Atoms:

Radius: 1x10^-10m

Nucleus:
In centre
Has protons & neutrons so has positive charge
Radius: 1x10^-14
Most of atom's mass concentrated in nucleus

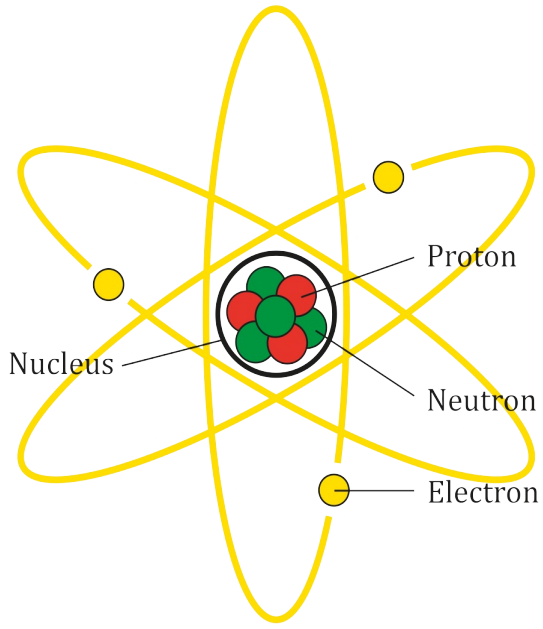
Electrons:
In energy levels orbiting nucleus (volume of their orbits determines atom's size)
Negatively charged

Number of Protons = Number of Electrons so atoms have no overall charge (opposite charges cancel out)

Atomic number: number of protons/electrons
Mass number: protons + neutrons in nucleus
Neutrons = Mass number - Atomic number

Properties of protons, neutrons and electrons

	Position in the atom	*Relative mass*	*Relative electric charge*
PROTON	nucleus	1	+ 1
NEUTRON	nucleus	1	0
ELECTRON	outside nucleus	0.005	- 1



Elements:

Substance that contains atoms with same number of protons (there are about 100)

Isotopes = atoms of the same element with same number of protons & different number of neutrons
So same atomic number, different mass number
E.g. Carbon-12 & Carbon-13

Relative atomic mass (Ar): an elements mass of 1 of its atoms relative to 1/12 the mass of one atom of Carbon-12

Ar= sum of (isotope abundance x isotope mass number) / (sum of abundances of all isotopes)

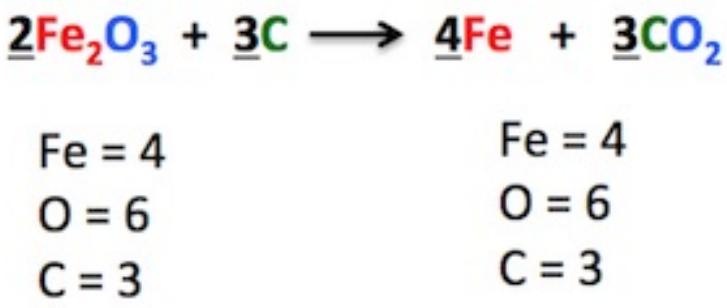
Compounds:

Substances of >2 elements chemically combined
Properties of compounds = different to original elements
Use chemical reactions to separate compounds

CO^2 = 1 atom of carbon, 2 atoms of oxygen
Ca(OH)^2 = 1 atom of calcium, 2 atoms of oxygen & 2 atoms of hydrogen

Balanced symbol equations:

Mass of reactants = Mass of products (conservation of mass)



Mixtures:

Substances made of >2 elements, NOT chemically bonded
Substance has similar properties to original elements
Use physical separation techniques to separate
E.g Air = mixture of: nitrogen, oxygen & argon, Crude oil = mixture of dif length hydrocarbon molecules

Separation techniques:

Filtration: separates insoluble solids from liquids
1. Pour solution into filter paper in a funnel into a beaker
2. Soluble molecules stick to paper so collect liquid in beaker

Soluble solids from solutions:

Evaporation:
1. Pour solution into evaporating dish
2. Heat with Bunsen & crystals will form as H20 evaporates
3. Collect dry crystals

