Chem 1A

Homework for Monday
Read: 6.1 Intro to Chemical Bonding
Do: 1-6 p.173

Friday 2/7/20

Start Ch 6 Intro to Chemical Bonding

Two types of chemical bonds (there are more)

covalent	ionic
→ these come from overlap of atomic orbitals on adjacent atoms.	→ these bonds form from the electrostatic (Coulombic) force that results when opposite charged ions are near one another.
→ Tend to occur between or more non-metals (and H)	$Na^+ Cl^-$
ex: CH_4 , H_2O	ex: NaCl NaF
N_2O_5 SO_3	SnF_2
CN^-	

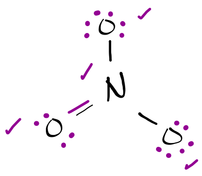
Whether a bond is covalent or ionic has to do mainly with the difference in electronegativity of the atoms being bonded.

Mon 2/10/20

Drawing Lewis Dot Structures for covalently-bonded (molecular) compounds.

Drawing Lewis Dot Structures

ex:1 NO_3^-

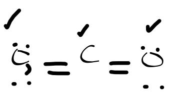


Valence e^-
$1 \times N = 5$
$3 \times O = 18$
$(-1) = +1$
$24e^-$ total
$-$ 3 bonds $-6e^-$
$18e^-$ to dist.

Steps For drawing LDS

1) Draw a skeleton molecule with least e/n atom as central atom. Draw one bond to each other atom
2) Count up total # of valence electrons for the molecule
   - → add e^- equal to charge on (−) ion
   - → subtract e^- equal to charge on (+) ion
   - → Sum all the electrons
   - Subtotal → total electrons
   - → subtract two electrons for each bond already on drawing.
   - Subtotal → e^- to distribute
   - → Distribute remaining e^- in pairs, attempting to satisfy octets for each atom in the drawing
   - ↳ check for octets (8) H (2) for each atom, if all satisfied you're done!
   - If not, donate lone pairs from adjacent atoms to make double (=) or triple (≡) bonds btw atoms.

ex:2 CO_2



Valence e^-
$1 \times C = 4$
$2 \times O = 12$
$16e^-$ total
-2 bonds $-4e^-$
$12e^-$ to dist.

ex:3 N_2

:N≡N:

Valence e^-
$2 \times N = 10e^-$ total
-1 bond $-2e^-$
$8e^-$ to dist.

ex 4: H_2O

H – Ö – H (with lone pairs on O)

Valence e^-
$1 \times O = 6$
$2 \times H = 2$
8 total
$-$ 2 bonds $-4e^-$
$4e^-$ to dist

Ex: 5 CN^-

$[\,:C \equiv N:\,]^-$

Valence e^-
$1 \times C = 4$
$1 \times N = +5$
(-1) ion $= +1$
$10e^-$ total
-1 bond $-2e^-$

Tuesday 2/11/20

Warm-up:

Draw Lewis Dot Structures for

a) NH_3

valence e^-

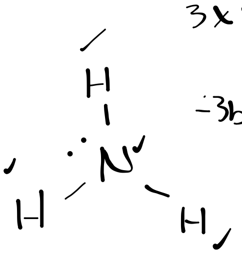
$1 \times N = 5$

$3 \times H = 3$

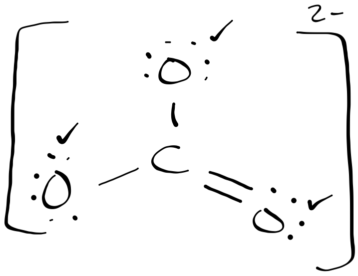
$8e^-$ total

$-3b$ $\quad -6e^-$

$2e^-$ to dist



b) CO_3^{2-}



valence e^-

$1 \times C = 4$

$3 \times O = 18$

(-2) ion $= +2$

$24e^-$ tot

$-$ 3 bonds $\quad -6e^-$

$18e^-$ to dist

— longest

= shorter

≡ shortest

c)

C) SO_2

valence e^-

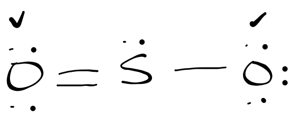
$1 \times S = 6$

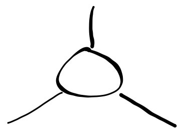
$2 \times O = 12$

$18e^-$ total

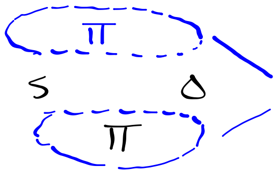
-2 bonds $- 4e^-$

$14e^-$ to dist.





molecular orbital



1 π molecular orbital

$:N \equiv N:$

valence e^-

2 x N = 10 total

\- 1 bond = 2

8 e to dist.

$\dot{P}\cdot$

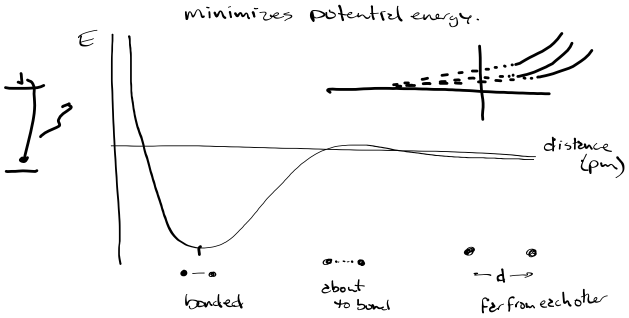
$Na\cdot$ $:\dot{Cl}\cdot$

Na^+ $:\ddot{Cl}:^-$

Wed 2/12/20

From the homework (probs 1–5 p.185)

① Bond Length – the distance between atoms that minimizes potential energy.



