Compounds Part 1:

Ionic Compounds: Formula Units and Nomenclature

Ions – Atoms can gain or lose electrons to become ions.

Cation:

Anion:

The Octet Rule for Ionic Bonds

atoms gain or lose electrons to achieve a full valence shell of 8 electrons

Metals lose e^- to form _____.

Non-metals can gain e^- to form _____.

Ions create neutral salts through Electrostatic Forces.

Chemical formulas give us the ratio of ions to create a neutral compound.

Names follow the same pattern as the chemical formula

Write the formula unit and name for the ionic compounds (salts) formed by the following pairs of ions.

Ions	Formula	Name
K^+ with Br^-		
Mg^{2+} with OH^-		
Fe^{2+} with PO_4^{3-}		
Pb^{4+} with CO_3^{2-}		

Ionic compounds are solids in their pure state. The ions are locked in the crystal lattice created by the cations and anions maximizing their attractive forces and minimizing their repulsive forces.

However, when an ionic compound dissolves in water, the ions become completely independent of each other.

Predict how many ions are released into an aqueous solution when 1 formula unit is dissolved in water. Write your answer by completing the reaction for each compound below.

K_3PO_4

$NaCH_3CO_2$

$Cu(NO_3)_2$

Compounds Part 2:

Lewis Structures & Molecular Compounds

Octet Rule for Covalent Bonds:

Atoms create compounds by sharing valence electrons to fill shells.

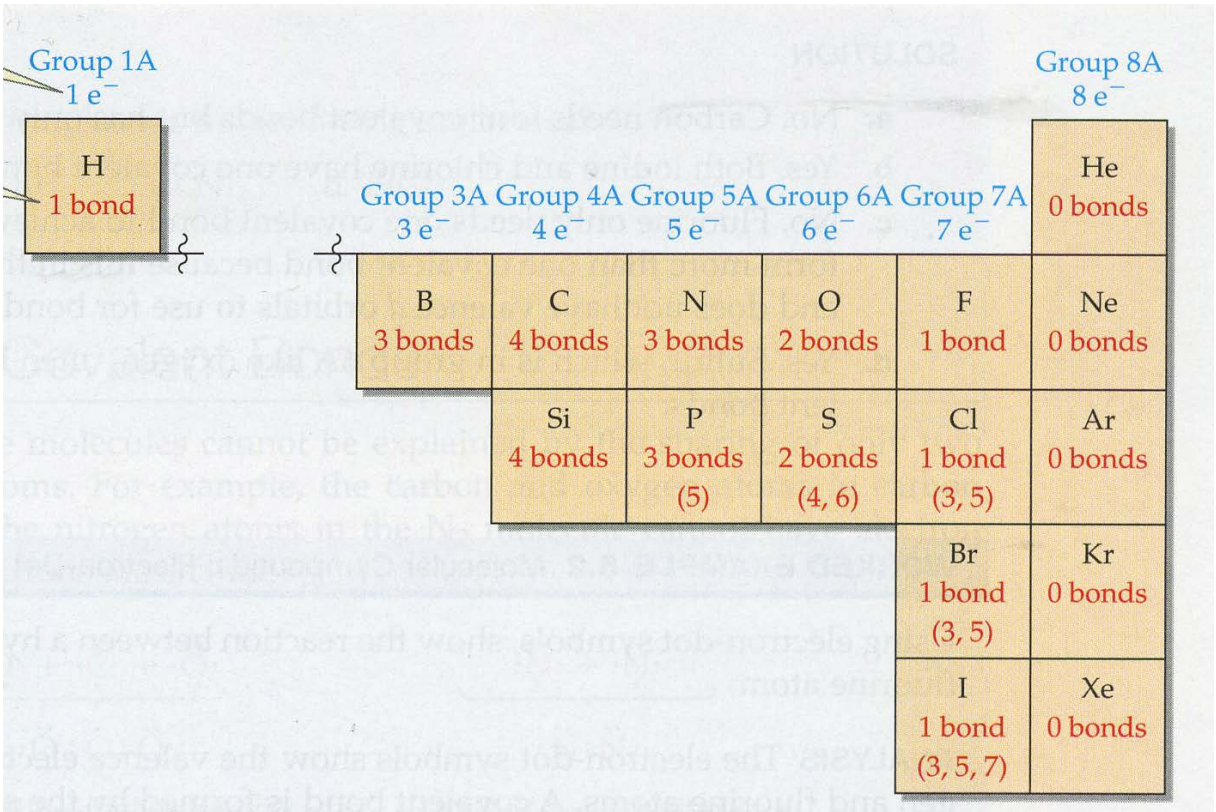
Lewis Structures

A diagram showing how the valence e⁻'s are arranged among atoms in compound

*Group # =

*If you do not understand this statement, then watch the "Valence electrons & the Octet Rule" Video first.

