

Announcements – Lecture X – Tuesday, Oct 8th

1. **Lab 3 – Saturday, October 19th, 1:00-4:00 pm – ISB 155/160 A-E**
Lab Owl II – Deadline – Saturday, October 19th, 11:59 pm

2.



iClicker:

Choose any letter: A-E

Announcements – Lecture X – Tuesday, Oct 8th

Exam I Statistics

Papers: 131

Average: 79

High Score: 100

100: 2

>90: 39

>80: 36

>70: 24

>60: 13

>55: 5

<55: 12

3.7

C

Group III:

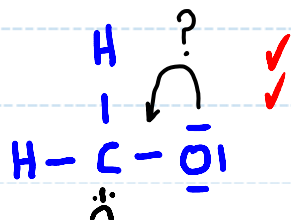
What Is a Covalent Bond and How Does One Form?

Drawing Lewis Structures of Covalent Compounds

Shortage of Electrons ... Multiple Bonds

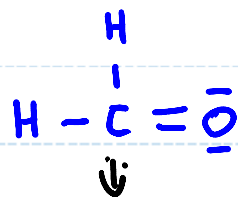


$$\begin{array}{r}
 \text{H:} \quad 2(1) \\
 \text{C:} \quad 4 \\
 \text{O:} \quad 6 \\
 \hline
 12 \\
 3 \times \text{BP} \quad -6 \\
 \hline
 6 \\
 3 \times \text{LP} \quad -6 \\
 \hline
 0
 \end{array}$$



? Do I have a terminal atom with at least one lone pair on it?

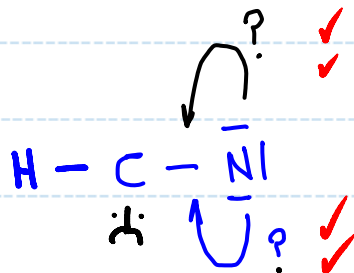
? Are both atoms that are about to form a multiple bond members of **INOPS**?



Yes to both questions ... make a multiple bond



$$\begin{array}{r}
 \text{H:} \quad 1 \\
 \text{C:} \quad 4 \\
 \text{N:} \quad 5 \\
 \hline
 10 \\
 2 \times \text{BP} \quad -4 \\
 \hline
 6 \\
 3 \times \text{LP} \quad -6 \\
 \hline
 0
 \end{array}$$



3.7

What Is a Covalent Bond and How Does One Form?

C

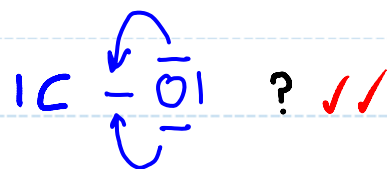
Drawing Lewis Structures of Covalent Compounds

Group III:

Shortage of Electrons ... Multiple Bonds

CO Class Homework Exercise

$$\begin{array}{r}
 \text{C:} \quad 4 \\
 \text{O:} \quad 6 \\
 \hline
 1 \times \text{BP} \quad -2 \\
 \hline
 8 \\
 3 \times \text{LP} \quad -6 \\
 \hline
 2 \\
 1 \times \text{LP} \quad -2 \\
 \hline
 0
 \end{array}$$

Notes

Multiple bonds a possibility when the central atom does not have an octet when all the valence electrons have been distributed if _

a) There is a terminal atom with at least one lone pair of electrons and ...

b) Both atoms forming the multiple bond are members of ENOPS

(Carbon, Nitrogen, Oxygen,
Phosphorus, Sulfur)

3.9

What is Resonance?

