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Scientists at work

Strand

Science and Society

Key concept

Science as a 'way of knowing' is shaped by the ways that humans construct their understandings.

Purpose

Activities in this module are designed to help students understand that there are different ways of knowing; that everyone has ideas about science; and that everyone can take part in science. Students have opportunities to:

- discuss their thinking about science and scientists;
- communicate with scientists about the work they do;
- investigate the workplace of scientists;
- collect information about scientists and the work they do;
- reflect on and consider their understanding of what a scientist is.

Overview of activities

The following table shows the activities in this module and the way in which these are organised in **introductory**, **developmental** and **culminating** phases.

Introductory ►

Who are scientists?

The way a scientist works

Developmental ►

Visits from scientists

Samantha, the scientist

Where scientists work

Culminating

Reflecting on scientists and their work



Core learning outcome

This module focuses on the following core learning outcome from the Years 1–10 Science Syllabus:

Science and Society

2.2 Students identify some ways scientists think and work.

Core content

This module incorporates the following core content from the syllabus:

Science and Society

- ways scientists think and work — locations and fields of work;
- people's views of science and scientists — stereotypes.

Assessment strategy

Suggestions for gathering information about student learning are provided in each of the activities in this module. Once sufficient information has been collected, judgments can be made about students' demonstrations of this outcome. Typical demonstrations of this module's intended outcome are provided here to indicate the pattern of behaviour to look for when making judgments.

Science and Society

2.2 Students identify some ways scientists think and work.

Students may:

- ask pertinent questions and make relevant comments about scientists and their work;
- generalise that there may be similarities in ways that scientists work;
- identify ways of working scientifically;
- engage with problems scientifically.

Background information

Students' prior understandings

Students arrive at school with many preconceptions about science, scientists and where scientists work. Their conceptions are, for the most part, developed through contact with their family, community groups and the media.

Characterisations of scientists in films, cartoons, advertisements and other related media are usually the construct of an adult world and are often inaccurate stereotypes and caricatures. For example, scientists are typically portrayed as Caucasian, middle-aged, balding men who wear white coats and glasses and work with chemicals in madcap explosive situations.

Teachers can broaden students' conceptions by providing opportunities for them to:

- meet scientists and see them in real-life situations;
- view pictures and read stories that feature scientists working in a wide variety of situations — for example, on farms, in factories, under water, in space and in isolated areas around the world;
- discuss equipment used by scientists, including safety equipment such as goggles, gloves and radiation shields.

Terminology

Terms associated with science and scientists are essential to the activities in this module — for example:

| | | |
|------------|--------------|------------|
| analyse | chemist | pharmacist |
| astronomer | entomologist | physicist |
| biologist | hospital | research |
| botanist | industry | zoologist |

Students may already be aware of some of this terminology. If so, activities will provide opportunities for them to evaluate current usage.

School authority policies

Teachers need to be aware of and observe school authority policies that may be relevant to this module.

Safety policies are of particular relevance to some of the activities that follow. It is essential that demonstrations and student activities are conducted according to procedures developed through appropriate risk assessments at the school.

In this module, teachers need to consider safety issues relating to conducting excursions to field study sites.

ACTIVITY

Who are scientists?

Introductory

Focus

This activity provides opportunities for students to reflect on their current understandings of science, scientists, the work scientists do, and how they have developed these understandings.

Materials

- sheets of paper
- coloured pencils, felt pens and pencils
- selection of books on scientists and their work

**Working scientifically**

Time: 60 minutes

**Clarifying and
challenging
Discussing
thinking
Listening and
questioning**

► Students draw pictures to show what they think a scientist looks like and discuss the ideas portrayed.

► In the class group, students discuss the questions ‘What is a scientist?’ and ‘What do scientists do?’. Responses could be recorded on a retrieval chart. In each case, students should indicate the source of their ideas — for example, cartoons, television, comics, computer games.

► Students discuss whether they have seen scientists in the community or if they know any scientists. They could follow up this discussion by reading a story from the class set of books.

► Students make a class list of questions they would like to ask a scientist — for example:

- Where do you work?
- How do you decide what you are going to investigate?
- How do you decide what information to collect and how to collect it?
- What do you do with the information you collect?

**Gathering information about student learning**

Sources of information could include:

- students’ illustrations of scientists;
- anecdotal notes about students’ contributions to discussion.

