Using models in science

This resource accompanies the article **A model approach to solving problems** rsc.li/3XleJq3, part of the **Teaching science skills** series in *Education in Chemistry* rsc.li/3RXdtbu.

The questions used in the activity are based on the Focus, Action and Reflection (FAR) approach, outlined in **Reflect on your use of models** rsc.li/2VBOrzG, also from *Education in Chemistry*. There you will find a checklist you can use to reflect on the models you choose to use in your teaching.

Learning objectives

1 Use a variety of models to develop scientific understanding of a molecule of hydrogen.

2 Discuss limitations of models in science.

The student worksheet contains five different models and representations of a hydrogen molecule. The questions will guide learners to evaluate each model.

How to use the resource

This resource could be used after you have taught covalent bonding, as a scientific skills lesson, or a revision lesson.

It starts off as a whole class activity by introducing the problem of multiple models.

Ensure key fundamentals are secure, such as the definitions of 'atom', 'molecule' and 'bond': this **Atoms, molecules and compounds quiz** could provide useful starter questions rsc.li/3XdAO9Z.

Learners then work independently, evaluating each model using their worksheet. There is an opportunity (slide four) for peer discussion if this would fit the needs of the class. Slide five offers a chance for self-assessment, with some possible answers. Question six is a challenging question; asking learners not only to reflect, but to improve.

Differentiation

Support learners with their evaluation by guiding them with questions. For example, what does the two in model B represent? How is that represented in the other models? Or ask them to begin by comparing just two of the models, eg C and H. Learners can support each other by discussing their answers.

Extension questions may be asked if learners want more challenge, such as applying the five models (A–E) to a different molecule, and then compound.

Answers

Some likely answers to questions one–four are given below, key points are summarised on slide five for learners to self-assess. Note: learners may have questions when self-assessing, as their answers may be similar but not worded in the exact same way. This opens up discussion about mark schemes and use of key words.

Be aware of common misconceptions surrounding covalent bonding in learners at this stage. **How to teach covalent bonding** gives an overview and advice on how to address them, see rsc.li/40SodvT.

Question	Possible responses
1. What is the purpose of these models?	• To show a molecule of hydrogen • To give information about how a molecule of hydrogen is formed
2. What scientific concepts are these models showing?	• Atoms combine to form molecules • A hydrogen molecule is formed from two atoms • The atoms form a covalent bond
3. How are these models similar to real life?	• All models show the hydrogen molecule is made of two atoms • Models A, C and D show a single bond between the two atoms • Model A includes the electrons and shows them overlapping to form the covalent bond • Models C and E show the structure in 3D giving information about the shape of the molecule
4. How are these models different to real life?	• Models B and E don't show any information about the type of bonding • Models C and E don't specify what atoms are in the molecule • Models B and D use letters to represent the atoms and don't give any information about the shape • Model A does suggest the shape of the atoms but is 2D, not 3D • Model C shows the bond as if it is a fixed structure, but E shows the atoms overlapping as they bond