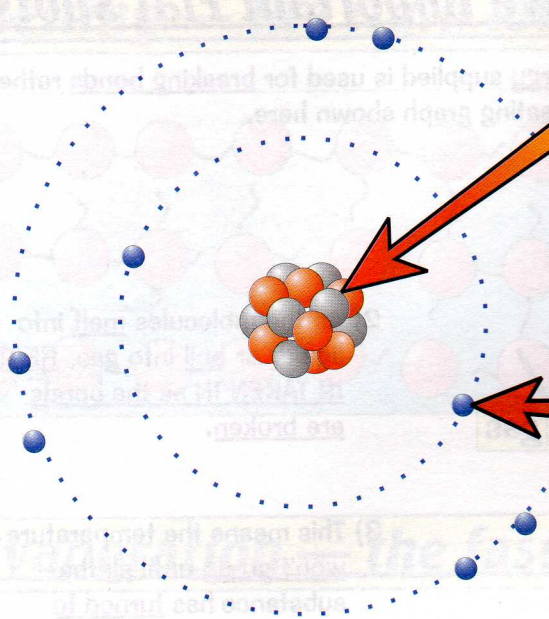


Atoms

The structure of atoms is real simple. I mean, gee, there's nothing to them. Just learn and enjoy.



The Nucleus

- 1) It's in the middle of the atom.
- 2) It contains protons and neutrons.
- 3) It has a positive charge because of the protons.
- 4) Almost the whole mass of the atom is concentrated in the nucleus.
- 5) But size-wise it's tiny compared to the atom as a whole.

The Electrons

- 1) Move around the nucleus.
- 2) They're negatively charged.
- 3) They're tiny, but they cover a lot of space.
- 4) The volume of their orbits determines how big the atom is.
- 5) They have virtually no mass.
- 6) They occupy shells around the nucleus.
- 7) These shells explain the whole of Chemistry.

Atoms are real tiny, don't forget.
They're too small to see, even with a microscope.

Number of Protons Equals Number of Electrons

- 1) Neutral atoms have no charge overall.
- 2) The charge on the electrons is the same size as the charge on the protons but opposite.
- 3) This means the number of protons always equals the number of electrons in a neutral atom.
- 4) If some electrons are added or removed, the atom becomes charged and is then an ION.
- 5) The number of neutrons isn't fixed but is usually just a bit higher than the number of protons.

Know Your Particles

PROTONS are HEAVY and POSITIVELY CHARGED

NEUTRONS are HEAVY and NEUTRAL

ELECTRONS are Tiny and NEGATIVELY CHARGED

PARTICLE	MASS	CHARGE
Proton	1	+1
Neutron	1	0
Electron	$\frac{1}{2000}$	-1

Basic Atom facts — they don't take up much space...

This stuff on atoms should be permanently engraved in the minds of everyone.

I don't understand how people can get through the day without knowing this stuff, really I don't.

LEARN IT NOW, and watch as the Universe unfolds and reveals its timeless mysteries to you...

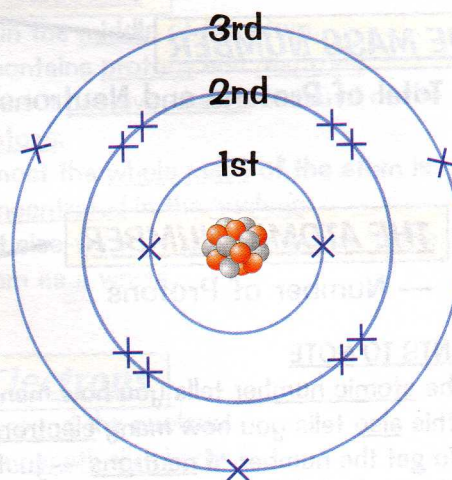
Electron Shells and Ionic Bonding

The fact that electrons occupy "shells" around the nucleus is what causes the whole of chemistry. Remember that, and watch how it applies to each bit of it. It's ace.

Electron Shell Rules:

- 1) Electrons always occupy **SHELLS** or **ENERGY LEVELS**.
- 2) The **LOWEST** energy levels are **ALWAYS FILLED FIRST**.
- 3) Only **a certain number** of electrons are allowed in each shell:

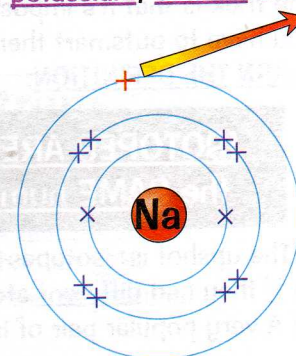
1st shell:	2
2nd Shell:	8
3rd Shell:	8
- 4) Atoms are much **HAPPIER** when they have **FULL** electron shells.
- 5) In most atoms the **OUTER SHELL** is **NOT FULL** and this makes the atom want to **REACT**.



3rd shell still filling

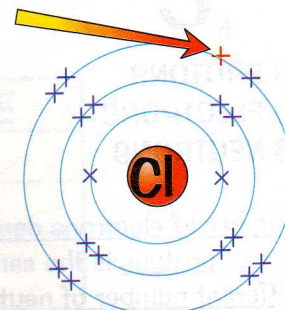
A shell with just one electron is well keen to get rid...

