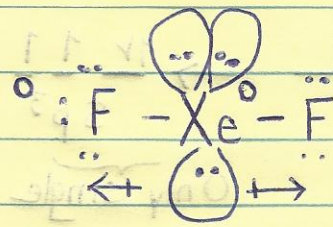
Unit 12 Problem Set

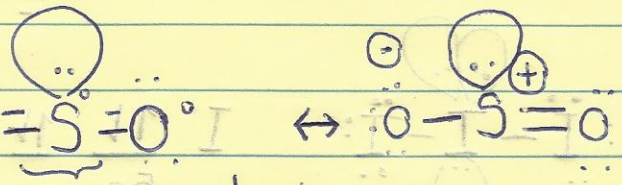
1) XeF_2 Valence $e^- = 8e^-$ for Xe + $2(7e^-$ for F$)$
$= 22e^-$



Note:
a. 5 e^- groups
b. 3 lone pairs
∴ Geometry linear
c. Formal charge is 0 on all atoms


= No dipole moment, Nonpolar molecule

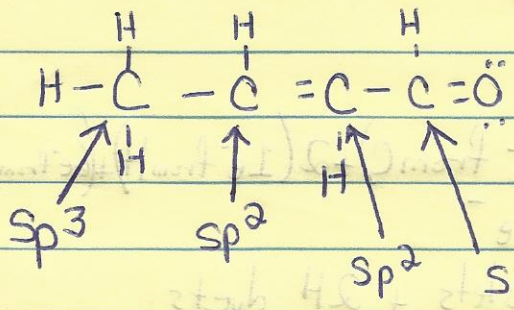
2) SO_2 Valence $e^- = 6e^- + 2(6e^-) = 18e^-$



will not be linear
· resonance structures

a. 3 e^- groups
b. 1 lone pair
c. Formal charges are 0
d. Bent geometry

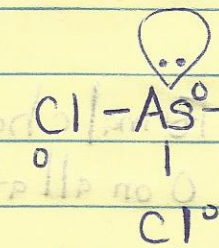
3)



- Imagine the C as central atoms
- sp^2 orbitals have trigonal planar geometry

(d)

4) a. $AsCl_3$ Valence $e^- = 5$ for As + 3(7e⁻ for Cl)
$= 26\ e^-$

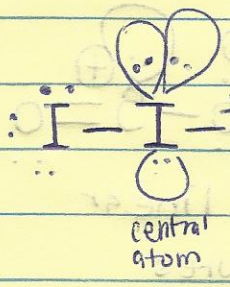


As $\underline{1\downarrow}$ (4s) $\underline{1}\ \underline{1}\ \underline{1}$ (4p) → $\underline{1\downarrow}\ \underline{1}\ \underline{1}\ \underline{1}$ (sp^3)

Only single bonds in the structure

- normal octet
- sp^3 hybrid orbitals

b. I_3^- Valence e^- = (3 × 7e⁻ for I) + 1e⁻
$= 22e^-$



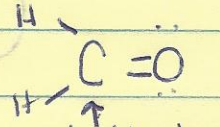
I $\underline{1\downarrow}$ (5s) $\underline{1\downarrow}\ \underline{1\downarrow}\ \underline{1}$ (5p) ____ (5d) → $\underline{1\downarrow}\ \underline{1\downarrow}\ \underline{1}\ \underline{1}$ (sp^3d) ____ (d)

- Expanded octet
- Must use d orbitals
- 5 e⁻ groups
- trigonal bipyramidal e⁻ geometry
- sp^3d

c. CH_2O Valence e^- = (4e⁻ from C) + 2(1e⁻ from H) + (6e⁻ from O)
$= 12e^-$

Need 20 e⁻ to satisfy C + O octets + 2H duets.

20 e⁻ need
- 12e⁻
8e⁻ ÷ 2e⁻ = 4 bonds
12e⁻ − 8e⁻ = 4e⁻ free



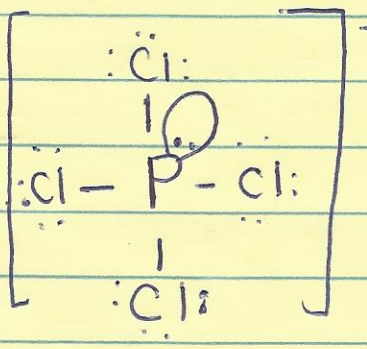
double bond; sp^2 orbitals, trigonal planar e⁻ geometry
normal octet

