Hydrogen, helium and lithium: Johnstone's triangle

This resource is from the **Johnstone's triangle** series which can be viewed at: rsc.li/43jMfSn. It will help learners to understand the different ways you need to think in chemistry, and to build their mental models and understanding.

Learning objectives

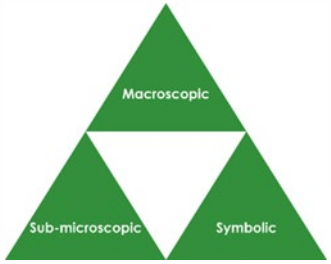
1 Match the name of the elements to a description of their use.

2 Name the element based on the arrangement of its atoms.

3 Identify the particle diagram that represents each element.

How to use Johnstone's triangle

Use Johnstone's triangle to develop learners' thinking about scientific concepts at three different conceptual levels:



- Macroscopic – what we can see. Think about the properties you can observe, measure and record.
- Sub-microscopic – smaller than we can see. Think about the particle or atomic level.
- Symbolic – representations. Think about how we represent chemical ideas including symbols and diagrams.

For learners to gain a deeper awareness of a topic, they need to understand it at all three levels.

When introducing a topic, don't introduce all three levels of thinking at once. This will overload working memory. Instead complete the triangle over a series of lessons, beginning with the macroscopic level and then introducing other levels, in turn, once secure.

The levels are interrelated, for example, learners need visual representation of the sub-microscopic in order to develop mental models of the particle or atomic level.

Find further reading about Johnstone's triangle and how to use it in your teaching at rsc.li/4wp8qUy.

Scaffolding

Share the structure of the triangle with learners prior to use. Tell them why you are using it and how it will help them to develop their understanding. Use an 'I try, we try, you try' approach when introducing Johnstone's triangle for the first time.

More resources

To further develop learner's thinking in all areas of Johnstone's triangle, try our **Developing understanding of atoms molecules and elements** worksheets (rsc.li/3TCOjUo).

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Macroscopic – what we can see

Give the name of each element from the description.

This gas can be used to fill balloons.

helium

This metal is used to make rechargeable batteries.

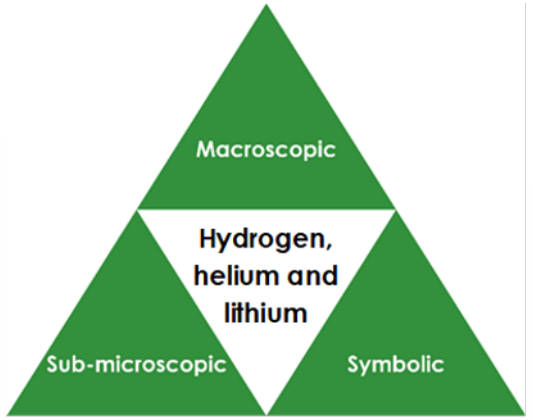
lithium

This gas may become a cleaner fuel for the future.

hydrogen



Image ©: Shutterstock/Soho A Studio



Sub-microscopic – smaller than we can see

The table describes the arrangement of atoms for each element.

Complete the table by naming the element that matches each description (hydrogen, helium or lithium).

Description of atom arrangement	Name of element
All atoms are joined together	lithium
Atoms are joined in pairs forming molecules	hydrogen
All atoms are separate	helium

Describe what happens to the arrangement of atoms when lithium melts.

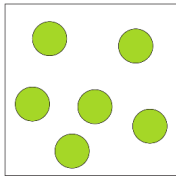
The lithium atoms are then able to move past each other.

Symbolic – representations

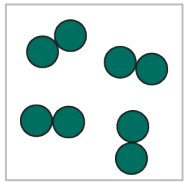
Write the name of the element represented by each element symbol.

Li lithium He helium H hydrogen

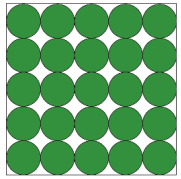
Give the letter of the particle diagram that represents each element.



A



B



C

hydrogen B helium A lithium C

Hydrogen gas has the formula H_2. Suggest why.

The formula shows that hydrogen is formed of molecules that are each made up of two hydrogen atoms.

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