KWANTLEN UNIVERSITY COLLEGE
CHEMISTRY 1110 S-10
EXAM No. 1
Thursday February 19, 1998

NAME: _____

Instructions: Ensure that this exam contains all **Nine** questions. Read the exam carefully and judge your time accordingly. **ALL WORK MUST BE SHOWN TO RECEIVE ANY CREDIT !** If you need extra space, use the back of a preceeding page and clearly indicate the question number. Rough work may also be done on the back of a preceeding page. A periodic chart is supplied with this exam.
Maximum Score: 90 points

USEFUL INFORMATION:

Avogadro's Number: 6.0221×10^{23}

Gas Constant: R = 0.0821 L-atm/mol-K

1 atm = 760 mm Hg

Ideal Gas Equation: PV = nRT

Question	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	
%	

Question One: (**8 MARKS**)

a) If $C_2H_4(g)$ escapes from a cylinder (effuses) at a rate of 75 mL every 25 seconds, how long would it take for 1.00 L of $H_2(g)$ to escape from the cylinder under the same conditions of temperature and pressure? **(3)**

b) What is the resulting concentration, if 25.0 mL of 1.00 *M* HNO_3 is mixed with 75.0 mL of 3.00 *M* HNO_3. **(2)**

c) Calculate the normality and molarity of a $Mg(OH)_2$ solution, if 20.00 mL of this solution reacts **completely** with 10.00 mL of 0.01000 *M* H_3PO_4. **(3)**

Question Two: (**9 MARKS**)

a) An unknown gas has a mass of 10.0 g and occupies 15.0 L at 27.0 ^{o}C and a pressure of 0.500 atm. Determine the molar mass of this unknown gas. **(3)**

b) Automobile air bags are designed to inflate rapidly in a crash. The impact of the collision closes an electric circuit which initiates the following reaction between sodium azide and Fe_2O_3:

$$6\ NaN_3(s) + Fe_2O_3(s) \longrightarrow 3\ Na_2O(s) + 2\ Fe(s) + 9\ N_2(g)$$

i) How many grams of sodium azide (in the presence of excess Fe_2O_3), would be required to inflate a 75.0 L air bag with nitrogen gas at 25.0 ^{o}C and 748 mm Hg pressure? (Assume 100% yield) **(4)**

ii) This reaction was carried out using the mass of sodium azide calculated above. After the reaction had finished 35.5 g of Fe(s) was recovered. Determine the % yield for this reaction. **(2)**

Question Three: (**6 MARKS**)
A 10.0 g sample of a Cu/Ag alloy reacted with concentrated HNO_3 solution according to the following equations:

$$Cu(s) + 4\ H^+(aq) + 2\ NO_3^-(aq) \rightarrow Cu^{2+}(aq) + 2\ NO_2(g) + 2\ H_2O(l)$$

$$Ag(s) + 2\ H^+(aq) + NO_3^-(aq) \rightarrow Ag^+(aq) + NO_2(g) + H_2O(l)$$

If a total of 10.00 g of $NO_2(g)$ was recovered from the reaction determine the % (by mass) of Ag in the alloy. (assume 100% yield) **(6)**

Question Four: (**6 MARKS**)
Provide complete structures (you may use condensed formulas like CH_3CH_3 to indicate H atoms) to illustrate each of the following: (No name necessary. **Show all hydrogens**)

a) a secondary amine

b) a ketone

c) a cyclic diene

d) an ortho substituted benzene

Question Four: (**Continued**)

e) an acid anhydride

f) an ether

Question Five: (**10 MARKS**)
Draw the structures (showing all hydrogens) for each of the following organic molecules:

a) *cis*-3-methyl-2-pentene

b) 5-ethyl-6,6-dimethyl-2-octyne

c) 3-methylcyclopentanone

d) *o* - chlorophenol

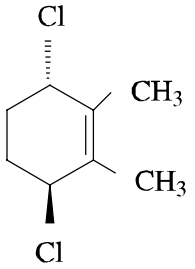
e) methyl benzoate

Question Six: (10 MARKS)

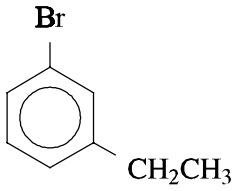
Name each of the following molecules using systematic (IUPAC) or other acceptable names.

a)

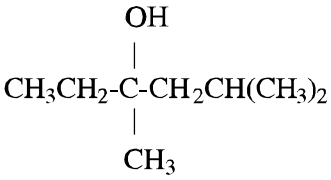
b)



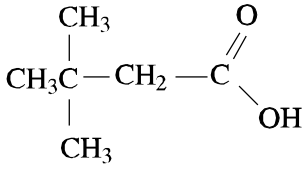
c)



d)



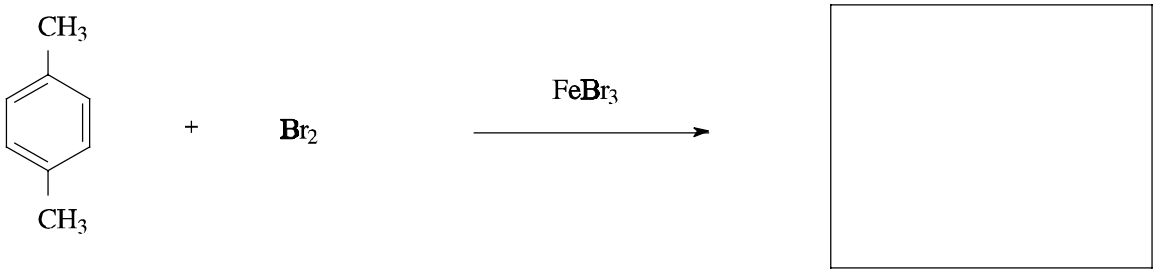
e)