Crystallisation:
1. Heat solution (in an evaporating dish) with a Bunsen
2. H20 will begin to evaporate, crystals will form
3. Filter crystals out of solution & leave to dry

Separating salt from seawater:
1. Mix sand & salt with H20 in a solution
2. Stir to dissolve sand
3. Filter the solution (the sand will stick to the filter paper)
4. Evaporate H20 off = dry crystals

Distillation:

Simple: separates liquid from solution

1. Heat solution
2. Vapour cools & condenses in the condenser & is collected

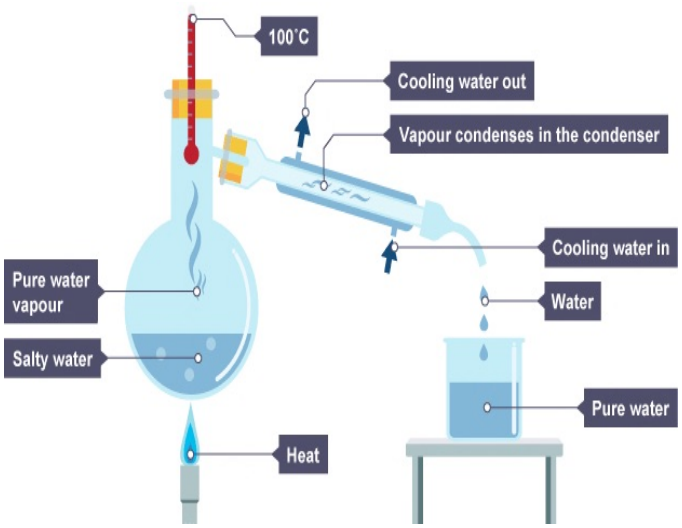
Can get pure water from seawater, H20 evaporates & salt collects in flask

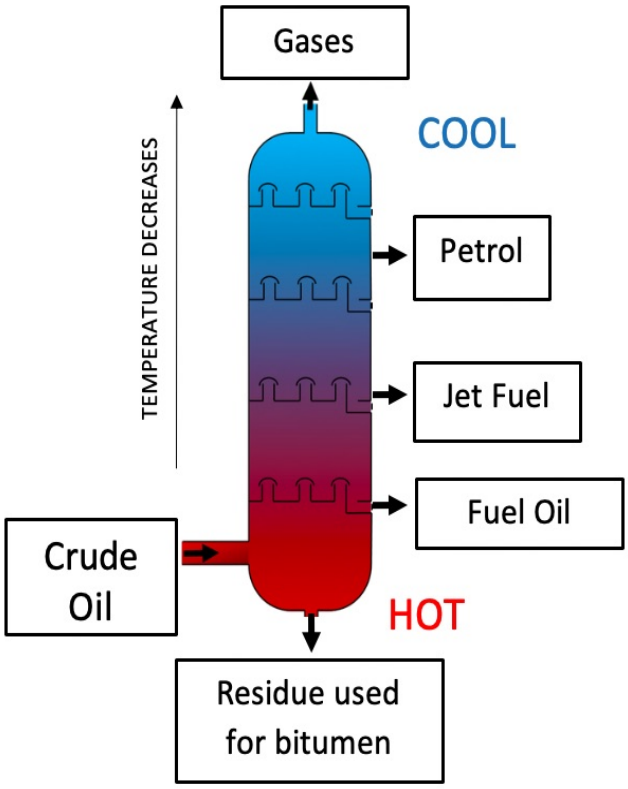
But can only use simple distillation to separate substances with DRASTIC boiling points (bp)

Fractional distillation:

Separates mixture of liquids with SIMILAR bp's

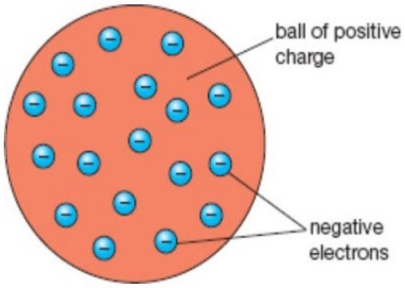
1. Heat mixture in flask using Bunsen
2. Liquids evaporate at dif points depending on their bp
3. Liquid with lowest bp evaporates 1st, condenses (column is cooler at the top) & is collected (once the thermometer temp of the mixture reaches its bp)