- 1) **All** the atoms over at the **left hand side** of the periodic table, such as **sodium**, **potassium**, **calcium** etc. have just **one or two electrons** in their outer shell.
- 2) And basically they're **pretty keen to get shot of them**, because then they'll only have **full shells** left, which is how they **like** it.
- 3) So given half a chance they do get rid, and that leaves the atom as an **ION** instead.
- 4) Now ions aren't the kind of things that sit around quietly watching the world go by.
- 5) They tend to **leap** at the first passing ion with an **opposite charge** and stick to it like glue.



A nearly full shell is well keen to get that extra electron...

- 1) On the **other side** of the periodic table, the elements in **Group Six** and **Group Seven**, such as **oxygen** and **chlorine** have outer shells which are **nearly full**.
- 2) They're obviously pretty keen to **gain** that **extra one or two electrons** to fill the shell up.
- 3) When they do of course they become **IONS**, you know, not the kind of things to sit around, and before you know it, **POP**, they've latched onto the atom (ion) that gave up the electron a moment earlier. The reaction of **sodium and chlorine** is a **classic case** as shown on the next page:



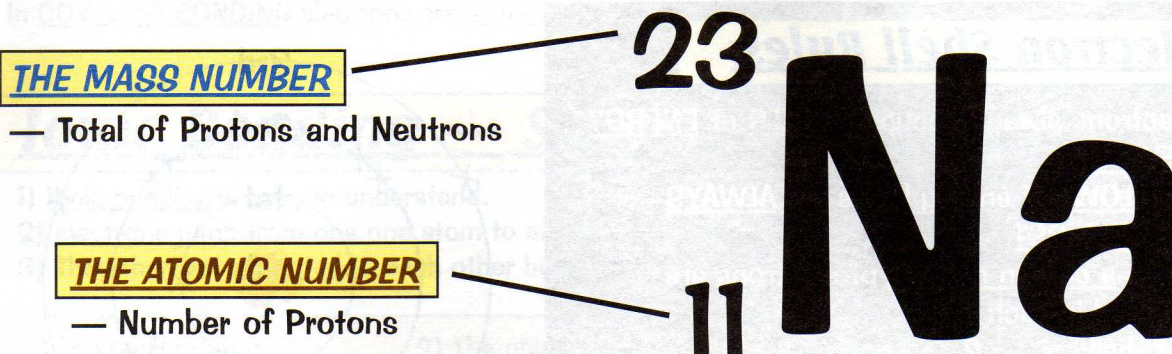
Full Shells — it's the name of the game, pal...

There's quite a lot of words on this page but only to hammer home two very basic points:

- 1) Electrons have shells — with rules.
- 2) Some atoms like to lose them, some like to gain them. **LEARN ALL THE HIGHLIGHTED BITS.**

Atomic Number and Mass Number

Come on. These are just two simple numbers for goodness' sake.
It just can't be that difficult to remember what they tell you about an atom.



POINTS TO NOTE

- 1) The atomic number tells you how many protons there are.
- 2) This also tells you how many electrons there are.
- 3) To get the number of neutrons — just subtract the atomic number from the mass number.
- 4) The mass number is always the biggest number. It tells you the relative mass of the atom.
- 5) The mass number is always roughly double the atomic number.
- 6) Which means there's about the same number of protons as neutrons in any nucleus.

Isotopes are the same except for an extra neutron or two

A favourite trick Exam question: "Explain what is meant by the term Isotope"

The trick is that it's impossible to explain what one isotope is.

You have to outsmart them and always start your answer "ISOTOPES ARE..."

LEARN THE DEFINITION:

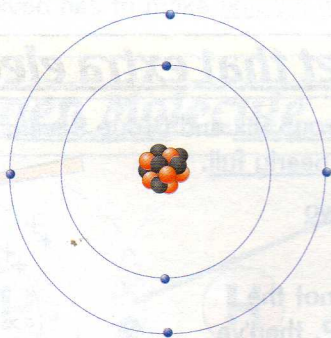
ISOTOPES ARE: different atomic forms of the same element, which have the SAME number of PROTONS but a DIFFERENT number of NEUTRONS.

- 1) The upshot is: isotopes must have the same atomic number but different mass numbers.
- 2) If they had different atomic numbers, they'd be different elements altogether.
- 3) A very popular pair of isotopes are carbon-12 and carbon-14.

Carbon-12

$^{12}_6\text{C}$

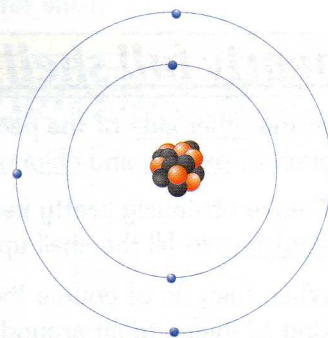
6 PROTONS
6 ELECTRONS
6 NEUTRONS



Carbon-14

$^{14}_6\text{C}$

6 PROTONS
6 ELECTRONS
8 NEUTRONS



The number of electrons decides the chemistry of the element. If the atomic number is the same, then the number of protons is the same, so the number of electrons is the same, so the chemistry is the same.
The different number of neutrons in the nucleus doesn't affect the chemical behaviour at all.

Learn what those blinking numbers mean...

There really isn't that much information on this page — three definitions, a couple of diagrams and a dozen or so extra details. All you gotta do is READ IT, LEARN IT, COVER THE PAGE and SCRIBBLE IT ALL DOWN AGAIN. Smile and enjoy.