What is in an atom?

Subatomic Particles

Particle	Symbol	Mass (amu)	Charge
Proton	p^+	1	1+
Neutron	n	1	0
Electron	e^-	$\frac{1}{1837}$	1-

amu = atomic mass unit = 1.66 x 10^{-27} kg

We use the atomic mass unit to avoid having to deal with very small numbers and it allows us to describe the mass of a proton and neutron as 1, and an electron as effectively 0.

Different elements have different numbers of protons, neutrons and electrons. We describe the number of subatomic particles in an atom using the nuclear symbol:

$$^A_Z X$$

Chemical symbol - X

The atomic number - Z

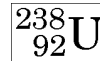Describes the number of protons in the atom.

Each element has a specific number of protons.

In a neutral atom, we will always have the same number of electrons as protons (so the charges cancel out).

$$^{12}_6 C$$

The mass number - A

Describes the total number of protons and neutrons in the atom.

$$^{238}_{92} U$$

$$^{48}_{22} Ti$$

Most elements have isotopes which are atoms with the same number of protons but a different number of neutrons.

Why are each of the examples below hydrogen atoms and how many subatomic particles are in each of them?

$^1_1 H$	$^2_1 H$	$^3_1 H$
(a) Hydrogen H – 1	(b) Deuterium H – 2	(c) Tritium H – 3

Isotopes have the same number or electrons so have the same chemical properties but can have different physical properties such as melting point and boiling point.

(*physical properties can be changed without changing the chemical composition of the element)

3 Use the Periodic Table to identify the sub-atomic particles present in the following species.

	Species	No. of protons	No. of neutrons	No. of electrons
(a)	^{7}Li			
(b)	^{1}H			
(c)	^{14}C			
(d)	^{19}F$^-$			
(e)	^{56}Fe^{3+}			

4 Isoelectronic species have the same number of electrons. Identify the following isoelectronic species by giving the correct symbol and charge. You will need a Periodic Table.
The first one has been done as an example.

	Species	No. of protons	No. of neutrons	No. of electrons
	^{40}Ca^{2+}	20	20	18
(a)		18	22	18
(b)		19	20	18
(c)		17	18	18

5 Which of the following species contain more electrons than neutrons?

  A $^2_1 H$ **B** $^{11}_5 B$ **C** $^{16}_8 O^{2-}$ **D** $^{19}_9 F^-$

1