Key!

Chemical Bonding Worksheet 2

What is the strongest type of bond, choose amongst single, double or triple.

Strongest = triple bond

single, double, triple $\longrightarrow$ increasing in strength

What is the longest type of bond? (single, double or triple)

longest = single bond

triple, double, single $\longrightarrow$ increasing in length

Define resonance

Used when one L.S. can't accurately depict a molecule.

Occurs when a molecule has at least 1 double bond.

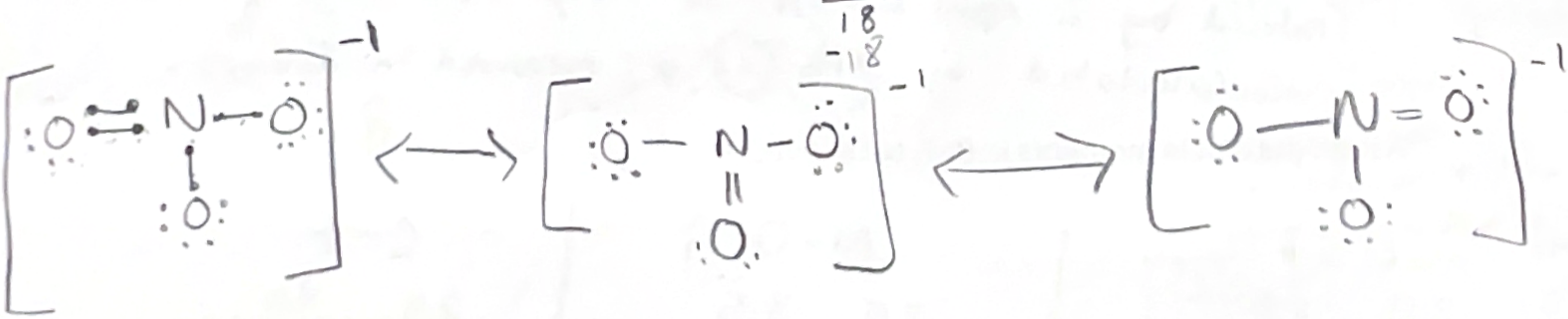
Draw the resonance structure for NO_3^-

$5 + 6(3) + 1 = 24$ valence $e^{(-)}$

-6

18

-18



What is the equation for formal charge?

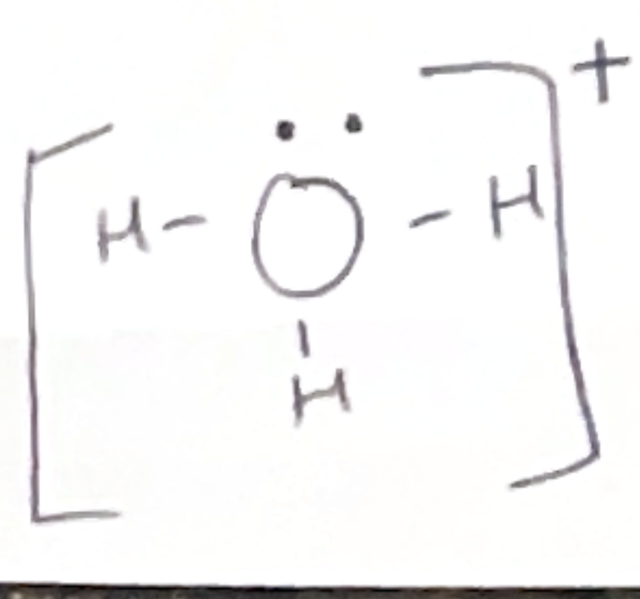
$$F.C = \text{Valence } e^{(-)} - (\# \text{ of bonds} + \text{free } e^{(-)})$$

$\boxed{\text{or}}$

$$F.C = \text{valence } e^{(-)} - \frac{1}{2}(\text{bonding } e^{(-)})$$

H_3O^+

$1(3) \quad 6 \quad -1 = 8$ valence $e^{(-)}$



F.C oxygen $= 6 - (3 + 2)$

$= 6 - 5$

$= +1$

Lattice energy is ________

a) Energy required to convert a mole of ionic solid into its constituent ions in the gas phase.
b) Energy given off when gaseous ions combine to form one mole of an ionic solid.
c) Energy required to produce one mole of an ionic compound from its constituent elements in their standard states.
d) Sum of ionization energies of the components in an ionic solid.
e) Sum of electron affinities of the components in an ionic solid.

