Level

| F | 1 | 2 | 3 | 4 | 5 | 6 | B6 |
|---|---|---|---|---|---|---|---|

# Features of the Earth and sky

**Strand**
Earth and Beyond

**Key concepts**
The Earth, solar system and universe are dynamic systems.

Events on Earth, in the solar system and in the universe occur on different scales of time and space.

## Purpose

Activities in this module are designed to help students understand that there are significant features on the Earth and in the sky, and that aspects of their immediate environment change. Students have opportunities to:

- investigate the visible components of the Earth, solar system and universe, and some of their features and interactions;
- understand how the Earth is situated in relation to the solar system and the universe;
- communicate their understandings of the features of the Earth and sky.

## 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 ► | Developmental ► | Culminating |
|---|---|---|
| Where might the Jigaree live? | I'm off to find a Jigaree! | Night-time sky observations |
| What do you know? | Words I'm learning | So, what are they? |
| What is it like in space? | How can stars be big? | What do you know now? |
| | What makes them smaller? | |
| | Investigating differences | |

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## Core learning outcomes

This module focuses on the following core learning outcomes from the Years 1 to 10 Science Syllabus:

Earth and Beyond

**1.1 Students identify and describe obvious features of the Earth and sky (including landforms and clouds).**

**1.2 Students describe obvious events (including day and night) that occur on the Earth and in the sky.**

**2.1** Students identify and describe changes in the obvious features of the Earth and sky (including changes in the appearance of the moon).

Activities in this module also provide opportunities for students to demonstrate a level of understanding before Level 1.

## Core content

This module incorporates the following core content from the syllabus:

Earth and Beyond

**The Earth as a system**

- features — landforms, bodies of water, clouds

**The solar system as a system**

- features — sunrise/sunset
- components — sun, moon, planets

**The universe as a system**

- components — the solar system
- interactions — light from stars

**Changes on Earth and beyond**

- day/night
- position of stars

**Scales of distance**

- distance on Earth

## 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 outcomes. Typical demonstrations of this module's intended outcomes are provided here to indicate the pattern of behaviour to look for when making judgments.

Earth and Beyond

## Foundation Level

**Students are developing an understanding of the features of the Earth and sky. They are developing an understanding of their immediate non-living environment and uses made of it.**

Students may:

- identify major features of the Earth and sky;
- create a presentation showing major features of the Earth and sky;
- identify changes in the sky related to their daily experience.

Earth and Beyond

**1.1 Students identify and describe obvious features of the Earth and sky.**

Students may:

- identify words, phenomena and objects related to features of the Earth and sky and match words to phenomena and objects;
- draw, construct or model and label components and features of the Earth, solar system or universe visible to the naked eye;
- explain their drawings, constructions or models;
- explore resources identifying and illustrating features of the Earth and sky;
- explore, through dramatic play, ideas about some objects and phenomena of the Earth and beyond and their spatial relationships;
- formulate questions and discuss ideas to clarify concepts about features of Earth and about space as a physical place beyond the sky.

Earth and Beyond

**1.2 Students describe obvious events (including day and night) that occur on the Earth and in the sky.**

Students may:

- identify words and events related to the Earth, the sky and space and match words with events;
- explain their drawings, constructions or models of events on the Earth and in the sky;
- discuss the effect of distance on the apparent size of objects;
- use role-play to represent events that occur on the Earth and in the sky;
- explore, through dramatic play, ideas about events on the Earth and beyond;
- compare obvious features of day and night.

Earth and Beyond

**2.1 Students identify and describe changes in the obvious features of the Earth and sky.**

Students may:

- draw, construct or model and label changes to components and/or features of the Earth, solar system or universe;
- collect information about changes in features of the Earth and sky;
- explain their drawings, constructions or models, discussing how they have, or have not, represented changes;
- compare and discuss features of daytime and night-time skies;
- formulate questions concerning Earth forms and space as a physical place beyond the sky but visible in it.

# Background information

## Current scientific conceptions

Stars, like the Earth's sun, are made up of gases. Nuclear reactions in the sun emit heat and light. As the light from stars enters and travels through the various layers of the Earth's atmosphere, it becomes distorted and the stars appear to twinkle. Most stars cannot be seen from Earth during the day because of the strong light from the sun. The sun is the closest star to Earth and so dominates the day sky.

The moon itself does not give out any light. The moon can be seen because light from the sun is reflected from the moon's surface. The part of the moon facing the sun reflects the sunlight. The shape of the moon appears to change because, as the moon rotates around the Earth every 28 days, the position of the moon changes in relation to the Earth and the sun; therefore different portions of the illuminated face of the moon are visible from Earth over the 28-day cycle.

Everyday units of distance and time used on Earth were devised by people. They are based on reference points and experiences that have everyday relevance. Distance on Earth is conveniently measured in metres, kilometres, feet and miles depending on the country. On Earth, time is marked by:

- the passing of day and night, which is the result of Earth's rotation on its axis;
- the passing of a year, which is the result of Earth's revolution around the sun.

The distances, times and forces operating in space are on a very different scale from those on Earth. In space, distances are so vast that scientists speak in terms of astronomical units and light years.

