Chem 1C Final
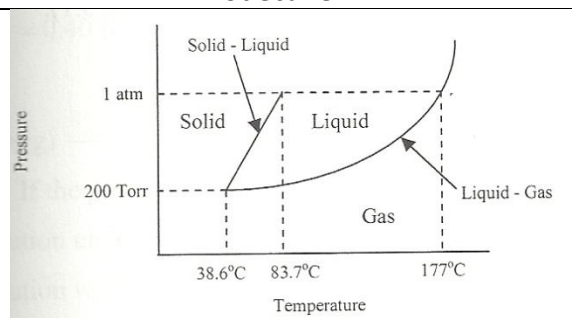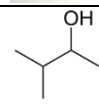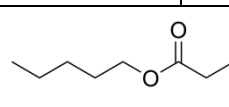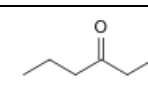
Practice Test

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 your 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 (7 pts) 5,2	$170. \frac{kJ}{mol}$ | Color: green
2 (9 pts) 2,2,2,3	○ HCl ● HF ○ HBr ● C$_3$H$_8$ ○ CH$_3$OH ○ N$_2$(l) ● Br$_2$(l) Hexane — Solid / Propane ✕ Liquid / Dodecane — Gas
3 (8 pts) 6,2	Denser: ● Solid ○ Liquid
4 (9 pts) 3,3,3	3-methyl-2-butanol | pentyl propanoate 3-hexanone
5 (7 pts) 1,1,5	Catalysts: None | Intermediates: HS⁻ Rate Law: $Rate = \frac{k_2 k_1}{k_{-1}} \frac{[Cl_2][H_2S]}{[H^+]}$
6 (6 pts)	$2.38 \times 10^{11} \frac{J}{g}$

Multiple Choice	
Question (Points)	**Answer**
7 (5 pts)	○ A ● B ○ C ○ D ○ E
8 (6 pts)	○ A ○ B ○ C ● D ○ E
9 (5 pts)	○ A ○ B ○ C ○ D ● E
10 (6 pts)	● A ○ B ○ C ○ D ○ E
11 (5 pts)	○ A ● B ○ C ○ D ○ E
12 (5 pts)	○ A ○ B ● C ○ D ○ E

Challenge Problems	
Question (Points)	**Answer**
13 (10 pts)	14.2%
14 (12 pts) 6,6	$17.7\frac{kJ}{mol}$
	210.K

Fundamental Questions

1) *7 pts* $[Fe(H_2O)_6]^{3+}$ absorbs light =700. nm. What is the value (in $\frac{kJ}{mol}$) of Δ_o and what color will the complex appear?

2) *9 pts*   Which has the highest boiling point: HCl   HF   HBr

   Which has the lowest melting point: C_3H_8 CH_3OH

   Which has the greatest surface tension: $N_2(l)$ $Br_2(l)$

   At room temperature each of the following organic molecules has a different phase. Match the molecule to the phase.

   Hexane   Solid

   Propane   Liquid

   Dodecane   Gas

3a) *6 pts*   A new substance developed in a laboratory has the following properties: normal melting 83.7°C; normal boiling point, 177°C; triple point 200. torr and 38.6°C. Sketch the approximate phase diagram and label the solid, liquid, and gaseous phases.

3b) *2 pts*   Based on your drawing is the solid or liquid denser?

4) *9 pts*   Determine the products of the following reaction and name the products of the reaction.

 $+ H_2O \xrightarrow{H^+}$

 $\xrightarrow{}$
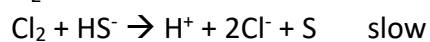
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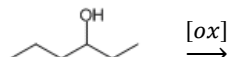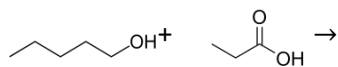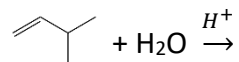
5) *7 pts*   Determine the rate law from the following mechanism.

$$H_2S \rightleftharpoons H^+ + HS^- \qquad \text{fast equilibrium}$$
$$Cl_2 + HS^- \rightarrow H^+ + 2Cl^- + S \qquad \text{slow}$$

Indicate if the reaction contains intermediates or catalysts and which substances they are.

