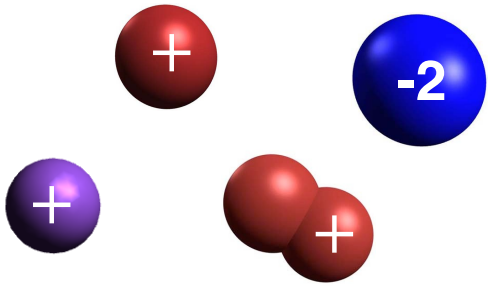
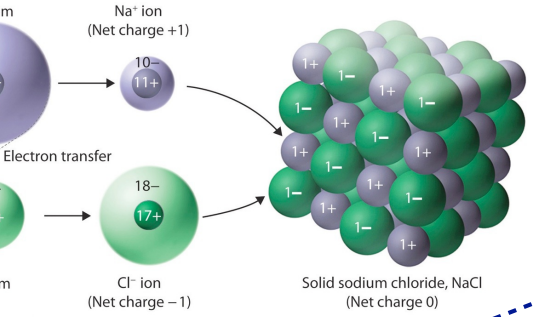
Exp 05: Compounds

Part A: Ions



Part B: Ions



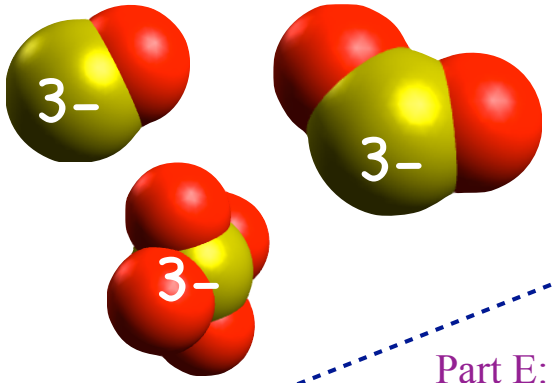
Part C: Ionic Compounds w/ Transition Metals