Time measured in days and years is different on another planet, such as Mars, with different periods of revolution and rotation. Time, measured in Earth units, has no applicability beyond the solar system.

The universe contains suns, moons, planets, galaxies, black holes, neutron stars, red giants, white dwarfs and other celestial bodies. Our solar system is only one of many such systems in the universe. The components of the universe are in constant motion. The material of the universe is constantly re-forming, with existing celestial objects 'disappearing' and new ones being formed.

Astronomers are the scientists who research these phenomena. On 25 April 1990 the Hubble telescope was deployed beyond Earth's atmosphere by the National Aeronautics and Space Administration (NASA). This telescope has allowed astronomers to gather information that is not distorted by Earth's atmosphere.

## Students' prior understandings

Students' prior understandings may differ from current scientific conceptions in a range of ways.

Some students may think that:

- the sun shines only during the day; the moon or clouds cover the sun to cause night; at night the sun goes behind a hill;
- stars do not shine during the day; the stars go behind the sun or 'below' the Earth during the day;
- it takes about two days to get to the moon;
- the moon makes or gives off light;
- the sun goes around the Earth;
- the Earth is shaped like a saucer;
- people only live on the 'upper' half of the Earth;
- the universe is a flat infinite space with humans at the centre.

Teachers can assist students to develop their understandings about Earth and beyond by providing experiences that challenge students' current ideas. What is obvious to adults may not be obvious to students. Teachers can provide students with opportunities to:

- view photographs/posters of Earth as seen from space;
- develop awareness of events occurring over time — daily and weekly events can be recorded in class and individual timelines or logbooks;
- use shadow sticks and sundials to follow the sun's pattern of movements;
- hear simple explanations of what scientists used to think, what they think now and why they changed their ideas. This allows students to understand that they also may need to reconsider their views as they gain more scientific knowledge.

Students may have strong cultural and spiritual beliefs associated with the Earth and beyond. Teachers can provide students with activities that explore the scientific explanations of phenomena associated with the Earth and beyond. They can encourage students to acknowledge and respect the wide range of views by clarifying the nature and purpose of a belief in a specific culture.

## Terminology

Terms associated with obvious features of the Earth and sky, as well as terms relating to size, distance and space travel, are essential to the activities in this module — for example:

| | | | |
|---|---|---|---|
| air | dam | mountain | sea |
| beach | far away | near | shadow |
| big/small | farm | planet | sky |
| close up | forest | playground | spaceship |
| cloud | hill | river | star |
| comet | lake | rocket | sun |
| creek | moon | satellite | visible/invisible |

Students may already be familiar with some of these terms and understand their meanings and use in scientific contexts. If so, the activities in this module will provide opportunities for them to evaluate current usage. If not, these activities will provide opportunities for students to develop their understandings.

### 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 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 classes in the sun — for example, exposing students to heat and UV rays, and the dangers of looking directly at the sun;
- conducting excursions to field study sites.

## Support materials and references

Australian Broadcasting Corporation, ABC Books, Sydney:
1993, *The Best of Sing: The Top 100 Songs from Ten Years of Sing 1982–1991*
1998, *The Sing Book 1998*

Cowley, Joy 1983, *The Jigaree,* Big Book, Story Box, Shortland Publishing, Auckland.

Dawes, G., Northfield, P. & Wallace, K. 1998, *Astronomy 1999: A Practical Guide to the Night Sky*, eastern Australian edition, Quasar Publishing, Strathfield, NSW. (This book contains sky charts and is updated annually.)

National Aeronautics and Space Administration. Available URL: http://www.nasa.gov. (accessed October 2000).

Skamp, K. (ed.) 1998, *Teaching Primary Science Constructively*, Harcourt Brace, Marrickville, NSW.

**Organisation**

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(Schools may join as borrowers.)

ACTIVITY

# Where might the Jigaree live?

*Introductory*

## Focus

This activity provides opportunities for students to develop an interest in, and expand their knowledge of, the features of land, sea and sky, the region beyond Earth and its celestial bodies, in a shared reading experience.

## Materials

- *The Jigaree* (Big Book, see 'Support materials and references', p. 6)
- a selection of other published material related to space and Earth — books, photographs, drawings, newspaper clippings, videos
- a large paper-covered pinboard, crayons
- optional extras: white candles, rollers, ink or powder paint washes

## Teaching considerations

Conduct a shared book experience with students to focus their thinking on imaginary physical settings. Any book about space or other worlds can be used as a basis for similar activities. At this level, students' observations of the features of Earth and beyond may include consideration of shades of brightness and darkness, and variations in colour, size, position, shape and appearance. Observations may be direct or second-hand from sources such as books, posters, pictures and videos.

Research answers to questions students might ask about the setting — for example, 'Is there really a planet on which the surface is orange, brown and red?'

Organise a display of material. Search resource material to find an image of a planet with surface colours of red, orange and brown (similar to the Jigaree's home planet).

Prepare materials for a class mural on the theme of Earth and space. This will provide a focus for students to communicate the understandings they develop during this activity and later activities. Pencil an outline of the mural on the pinboard for students to complete.

An alternative approach is to create the outline of the mural with a candle, prepare washes of appropriate colours and then apply these washes with a roller over the mural.

