1. Explain why the second ionization energy of sodium(4560 kJ/mole) is significantly higher than the second ionization energy of magnesium(1450 kJ/mole), even though the first ionization energy of sodium is less than that of magnesium.

2. Using differences in electronegativity, predict if the bond formed between the following atoms will be ionic, polar covalent, or nonpolar.
a) B, Br; b) Ba, Br; c) Rb, Br; d) C, S; e) C, O; f) Al, Cl; g) C, H; h) C, I; i) C, N; j) Ca, N

3. Assign formal charges to the atoms in the following structures. Which do you think of the two is the most likely structure? Explain.

a)

b)
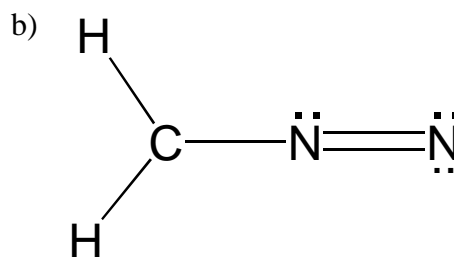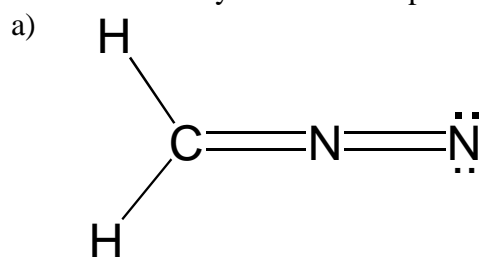
4. Draw lewis structures, including formal charges for the following molecules or ions. When a subscript is added to a symbol in a formula, the atoms denoted are directly and separately bonded to the atom immediately following or immediately preceeding it in the formula.
a) BrO^-; b) IO_4^-; c) O_2^{2-}; d) NO^+; e) AsO_3^{3-}; f) H_2Se; g) CCl_2O; h) $BrSSCl$; i) $O_3SSSO_3^{2-}$; j) SO_2Cl_2

5. Draw the resonance forms for the following molecules: a) N_3^- ; b)FNNN; c) ClCN; d) $ClNO_2$

6. The following are examples of molecules or ions that do not obey the octet rule. The molecules or ions contain a central atom with an expanded octet and only contain single bonds. The total number of valence electrons each molecule or ion calculated must equal the number of valence electrons indicated by covalent bonds and lone pairs. Draw the lewis structure for each molecule or ion and using VSEPR theory predict the geometry. a) SiF_6^{2-} ; b) SF_4; c) PF_5; d) XeF_4

7. Describe the hybridization of the sulfur atom in SF_2, SF_4, SF_6, molecules.

8. The bond distance in the BrCl molecule is 214 pm and has a charge separation of 8.90×10^{-21} C. Calculate the dipole moment of the molecule. $1.00 D = 3.34 \times 10^{-30}$ C·m. Calculate the percent partial ionic character of the Br-Cl bond. The unit charge, e, is 1.60×10^{-19} C.

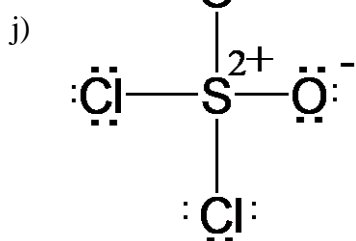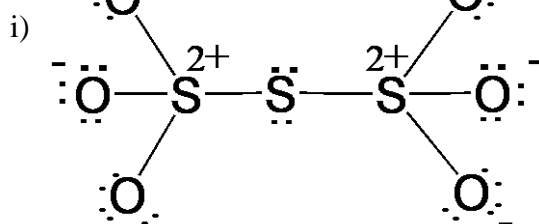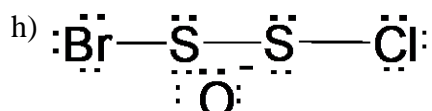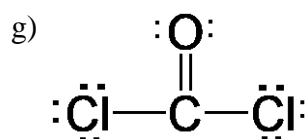9. How can you account for the fact that the dipole moment of SO_2 is 1.63 D, but that of CO_2 is zero?

