Electronic Structure
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- Electronic structure
- Calculating electronic structure
- Summary activities
Everything is made up of atoms. Atoms are the smallest unit of any element and cannot be seen with the naked eye.

Atoms have a unique structure. They are made up of a very small core **nucleus** which contains **protons** and **neutrons**. The nucleus is surrounded by **electrons** which are in fixed energy levels, known as **electron shells**.

This is known as the nuclear model of the atom.
How are electrons arranged?

Electrons are arranged in shells (energy levels) around an atom’s nucleus.

Each shell has a maximum number of electrons that it is able to hold. Electrons fill the shells nearest the nucleus first.

1\textsuperscript{st} shell holds a maximum of 2 electrons

2\textsuperscript{nd} shell holds a maximum of 8 electrons

3\textsuperscript{rd} shell holds a maximum of 8 electrons

This electron arrangement is written as \(2,8,8\).
How are electrons arranged? (2)
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The elements in the periodic table are arranged in order of increasing **atomic number**.

\[
\text{atomic number} = \text{number of protons} \\
\text{number of protons} = \text{number of electrons} \\
\text{atomic number} = \text{number of electrons}
\]

As atomic number increases by one, the number of electrons also increases by one.

Therefore, the elements in the periodic table are also arranged in order of number of electrons.
Elements in **period 1** only have electrons in the first shell.

Why are there only two elements in period 1?

The first shell can hold a maximum of two electrons, so period 1 only includes the elements hydrogen and helium.

What is special about the outer shell of helium?
Elements in **period 2** all have a complete first shell. What happens to electrons in the **second shell** in period 2?

The second shell is filled across the period from left to right.

What is special about the outer shell of **neon**?
**Electrons in period 3**

Elements in **period 3** have complete first and second shells. What happens to electrons in the **third shell** in period 3?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na</td>
<td>Mg</td>
<td>Al</td>
<td>Si</td>
<td>P</td>
<td>S</td>
<td>Cl</td>
<td>Ar</td>
</tr>
</tbody>
</table>

The third shell is filled across the period from left to right.

What is special about the outer shell of argon?
Patterns of electron arrangement

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

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>2,1</td>
<td>2,2</td>
<td>2,3</td>
<td>2,4</td>
<td>2,5</td>
<td>2,6</td>
<td>2,7</td>
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<td>2,8,3</td>
<td>2,8,4</td>
<td>2,8,5</td>
<td>2,8,6</td>
<td>2,8,7</td>
<td>2,8,8</td>
</tr>
<tr>
<td>3</td>
<td>2,8,8,1</td>
<td>2,8,8,2</td>
<td></td>
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</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.
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What’s the electron arrangement?
Which atom is shown by the electron arrangement?

**Key:**
- Green: neutron
- Red: proton
- Black: electron

Atom 1 of 4

Options:
- F
- Be
- Ar

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