## Working scientifically

Time: Part 1, 30 minutes; Part 2, 40 minutes

**Accessing resources**
**Collecting information**
**Identifying**
**Illustrating**

### Part 1: Shared book experience

▶ Students take part in a shared reading of *The Jigaree* and consider the story from the perspective of social interaction between the characters. They identify features of the physical setting of the story — for example, landforms, bodies of water such as creeks and dams, and objects visible in the sky.

▶ Students then decide whether the story told in the book is fact or fiction. They list and discuss features of land, sea and sky in their local area, then compare and contrast features described in the story with those of their familiar surroundings. (This can be done using a simple retrieval chart.)

▶ Students consider the questions: 'Where might the Jigaree live?' and 'Is there really a place like this imaginary land? If so, where could it be?' Students seek possible answers to these questions from the class display of materials by separating resources into two groups: fact and fiction.

▶ Working together, students find the image of the planet chosen as the Jigaree's possible home. They list the features of land, sea and sky that identify it as the Jigaree's home.

▶ Students discuss the proposed mural and its purpose.

**Part 2: Class mural**

▶ Students discuss their understandings of other worlds that have features similar to Earth's but are obviously different. They list the features to be included in the mural and the tasks to be performed.

▶ Students work in groups on their allocated tasks to construct the class mural, illustrating the understandings they have developed.

**Gathering information about student learning**

Sources of information could include:

- students' contributions to discussions;
- students' contributions to the mural.

ACTIVITY

# What do you know?

*Introductory*

## Focus

This activity provides opportunities for students to relate through interviews their current understandings of the Earth and sky, the region beyond it and its celestial bodies.

## Materials

- five or six open-ended interview questions from Resource Sheet 1, 'Suggested interview questions'

## Teaching considerations

Knowledge of students' prior understandings can guide the selection of future activities and encourage students to reassess their conceptual understandings. Students' prior understandings may be determined using different strategies (see the initial in-service materials, pp. 38–42).

Conducting interviews at the beginning and end of a sequence of activities is an effective way of ascertaining the development of students' understandings. Similar sets of questions should be used in both interviews so that both sets of responses can be compared.

Explain the reasons for the interview and the interview process to students. Read the questions to the class before beginning the interviews. Allow students time to think through their responses to the interview questions. Invite students to bring simple objects and materials to model their explanations.

If a parent or a classroom assistant is available, individual interviews could be conducted and recorded. Ensure students are comfortable with the interviewer.

As an alternative to an interview, students could respond to the questions in small discussion groups or in the class group.

Record interviews or discussions where possible.

Organise a display of relevant features, objects and phenomena related to the solar system so that students may add to it (see the activity 'Where might the Jigaree live?', p. 7). Allow students to face the class mural and display during interviews.

## Working scientifically

Time: Part 1, 15 minutes; Part 2, 15 minutes (each student)

**Making observations**
**Reflecting**
**Discussing thinking**
**Exploring and elaborating ideas**

### Part 1: Whole class introduction

▶ Students prepare for their interviews by perusing the class display on the theme of Earth and space. With teacher guidance, students discuss how the display communicates many people's ideas about Earth and space, and that all of them are valuable in different ways. Students consider whether those ideas are, for example, factual, fantasy, based on fact but not strictly accurate, scientific, religious or cultural.


▶ The nature and purpose of the interview questions from Resource Sheet 1 are explained.

**Part 2: Interview**

▶ With the mural or display as stimulus material, students respond to interview questions about their understandings of the Earth and sky, the region beyond it and the celestial bodies. They may draw diagrams or construct a model to elaborate.

**Gathering information about student learning**

Sources of information could include:

- students' interviews;
- students' diagrams or models.

ACTIVITY

# What is it like in space?

*Introductory*

## Focus

These activities provide opportunities for students to engage with some aspects of current scientific understandings of the Earth, the sky, the region beyond it and its celestial bodies.

Students view video segments and retell what they have learned.

## Materials

- four video segments of actual space travel, each about 15 minutes long
- word processors, printers
- Plasticine or other modelling medium
- art and collage materials
- *The Jigaree* (Big Book, see 'Support materials and references', p. 6) or other story book about space or other worlds

## Teaching considerations

Through viewing video segments of actual space travel, building up lists of words to do with space, modelling celestial bodies and investigating published material in the classroom display, students will enhance their concepts of space as a place that is accessible to human beings under certain controlled conditions. They will also become aware of the actual shapes of the Earth, celestial bodies and human-manufactured objects sent into space — for example, rockets and satellites.

View the videos as a whole class on four separate occasions. Preview the material and prepare suitable commentaries.

Use the pause function and allow time for extensive questioning by students.

Set up four learning centres that students can choose to work at after viewing the video:

1. Art/collage learning centres;
2. Modelling learning centres;
3. Word list learning centres;
4. Read and write learning centres.

## Working scientifically

Time: Part 1, 4 x 25 minutes; Part 2, 4 x 30 minutes

**Collecting information**
**Exploring phenomena**
**Formulating questions**
**Constructing meaning**
**Constructing and using models**
**Relating**

### Part 1: Movie time

► Students view four video segments of people actually travelling in space. The purpose of viewing is to gain new **scientific** understandings about the Earth, the sky, the region beyond it, and the celestial bodies.

