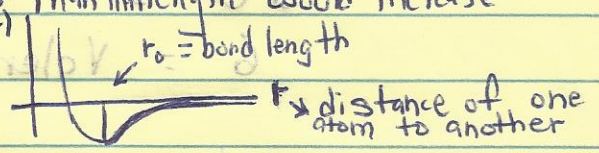
Unit 11 Problem Set

1) c. The bond length ~~repr~~ results in a minimization of the potential energy of the participating atoms by minimizing the repulsive interactions (electron-electron, proton-proton) and maximizing the attractive interactions (proton-electron). Anything less than that length would increase the potential energy.



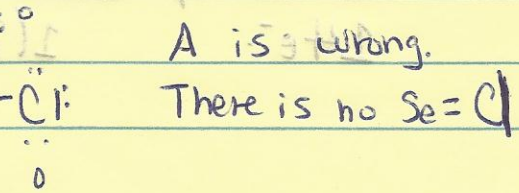
2) Both atoms have a positively charged nuclei that will repel each other if brought closer than the energetically stable bond length. It would require energy to bring them any closer.

3) Ionic compounds a. Between Metals + nonmetals
b. e^- transferred from metal to nonmetal. (cations + anions form)
Covalent compounds a. Between nonmetals
b. e^- are shared by the elements

4) Si - O ; greatest ΔEN = 3.5 - 1.8 = **1.7**
1.8 3.5

5) $SeCl_3^+$ Valence e^- = (valence e^- Se) + 3(valence e^- Cl) - $1e^-$
= $6e^- + 3(7e^-) - 1e^-$
= $26e^-$

To satisfy octet for Se + 3Cl Need $4(8e^-) = 32e^-$
$32e^-$
$-\ 26e^-$
$6e^- \div 2e^- = 3$ bonds
$26e^- - 6e^- = 20$ free e^-



A is wrong.
There is no Se = Cl

6) :F: X :F: Total # of valence e^- = 20

Total valence e^- = Valence e^- for X + 2(valence for F)

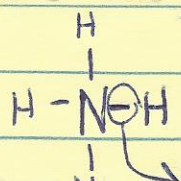
20 = 11 + 2(7e^-)

20 = 11 + 14e^-

6 = Valence e^- for X

X = O (C)

7) c)



This bond in ammonium is formed from ~~the~~ a pair of electrons that came from the N atom. That pair of electrons interacts with a H^+ that originated from an acid. This is ~~covalent~~ a coordinate covalent bond.

8) b) ~~#~~ These elements do not have energetically accessible d-orbitals.

9) a. NH_3 # of valence e^-: 5 for N and 1 for each H

= 8e^-

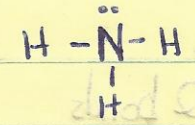
To satisfy octet for N and duet for H need 14e^-. 1(8e^-) + 3(2e^-) = 14e^-

Need 14 e⁻

- 8 e⁻ Valence

6 e⁻ ÷ 2 e⁻ = 3 bonds

8 - 6 e⁻ = 2 free e⁻



b. CH_4 # of valence e⁻: 4 for C + 4 (1 for H)

= 8 e⁻

To satisfy C octet + H duet need

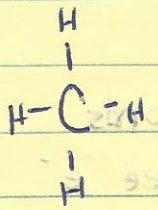
1 (# 8 e⁻) + 4 (2 e⁻) = 16 e⁻

16 e⁻ Need

- 8 e⁻ Valence

8 e⁻ ÷ 2 e⁻ = 4 bonds

8 e⁻ - 8 e⁻ = 0 free e⁻



c. CO_3^{2-} # of valence e⁻: 4 for C + 3 (6 for O) + 2 e⁻

= 24 e⁻

To satisfy octet for C + O need

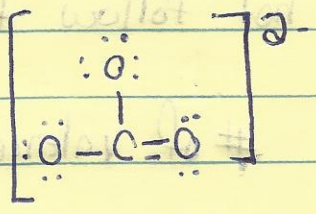
4 (8 e⁻) = 32 e⁻

32 e⁻ Need

- 24 e⁻ Valence

8 e⁻ ÷ 2 e⁻ = 4 bonds

24 e⁻ - 8 e⁻ = 16 e⁻ free

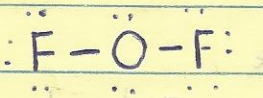


d. OF_2 # of valence e⁻ = 6 for O + 2 (7 for F)

