# SOLUTIONS

**solution**: a mixture that is physically combined in which you cannot distinguish between the different phases

**solute**: what is dissolved (lesser quantity)

**solvent**: what is doing the dissolving (greater quantity) ⇒ often $H_2O$

**types**: solid in liquid, liquid in liquid, solid and solid
gas in liquid, gas and gas
↳ no bonds broken, just adjacent

**solubility**: the ability of any solute to dissolve in a solvent.
↓ measured in terms of the max. amount of solute that can be dissolved in a solvent
how much?

**like dissolves like**: polar can dissolve polar/ionic
non polar dissolves non polar

**miscible**: a solute is soluble in a solvent
mixes evenly, homogenous solution

**immiscible**: not soluble

**saturation**: max amount of solute that can be dissolved in a given amount at a given temperature.

**saturated**: the solvent has dissolved the max amount of solute that it can at the given temp.
may be uniform throughout or contain extra solute settled at the bottom of the solution

**unsaturated**: the solvent is capable of dissolving more solute.
has less than the max. amount of solute
is uniform throughout

**supersaturated**: the solvent contains more solute than it can stably hold at a given temp.
often formed by heating a solution and dissolving more solute than cooling the solution slowly
will appear uniform throughout (until disturbed),
no excess visible in the container

**concentration**: amount of solute dissolved in a solvent

**concentrated**: large amount of solute dissolved

**dilute**: small amount of solute dissolved

# FACTORS THAT AFFECT SOLUBILITY

* different factors when talking about solubility, cause different properties

* solubility: amount

**solid solute / liquid solvent** = increasing temp. increases solubility
↳ particles are faster, increasing chance of collision
polarity = same
↳ having charges of greater magnitude

**gas solute / liquid solvent** = increasing temp. decreases solubility
increasing agitation decreases solubility
increasing pressure increases solubility
↳ the high pressure pushes down on the gas molecules and they are forced to collide (small space)

both increase kinetic energy which can cause gas molecules to move, and they escape

# EQUATIONS

**molarity**: $M = \frac{\text{mol of solute}}{\text{L of solution}}$ measures the concentration

**dilutions**: $M_1 \times V_1 = M_2 \times V_2$

$M_1$ = starting molarity (stock solution)
$V_1$ = starting solution

# PROCESS OF DISSOLVING

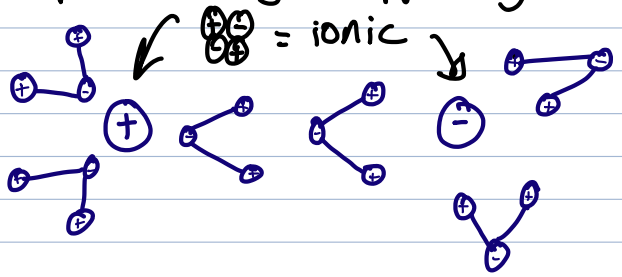
in water, process is called hydration

in anything else, called solvation

partial +ve H atoms are attracted to the -ve ions of the solute and pull away from the compound, forming ion-dipole attraction

partial -ve O atoms are attracted to and surround the +ve ions of solute and pull away from the compound, forming ion-dipole attraction

**Dipole**: having 2 oppositely charged poles ↳ $H_2O$ makes room for ions in middle




The oppositely charged atoms separate/dissociate when there is a stronger attraction between the solute and solvent than the attraction between individual solvent particles/solute particles

# ENDOTHERMIC / EXOTHERMIC SOLUTIONS

When dissolving a compound, need to overcome 2 inter-molecular attractions

1) solute-solute bonds break (absorbs energy = endothermic)
2) solvent-solvent bonds break (absorbs energy = endothermic)
3) solute-solvent bonds form (releases energy = exothermic)
   ↳ depending on the net energy, the process is exo/endo

**exothermic**: more energy is released when forming bonds than breaking them

**endothermic**: more energy is absorbed when breaking bonds than forming them

Because solute and solvent particles must be attracted to one another in order to dissolve, like dissolves like

Solutes and solvents with opposite attractive forces are more attracted to their own particles than they are to one another, so compound will not dissolve

**non polar dissolving**: covalent solids just break down in smaller versions of the compounds
bonds are NOT broken
they are partially +ve/-ve and attract when dissolving but the magnitudes are small

Ionic compounds are strong electrolyte (break into ions)

# FACTORS THAT AFFECT RATE

rate = speed of dissolving

**surface area**: the greater the surface area, the greater the molecules are in contact with the solvent, which increases the speed

**stirring**: agitation brings fresh solvent into contact with undissolved solid since new molecules dissolve, the rate is faster

**temp**: increasing temp increases kinetic energy, which makes the particles faster, allowing more collision and faster solubility

The more similar the IMF, the better solubility/dissolviability.