Useful data: **Speed of light : 2.9979 X 10^{8} m/s**
Planck's constant : 6.626 X 10^{-34} Js
E_n = -2.179 X 10^{-18} J/n^2

1. (15) (a) (3) What is the maximum number of electrons in the 2p subshell of an atom?

(b) (3) Give the complete set of quantum numbers for each of these electrons

(c) (3) Choose the largest atom among the following: Ge, As, Sn, Sb

(d) (3) Choose the most electronegative atom among the following: S, Se, Cl, Br

(e) (3) Put the atoms Cr, Zn, W in order of increasing ionization energy

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2. (a) (7) Calculate the frequency and wavelength of the spectral line of hydrogen corresponding to a transition of an electron from n=6 to n=3.

b) (3) In what region of the electromagnetic spectrum would this spectral line be?

3. (15) What is the electron configuration of the following elements or ions (use noble gas core abbreviated notation):

a) Si

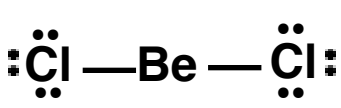
b) Co^{2+}

(c) Show the orbital diagram for Co^{2+} and say whether it is diamagnetic or paramagnetic.

4. (10) Draw a Lewis structure that satisfies the octet rule for iodic acid (HIO_3) and indicate the formal charge on each atom.

5. (10) Draw a Lewis structure for the NO^+ ion.

6. (10) Below are two Lewis structures for $BeCl_2$. Which one is better and why? (give two reasons)



7. (a) (12) Use data from the tables of ionization energies and electron affinities to calculate energy changes for the following reactions:

$Na\ (g) + Cl\ (g) \rightarrow Na^{+}\ (g) + Cl^{-}\ (g)$

$Na\ (g) + 2\ Cl\ (g) \rightarrow Na^{2+}\ (g) + 2\ Cl^{-}\ (g)$

(b) (3) How much larger would the lattice energy of $NaCl_2$ have to be compared to the lattice energy of NaCl for $NaCl_2$ to be more stable than NaCl ?

8. (15) Use bond energy data to estimate the enthalpy change for the following reaction:

$CH_4 + 2\ O_2 \quad \text{----}> CO_2 + 2\ H_2O$

Is it exothermic or endothermic?