Solomon Islands

Primary Science

TEACHER'S BOOK Year 4

PEARSON

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Primary Science

TEACHER'S GUIDE Year 4

PEARSON

Pearson Australia

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Contents

Introduction to *Teacher's Guide Year 4*		4
Resources for Primary Science		4
Using the glossary in the Learner's Book		7
Time allocation for Primary Science		8
Assessment		9
Year 4 Primary Science program		10
Chapter 1	Organisms and their environment	11
Chapter 2	Cycle of life	22
Chapter 3	Heat	28
Chapter 4	Push and pull	38
Chapter 5	Exploring water	47
Chapter 6	Farming	58
Chapter 7	The stars, the Earth and the cycle of time	68
Appendix	Glossary for Learner's Book	75

Introduction to *Teacher's Guide*

This Teacher's Guide supports the *Solomon Islands Primary Science Learner's Book Year 4*. Year 4 teachers should use it to help them to use the Learner's Book during lessons.

For each chapter of the Learner's Book, there is a section in the Teacher's Guide. The first page of each section gives the sub-strand statement, the learning outcomes and the indicators for the Learner's Book chapter. The material on this page is taken from the Primary Science syllabus.

The main pages of each section are arranged in columns:

- column 1 gives important science processes and skills being developed in the chapter
- column 2 mentions resources that are needed for the learner activities and also gives the reference to the *Primary Science Encyclopedia* (Matthew Cole (2005) Explore Science, Pearson Education, South Asia)
- column 3 gives the supporting activities for each page of the Learner's Book
- column 4 gives the reference to the pages in the Learner's Book.

Each chapter section finishes with the answers to activities and assessment activities in the Learner's Book.

At the beginning of the Teacher's Guide, there are also sections on resources, the time allocation for science and information about how to use the assessment event recording chart. The Learner's Book glossary is included at the end of the book.

Resources for Primary Science

Following is a list of materials and equipment that a teacher should have. To complete practical activities, learners need to have these items available.

General resource items

Learners can collect many of these items. The school should use some of its grant money to buy the other items in the shops. They are all available.

Aluminium foil
Balloons
Bamboo pipes
Batteries
Bicarbonate of soda
Blotting paper
Blu Tack
Bricks
Buckets
Candles
Cardboard
Chalk
Cling wrap
Clothes pegs
Coconut frond stalks
Coconut shells
Coins
Coloured card
Coloured pencils
Corks
Cotton wool
Counters, marbles, stones, shells, bottle tops, seeds, buttons
Crayons
Drawing pins
Egg cartons
Elastic bands
Empty containers and cans
Eraser
Food colouring
Funnels
Glue (carpenter's white PVA wood glue)
Glue stick
Gravel
Jars and bottles with lids
Lids (from jars)
Lime juice
Magnets
Masking tape
Match boxes
Measuring jugs
Metre sticks
Milk packets
Mirrors
Modeling clay
Nails, screws, pins
Needles
Nuts and bolts
Oil
Paint brushes
Paper clips
Paper towels
Pieces of clothing

Pieces of wood
Pipe cleaners
Plastic bags
Plastic blocks
Plastic cups, knives, forks
Protractor
PVA wall paint
Rulers (30 centimetre and 1 metre)
Sago palm pith
Sand
Scissors
Sellotape
Set square
Sieve
Soap
Soft drink bottles
Split pins, safety pins
Squared paper
Sticky labels
Stiff cards
Straws
String
Styrofoam
Thread
Toothpicks
Torches
Trundle wheel
Vaseline
Vines

Items for specific strands

The learners can collect many of these items. The school should use some of its grant money to buy the other items in the shops. They are all available.

Life and Living

Bathroom scales
Cactus
Clip board
Dinosaur toys
Dried beans
Flat tray
Fossil samples
Hand lens
Hoops
Magnifying glass
Measuring tape
Nets
Newspaper clippings about energy resources, environmental pollution, etc.
Photographs and charts of animals and plants at different stages of their life span
Photographs and charts of animals and plants from different climates showing special adaptations to their environments
Photographs showing people of various ages, sizes, shapes and cultures
Pictures or charts of the digestive system
Pictures or photos of natural features and different environments
Postcards
Reference books about dinosaurs
Shoe boxes

Energy and Change

Bamboo pipes
Black paper
Clickers
Digital alarm clock
Earmuffs
Electric appliances for display
Eye-dropper
Guitars
Horseshoe magnet
Iron filings
Machine toys
Maracas (improvised)
Mudi musical instrument
Pictures of dolphins and whales
Rattle
Telephone
Traditional fire making (wood rubbing)
Torch and batteries
Tubes
Ukulele
Wheelbarrow
Whistle
Wooden drum

