Chem 1C Midterm 1

Practice Test

Credit will only be given for answers on this sheet. Units must be included in your answers and points will be taken off for incorrect or missing units. No partial credit will be awarded. Calculators are allowed. Cell phones may not be used as calculators.

Name:	**Perm Number**

Make sure writing is dark and large enough to be picked up by a scanner. Failure to do this results in the loss of 5 points on the exam.

If you are sitting next to someone with the same version of the test you both will lose 5 points.

Fundamentals			
Question (Points)	**Answer**		
1 (6 pts) 2,2,2	○ $CH_3CH_2CH_2CH_3$	○ $CH_3CH_2CH_2OH$	● $HOCH_2CH_2OH$
	● CH_3OCH_3	○ CH_3CH_2OH	○ H_2O
	○ H_2O ○ O_2	● He	○ CO_2
2 (6 pts)	0.0076 s		
3 (6 pts)	94°C		
4 (6 pts) 2,2,2	● London	● Dipole-Dipole	● H-Boning
	● London	● Dipole-Dipole	○ H-Boning
	● London	○ Dipole-Dipole	○ H-Boning
5 (6 pts) 2,2,2	$2NO_2Cl \rightarrow 2NO_2 + Cl_2$		
	N_2O, ClO_2, NOCl, and ClO		
	None		
6 (9 pts) 3,3,3	F	H	B

Multiple Choice	
Question (Points)	**Answer**
7 (6 pts)	○ A ○ B ○ C ○ D ● E
8 (6 pts)	○ A ○ B ○ C ○ D ● E
9 (6 pts)	○ A ○ B ○ C ● D ○ E
10 (6 pts)	○ A ○ B ○ C ● D ○ E
11 (6 pts)	○ A ○ B ● C ○ D ○ E
12 (7 pts)	● A ○ B ○ C ○ D ○ E

Challenge Problems	
Question (Points)	**Answer**
13 (14 pts) 8,6	Rate=k[A]$^{1.5}$[B]
	$120\ \frac{mol^{0.3}}{L^{0.3} \cdot s}$
14 (10 pts)	Silver

Fundamental Questions

1a) *2 pts* Which has the greatest viscosity?

$CH_3CH_2CH_2CH_3$ $CH_3CH_2CH_2OH$ $HOCH_2CH_2OH$

1b) *2 pts* Which has the highest vapor pressure at 1 atm and 25°C?

CH_3OCH_3 CH_3CH_2OH H_2O

1c) *2 pts* Which has the lowest freezing point?

H_2O O_2 He CO_2

2) *6 pts* What is the 2nd half-life for a second order reaction with k = 22 $\frac{L}{mol \cdot s}$ and an initial concentration of 12 M.

3) *6 pts* What is the boiling point of water in Denver if atmospheric pressure is 0.82 atm, and ΔH_{vap}=40.7 $\frac{kJ}{mol}$?

4a) *2 pts* What kinds of intermolecular forces are present between molecules of CH_3NH_2?

4b) *2 pts* What kinds of intermolecular forces are present between molecules of PCl_3?

4c) *2 pts* What kinds of intermolecular forces are present between molecules of PCl_5?

5a) *2 pts* Given the following reaction mechanism:

$2NO_2Cl \rightleftharpoons ClO_2 + N_2O + ClO$

$N_2O + ClO_2 \rightleftharpoons NO_2 + NOCl$

$NOCl + ClO \rightarrow NO_2 + Cl_2$

Write the overall reaction.

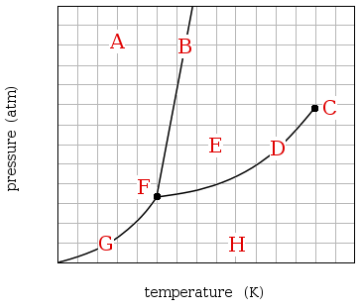
5b) *2 pts* Identify the intermediate(s) if any in the reaction.

5c) *2 pts* Identify the catalyst(s) if any in the reaction.

6a) *3 pts* Study the following phase diagram of Substance X.

