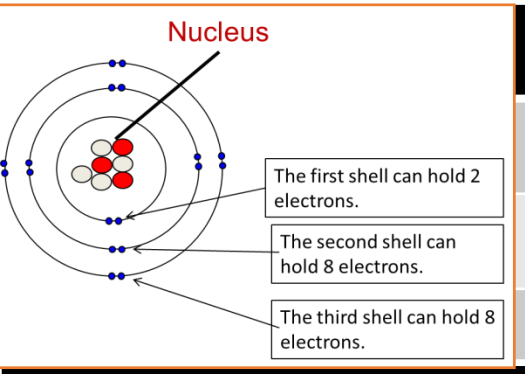
Chemistry 7: Atomic Structure

Section 1:

Atom	Simplest form of matter
Element	Made up of only one type of atom
Compound	Made up of two or more different types of atoms **chemically bonded**.
Mixture	Two or more atoms **not** chemically bonded.

Section 2: Atomic Structure



	Proton	Neutron	Electron
Mass	1	1	Negligible (very small)
Charge	+1	0	-1
Location	Nucleus	Nucleus	Shells

Section 2a:

Radius of an atom	Distance from the centre of the nucleus to the outer shell ~ 1 x10^{-10}
Radius of a nucleus	Distance from the middle of the nucleus to the outside ~1x10^{-10}
Isotope	An atom of the same element that has the same number of protons but a different number of neutrons.
Relative atomic mass	average value that takes account of the abundance of the isotopes of that element. = sum (isotope abundance x isotope mass) / sum of abundance of all isoptopes

Section 3 Separation techniques

Separation technique	What is it used to separate?	How does it work?
Filtration	An insoluble solid from a liquid	The mixture is poured through filter paper. The liquid goes through the filter paper and the solid remains in the filter paper.
Evaporation	A soluble solid from a solution	The solution is slowly heated until all of the liquid has evaporated. You are left with a dry solid.
Crystallisation	A soluble solid from a solution	The solution is slowly heated until the point of crystallisation. The concentrated solution is left to cool until crystals form. The crystals are filtered and dried.
Distillation	A liquid from a solution (can be two liquids or a soluble solid and a liquid).	The solution is heated until the part of the solution with the lowest boiling point evaporates. The vapour is condensed and the liquid collected.
Fractional distillation	A mixture of liquids with different boiling points.	The solution is heated until the part of the solution with the lowest boiling point evaporates. The vapour is condensed and the liquid collected. This is repeated at higher temperatures to collect fractions with higher boiling points.
Chromatography	A mixture of dissolved solids or liquids (such as dyes in inks or food).	A mixture of the dissolved substance is put onto chromatography paper. A solvent is added and this runs up the paper. The different substances in the mixture move at different speeds.

Section 4: Development of the theory of the atom

Person	Year	Theory
Dalton	Early 1800s	Atoms were hard spheres that couldn't be broken down into anything more simple.
Thompson	1897	Plum pudding model' – ball of positive charge with electrons spread throughout it.
Rutherford	1911	Alpha scattering experiment this gave unexpected results and gave us the nuclear model – positive nucleus with electrons around the outside.
Bohr	1913	Electrons are in fixed shells around the nucleus.
Chadwick	1932	Discovered neutrons.

Section 4: Development of the theory of the periodic table

Stage	People	Idea
1	Dalton, Newlands	attempted to classify the elements by arranging them in order of their atomic weights The early periodic tables were incomplete and some elements were placed in inappropriate groups if the strict order of atomic weights was followed.
2	Mendeleev	Overcame some of the problems by leaving gaps for elements that he thought had not been discovered and in some places changed the order based on properties instead of atomic mass.
3		Elements with properties predicted by Mendeleev were discovered and filled the gaps. Knowledge of isotopes made it possible to explain why the order based on atomic weights was not always correct.

Section 5:Trends in groups

Group	Properties	Trends (going down the group)	Reactions
0	Unreactive and do not easily form molecules because their atoms have stable arrangements of electrons (monatomic). Colourless gases. Non-flammable. The noble gases have 8 electrons in their outer shell, except for helium, which only has 2 electrons.	Boiling points increase. Relative atomic mass increases.	Unreactive
1	Low density (the first three elements in the group are less dense than water). Soft. 1 electron in outer shell. Very reactive.	Reactivity increases (electron is more easily lost). Melting and boiling points decrease. Relative atomic mass increases.	React with water to produce a metal hydroxide and hydrogen. React with chlorine to produce a metal chloride salt. React with oxygen to produce a metal oxide.
7	Exist as pairs of atoms (e.g. Cl_2). Have 7 electrons in their outer shell.	Reactivity decreases (it is harder to gain an electron). Melting and boiling points increase. Relative atomic mass increases.	Share electrons with other non-metals in covalent bonding (e.g. HCl). Form ionic bonds with metals (e.g. NaCl). More reactive halogens will displace less reactive ones.

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Transition metals: Comparing with Group 1		
	Group 1	**Transition metals**
Melting points	Low	High
Reactivity	High	Low
Strength	Soft or liquid	Hard
Density	Low	High
Compounds	White or colourless	Coloured
Ions	+1	Can have more than one ion e.g Cu^{+} and Cu^{2+}
Uses		Catalysts e.g Iron for Haber process or Ni for hydrogenation of alkenes