2000 Questions over last section

1 (20 points) Discuss the quantum numbers that are used to describe the orbitals of an atom. Name the quantum number, give its range of values, and tell what property of the orbital it describes.

Principal Quantum number, (n) ,can be any integer>0, Describes energy or size of orbital
Angular momentum quantum #, (ℓ), Integers between 0 and n-1, Describes shape of orbital
magnetic quantum #, (m_ℓ), Integers between -ℓ and + ℓ, Describes orientation of orbital
electron spin quantum #, (m_s), - ½ or + ½ describes spin of electron

2. (20 points) Give the electron configuration of the following atoms or ions

H	Mg^{2+}
$1s^1$	[Ne] or $1s^22s^22p^6$
S^{-2}	Cr^{3+}
[Ar] or [Ne] $3s^23p^6$	[Ar] $4s^23d^1$

3. (20 points) Calculate the ΔH_f MgF_2 [$Mg(s) + F_2(g) \rightarrow MgF_2(s)$] given the following information:

Lattice energy	-3916 kJ/mol
First ionization of Mg	735 kJ/mol
Second ionization of Mg	1445 kJ/mol
Electron affinity of F	-328 kJ/mol
Bond energy of F_2	154 kJ/mol
Enthalpy of Sublimation of Mg	150. kJ/mol

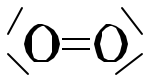
Want: $Mg(s) + F_2(g) \rightarrow MgF_2(s)$

Have:	Lattice energy	$Mg^{2+}(g) + 2F^-(g) \rightarrow MgF_2(s)$	-3916 kJ/mol
	First ionization of Mg	$Mg(g) \rightarrow Mg^+(g) + e^-$	735 kJ/mol
	Second ionization of Mg	$Mg^+(g) \rightarrow Mg^{2+}(g) + e^-$	1445 kJ/mol
	Enthalpy of Sublimation of Mg	$Mg(s) \rightarrow Mg(g)$	150. kJ/mol
	Electron affinity of F	$2x(F(g) + e^- \rightarrow F^-(g)$	2X(-328 kJ/mol)
	Bond energy of F_2	$F_2(g) \rightarrow 2F(g)$	154 kJ/mol
	Net	$Mg(s) + F_2(g) \rightarrow MgF_2(s)$	-2088 kJ/mol

4. (20 points) Write Lewis structures for the following compounds:

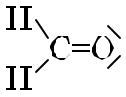
O_2

2x6 = 12 e^- or 6 pairs



H_2CO (C is central atom)

2+4+6 = 12e^-, 6 pairs



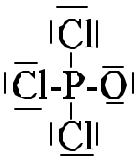
BeH_2

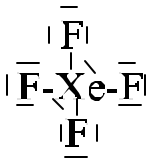
2+2=4e^-, 2 pairs

H-Be-H

$POCl_3$ (P is the central atom)

5+6+ 7(3)= 32e^- = 16 pairs

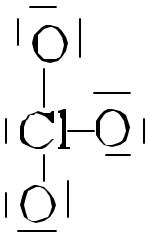


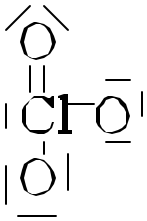


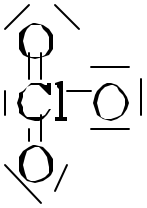
(Be can be less than octet)

XeF

8+4(7) = 36e^- or 18 pairs







5. (20 points) Draw at least 2 non-equivalent Lewis structures for ClO_3^-. Use Formal charge to evaluate these structures and determine the 'best' structure.

7+3(6) +1 = 26 e^- or 13 pairs

Formal Charge

Cl =7-5 = +2
-O = 6-7 = -1

Cl = 7-6 = +1
-O = 6-7 = -1
=O 6-6 =0
Better

Cl=7-7 = 0
-O = 6-7 = -1
=O 6-6 = 0
Best