Natural and Processed Materials

Cocoa
Cordial
Dishwashing liquid
Foam
Jam
Kettle
Kitchen sponge
Perfume
Pictures of snow and snow flakes, germs or crystals
Salt
Steel wool
Sugar
Szeba drinks
Vinegar

Farming

Bucket
Farming tools
Hose pipes
Pictures of different climates
Potting mix
Rubber gloves
Soluble fertilizer

Earth and Beyond

Ball
Chart showing the months and seasons of the year
Charts of night sky
Globes
Jars with screw top lids
Kite (improvised)
Magnifying glass
Masking tape
Modeling clay
Photograph of nocturnal animals
Photographs of different types of weather
Picture of sun clock
Pictures of sand dunes
Ping-pong ball
Powerful flash light or lamp
Television and video tapes
Thick paper plates

Using the glossary in the Learner's Book

The *Primary Science Learner's Book Year 4* has a glossary at the end of the text summarizing the meaning of important concept words. The glossary is arranged alphabetically. A copy of the glossary is included as an appendix in this Teacher's Guide. Some of the meanings in this teacher's version are slightly different from those in the Learner's Book.

Time allocation for Primary Science

The time available for science in Year 4 is five periods of 40 minutes per week. This table show the total subject time allocation for Years 4–6.

Primary curriculum profile: Years 4–6

Subject	Periods/ week	Minutes/ period	Minutes/ week	Hours/ week	%/week
English Language	10	40	400	6.67	26.32
Maths	8	40	320	5.33	21.05
Science	5	40	200	3.33	13.16
Social Studies	5	40	200	3.33	13.16
Health Education	2	40	80	1.33	5.26
Physical Education and Sports	2	40	80	1.33	5.26
Creative Arts (including Music)	2	40	80	1.33	5.26
Religious Education	2	40	80	1.33	5.26
ICT	2	40	80	1.33	5.26
Total	**38**		**1520**	**25.31**	**100.00**

Assessment

	Term 1			Term 2			Term 3			Term 4		
Strand	**Life and Living**	**Life and Living**		**Energy and Change**	**Energy and Change**		**Natural and Processed Materials**	**Farming**		**Farming**	**Earth and Beyond**	
Assessment event	Items 1 and 2 in the Learner's Book, page 21	Items 1 and 2 in the Learner's Book, page 43	**End of term test** (out of 20)	Match sentence beginnings to their correct endings in the Teacher's Guide, page 35	Items 2 to 4 in the Learner's Book, pages 81–82	**End of term test** (out of 20)	Choose the correct answer for items 1/2 and 3 in the Teacher's Guide, page 53		**End of term test** (out of 20)	Write in column 2 the correct vegetative propagation methods for the food types in column 1 in the Teacher's Guide, page 67	Items 1 and 2 in the Learner's Book, page 149	**End of term test** (out of 20)
Name												
Nancy	A	PA		A	A	16	A	PA	18	PA	A	18
Linda	PA	A		A	PA	16	A	PA	17	NA	A	12
Marceline												
Rosalyn												

Key
A = LO achieved
PA = LO partially achieved
NA = LO not achieved
An assessment activity is suggested for each chapter in the textbook. These are in the Learner's Book or in this Teacher's Guide. Record the assessment item and the learner's achievement on an assessment record sheet like the one shown below.

Year 4 Primary Science programme

This chart presents the program of work for Year 4 Science. It shows the strands and sub-strands of the Primary Science syllabus. The chart shows the number of weeks and the number of periods for each sub-strand. For example, Term 2 sub-strand: Heating and Cooling; strand: Energy and Change; 20 periods; 4 weeks.

Term 1											Periods
Week	1	2	3	4	5	6	7	8	9	10	
		Organisms in the Environment					Cycle of Life				40
		LL					LL				
		25 periods					15 periods				
		5 weeks					3 weeks				

Term 2											Periods
Week	1	2	3	4	5	6	7	8	9	10	
		Heating and Cooling				Forces					40
		EC				EC					
		20 periods				20 periods					
		4 weeks				4 weeks					

Term 3											Periods
Week	1	2	3	4	5	6	7	8	9	10	
		Exploring Water						(ESF)			40
		NPM						F			
		30 periods						10 periods			
		6 weeks						2 weeks			

