Question 1
10 Points

Using noble gas notation, write the electron configuration for the following:

1. Ni **[Ar]$4s^2 3d^8$**
2. Cr **[Ar]$4s^1 3d^5$**
3. Fe^{2+} **[Ar]$3d^6$**

The rare earth elements, or lanthanides exist as +3 ions. Using the noble gas notation, show the electron configuration of:

1. Eu **[Xe]$6s^2 4f^7$**
2. Eu^{3+} **[Xe]$4f^6$**

Question 2
5 Points

Arrange the following elements in order of **increasing size**, by ranking then from 1 (**smallest**) to 5 (**largest**)

Al	3	K	5
B	2	Na	4
C	1		

Question 3
4 Points

Arrange the following elements in order of **increasing ionization energy**, by ranking them from 1 (**least**) to 4 (**greatest**)

S	1	O	2
F	3	He	4

Question 4
4 Points

Consider the elements **Na**, **O**, **F** and **Cl**:

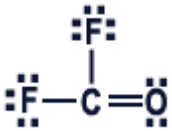
1. Which element has the **greatest electronegativity**? **F**
2. Which element has the **greatest metallic character**? **Na**

Question 5
16 Points

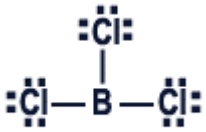
Draw the **best** Lewis Dot structure for the following

CO

F_2CO

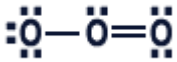


BCl_3



IBr_2^-

Question 6
6 Points



1 2 3

What is the **formal charge** on the oxygen atoms on the Lewis Dot Structure depicted on the left.

*O*1: **-1** *O*2: **+1** *O*3: **0**

Question 7
12 Points

Draw all **reasonable** resonance structure for FNO_2.

Circle the correct answer:

Average bond length table is on the front page of this exam.

The **F** to **N** bond length is expected to be:

1. > 134 pm
2. < 134 pm
3. **= 134 pm**

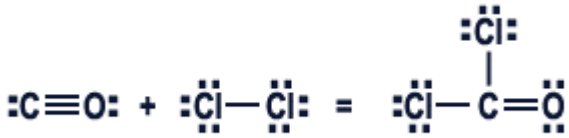
The **N** to **O** bond length is expected to be:

1. = 136 pm
2. > 136 pm
3. = 115 pm
4. **> 115 pm**

Question 8
6 Points

Phosgene, Cl_2CO is a highly toxic gas. Using the ***bond energies given on the front page*** of this exam, estimate the enthalpy change for the reaction of carbon monoxide and chlorine to produce phosgene.

$$CO(g) + Cl_2(g) = Cl_2CO(g)$$



Bonds Broken: $C\equiv O + Cl\text{-}Cl$ = 1075 + 243 = **1318 kJ.mol^{-1}**

Bonds Formed: $C=O + 2(C\text{-}Cl)$ = 745 + 2(330) = **1405 kJ.mol^{-1}**

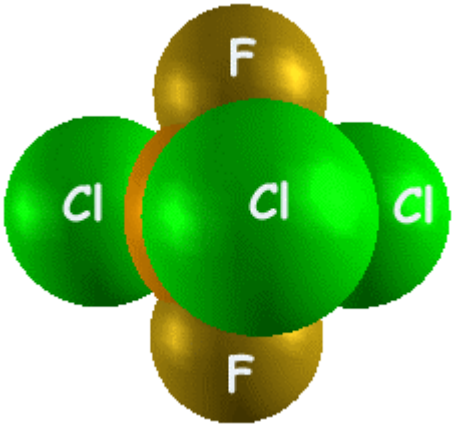
ΔH = Sum Bonds Broken – Sum Bonds Formed = 1318-1405 = **-87 kJ.mol^{-1}**

Question 9
10 Points

Give the **electron pair geometry** and the **molecular geometry** for the following.

		Electron Pair Geometry	Molecular Geometry
1.	CH_2Cl_2	**Tetrahedron**	**Tetrahedron**
2.	NO_2^-	**Trigonal planar**	**Angular or Bent**
3.	NO_2^+	**Linear**	**Linear**
4.	SF_4	**Trigonal bipyramid**	**See-saw**
5.	BrF_5	**Octahedron**	**Square pryamid**

Question 10
6 Points

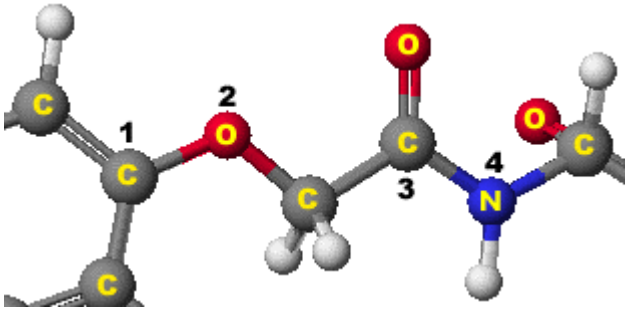


The geometry of PF_2Cl_3 is depicted on the left. Note that the Chlorine atoms occupy the trigonal planar portion of this geometry.

1. Why do you think this is?
   Size, chlorine is bigger than fluorine, occupies site the best accommodates this size difference, that being the trigonal planar sites

2. What molecular property of this molecule would further verify the structure depicted?
   No net dipole moment … Non polar molecule.

Question 11
8 Points



What is the bond angle about the **numbered** atoms

1. **120**
2. **109**
3. **120**
4. **109**

Question 12
8 Points

Classify each of the following molecules as either **polar** or **non-polar**.

1. CH_2Cl_2 **Polar**
2. NH_3 **Polar**
3. I_3^- **Non polar**
4. N_2 **Non polar**

Question 13
5 Points

Which of the following would you anticipate as being the **least soluble** in water. [**Circle your choice**]

1. Sodium nitrate
2. **Carbon disulfide**
3. Hydrochloric acid
4. Ammonia

Briefly justify your choice.

Carbon disulfide is a non polar molecule and thus would be the least soluble in water, as H_2O is polar. All the other molecules are polar and should readily dissolve in water.

Exam I … Extra Credit Question
You must get all five absolutely correct to obtain the bonus 5 points

Fill in the name or the formula for the following ionic salts

1. Sodium hydrogen carbonate — $NaHCO_3$
2. **Iron(III) chlorite** — $Fe(ClO_2)_3$
3. Potassium dichromate — $K_2Cr_2O_7$
4. **Aluminum nitrite** — $Al(NO_2)_3$
5. Sodium nitride — Na_3N

Do Not Write Below This Line

Exam II Score