Office Hours: M 1:30pm – 3:00pm
(in Park 169) W 11:00am – 12:00pm
or by appointment (email me)
or just email me with questions!

TA Hours: TBD

Q-center: https://www.brynmawr.edu/inside/offices-services/q-center/q-center-schedule

Lewis Structure, Formal Charge, and Bonding

8/31/2026

Syllabus & Course Resources

Syllabus link

Course Calendar w/HW problems

Office hours (in Park 169): M 1:30pm – 3:00pm
W 11:00am – 12:00pm
or by appointment (email me)
or just email me with questions!

When2meet poll for TA/office hours

All of this is on Moodle

In-class Polling with PollEverywhere

pollev.com/timcook653 or text timcook653 to 22333
(Also has Android/iPhone app)

Poll

Is cheesecake a cake or a pie?

A. Cake
B. Pie
C. Neither
D. I need more time to decide

Poll

Do you want a printed copy of each handout?

A. Yes

B. No

C. Sometimes/Maybe

Tips for success

- Know how to do every assigned homework problem.
  - "2nd language" textbook has additional problems as well
- Use all the resources at your disposal.
  - Office hours, TA hours, textbook, email/talk to me!
- Study with others.
- Practice consistently & effectively.
  - "Retrieval Practice" versus re-reading/reviewing
  - Work problems!
- Come to class prepared.
  - Read the assigned text sections before class.
  - Lectures will not be recorded.
- Be active in class.
  - Ask questions!

What is organic chemistry?

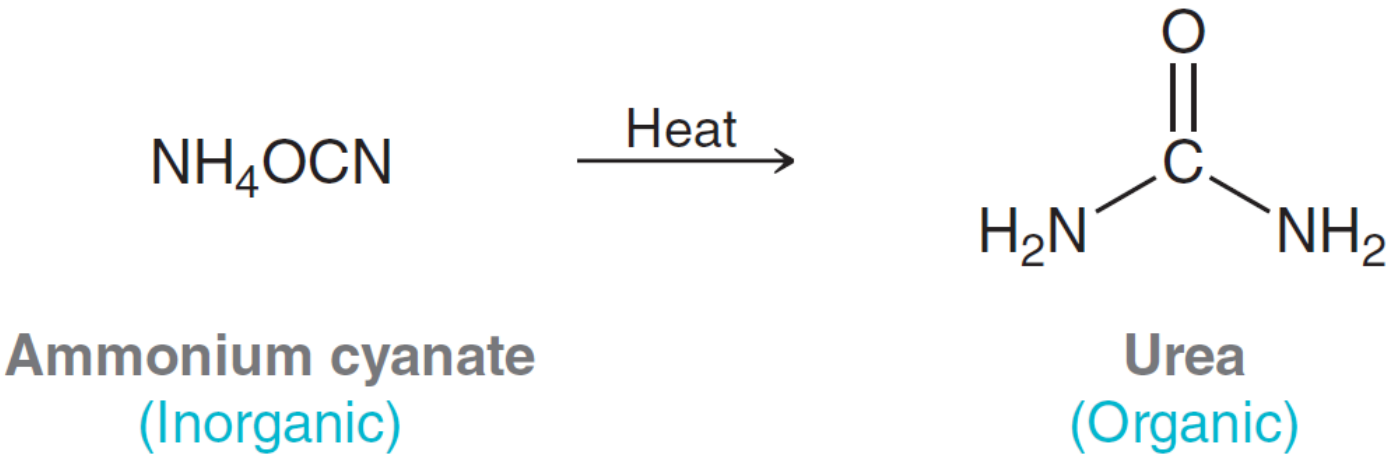
had a "soul"

Early 1800's: *Organic matter* – derived from living things

Inorganic matter – derived from nonliving things

Vitalism – organic matter is imbued with a "life force"

inorganic is not, and cannot be converted to organic matter



Friedrich Wohler, 1828

Called "vitalism" into question

What is organic chemistry?

The study of biomolecules, and their analogs (molecules with similar structures).

things that look like

amino acids sugars lipids (fats)

Most biomolecules are made from "Carbon and Friends"

C, H, O, N, "X", S, P

"X" → halogens

Why does it matter to you?

medicine! Life is a set of self-perpetuating chemical reactions.

