CHURCH STRETTON SCHOOL

Triple Science - Chemistry

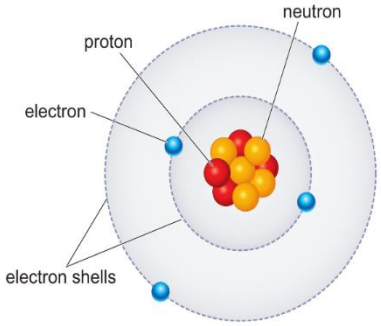
SC3-4 Knowledge organiser

SC3-4: Atoms and the periodic table

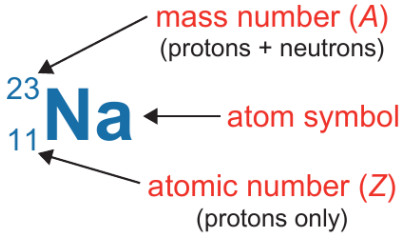
Sequence

1. Structure of atoms
2. Detailed structure of atoms
3. Isotopes
4. Mendeleev's periodic table
5. The modern periodic table
6. Electron configuration

1. Structure of atoms	
Particle	The tiny pieces that all matter is made from.
Atom	The smallest independent particle. Everything is made of atoms.
Size of atoms	About 1 x 10^{-10} m in diameter.
Dalton's model of atoms	- Tiny hard spheres - Can't be broken down - Can't be created or destroyed - Atoms of an element are identical - Different elements have different atoms
Subatomic particles	Smaller particles that atoms are made from.
Proton	Mass = 1 Charge = +1 Location = nucleus
Neutron	Mass = 1 Charge = 0 Location = nucleus
Electron	Mass = 1/1835 (negligible) Charge = -1 Location = shells orbiting nucleus
Nucleus	Central part of an atom, 100,000 times smaller than the overall atom



2. Detailed structure of atoms	
Alpha particle	Small positively charged particle made of two protons and two neutrons.
Scattering	When particles bounce back or change direction.
Rutherford's experiment	Fired alpha particles at gold leaf, used a phosphor-coated screen to track where they went.
Rutherford's results	Most alpha particles went through, some scattered (changed direction).
Rutherford's explanation	Scattered particles hit a solid nucleus. Most did not hit it, therefore nucleus is small
Atomic number	The bottom number on the periodic table, gives the number of protons and electrons.
Atomic mass	The top number on the periodic table, gives the total protons and neutrons together.
Number of protons	The atomic number.
Number of electrons	The atomic number.
Number of neutrons	Atomic mass minus atomic number.
Number of protons and electrons	Equal, because each negative electron is attracted to a positive proton in the nucleus.



Subatomic particle	Relative charge	Relative mass
proton	+1 (positive)	1
electron	−1 (negative)	1/1835 (negligible)
neutron	0 (no charge)	1

3. Isotopes	
Isotopes	Atoms with the same number of protons but different number of neutrons.
Describing isotopes	Mass after the name (e.g. boron-10) or superscript mass before the symbol (^{10}B).
Nuclear fission	Large unstable atoms break into two smaller stable ones.
Uses of fission	Nuclear power, nuclear weapons.
Relative atomic mass, A_r	The weighted average of the masses of all of the isotopes of an element.
Isotopic abundance	The percentage of an element that is made of a particular isotope.
Calculating A_r	- Multiply each mass by the decimal % - Add these up **Note:** (decimal % = %/100)

4. Mendeleev's periodic table	
Dmitri Mendeleev	Russian chemist, developed the periodic table.
Mendeleev's periodic table	Ordered by increasing A_r, some elements switched according to their properties.
Chemical properties	Includes reaction with acid and formula of oxide.
Physical properties	Includes melting point and density.
Gaps in Mendeleev's periodic table	Mendeleev left gaps where no known element fitted and predicted these would be filled with newly discovered elements.
Eka-aluminium	An element that Mendeleev thought would fill a gap. He predicted its properties, which matched gallium when discovered.

5. The modern periodic table	
Noble gases	Gases that do not react: He, Ne, Ar, Kr.
Moseley's experiment	Fired electrons at samples of elements and measured X-rays produced.
Moseley's results	Energy of x-rays produced proportional to the positive charge of the element.
Conc. from Moseley's work	The atomic number must be the number of protons in the atoms.
Pair reversals	Elements (like Ar and K) that are not in order of increasing mass.
Explaining pair reversals	It means elements should be order elements by increasing atomic number instead.

6. Electron configuration	
Shells	Electrons orbit atoms in shells.
First shell	Holds up to two electrons.
Second shell	Holds up to eight electrons.
Third shell	Holds up to eight electrons.
Number of electrons	Given by the atomic number.
Filling shells	Fill shells from the first shell out. Move up a shell when current one is full.
Electron configuration	The number of electrons in each shell (e.g. Al is 2.8.3).
Outer shell	The last shell with any electrons in it.
Groups	Columns in the periodic table, tell you the number of electrons in the outer shell.
Periods	Rows in the periodic table, tell you the number of electron shells.