Term 4											Periods	Periods for year
Week	1	2	3	4	5	6	7	8	9	10		
		(ESF)			Earth Movements						40	160
		F			EB							
		15 periods			25 periods							
		3 weeks			5 weeks							

Strand titles

LL = Life and Living EC = Energy and Change NPM = Natural and Processed Materials EB – Earth and Beyond F – Farming

Chapter 1 Organisms and their environment

Suggested periods: 25 (5 weeks)

Strand: Life and Living

Sub-strand statement

The environment is made up of living and non-living things. Living things in the environment are identified by their functions and behaviour. Many types of interactions take place within the environment. Organisms interact with one another as well as with other elements of their environment. An ecosystem is a specific area within the environment in which a set of living things interact with each other. Humans have great impact on other organisms as well as on the environment.

Learning outcomes

Learners should:

- know the characteristics of the local environment (K)
- understand that an ecosystem is a network of living and non-living things in an area (U)
- recognize some similarities and differences both within and between groups of plants and animals (K)
- differentiate amongst the terms organism, habitat, community and population (U)
- appreciate that animals and plants depend on the environment for food and shelter (V)
- know that human impact causes negative changes to ecosystems. (K)

Indicators

Learners should be able to:

- describe three physical characteristics of the local environment
- use the observed characteristics of the local environment to identify the ecosystem type

- plan and carry out a survey on a selected local ecosystem
- state some characteristics of plants and animals
- state the meaning of the terms organism, habitat, community, population and ecosystem
- identify a habitat within the local ecosystem and name some organisms in the habitat that depend on each other and/or the environment for food and shelter (coral reef or rainforest)
- identify the effect of human activities on an ecosystem.

Processes and skills	Resources	Teacher's support notes	Learner's Book
Observe and collect data on places that undergo changes, both natural and human made.	*Primary Science Encyclopedia* (Pearson), pages 166–7, 174–7 Area of the school environment	**Activity 1** The learning outcomes are regular observation, recording changes, keeping a diary, understanding that a place undergoes changes, both natural and human made. Choose a place near the school that can be easily visited each day for a week. The place should have natural organisms in it, like plants and trees. It is good to have human made things in the place also, for example a copra or cocoa drier, garden seedling beds, water supply tap.	Page 2
		Looking at the tropical rainforest Most schools in the country are near an area of tropical rainforest. The class should visit such an area. Learners should observe in reality what is shown in the picture on the page of the textbook. Identify interactions between living things in the rainforest that you visit.	
		Mangrove swamp Visit a mangrove ecosystem, if the school is on the coast. Learners list living and non-living things they observe. Identify some interactions between the living things in the mangrove swamps.	
Observe and record specific interaction between living things.	*Primary Science Encyclopedia* (Pearson), pages 166–167 Area of the school environment	**Activity 2** A good way to assist learners to focus on these questions is to go outside and find real examples. Then they can answer the questions based on real experiences. Find a place near the school. Observe how living things interact with each other in the environment. The place should have organisms like plants, flowers and insects. Places like a riverbank give opportunities for observing interactions—the long grass, seeds floating in the river, seeds lying on the ground, animals in the water.	Page 5

Processes and skills	Resources	Teacher's support notes	Learner's Book
		Activity 3 **1** If possible, observe places where puddles of water are standing after rain. Ask why there are puddles in some places only. Where has all the rain water gone—into the Earth, drained away, evaporated? **2** The moss on the tree trunk is clearly more pronounced on the shady side of trees. **3** The answer to this question is very clear when one is outside, seeing the difference between shady area and non-shady area. There is not much grass in an area under a tree. Learners should make comparisons. **4** The Solomon Islands rainforest environment has orchids—an epiphyte.	Page 6
Observe and record actual human activities in the real environment.	*Primary Science Encyclopedia* (Pearson), pages 198–200	**Activity 4** Take learners to observe actual sites before answering the questions. Examples: a log pond or new area cleared for garden; nearby reef destroyed by dynamite; nearby beach or sea front used as rubbish disposal area; children's park. Identify how human activities affect other organisms living in these types of environments.	Page 7
Observe and describe interactions between non-living and living things in different habitats.		Three important non-living parts of the environment: • climate • landscape • soil. Visit and observe coconut palms growing in sand and mangroves growing in clay soil. How do different plants grow well in different types of soil? **Habitats** Visit a fresh water habitat. Learners observe and list living and non-living things in the fresh water habitat.	Page 8