"Electrons go from where they <u>are</u> to where they <u>aren't</u>." – describes most chemical processes.

bond making & bond breaking
↳ e^- move around

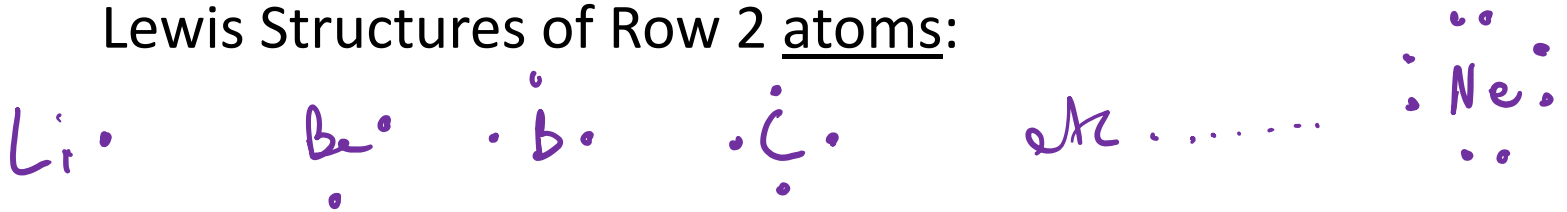
Where can electrons be in a molecule?

bonds
or
lone pairs
(non bonding orbitals)

Lewis Structures

- Represent valence electrons in a molecule as bonding or nonbonding ("lone pairs")
  - Use "dots" to represent nonbonding electrons
  - Use lines to represent bonding electrons
    - 1 line -> single bond -> 2 electrons

Lewis Structures of Row 2 <u>atoms</u>:

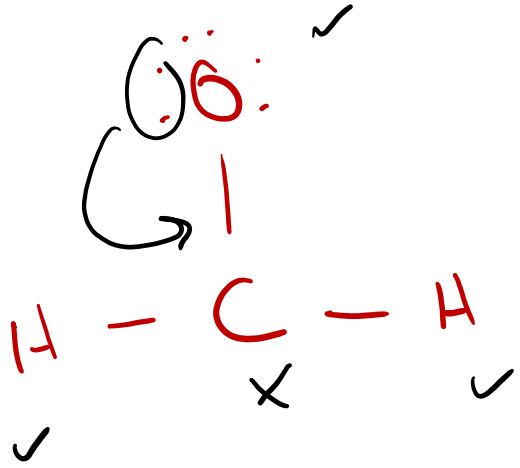


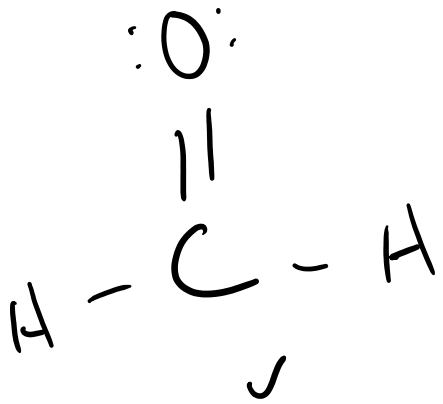
- Can predict geometry, polarity, and stability of a molecule

- Based on the octet rule – atoms are most stable with 8 valence electrons
  - Hydrogen (and Helium): stable with 2 valence electrons

- To generate Lewis Structure: count total valence electrons in molecule and distribute so every atom has an octet!