If a sample of pure X is to be a mixture of liquid and gas, which point marks the lowest possible temperature and pressure of the sample?

_____



6b) *3 pts* If a sample of pure X is a gas, in which region must the temperature and pressure be? _____

6b) *3 pts* Which line must the temperature and pressure have crossed if a solid sample of X is observed to melt? _____

Multiple Choice

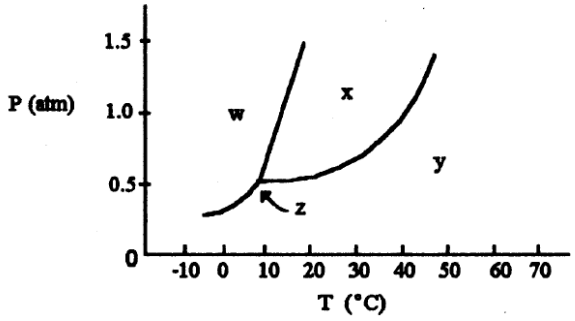
7) *6 pts* Which statement regarding water is true

a. Liquid water is less dense than solid water
b. Only covalent bonds are broken when ice melts.
c. Hydrogen bonds are stronger than covalent bonds.
d. Energy must be given off in order to break down the crystalline lattice of ice to a liquid.
e. All of these statements are false.

8) *6 pts* For the reaction aA → products, select the reaction order(s) that best fit(s) the observations that a plot of $[A]^2$ vs t gives a straight line.

a. First order in A
b. Second order in A
c. Zero order in A
d. All of these
e. None of these

9) *6 pts* The normal boiling point of the substance with the phase diagram shown below is ____°C.



a. 50
b. 10
c. 15
d. 40
e. None of the above

10) *6 pts* The reaction profile for the mechanism

$NO_2(g) + F_2(g) \rightarrow NO_2F(g) + F(g)$ slow

$F(g) + NO_2(g) \rightarrow NO_2F(g)$ fast

Shows

a. two maxima, the second maximum being the higher
b. one maximum for the second step.
c. two maxima, both the same height
d. two maxima, the first maximum being the higher.

11) *6 pts* All of the following statements with respect to the effect of a catalyst on a reaction are true except

a. A catalyst speeds up a reaction by providing an alternative pathway for the reaction.
b. When a reaction is catalyzed, both forward and reverse reaction are accelerated.
c. When a catalyst speeds up a reaction, the rate law stays the same.
d. A catalyst provides a lower activation energy for the reaction.
e. A catalyst has no effect of the equilibrium composition of the reaction.

12) *7 pts* The rate law for a reaction is found to be Rate = $k[A]^2[B]$. Which of the following mechanisms gives this rate law?

I. $A + B \rightleftharpoons E$ (fast equilibrium)
$E + B \rightarrow C + D$ (slow)

II. $A + B \rightleftharpoons E$ (fast equilibrium)
$E + A \rightarrow C + D$ (slow)

III. $A + A \rightarrow E$ (slow)
$E + B \rightleftharpoons C + D$ (fast equilibrium)

a. II only
b. III only
c. I only
d. Two of these
e. None of the these

Challenge Problems

13a) *8 pts* The following data were obtained for the reaction
A+B →products

$[A]_o$ (M)	$[B]_o$ (M)	Initial Rate $\left(\frac{mol}{L \cdot s}\right)$
0.0500	0.100	6.0
0.100	0.100	17
0.100	0.200	34

What is the rate law?

13b) *6 pts* If the rate law was determined to be

$$rate = k[A]^2[B]^{-1.3}$$

And the following data was collected

$[A]_o$ (M)	$[B]_o$ (M)	Initial Rate $\left(\frac{mol}{L \cdot s}\right)$
0.0500	0.100	6.0

What is k? Remember to include units.

14) *10 pts* You are given a small bar of an unknown metal X. You find the density of the metal to be 10.5 $\frac{g}{cm^3}$. An X-ray diffraction experiment measures the edge of face-centered cubic unit cell at 4.09 Å (1 Å = 10^{-10} m). Identify the metal.