Atoms and Bonds

1) Chemical bond- Mutual electrical attraction between the nuclei and valence electrons of different atoms that binds the atoms together.

2) Ionic bonding- bonding where one atom pulls the electron and the other atom gives up the electron setting up opposite charges on the atoms involved. The attraction of the opposite charged atoms creates the bond.

3) Examples (Ionic bonding)

#1 Li^{+1} F^{-1}

Electron configuration

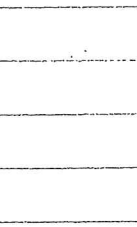
F^{-1} - $1s^2 2s^2 2p^5$

Li^{+1} - $1s^2 2s^1$

High electronegativity

Low "

Dot structure



#2 Be^{+2} F_2^{-1}

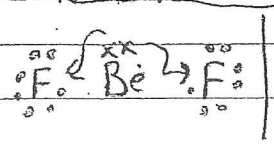
F - $1s^2 2s^2 2p^5$ F - $1s^2 2s^2 2p^5$

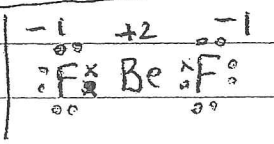
Be - $1s^2 2s^2$

F^{-1} - $1s^2 2s^2 2p^5$ F^{-1} - $1s^2 2s^2 2p^5$

Be^{+2} - $1s^2$ $2s^2$

(107) (1)



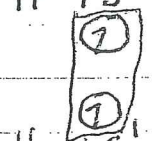


4) Covalent bonding - where 2 atoms ½ filled orbitals overlap and share the electrons, creating the bond.

5) Examples (Covalent bonding)

H_2

H - $1s^1$



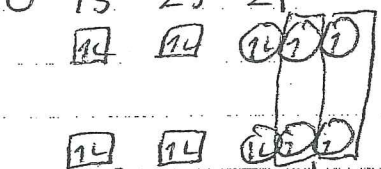
H - $1s^1$

Dot structure:

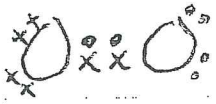
Note: Electronegativity of each H atom is the same.

O_2

O - $1s^2\ 2s^2\ 2p^4$



O - $1s^2\ 2s^2\ 2p^4$



6) Polar Covalent bond - bond that has both ionic and covalent character.

12) Ionic Compound – Composed of positive and negative ions that are combined so that the numbers of positive and negative charges are equal.

13) Examples of Ionic Compounds:

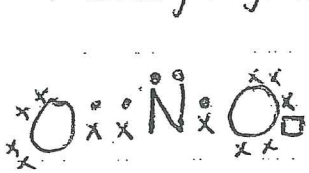
$Ca^{+2}\ F^{-1}$	$Ca^{+2}\ N^{-3}$	$P^{+3}\ O^{-2}$	$P^{+5}\ O^{-2}$
$+2\ -2\ -1 = 0$	$+6\ -6 = 0$	$+6\ -6 = 0$	$+10\ -10 = 0$
Correct formula: $Ca^{+2}F_2^{-1}$	$Ca_3^{+2}N_2^{-3}$	$P_2^{+3}O_3^{-2}$	$P_2^{+5}O_5^{-2}$

Correct Formula = Algebraic sum of the charges equals zero!!

14) Crystal lattice – Orderly arrangement of ionic crystals in which the ions minimize their potential energy.

15) Comparison of Properties of Ionic and covalent Compounds.
Ionic – ① higher melting pt. ② boiling pt. ③ Hardness ④ Conductivity

16) Polyatomic ions – Charged group of covalently bonded atoms.

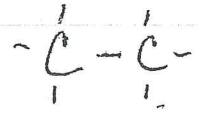


(NO_2^{-1})

17) Metallic bonding – Chemical bonding that results from the attraction between metal atoms and the surrounding sea of electrons.

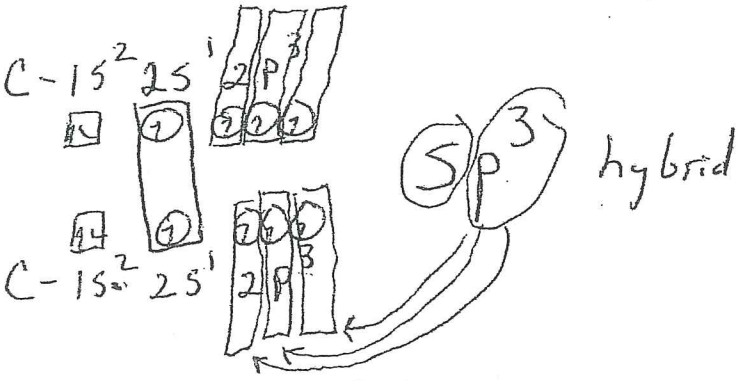
18B) Hybridization – mixture of two or more atomic orbitals of similar energies on the same atom to produce new hybrid atomic orbitals of equal energies.

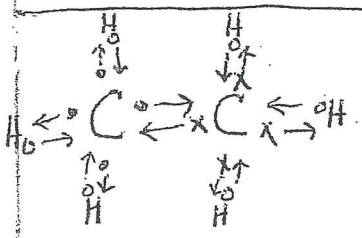
18C) sp^3 hybridization – single bonds between atoms.