Processes and skills	Resources	Teacher's support notes	Learner's Book
Observe and identify animals found in the log habitat.	Area in or near the school	**Population** Identify a range of examples to support the textbook explanation of the term population, for example ants in an anthill, birds in a mango tree, cockroaches in a dark, damp cupboard, frogs in a pond, shoal of fish on a reef.	Page 9
List and compare organisms found in tree and log habitats.		Visit a rotten log habitat and list animals found on the site.	
Observe, list and share with others the organisms found in the mangrove swamp habitat.	*Primary Science Encyclopedia* (Pearson), page 77 Area near the school	**Activity 5** Visit a mango tree habitat. Record or list animals observed. Ask learners to compare the rotting log and mango tree habitat.	Page 10
		Mangrove swamp Visit a mangrove swamp habitat, if possible. Ask learners to list the living things they observe in the habitat. Ensure that groups share their findings.	Page 11
Observe, record and describe organisms in the seashore habitat.	*Primary Science Encyclopedia* (Pearson), page 166	**Seashore** Visit a seashore habitat, if near the coast. Ask learners to make a record of living things found in the habitat. Do this by drawing a sketch of a rock pool and show what is observed.	Page 12
		Activity 6 Use the experiences from the visits to habitats to generate the material for learners' work.	Page 12

Processes and skills	Resources	Teacher's support notes	Learner's Book
	Primary Science Encyclopedia (Pearson), page 209	**Energy from the Sun** Learners should visit a vegetable garden on a sunny day and discuss how the young plants get energy for growth.	Page 13
	Primary Science Encyclopedia (Pearson), page 166	**Ecosystem** Explain the idea of an ecosystem to learners by referring to the concept map in the Learner's Book. Help learners to appreciate what the concept map is—a chart presenting a summary of the ideas in the chapter.	Page 14
Observe and record good and bad examples of human impact on a rainforest.		**Humans and the environment** If possible, visit a nearby forest where humans have been clearing the vegetation. Observe and record changes seen after clearing of the rainforest. Use these questions to help learners brainstorm their observations of deforestation:	Page 15
Observe instances of deforestation.	*Primary Science Encyclopedia (Pearson), page 201 Area near the school*	• What was the forest like before? • What human activity is taking place? • What benefits are there for people? • What are some disadvantages for other living things? • What is the impact on the forest? • Are there impacts on other parts of the environment?	Page 16
		Activity 7 Visit a rainforest area near the school that has been cleared for a new garden site. Collect dead or living organisms found in the area. Discuss the collection of organisms that are in danger. List them.	Page 16
		Activity 8 Learners study the photos in the book. Find out whether learners know any other living things that are in danger.	Page 16

Processes and skills	Resources	Teacher's support notes	Learner's Book
Identify, observe and keep a diary on nearby polluted areas such as sewage beach, industry area, unused land.	*Primary Science Encyclopedia* (Pearson), pages 198– 200 Industrial areas in a town	**Pollution** Learners visit the following areas: • sewage area • beach • industrial area • unused land.	Page 17
	Primary Science Encyclopedia (Pearson), pages 198–201	Ask them to note things that are bad for the environment. Use the glossary entry for pollution to help summarize the observations.	
Identify and comment on what happens in a conservation area.		**Conservation** Examples of conservation areas in this country are: • Arnavon Island Community Marine Conservation • Lake Tenggano in East Rennel.	Page 18
List ways of conserving birds in the Solomon Islands.		**Activity 9** Encourage learners to answer the questions based on their experiences during the visits to polluted areas. List different types of pollution caused by humans.	Page 18
Write a summary of what has been learnt in this chapter.	*Primary Science Encyclopedia* (Pearson), pages 166–167, 198–201	**Chapter review** Go through the chapter review to revise the work in the chapter. This can be a single lesson. Refer back to the appropriate pages of the chapter.	Page 20
		Assessment Give learners revision questions 1 and 2 as the assessment event for this chapter. Record the performances of each learner. Use the assessment table shown on page 9.	Pages 20–21

Activities and assessment answers

Activity 1 (page 2)

Examples of the kind of changes to be observed during a week:

- branch of a tree fallen down
- flowers appearing
- firewood brought for a copra drier
- a rotten log moved by a person
- new planting bed in a garden
- a water tap leaking.

Understanding the environment (page 3)

Some of the interactions seen in the tropical rainforest are:

- snake on the ground
- different types of bird on tree tops
- man hunting for wild pigs
- wild pig digging
- people harvesting wild kasume fern
- frog jumping and catching grasshoppers
- spider weaving its web to catch food
- ants eating materials on other trees
- birds nesting in the branches of a tree
- plants and vines growing on trees
- ants making a nest in a tree.