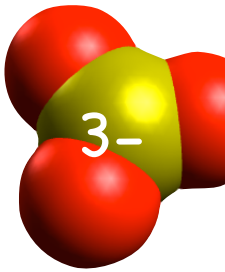
Cr Fe Co
+2/+3

Cu Hg
+1/+2

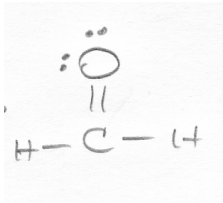
Sn Pb Mn
+2/+4

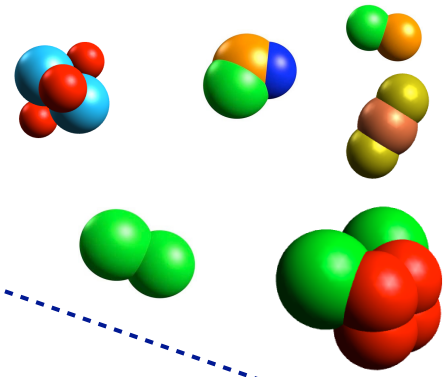
Part D: Ionic Compounds w/ Oxy-Ions





Part E: Molecular Compounds

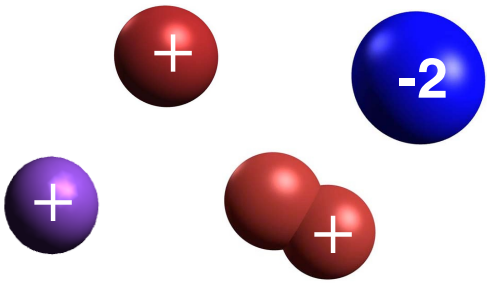




Part F: Molecular Shape

Exp 05: Compounds

Part A: Ions

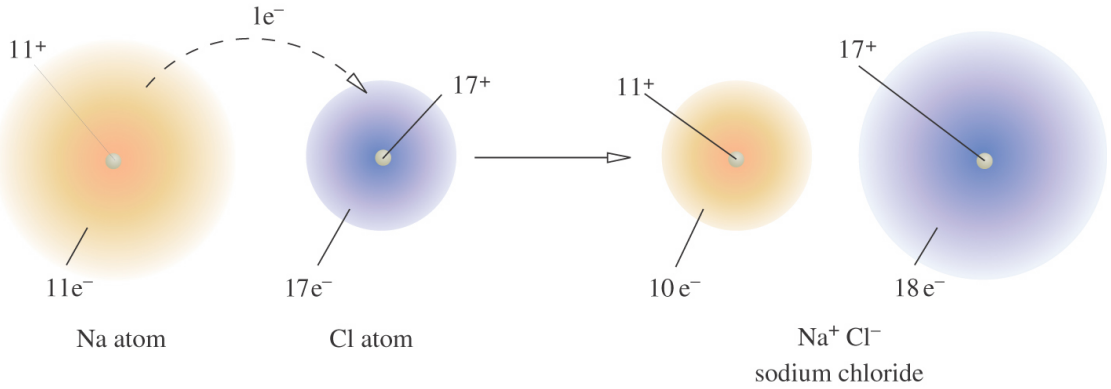


+1 +2 +3 +4 -3 -2 -1 0

	1A 1	2A 2	3B 3	4B 4	5B 5	6B 6	7B 7	8B 8	8B 9	8B 10	1B 11	2B 12	3A 13	4A 14	5A 15	6A 16	7A 17	8A 18
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112	113	114	115	116		118

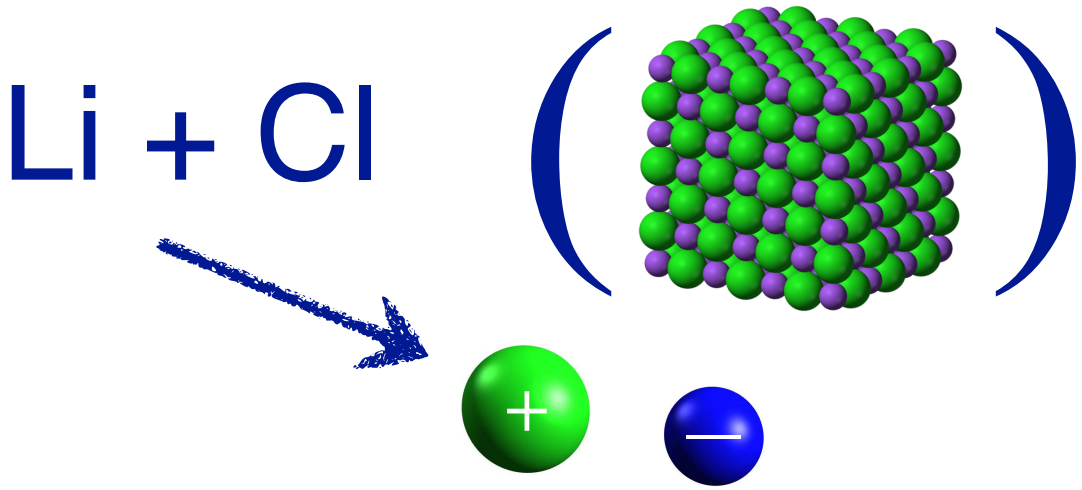
	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb
	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No

Metals
Metalloids
Nonmetals



Exp 05: Compounds

Part B: Ionic Compounds



Sodium chloride

Chemical Compound

Sodium chloride /ˌsoʊdiəm ˈklɔraɪd/, also known as salt, common salt, table salt or halite, is an ionic compound with the chemical formula NaCl, representing a 1:1 ratio of sodium and chloride ions. Wikipedia

Brand names: Cleanoz, Na-zone

Boiling point: 2,575°F (1,413°C)

Density: 2.17 g/cm³

Formula: NaCl

Molar mass: 58.44 g/mol

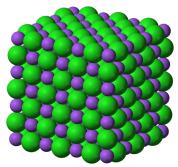
IUPAC ID: Sodium chloride

Melting point: 1,474°F (801°C)