► Students discuss the video segments and consider the types of questions they might ask to clarify their understandings.

**Part 2: Learning centres**

▶ Students form small groups to work at the four learning centres:

1. Art/collage: students add to the mural the things that Jigarees might see regularly in their night sky.
2. Modelling: students use materials provided to model natural and manufactured things in space.
3. Word list: students find out new words to do with Earth and space, and use a word processor to key in the words and print them out. They illustrate each word and prepare a display.
4. Read and write: students write their reactions to *The Jigaree* in any genre and record questions they have that arose from reading the story.

**Gathering information about student learning**

Sources of information could include:

- students' questions relating to the video clips or work at learning centres;
- students' work at learning centres.

ACTIVITY

# I'm off to find a Jigaree!

*Developmental*

## Focus

This activity provides opportunities for students to extend their concepts of the dynamic nature of the solar system within the universe through creative play and drama.

## Materials

- *The Jigaree* (Big Book, see 'Support materials and references', p. 6) or other story book about space or other worlds
- a selection of illustrations about space travel and texts featuring interplanetary travel — for example, photos of lunar vehicles
- music to a popular children's song (see 'Support materials and references', p. 6)
- recycled cartons, paper, tubes, string, hole punchers, masking tape, cellophane, paper plates, pens, broom handles, hessian

## Teaching considerations

Through imaginative play in response to learning a song about finding a Jigaree, students can think through some of the real issues involved in human interaction with space.

This activity focuses on student-centred, student-directed participation. The teacher's role is consultative and supportive.

Create new lyrics about searching for and finding a Jigaree on another planet to accompany the music chosen. Write the lyrics of the new song in two formats — one to share with the whole group, the other double-spaced in large size (preferably Beginner's Alphabet font) for students to trace over, copy, or illustrate.

## Working scientifically

Time: Part 1, 3 x 20 minutes; Part 2, 30 minutes

**Identifying**
**Examining and evaluating**
**Preparing scenarios**

**Part 1: Music!**

▶ Students listen to the song to become familiar with it and the images the lyrics portray about searching for, finding and riding a Jigaree.

▶ Students compare these images with other familiar experiences of searching for living things. They discuss and list essential procedures and equipment needed to engage in a search — for example, going fishing or searching for a wallaby or pig.

▶ Students discuss and list the corresponding items needed for finding a Jigaree, given that the Jigaree lives on the students' choice of planet. They list real-life difficulties in carrying out the venture and use imaginative play as an alternative to carrying out the planned search.

▶ Students prepare a play area in the classroom, name it (for example, the 'Venus set') and use recycled 'junk' materials to decorate it.

**Part 2: Imaginative play — 'I'm off to find a Jigaree'**

▶ Students participate in imaginative play about travelling to another planet and searching for a Jigaree. If there is no flow of ideas from the students, the teacher models the activity, explaining all actions.

► Students collaboratively discuss ideas based on how to prepare for and carry out the search — for example, they might consider the following:

- suitable storage of supplies such as air, water, food and Jigaree bait;
- constructing vehicles suitable for transport to, and on, the planet;
- time taken on the journey;
- finding where Jigarees live by following their tracks;
- best way to find a Jigaree — lure it or track it?

► Students relate real situations that they know about or have discussed to the imagined situations on the set.

**Gathering information about student learning**

Sources of information could include:

- students' contributions to discussions;
- students' illustrations of songs;
- students' imaginative play.

ACTIVITY

# Words I'm learning

*Developmental*

## Focus

This activity provides opportunities for students to develop their concepts of the region beyond Earth.

They use the words that scientists use to name phenomena encountered on Earth and beyond.

## Materials

- mural from the activity 'Where might the Jigaree live?' (p. 7)
- play area created in the activity 'I'm off to find a Jigaree!' (p. 13)
- books, pictures, videos depicting relevant words
- coloured paper for printing
- word processors with suitable outline font — for example, Beginner's Alphabet (optional)

## Teaching considerations

This activity will assist students in using appropriate scientific words in context. Use the words generated in this activity for as many different purposes as needed in your context. For some word games it is helpful to display a class list with the words illustrated. If there is no word processor or outline fonts available, words can be hand drawn.

The amount of time devoted to part 2 of this activity will depend on the knowledge, understanding and interest of the students.

## Working scientifically

Time: Part 1, 25 minutes; Part 2, 5-minute periods

**Exploring phenomena**
**Identifying**
**Constructing meaning**
**Relating**

### Part 1: Make a list

▶ Students recall new words that they have learned and put these on coloured paper. Each student colours, traces or illustrates a word to be displayed collectively on a pinboard. Students can add other words as they learn them.

### Part 2: Use a list

▶ Students play word games to consolidate their understandings of Earth as part of the solar system and the universe — for example:

- **Word sorts.** Students sort the words they have suggested into one category or another — for example, celestial bodies/not celestial bodies; fact/fantasy; real/imaginary; visible by day/not visible by day. The words may be re-sorted into different categories any number of times. Students may suggest categories.
- **'What am I?'** A student or the teacher describes a phenomenon; the other students guess which word applies to the phenomenon being described. (This may be either a teacher-led or student-led activity.)
- **'I'm thinking of a word'**. Students describe the word's meaning for other students to guess.

