

## Introduction

*Secrets of the Ice* is a new practical activity. The context is the search for alien life. The activity focuses on pollution and environmental change. Pupils carry out chemical and physical tests to analyse an ice sample from another planet. Having drawn conclusions from their results they discover what conditions on the alien planet are like, and decode a message from the extra-terrestrials.

## Running the activities

Pupils read the sheet *Secrets of the Ice* to receive their mission. Each group should then be given their ice cores in the alien container for testing. Pupils should detect a difference between the two layers, indicating that in layer one there is little pollution, but in layer two there is a lot. Conversely, when they test for life in the ice samples, they will find it exists in layer one but not layer two. The practical instruction W/S *Ice core tests 1 & Ice core tests 2* include *Vital data* sections to help pupils draw sensible deductions from their results. Overall, pupils should conclude that pollution has changed the climate and harmed plant life. This is the alien message in the ice: 'Don't pollute your planet as badly as we've done'.

- Objective 1: Separate the ice layers.
- Objective 2: Compare the rainfall in each layer.
- Before objectives 3-6 can be done, the ice has to be melted.
- Objective 3: Compare the dust in each layer. Pupils make a home-made dust scale. Alternatively use a light meter to develop pupils' ICT skills.
- Objective 4: Compare the presence or absence of heavy metals in the layers. Pupils test for the presence of copper, indicated by a blue colour from the reaction between copper and added hydroxide ions.
- Objective 5: Compare amount of CO<sub>2</sub> in the layers by observing how much NaOH is needed to neutralise the acidic CO<sub>2</sub>, and thus changing the colour of the indicator. Pupils will need access to a burette or a graduated pipette in order to measure out small amounts of NaOH and calculate the volume added.
- Objective 6: Pupils look for plant life in the layers by observing the presence or absence of algae (*Chlorella*) using a microscope.

After the tests have been completed, pupils can present their hypotheses and results. This could be done as government statement for the press (either orally as a press conference) or as a written report.

## More ideas

- Add mystery by bringing out the ice core samples direct from the freezer in a biscuit tin. When you open it, water vapour comes out.
- Run the activity as a competition. Each group of pupils is a different group of scientists from around the world, racing to be the first to decode the message. Alternatively different groups can carry out different tests and pool their results, to illustrate how scientific progress is achieved by collaborating teams.
- Possible homework activity: 'How should the government respond? Compose a message (in code) to be sent back to the aliens.'

## Learning outcomes

- The atmosphere contains carbon dioxide gas, which can dissolve in rainwater causing it to be weakly acidic.
- What are the possible causes of global warming? What evidence is there that this is occurring?

### Investigative skills:

- Use observations to draw conclusions & use scientific knowledge to interpret conclusions.
- Decide whether evidence is good enough to answer a question.
- Evaluate evidence put forward by others.

### Ideas and evidence:

- How scientists work today, including the roles of experimentation, evidence and creative thought.

### Citizenship:

- The world as a global community, with its environmental issues having implications for us all.

## Prior learning

None

## Where the activity fits in

QCA Unit 9G Environmental chemistry

## Skills

Communication, investigative skills, reasoning (make deductions), creativity (apply imagination).

## Safety

- Pupils should take care when handling the can, which has sharp edges, and the knife. Pupils should melt enough ice so the core comes out easily and does not need to be forced.
- Pupils should wear eye protection for the tests in objectives 4 and 5. Sodium hydroxide is an irritant.