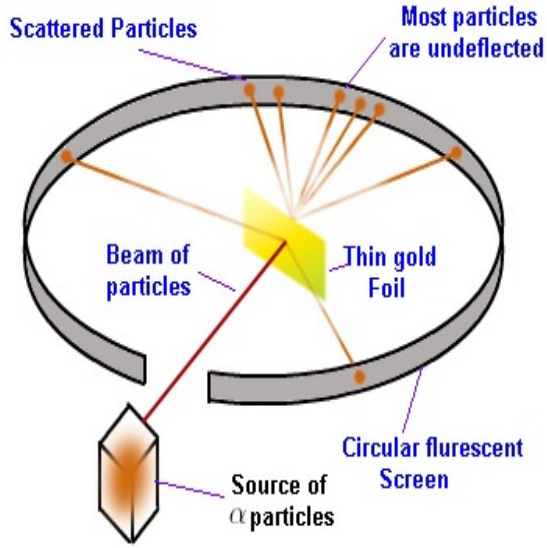
History of atom:

Dalton: atoms = solid spheres
1897: Thompson debunked this, by discovering electrons = Plum pudding model created (ball of positive charge with negative electrons embedded in it)



Thomson's 'plum-pudding' model of the atom

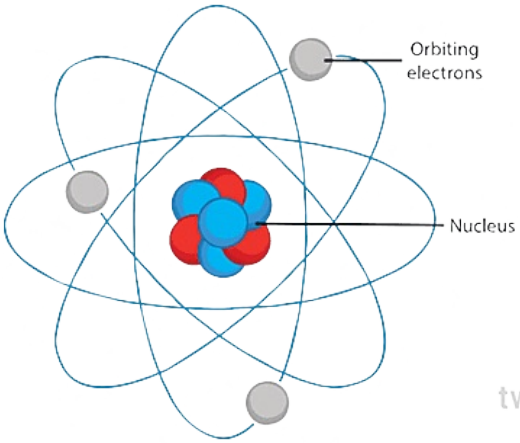
1909: Alpha Scattering experiment
Rutherford fired positive alphas at sheet of gold
Results:
Alphas reflected = central, nucleus with positive charge
Alphas straight through = atom is mostly empty space
Alphas deflected= atom's mass concentrated in nucleus



Bohr: electrons orbit nucleus in fixed energy levels (a cloud of electrons would've caused the atom to collapse due to their attraction to the nucleus)

Rutherford: nucleus can be divided into smaller positive particles (had the same charge as hydrogen nucleus) = protons
Chadwick: discovered neutrons in nucleus

So Nuclear model created



Electronic structure:

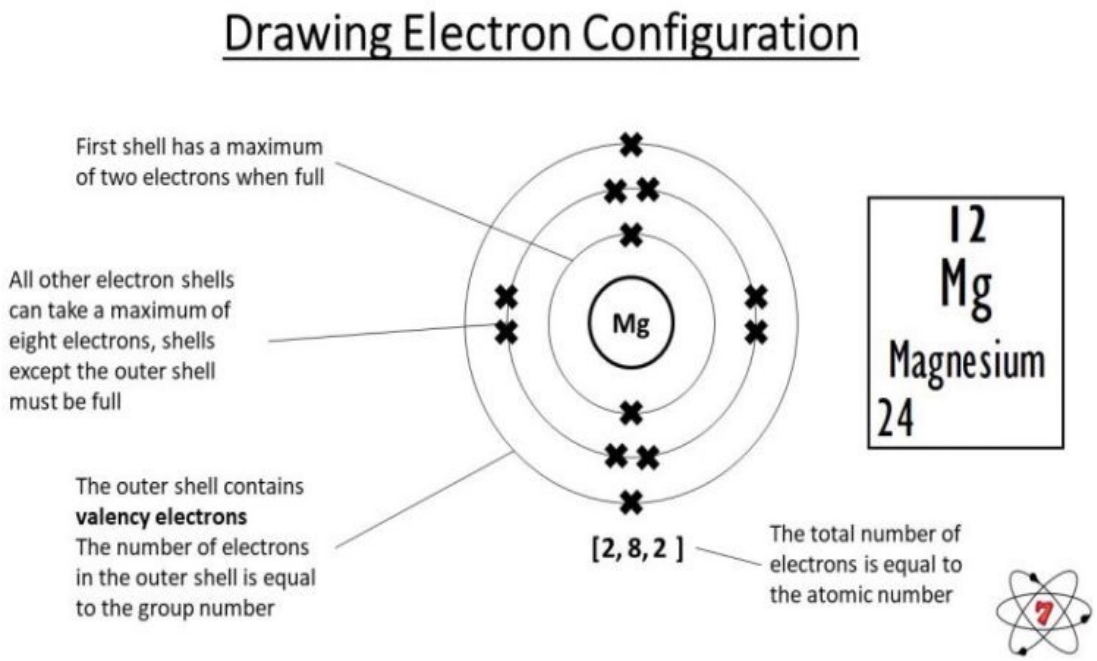
Lowest energy levels (closest to nucleus) filled 1st