- **True/false**. Two students are each given two cards — one labelled 'True', the other 'False' — and stand at the front of the class. Another student selects a word for the class to focus on and says, for example, '(word) is the name of a planet.' Students with the 'True' and 'False' cards display the correct one in response to the statement. The remainder of the group decide whether or not the students have selected the correct response. After two or three statements, different students are given the 'True' and 'False' cards.
- **Making sentences**. Two students stand facing away from the class and away from an illustrated word display. The rest of the class face the illustrated words.

  A student or the teacher silently points to a word. The group reads it aloud. The two standing students listen and then attempt to put the word in a sentence (matching any criteria that have been decided on). They turn to face the group as the signal that they are ready to say their sentence.

  The first student to turn speaks first. Students in the group ask questions to clarify the ideas presented in the sentences.
- **Change a sentence**. A student suggests a sentence to be written on a board for all to see — for example, 'The astronaut is going to the moon in a spacecraft'. Students take turns to change one word in the sentence at a time so that, although still making sense, a completely different message is conveyed as each word is changed.

### Gathering information about student learning

Sources of information could include:

- students' participation in games;
- students' capabilities with new vocabulary;
- students' use of scientific terminology.

ACTIVITY

# How can stars be big?

***Developmental***

## Focus

This activity provides opportunities for students to develop an understanding of the effect of distance on the apparent size of an object and how this affects the apparent size of objects in the sky.

Students compare the apparent and actual size of two objects at various distances from the observer.

## Materials

- camera
- a cover for a class-made book in which to record comments about the experience
- a large ball such as a soccer ball or basketball

## Teaching considerations

Photographs taken with a digital camera, video camera or Polaroid camera allow students to compare and discuss images without delay. Copies of photographs taken in Part 1 are needed for Part 2.

Select a suitable area such as the school oval for placing and viewing a chosen object (for example, a soccer ball) for both near and far viewing. The object should be placed in position before the students come into the area to begin their observations.

Students are encouraged to make links between the effect of distance on the apparent size of the chosen object and the perceived size of celestial bodies that are visible at night.

The activity may be extended to viewing large items at varying distances — for example, aircraft in the sky.

***Students with vision impairment***

Some students with vision impairment may need assistance for this activity. Seek advice from their support teacher.

## Working scientifically

Time: Part 1, 60 minutes; Part 2, 15 minutes as a whole group plus individual time with each student

**Looking for patterns and meanings**
**Making comparisons**
**Making links**

### Part 1: Observe the object

► Students observe from the edge of the oval the object that has been placed in the centre of the oval. They compare its apparent size to that of trees and people at various distances from the viewer and, based on their observations from a distance, suggest what type or size of 'object' or 'ball' it might be. A photograph is taken of the object in the distance with a student's face in the foreground.

► Students walk up to the ball, hold it near their faces and compare the size of the ball with the size of their heads. They photograph the ball held beside a student's face and discuss the effect of distance on apparent size as the explanation for the phenomenon they have just observed.

► Students decide how far away the ball would need to be placed for it to appear approximately half the size it originally appeared when placed in the centre of the oval and viewed from the boundary. They test their predictions and adjust the distance until they are satisfied that the apparent size of the ball at the new distance is approximately half the size it was in its original position. They photograph the face of a student near the camera with the ball visible in the distance. They measure and compare the new distance with the initial distance. The photographs are printed and displayed with annotations and explanations.

**Part 2: Response**

► Students view the photographs of their classmate's head and the ball and identify reasons for the apparent change in size of the ball. They make links between the apparent size of the ball and its real size, and the apparent size of celestial bodies and what must be their actual size.

► Students respond to the activity by composing a contribution to the class book appropriate to their literacy skills.

**Gathering information about student learning**

Sources of information could include:

- students' contributions to the class book.

ACTIVITY

# What makes them smaller?

*Developmental*

## Focus

This activity provides opportunities for students to develop their concept of perceived size related to distance.

Students investigate the visual effect of decreasing a shadow puppet's size as a model of the effect of vast distances in space on sizes of objects.

## Materials

- overhead projector and screen (more of both if available)
- a coloured overhead transparency of a landscape depicting a familiar bush scene (optional)
- shadow puppets and materials suitable for making simple puppets
- classroom display of published materials, particularly photographs of celestial bodies
- class book established in the activity 'How can stars be big?' (p. 17)

## Teaching considerations

On an overhead transparency create a landscape that includes land and sky meeting on a treed horizon with a tall tree in the foreground.

Resource Sheet 2

Cutouts shaped like wallabies make good shadow puppets. Draw and cut out shapes to suit your storyline, or photocopy the illustrations on Resource Sheet 2 to suit the wallaby story that follows. Make two photocopies, one larger than the other, so that the shadow puppets made from these photocopies can be used to illustrate the difference in apparent size of objects seen nearer to or farther from the viewer. Attach each to 20 cm lengths of pipe cleaners or other support.