ACTIVITY

The way a scientist works

Introductory

Focus

This activity provides opportunities for students to develop an understanding that everyone can take part in science.

Students solve a problem by working through the steps commonly followed by scientists.

Materials

For each group of students:

- 2 balloons
- 1 piece of plastic hose pipe or hollow tubing per group (hose/tube should be approximately 10 cm long and wide enough for the neck of the balloon to fit over it snugly)
- 1 peg

Teaching consideration

Teachers could record the steps taken and questions asked on a chart that can be kept for student reference.

**Working scientifically**

Time: 30 minutes

Clarifying and challenging

Collecting information

Constructing meaning

Discuss thinking

Listening and questioning

► Students observe the teacher set up an activity using a piece of hollow plastic hose/tube, two balloons and a peg. One balloon is placed firmly over one end of the hose/tube. The second balloon is blown up, sealed off with a peg and placed over the other end of the hose/tube. Students suggest what the activity may be trying to find out, and the teacher records the question:

What are we trying to find out?

► Students list the materials needed to do this activity, and the teacher records this as: **What do we need?**

► Students suggest what will happen when the peg is taken off the second balloon. Their suggestions may include:

- the air from the full balloon may inflate the other so that both balloons are of equal size;
- there will be a seesawing effect as one balloon blows up the other balloon then vice versa.

The teacher records this as the next step: **What do I think will happen?**

► Students form small groups, collect the materials they need and put them together as suggested to test what happens. They then observe what happens to the balloons. The teacher records this as the next step in what a scientist does: **What happened?**

► Students discuss what happened and consider it in light of what they thought would happen. They then suggest reasons for the outcome. The teacher records this as the next step in the scientific process: **Why do I think that happened?**

► Students suggest what they could do next. They may propose doing the activity again to see if they get the same result, or they may suggest another way of checking what happened and why. The teacher records this as: **What will I do next?**

► Students may repeat the activity at home with their family or friends to see what happens.



Gathering information about student learning

Sources of information could include:

- anecdotal notes about students' contributions to discussion.

ACTIVITY

Visits from scientists

Developmental

Focus

This activity provides opportunities for students to develop an understanding of science as a human construct by listening and talking to scientists and reflecting on the nature of scientists and their work.

Teaching considerations

Invite a range of scientists from the local community to visit the class — for example, an optometrist; a pharmacist; the school dentist; a doctor; scientists from local industries, government departments, hospitals, universities or the Chemists in Schools Program. Try to organise a minimum of three visits (spread over three class sessions). As a major aim of the visits is to break down any stereotyped views that students may have, make sure the visitors include a mixture of males and females from different age-groups and disciplines.

Brief the visitors beforehand about the aims of the activity — that is, to help students understand how scientists ‘go about their business’ and to convey a sense of the excitement of science and the wonder of science enterprises.

**Working scientifically**

Time: 3 x 30 minutes

Making links
Exploring and
elaborating ideas
**Listening and
questioning**

- ▶ Students prepare for the visits by reviewing the questions for scientists listed during the activity ‘Who are scientists?’ (see p. 4). They could suggest further questions for the list if they wish.
- ▶ During the visits, students listen to and interact with the scientists as they talk about where they work and the nature of their work.
- ▶ The follow-up class discussion could include questions such as:
 - Where does the scientist work?
 - What does the scientist do?
 - Is this different/similar from what you thought scientists did? How?
 - Was the scientist like the scientists you see in films/cartoons/advertisements/computer games? How was the scientist different/similar?
- ▶ The students and teacher could sort responses to the question ‘What does the scientist do?’ to create a retrieval chart. Headings could include:
 - what the scientist is trying to find out;
 - information the scientist needs;
 - equipment the scientist uses;
 - what the scientist does with the information he/she gathers.

**Gathering information about student learning**

Sources of information could include:

- anecdotal notes about students’ contributions to discussion;
- anecdotal notes about students’ contributions to the retrieval chart.

ACTIVITY

Samantha, the scientist

Developmental

Focus

This activity provides opportunities for students to develop an understanding that everyone can take part in science.

Students participate in a problem-solving exercise.

