



**GENERAL CHEMISTRY 2  
SECOND EXAM**

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

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

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

**Part 1** \_\_\_\_\_ **(16 points)**

**Part 2** \_\_\_\_\_ **(38 points)**

**Part 3** \_\_\_\_\_ **(26 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) The numerical value for the equilibrium constant for the reaction  $A_2(g) + 2 B(g) \rightleftharpoons 2 AB(g)$  is  $K_C = 25$ . The numerical value for the equilibrium constant for the reaction  $AB(g) \rightleftharpoons \frac{1}{2} A_2(g) + B(g)$ , measured at the same temperature, is

- a)  $K_C = 0.040$
- b)  $K_C = 0.20$
- c)  $K_C = 5.0$
- d)  $K_C = 25$ .
- e) Cannot tell from the information given

2) Consider the following chemical reaction.



A system containing  $PCl_3$ ,  $PCl_5$ , and  $Cl_2$  at a fixed temperature is initially at equilibrium. Which of the following changes will lead to an increase in the number of moles of  $PCl_3$  in the system?

- a) Addition of 0.100 moles of  $Cl_2$  into the system
- b) Addition of 0.100 moles of  $PCl_5$  into the system
- c) Decreasing the volume of the system by 2.00 L
- d) Both a and c
- e) Both b and c

3) A Bronsted base is

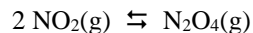
- a) a proton acceptor
- b) a proton donor
- c) an electron pair acceptor
- d) an electron pair donor
- e) any ionic compound that will dissolve in water

4) Which of the following is a polyprotic acid?

- a)  $HClO_2$
- b)  $HClO_3$
- c)  $HI$
- d)  $HNO_3$
- e)  $H_2SO_3$

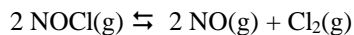
**Part 2. Short answer.**

1) The free energy change for the reaction



is  $\Delta G^\circ_{rxn} = -5.3 \text{ kJ/mol}$  at  $T = 25.^\circ\text{C}$ . Based on this information, find the numerical value for  $K$ , the equilibrium constant, for this reaction. [6 points]

2) A system containing the gases  $\text{Cl}_2$ ,  $\text{NO}$ , and  $\text{NOCl}$  will achieve equilibrium. The process that takes place is



At  $T = 500. \text{ K}$ , the partial pressures of gas present at equilibrium are  $p(\text{Cl}_2) = 0.608 \text{ atm}$ ,  $p(\text{NO}) = 0.240 \text{ atm}$ , and  $p(\text{NOCl}) = 1.36 \text{ atm}$ .

a) What is the numerical value for  $K_p$  for the above reaction at  $T = 500. \text{ K}$ ? [4 points]

b) What is the numerical value for  $K_C$  for the above reaction at  $T = 500. \text{ K}$ ? [4 points]

3) The pH of an aqueous solution is  $\text{pH} = 8.82$  at  $T = 25 \text{ }^\circ\text{C}$ . Find  $[\text{H}_3\text{O}^+]$ ,  $[\text{OH}^-]$ , and the pOH for the solution. [8 points total]

4) Answer each of the following questions by filling in the blank. [4 points each]

a) The conjugate base of  $\text{HCO}_3^-$ . \_\_\_\_\_

b) The pH of pure water at  $T = 50.^\circ\text{C}$ . \_\_\_\_\_  
(Note  $K_w = 5.5 \times 10^{-14}$  at  $T = 50.^\circ\text{C}$ )

5) For each of the following questions circle the correct answer. There is one and only one correct answer per question. [4 points each]

A weak acid

HI

HBr

HCl

HF

A strong soluble base

AgOH

Cu(OH)<sub>2</sub>

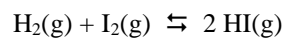
Ba(OH)<sub>2</sub>

Fe(OH)<sub>3</sub>

**Part 3. Problems.**

1) A solution is prepared (at  $T = 25.0\text{ }^{\circ}\text{C}$ ) by adding 2.97 g of potassium hydroxide (KOH, MW = 56.11 g/mol) to water. The final volume of the solution is  $V = 250.0\text{ mL}$ . What is the pH of the solution? [10 points]

2) The numerical value for the equilibrium constant for the reaction



is  $K_C = 57.0$  at  $T = 700. \text{ K}$ .

The initial concentration of  $\text{H}_2$  and  $\text{I}_2$  in a system at  $T = 700. \text{ K}$  are  $[\text{H}_2] = 0.2000 \text{ mol/L}$  and  $[\text{I}_2] = 0.1000 \text{ mol/L}$ . No  $\text{HI}$  is initially present in the system. What are the concentrations of  $\text{H}_2$ ,  $\text{I}_2$ , and  $\text{HI}$  that are present when the system reaches equilibrium? [16 points]