Prepare a simple puppet sequence with a story — for example: 'A wallaby lying under a tree saw his cousin in the distance. After a while his cousin came and joined him under the shade of the tree. Together they got up and went to the far waterhole. One lay down and the other stood watching for their friends to arrive.'

Explain to students that the shadow puppet theatre activity is in two parts: a teacher demonstration, and their participation. For the first part of this activity, seat the students below the level of the overhead projector so that they cannot see the puppets being manipulated. If there is only one overhead projector, the second part of the activity may be done with small groups in rotation.

***Students with vision impairment***

Some students with vision impairment may need assistance for this activity. Seek advice from their support teacher.

## Working scientifically

Time: Part 1, 10 minutes; Part 2, 15 minutes

**Analysing**
**Improvising and performing**
**Reflecting and considering**

### Part 1: Puppet theatre demonstration

▶ Students discuss the purpose of the activity then watch the puppet show from a seated position. As they watch it a second time with appropriate pauses, they point out the wallaby on the screen they judge to be farther from or closer to them, and discuss how they made that decision.

► Students stand to watch the teacher manipulating the puppets during a third performance. On this occasion, appropriate pauses allow students to grasp the effect of decreased size creating an illusion of distance.

**Part 2: Student puppet theatre**

► Students collect the puppet-making materials, make their own puppet and create shadows using an overhead projector. They vary the position of the overhead projector to create larger or smaller shadows.

► Referring to the classroom display, students discuss the notion of the sun, moon and stars being very large and being very large distances from the Earth and each other.

**Gathering information about student learning**

Sources of information could include:

- students' discussions, inferences and puppet demonstrations;
- additional entries in the class book from the activity 'How can stars be big?' (p. 17)

ACTIVITY

# Investigating differences

***Developmental***

## Focus

This activity provides opportunities for students to develop an understanding of the vast distances between objects in space.

Students investigate the visual effect of increasing the distances between themselves and objects of various sizes and record their observations.

## Materials

- five balls ranging in diameter from 2 cm to 30 cm
- Resource Sheet 3, 'The effect of distance'

## Teaching considerations

This activity needs to be conducted in an area such as the school oval.

Assist students to investigate answers to questions arising from the topic — for example:

- Things seem to disappear in the distance. Why do some things seem to disappear faster than others?
- How far away do we have to be from objects before they disappear?

Involve other class members in the activity — for example, they could:

- brainstorm possible ways of investigating the questions;
- predict the outcome of the investigations;
- suggest a recording format for each investigation;
- discuss the final comparisons between actual results and predicted results.

Modify ideas described in this activity to suit individual needs. Further questions suitable for investigation are listed in *Teaching Primary Science Constructively*, p. 336 (see 'Support materials and references', p. 6) — for example:

- Are stars in the same place every night?
- What changes are there in the shape of the moon?
- What path does the moon take across the sky?
- When are shadows the shortest or longest?

***Students with vision impairment***

Some students with vision impairment may need assistance for this activity. Seek advice from their support teacher.

## Working scientifically

Time: 30 minutes

**Making plans**
**Predicting**
**Making comparisons**
**Creating tables**
**Responding**

▶ Before the activity, students discuss and amend the suggested procedure to be followed and decide how they will record their observations.

Suggested procedure:

1. Take five different-sized balls out to the oval and line them up at the boundary.
2. Turn and walk away. Count the steps. After ten steps, turn back to check if any one of the balls is now too small to be seen from that distance.

Resource Sheet 3

3. Write 'yes' or 'no' on Resource Sheet 3 in the appropriate places.
4. Repeat steps 2 and 3 until none of the balls can be seen.

▶ Students predict, using 'number of steps' as the measure, how far they will have to walk before they are unable to see any of the balls. They record their predictions.

▶ Students carry out their investigation, recording observations on Resource Sheet 3. They compare their results with their predictions and write comments about the visual effect caused by increasing the distance between an object and an observer. They draw a picture illustrating what they observed.

### Gathering information about student learning

Sources of information could include:

- students' contributions to discussions;
- students' written responses on the resource sheet.

ACTIVITY

# Night-time sky observations

*Culminating*

## Focus

This activity provides opportunities for students to observe features and events in the sky and report on them in a scientific manner.

## Materials

No particular materials are required.

## Teaching considerations

Through observing the daytime sky together at school, drawing what they see, and reporting on it together, students focus on performing the kinds of activities that astronomers have engaged in for centuries. Students can then observe the night sky at home. By drawing what they observe and using drawings to report on their observations at school, students focus on the scientific understandings of the Earth and beyond that they have gained.

***Preparation***

Prepare a letter to parents explaining the task for students to complete at home. Consider possible cultural issues relating to students looking at particular celestial bodies — for example, in some communities there may be cultural restrictions regarding observing the moon. Students may tap into adults' knowledge about the night skies.

Observe the night sky yourself as preparation for this activity. Time the activity during a dry period when the sky is clear.

***Safety***

Inform students about ways of protecting themselves from the sun during outdoor activities.

***Students with vision impairment***

Some students with vision impairment may need assistance for this activity. Seek advice from their support teacher.