- A binary compound of a metal and a non-metal forms ions — not a molecule.
- The ions collect into a huge ionic mass.
- We still write the formula as the ratio of the two ions in the compound (e.g. LiCl, $MgCl_2$, Li_3N, etc)
- We name binary compounds by just writing the names of the two ions:

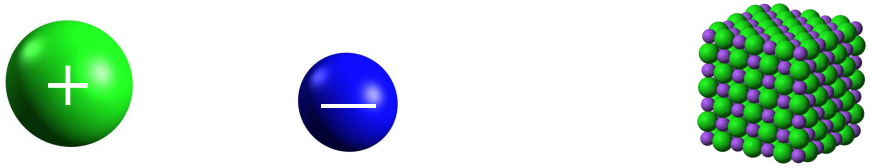
Lithium ion + chloride ion = lithium chloride

The cation always goes first!



Exp 05: Compounds

Part C: Ionic Compounds w/ Transition Metals



Chromium	Cr^{2+}	Chromous ion	Chromium (II) ion
	Cr^{3+}	Chromic ion	Chromium (III) ion
Iron	Fe^{2+}	Ferrous ion	Iron (II) Ion
	Fe^{3+}	Ferric ion	Iron (III) Ion
Cobalt	Co^{2+}	Cobaltous ion	Cobalt (II) ion
	Co^{3+}	Cobaltic ion	Cobalt (III) ion
Copper	Cu^{+}	Cuprous ion	Copper (I) Ion
	Cu^{2+}	Cupric ion	Copper (II) Ion
Mercury	Hg_2^{2+}	Mercurous ion	Mercury (I) Ion
	Hg^{2+}	Mercuric ion	Mercury (II) Ion
Tin	Sn^{2+}	Stannous ion	Tin (II) ion
	Sn^{4+}	Stannic ion	Tin (IV) ion
Lead	Pb^{2+}	Plumbous ion	Lead (II) ion
	Pb^{4+}	Plumbic ion	Lead (IV) ion
Manganese	Mn^{2+}	Manganous ion	Manganese (II) Ion
	Mn^{4+}	Manganic ion	Manganese (IV) Ion

Cr Fe Co +2/+3

Cu Hg +1/+2

Sn Pb Mn +2/+4

Iron(III) chloride

Chemical Compound

Iron(III) chloride, also called ferric chloride, is an industrial scale commodity chemical compound, with the formula $FeCl_3$ and with iron in the +3 oxidation state. Wikipedia

Formula: $FeCl_3$

Molar mass: 162.2 g/mol

Density: 2.90 g/cm³

Melting point: 582.8°F (306°C)

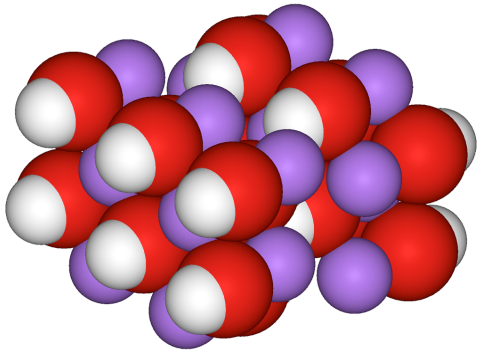
Boiling point: 599°F (315°C)

Soluble in: Properties of water

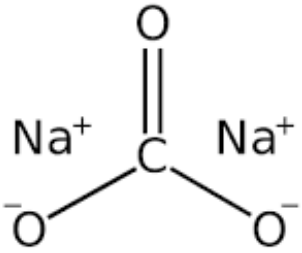
IUPAC ID: Iron trichloride, Iron(III) chloride

Exp 05: Compounds

Part D: Ionic Compounds w/ Oxy-Ions



Sodium carbonate



Sodium carbonate, Na_2CO_3, is the water-soluble sodium salt of carbonic acid. It most commonly occurs as a crystalline heptahydrate, which readily effloresces to form a white powder, the monohydrate. Wikipedia