Determining the lattice energy from Born-Haber cycle data requires the use of ________

a) The octet rule
b) Coulomb's law
c) Periodic law
d) Hess's law
e) Avogadro's number

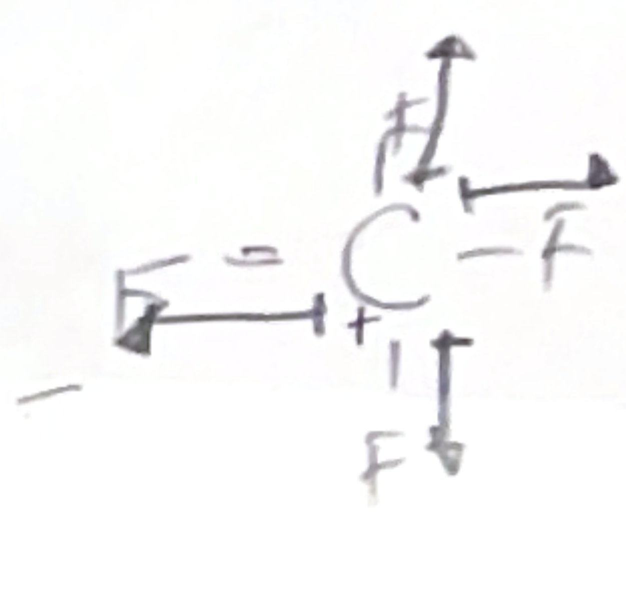
Define a dipole moment.

μ

Produced by 2 equal but opposite charges separated by a distance r, calculated by $\mu = Qr$; measured in debyes.

Assign the dipole moments in Br-F, N-O, and C-F

Br - F	N - O	C - F
2.0 4.0	3.0 3.5	2.5 4.0
δ^+ δ^-	δ^+ δ^-	δ^+ δ^-
Br - F	N — O	C - F
$\longmapsto$	$\longmapsto$	$\longmapsto$



0.0 – 0.4 = Non Polar

0.4 – 1.8 = Polar

1.8 – 3.3 = Ionic

Using the table given determine whether each bond is ionic, nonpolar, or polar.

N-H, S-Se, and Li-O.

N–H
3.0 2.1

3.0 – 2.1 = 0.9

Polar covalent bond

S – Se
2.5 – 2.6

2.6 – 2.5 = 0.1

Nonpolar covalent bond

Li – O
1.0 – 3.5

3.5 – 1.0 = 2.5

Ionic Bond

1	2	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	3 (13)	4 (14)	5 (15)	6 (16)	7 (17)	8 (18)
H 2.1																	He —
Li 1.0	Be 1.6											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	Ne —
Na 0.9	Mg 1.3											Al 1.6	Si 1.9	P 2.2	S 2.5	Cl 3.0	Ar —
K 0.8	Ca 1.3	Sc 1.4	Ti 1.5	V 1.6	Cr 1.7	Mn 1.6	Fe 1.8	Co 1.9	Ni 1.9	Cu 1.9	Zn 1.7	Ga 1.6	Ge 2.0	As 2.2	Se 2.6	Br 2.8	Kr —
Rb 0.8	Sr 1.0	Y 1.2	Zr 1.3	Nb 1.6	Mo 2.2	Tc 2.1	Ru 2.2	Rh 2.3	Pd 2.2	Ag 1.9	Cd 1.7	In 1.8	Sn 2.0	Sb 2.1	Te 2.1	I 2.7	Xe 2.6
Cs 0.8	Ba 0.9	La 1.1	Hf 1.3	Ta 1.5	W 1.7	Re 1.9	Os 2.2	Ir 2.2	Pt 2.2	Au 2.4	Hg 1.9	Tl 2.0	Pb 2.3	Bi 2.0	Po 2.0	At 2.2	Rn —
Fr 0.7	Ra 0.9	Ac 1.1	Rf —	Db —	Sg —	Bh —	Hs —	Mt —	Uun —	Uuu —	Uub —		Uuq				

Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

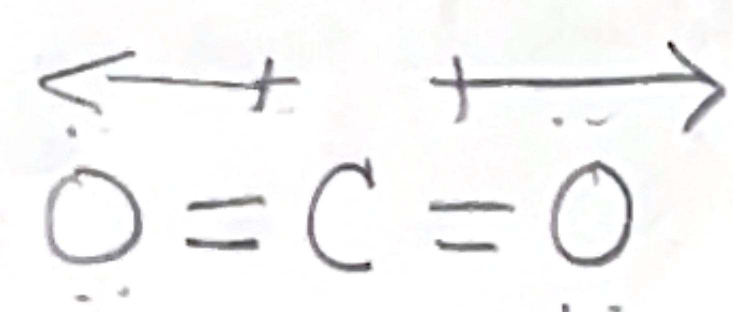
Determine if the compound is polar or nonpolar without referencing the table above.

