

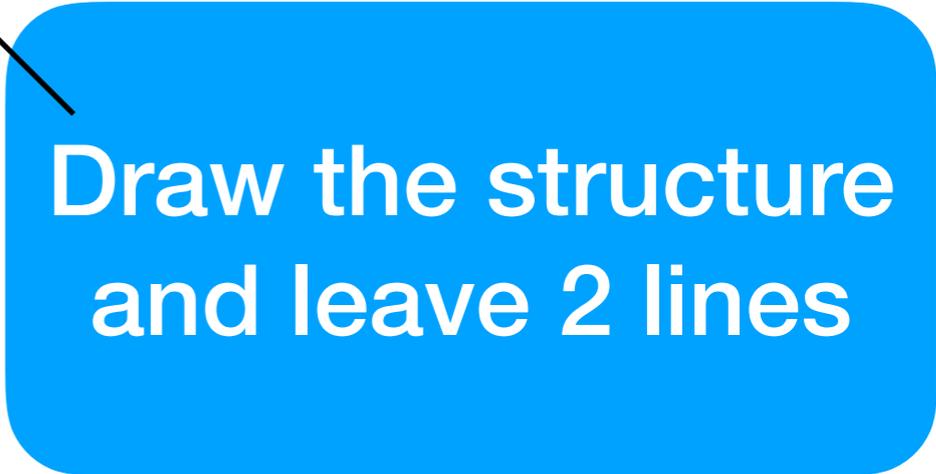
Molecular Structures

Resonance

Bond length and strength

Formal Charge

Draw the Lewis Structure for O₃ (ozone)



Draw the structure
and leave 2 lines

1) Resonance Structures:

A molecule or polyatomic ion that cannot be represented by a single Lewis Structure (there will be a double bond that can be placed on more than one identically attached atom)

***the actual molecule is a hybrid of the resonance structures**

Bond Length and Strength

	Bond Length	Bond Strength
Single bonds	longest	Weakest
Double bonds	middle	middle
Triple bonds	shortest	strongest

Note: The greater the bond energy, the shorter and stronger the bond.

Bond Energy:

Bond energy (kJ/mol)	
H—F	570
C—F	552
O—O	498
H—H	436
H—Cl	432
C—Cl	397
H—Br	366
H—I	299
C—Br	280
Cl—Cl	243
C—I	209
Br—Br	193
F—F	159
I—I	151

Don't write
this down!

Practice:



Leave 3 lines.

Which compound contains the longest C-C bond?

Leave 1 line.

Which compound contains the strongest C-C bond?

Leave 1 line.

2) Bond Energy:

Energy required to break a chemical bond and form neutral isolated atoms (reported in kJ/mol)

FIGURE 2.5

BOND LENGTHS AND BOND ENERGIES FOR SELECTED COVALENT BONDS

Don't write the table!

Bond	Average bond length (pm)	Average bond energy (kJ/mol)	Bond	Average bond length (pm)	Average bond energy (kJ/mol)
H—H	75	436	C—C	154	346
F—F	142	159	C—N	147	305
Cl—Cl	199	243	C—O	143	358
Br—Br	229	193	C—H	109	418
I—I	266	151	C—Cl	177	327
H—F	92	569	C—Br	194	285
H—Cl	127	432	N—N	145	163
H—Br	141	366	N—H	101	386
H—I	161	299	O—H	96	459

Use the bond energy table to calculate the energy needed to break all covalent bonds in CH₄.

Leave 4-5 lines.

**Use the bond energy table to
calculate the energy needed to
break all covalent bonds in
CH₂O.**

Leave 4-5 lines.

3) Formal Charge (FC):

- **A method used to determine the most likely possible Lewis structure**
- **The charge an atom would have if all the atoms in a molecule had the same electronegativity**

Steps for FC:

1. Draw a possible Lewis structure.

2. Calculate the FC for each unique atom, where

$$FC = (\# \text{ valence electrons}) - \text{dashes} - \text{dots}$$

3. Total the FC for all unique atoms.

4. Calculate the ΔFC for the structure.

$$\Delta FC = FC_{max} - FC_{min}$$

5. Do steps #1-4 for all possible structures. The

Lewis structure with the ΔFC closest to zero

will be preferred.

6. When two Lewis structures have the same ΔFC , choose the one that has the more negative charge on the most electronegative element.

**Draw 3 possible Lewis structures for SCN^-
(make sure you put C in the center)**

Draw the structures and we will
finish the FC in class!