Materials

- Resource Sheet 1, 'Samantha, the scientist'
- Resource Sheet 2, 'Pets and name tags'
- Resource Sheet 3, 'Pet owners'

**Working scientifically**

Time: 60 minutes

Clarifying and challenging

Collecting information

Drawing conclusions

Creating diagrams

Discussing thinking

► Students listen to the teacher read 'Samantha, the scientist' (Resource Sheet 1), and then attempt to solve the problem posed in the story using Resource Sheets 2 and 3 as guides.

► Students discuss their answers with the teacher individually.



**Resource
Sheets 1, 2, 3**

**Gathering information about student learning**

Sources of information could include:

- students' completion of the task;
- anecdotal records made during student–teacher conferences.

ACTIVITY

Where scientists work

Developmental

Focus

This activity provides opportunities for students to develop an understanding of science as a human construct by observing scientists and reflecting on the nature of scientists and their work.

Materials

- Resource Sheets 4a–d, 'Excursion workbook'

Teaching considerations

Organise an excursion to a place where scientists work — for example, hospital, museum, government department, Commonwealth Scientific and Industrial Research Organisation (CSIRO), sugar factory, milk factory, food-processing factory, cement factory. If possible, brief the people whom students will meet about the aims of the activity and the information that students will be gathering.

Material for a workbook for students to complete during the excursion is provided on Resource Sheets 4a–d. The sheets need to be collated.



Resource
Sheets 4a–d

**Safety**

Ensure that school excursion policies and worksite safety policies are followed.

**Working scientifically**

Time: 3 hours

Collecting
information
Looking for
patterns and
meanings

► Students prepare for the excursion by reviewing information gathered in earlier activities about scientists and their work. The workbook could provide a focus for this preparation.

► Students undertake the excursion and make notes and draw pictures in their workbooks about their observations and interactions.

► The follow-up class discussion could include questions such as:

- What work were the scientists doing?
- What did you notice about the place where the scientists were working?
- Was their workplace as you expected it to be? Why or why not?
- Was the scientists' workplace similar/different to other workplaces? How?

**Gathering information about student learning**

Sources of information could include:

- students' completed workbooks;
- anecdotal notes about students' contributions to discussion.

ACTIVITY

Reflecting on scientists and their work

Culminating

Focus

This activity provides opportunities for students to demonstrate their understanding of some of the ways scientists think and work and to reflect on how their views of science and scientists have changed during the module.

Materials

- sheets of paper
- coloured pencils, felt pens and pencils
- note paper and envelopes

**Working scientifically**

Time: 30 minutes

**Clarifying and
challenging**
**Reflecting and
considering**
**Discussing
thinking**

► Students reconsider the pictures of scientists they drew at the beginning of the module (see ‘Who are scientists?’, p. 4) and draw another picture showing how they view scientists now. They can share their ‘old’ and ‘new’ pictures and identify and discuss some of the differences. Students could also amend or add to the retrieval chart where their ideas about scientists were recorded during the first activity of the module.

► Students make a class list of the ways in which scientists are important to the community.

► Students write a short letter of thanks to the scientists they met during the module. Their notes should reflect their new views and understandings of scientists. They then select and send letters to the scientists concerned. Students’ drawings of scientists could be included with the letters.

**Gathering information about student learning**

Sources of information could include:

- students’ ‘new’ illustrations of scientists;
- anecdotal notes about students’ contributions to discussion;
- students’ letters of thanks to scientists.

Samantha, the scientist



Resource Sheet 1

Samantha really enjoyed science. At school it was one of her favourite lessons because she was able to solve problems and work out the answers to questions.

One day the children in Samantha's Year 2 class were going to have a pet parade. All the children brought their pets along in boxes, and put them in different classrooms while they waited for the judges to pick the prize winner. Each pet wore a name tag and the box it was in had its owner's name written on it. In one classroom there were two dogs and three cats. Unfortunately, the dogs and the cats somehow got out of their boxes and had a fight. Hearing the noise of the dogs and cats fighting, Samantha and her teacher, Miss Louise, ran to the classroom and stopped the fight. They put each animal back into a box and picked up four of the animals' name tags. Unfortunately, they couldn't find the fifth name tag.

Miss Louise was very unhappy because she couldn't remember all the animals' names or who owned each pet. Samantha decided to help her. She told Miss Louise that she had a way of solving problems which she used when she was being a scientist. Samantha got out her notebook and wrote down these six questions: *(Teachers may want to show these questions on the board or overhead projector as the story progresses.)*

1. What do I want to find out?
2. What do I need?
3. What do I think will happen?
4. What happened?
5. Why do I think that happened?
6. What will I do next?