2,8,8 = configuration

Thus...

2 electrons on 1st shell, 8 on the 2nd, 8 on the 3rd shell

Atoms = stable if have full outer electron shell



Development of periodic table:

<20th cent: elements categorised by: physical & chemical properties and atomic weight

So wrong arrangement due to elements being arranged by atomic weight (mass)

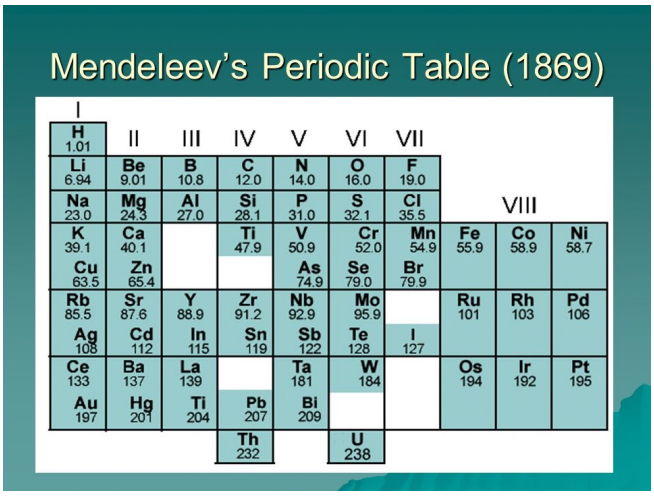
1869: Mendeleev created periodic table of 50 elements
He ordered elements by: atomic weight BUT left gaps by predicting the properties of elements
His predictions were correct & isotopes proved order wasn't just based on weight but also properties of elements (isotopes= different masses, same properties)

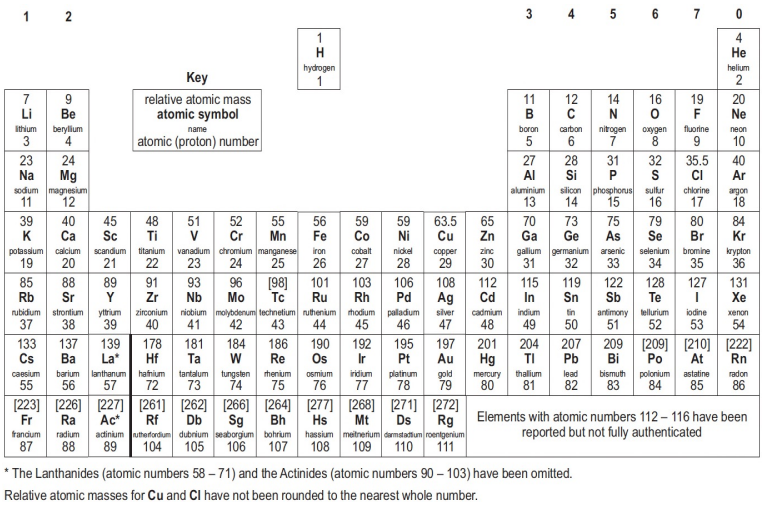
Modern periodic table:

