

KWANTLEN COLLEGE
CHEMISTRY 1105 R-10
EXAM No. 2
August 11, 1994

NAME: _____

Instructions: This exam contains **8 + 1 bonus** questions. Read the exam carefully and judge your time accordingly. **ALL CALCULATIONS MUST BE SHOWN AND REPORT ALL NUMERICAL ANSWERS WITH THE CORRECT NUMBER OF SIGNIFICANT FIGURES TO RECEIVE FULL CREDIT!** If you need extra space, use the back of a preceding page and clearly indicate the question number. A periodic chart is included with this exam.
Maximum Score: 66 points + 4 bonus points

USEFUL INFORMATION

$$\Delta H^{\circ} = \sum n \Delta H_f^{\circ} \text{ products} - \sum n \Delta H_f^{\circ} \text{ reactants}$$

$$K_w \text{ for water at } 25^{\circ}\text{C} = 1.0 \times 10^{-14}$$

1	
2	
3	
4	
5	
6	
7	
8	
Bonus	
Total	

Question One: (4 MARKS)

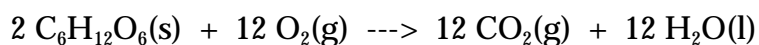
A gaseous mixture containing 59.9 g of argon and 154 g of CO₂ has a total pressure of 7.00 atm. What are the partial pressures of Ar and CO₂?

Question Two: (5 MARKS)

The burning of 2.051 g of glucose, C₆H₁₂O₆ (molar mass = 180.2 g/mol), in a bomb calorimeter causes the temperature to rise from 24.92 to 31.41 °C. The bomb calorimeter has a heat capacity (calorimeter constant) of 4.921 kJ/°C. (Note: the calorimeter constant includes the water in the water jacket.)

a) What is the heat of combustion of glucose in kJ/mol C₆H₁₂O₆?

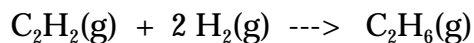
b) Determine ΔH for the combustion of glucose based on the following equation:



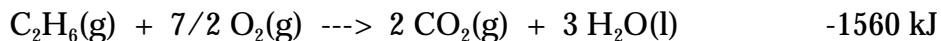
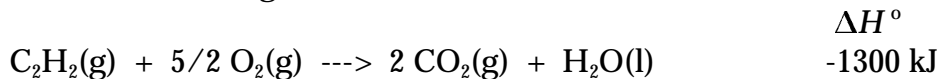
Note: $\Delta H = \Delta U$ for this reaction.

Question Three: (8 MARKS)

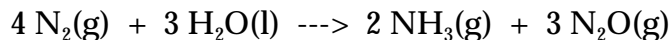
a) Calculate ΔH° for the reaction,



from the following combustion data: (4)



b) Calculate ΔH° for the reaction,



given the following standard enthalpies of formation: (3)

$$\Delta H_f^\circ (\text{H}_2\text{O}(\text{l})) = -285.8 \text{ kJ} \quad \Delta H_f^\circ (\text{NH}_3(\text{g})) = -45.9 \text{ kJ}$$

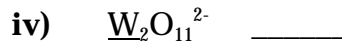
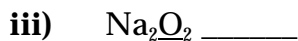
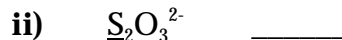
$$\Delta H_f^\circ (\text{N}_2\text{O}(\text{g})) = +81.6 \text{ kJ}$$

i) Is the reaction endothermic or exothermic? (½)

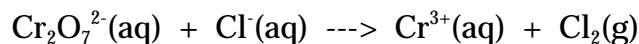
ii) Is heat absorbed or released during the course of this reaction? (½)

Question Four: (9 MARKS)

a) Determine the oxidation number of the underlined element in each of the following: (2)



b) The following reaction takes place in acid solution:



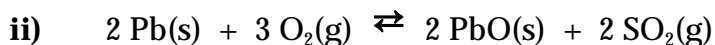
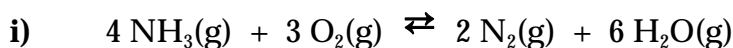
i) Write the balanced equations for each half reaction, identifying the oxidation and reduction half reactions. (4)

ii) Write the balanced equation for the overall reaction. (2)

iii) Identify the oxidizing agent in this reaction. (1)

Question Five: (17 MARKS)

a) Write the proper expression for K_c for each of the following equilibria: (2)



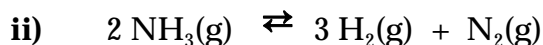
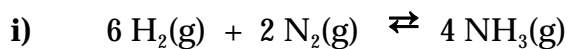
- b) Give the balanced equation for the equilibrium system which would have the following expression for K_c : (Indicate the physical state of all species in your equation) (3)

$$K_c = \frac{[\text{SO}_2(\text{g})]^2}{[\text{H}_2\text{S}(\text{g})]^2 [\text{O}_2(\text{g})]^3}$$

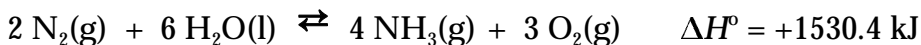
- c) Given the following equilibrium system at 300 °C:



What is the value of K_c for the following reactions at 300 °C? (3)



- d) Consider the following equilibrium process:



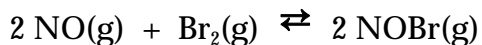
- i) Indicate the effect on the mass of NH_3 and the value of K_c by each of the following: (I = increase, D = decrease, NC = no change) (8)

<u>ACTION TAKEN:</u>	Mass of NH_3	K_c
Some N_2 is removed	_____	_____
Some H_2O is added	_____	_____
Volume of Container is increased	_____	_____
Temperature is decreased	_____	_____

- ii) What is more stable the reactants or products? (1)

Question Six: (5 MARKS)

When 0.0930 moles of nitrogen monoxide gas and 0.0652 moles of bromine gas are sealed in a 1.00 L container at 77 °C, the following equilibrium is established:



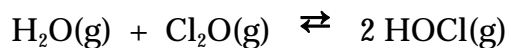
At equilibrium the concentration of NOBr was measured to be 0.0612 M. Determine the following:

a) the equilibrium concentration of NO(g) and Br₂(g).

b) the numerical value of K_c.

Question Seven: (6 MARKS)

The equilibrium constant, K_c, for the reaction



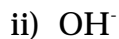
is 0.090 at a given temperature. Initially 0.80 mol of H₂O and 0.80 mol of Cl₂O are injected into a 5.00 L reaction vessel at this temperature. Calculate the concentrations of H₂O, Cl₂O, and HOCl at equilibrium.

Question Eight: (12 MARKS)

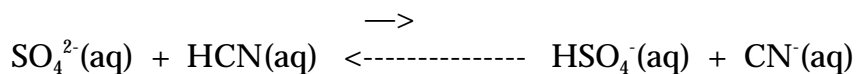
a) Give the conjugate acids for (2)



b) Give the conjugate bases for (2)



c) Given the acid/base equilibrium system:



indicate the following: (2)

i) Stronger acid: _____ ii) Stronger base: _____

iii) Weaker acid: _____ iv) Weaker base: _____

d) Complete the following table: (6)

$[\text{H}_3\text{O}^+]$	$[\text{OH}^-]$	pH	pOH
3.3×10^{-4}	_____	_____	_____
_____	_____	8.57	_____

Bonus: (4 MARKS)

Determine the pH of a solution prepared by adding 0.315 g of $\text{Ca(OH)}_2(\text{s})$ to 75.0 mL of a 0.162 M HNO_3 solution. Assume that the volume of the solution does not change upon the addition of Ca(OH)_2 . The reaction is