Mangrove ecosystem (page 4)

Interactions that learners will observe:

- pigeon making a nest in a tree
- people picking up mangrove fruit
- people picking up shellfish and crab in the mangrove swamp
- fish taking shelter under mangrove trees
- people cutting mangrove tree for houses
- mushrooms growing on mangrove logs
- small fish hiding under dead shells, stones and mangrove roots.

Activity 2 (page 5)

Interactions that learners will observe:

- plants compete for light, water and living space
- animals depend on plants and other animals for food

- flowers depend on insects and wind for the pollination process—insects and wind carry pollen from the male part of a flower to the female part of another flower.

Examples of insects and animals affecting other organisms are:

- flower pollination
- ants eating dead organisms
- malaria mosquitoes infecting humans
- flies carrying germs from faeces to food eaten by people
- seeds are moved to other places by animals, for example flying foxes eating mangoes
- animals help plants by spreading their seeds on their fur or in their faeces.

Activity 3 (page 6)

1 After heavy rain, there are puddles in clay soil and earthworms and snails on the surface.
2 Moss plants usually live in damp, shady areas.
3 Ground around a shady tree is wet.
4 A rainforest environment has eiphytes. Orchids are an example of epiphytes in the Solomon Islands.

Activity 4 (page 7)

1 Yes, the homes of many organisms are destroyed when we cut down trees.
2 Flying fox, opossum, wild pig, prawn.
3 Yes, our land and water is polluted:
   - when logging companies operate in an area because they:
     – spill oil on the land for gardening
     – cause the river to be dirty with silt
     – make tracks which form gullies
     – leave damaged logging trucks on the land.
   - when rubbish is disposed of in the school compound, village or town.
4 Some places are not allowed to be used for gardening, hunting or building houses because they are preserved for special reasons such as leisure activities, picnics or as a children's play park or they are taboo sites.

Activity 5 (page 10)

Rotting log habitat	Mango tree habitat
Bracket fungi	Caterpillar
Toad stools	Butterfly
Wood lice	Bees
Snail	Birds
Beetles	Praying mantis
Flies	Beetle
Ants	Birds nest fern
Termites	Grasshopper
Millipedes	Moss spider
Centipedes	Lichen
	Ants
	Flies

Activity 6 (page 12)

An organism lives in a habitat because it contains all the things it needs to survive. It:

- depends on other living things in that habitat
- has evolved to suit the habitat
- has colonized the habitat over time.

Some organisms that are found in more than one habitat are:

- flies
- ants
- beetles.

These organisms can be found in more than one habitat because of the following reasons:

- food availability
- adaptation to wide variety of conditions.

Activity 7 (page 16)

Clearing of the natural forest by burning and cutting is known as deforestation.

- If we continue to clear the rainforest the results will be:
  - habitat loss—many organisms will be homeless and without food; this has caused many organisms to become extinct

  - biodiversity loss—more than 50 per cent of the species on the Earth have disappeared
  - erosion—top soil is exposed and can be easily washed away
  - global warming—the amount of carbon dioxide in the air will increase.
- Not all organisms will survive in the rainforest habitat—only those which can adapt.

Activity 8 (page 16)

Endangered species:

- parrot
- opossum
- cockatoo
- flying fox
- pigeon bird
- wild pig.

Activity 9 (page 18)

Answers to this question will depend largely on the location of the school (rural or urban). For example:

- town—rubbish disposal in the school area; piling house rubbish in heaps near homes; plastic bottles thrown on the beach and in creeks
- village—human faeces near the village (no latrines).

Activity 10 (page 19)

These birds can be conserved if the country's natural rainforest is preserved and cared for, and if the birds are not killed for food.

Chapter revision (page 21)

1 A

2 D

3 More insects are consumed.

4 The non-living parts of the environment are:
  - the climate
  - the landscape
  - the soil.

  Different species of plants and animals adapt to differing environments (the combination of climate, landscape, soil).

5 D

6 A

7 This is to enable native plants and animals or organisms in the land to survive in their own habitats.

Chapter 2 Cycle of life

Strand: Life and Living

Suggested periods: 15 (3 weeks)

Sub-strand statement:

Animals and plants have different structural reproductive systems. The process of reproduction is different in flowering plants and animals. The stages of development of the human body begin with conception and end with death.