Molar mass: 105.9888 g/mol

Formula: Na_2CO_3

Melting point: 1,564°F (851°C)

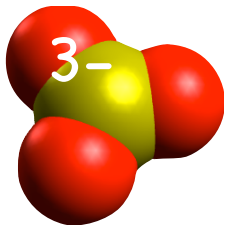
Density: 2.54 g/cm³

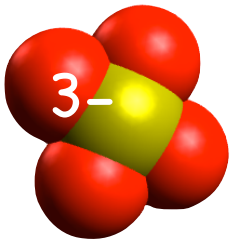
Boiling point: 2,912°F (1,600°C)

Soluble in: Properties of water

Exp 05: Compounds

Part D: Ionic Compounds w/ Oxy-Ions





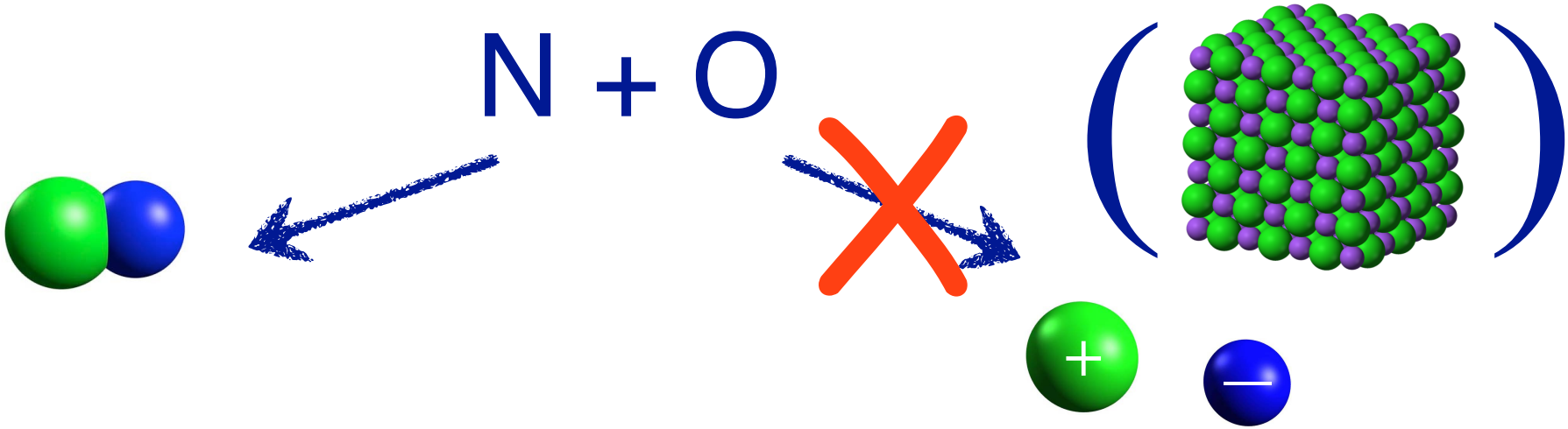
	The Element at the center of the ion	Chg the element prefers	Chg of the ion			
3/4 ions	P	-3	-3	4 oxygens	PO_4^{3-}	Phosphate ion
				3 oxygens	PO_3^{3-}	Phosphite ion
	S	-2	-2	4 oxygens	SO_4^{2-}	Sulfate ion
				3 oxygens	SO_3^{2-}	Sulfite ion
2/3 ions	C	-4/+4	-2	3 oxygens	CO_3^{2-}	Carbonate ion
				2 oxygens	CO_2^{2-}	Carbonite ion
	N	-3	-1	3 oxygens	NO_3^{1-}	Nitrate ion
				2 oxygens	NO_2^{1-}	Nitrite ion
	Cl, Br, I	-1	-1	4 oxygens	BrO_4^{1-}	*Per*bromate ion
				3 oxygens	BrO_3^{1-}	Bromate ion
				2 oxygens	BrO_2^{1-}	Bromite ion
				1 oxygen	BrO_1^{1-}	*Hypo*bromite ion