Bond Energy – the amount of energy required to break 1 mol of bonds.

ex: C–C 346 kJ/mol C=C 835 kJ/mol

Bond Lengths		length	bond energy
	C–C	longest	least
	C=C	shorter	greater
	C≡C	shortest	greatest

The Octet rule...

② When covalent compounds form, the atoms in the compound share electrons in such a manner that they tend to end up with eight valence electrons in their vicinities.

exceptions to octet rule: H → $2e^-$

B → $6e^-$

expanded octet → 3^{rd} row and lower can sometimes go 10 or $12e^-$

③ How many electrons are being shared in...

a) single-bond = 2

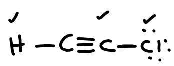
b) double bond = 4

c) triple bond = 6

④ Draw LDS

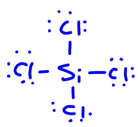
a) C  b) Al 

c) C_2HCl



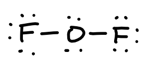
valence e^-
$2 \times C = 8$
$1 \times Cl = 7$
$1 \times H = 1$
$16e^-$ tot
$-6e^-$ $6e^-$
$10e^-$

d) $SiCl_4$



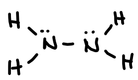
valence e^-
$1 \times Si = 4$
$4 \times Cl = 28$
$32e^-$
-4 bonds $-8e^-$
$24e^-$ to dist

d) OF_2

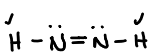


valence e^-
$1 \times O = 6$
$2 \times F = 14$
$20e^-$ total
-2 bonds $-4e^-$
$16e^-$ to dist.

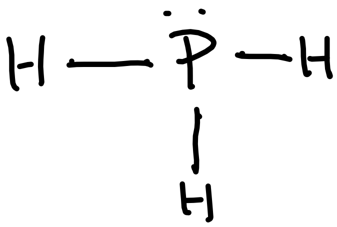
⑤ H_2NNH_2 vs HNNH

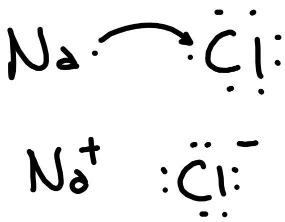


valence e^-
$4 \times H = 4$
$2 \times N = 10$
$14e^-$
-5 bonds $-10e^-$
$4e^-$ to dist



valence e^-
$2 \times H = 2$
$2 \times N = 10$
12 tot.
-3 bond -6
$6e^-$ to dist





Thursday 2/13/20

VSEPR = Valence-Shell Electron-Pair Repulsion Theory

→ Effective pairs of electrons are jockeying for position around a central atom (that's the "Repulsion" part)

Effective pairs are; LONE PAIRS (··)

& Single (σ) bonded pairs (—) = 1 eff pair

single bond (=) = 1 eff pair

single bond (≡) = 1 eff pair

Steric Factor (# of effective pairs)	lone pairs (effective pairs)	single (σ) bonded pairs (effective pairs)	electronic geometry (where the pairs are)	molecular geometry (where the atoms are)
2	0	2	linear	linear
3	0	3	trigonal planar	trigonal planar
	1	2	trigonal planar	bent 120°
4	0	4	tetrahedral	tetrahedral $\alpha = 109.5°$
	1	3		trigonal pyramidal $\alpha < 109.5°$
	2	2		bent $\alpha < 109.5$

Draw LDS and predict the shapes of the following compounds using VSEPR.

a) H_2O

valence e^-

$1 \times O = 6$

$2 \times H = 2$

$8e^-$ tot.

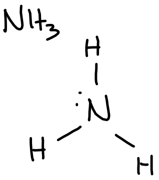
H — Ö — H

−2b $-4e^-$

$4e^-$ to dist.

molec. geom. = bent $\alpha < 109.5°$

b) NH_3



valence e^-

$1 \times N = 5$

$3 \times H = 3$

$8e^-$ total

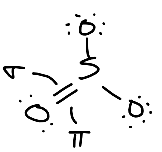
−3bond $6e^-$

$2e^-$ to dist.

electronic geom. = tetrahedral

molec. geometry = trigonal pyramidal

c) SO_3



valence e^-

$1 \times S = 6$

$3 \times O = 18$

$24e^-$ tot

−3b $-6e^-$

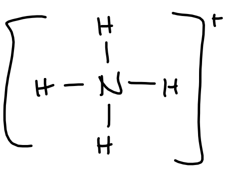
$18e^-$ to dist

trigonal planar

Elec & molecular

d) NH_4^+

valence e^-



$1 \times N = 5$

$4 \times H = 4$

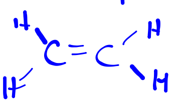
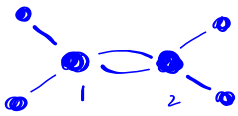
(+1) ion = -1

$8e^-$ tot

$-4b$ $-8e^-$

$0e^-$ to dist

tetrahedral molecular & electronic geom.

Lewis dot structure.		
① $H-\ddot{\underset{..}{O}}-H$ Valence e^- $1\times O = 6$ $2\times H = 2$ 8 total $-2b$ $-4e^-$ $4e^-$ to dist	 $<109.5°$	bent or bent, triatomic
② C_2H_4  Val e^- $2\times C = 8$ $4\times H = 4$ 12e tot. $-5b$ $-10e$ 2e to dist		~ nonane C_1, C_2 = trigonal planar coord.