Learning outcomes

Learners should:

- understand the process of reproduction in mammals (U)
- know the process of conception in human beings (K)
- recognize the major organs and organ systems of flowering plants and mammals (K)
- describe the main stages of reproduction in flowering plants (K)
- appreciate that sexual reproduction is used by both plants and animals. (A)

Indicators

Learners should be able to:

- describe the process of reproduction in mammals, from conception to birth
- explain how male and female eggs fuse to make an embryo in the process of conception
- draw diagrams and label them to show the major organs and organ systems in flowering plants and mammals of the local environment
- illustrate pollination, fertilization and seed dispersal in plant reproduction, by identifying real plant parts in the environment.

Processes and skills	Resources	Teacher's support notes	Learner's Book
Observe, identify and make comparisons between birds and mammals.	*Primary Science Encyclopedia* (Pearson), page 21	**Birds and mammals** Bring these pages to life by doing at least two lessons outside, observing a range of mammals and birds in the environment. Ask learners to collect pictures of birds and mammals. Bring the pictures to class. Discuss in what ways birds and mammals are alike.	Pages 24–25
Give a clear explanation about the life cycle of a chosen mammal.	*Primary Science Encyclopedia* (Pearson), pages 56– 62	**Pregnancy** Observe a pregnant female dog, pig or human. Note where the young is growing inside the body. Arrange for learners to ask adults at home how long the young of these species spend inside the mother's body.	Page 26
Make comparisons, observe then explain the term heredity.	*Primary Science Encyclopedia* (Pearson), page 60	**Heredity** Use the definition of heredity in the glossary in the Teacher's Guide. Summarise learner responses on the chalkboard. Observe actual examples of mammal young—dog pups, kittens, piglets, children—to illustrate the Bandit and Lady piece in the Learner's Book.	Page 27
Observe and identify the sex organs in plants.	*Primary Science Encyclopedia* (Pearson), page 104	**Sex organs in plants** Ask learners to pick one hibiscus flower each and bring it back to class. Ensure that learners identify each part. Refer to the illustration in the Learner's Book. Carefully break off the sepals and petals, and open the ovary.	Page 29
Discuss and explain the plant fertilization diagram.	*Primary Science Encyclopedia* (Pearson), page 69	Use the hibiscus flower to show where fertilisation takes place, while following the illustration in the Learner's Book.	Page 29
Observe the role of insects in pollinating flowers.	Area near school	**Fertilization** Learners closely observe insects flying from one flower to another. Link the activity of the insects to the pollination piece in the Learner's Book.	Pages 30–31

Processes and skills	Resources	Teacher's support notes	Learner's Book
Observe insect interaction with flowers.	Flowers in or around the school area	**Activity 2** Find flowers that attract insects. Observe insects moving in and out. Bring flower samples back to class. Ask questions about the flowers. Notice the difference in the shapes of the flowers: • Which flowers are scented? • Which flowers have large petals? • Which flowers are brightly coloured? • Which flowers have lines or nectar guides?	Page 30
Respond to observations on sex organs in flowers.	*Primary Science Encyclopedia* (Pearson), page 69	**Activity 3** Ask learners to collect flowers that: • are both male and female in one, for example hibiscus • have only one sex organ (either male or female), for example corn or maize.	Page 32
Collect fruits and explain reasons for favouring particular fruits.	Fruits from home	**Reminder** Ask learners to bring favourite fruits from home. Ask learners to give reasons for favouring the type of fruits. Identify the seeds in the fruits and the variety of seed types.	Page 34
Collect different types of seeds then describe methods of seed dispersal.	Area around the school, village or market	**Activity 4** Learners collect and bring different types of seed boxes to class. They identify the method of seed dispersal and make a classroom display of seed boxes.	Page 35
Observe and characterize seeds. Identify seed boxes according to type of dispersal.	*Primary Science Encyclopedia* (Pearson), page 190 Different types of seed boxes	**Activity 5** Learners closely observe pictures in the text. They identify and group the seed boxes according to the method of dispersal.	Page 36