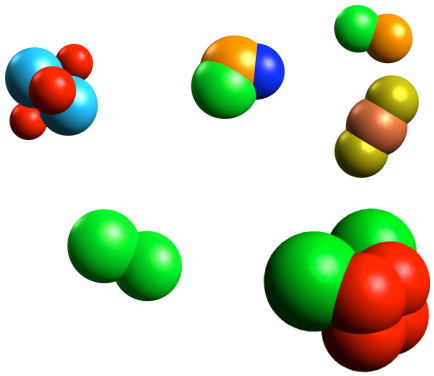
Think of a party, and remember: I "ate more". The ate ion has more oxygens.

NH_4^{1+}	Ammonium ion
OH^{1-}	Hydroxide ion
OAc^{1-} ($CH_3CO_2^{1-}$)	Acetate Ion
CN^{1-}	Cyanide Ion

Exp 05: Compounds

Part E: Molecular Compounds



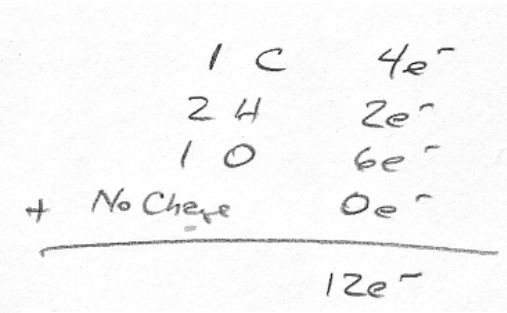


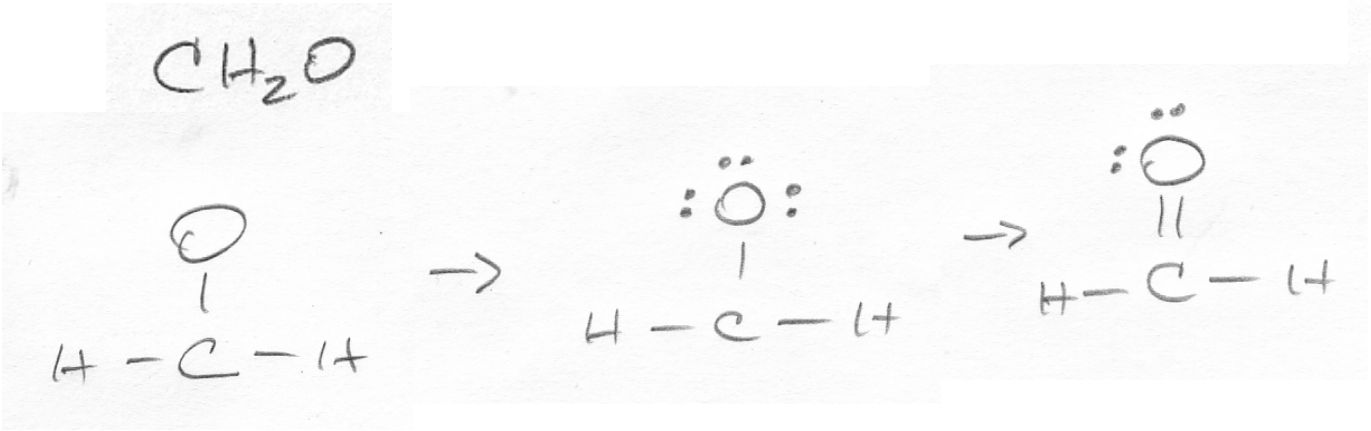
1 = mono*	6 = hexa
2 = di	7 = hepta
3 = tri	8 = octa
4 = tetra	9 = nona
5 = penta	10 = deca

