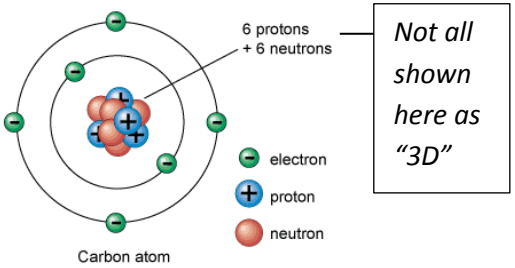
Atomic structure

- $^{24}_{12}Mg$ – the big number (#) is mass number, the smaller # is atomic number.
- Mass number = # of protons PLUS # of neutrons
- Atomic number = # of protons
  - Protons are positive (+), neutrons are neutral, electrons are negative (-)
- Atoms are neutral overall since the # of protons (+) = # of electrons (-)

Periodic table

- Rows are periods, columns are groups
- The group # tells us how many valence (outer shell electrons) an atom has
  - Group 1 – has 1, Group 2 – have 2
  - Groups 13, 14, 15 etc have 3, 4 & 5 etc
  - Group 18 have 2 (He) & the rest have 8
- Metals (m) on the left and middle of the table, non-metals (nm) on the right
- KNOW how to draw in the "stairs" to separate metals & non-metals (H is nm too)



Not all shown here as "3D"

$^{12}_{6}C$ mass number 12, atomic number 6

6 p, 6 e & 6 n (12 - 6 = 6). Elec. configuration 2,4

Atomic particles

- The mass of the atom depends on the # of protons and neutrons in the nucleus since the electrons are very very light (about 1/2000 as heavy).
- Electrons are arranged in shells / energy levels
  - First shell can hold up to 2
  - Second shell can hold up to 8
  - Third shell can hold up to 8
- E.g. Mg (atomic # 12) has electron configuration (arrangement) of 2,8,2

ACIDS & BASES

SURVIVAL SHEET – PART 1 OF 2

Ionic compounds

Ions come together to make ionic compounds, where the overall charges cancel out / add up to zero.

e.g. magnesium oxide Mg^{2+} ion and O^{2-} ion make MgO (as 2+ and 2- = 0); Ratio of ions is 1:1

e.g. magnesium chloride Mg^{2+} ion and Cl^{-} ion; this one needs 2 x Cl^{-} ion to make $MgCl_2$ (as 2+ + 1- +1- = 0); Ratio of ions is 2 : 1

e.g. aluminium oxide Al^{3+} ion and O^{2-} ion; needs to be Al_2O_3 as (2 x 3+) + (3 x 2-) = 0

Isotopes

- Are different forms of the same element
- Are chemically identical (as they have the same electron arrangement)
- Have same atomic # but different mass #
- Have a slightly different <u>mass</u> to each other because of different numbers of neutrons in the nucleus

E.g. $^{24}_{12}Mg$ and $^{26}_{12}Mg$, $^{35}_{17}Cl$ and $^{37}_{17}Cl$

Ions

- *Some* elements form ions
- Metals lose electrons and form positive ions, non-metals gain electrons and form negative ions
- Atoms lose or gain electrons to achieve a full valence shell because this is a stable arrangement.

E.g. Mg (2,8,2) will lose 2 electrons and become Mg^{2+}, Cl (2,8,7) will gain 1 electron to become Cl^{-}.

Ionic formulae (and brackets)

- Brackets are needed when a polyatomic ion is used *more than once*.
  - NH_4^+ ammonium OH^- hydroxide HCO_3^- hydrogen carbonate NO_3^- nitrate SO_4^{2-} sulfate CO_3^{2-} carbonate
- E.g. Cu^{2+} & OH^- makes the formula $Cu(OH)_2$ but Cu^{2+} & CO_3^{2-} is just $CuCO_3$
- E.g.iron (III) hydroxide is $Fe(OH)_3$

You get given a table of ions but need to learn their names

Balanced chemical equations

# of atoms on left (reactants) of the → must equal # of atoms on right (products)

1. Write the correct formulas (use table of ions)
2. Balance by adding numbers in front of formula – you can't change a formula!
3. Sometimes it won't need balancing at all

$Mg + 2HCl \rightarrow MgCl_2 + H_2$ ✓

$Mg + HCl_2 \rightarrow MgCl_2 + H$ ✗ (not HCl_2 or just H)

$CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + H_2O + CO_2$ ✓

General equations – memorise these

Acid + metal → salt + hydrogen

Acid + base→ salt + water

Acid + carbonate → salt + water + carbon dioxide

<u>Acids – memorise these</u>

HCl – hydrochloric acid – forms salts called chlorides

HNO_3 – nitric acid – forms salts called nitrates

H_2SO_4 – sulfuric acid – forms salts called sulfates

Rates of reaction

Rate is an amount / time. E.g. mL of gas produced per second.

Collision theory

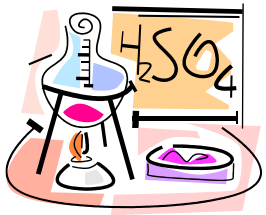
To react, particles must

- colllide with sufficient energy & the correct orientation
- a collision that leads to a reaction is called a sucessful collision

Bases and carbonates

- Bases are metal oxides e.g. CuO and metal hydroxides e.g. NaOH
- Carbonates & hydrogen carbonates contain the CO_3^{2-} & HCO_3^- ion e.g. Na_2CO_3 & $NaHCO_3$
- Bases and carbonates will neutralise acids.
- When a carbonate or hydrogen carbonate reacts with an acid the VISIBLE SIGN of the reaction is bubbles of a colourless gas; the gas is CO_2. It will turn limewater milky/cloudy.

ACIDS & BASES



SURVIVAL SHEET – PART 2 OF 2

Concentration

Increasing the concentration of a solution e.g. acid means more particles / volume

So there will be <u>*more frequent*</u> collisions between particles of acid and a solid, e.g. Mg

So the rate of reaction will increase

Surface area

Increasing the surface area of a solid e.g. Mg, means more Mg particles are exposed for reaction

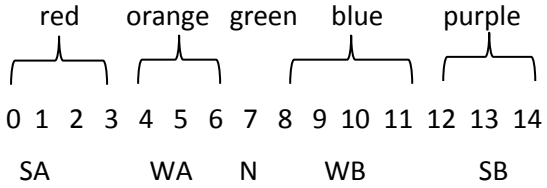
So there will be <u>*more frequent*</u> collisions between particles of acid and Mg

So the rate of reaction will increase

The pH scale (0-14) & indicators

pH < 7 = acid, pH = 7 neutral, pH> 7 alkaline/basic

Universal indicator colours



Red litmus stays red in acid, turns blue in alkali

Blue litmus turns red in acid, stays blue in alkali

The rate of a reaction can be increased by

- Increasing the concentration of a solution
- Increasing the surface area of a solid
- Heating
- Adding a catalyst

Catalyst

Lowers the energy needed for a reaction to occur so more particles have enough energy to react. <u>*More of the collisions will be successful collisions*</u>. So the rate of reaction will increase.

Temperature

Increasing the temperature of a solution e.g. acid means the particles have more E_K (move faster.)

So there will be <u>*more frequent*</u> collisions between particles of acid and a solid, e.g. Mg

Also the collisions will have more energy so <u>*more of the collisions will be successful collisions*</u> (lead to a reaction)

So the rate of reaction will increase

AVOID "forceful" and avoid "chance / likelihood"