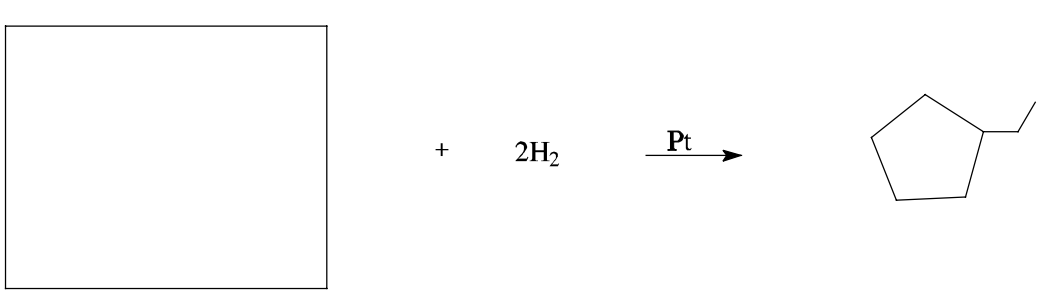
Question Seven: (**21 MARKS**)

Draw the structure(s) for the organic reactants *or* products in each case.

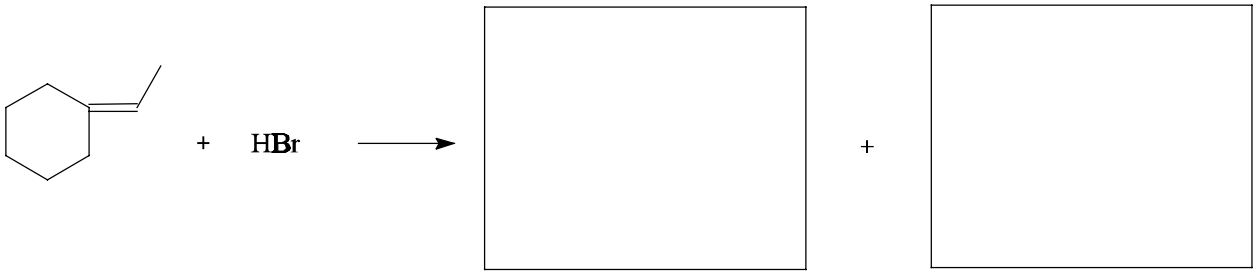
a)



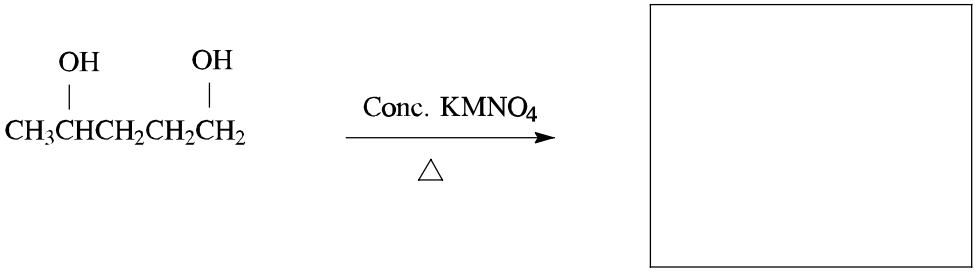
b)



c)

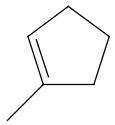


d)



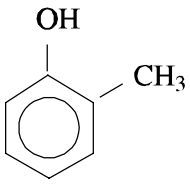
Question Seven: (Continued)

e)



$\xrightarrow[\triangle]{\text{Conc. } KMnO_4}$

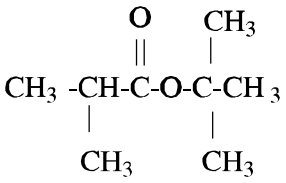
f)



+ NaOH $\longrightarrow$ [ ] + [ ]

g)

[ ] + [ ] $\xrightarrow{H^+}$



Question Eight: (**8 MARKS**)

In each case draw open chain (non-cyclic) structures to illustrate the following: (**No name nesessary**)

a) a pair of positional isomers having the formula $C_6H_{11}Br$.

b) a pair of functional isomers having the formula $C_5H_{10}O$.

c) a pair of geometric isomers having the formula $C_3H_4Cl_2$.

d) a structure having the formula $C_5H_{12}O$ containing one chiral carbon atom. Label this atom with an asterisk (*).

Question Nine: (**12 MARKS**)

There are **three** isomers for the methyl cyclopentanols with the formula $C_6H_{12}O$. (**Note:** We will count each cis-trans pair as only one isomer.)

a) Draw the structures for the **three** isomers. Be sure to show all hydrogens.

b) Based on the information given below, identify the above **three** isomers: **A, B,** and **C**, as well as, the **six** products(**I** to **VI**). Provide structures for the products.

i) **A** $\xrightarrow[\Delta]{\text{Conc. } KMnO_4}$ no reaction

B $\xrightarrow[\Delta]{\text{Conc. } KMnO_4}$ a ketone **(I)**

C $\xrightarrow[\Delta]{\text{Conc. } KMnO_4}$ a ketone **(II)**

Question Nine: (**Continued**)

ii) **A** $\xrightarrow[\Delta]{\text{Conc. } H_2SO_4}$ alkenes **(III)** and **(IV)**

B $\xrightarrow[\Delta]{\text{Conc. } H_2SO_4}$ alkenes **(IV)** and **(V)**

C $\xrightarrow[\Delta]{\text{Conc. } H_2SO_4}$ alkenes **(V)** and **(VI)**