Example: Draw the Lewis Structure of CH_2O

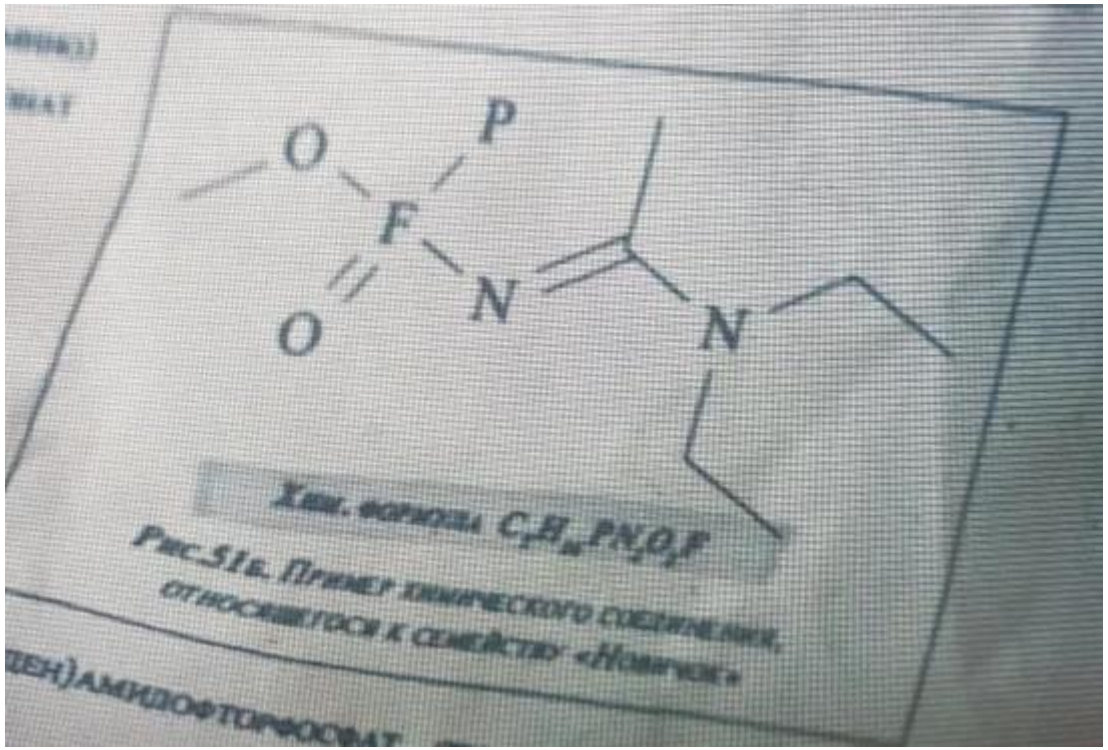




O	$6e^-$
C	$4e^-$
H_2	$2 \times 1e^-$
	$12e^-$
	$-6e^-$
	$6e^-$

1. Draw skeleton
2. Count e^- valence for all atoms
3. add single bonds ✓
4. add lone pairs to outside atoms.
5. check octets & make pi bonds as needed.

