Question 1
8 Points

Give the noble gas electronic configuration for the following:

1. P^{3-} **[Ar] or [Ne]$3s^2 3p^6$**

2. Co   **[Ar]$4s^2 3d^7$**

3. Cr   **[Ar]$4s^1 3d^5$**

4. Fe^{2+} **[Ar]$3d^6$**

Question 2
10 Points

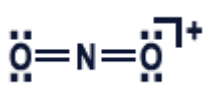Consider the two elements lithium and beryllium:
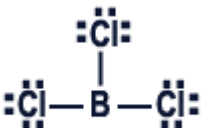
1. Greatest metallic character?   **Li**

2. Highest ionization energy?   **Be**

3. Least electronegative?   **Li**

Consider the two elements fluorine and chlorine

4. Greatest electron affinity?   **F**

5. Smallest atomic size?   **F**

Question 3
16 Points

Draw the **<u>best</u>** Lewis Dot structures for the following:

NO_2^+	SF_4
BCl_3	I_3^-

Question 4
5 Points

Which of the following molecules is expected to have a nitrogen to oxygen bond length closest to 136pm? [Circle your choice]

4 Points

NO^+	NO_2^+	NO_2^-
:N≡O:⁺	Ö=N=Ö⁺	Ö=N̈—Ö:⁻ ↕ :Ö—N̈=Ö⁻
NO Bond Order = 3	NO Bond Order = 2	NO Bond Order = 1½

Briefly justify your choice?

136pm = NO single bond. Looking for the molecule with a bond order closest to 1.

Question 5
9 Points

The molecule N_2O, connectivity N-N-O, has three resonance structures. Draw all three.

1.	2.	3.
:N≡N—Ö:	N̈=N=Ö	:N̈—N≡O:
[0] [+1] [-1]	[-1] [+1] [0]	[-2] [+1] [+1]

6 Points

Using formal charges can you eliminate one of these structures? If so which one? Briefly justify your answer.

Structure 3 Can definitely be eliminated.   Structure 2 also a possible candidate.

Question 6
6 Points

Using the average bond estimate the amount of energy that would be produced by the combustion of 1 mole of H_2CO?