Bonding Patterns



Neutral Bonding Patterns for Organic Compounds

Periodic Table of the Elements

1 Group IA	2 Group IIA	3 Group IIIB	4 Group IVB	5 Group VB	6 Group VIB	7 Group VIIB	8 Group	9 Group VIIIB	10 Group	11 Group IB	12 Group IIB	13 Group IIIA	14 Group IVA	15 Group VA	16 Group VIA	17 Group VIIA	18 Group VIIIA
1 H 1.01																	2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.30											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.84	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183,84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (269)	109 Mt (268)	110 – (271)	111 – (272)	112 – (277)		114 – (289)		116 – (289)		118 – (293)

$_{6}$C – Carbon

Because carbon atoms have 4 valence electrons, they will share these electrons to form 4 bonds.

$_{7}$N – Nitrogen

Because nitrogen atoms have 5 valence electrons, they will share these electrons to form 3 bonds and 1 lone pair.

$_{8}$O – Oxygen

Because oxygen atoms have 6 valence electrons, they will share these electrons to form 2 bonds and 2 lone pairs.

$_{1}$H – Hydrogen

Because hydrogen atoms have 1 valence electron, they form 1 bond.

Drawing Lewis Structures for Covalent Compounds

1) Determine the number of valence electrons for each atom.

2) Write the symbols for each atom in the molecule arranged around the central atom

3) Arrange the atoms so that there is a single covalent bond between each pair of bonded atoms (1 covalent bond = 1 e^- pair = 2 e^-'s)

4) Add remaining e^- pairs as lone pairs to create octets as needed

5) If an atom does not have an 'octet', shift lone pairs to form multiple bonds between atoms.

6) Verify each atom has an 'octet'

Examples of writing Lewis Structures

CH_3OH

CH_2CH_2

Your turn: Draw Lewis Structures for the following compounds.

CH_3NH_2

CH_3CHO

Polyatomic Ions

A group of atoms held together by covalent bonds that have a net charge

Add or remove e^- from total number of electrons available.

For Cations:

For Anions:

Neutral Bonding Patterns NO Longer Apply

Exceptions to the Octet Rule can occur for S and P

Draw the Lewis Structures for the following polyatomic ions.

CO_3^{2-}

HPO_4^{2-}

Compounds Part 3: The Mole

Mole: amount of a substance

	Average Atomic Mass	Molar Mass
^{12}C and ^{13}C (99% and 1%)		
^{107}Ag and ^{109}Ag (56.5% and 43.5%)		

6.02×10^{23} = 1 mole = X grams

where

Avogadro's number: defined as 6.02×10^{23}

Molar Mass: determined from the chemical formula and atomic masses of the atoms that form the compound

Which sample contains more atoms: 21 g of carbon or 21 g of silver?

The "Mole" is the bridge between the individual atoms and compounds we imagine when we discuss the theories of chemistry and the grams of atoms and compounds we weigh and measure when perform experiments in the lab to test these theories.

Compounds and the Mole

The chemical formula is the _____ of the atoms that form 1 mole of the compound.

Let's compare calcium chloride ($CaCl_2$) and glucose ($C_6H_{12}O_6$).

	calcium chloride	glucose
type of cpd		
structure when dissolved in H_2O		

How many moles of the compound are present in a 21 g sample?

a) calcium chloride

b) glucose

How many moles of chloride ions are present in 21 g of calcium chloride?

How many moles of carbon atoms are present in 21 g of glucose?

Molecules and Moles can be used interchangeably because they are linked by Avogadro's number.

We can NOT compare grams of samples directly. We need to adjust for the different atomic masses of the elements involved.

Example:
Glucose reacts with oxygen to produce carbon dioxide and water according to the balanced reaction shown below.

$$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$$

molecules

moles

molar mass

grams for
the mole ratio
above