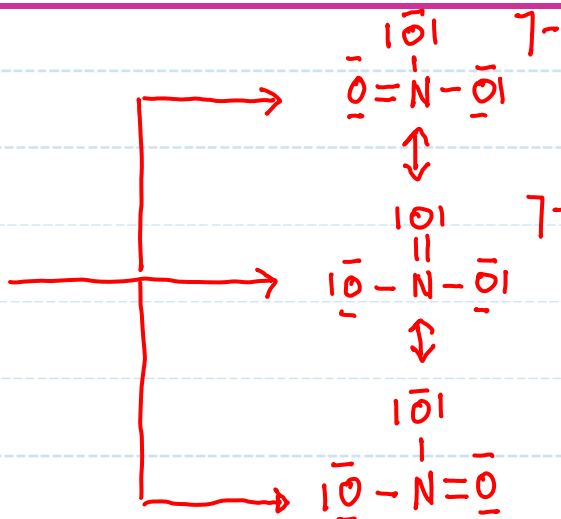
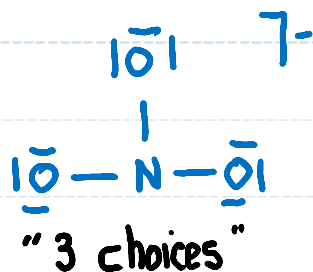
Drawing Lewis Structures of Covalent Compounds

Group IV:

Choices When Forming Multiple Bonds ... Resonance



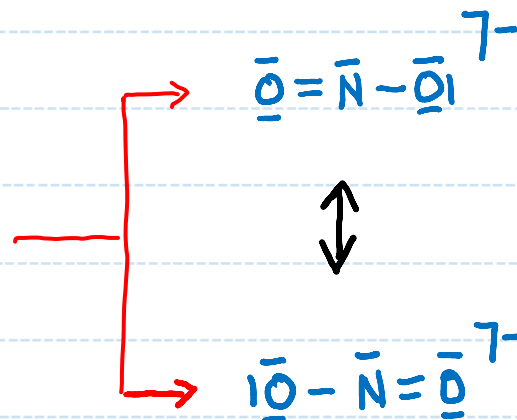
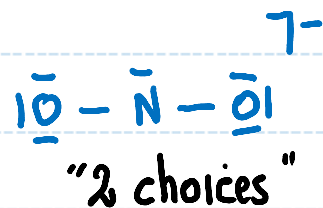
$$\begin{array}{r}
 \text{N:} \quad 5 \\
 \text{O:} \quad 3(6) \\
 \text{---} \quad 1 \\
 \hline
 24 \\
 3 \times \text{BP} \quad -6 \\
 \hline
 18 \\
 9 \times \text{LP} \quad -18 \\
 \hline
 0
 \end{array}$$



↔ denotes that the structures are Resonance ones.



$$\begin{array}{r}
 \text{N:} \quad 5 \\
 \text{O:} \quad 2(6) \\
 \text{---} \quad 1 \\
 \hline
 18 \\
 2 \times \text{BP} \quad -4 \\
 \hline
 14 \\
 6 \times \text{LP} \quad -12 \\
 \hline
 2 \\
 1 \times \text{LP} \quad -2 \\
 \hline
 0
 \end{array}$$



3.9

What is Resonance?

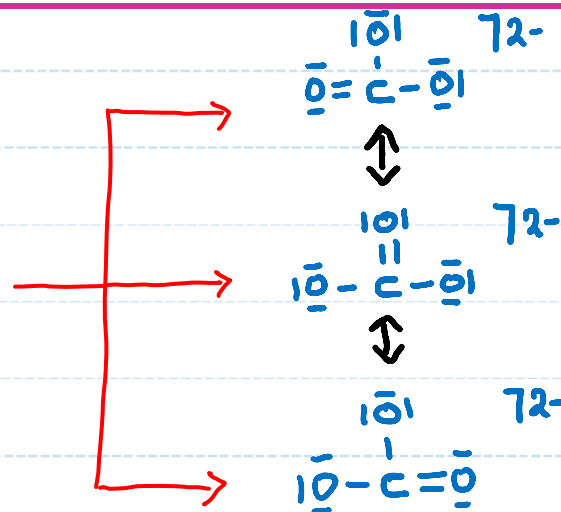
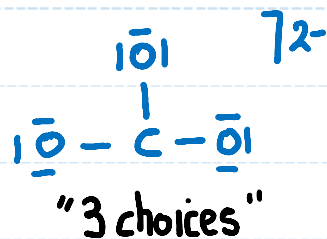
Drawing Lewis Structures of Covalent Compounds

