Constituents of the atom

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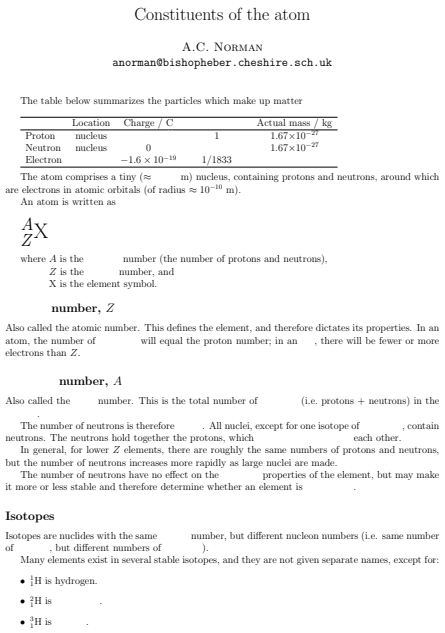
Notes

You ought already to have printed a copy of the notes with blanks in from E:HEBER:



Constituents of the atom

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The table below summarizes the particles which make up matter

	Location	Charge / C		Actual mass / kg
Proton	nucleus		1	1.67×10^{-27}
Neutron	nucleus	0		1.67×10^{-27}
Electron		-1.6×10^{-19}	1/1833	

The atom comprises a tiny (≈ m) nucleus, containing protons and neutrons, around which are electrons in atomic orbitals (of radius ≈ 10^{-10} m).

An atom is written as

$$^{A}_{Z}\mathrm{X}$$

where A is the number (the number of protons and neutrons),
Z is the number, and
X is the element symbol.

number, Z

Also called the atomic number. This defines the element, and therefore dictates its properties. In an atom, the number of will equal the proton number; in an , there will be fewer or more electrons than Z.

number, A

Also called the number. This is the total number of (i.e. protons + neutrons) in the .

The number of neutrons is therefore . All nuclei, except for one isotope of , contain neutrons. The neutrons hold together the protons, which each other.

In general, for lower Z elements, there are roughly the same numbers of protons and neutrons, but the number of neutrons increases more rapidly as large nuclei are made.

The number of neutrons have no effect on the properties of the element, but may make it more or less stable and therefore determine whether an element is .

Isotopes

Isotopes are nuclides with the same number, but different nucleon numbers (i.e. same number of , but different numbers of).

Many elements exist in several stable isotopes, and they are not given separate names, except for:

- $^{1}_{1}$H is hydrogen.
- $^{2}_{1}$H is .
- $^{3}_{1}$H is .

Lesson Objectives

1. To revise atomic structure from GCSE.
2. To learn how to use nuclide notation and the definition of an isotope.
3. To practise short atomic structure questions.

Textbook pp. 4–5

REMINDER: Office hours are week 1 Tuesdays 3.45–5.0 p.m. in room 19.
Next office hours: Tuesday 25 September 2012

Specification Requirement

Constituents of the atom

Proton, neutron, electron Their charge and mass in SI units and relative units. Specific charge of nuclei and ions. Atomic mass unit is not required.
Proton number Z, nucleon number A, nuclide notation, isotopes

[AQA GCE AS and A Level Specification Physics A, 2009/10 onwards]

Inside the atom

The table below summarizes the particles which make up matter

Name	Location	Charge / C	Relative mass	Actual mass / kg

Inside the atom

The table below summarizes the particles which make up matter

Name	Location	Charge / C	Relative mass	Actual mass / kg
Proton	nucleus	$+1.6 \times 10^{-19}$	1	1.67×10^{-27}
Neutron	nucleus	0	1	1.67×10^{-27}
Electron	orbitals	-1.6×10^{-19}	1/1833	9.11×10^{-31}

Nuclide notation

An atom is written as

$${}^{A}_{Z}\mathrm{X}$$

where

A is the nucleon number (the number of protons and neutrons),

Z is the proton number, and

X is the element symbol.

Isotopes

Isotopes are nuclides with the same proton number, but different nucleon numbers (i.e. same number of protons, but different numbers of neutrons).
Many elements exist in several stable isotopes, and they are not given separate names, except for:

- ${}^{1}_{1}\mathrm{H}$ is hydrogen.
- ${}^{2}_{1}\mathrm{H}$ is deuterium.
- ${}^{3}_{1}\mathrm{H}$ is tritium.