$$H_2CO(g) + O_2(g) = H_2O(g) + CO_2(g)$$
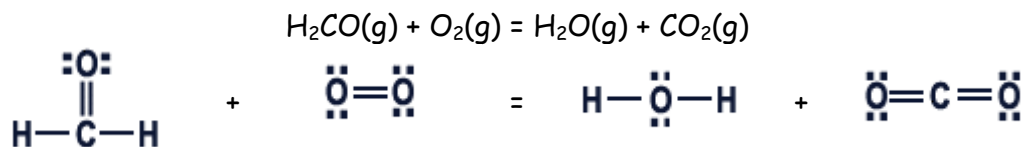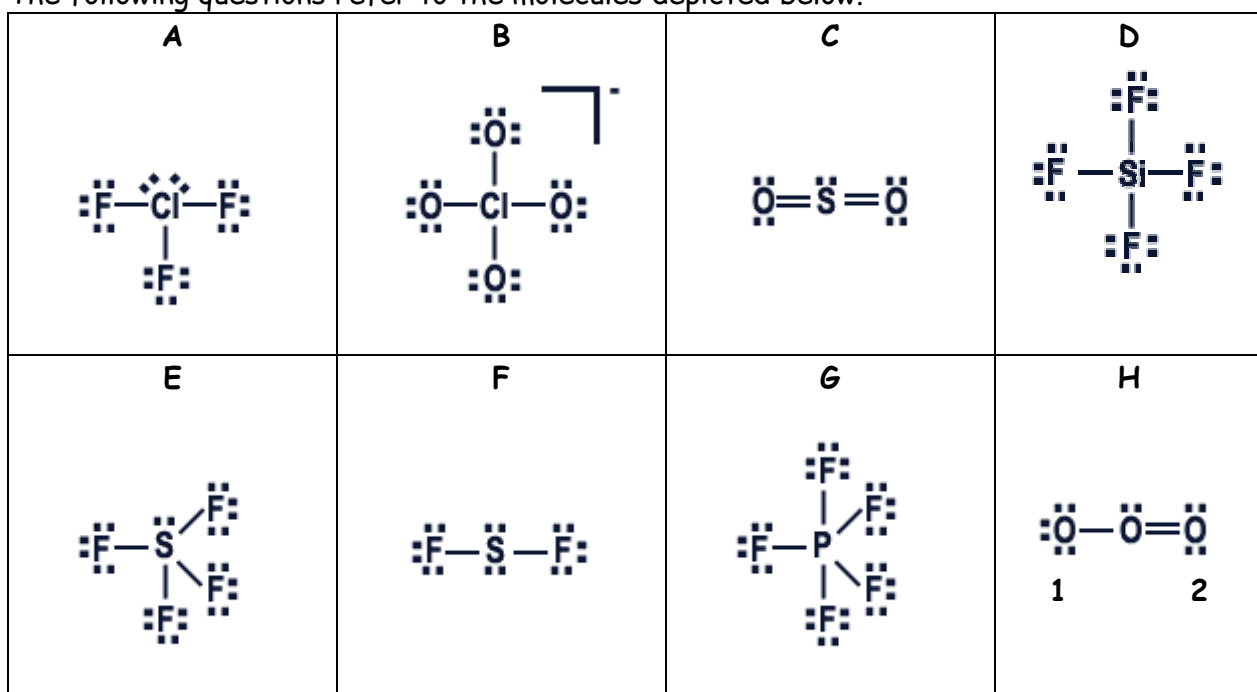
$$\Delta H_{rxn} = \Sigma \text{Bonds Broken} - \Sigma \text{Bonds Formed}$$
$$\Delta H_{rxn} = 2(C-H) + (C=O) + (O=O) - 2(O-H) - 2(C=O)$$
$$\Delta H_{rxn} = 2(414) + (745) + (498) - 2(464) - 2(803) = \textbf{-463kJ.mol}^{-1}$$

Question 7

36 Points

The following questions refer to the molecules depicted below.

A	B	C	D
$:\ddot{F}-\overset{..}{C}l-\ddot{F}:$ with $:\ddot{F}:$ below	$:\ddot{O}-\overset{..}{C}l-\ddot{O}:$ with $:\ddot{O}:$ above and $:\ddot{O}:$ below (with bracket and − charge)	$\ddot{O}=\overset{..}{S}=\ddot{O}$	$:\ddot{F}-Si-\ddot{F}:$ with $:\ddot{F}:$ above and $:\ddot{F}:$ below
E	**F**	**G**	**H**
$:\ddot{F}-S$ with $\ddot{F}:$, $\ddot{F}:$, $\ddot{F}:$	$:\ddot{F}-\overset{..}{S}-\ddot{F}:$	$:\ddot{F}-P$ with $\ddot{F}:$, $\ddot{F}:$, $\ddot{F}:$, $\ddot{F}:$	$:\ddot{O}-\ddot{O}=\ddot{O}$ **1** **2**

1. What is the **electron pair geometry** of:

    A   **Trigonal Bipyramid**   C   Trigonal planar

    B   **Tetrahedron**   F   **Tetrahedron**

2. What is the **molecular geometry** of:

    D   **Tetrahedron**   G   **Trigonal Bipyramid**

    E   **Sea Saw**   H   **Angular or Bent**

3. What is the **formal charge** on the oxygen atoms in H

    O1: **-1**   O2: **0**

4. What is the **oxidation number** on the oxygen atoms in H

    O1: **-1**   O2: **0**

5. What is the **bond angle** about the central atom in:

    C: **120**   F: **109**   H: **120**

6. Which, if any, of the above are **non-polar?**   **B, D, G**