2. Looking for Evidence of Microorganisms

1 hour

Children consider what life might look like if it exists on Mars and think about how scientists could prove that life was (or ever had been) present. They are then given 'Martian soil' samples. They plan and carry out a test to ascertain whether any of them contain microorganisms.

OBJECTIVES

- To plan different types of scientific enquiries to answer questions, including recognising and controlling variables if necessary
- To report and present findings from enquiries, including conclusions, causal relationships and explanation of and degrees of trust in results in oral and written forms such as displays and other presentations.
- To develop their understanding of microorganisms as living things

RESOURCES

(Per group of 4 children unless otherwise stated)

- Activity sheets 4-5
- 2 tsp soil samples A-C
- ¼ cup sugar
- Thermometer
- Teaspoon
- Warm water (45-50°C)
- Plastic cup or beaker

ADVANCE PREPARATION

- Soil samples (Appendix 1)
- Add a packet of dried instant yeast to sample C, ensuring it remains completely salt-free.

INTRODUCTION

The teacher explains that the children will look for evidence of the presence of life (microorganisms) in the soils and record their observations. If life is present, adding warm water and sugar to each sample may result in the production of gas (carbon dioxide). Groups are provided with helpful hints and facts cards (Activity sheets 4-5).

ACTIVITY

The children:

1. Dissolve 2 teaspoons of sugar in 30ml of warm water (45-50°C) and quickly add this to the sample.
2. Press the bag to remove air excess air and seal.
3. Mix the contents together by gently pressing the contents with their fingers, ensuring that the bag is completely sealed to prevent escape of carbon dioxide should microorganisms be present.

The children may record the gradual inflation of the samples using drawings, video or photographs.

Photograph showing the inflated bag of Sample C after 20 minutes

PLENARY

The children share their observations with the class.

- *Did the groups all have similar results?*
- *Were there any unexpected results?*
- *Can they explain what happened?*

The teacher should explain that scientists take great care when they draw conclusions from tests such as these. The production of gas does not necessarily mean that life is definitely present.

SAFETY NOTES, PRACTICAL TIPS AND GUIDANCE

Teachers check that the water is no hotter than 50°c to avoid killing the yeast. If yeast is present, the children should see the formation of bubbles of carbon dioxide very quickly. The bag should begin to swell after about 20 minutes and after an hour should be well-inflated.

EXTENSION

The children could be encouraged to suggest further investigations to discover how different conditions may affect the growth of micro-organisms. They may wish to try investigating the effect of light, temperature or different nutrients upon the growth of the yeast.

BACKGROUND INFORMATION

When scientists study very small samples or fossilised material, the characteristics of present or past life are very difficult to determine. The tests used by previous missions to Mars were based around the belief that life would cause changes in the air or soil, in a similar way to life on Earth. The missions did not detect the presence of life. It is intended that the children will not find evidence of life in the sample most like Martian soil.

One of several signs of life scientists search for is the exchange of gases in respiration or fermentation, as modelled in this activity. Here, the micro-organism yeast is using sugar as a source of energy and is producing carbon dioxide. Most living things on Earth need oxygen to survive, but some organisms have adapted to extreme conditions where oxygen is absent, as on Mars. Sensitive techniques are used by scientists to detect minute quantities of gases that might indicate evidence (but not prove) that some form of life exists or once existed on Mars.