Processes and skills	Resources	Teacher's support notes	Learner's Book
Use simple materials to make fruit models from paper.		**Activity 6** Each learner should be given a sheet of paper and a paper clip. Scissors should be available to groups of two or three. Explain the instructions in the book. Try the activity out first, so that you can help learners make the cuts and folds correctly. Do the tracing by using a pin to prick through the diagram on the page to a sheet of paper. Then join up the pricks. Make sure that the cuts are done along all the solid black lines. Make the folds sharp, along the dotted lines. The two pieces folded in opposite directions from A and B are the rotary 'blades' of the model. The paper clip at E acts as a weight; it makes the model float better. When their models are ready, learners should stand on a chair so that the model can fall from a height. The model should float slowly down, twisting in the air, just like the rotor of a helicopter.	Page 37
Prepare equipment for experiment. Observe and record the process of germination.	Bean seeds	**Activity 7** If there are no bean seeds in the school garden, ask learners to bring them from their homes. Explain the term germination or ask learners to explain. Ensure that groups of learners carry out the investigation, so that they observe the process of germination. Summarize the findings of all groups, based on the four questions in the Learner's Book.	Page 38
Make comparisons on fertilization in plants and reproduction in animals. Demonstrate an awareness of the idea of sexual reproduction in humans.	*Primary Science Encyclopedia* (Pearson), page 58	**Human reproduction** This may the first time that Year 4 learners will learn about the reproductive parts of their bodies. At this age, it is best to simply focus on those parts that are external. For the male, these are the testes which make the sperm in the male's sac of skin (scrotum), and the penis which puts the sperm into the female's body. For the female, it is the vagina, the opening which allows the penis to put the sperm inside the female's body. If the sperm meets an egg at the correct time, then the female's egg is fertilized. Discuss how you handle page 40 of the Learner's Book with your teacher colleagues and with the principal of the school. Do not encourage observation of actual body parts. Learners may have observed animals mating. Use these experiences to clarify that men and women also mate .	Page 40

Processes and skills	Resources	Teacher's support notes	Learner's Book
Demonstrate awareness, based on concepts reviewed.		**Chapter review** Do the chapter review. Go through all the items. Refer back to the appropriate pages of the Learner's Book. Ask pairs of learners to work together to follow the concept map. Help them to understand that the arrows connect the steps of the process.	Pages 41–42
		Assessment Give learners Revision questions 1 and 2 as the assessment event for this chapter.	Page 43

Activities and assessment answers

Activity 2 (page 30)

Insects usually suck the liquid nectar in flowers.

Activity 4 (page 35)

Common type of seed boxes that should be collected: jacaranda, tomato, melon, apple, guava, kat-nut, mango, bean, avocado.

Types of seed dispersal

Characteristics	Dispersal
Brush fruit	Carried by wind, humans or animals to new places.
Bermuda grass	Carried by wind, humans or animals to new places.
Kat-nut	Carried by birds or humans to new places.
Coconut	Fruits float on water and carried to new places.
Tomato	Eaten by animals or humans and seeds carried to new places.
Balsam	Splitting or exploding seeds to new places.
Creeping daisy	Carried by wind, birds or animals to new places.
Broad-leaved mahogany	Carried by air to new places.

Activity 8 (page 39)

- Yes, the stages are similar.
- Pollen grain
- Sperm

Chapter revision (page 43)

1 Flowering, animals, pollen, big, inside, nectar

2 D

3 **a** attracts insects
b the male reproductive part of the flower
c by visiting insects or by the wind
d the stigma to the ovary
e the female reproductive parts of the flower
f when it is fertilized by pollen

4 **a** dispersal
b fleshy
c burst
d disperses
e hooked

5 A

Chapter 3 Heat

Strand: Energy and Change

Suggested periods: 20 (4 weeks)

Sub-strand statement

Heat is a form of energy. It can be transferred through the air and through liquids. Objects can gain or lose heat energy. When objects are heated they gain heat energy. They lose heat energy when cooled. Temperature is the measure of how hot or how cold an object is. When substances are heated or cooled, physical changes occur.

Learning outcomes

Learners should:

- know that heating and cooling are to do with gain or loss of heat (K)
- understand that changes occur when substances are heated or cooled (U)
- recognize that temperature is a measure of how hot or cold an object is (K)
- relate the change in temperature of an object to the gain and loss of heat (K)
- know that a thermometer is an instrument for measuring the degree of hotness or coldness (K)
- understand that some solid substances allow heat energy to travel through them (conductors); others do not (insulators) (U)
- understand that heat energy is transferred in liquids by convection (U)
- appreciate that energy from a heat source is transferred through air by radiation. (A)

Indicators

Learners should be able to:

- describe the effects of heating and cooling in solids, liquids and gases
- explain how change in an object is related to object expansion and contraction due to heat gain and heat loss

- read and record the temperature of an object in degrees
- explain the change in temperature in terms of heat gain and heat loss
- record temperature from a thermometer
- identify two examples of heat loss and heat gain in daily life
- list examples of conductors and insulators
- explain why conductors allow heat to travel and insulators do not
- differentiate the process of heat transfer in liquids and air.

