

**GENERAL CHEMISTRY 2
SECOND HOUR EXAM**

Name _____

Panthersoft ID _____

Signature _____

Part 1 _____ (20 points)

Part 2 _____ (43 points)

Part 3 _____ (37 points)

TOTAL _____ (100 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 $2 AB(g) \rightleftharpoons A_2(g) + 2 B(g)$, 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?

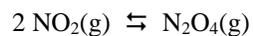
- a) $HClO_2$
- b) $HClO_3$
- c) HI
- d) HNO_3
- e) H_2SO_3

5) Which of the following salts will form an acidic solution when added to water?

- a) the salt of a strong acid and a strong base
- b) the salt of a strong acid and a weak base
- c) the salt of a weak acid and a strong base
- d) both a and b
- e) both a and c

Part 2. Short answer.

1) The free energy change for the reaction



is $\Delta G^\circ_{\text{rxn}} = -5.3 \text{ kJ/mol}$ at $T = 25.^\circ\text{C}$. Based on this information, find the numerical value for K , the equilibrium constant, for this reaction. [8 points]

2) A system containing the gases Cl_2 , NO , and 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 $T = 500. \text{ K}$? [5 points]

b) What is the numerical value for K_C for the above reaction at $T = 500. \text{ K}$? [5 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. [9 points total]

4) What is the pH of a 0.0385 M aqueous solution of sodium hydroxide (NaOH), at $T = 25\text{ }^\circ\text{C}$? [8 points]

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

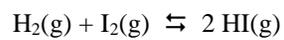
$\text{Cu}(\text{OH})_2$

$\text{Ba}(\text{OH})_2$

$\text{Fe}(\text{OH})_3$

Part 3. Problems.

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



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

The initial concentration of H_2 and 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 HI is initially present in the system. What are the concentrations of H_2 , I_2 , and HI that are present when the system reaches equilibrium? [16 points]

2) Propionic acid ($\text{C}_3\text{H}_5\text{COOH}$, $K_a = 1.32 \times 10^{-5}$ at $T = 25. \text{ }^\circ\text{C}$) is a monoprotic weak acid

a) Give the formula for the conjugate base of propionic acid (including correct charge). [5 points]

b) Find the pH for a 0.0898 M aqueous solution of propionic acid at $T = 25. \text{ }^\circ\text{C}$. [16 points]