1. Both the first and second electrons lost from magnesium are 3s. The second electron for sodium must be removed from a 2p level that is filled and has a complete octet. Thus the second ionization energy of sodium is very high.
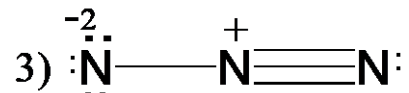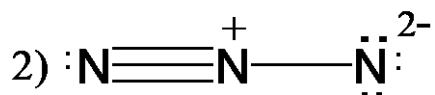
2. Pair	Electronegativity Difference	Type of Bond
a) B, Br	0.8	polar covalent bond
b) Ba, Br	1.9	polar covalent bond
c) Rb, Br	2.0	ionic bond
d) C, S	0	nonpolar covalent bond
e) C, O	1.0	polar covalent bond
f) Al, Cl	1.5	polar covalent bond
g) C, H	0.4	nonpolar covalent bond
h) C, I	0	nonpolar covalent bond
i) C, N	0.5	polar covalent bond
j) j) Ca, N	2.0	ionic bond

3. a)

b)
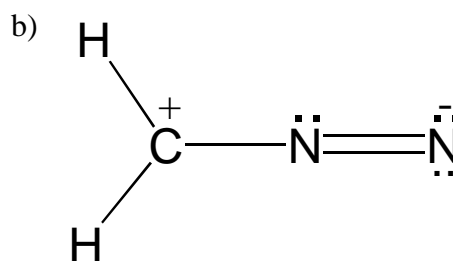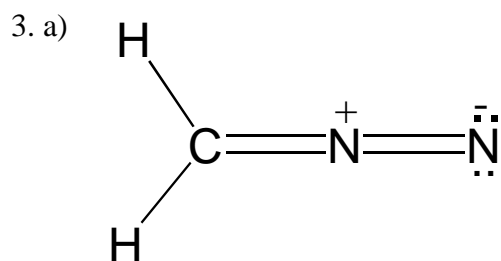
Structure a) is more important because it allows an octet of electrons for all the atoms.

4.a)

b)

c)

d)

e)

f)

g)

h)

i)

j)

5. a)

1) $:\!\overset{\displaystyle -}{\underset{\displaystyle ..}{N}}\!=\!\!=\!\overset{\displaystyle +}{N}\!=\!\!=\!\overset{\displaystyle -}{\underset{\displaystyle ..}{N}}\!:$
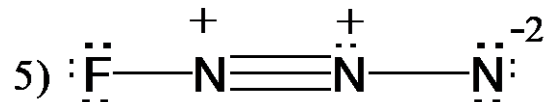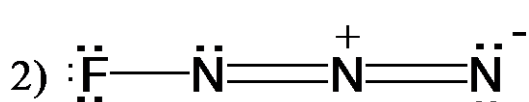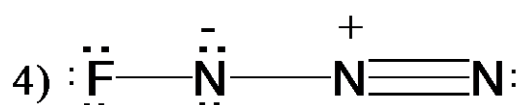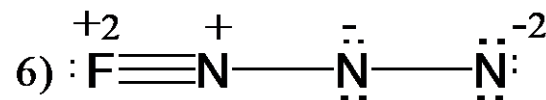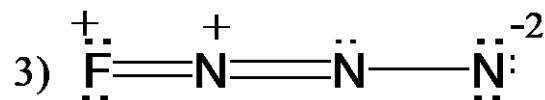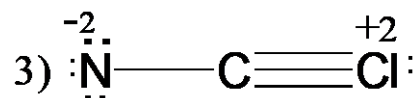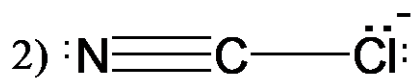
2) $:N\!\equiv\!\overset{\displaystyle +}{N}\!-\!\overset{\displaystyle 2-}{\underset{\displaystyle ..}{N}}\!:$

3) $:\overset{\displaystyle -2}{\underset{\displaystyle ..}{N}}\!-\!\overset{\displaystyle +}{N}\!\equiv\!N\!:$

5. b)