= 20 e⁻

To satisfy octet for O + F need 3 (8 e⁻) = 24 e⁻

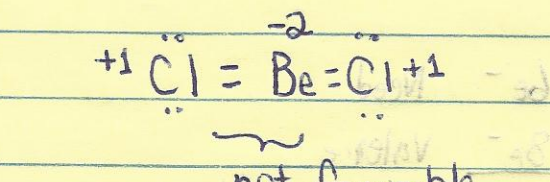
$24e^-$ Need
$20e^-$ Valence
$4e^- \div 2e^- = 2$ bonds
$20e^- - 4e^- = 16$ free e^-

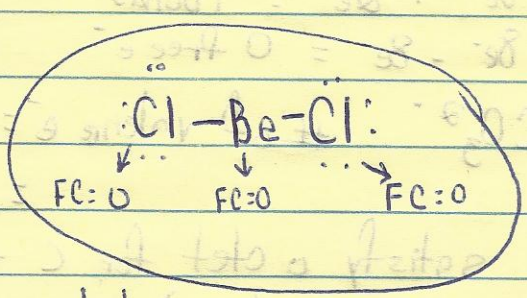


e. $BeCl_2$ # of valence e^- = 2 for Be + 2(7 for Cl)
= $16e^-$

To satisfy octet for Be + Cl need $3(8e^-) = 24e^-$

$24e^-$ Need
$16e^-$ Valence
$8e^- \div 2e^- = 4$ bonds
$16e^- - 8e^- = 8$ free e^-





Does not follow the octet rule.

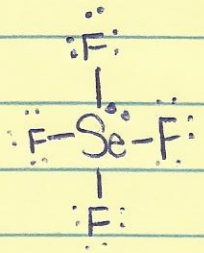
10) SeF_4 # of valence e = 6 for Se + 4($7e^-$ for F)
= $34e^-$

To satisfy octet for Se + F need $5(8e^-) = 40e^-$

$40e^-$ Need
$34e^-$ Valence
$6e^- \div 2e^- =$ 3 bonds
$34e^- - 6e^- = 28$ free e^-

NOTE:
Does not make sense here because should be 4 bond. Recall that Se is an element that has energetically accessible d-orbital.

There should be 4 bonds and more e^- on Se if there are extra e^-. Fill the octet for F first. Then fill octet for Se + add extra e^-



11) a. Mg S $\Delta EN = 2.5 - 1.2 = 1.3$

Be S $\Delta EN = 2.5 - 1.5 = 1.0$ lower ΔEN; more covalent

b. L:F $\Delta EN = 4.0 - 1.0 = 3.0$

L:I $\Delta EN = 2.5 - 1.0 = 1.5$ lower ΔEN

c. Hg S $\Delta EN = 2.5 - 1.9 = 0.6$ lower ΔEN

Ba S $\Delta EN = 2.5 - 0.9 = 1.6$ ~~lower ΔEN~~

d. $MgCl_2$ $\Delta EN = 3.0 - 1.2 = 1.8$

$AlCl_3$ $\Delta EN = 3.0 - 1.5 = 1.5$ lower ΔEN

Sorry, I kept circling the wrong ones first.

12) Single bond = 2e⁻ are shared

Double bond = 4e⁻ " "

Triple bond = 6e⁻ " "

Relative bond strength triple bond > double bond > single bond