After writing down these questions, Samantha thought about the first question — What do I want to find out? — and then wrote down the answer. *(The teacher asks the students to provide some answers to this question. A possible answer may be 'I want to know the names of the animals and who owns them'.)*

Next Samantha wrote down what she needed to solve the problem. *(The teacher asks students for the ideas that might be useful.)* She thought that she would need the names of the pets, the names of the owners and the type of pets.

Miss Louise and Samantha looked at the four name tags. They read 'Max', 'Bluey', 'Toby' and 'Simpkin'. Samantha also wrote down the names of the owners that were on the boxes that the pets were kept in. They were Sarah, Mark, Tuan, Jenny and Kym. Next she wrote down the types of pets there were in the room. There were two white animals, two black animals and one animal with a black spot. There was one white dog and one white cat, and one black dog and one black cat. She also remembered that the animal with the longest name lived with the owner with the shortest name.

(continued)

Samantha, the scientist (*continued*)



Miss Louise said she remembered that Sarah's dog was white and that Jenny had a white animal. Miss Louise also said Michael called his cat Toby and it was not black. Mark had a dog called Max, and Bluey was not a cat.

Samantha then began working on the third question in her list — What do I think will happen? She drew pictures of the animals and their name tags (see Resource Sheet 2). Then she cut out the pictures and name tags and arranged them on a table.

Samantha and her teacher looked at the puzzle. Samantha suggested that a way of solving the problem was to just guess which animal belonged to each child. Miss Louise asked if this would be an accurate way of solving the puzzle, and Samantha answered that it would not. Samantha agreed she would have to work out the puzzle. Miss Louise asked her if she had enough information to solve the problem. Samantha said she thought she had all that she needed and then began working on solving the puzzle.

On a sheet of paper she drew five boxes and in each box she wrote one of the five owners' names (see Resource Sheet 3). Then she thought about the information she had on the colour of each pet. Using this information, she placed her drawings of the animals and their name tags in the boxes of the correct owners. Finally, Samantha was able to place all the pets with their owners except for one. This meant she had an answer to her fourth question — What happened?

She talked to Miss Louise about what had happened. Miss Louise asked Samantha the fifth question — Why do I think that happened? Samantha replied that she needed the name of the unmatched animal to complete the puzzle.

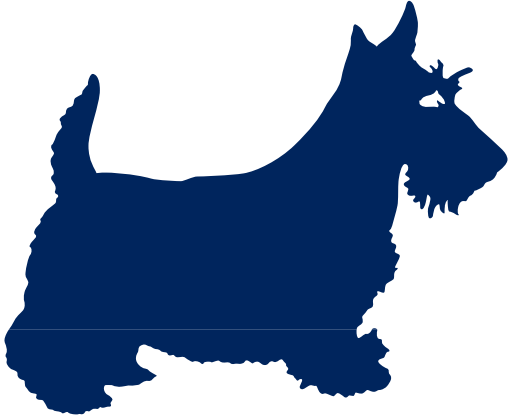

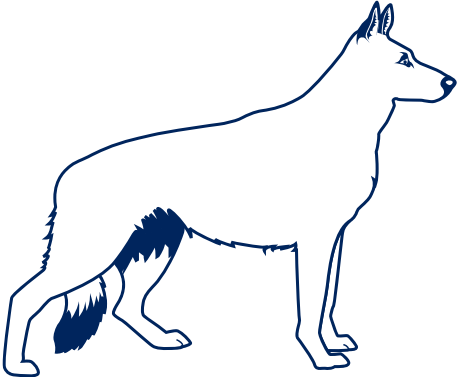
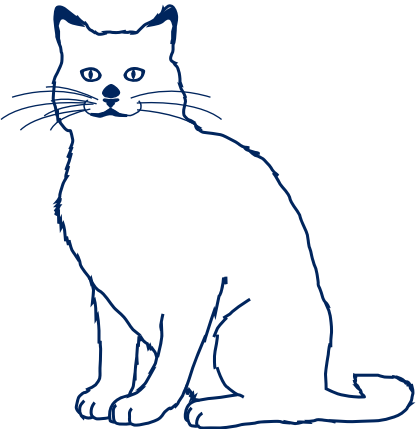
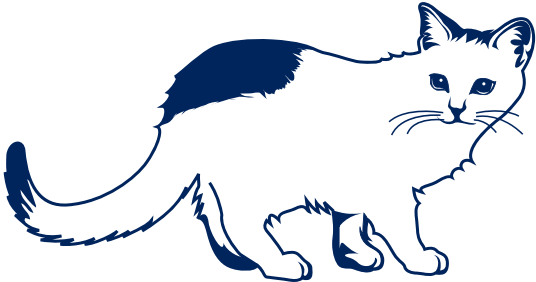
Samantha then concentrated on answering her sixth question — What will I do next? She thought she could look for the missing name tag, guess the pet's name, or ask the owner. Miss Louise asked Samantha what she might call the animal if she had to guess. Samantha suggested . . .