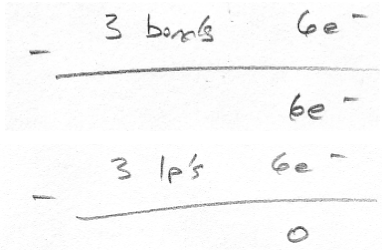
Exp 05: Compounds

Part E: Molecular Compounds

- Lewis structures are created by pooling all the electrons in a compound or ion and assigning them to bonds (shared electrons) and lone pairs (electrons dedicated to one atom).
- Use these five steps:
  - Step 1: Take Stock
  - Step 2: Draw a Simple Skeleton
  - Step 3: Fill in the Octets
  - Step 4: Push LP's into Bonds
    - (if needed)
  - Step 5: Show any Charge





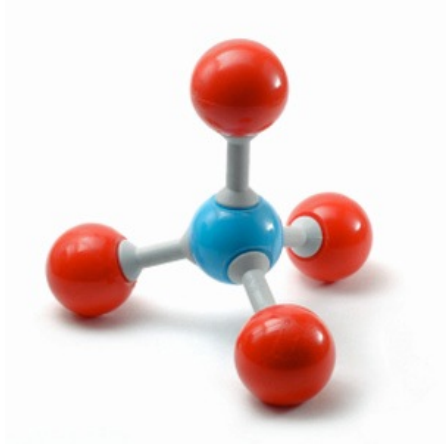


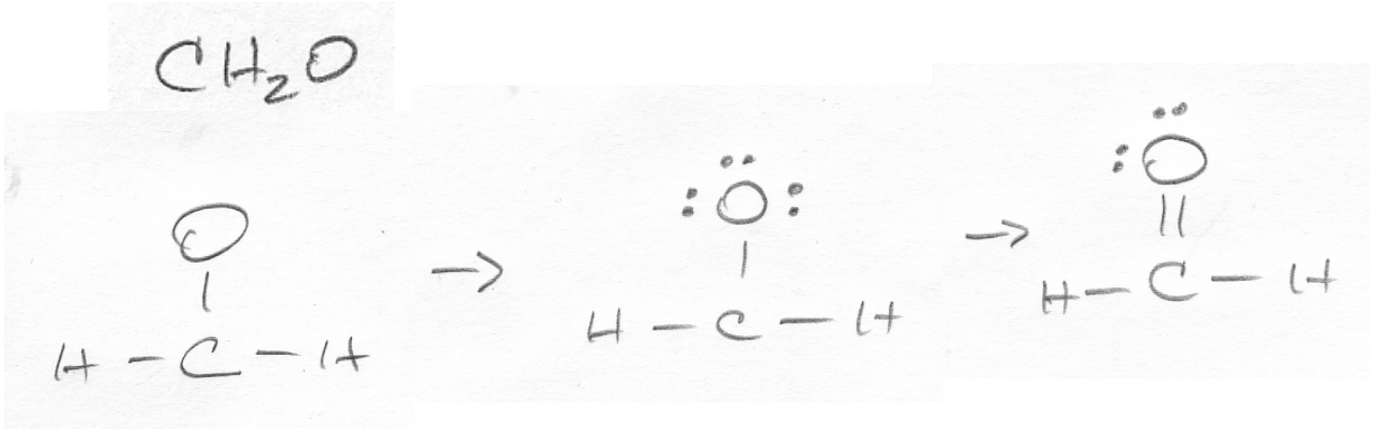
Exp 05: Compounds

Part F: Molecular Shape

- Lewis structures are created by pooling all the electrons in a compound or ion and assigning them to bonds (shared electrons) and lone pairs (electrons dedicated to one atom).
- Use these five steps:
  - Step 1: Take Stock
  - Step 2: Draw a Simple Skeleton
  - Step 3: Fill in the Octets
  - Step 4: Push LP's into Bonds
    - (if needed)
  - Step 5: Show any Charge

We will discuss how to determine molecular shape and polarity in lecture today.





Questions?