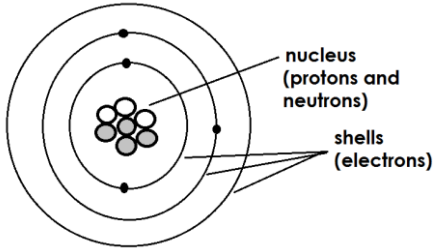
Chapter 1 Atomic Structure – GCSE Assumed Knowledge

<table>
<tr><th>Learning Objectives</th><th>Keypoints</th></tr>
<tr><td>Recall the typical sizes of atoms and molecules</td><td>We use the atomic radius to compare the size of atoms.
An atom is typically about 10^{-10}m</td></tr>
<tr><td>Describe the structure of the atom</td><td> 
</td></tr>
<tr><td>Recall the properties of subatomic particles</td><td>
<table>
<tr><th>Subatomic particle</th><th>Relative mass</th><th>Relative charge</th><th>Location</th></tr>
<tr><td>Electron</td><td>1/2000</td><td>-1</td><td>Shells around the nucleus</td></tr>
<tr><td>Proton</td><td>1</td><td>+1</td><td>Nucleus</td></tr>
<tr><td>Neutron</td><td>1</td><td>0</td><td>Nucleus</td></tr>
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</td></tr>
<tr><td>Calculate the numbers of subatomic particles in atoms and ions</td><td>For an atom:
Number of protons = number of electrons = atomic number
Number of neutrons = mass number – atomic number
For an ion, protons and neutrons are calculated in the same way.
However, for a positive ion, number of electrons = atomic number – charge on the ion
For a negative ion, number of electrons = atomic number + charge on the ion</td></tr>
<tr><td>Explain what isotopes are</td><td>An isotope is an atom of the same element which has the same number of protons but different number of neutrons. This means that its atomic number is the same, but its mass number is different.
Chemical properties of isotopes are identical as they have the same number of electrons.</td></tr>
<tr><td>Describe how and why the atomic model has changed over time</td><td>In 1803, John Dalton proposed that all matter was made from particles. He also said that in an element, all of the atoms are identical and that different elements would contain different types of atoms. He described atoms as ‘indivisible’.
In 1897, JJ Thomson discovered the electron. This contradicted Dalton’s idea that atoms were indivisible. This led to the development of the ‘plum pudding model’ in which atoms were spheres of positive charge with electrons spread throughout them.
In 1909, Rutherford, Geiger and Marsden fired alpha particles at gold foil. They expected them to pass straight through but a few were deflected or reflected back. This led to the idea of a positive nucleus surrounded by shells of electrons. This model was known as the ‘solar system model’
In 1913 Bohr developed this idea further by suggesting that the electrons were not just in one shell. He showed that electrons occupied fixed shells around the nucleus.</td></tr>
<tr><td>Describe the electronic structure of the first 20 elements</td><td>Electrons are arranged in shells. The shell closest to the nucleus can hold up to 2 electrons. All other shells can hold up to 8 electrons. The electrons will fill the shells closest to the nucleus first.
Commas represent a new shell being entered.
For example, Li has 3 electrons so its electronic structure is 2,1. This shows that it has 2 electrons in its first shell and 1 electron in the outer shell.</td></tr>
<tr><td>Explain how the position of an element in the Periodic Table relates to its electronic structure</td><td>The last number in an electronic structure shows which group number the element is in. For example, 2,8,2 and 2,8,8,2 are both in Group 2, whereas 2,8,7 and 2,8,8,7 are both in Group 7.
The number of numbers in an electronic structure shows which period the element is in. For example, 2,8,2 and 2,8,8 are both in Period 3, whereas 2,5 and 2,7 are both in Period 2.</td></tr>
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