Pets and name tags

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Resource Sheet 2

SCIENTISTS AT WORK • LOWER PRIMARY

| | |
|---|--|
|  |  |
|  |  |
|  | <div data-bbox="858 1518 1294 1597">Toby</div> <div data-bbox="858 1630 1294 1709">Max</div> <div data-bbox="858 1742 1294 1821">Bluey</div> <div data-bbox="858 1854 1294 1933">Simpkin</div> |

Pet owners



| | |
|-------|-------------|
| Jenny | Sarah |
| Kym | Mark |
| Tuan | Name: _____ |

Excursion workbook

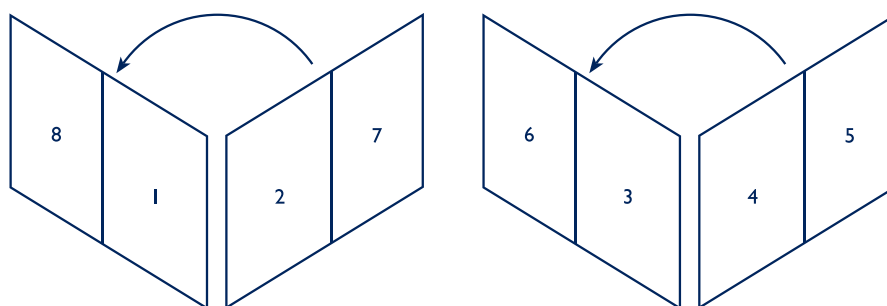
R4

Resource Sheets 4a-d

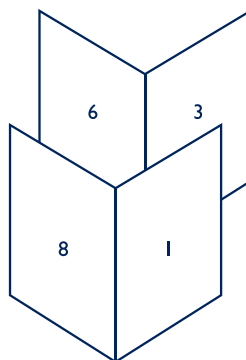
SCIENTISTS AT WORK • LOWER PRIMARY

The following four pages can be copied and then arranged as shown below to make an eight-page booklet for students to use with the activity 'Where scientists work'.