d. C_2H_2 Valence e^- = 2x(4e^- from C) + 2x(1e^- from H)
= 10e^-

20e^- need
-10e^- valence
10e^- ÷ 2e^- = 5 bonds
20e^- - 10e^- = 10e^- free

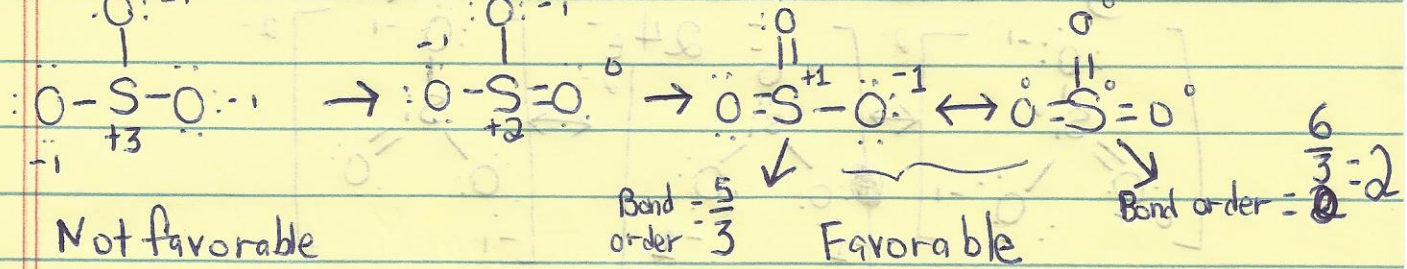
H-C≡C-H

5) PCl_4^- Valence e^- = (5e^- for P) + 4(7e^- for Cl) + 1e^-
= 34 e^-



- Expanded octet
- P has a formal charge of -1 but that is ok because of the accessible d orbitals
- 5 e^- groups
- See saw shape
- ⓔ tetraedral distorsionada

