

## Molecules in the ISM: Are these clues to life in space?

You are going to work as a member of a team of astrochemists.

- Each team member has to take on one role (see the next page).
- You will analyse the data obtained from a radio telescope trained on the Milky Way.
- The team needs to answer the question, *Molecules in the ISM: Are these clues to life in space?*

The team must present their findings to the class.

- To make a good presentation, work together to answer the questions each team member has.
- Don't forget that you must answer the main question you have been set!
- Everyone in the team must agree the final presentation.
- The class will agree the criteria for assessing the presentations.

<p><b>Researching background: element analysis</b></p> <p>Use a Periodic Table to find out the names of the elements that are found in space.</p> <p><b>To look for</b></p> <ul style="list-style-type: none"> <li>▪ The three most common elements.</li> <li>▪ The element with the highest atomic number.</li> <li>▪ How many metals and non-metals are found.</li> </ul> <p><b>Questions</b></p> <ol style="list-style-type: none"> <li>1. Which elements are needed to support life?</li> <li>2. Are these present in space?</li> <li>3. One group of elements does not appear in space. Find out which group and explain why.</li> <li>4. What is the total number of molecules found in space? Does this surprise you? Explain!</li> <li>5. Have any more molecules been found in space? Use the internet to see if you can find out.</li> </ol>	<p><b>Testing the data: molecular modelling</b></p> <p>Make some of the molecules in the <i>Molecules in space</i> table using the molecular modelling kit.</p> <p><b>Molecules to make</b></p> <ul style="list-style-type: none"> <li>▪ HCl, CN, CO, CO<sub>2</sub>, NH<sub>3</sub>, C<sub>2</sub>H<sub>4</sub> and CH<sub>3</sub>CHO. These have bonds which we think of as <i>covalent</i> in conditions on Earth.</li> <li>▪ NaCl, KCl, NaCN, MgCN. These have bonds we think of as <i>ionic</i> in conditions on Earth. They may have covalent bonds in space as conditions are very different.</li> <li>▪ Make any others from the <i>Molecules in space</i>.</li> <li>▪ Make drawings of some molecules.</li> </ul> <p><b>Questions</b></p> <ol style="list-style-type: none"> <li>1. All available bonds are not always used. Why is this important for forming larger molecules?</li> <li>2. Work out and explain the differences between an <i>atom</i>, a <i>molecule</i>, a <i>radical</i> and an <i>ion</i>. Give examples from the <i>Molecules in space</i> table.</li> </ol>
<p><b>Collecting data: practical techniques</b></p> <p>Find out how the molecules in the <i>Molecules in space</i> table are detected. Describe this in your <i>experimental procedures</i> section.</p> <p><b>Questions</b></p> <ol style="list-style-type: none"> <li>1. How can such tiny molecules be detected from so far away?</li> <li>2. How do we know that the signals are from a particular molecule?</li> <li>3. What molecules would need to be detected to show there is life elsewhere?</li> </ol>	<p><b>Making conclusions</b></p> <p>Research how molecules form in space. Try typing <i>How do molecules form in space?</i> in a search engine. See if you can work out how and where molecules form.</p> <p><b>Questions</b></p> <ol style="list-style-type: none"> <li>1. Explain why there are more molecules with smaller numbers of atoms.</li> <li>2. To make life, large molecules called <i>polymers</i> are needed. Molecules with double and triple bonds can form polymers. List these from the <i>Molecules in space</i> table.</li> <li>3. Look at the largest molecules in the <i>Molecules in space</i> table. Could these make life?</li> <li>4. What other experiments could be done to find out if there is life elsewhere in space?</li> </ol>