

## LONGMAN GCSE CHEMISTRY WORKSHEETS

### 24: Things to think about when you answer ideas and evidence questions

Apart from the Chemistry content there are several things you might need to think about when you answer "ideas and evidence" questions. This sheet explains some of these to you.

#### How scientists present their findings

Scientists present the findings from their research in specialist magazines like "Nature" or the "British Medical Journal". Before they are published, the results are criticised by other scientists who would understand the work and could tell if it had been done properly and whether the conclusions were valid. This is rather like your investigation work being assessed by your teacher.

Following publication, other scientists will try to repeat the work to see if the findings are reliable.

Any theory which comes out of the work is more likely to be accepted if it can account for existing facts and make predictions which can be tested by doing new experiments. If the results of those new experiments agree with the predictions, that is very good evidence that the new theory is right.

#### Scientists are only human

There may be more than one explanation for a set of experimental findings. Scientists have to use their imaginations to try to find explanations. How they do this will depend on their backgrounds - what sort of people they are, their religious and social views, the science they already believe in.

It may be possible to think of more than one explanation for a particular set of findings. A scientist may well be reluctant to accept an explanation which goes against their existing scientific, religious, social or moral views.

#### Uncertainty

Sometimes situations are so complicated that it is difficult to be sure about exactly what the findings show. This often happens in studies affecting, for example, people's diets. Is red wine really good for you? Does taking extra vitamin C help to prevent cancer? In cases like this there are so many factors at work, that it is very hard to select out the effect of just one of them.

In other situations, the number of cases studied is very small. If you were studying an effect in only 20 people, could you be sure that you could apply the same results to the population as a whole? Are you sure that the people you studied were absolutely typical?

It sometimes happens that scientists get results which they are fairly confident about, but can't find any obvious explanation for them. In that case, it is easy to question whether the results were right. They may be - in which case, more imagination is needed to account for them. Or they may be wrong - in which case, there must have been a flaw in the experimental design.

## **Science and the public**

The public depend on TV, radio, newspapers and magazines to keep them informed about scientific advances. Because the information is often presented by people with limited scientific knowledge, the results are often simplified or made over-dramatic. If you ever get the chance to compare scientists talking about their own work with news headlines about the same work, you will normally find the scientists are much more cautious about what their results show.

The science that the mass media presents has a real influence on which issues are discussed and what the public thinks about these issues. That in turn affects the amount of money the government or companies are prepared to spend in further research in particular areas of science.

## **Environmental and moral problems**

Advances in science and technology have made enormous improvements in people's lives, but those benefits often have a cost. For example, the increased use of cars has improved people's lives by making them more mobile, but has had negative effects in terms of pollution - global warming due to increased carbon dioxide emissions, acid rain caused by sulphur and nitrogen oxides, cancers caused by tiny particles in exhaust gases. It also has social costs as people's lives are made more difficult by heavy traffic in their towns and villages.

There may be economic costs as well. For example, advances in medicine are often very expensive to provide to everybody, even in rich countries like Britain. In poor countries, many people may die unnecessarily because the money isn't available to treat them.

Even where scientists generally agree about the benefits of a process and its likely effects, there may be moral or ethical questions about whether it should be used. Testing of drugs on animals is an obvious example.