1) $\overset{\displaystyle +}{F}\!=\!\!=\!N\!-\!N\!=\!\!=\!\overset{\displaystyle -}{N}$

2) $:F\!-\!N\!=\!\!=\!\overset{\displaystyle +}{N}\!=\!\!=\!\overset{\displaystyle -}{N}$

3) $\overset{\displaystyle +}{F}\!=\!\!=\!\overset{\displaystyle +}{N}\!=\!\!=\!N\!-\!\overset{\displaystyle -2}{N}:$

4) $:F\!-\!\overset{\displaystyle -}{N}\!-\!N\!\equiv\!N:$ ... $\overset{\displaystyle +}{}$

5) $:F\!-\!\overset{\displaystyle +}{N}\!\equiv\!\overset{\displaystyle +}{N}\!-\!\overset{\displaystyle -2}{N}:$ **Not Likely**

6) $:\overset{\displaystyle +2}{F}\!\equiv\!N\!-\!\overset{\displaystyle +}{N}\!-\!\overset{\displaystyle -2}{N}:$

c)

1) $\overset{\displaystyle -}{N}\!=\!\!=\!C\!=\!\!=\!\overset{\displaystyle +}{Cl}$

2) $:N\!\equiv\!C\!-\!\overset{\displaystyle -}{Cl}:$

3) $:\overset{\displaystyle -2}{N}\!-\!C\!\equiv\!\overset{\displaystyle +2}{Cl}:$

d)

1) $:Cl\!-\!\overset{\displaystyle +}{N}$ bonded to $=O$ and $-O^{-}$

2) $:Cl\!-\!\overset{\displaystyle +}{N}$ bonded to $-O^{-}$ and $=O$
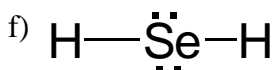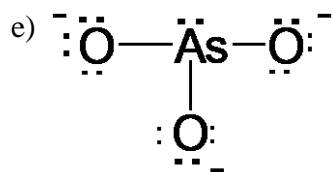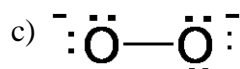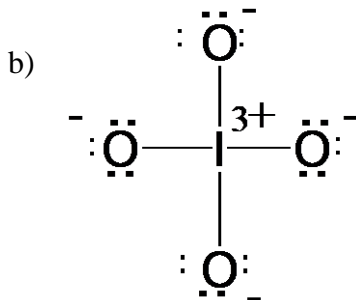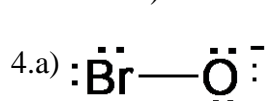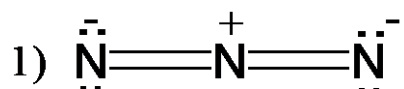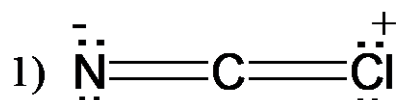
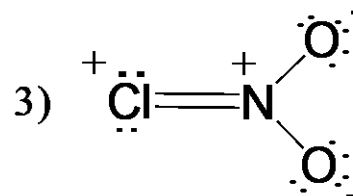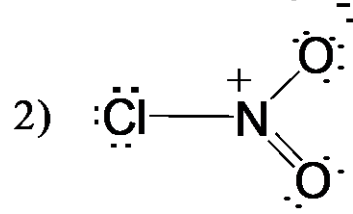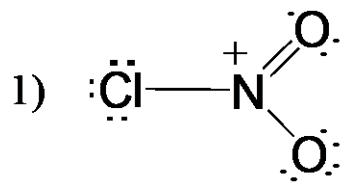3) $\overset{\displaystyle +}{Cl}\!=\!\overset{\displaystyle +}{N}$ bonded to $-O^{-}$ and $-O^{-}$ **Not Likely**

6. a) SiF_6^{2-} : octahedral b) SF_4: see-saw c) PF_5: triangular bipyramidal d) XeF_4: square planar

7. SF_2: sp^3, SF_4: sp^3d, SF_6: sp^3d^2

8. dipole moment is 0.57 D, 5.5% ionic character in the Br-Cl bond.