Predicting stability



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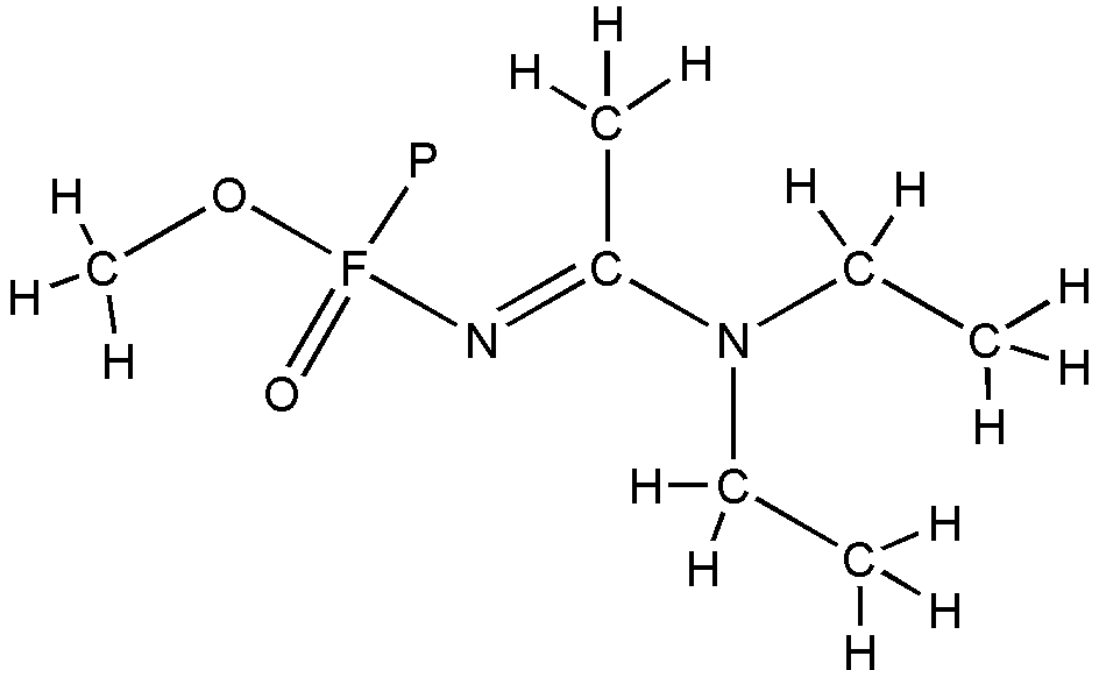
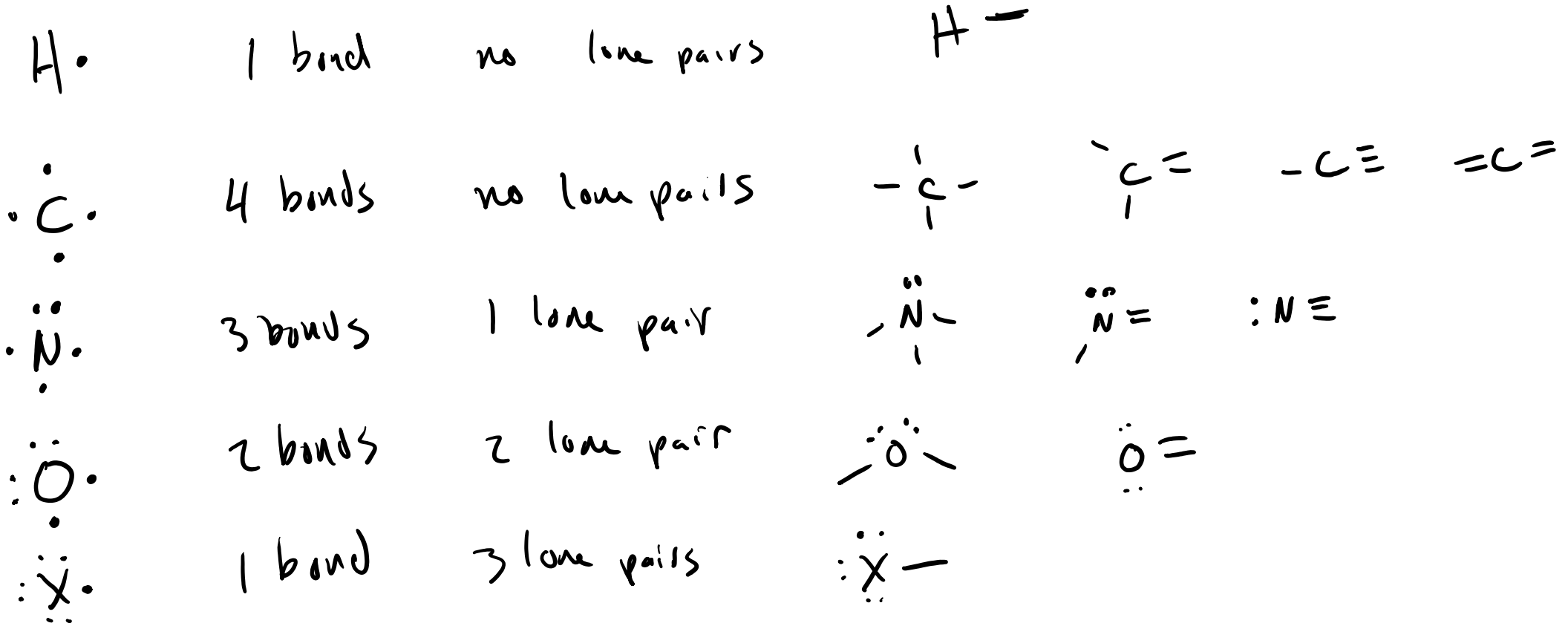


"Bond-line" drawing: revisit next week
Also called "line-angle" drawing

Is this a feasible molecule? Why or why not?

