CHEM. 111 NAME_____ _____
100 points

Exam 2

Significant Figures must be correct. All set-ups must be shown in a clear and organized way.

1. Toluene C_7H_8 has a specific heat of 1.13 J/gK. To what temperature will toluene be raised if 35.50 grams of toluene starting at 25.15 degrees C are heated with 1125 calories. (1calorie = 4.18 Joules) (10 points)

Answer_____

2. Draw the lewis dot structures for the following: (12 points)

a. CO_3^{2-} b. NF_3

c. $POCl_3$ d. BH_3

3. (14 pts) Draw and label the Born-Haber cycle for the formation of lithium fluoride.

From the following data, **calculate the lattice energy** of cesium oxide.
Enthalpy of bond dissociation of fluorine: +75.3 kJ/mol
Enthalpy of formation of lithium fluoride: -594 kJ/mol
First electron affinity of fluorine: -328 kJ/mol
First ionization energy of lithium: +520 kJ/mol
Enthalpy of sublimation of lithium: + 155 kJ/mol

Answer_____

/14 poin

5. Place the following in order of decreasing radius. (2 points)

Ca^{2+} S^{2-} Cl^{-} ____>____>____

6. Arrange the following elements in order of decreasing first ionization energy: (2 points)

As, Br, K ____>____>____

7. Arrange the following in order of increasing atomic radius: (8 points)

F^{-}, O^{2-}, Cl^{-} Mg^{2+} Na^{+} K _____>_____>_____>_____>_____>_____

Which of the above are iso electronic_____

8. Pick the larger (larger radius) species from each of the following pairs. (3 points)

Ba^{2+} or Ba _____

S or S^{2-} _____

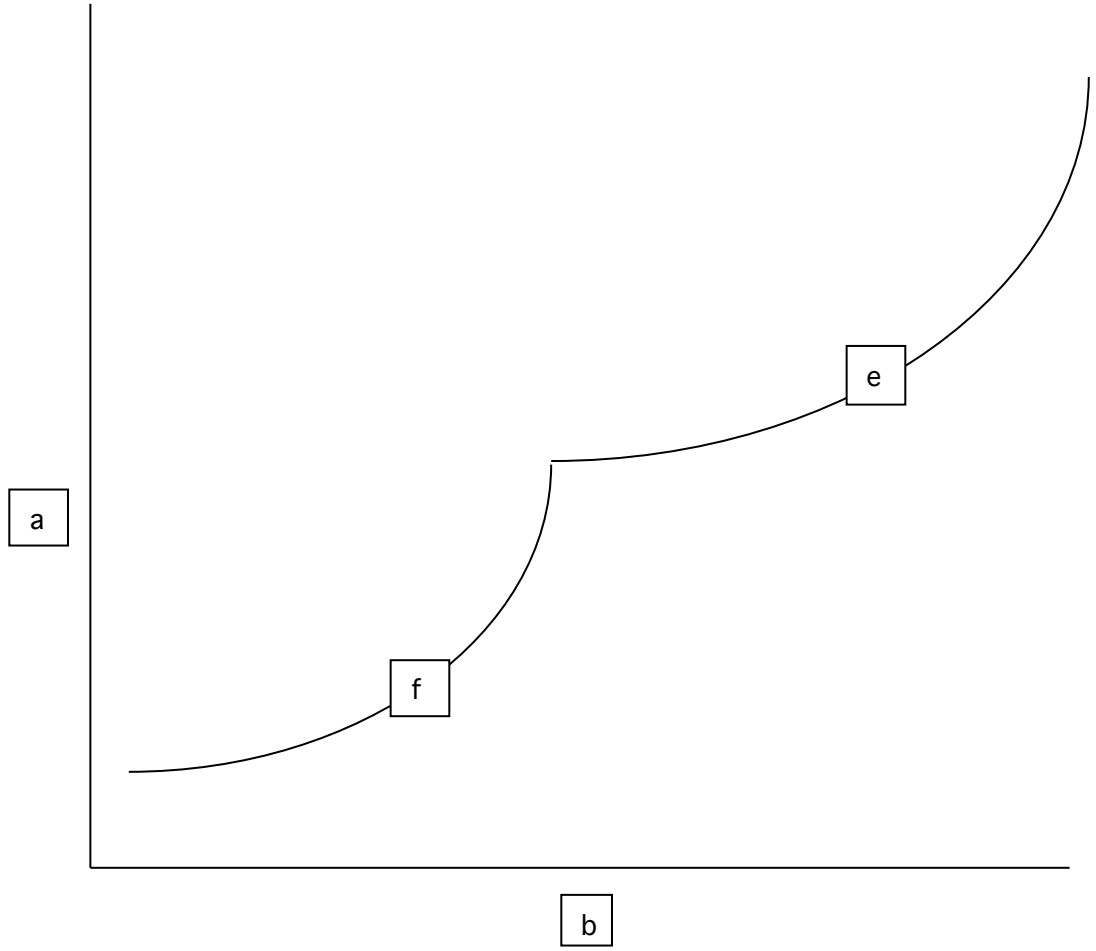
Na or S _____

9. Is the following an ionic compound, polar molecule or nonpolar molecule? State the type of intermolecular bond between two different molecules of the same compound. (6 points)

	Type of Compound	Type of intermolecular bond
O=C=O	_____	_____
H-Cl	_____	_____
H H-C-Cl H	_____	_____
C=O	_____	_____

/21 points

For question 10, consider the following diagram and answer what follows (31 points)



How would you label the axes a. _____ b._____
(2 points)

Put a “c” where the three states of matter exist in equilibrium. What is this point called?