IMAGES OF THE MARTIAN SURFACE

Images can be downloaded from www.cciproject.org/topicbank/space.htm

Image A

Mars through a telescope showing the canals

Image B

Surface of Mars taken from orbiting satellite

Image C

Mars Rover

Image D

Surface of Mars taken from Rover

EXTREMOPHILE HABITATS

Images can be downloaded from www.cciproject.org/topicbank/space.htm

Image E

Antarctica

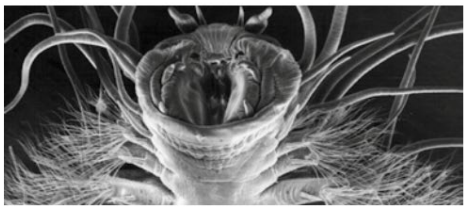
Image F

Volcanic lava

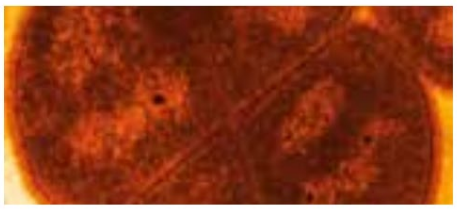
Image G

Volcanic ash

Image H



Methane worm

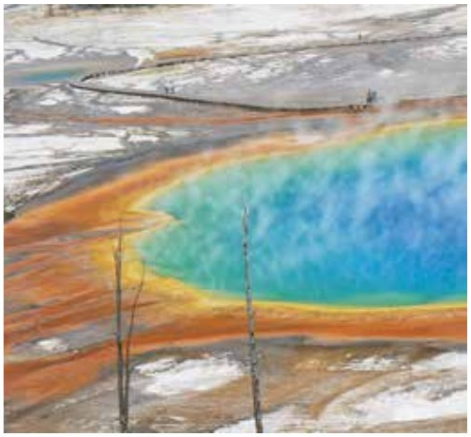


Deinococcus radiodurans

Image I

Ocean depths

Image J



Yellowstone hot springs

Appendix 1: Advance Preparation

ACTIVITIES 1 AND 2[1] SOIL TESTING

3 samples of 'Martian soil' in sealable sandwich bags, labelled A, B, C.

Sample A	Sample B	Sample C
2 tbs building sand	2 tbs building sand	2 tbs building sand
2 tbs rock salt	2 tbs rock salt	1 tbs fine grit
1 tbs table salt	1 tbs table salt	1 tbs gravel
1 tbs fine grit	1 tbs fine grit	1 tbs flour or talc
1 tbs gravel	1 tbs gravel	
	1 tbs flour or talc	

ACTIVITY 7 CHOCOLATE VOLCANO

Milk chocolate	White chocolate	Dark Chocolate
Any supermarket own Belgian chocolate	Any supermarket own brand	Any supermarket own brand
Green & Black, 34% Cocoa solids	Green & Black	Green & Black cooking chocolate 72% Cocoa solids
Ryelands	Ryelands	Ryelands

1 For the microorganism test, Activity 2, yeast should be added to sample C and it should remain salt free.

ADDITIONAL IMAGES FOR LANDINGS SECTION

Image number	Name of feature	Description of feature
Introduction Landing 1	Depositional fan of sediment.	Fan of material in unnamed crater.
Introduction Landing 2	Impact crater.	Well preserved 'simple' structure. 4 km impact crater.
Introduction Landing 3	Fissure formed by tectonic faulting with boulder-covered scree slopes coming down the fissure edges.	Boulder slopes in Cerberus Fossae. The Cerberus Fossae are a series of semi-parallel fissures on Mars formed by faults which pulled the crust apart. Ripples seen at the bottom of the fault are sand blown by the wind. The faults pass through pre-existing features such as hills, indicting that it is a younger feature. The formation of the fossaeis suspected to have released pressurised underground water.
Introduction Landing 4	Impact crater superimposed on a ridge formed by folding of lava.	Impact crater of top of wrinkle ridge close to the Viking 1 landing site.
Introduction Landing 5	Fresh impact crater with prominent rays.	Fresh impact crater formed February-July 2005.

ROLE BADGES

All of the classroom sessions involve children working together in groups of four.

Each child is responsible for a different job or role within the group and wears a badge to identify this. The images below may be photocopied onto card and made into badges, by slipping them in to plastic badge sleeves. Keep sets of badges in 'group' wallets, to be used on a regular basis in all science lessons.

Children should be encouraged to swap badges in subsequent lessons; this will enable every child to experience the responsibilities of each role.

Administrator keeps a written and pictorial record for the group.

Resource Manager collects, sets up and returns all equipment used by the group.

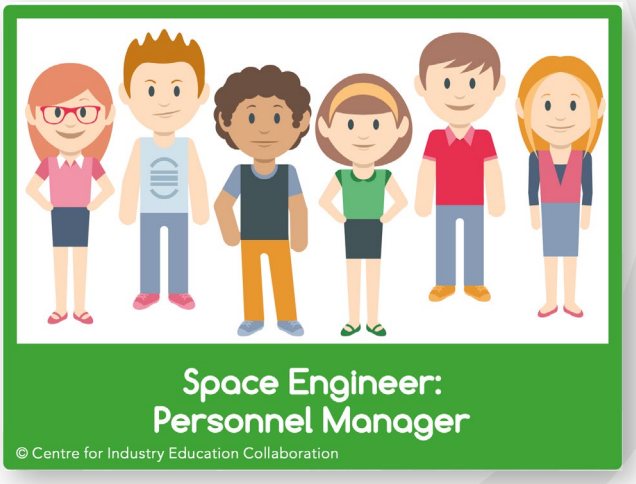
Communications Officer collects the group's ideas and reports back to the rest of the class.