1. Photocopy pages back to back or paste copies together as shown.

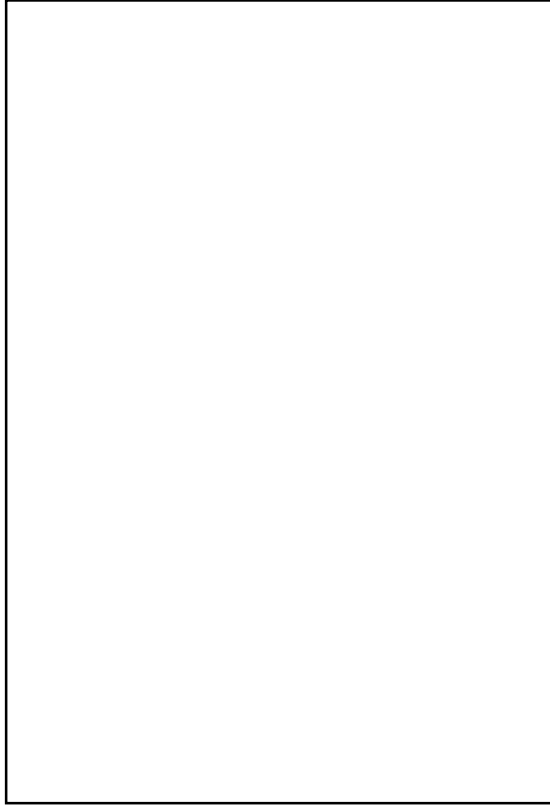


2. Fold pages in half, assemble as shown and staple.



A visit to

on _____



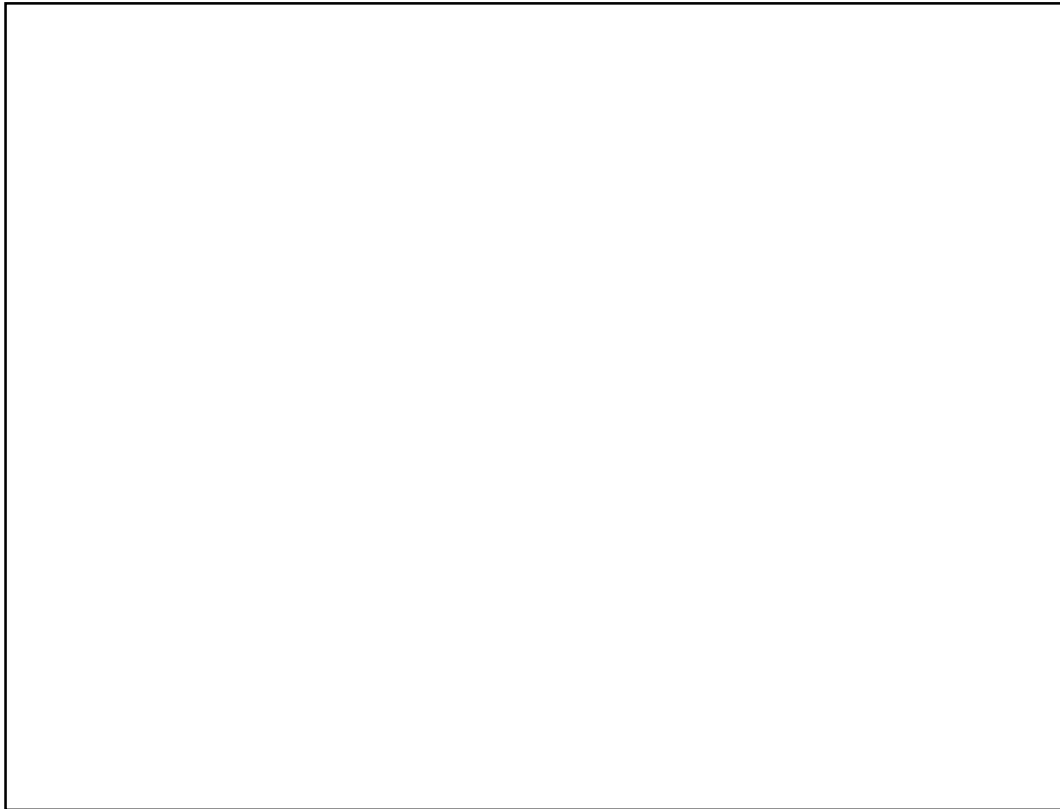
by _____

Year _____

The scientists said that the next thing they
will do is ...

The work that the scientists are doing is
important because ...

Here is a picture of the scientists.

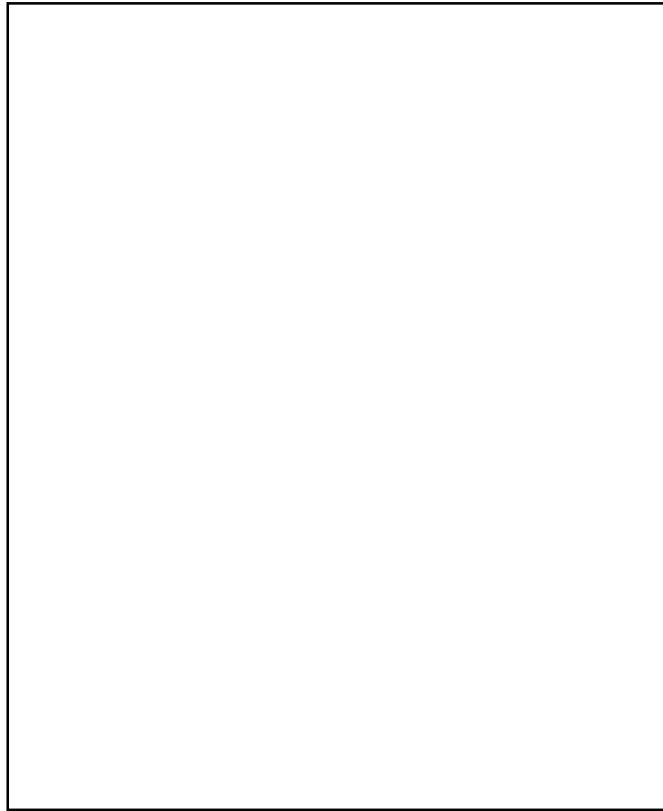


During their work the scientists found that ...

