USING THE *VISCHEM*: MOLECULAR LEVEL CONSTRUCTION TOOL
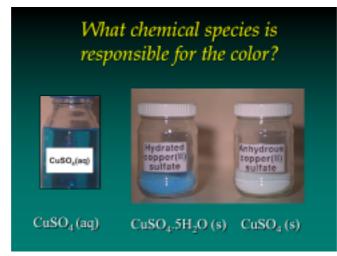
The ***VisChem* Molecular Level Construction Tool** enables you to build representations of aqueous ionic solutions at the molecular level. By constructing, checking, and refining your construction you can learn the *seven key features* that are important for explaining chemical processes and reactions in these solutions.

Ideally, in the VisChem Learning Design sequence, this tool should be used after observing a chemical reaction or property involving ionic solutions. In order to explain your observations you would need to have an accurate mental model of the arrangement of ions and molecules in an ionic solution. Using the Tool focuses your attention on key features of the model so that you can identify them in the three-dimensional VisChem animations.

Example of the Use of the Tool in the Learning Design

1. Observing

Suppose we start with an interesting phenomenon. Solid hydrated copper(II) sulfate and aqueous copper(II) sulfate solution are both light blue, but solid anhydrous copper(II) sulfate (ie. containing no water) is white. What is the chemical species responsible for the blue colour?
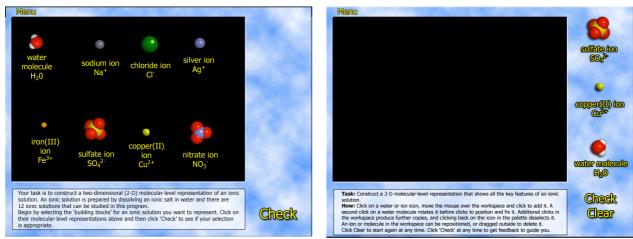

How can we identify the chemical species?

An immediate, but incorrect suggestion might be that since only the blue substances contain water, perhaps water is responsible for the blue colour. A moment's thought tells you that this volume of pure water is colourless, so the answer must be a bit more interesting than that!

2. Describing/Drawing

Perhaps there is an interaction between the ions and the water molecules in the blue solid and solution? The Molecular Construction Tool enables you to build a model of an ionic solution – in this case, copper(II) sulfate solution – at the molecular level.

Open the VisChem Tool application and then click on "Start" to go to the selection screen. Here you can select the three types of building block in a copper(II) sulfate solution. This takes you to the construction screen.
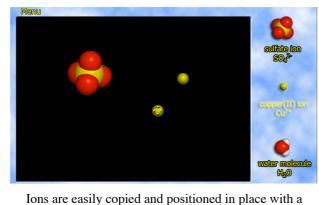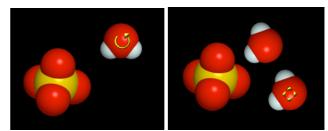

Selection Screen   Construction Screen

An ion is placed in the black workspace by clicking on its icon on the right, then moving the cursor into the space, and clicking to position it. Moving the cursor now produces a copy for positioning with another click, or removal from the space by clicking on the icon again.

Ions are easily copied and positioned in place with a click.

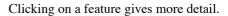A water molecule can be rotated, dragged into place and fixed with consecutive clicks.

Water molecules are selected and positioned in a similar way, but the first click enables you to rotate it, the second click enables you to drag it where you want it, and the third click fixes it in position. Moving the cursor now produces a copy that can be rotated and placed in the same way.

After you have constructed a representation you can click on "Check" to see whether your construction has the required *seven key features*. You can click on each feature to see more detail on what it means.

Clicking on "Check" gives feedback on your construction.

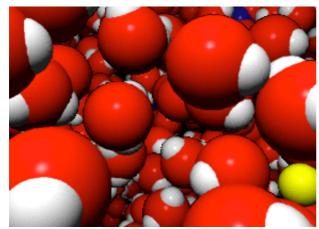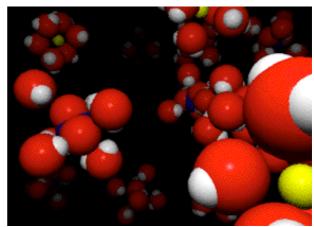Clicking on a feature gives more detail.

3.   Discussing

The feedback in the Tool is designed to help you build an accurate mental model of ionic solutions. If possible, also discuss your representation with another student, or a tutor. This helps you to resolve difficulties, or reinforce ideas.

4.   Viewing

Now when you see the appropriate VisChem animations you can look for the seven key features in three dimensions.

You should now look for the key features in the VisChem animations.

Some VisChem animations have water molecules removed for clarity

5, 6, and 7.   Reflecting, Relating and Adapting

The other steps in the Learning Design are designed to exploit your refined mental model of the molecular world to answer the present question posed, and apply your model to new reactions and processes.