6) SO_3 Valence e^- = (6e^- for S) + 3(6e^- for O)
= 24e^-



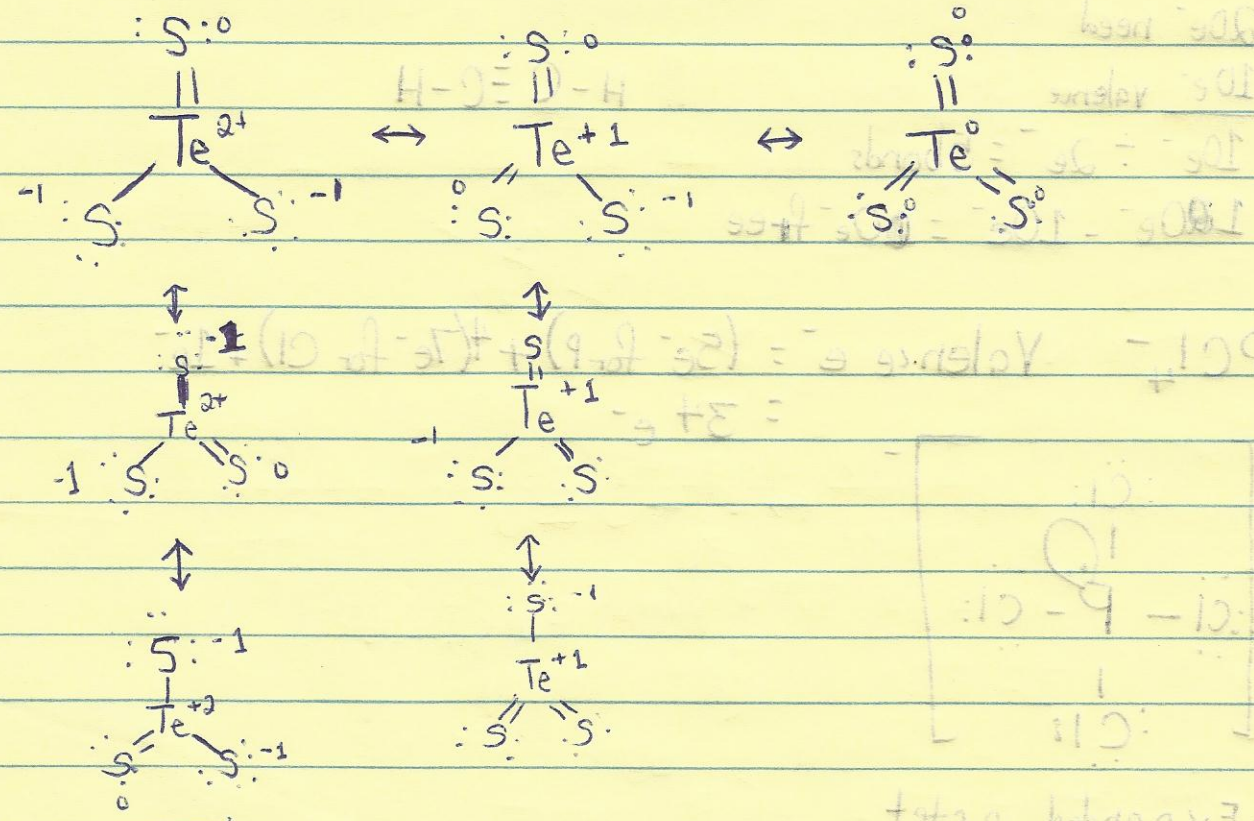
Not favorable

Bond order = 5/3

Favorable

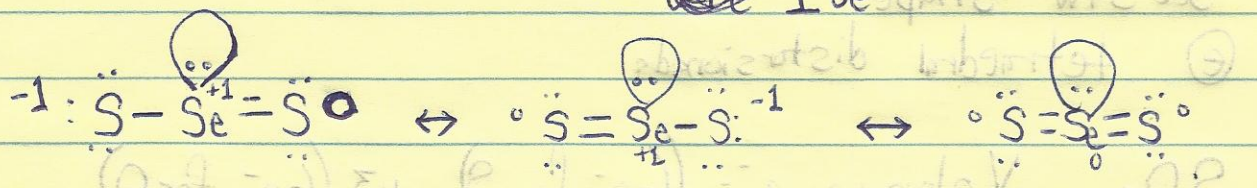
Bond order = 6/3 = 2

7) a. TeS_3 Valence e^- : $(6e^-$ for Te$) + 3(6e^-$ for S$)$
: $24\ e^-$

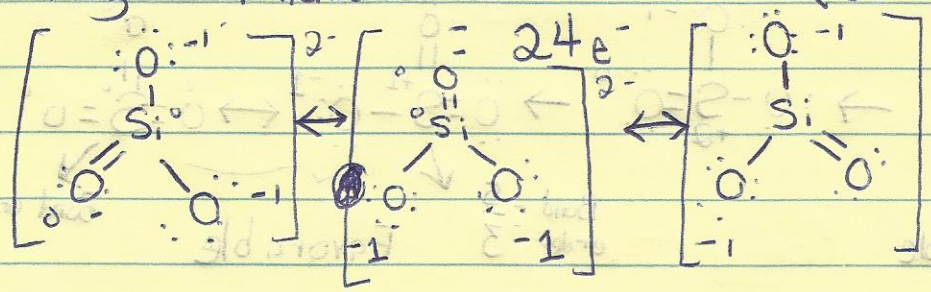


All 3 are less favorable due to charge separation.

b. SeS_2 Valence e^- : $(6e^-$ for Se$) + 2(6e^-$ for S$)$
: $18e^-$

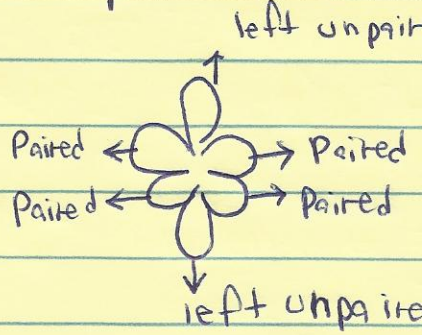


c. SiO_3^{2-} Valence e^- : $(4e^-$ for Si$) + 3(6e^-$ for O$) + 2e^-$
: $24\ e^-$



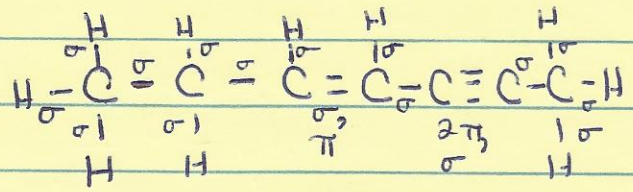
In my opinion, the number of resonance structures is not a good indicator of stability.

8) d. sp^3d^2



} Then the structure would be square planar

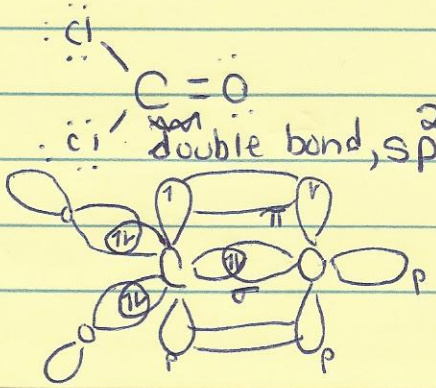
9)



d. 16 σ bonds,
3π bonds

10) $COCl_2$ Valence e^- = (4e⁻ for C) + (6e⁻ for O) + 2(7e⁻ for Cl)
= 24 e⁻

Need 32e⁻
Valence 24e⁻
8e⁻ ÷ 2e⁻ = 4 bonds
24e⁻ − 8e⁻ = 16e⁻



O 1↿ 1↿ 1 1
2s 2p

Cl 1↿ 1↿ 1↿ 1 _
2s 2p

C 1↿ 1 1 _ → 1 1 1 1
2s 2p sp^2 p