_____ (2 points)

Put a “d” where the critical temperature is. What is the critical temperature?

_____(2 Points)

What process(es) is/are occurring at e. _____ _____

f_____ _____ (4 points)

Complete the above phase diagram as it should look for water (2 points)

What processes occur at any point on the curve that you added to the above

graph_____ _____ (2 points)

/14

On the correct axis put 1 atm at the approximate position
On the correct axis put 100 °C in the approximate position 4 points

Label the following points with the appropriate letter.

Boiling point g 1 point

Label the following regions.

Solid Liquid Gas
3 points

Label point h in the liquid region. Draw a straight line to a point where the water would freeze at constant pressure and label the point i.
Label point J in the gaseous region. Draw a straight line to a point where the water would condense at constant pressure and label the point K.
4 points

How is the phase diagram for water different from the phase diagram for carbon dioxide.
Explain how this diagram shows that water is more dense as a liquid than as a solid. 5 points

If a liquid A has a higher boiling point than liquid B which liquid has weaker intermolecular bonds?

Which liquid A or B above is more volatile?_____

Which liquid A or B has the higher vapor pressure at 25 ^{o}C_____

11. How much energy [Heat in kilojoules] is needed to convert 225.0 g of ice at -5.0oC to steam at 102.0 oC?
H_{fusion}= 335 J/g H_{vap} = 2.26 kJ/g
Specific heat of ice = 2.10 J /g oC
Specific heat of water = 4.18 J /g oC
Specific heat of steam = 2.0 J /g oC

Periodic Table with Electronegativities

1A	2A	3B	4B	5B	6B	7B	8B			1B	2B	3A	4A	5A	6A	7A	8A
1 **H** 2.1																	2 **He**
3 **Li** 1.0	4 **Be** 1.5											5 **B** 2.0	6 **C** 2.5	7 **N** 3.0	8 **O** 3.5	9 **F** 4.0	10 **Ne**
11 **Na** 0.9	12 **Mg** 1.2											13 **Al** 1.5	14 **Si** 1.8	15 **P** 2.1	16 **S** 2.5	17 **Cl** 3.0	18 **Ar**
19 **K** 0.8	20 **Ca** 1.0	21 **Sc** 1.3	22 **Ti** 1.5	23 **V** 1.6	24 **Cr** 1.6	25 **Mn** 1.5	26 **Fe** 1.8	27 **Co** 1.9	28 **Ni** 1.9	29 **Cu** 1.9	30 **Zn** 1.6	31 **Ga** 1.6	32 **Ge** 1.8	33 **As** 2.0	34 **Se** 2.4	35 **Br** 2.8	36 **Kr** 3.0
37 **Rb** 0.8	38 **Sr** 1.0	39 **Y** 1.2	40 **Zr** 1.4	41 **Nb** 1.6	42 **Mo** 1.8	43 **Tc** 1.9	44 **Ru** 2.2	45 **Rh** 2.2	46 **Pd** 2.2	47 **Ag** 1.9	48 **Cd** 1.7	49 **In** 1.7	50 **Sn** 1.8	51 **Sb** 1.9	52 **Te** 2.1	53 **I** 2.5	54 **Xe** 2.6
55 **Cs** 0.7	56 **Ba** 0.9	57 **La** 1.1	72 **Hf** 1.3	73 **Ta** 1.5	74 **W** 1.7	75 **Re** 1.9	76 **Os** 2.2	77 **Ir** 2.2	78 **Pt** 2.2	79 **Au** 2.4	80 **Hg** 1.9	81 **Tl** 1.8	82 **Pb** 1.9	83 **Bi** 1.9	84 **Po** 2.0	85 **At** 2.2	86 **Rn** 2.4
87 **Fr** 0.7	88 **Ra** 0.9	89 **Ac** 1.1	104 **Rf**	105 **Db**	106 **Sg**	107 **Bh**	108 **Hs**	109 **Mt**	110 **Ds**	111 **Uuu**	112 **Uub**	113 **Uut**	114 **Uuq**	115 **Uup**	116 **Uuh**		

58 **Ce** 1.1	59 **Pr** 1.1	60 **Nd** 1.1	61 **Pm** 1.2	62 **Sm** 1.2	63 **Eu** 1.1	64 **Gd** 1.2	65 **Tb** 1.2	66 **Dy** 1.2	67 **Ho** 1.2	68 **Er** 1.2	69 **Tm** 1.2	70 **Yb** 1.2	71 **Lu** 1.3
90 **Th** 1.3	91 **Pa** 1.5	92 **U** 1.7	93 **Np** 1.3	94 **Pu** 1.3	95 **Am** 1.3	96 **Cm** 1.3	97 **Bk** 1.3	98 **Cf** 1.3	99 **Es** 1.3	100 **Fm** 1.3	101 **Md** 1.3	102 **No** 1.5	103 **Lr**