## Working scientifically

Time: Part 1, 45 minutes; Part 2, student independent time; Part 3, 2 minutes per student

**Collecting information**
**Making observations**
**Illustrating**
**Summarising and reporting**

### Part 1: Daytime sky observations

▶ As a class students discuss their understanding of observing the sky in a scientific way.

▶ Students leave the classroom (if necessary) to observe and draw two scenes:

- what they can see in the sky now;
- what they know to be visible in the daytime sky at other times but is not there currently.

▶ On returning to the classroom, students display their drawings in two separate areas — what can be seen in the daytime sky today and what may be seen on another day.

► Working in a whole class group, students prepare an oral report about the accumulated findings represented in the drawings. They record the report on an audiotape or a videotape for future reference.

**Part 2: Night-time sky observations**

► Students observe the night sky and draw what they see. In class they use their drawings to prepare a report on their observations in a scientific manner appropriate to their development.

**Part 3: Reporting**

► Students display their drawings of the night-time sky and report on their observations in writing or on an audiotape or a videotape. They compare the features of the sky observed by day and by night.

**Gathering information about student learning**

Sources of information could include:

- students' contributions to discussions;
- students' drawings;
- students' reports and comparisons.

ACTIVITY

# So, what are they?

*Culminating*

## Focus

This activity provides opportunities for students to reflect on and report their understandings of the obvious features of the Earth and sky.

Students summarise what they have learned and publish these findings as a class book: 'What I have learned about space'.

## Materials

- word processors, paper, printers
- art materials to illustrate books
- Resource Sheet 4, 'So, what are they?'

## Teaching considerations

This activity may be open-ended or teacher-directed. The choice of topics may be confined to one category (for example, 'Celestial bodies that I have learned about') or different categories may be offered to different groups of students.

This activity is based on a Think, Pair, Share strategy. This involves students:

- thinking of all the ideas they have that are related to the stated topic;
- pairing off with another student to exchange and combine ideas;
- sharing the ideas of their pair with those of several other pairs in a larger group.

## Working scientifically

Time: Part 1, 25 minutes; Part 2, 25 minutes

**Suggesting**
**Formulating and elaborating ideas**
**Clarifying ideas and concepts**
**Explaining ideas and decisions**

▶ Students use the Think, Pair, Share strategy to choose a topic or topics that they wish to include in a class book. They prepare a sheet listing their current ideas about their selected topic(s). The teacher edits and publishes them as a class book. The following are examples of what students might write:

- The sun is a very, very bright light. When it appears in the sky, night changes into day.
- The moon reflects the sun's light. It appears in the sky sometimes by night and sometimes by day.
- Planets can be seen in the night sky when they reflect the sun's light.
- Stars are bright lights like the sun. We can't see them during the day because of the strong light from the sun.
- Comets have tails of dust and frozen gases that reflect light.
- Satellites are made by people and reflect the sun's light at night. They are very useful.

**Resource Sheet 4**

▶ Students complete one cloze activity at a time on Resource Sheet 4. They glue each completed cloze activity into their books and illustrate the statement, referring to the research materials in the classroom.

► Students ensure that their statements are factual and scientifically accurate. They display and explain their books to the class.

**Gathering information about student learning**

Sources of information could include:

- students' contributions to discussions;
- students' books containing definitions and explanations.

ACTIVITY

# What do you know now?

*Culminating*

## Focus

This activity provides opportunities for students to demonstrate in interviews their understandings of the Earth, the sky, the region beyond it, and celestial bodies.

## Materials

- the same list of interview questions used in the introductory activity 'What do you know?' (p. 9)

## Teaching considerations

This is the second of two interviews, the first having been conducted at the beginning of the sequence of activities. The same questions are asked in both interviews. Ascertain the development of students' understandings by comparing students' answers on each occasion. Plan for other adults to be available to assist in this activity.

Explain to students when and where the interview will take place.

Invite students to bring simple objects and materials to model their explanations if they wish.

Consult the teaching considerations for the activity 'What do you know?' (p. 9).

## Working scientifically

Time: Part 1, 15 minutes; Part 2, 15 minutes each student

**Clarifying and challenging**
**Looking for patterns and meanings**
**Clarifying ideas and concepts**
**Formulating and elaborating ideas**
**Reflecting and considering**
**Describing**
**Discussing thinking**

### Part 1: Whole class introduction

► Students reflect on their own understandings of the topic of Earth and beyond, and the importance of the continued development of these understandings through investigation, and communication with others.

► Students peruse the display on the theme of Earth and space.

► The teacher explains that, to analyse the new understandings they have gained about Earth and beyond, they will be interviewed using the same questions as in the activity 'What do you know?'.

### Part 2: Interview

► Students discuss, draw or construct a model as they answer the interview questions to explain and elaborate their understandings of the Earth, the sky, the region beyond it, and celestial bodies.

## Gathering information about student learning

Sources of information could include:

- students' interviews;
- students' drawings or models.