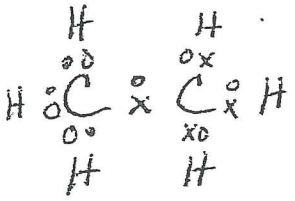


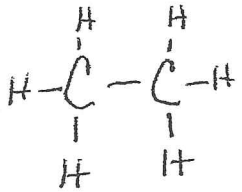
C – $1s^2 2s^2 2p^2$ (Normal)

C – $1s^2 2s^1 2p^3$ (hybridized)









(11B) (5B)

19) Chemical Formula – represents the atom types and the numbers of each in a substance.

20) Monoatomic ions – ions formed from a single atom.

21) Cation +1 Naming Old system ous ending – lower charge
ic ending – higher charge

1) Elements in alkali group #1 and named as their are H^+ - Hydrogen
2) Cu^{+1} – Copper (I) – Cuprous
3) Ag^{+1} – Silver
4) Na^{+1} – Sodium
5) NH_4^{+1} – Ammonium
6) Hg^{+1} Hg_2^{+2} Mercury (I), Mercurous
No

22) Cation +2

1) Elements in Group 2 Ca^{+2} – Calcium
2) Cu^{+2} – Copper (II), Cupric
3) Fe^{+2} – Iron (II), Ferrous
4) Hg^{+2} – Mercury (II), Mercuric
5) Pb^{+2} – Lead (II), Plumbous
6) Sn^{+2} – Tin (II), stannous
7) Ni^{+2} – Nickel (II), Nickelous
8) Co^{+2} – Cobalt (II), Cobaltous
9) Zn^{+2} – Zinc
10) Cr^{+2} – Chromium (II), Chromous
11) V^{+2} – Vanadium (II)
12) Mn^{+2} – Manganese (II)
13) Cd^{+2} – Cadmium

(112) (6)

11) ClO^{-1} - hypochlorite
12) ClO_4^{-1} - perchlorate
13) MnO_4^{-1} - permanganate
14) $H_2PO_4^{-1}$ - Dihydrogen Phosphate
15) HCO_3^{-1} - hydrogen Carbonate
16) HSO_4^{-1} - hydrogen Sulfate

26) Anion -2

1) S^{-2} - Sulfide
2) SO_3^{-2} - Sulfite
3) SO_4^{-2} - Sulfate
4) O^{-2} - Oxide
5) O_2^{-2} - Peroxide
6) CO_3^{-2} - Carbonate
7) CrO_4^{-2} - Chromate
8) $Cr_2O_7^{-2}$ - Dichromate
9) $C_2O_4^{-2}$ - Oxalate
10) HPO_4^{-2} - hydrogen Phosphate

27) Anion -3

1) P^{-3} - Phosphide
2) PO_3^{-3} - Phosphite
3) PO_4^{-3} - Phosphate
4) N^{-3} - Nitride
5) AsO_4^{-3} - Arsenate

28) Binary Compounds - Compounds composed of two elements.

2) $\overset{+1}{Cu}\ \overset{-2}{CO_3}$

$\overset{+1}{Cu_2}\ \overset{-2}{CO_3}$ Copper (I) Carbonate, Cuprous Carbonate

3) $\overset{+3}{Fe}\ \overset{-2}{SO_4}$

$\overset{+3}{Fe_2}(\overset{-2}{SO_4})_3$ Iron(III) Sulfate, Ferric Sulfate

32) Prefixes used in Naming Compounds

1) Mono - 1
2) Di or Bi - 2
3) Tri - 3
4) Tetra - 4
5) Pent - 5
6) Hex - 6
7) Hept - 7
8) Oct - 8
9) Nona - 9
10) deca - 10

33) Prefixes used with non-metal cations in Compounds,

Example: $\overset{+3}{N_2}\ \overset{-2}{O_3}$	$\overset{+5}{N_2}\ \overset{-2}{O_5}$
Dinitrogen Oxide	Dinitrogen Pentoxide
Nitrogen(III) Oxide	Nitrogen(V) Oxide

(116) (60)

- practice sheet

Anion → / Cations ↓	Fluoride F^{-1}	Phosphate PO_4^{-3}	Sulfide S^{-2}	Phosphide P^{-3}	Carbonate CO_3^{-2}	Hydroxide OH^{-1}
Hydrogen H^{+1}	$H^{+1}F^{-1}$					
~~Name~~	Hydrogen Fluoride					
Copper(I) Cu^{+1}						
cuprous						
Copper(II) Cu^{+2}		$Cu_3^{+2}(PO_4^{-3})_2$			$Cu^{+2}CO_3^{-2}$	
cupric		Copper(II) phosphate			Cupric Carbonate	
Silver Ag^{+1}						
Iron(II) Fe^{+2}						
ferrous						
Iron(III) Fe^{+3}						
ferric						
Mercury(II) Hg^{+2}						
mercuric						
Calcium Ca^{+2}						
Aluminum Al^{+3}						
Chromium(III) Cr^{+3}						
chromic						
Lead(II) Pb^{+2}						
plumbous						
Lead(IV) Pb^{+4}						
plumbic						
Tin(II) Sn^{+2}						
stannous						
Tin(IV) Sn^{+4}						
stannic						