The scientists suggested that this happened because ...

The scientists are wearing ...

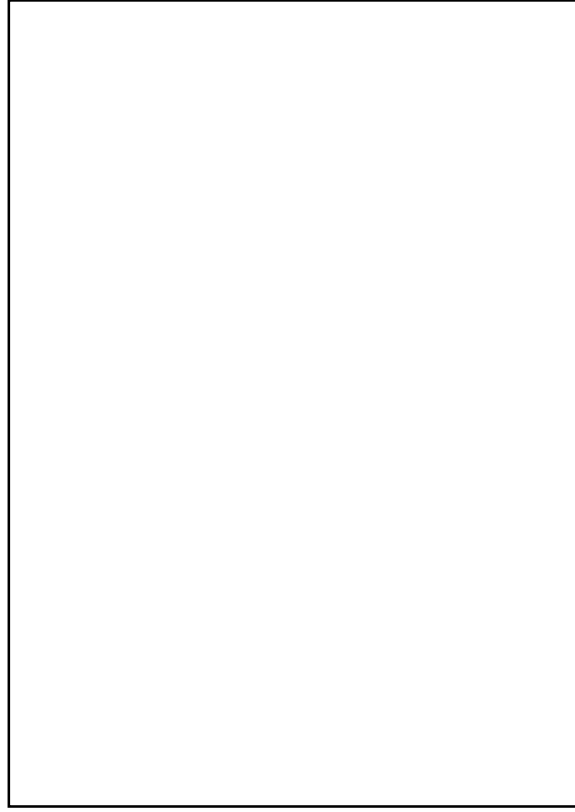
Here is a picture of what they are wearing.



Page 6

The scientists are trying to find out ...

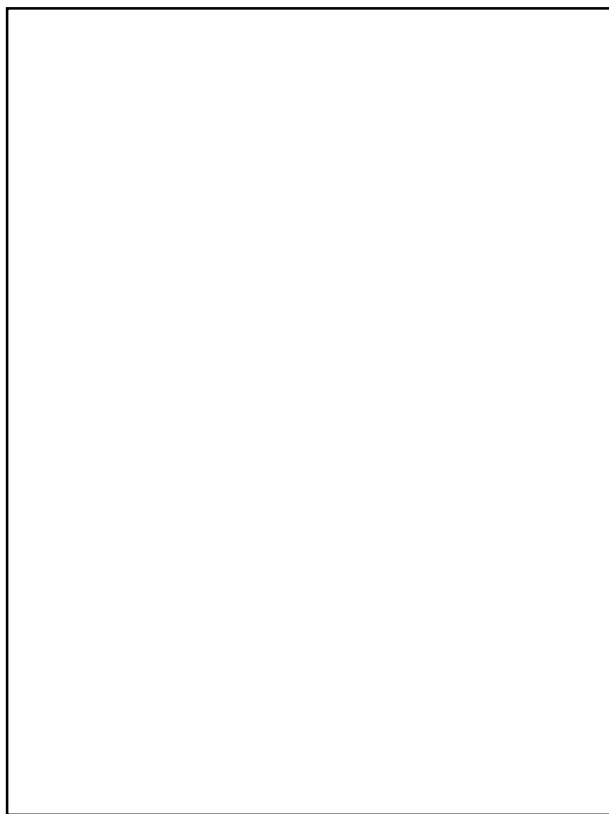
Here is a picture of what the scientists are doing.



Page 3

To do their work, the scientists
are using ...

Here is a picture of what they are using.



Page 4

To collect information, the
scientists are using ...

Here is a picture of the scientists
collecting information.



Page 5

This sourcebook module should be read in conjunction with the following Queensland School Curriculum Council materials:

Years 1 to 10 Science Syllabus

Years 1 to 10 Science Sourcebook: Guidelines

Science Initial In-service Materials

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