100 elements

Metals on left, non-metals on right
Periods (across) = elements in order of atomic number
Groups (down) = elements by properties (determined by electrons in outer shell so elements in the same group have same proton number)

Elements in same group react similarly & are ordered by reactivity





* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

Metals & non-metals:

Metals:
Form positive ions

Non-metals:
Form negative ions

Group 1 & 2:
electrons on higher energy levels are further from the nucleus so have a lower electrostatic attraction
so larger atomic radius = easier to LOOSE electrons to get a full outer shell

Group 6 & 7:
electrons on lower energy levels are closer to the nucleus so have a higher electrostatic attraction
so smaller atomic radius = easier to GAIN electrons to get a full outer shell (to gain electrons, need strong electrostatic attraction between nucleus & electrons)

Properties of metals:

Metallic bonding so:
Strong but malleable (bent into shape)
Good conductors of heat & electricity
High b.p & m.p

Properties of non-metals:

Dull
Lower b.p & m.p

Group 1 elements:

Alkali metals properties:

Have 1 outer electron (so very reactive)
Soft with low densities

Trend:

Reactivity INCREASES DOWN the group (more energy is released in reactions)
As atomic radius increases, there's a weaker electrostatic attraction between the nucleus & electrons so easier to loose outer electron
So LOWER bp & mp DOWN with a HIGHER Ar

Form +1 ions (via ionic bonding):

Reactions: (vigorous):

Water + Metal -> Metal hydroxide + hydrogen
Chlorine + Metal -> Metal chloride salt
Oxygen + Metal -> Metal oxide

Alkali metals more reactive, less dense with lower mp than Transition metals

Group 7 elements:

Halogens:

Non-metals with coloured vapours e.g. Flourine (yellow gas) & Bromine (red, volatile liquid)

All diatomic

Trends:

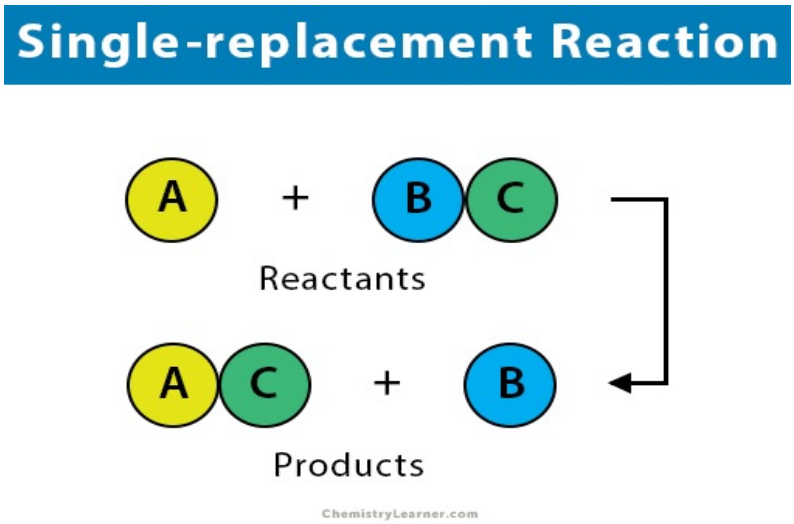
DOWN group reactivity DECREASES
As atomic radius increases, the electrostatic attraction between the nucleus & electrons decreases so it's harder to GAIN electrons
Higher mp & bp DOWN the group
Higher relative atomic masses DOWN the group

Bond covalently to form elements with simple molecular structures

Bond ionically to form halides

Displacement reactions:

Occurs with more reactive halogen & less reactive salt which is displaced



Group 0 elements:

Nobel Gases are:

Inert (have full outer shell so not flammable),
colourless gases at room temp
All monatomic gases (single un- bonded atoms)

Trends:

Bp INCREASES DOWN the group (more
electron shells = greater intermolecular forces
so need more energy to overcome)
Ar increases DOWN the group