OCR B GCSE Chemistry

Topic 2: Chemical patterns

How have our ideas about atoms developed over time?

Notes

1. Describe how and why the atomic model has changed over time to include the main ideas of Dalton, Thomson, Rutherford and Bohr

- John Dalton:
  - proposed the atomic theory that:
    - atoms of an element are identical, different elements have different atoms
    - atoms can't be divided and make up all substances
    - atoms join to make new substances
- Thomson:
  - plum pudding model- atom is a positively charged sphere with electrons dotted inside
  - used a cathode-ray tube to conduct an experiment which showed that there are small particles inside atoms- disproved Dalton that atoms couldn't be split
- Rutherford:
  - proposed atoms were made up of a positive nucleus with negative electrons orbiting around
  - later discovered the proton
- Bohr:
  - proposed that electrons occupy shells around nucleus

2. Describe the atom as a positively charged nucleus surrounded by negatively charged electrons, with the nuclear radius much smaller than that of the atom and with most of the mass in the nucleus

3. Recall relative charges and approximate relative masses of protons, neutrons and electrons

sub-atomic particle	relative mass	relative charge
proton	1	+1
neutron	1	0
electron	1/1836	-1

4. Estimate the size and scale of atoms relative to other particles

- Typical atomic radii and bond length are in the order of 10^{-10}m
- the nucleus is about a hundred-thousandth of the diameter of the atom.
- Molecules are larger, containing from two to hundreds of atoms.
- Objects that can be seen with the naked eye contain millions of atoms

5. Recall the typical size (order of magnitude) of atoms and small molecules

- molecules are made up of atoms, therefore they are larger in size

6. Relate size and scale of atoms to objects in the physical world

- see 4

7. Calculate numbers of protons, neutrons and electrons in atoms, given atomic number and mass number of isotopes or by extracting data from the Periodic Table

- atomic number: number of protons (= number of electrons if it's an atom not an ion)
- isotope: atoms of the same element with different numbers of neutrons, but the same number of protons and neutrons
- mass number: number of protons + number of neutrons
- ion: an atom (or group of atoms) with a positive or negative charge

if given atomic number and mass number of an isotope:

- to find number of protons:
  - number of protons=atomic number
- to find number of neutrons:
  - number of protons + number of neutrons=mass of isotope
  - number of protons=atomic number
  - therefore, number of neutrons=mass of isotope - atomic number
- to find number of electrons:
  - for an atom of an element:
    - in an atom of an element, the overall charge is zero, meaning there are the same number of protons and electrons
    - number of electrons= number of protons= atomic number
  - for an ion:
    - in an ion, electrons (-1 charge) have been lost or gained, leaving the atom with a positive or negative charge
    - work out the number of protons (this doesn't change for an ion)
    - look at the charge on the ion to work out how many electrons have been lost/gained and add/take the number off of the proton number