Group IV:

Choices When Forming Multiple Bonds ... Resonance



$$\begin{array}{r} \text{C:} \quad 4 \\ \text{O:} \quad 3(6) \\ 2-: \quad 2 \\ \hline 24 \\ 3 \times \text{BP} \quad -6 \\ \hline 18 \\ 9 \times \text{LP} \quad -18 \\ \hline 0 \end{array}$$

Notes

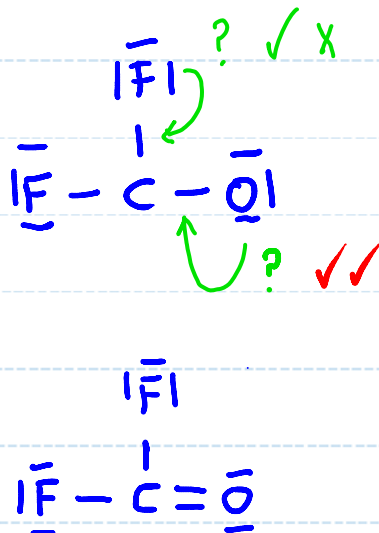
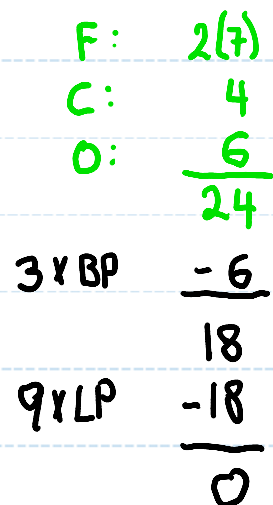
a) \leftrightarrow used to denote Lewis Structures that are Resonance Structures.

b) Resonance Structures are not "real" structures - they are extremes - the actual structure is the weighted average of all the reasonable Resonance Structures.

3.7
C

What Is a Covalent Bond and How Does One Form?
Multiple Bonds – Resonance?

F_2CO (Not on Worksheet)



How many equivalent Lewis structures are necessary to describe the bonding in F_2CO

- a) 0 **b) 1** c) 2
d) 3 e) Help

3.7

C

Group V:

What Is a Covalent Bond and How Does One Form?

Drawing Lewis Structures of Covalent Compounds

Organic Molecules



$$\text{C} : 2(4)$$

$$\text{H} : 6(1)$$

$$\text{O} : 6$$

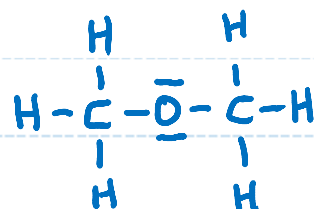
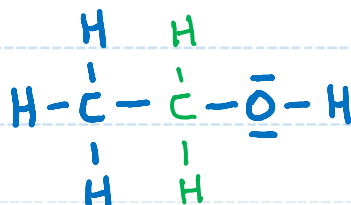
$$\hline 20$$

$$8 \times \text{BP} \quad -16$$

$$\hline 4$$

$$2 \times \text{LP} \quad -4$$

$$\hline 0$$



How many C-H bonds are there in $\text{C}_2\text{H}_6\text{O}$

a) 3

b) 4

c) 5

d) 6

e) Help



How do I know which one?
Does it matter?

Notes

When dealing with organic molecules we can assume with some degree of certainty that the "Octet Rule" is not violated and thus:

C: 4 bonds, 0 lone pairs

N: 3 bonds, 1 lone pair

O: 2 bonds, 2 lone pairs

Halides: 1 bond, 3 lone pairs