# Suggested interview questions



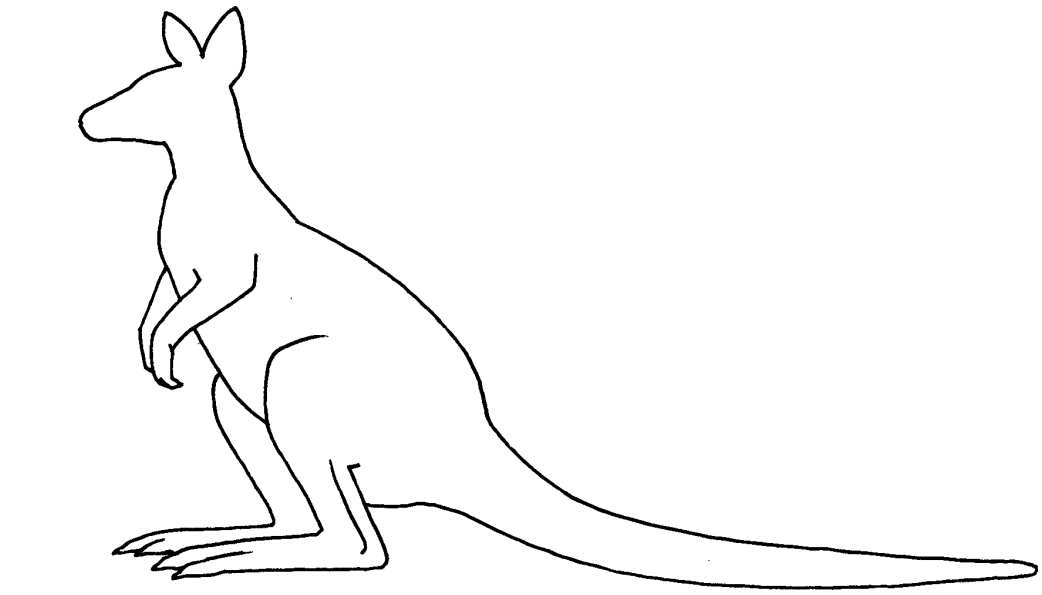
Ask open-ended questions. If working with other teachers, compile the questions together. The backgrounds and experiences of the students should help determine the content.

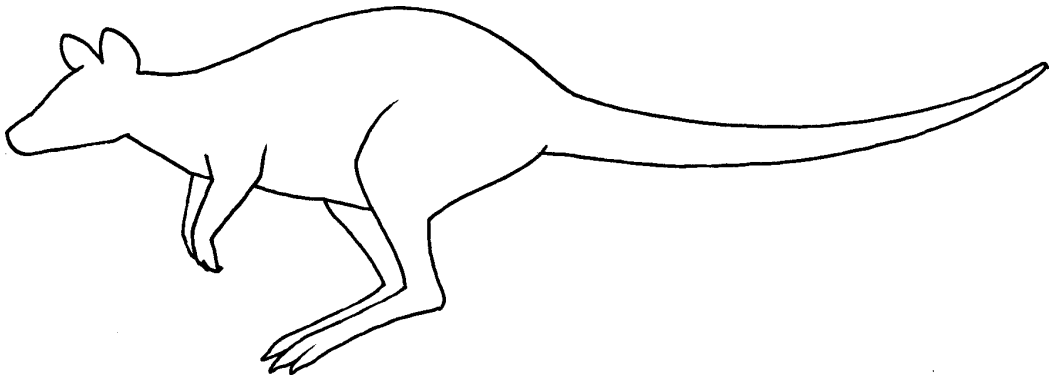
- Why is it dark at night?
- What do you know about the sun/stars/moon?
- How big is the sun/moon?
- Why can't we see the sun at night?
- What colour is the moon? Does it ever change colour?
- Where do clouds come from?
- How are shadows made?
- What things can you see in the sky at night? Why can't you see them all in the daytime?
- How long do you think it would take you to get to the moon?
- What shape is the Earth?
- Imagine you go on a rocket trip into space for a day and you look out the window and see the Earth. Draw a picture of the Earth to show what it would look like. Add some people to show where they would live, some clouds and some rain falling from the clouds.

# Three wallabies

R2

Resource Sheet 2





# The effect of distance



**My predictions:** Number of steps I will take before I cannot see the balls.

| Size of balls |  biggest |  |  |  |  smallest |
|---|---|---|---|---|---|
| I will not see ball after . . . | _____ steps | _____ steps | _____ steps | _____ steps | _____ steps |

**On the oval:** Can you still see the ball? Write 'yes' or 'no'.

| |  |  |  |  |  |
|---|---|---|---|---|---|
| After 10 steps | | | | | |
| After 20 steps | | | | | |
| After 30 steps | | | | | |
| After 40 steps | | | | | |
| After 50 steps | | | | | |
| After 60 steps | | | | | |
| After 70 steps | | | | | |

Comments: _____

_____

_____

# Cloze activity: 'So, what are they?'




Fill in the blanks with words that make sense.

The sun is a very, very bright _____.
When it appears in the _____, night changes into _____.

The moon reflects the sun's _____.
The moon appears in the _____ by _____ and by day.

Planets can be seen in the _____ sky. They reflect the sun's _____.

Comets have _____ of dust and frozen gases that reflect light. Some appear in the night _____ only once in a lifetime.

Stars are bright lights like the _____.
We can't see them during the _____ because of the strong _____ from the sun.

## Acknowledgments

This module is based on material developed by Kym Dickman in association with the Queensland School Curriculum Council.

**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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