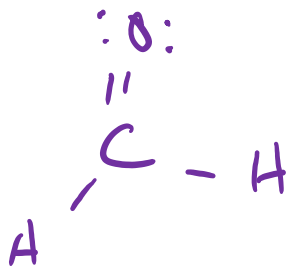
Typical #'s of Covalent Bonds

- Atoms bond in predictable ways to reach octet, based on their starting # of valence electrons



- If an atom bonds in a *different* way than above, it likely lacks an octet (*usually very unstable*) and/or **have a nonzero formal charge**

Formal charge



- A method of keeping track of electrons in a molecule
- Considers all electron pairs to be shared equally
  - Oxidation state is a different method that accounts for *unequal sharing*
- "VUSF"

(note – the book uses a different approach, but the same math, and you are welcome to use whichever method you prefer)

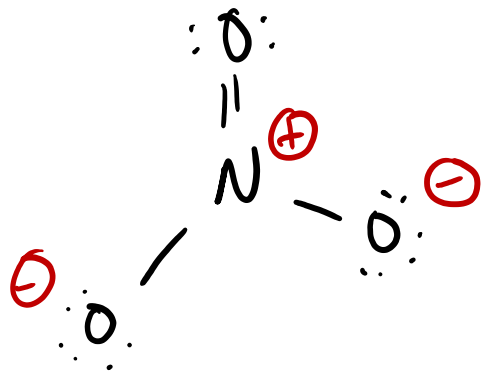
* from periodic table

	C	O	H
Valence e⁻ *	4	6	1
− unshared	− 0	− 4	− 0
− ½ shared	− 4	− 2	− 1
Formal − charge	0	0	0

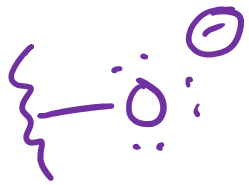
- Sum of individual formal charges = charge of molecule
- Molecules with individual formal charges close to 0 tend to be more stable.
  - If multiple structures are possible, the "best" structure follows this rule most closely.

Example: find the formal charge of each atom in the molecules below.

NO_3^-



	N	=O	−O:
V	5	6	6
− U	− 0	− 4	− 6
$-\frac{1}{2}S$	− 4	− 2	− 1
− F	+1	0	−1



O_3

Poll

Which atom has a nonzero formal charge?