Health and Safety Manager takes responsibility for the safety of the group, making sure everyone is working sensibly with the equipment.

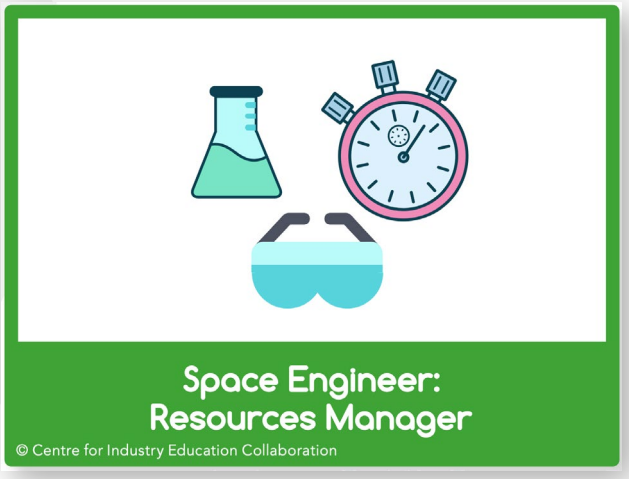
Where groups of 5 are necessary, the following role can be used:

Personnel Manager – takes responsibility for resolving disputes within the group and ensuring the team works cooperatively.

Appendix 1: Role Badges



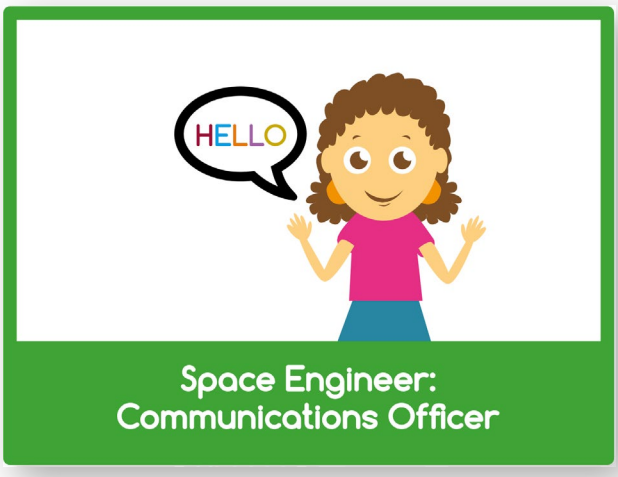
Space Engineer:
Personnel Manager



Space Engineer:
Resources Manager

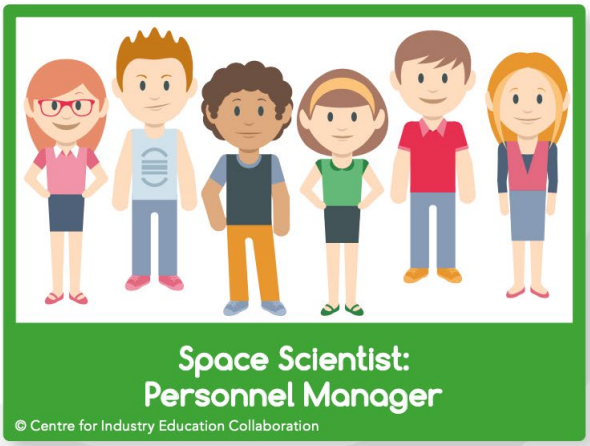
Space Engineer:
Administration Officer

Space Engineer:
Health and Safety Manager



Space Engineer:
Communications Officer

Appendix 1: Role Badges

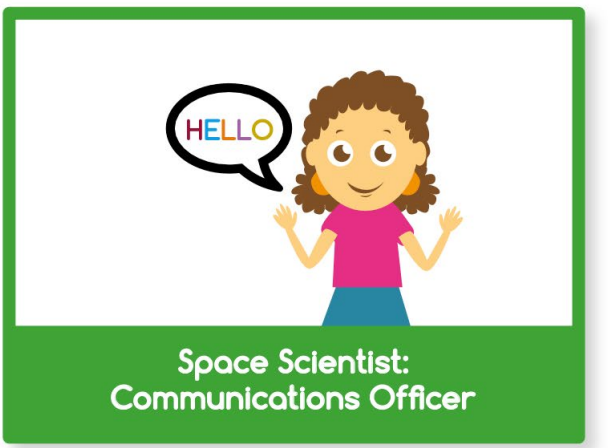


Space Scientist:
Personnel Manager

Space Scientist:
Resources Manager

Space Scientist:
Administration Officer

Space Scientist:
Health and Safety Manager



Space Scientist:
Communications Officer