6) *6 pts*   Calculate the energy release per gram of ^7Li for the following reaction:

$$^7Li + {}^1H \rightarrow 2{}^4He$$
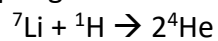
$m_{^4_2He} = 4.0026\ u,\ m_{^1_1H} = 1.0078\ u,$ and $m_{^7_3Li} = 7.0160\ u$

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Multiple Choice

7) *5 pts*   A solution of two liquids, A and B, shows negative deviation from Raoult's law. This means that:

    a. molecules of A interact weakly, if at all, with B molecules.
    b. molecules of A interact more strongly with B than with A or and more strongly than B with B.
    c. the two liquids have a positive heat of solution.
    d. molecules of A interact strongly with other A-type molecules.
    e. the molecules of A hinder the strong interaction between B molecules.

8) *6 pts*   For the reaction 2A+B → products determine the value of K given the following data:

Exp	$[A]_o$ (M)	$[B]_o$ (M)	Initial Rate $\left(\frac{mol}{L \cdot s}\right)$
1	0.1	0.1	6.3×10^{-4}
2	0.2	0.1	1.8×10^{-3}
3	0.3	0.1	3.3×10^{-3}
4	0.2	0.2	7.2×10^{-3}

    a. 0.29
    b. 0.63
    c. 1.3
   d. 2.0
    e. None of the above

9) *5 pts*   Which of the following statements is true of the fission of uranium-235?

    a. The nuclides produced are individually heavier than the uranium nuclide.
    b. The ultimate nuclides produced are more stable than the uranium nuclide.
    c. The products include neutrons.
    d. The electron is captured by the nucleus, which becomes unstable.
    e. Two of these are true.

10) *6 pts*   The unit cell in a certain lattice consists of a cube formed by an anion at each corner, an anion in the center, and a cation at the center of each face. The unit cell contains a net

    a. 2 anions and 3 cations.
    b. 5 anions and 6 cations.
    c. 3 anions and 4 cations.
    d. 5 anions and 3 cations.
    e. None of the above

11) *5 pts*   Consider the following four compounds:

(I)   (II)

(III)   (IV)
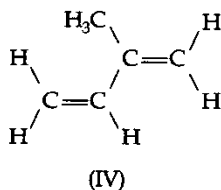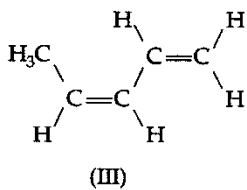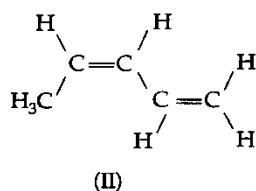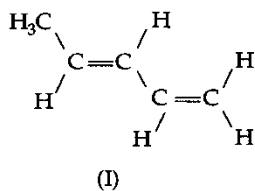
Which of these compounds would have the same physical properties
(melting point, boiling point, density, and so on)?

a. I and IV
b. II and III
c. III and IV
d. I and II
e. I and III

12) *5 pts*   Which of the following is paramagnetic?

a. $[Co(NH_3)_6]^{3+}$
b. $[Fe(CN)_6]^{4-}$
c. $[Mn(en)_3]^{2+}$
d. $[Zn(H_2O)_6]^{2+}$
e. $[Cu(en)_3]^+$

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Challenge Problems

13) *10 pts*   A mixture of NaCl and sucrose ($C_{12}H_{22}O_{11}$) of combined mass 10.2 g is dissolved in enough water to make up a 250.0 ml solution. The osmotic pressure of the solution is 7.32 atm at 23˚C. Calculate the mass present of NaCl in the mixture.

14a) *6 pts* Arsine, AsH_3, is a highly toxic compound used in electronic industry for the production of semiconductors. Its vapor pressure is 35 torr at -111.95˚C and 253 torr at -83.6˚C. Using this date calculate the standard enthalpy of vaporization.

14b) *6 pts* What is the normal boiling point of arsine?