

2. Recall that all matter is composed of atoms and has mass

Matter is everything around you. **Atoms** and molecules are all composed of matter. Matter is anything that has mass and takes up space. If you are new to the idea of mass, it is the amount of stuff in an object.

3. Describe the structure of an atom in terms of location and charge of the protons, neutrons and electrons

Protons- Subatomic particles with a positive charge and a relative mass of 1

Neutrons- Uncharged sub-atomic particles, with a mass of 1 relative to a proton

Electrons- Sub-atomic particles, with a negative charge and negligible mass relative to protons and neutrons

Atomic structure:

Atoms consist of electrons [*electrons: Sub-atomic particles, with a negative charge and a negligible mass relative to protons and neutrons.*] **surrounding a nucleus** [*nucleus: The central part of an atom. It contains protons and neutrons, and has most of the mass of the atom.*] **that contains protons**. **Protons:** Sub

atomic particles with a positive charge and a relative mass of 1, and **neutrons**, **neutrons:** Uncharged sub-atomic particles, with a mass of 1 relative to a proton..

Neutrons are neutral, but protons and electrons are electrically charged.

Protons have a relative charge of +1, while electrons have a relative charge of -1.

The number of protons in an atom is called its atomic number. In the periodic table elements are arranged in atomic number order.

Electrons are arranged in energy levels or shells, and different energy levels can hold different numbers of electrons. The electronic structure of an atom is a description of how the electrons are arranged, which can be shown in a diagram or by numbers. There is a link between the position of an element in the periodic table and its electronic structure.

The structure of an atom

Although the word 'atom' comes from the Greek for *indivisible*, we now know that atoms are not the smallest particles of matter. Atoms are made from smaller **subatomic particles**.

	Group								
	1	2	3	4	5	6	7	0	Number of occupied energy levels
Period 1								2 He 2	1
Period 2	3 Li 2,1	4 Be 2,2	5 B 2,3	6 C 2,4	7 N 2,5	8 O 2,6	9 F 2,7	10 Ne 2,8	2
Period 3	11 Na 2,8,1	12 Mg 2,8,2	13 Al 2,8,3	14 Si 2,8,4	15 P 2,8,5	16 S 2,8,6	17 Cl 2,8,7	18 Ar 2,8,8	3
Period 4	19 K 2,8,8,1	20 Ca 2,8,8,2							4
	1	2	3	4	5	6	7	8	
	Number of electrons in highest occupied energy level (except for helium)								

Periodic table related to electronic structure

The diagram shows a section of the periodic table, with the elements arranged as usual in the order of their atomic number, from 2 to 20. The red numbers below each chemical symbol show its electronic structure.

Moving **across each period**, you can see that the number of occupied energy levels is the same as the period number.

As you go **across each period** from left to right, an energy level gradually becomes filled with electrons. The highest occupied energy level contains just one electron on the left-hand side of the table. It is filled by the time you get to the right-hand side.

Moving **down each group**, you can see that the number of electrons in the highest occupied energy level is the same as the group number.

Each element in a group therefore has the same number of electrons in its highest occupied energy level. Group 0 is a partial exception to this rule.

Although it comes after Group 7, it is not called Group 8 - and it contains helium, which has only two electrons in its outer shell.

Working out an element's electronic structure

Here is how to use the periodic table to work out an electronic structure:

- 1 Find the element in the periodic table. Work out which period it is in, and draw that number of circles around the nucleus.
- 2 Work out which group the element is in and draw that number of electrons in the outer circle - with eight for Group 0 elements - except helium.
- 3 Fill the other circles with electrons. Remember - two in the first, eight in the second and third, and 18 in the fourth.

Finally, count your electrons and check that they equal the atomic number.