A. O
B. C
C. N
D. Br

Poll

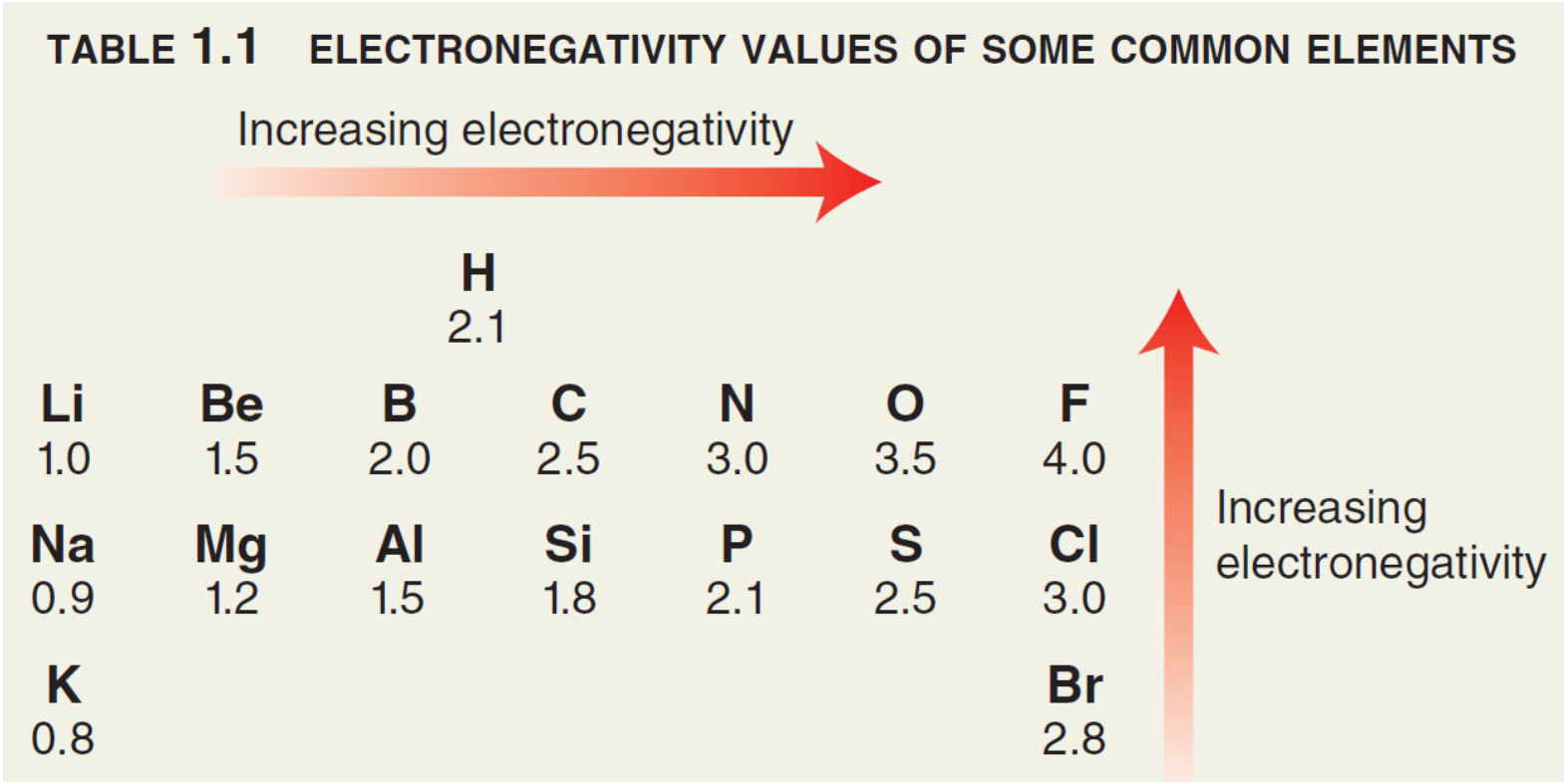
MCAT Question

The formal charges of the atoms in the hypochlorite ion ClO^- are:

A. +1 for chlorine, -2 for oxygen
B. -1 for chlorine, 0 for oxygen
C. 0 for chlorine, -1 for oxygen
D. -1/2 for both atoms

Bond polarity

TABLE 1.1 ELECTRONEGATIVITY VALUES OF SOME COMMON ELEMENTS



Bond polarity is shown with a crossed arrow pointing toward the more Electronegative (EN) atom.

Partial charges (δ) depict unequal distribution of electrons in a bond.

For an individual bond between two atoms…. (from Gen Chem)

If ΔEN < 0.5 → bond is *nonpolar*

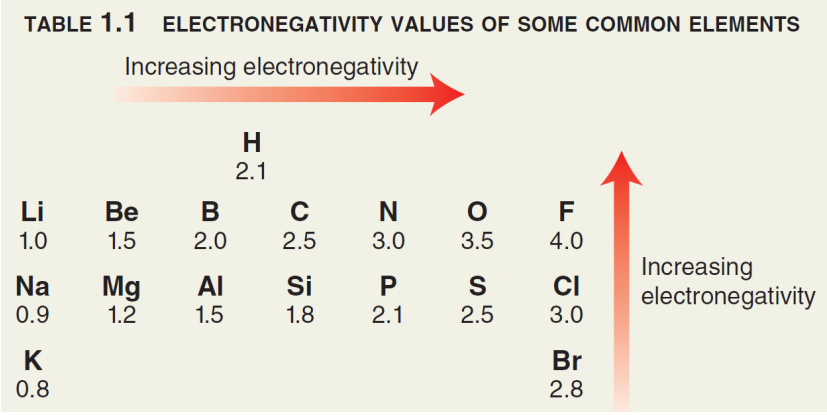
If ΔEN is between 0.5 and 1.7 → bond is *polar*

If ΔEN > 1.7 → "bond" is *ionic* & e^- are not shared!

Bond polarity (for Organic Chemists)

- Organic chemists characterize bonds between Carbon & Friends based more on

  _____ _____ than Pauling Scale EN values.



"Pauling Scale" electronegativity (EN)

Common **nonpolar** *bonds*:

Common **polar** *bonds*: