

Remote education lesson example: key stage 4 chemistry

October 2020

Example chemistry lesson plan for remote education

This lesson plan was provided by Kendrick School to help teachers consider how they might adapt their usual classroom practice for remote teaching.

Schools have shared a range of lesson plans annotated with tips and ideas they have found useful when teaching remotely.

The purpose of the lesson plans is to help teachers consider how they might adapt their teaching practice for the remote context. The examples are intended as a source of ideas, not as teaching resources or lessons the department expects schools to teach. They do not reflect departmental endorsement of any particular approach to remote teaching.

The department does not expect teachers to create formal lesson plans.

Lesson overview

This lesson is:

- on elements, mixture and compounds
- lesson 1 from Chemical Formulae of Elements and Compounds
- the first lesson of GCSE chemistry

Lesson outcomes

By the end of the lesson pupils should be able to:

- define an atom, an element and a compound in words and recognise these from particle diagrams (revision from key stage 3)
- work out how many atoms and elements are present from the formula of a compound
- use “ball and stick” diagrams of elements and compounds to write a chemical formula

Syllabus statements addressed

The lesson addresses the following statements:

- all substances are made of atoms - an atom is the smallest part of an element that can exist
- there are about 100 different elements - elements are shown in the periodic table

- atoms of each element are represented by a chemical symbol (for example, O represents an atom of oxygen, Na represents an atom of sodium)
- compounds contain two or more elements chemically combined in fixed proportions and can be represented by formulae using the symbols of the atoms from which they were formed

The syllabus references are:

- AQA GCSE Chemistry 4.1.1.1
- AQA GCSE Combined Science Trilogy 5.1.1.1

Key vocabulary

By the end of the end of the lesson pupils should know:

- atom
- element
- compound
- chemical formula
- periodic table

What pupils will need

Pupils must have:

- rough paper
- the AQA periodic table
- pupil worksheet or pupil version of PowerPoint to accompany lesson

Lesson preparation

Assign each pupil a partner and ensure that pupils know who their partner is.


Safeguarding in online lessons

It's important to:

- agree a code of conduct for online lessons with pupils and their parents or carers in advance
- circulate the online lesson code or link to the pupils only a short time before the lesson is due to take place - this reduces the chance of it being shared with outsiders
- avoid using repeating links or codes for the same time each week or fortnight - generate a new one each time to reduce the chance of it being known to outsiders
- ensure pupils know they must not share online meeting codes with anyone else
- record every online lesson
- never admit anyone to the online lesson from outside the school domain

- if someone is present in the online lesson who should not be, remove them immediately
- if the security of the online lesson has been breached, stop the lesson - you could resend a new meeting link or code to the pupils to restart it
- if you intend to share your screen during the lesson, make sure you have closed all windows that may contain personal or confidential information (for example, your email account)
- if you'll be on camera, ensure you're professionally dressed - blur your background and keep family members out of camera shot

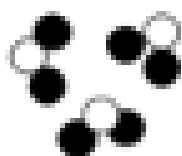
Task	Adaptation for remote teaching
<p>As pupils arrive, respond to the register. Pupils greet the teacher.</p>	<p>Establish remote routines</p> <p>It's even more essential to establish routine in the remote context. Each school will have their own policies on the use of pupils' cameras during online lessons, but it can be helpful for pupils to turn on their cameras so that you can check they are ready.</p> <p>Record the lesson</p> <p>It's recommended that you record every online lesson. This is a safeguarding measure that can also be helpful for pupils who were unable to access the lesson at the scheduled time.</p>
<p>Starter (5 minutes)</p> <p>Element and compound matrix.</p> <div data-bbox="258 1496 667 1720" data-label="Image"> </div> <p>The teacher displays a PowerPoint slide by sharing their screen. The slide displays 6 images (a range of elements and compounds), for example a picture of the sky or the chemical symbol for magnesium</p>	

<p>labelled from A to F.</p> <p>Pupils write down which letters from the images presented in the PowerPoint represent elements, which represent compounds and note down any they are not sure about.</p>	
<p>Main activity - lesson outcome 1 (5 minutes)</p> <p>Revise the definitions of atom, element and compound from key stage 3 knowledge.</p> <p>The teacher displays 3 PowerPoint slides - one per definition. The written definitions contain missing words.</p> <p>Pupils fill in the missing words, either on their own copy of the PowerPoint or on an equivalent worksheet for the lesson.</p> <p>Atoms</p> <p>Complete the sentences:</p> <ul style="list-style-type: none"> • Atoms are particles that make up [...] • Atoms are the [...] part of an element that can exist. <p>Joke: Why should you never trust an atom? Because they make up everything!</p> <p>Elements</p> <p>Complete the sentences:</p> <ul style="list-style-type: none"> • Elements are substances made of only 'what?' type of atom • Elements cannot be broken down in 'what?' reactions • Elements are found in the P... T... <p>Example to display: Oxygen gas, O₂</p>  <p>Compounds</p>	<p>Pupils answers to the starter lead to a recap of the definitions of atom, element and compound. You could also include mixture, or leave it for a later lesson.</p> <p>The cloze activity could be pre-printed on a worksheet for pupils to fill in.</p> <p>Ensure that either you or a pupil explains clearly how the particle diagram exemplifies the definition.</p> <p>A different way of doing this would be to split the definitions into groups of 2 or 3 words which pupils must “put back together” in the right order to form the definition.</p> <p>Normalise online communication</p> <p>If pupils are reluctant to speak online , keep persevering. Research shows that although pupils may be reluctant to participate at first, their comfort levels will increase the more remote education becomes normalised, and that it may also lead to more voluntary contributions and questions from pupils.</p> <p>Display correctly completed definitions at the end (for example, by writing onto the slide).</p> <p>Top teacher tip</p> <p>Remember that you can write on a Powerpoint in slideshow mode by right-clicking the screen and selecting pen. Then use the mouse pointer to write by hand.</p> <p>This would allow you to fill in your cloze (gap-fill) activity as you go through the answers. You can also select different pen</p>

Complete the sentences:

- Compounds are substances made of 'what?' type of atom
- The atoms in a compound are 'what?' together in a fixed ratio
- Compounds can be broken down in 'what?' reactions

Example to display: water, H₂O



colours and there is an eraser. If you cannot write legibly using this method, it may be a good idea to have pre-prepared answer slides.

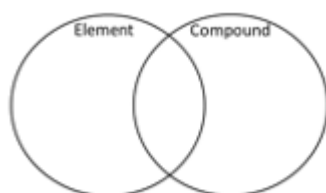
Main activity 2 - lesson outcome 1 (10 minutes)

Mini-plenary, large matrix game: element, compound, both or neither?

The teacher displays a PowerPoint slide on which a grid (labelled alphabetically) displays a range of images, chemical symbols, and written clues. For example, an image of salt or the clue, '2 or more elements chemically combined'.

Pupils record which letters apply to elements, which to compounds, which to both and which to neither.

One possible enhancement is to ask pupils to use a Venn diagram (perhaps pre-drawn for them) to record their answers, for example a Venn diagram with one circle for element and one circle for compound:



This activity is an extended version of the starter, used to check pupils' understanding and application of the definitions.

Create a sense of community

You may want pupils to work with a partner to try to recreate a sense of the classroom community even in a remote situation.

Google Jamboard

If you wanted pupils to collaborate in pairs on a Venn diagram, a helpful app to use is Google Jamboard. If you set it up and share it with pupils, both can write on it simultaneously. If you can't see this in your Google Suite, then contact your IT administrator to ask them for access.

Top teacher tip

When asking pupils to feed back from this activity, you could ask them to declare how many pictures they could sort in a

	<p>“bidding war”.</p> <p>Choose a pupil to give enough answers to match their bid – at first, not one who bid the most. Start with a pupil who bid three and then move to a pupil who bid six, for example. This should ensure contributions from a range of abilities.</p> <p>Encourage articulation of reasoning for some of the examples.</p> <p>Common misconception</p> <p>Pupils may say or write “an element contains only one atom” or “a compound contains more than one atom” (rather than <i>type</i> of atom).</p> <p>Display answers at the end.</p>
<p>Pause video - lesson outcome 1 (3 to 5 minutes)</p> <p>Pupils watch a short video relevant to the lesson. For example, for this lesson.</p> <p>Before watching, pupils can be asked to reflect upon how this video contributes to their understanding of atoms, elements and compounds. For example, “What did you find helpful about this explanation?” Or, “How was this explanation different from mine?”</p> <p>If there is no video relevant to this lesson, you could use a video from a previous topic to facilitate interleaving and memory retrieval practice.</p>	<p>This is a sort of “midpoint rest” in the lesson, which we have found particularly useful for remote teaching. Pupils have been listening, contributing and concentrating for half an hour. It also allows them to hear a different voice and a different style of explanation.</p> <p>Top teacher tip</p> <p>Paste the video link into the text chat and let pupils click on it to watch it on their own computers. Often there can be problems with sound if you try to show it on your machine.</p> <p>The point of this video is that it enhances the explanation of element and compound so far by introducing a new analogy (nuts and bolts). This gives pupils a question to reflect on as they watch, which will hopefully increase engagement and make</p>

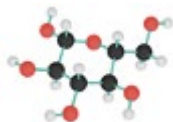
	<p>sure that they actually watch the video.</p>
<p>Main activity 3 - lesson outcome 2 (15 minutes)</p> <p>New learning point – what do chemical formulae mean? Pupils will need their AQA periodic table datasheet.</p> <p>Pupils first listen to the teacher’s explanation and then try some examples. For example, the teacher displays a series of PowerPoint slides.</p> <p>The first slide contains a definition of what chemical formulae mean and the following slides include a range of tasks with their corresponding answers, for example:</p> <ul style="list-style-type: none"> • a missing word task for pupils to fill in: Carbon dioxide, CO₂, contains [...] elements and [...] atoms • a missing numbers task, where pupils fill in how many atoms and how many elements are contained within a list of chemical formulae <p>Pupils should use their periodic tables to make sure they can name all the elements shown.</p> <p>Note</p> <p>This section is written assuming that ionic bonding has not yet been covered. If your class is already familiar with ionic bonding, then you may also wish to introduce ideas about the formula of an ionic compound being the ratio of the different types of ions in the lattice.</p> <p>This new learning section begins with some teacher input to explain the theory. Then there is an opportunity for pupils to practise.</p>	<p>Top teacher tip: collaborate on Google Docs</p> <p>If you want your pupils to work in pairs on a task like this, you could paste the problems into a Google Doc and share it with both pupils in the pair (make sure you give them edit access, not just view).</p> <p>Both pupils can then edit the document and you could look at their work either during or after the lesson.</p> <p>Encourage pupils to ask questions in the text chat throughout.</p> <p>Top teacher tip: join from two devices</p> <p>Join the lesson from your phone as well as your computer in order to be able to see the text chat on your phone and the PowerPoint on your computer simultaneously.</p> <p>Where examples of formulae are trickier as they include brackets, you could point out that the same principles apply to brackets as in maths.</p> <p>Random name generators</p> <p>When pupils are feeding back, you could use a random name generator on screen to ensure that all are engaged and participate.</p>

Main activity 4 - lesson outcome 3 and revisit to lesson outcomes 1 and 2 (15 minutes)

What is the formula?

New learning point – writing a chemical formula from a “ball and stick” diagram of the compound.

In this activity, pupils will write chemical formulae from diagrams of molecules displayed on PowerPoint slides. They will also bring together knowledge from the whole lesson to explain whether they are looking at an element or a compound. For example:



Is it an element or a compound? Why?

What is the formula?

Black = carbon

Red = oxygen

White = hydrogen

Periodic table datasheet

Use the periodic table datasheet to find out the symbols of the elements needed.

This section begins with a worked example and then some examples for pupils to try.

Pupils are given the names of the elements in the key, rather than the symbols, to encourage them to become familiar with the periodic table datasheet as they look up the symbol.

Reassure pupils not to worry too much about the order of the elements in the formula – the important thing is the right number of each type of atom.

Share answers online

Pupils could then share answers with a partner (by sending a photograph, text or email) in order to use peer assessment. Including interaction between pupils helps to recreate a sense of the classroom community even in a remote situation.

The sharing of answers to the quiz with a partner makes this a low stakes (not “no stakes”) form of assessment and encourages all to participate.

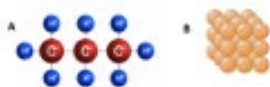
If pupils are nervous online

If you have a class where pupils are nervous about contributing online, you could ask them to share their partner’s answer rather than their own but make sure no one except you knows who their partner is.

To collect formative assessment information, ask pupils to email or private message their score (or their partner’s score) to you.

Plenary - all lesson outcomes (5 minutes)

Exit-ticket style assessment to check knowledge.



The teacher displays a final slide asking the pupils to identify two images labelled A and B: one a compound, the other an element.

Pupils should answer whether the images show atoms or elements and why. Then answer two further questions, for example:

1. HNO_3 - how many atoms and elements?
2. Can you write down the chemical formula for the substance in picture A?

Top teacher tip

If you are able, you could make your plenary into a Google Assessment containing 3 multiple choice questions. This makes it easy to see and analyse the performance of your whole class. If you are teaching multiple classes at once, you can also share the results with other teachers easily.

Additional resources

The following resources were selected by Kendrick School as useful to teachers:

- [Molecule builder interactive animation](#) – you could either look at this together or invite pupils to try it after the lesson, pupils must “drag and drop” atoms to make the required molecules (for example, oxygen, hydrogen, water)
- This website contains many other animations and simulations that may be useful in other science lessons
- [Advice and resources for teaching chemicals formulae and equations](#)

References

The following resources were used by Kendrick School to inform this lesson plan:

- [The Value of Applied Research: Retrieval Practice Improves Classroom Learning and Recommendations from a Teacher, a Principal, and a Scientist by Pooja K. Agarwal & Patrice M. Bain & Roger W. Chamberlain](#)
- Retrieval Practice and the Maintenance of Knowledge by Robert A Bjork in M. M. Gruneberg, P. E. Morris and R. N. Sykes (Eds.) Practical Aspects of Memory: Current Research and Issues. New York, Wiley 1988 pp396-401
- [\[1\] Impact of Cold-Calling on Student Voluntary Participation by Elise J. Dallimore, Julie H. Hertenstein, and Marjorie B. Platt](#)
- [\[1\] Strengthening the Student Toolbox – Study Strategies to Boost Learning by John Dunlosky](#) accessed 04/09/20