Carbon Dioxide: CO_2

NM NM

covalent

4 $6(2) = 16$
-4
12

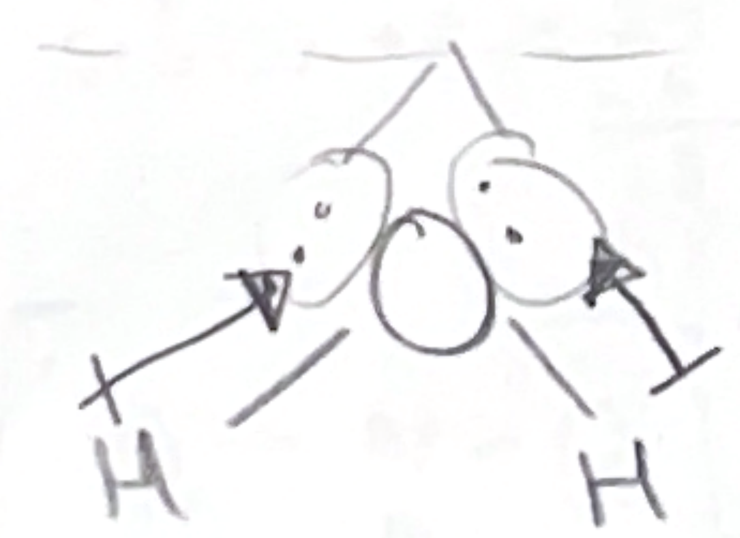


- linear geometry
- symmetrical
- dipoles cancel

$\boxed{\text{NON POLAR}}$

Water: H_2O

$= 8$



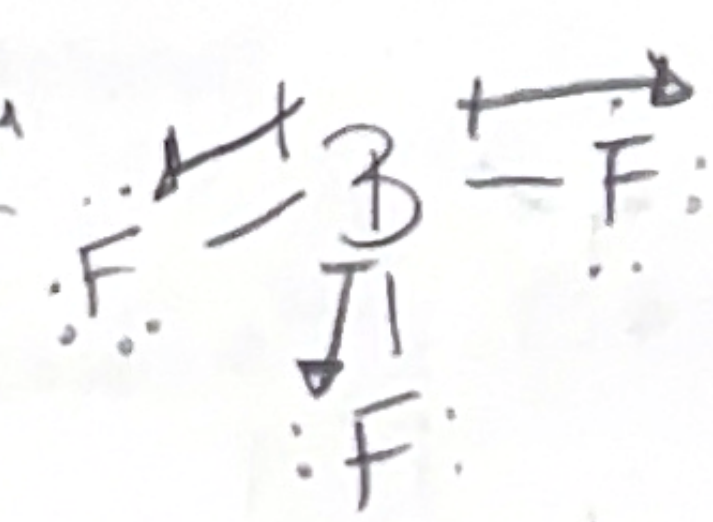
- Bent molecular geometry
- assymetrical
- oxygen more electronegative than H so there's a dipole moment

$\boxed{\text{Polar}}$

Boron Trifluoride: BF_3

3 $7(3) = 24$
-6
18

* Boron exception to octet

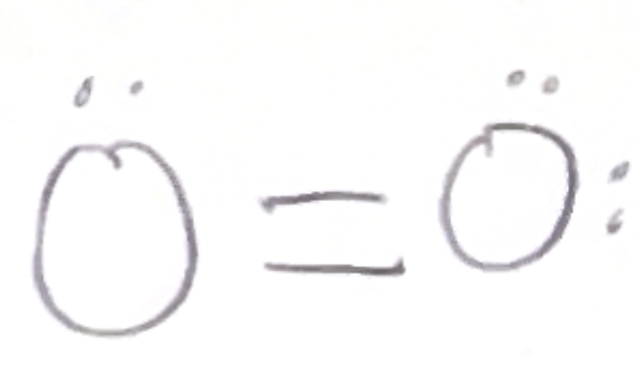


- trigonal planar geometry
- symmetrical / evenly spaced
- dipoles from B–F bonds cancel each other out

$\boxed{\text{NON Polar}}$

O_2

$6(2) = 12$
-2
10



- diatomic molecule
- linear geometry
- symmetrical
- there's no diff. in electronegativity

NON-Polar

→ H O N C
1 2 3 4