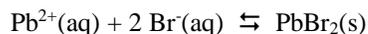
- a) KOH (potassium hydroxide)
- b) AgOH (silver hydroxide)
- c)  $\text{Ni}(\text{OH})_2$  (nickel II hydroxide)
- d) Both a and b
- e) Both a and b and c

5) The conjugate base of the  $\text{HSO}_4^-$  anion (hydrogen sulfate anion) is

- a)  $\text{H}_2\text{SO}_4$
- b)  $\text{HSO}_4^-$
- c)  $\text{SO}_4^{2-}$
- d)  $\text{H}_3\text{O}^+$
- e)  $\text{OH}^-$

**Part 2. Short answer.**

1) Give the expression for  $K_C$  for the following chemical reaction [4 points]



2) Consider the following chemical reaction



A system at constant volume containing CO, H<sub>2</sub>, and H<sub>2</sub>CO is initially at equilibrium. For each of the following changes to the system indicate whether the number of moles of H<sub>2</sub>CO in the system will increase, remain the same, or decrease as the system returns to equilibrium. Circle your answer. [4 points each]

a) 0.0200 moles of CO(g) is added to the system

moles of H<sub>2</sub>CO  
increases

moles of H<sub>2</sub>CO  
remains the same

moles of H<sub>2</sub>CO  
decreases

b) The temperature of the system is increased by 20.0 °C

moles of H<sub>2</sub>CO  
increases

moles of H<sub>2</sub>CO  
remains the same

moles of H<sub>2</sub>CO  
decreases

3) An aqueous solution of a weak acid has pH = 5.18 at T = 25. °C. What are the values for pOH and [H<sub>3</sub>O<sup>+</sup>] for the solution? [4 points each]

pOH = \_\_\_\_\_

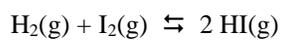
[H<sub>3</sub>O<sup>+</sup>] = \_\_\_\_\_

4) A solution is prepared by dissolving 18.45 g of potassium hydroxide (KOH, M = 56.11 g/mol), a strong soluble base, in water. The temperature of the solution is T = 25.0 °C, and the final volume of the solution is V = 400.0 mL. What is the pH of the solution? [6 points]

5) Hypochlorous acid (HOCl) is a weak acid often used as a disinfectant. Give the correctly balanced reaction corresponding to the addition of HOCl to water in the Bronsted picture of acids and bases. [4 points]

**Part 3. Problems.**

1) Using the information given below find the numerical values for  $\Delta G^\circ_{\text{rxn}}$  and K for the following reaction. You may assume that T = 25. °C. [15 points]



Substance	$\Delta H^\circ_f$ (kJ/mol)	$\Delta G^\circ_f$ (kJ/mol)	$S^\circ$ (J/mol·K)
H <sub>2</sub> (g)	0.00	0.00	130.68
HI(g)	26.48	1.70	206.59
I <sub>2</sub> (g)	62.44	19.33	260.69

2) Because the F-F single bond in  $F_2$  is a weak bond, diatomic fluorine will dissociate at high temperatures. The reaction may be written as



A closed system at  $T = 1500. \text{ K}$  initially has  $[F_2] = 0.1400 \text{ mol/L}$ . No fluorine atoms are initially present in the system. What will be the value for  $[F]$ , the concentration of fluorine atoms in the system, when equilibrium is reached? [15 points]