Atoms and Elements
Atoms and Elements

What are atoms and elements?

- Elements in the periodic table
- Electron trends
- Summary activities
Elements are the simplest substances. There are about 100 different elements, which are shown in the periodic table.

Each element is made up of very tiny particles called atoms. Each element is made up of just one particular type of atom, which is different to the atoms in any other element.

Gold is an element made up of only gold atoms.

Carbon is an element made up of only carbon atoms.
How big are atoms?

Atoms have a diameter of about 0.00000001 cm, which is far too small to be seen with your eyes.

However, some microscopes allow scientists to see the outlines of atoms.

In one glass of water there are around:

- 12,000,000,000,000,000,000,000 oxygen atoms
- 24,000,000,000,000,000,000,000 hydrogen atoms.
Who discovered the elements?

Some elements, such as silver and gold, have been known about for a very long time. However, many of the elements were only discovered more recently.

British scientist Joseph Priestley discovered oxygen when he experimented with heating gases.

Humphrey Davy used electrolysis to isolate elements such as sodium and potassium for the first time.

Marie Curie discovered radioactive elements like polonium and radium.

What were these elements named after?
How many elements are there?

There are currently 117 elements that have been discovered, 94 of which are naturally occurring. The remaining 23 elements only exist under laboratory conditions.

How many naturally-occurring elements can you name?
How are artificial elements made?

The first element to be artificially created was technetium, which was discovered in 1937 by Italian scientists working with the naturally-occurring element molybdenum.

Since then, other artificial elements have been made in particle accelerators. CERN is one of the world’s largest particle accelerators. It is underground on the French-Swiss border and is run by scientists from all over Europe.

Most artificial elements are very unstable and usually only exist for milliseconds before they break apart.
Symbols for elements

Each element can be represented by a symbol. For many elements, the symbol is the start of the name, for example H = hydrogen or Li = lithium.

Can you think of any other symbols like this?

Some of the symbols are not as obvious: Pb = lead.

Can you think of other elements with unexpected symbols?

The first letter of an element’s symbol is always a capital letter, e.g. N (not n) for nitrogen.

If there are two letters in the element’s symbol, the second letter is always a small letter, e.g. Co (not CO) for cobalt.
Chemical symbols game

What's that element?
Why are symbols important?

Why might scientists find it easier to use symbols for elements rather than names?

- Elements have different names in different languages, e.g. in Portuguese, nitrogen is called ‘azote’, and iron is called ‘ferro’.

- Symbols are quicker to write than names, and can be easily used in chemical formulae, diagrams and equations.

The current system for naming elements and compounds was devised by the International Union of Pure and Applied Chemistry (IUPAC) so that scientists all around the world could communicate without confusion.
What are atoms made of?
What are atoms and elements?

Elements in the periodic table

Electron trends

Summary activities
The periodic table is the result of scientists from around the world trying to find order among the elements.
The development of the periodic table is the result of many scientists all over the world trying to find order among the elements.

Click "start" to find out more about how the elements were arranged into the periodic table.
How are the elements arranged?

How are the elements arranged in the periodic table?
Are there any patterns in this arrangement?
Press "play" to find out more about how the elements are arranged.
Missing elements!

In this periodic table, the symbols are replaced by atomic numbers. Some of the numbers are missing – where?

Two more rows of elements fit here. They are called the lanthanides and actinides.
The elements in the periodic table

Click a symbol for more information about the element.
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Elements in the periodic table

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Columns of elements

What are **columns** of elements called?

1 2

---

3 4 5 6 7 0

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groups
Elements in the same group in the periodic table have very similar properties.

This is because elements in a group have the same number of electrons in their outer shell and so react in a similar manner.

Elements in **Group 0** (at the far right of the periodic table) are called the **noble gases**.

These elements are very unreactive, or stable, because they have full outer electron shells.
Rows of elements

What are **rows** of elements called?

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**periods**
Patterns of electron arrangement

Consider the electron arrangements of the first 20 elements in the periodic table.

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<th>4</th>
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<td>2,8,8,2</td>
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<td></td>
</tr>
</tbody>
</table>

What is the pattern of outer shell electrons in a group?

What is the pattern of outer shell electrons across a period?

What is the pattern of full electron shells in a group?
Electron trends in the periodic table

Trends **down** a group:
- the number of outer shell electrons is the same
- the number of complete electron shells increases by one.

The number of a group is the same as the number of electrons in the outer shell of elements in that group, except for group 0.

Trends **across** a period:
- the number of outer shell electrons increases by one
- the number of complete electron shells stays the same.

The point at which a new period starts is the point at which electrons begin to fill a new shell.
Groups and periods
Complete the sentences
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