

WJEC England GCSE Chemistry

Topic 2: Particles and Atomic Structure

Notes

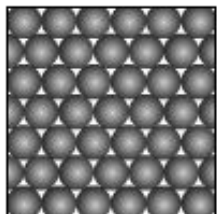
(Content in bold is for Higher Tier only)



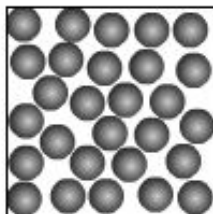


States of matter

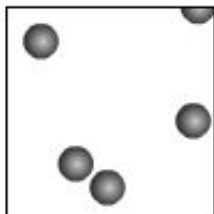
- The three states of matter are solid, liquid and gas
- Melting and freezing take place at the melting point
- Boiling and condensing take place at the boiling point



Solid



Liquid



Gas

- They can be represented by the simple model above, particles are represented by small solid spheres
- Gas: particles have the most energy – shown by the diagram, as the particles are the most spread apart
 - Liquid: particles have more energy than those in a solid, but less than those in a gas and solid has least energy – particles are fixed

Changes of state

- Physical changes – therefore involves the forces between the particles of the substances, instead of these interconversions being chemical changes
- at temperatures below the melting point: solid
- at temperatures between the melting and boiling point: liquid
- at temperatures above the boiling point: gas
- Particle theory can help to explain melting, boiling, freezing and condensing...
 - The amount of energy needed to change state from solid to liquid and from liquid to gas depends on the strength of the forces between the particles of the substance.
 - The nature of the particles involved depends on the type of bonding and the structure of the substance.
 - The stronger the forces between the particles the higher the melting point and boiling point of the substance.
- Limitations of the simple model above include that in the model there are no forces, that all particles are represented as spheres and that the spheres are solid.
 - Particle model does not explain why atoms of some elements react with one another

Size and mass of atoms

- Atoms are very small, having a radius of about 0.1nm (1×10^{-10} m). The radius of a nucleus is less than 1/10,000 of that of the atom (about 1×10^{-14} m).
- Atoms are mostly empty space with almost all the mass in a central nucleus





Relative atomic mass

- Relative formula mass (M_r) of a compound: sum of the relative atomic masses of the atoms in the numbers shown in the formula (remember you could have more than 1 atom of a certain element in a compound e.g. in CaCl_2 , there are 2 atoms of chlorine so you need to add on 35.5×2)
- In a balanced chemical equation:
sum of M_r of reactants in quantities shown = sum of M_r of products in quantities shown
- Atoms of the same element can have different numbers of neutrons; these atoms are called isotopes of that element.

to calculate numbers of protons, neutrons and electrons in atoms and ions, given atomic number and mass number of isotopes:

- atomic number = number of protons
- mass number = number of protons + number of neutrons
- to calculate number of neutrons: mass number - atomic number
- in an atom the overall charge is zero, so number of electrons = number of protons = atomic number

Mendeleev

- Mendeleev proposed an arrangement based on 'atomic weights'
- in some cases the order was not quite correct because different isotopes have different masses
- he organised the elements so that they were arranged in groups with similar chemical properties and so he left some gaps where elements had not yet been found

