CHEMICAL BONDING

chemical bond: a mutual attraction between the valence electrons of one atom and the positive nucleus of another atom

The different types of chemical bonding are determined by how the valence electrons are shared among the bonded atoms

Electronegativity: (EN) ability of an atom to attract a bonding pair of electrons in a covalent compound
The type of bond formed depends on the difference between the EN of atoms

Difference of EN scale

0 — 0.3 — 1.7 — 3.3

0 – 0.3	0.3 – 1.7	1.7 – 3.3
electrons are shared evenly	electrons shared unevenly	electrons transferred
non-polar covalent bond	polar covalent bond	ionic bond

* at 0 ~ 1.7, the electronegativity of an atom isn't high enough for one atom to attract the electrons

but, at 0.3 - 1.7, one atom has more reactivity which makes that atom pull the electrons closer to it, making it partial negative:

$H - F \rightarrow H^{\delta+} :F^{\delta-}$ this is polarity

ELECTROLYTE

electrolyte: something that conducts electricity

ionic compounds <u>are</u> electrolytes when disolved in water or when they are molten

ionic compounds disociates when disolved in water.
↳ break apart into seperate ions in water

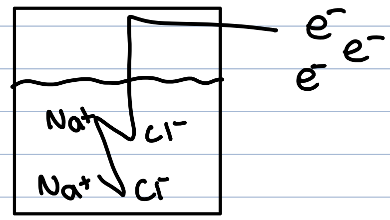
$H^{\delta+}$ $H^{\delta+}$
$O^{\delta-}$

H_2O is a polar covalent molecule. oxygen is more reactive so the electrons go to oxygen making oxygen partial negative and the hydrogen partial positive

Ionic compounds are bonds between +ve cations and -ve anions
the +ve cation is attracted to -ve oxygen end and -ve anion is attracted to +ve hydrogen end.

This makes the ionic compound dissociated in water. Then, electrons jump around and bounce off the ions in water which allows the solution to conduct electricity

electricity = a stream of electrons



Ex. $NaCl_{(s)} \rightarrow Na^+_{(aq)} + Cl^-_{(aq)}$
(s) = solid (aq) = aqueos (dissolved in H_2O)

covalent things do not conduct energy. → non-electrolyte
↳ they don't dissociate in water

non polar covalent compounds do not dissolve because they do not have a charge and does not react to water molecule

polar covalent compound disolve in water, but do not dissociate, so not electrolytes

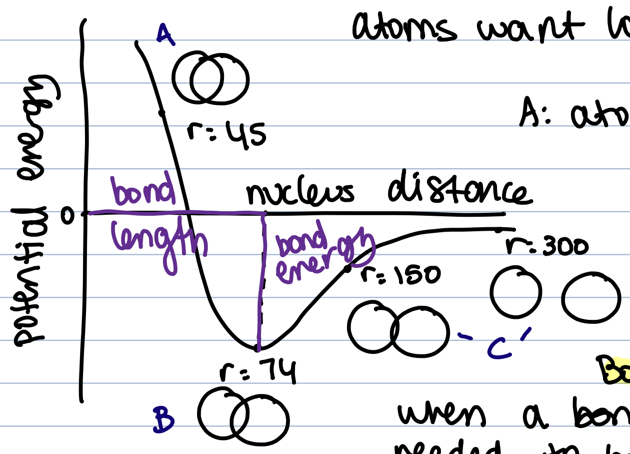
COVALENT BONDING

covalent character: DEN = 0 - 1.7
low melting points → tend to be liquid / gas at room temp
in molecules → smallest unit of covalent compound

electrons are being shared between atoms

balancing 2 types of forces (attraction/repulsion)
- protons repel protons electrons repel electrons
  protons of one atom are attracted to the electron of

Covalent bond formation:
- nature forms bonds between atoms to achieve lower energy (potential energy) and greater stability
- bonding occurs when repelling forces = attractive forces



atoms want lowest energy required to satisfy octet rule (lazy)

A: atoms are too close. too much repulsion

B: good. less repulsion, more attraction

C: not enough attraction

Bond energy: the amount of energy released when a bond is formed AND the amount of energy needed to break the bond

Bond length: distance between 2 nuclei at their max potential energy

more bonds = more bond energy
↳ harder to break apart a compound that is strong

small bond length → higher bond energy (columbs law)

bigger bonded atoms have larger bond length, therefore less bond energy

* when bond formed → release energy   break bond → absorb energy

IONIC BONDING

ionic character: DEN : 1.7 - 3.3
high melting points → hard, brittle and solid
in formula unit → smallest ratio of ionic compound

Ionic bonds are hard/brittle because adding force to the crystalline structure pushes like ions next to each other, repel, and break apart.

Ionic compounds have orderly, repeating arrangement, AKA crystal lattice

lattice energy: used to approximate the bond strength for ionic compounds

The energy is released when one mole of one ionic crystalline compound is formed from its gaseous ions

similar to bond energy, but for ionic compounds

The crystal structure makes ionic compounds strongest compounds

Bigger ions = weaker f_q (columbs law) $f = \frac{q_1 q_2}{r^2}$ q_1, q_2 = charges
↳ less reactivity → less lattice energy

As the charges of the ions increase, so does the force and therefore the lattice energy.

As size of ions increase, force and lattice energy decrease

METALS AND METALLIC BONDS

characteristics: shiny, maleable, ductile, conduct heat/electricity

Metals are made of positive ions closely packed together in crystalline solids

The positive ions are surrounded in a mobile "sea of electrons"
↳ These valence electrons are free to move away from their atoms of origin
once one electron flows away, another one takes its place because of electrostatic attraction between nucleus and electrons
↳ what holds a metal together

e^- sea is always moving, going to higher/lower energy levels

mettalic bonds are weaker than ionic/covalent bonds

light is absorbed by e^- easily because of electron sea
↳ makes metals shiny

free flow of e^- make them good conductors of heat
↳ heat makes e^- move faster, increasing kinetic energy, more heat

when current is applied to metals, e^- enter from one side, causing repulsion and pushes e^- out.
↳ generates movement and e^- exited = e^- entered

metals are malleable because they can deform in response to forse.
↳ mobile sea of e^- sheilds cations from repulsion

metals are ductile (can be made into wires) because they can be bent into thin lines without breaking

metals are usually solid at room temp

SIMILARITIES AND DIFFERENCES

metal + non metal (or polyatomic) → ionic

non metal + non metal → covalent (polar/non-polar)

metal + metal → mettallic bond

Polyatomic: a group of covalently bonded atoms that then loose/gain e^-

Diatomic elements: Br_2 I_2 N_2 Cl_2 H_2 O_2 F_2
↳ never by themselves
these atoms are either bonded together or with another element
very reactive elements

ISOMERES = when you can have more than one combination of a lewis structure for a covalent bond

IONIC = metals, non metals, polyatomic ions
COVALENT: only non metals

IONIC = e^- are transfered from atoms forming cations/anions
bond formed by attraction of oppositely charged particles
COVALENT: e^- are shared between atoms in pairs
e^- are attracted to proton of other atom

IONIC = hard, conductive, crystallized solids, high melting/boiling point, sollvable

COVALENT: soft, not conductive, all states, low melting/boiling point. polar: sollvable

Both: have charge of 0
compounds have full valence shell
minimizes potential energy