Processes and skills	Resources	Teacher's support notes	Learner's Book
Plan an outdoor experience.	*Primary Science Encyclopedia* (Pearson), pages 217–218 Location outside the classroom	**Heat sources** Make sure the class stands outdoors to experience the heat of the Sun so that they can talk about it among themselves.	Page 46
List sources of heat at home.		**Heat sources** Learners should list the sources of heat they have at home.	
Identify materials used as sources of heat. Plan an investigation and keep a record of observations.	Two pots and spoons of the same size and material	**Activity 1** The pots and spoons must be of the same size and material. Fill the pots to the same water level. Allow learners to do this in groups. Pot 1 gets heat directly from the Sun outdoors, while Pot 2 is indoors, in shade. Learners should compare findings, based on observation. This kind of science investigation tests the impact of one variable. All aspects of the investigation in the two situations are exactly the same except for one. In the outdoor situation the Sun provides heat to Pot 1.	Page 48
Plan an experiment to differentiate between heat and temperature.		**Activity 2** Remind learners to be careful when handling hot water. The increase in temperature is caused by heat energy that the water has gained. It takes longer to boil Pot B. The temperature in Pot A and Pot B will be the same when they are boiling. There is more heat energy in Pot B because the bigger volume of water requires more heat energy to raise its temperature to boiling point.	Page 49

Processes and skills	Resources	Teacher's support notes	Learner's Book
Carry out an investigation to show how our sense of touch registers different temperatures.		**Activity 3** Use three glasses of the same size. Place them on the table so that they are clearly visible. Allow two or three learners to do the activity so that they can describe their experiences to everyone. The sense of touch does not tell us anything about the amount of heat energy. Our senses detect that the degree of hotness or coldness in the glasses of water is different.	Page 51
Record different temperatures, using a thermometer.	Thermometer, if possible	**Activity 4** Use a thermometer, if possible. If a thermometer is not available, use touch to sense the different temperatures of a range of items—cold water, warm water, piece of metal exposed to the hot sun, hot rock. You may be able to ask a clinic nurse to come into your lesson and show the class a thermometer.	Page 52
Use a model to illustrate temperatures on a scale.		If you don't have a thermometer, a good way to demonstrate how a thermometer works is to show a liquid expanding upwards in a narrow tube. Set up the glass jar, cork and drinking straw equipment, as on page 55 of the Learner's Book. Another good idea is to make a simple model. Use a cardboard strip. Draw the narrow tube on the strip with a marker pen. Use a ruler to mark the temperature intervals on the scale—from 0 to 100, every ten degrees. Show imaginary temperatures by sliding a paper clip along the scale.	
		Allow learners to read the Learner's Book before getting experience of reading different temperatures and recording the data by using the temperature unit, degree Celsius (°C). If you do not have a real thermometer, show a couple of temperatures on the model. Ensure that learners experiment with real situations in school or at home.	Pages 50–52

Processes and skills	Resources	Teacher's support notes	Learner's Book
Observe and analyze the changes when heat flows through substances.	*Primary Science Encyclopedia* (Pearson), pages 218–219	**Heat gain, loss, expansion, contraction** Solids, liquids and gases expand and contract with heat gain and heat loss. This section gives a range of experiences to illustrate this principle. You have to arrange for learners to have real experiences of how heat loss and heat gain causes contraction and expansion of materials. The bottle and cap activity (Activity 7) is one. Another simple activity is the steel bar and ring investigation. Make a ring of wire by wrapping the wire round a steel bar. Remove the ring. Heat the steel bar in the fire (Be careful! Hold the bar with insulating material). Then try to push the hot bar into the ring. Why won't it enter the ring?	Page 53
Investigate and observe the effect of temperature on the expansion and contraction of water.	Three plastic dishes and three glass bottles	**Activity 8** If you cannot get ice for this investigation, try to have the coldest water you can find (for example from a creek). The bottles should be narrow ones, so that you can observe the differences in water levels. This is another example of an investigation where one thing remains the same, while others change. In this case, the rainwater in the dish for Bottle A remains at the same temperature. In science, this idea is a 'control'. This means that the variable is controlled (stays the same) as others change.	Page 55
Investigate and observe expansion and contraction of a gas.	Three balloons, three bottles and three dishes; ice, if possible (if not, then the coldest water available)	**Activity 9** This investigation works well if there is ice water (or very cold water). The balloons on Bottle B and Bottle C inflate, as the air in the bottles expands when the bottles are set into the hot water. When Bottle C is then set into the dish of ice water (or very cold water), the balloon begins to *deflate*. The air inside contracts, and the balloon shrinks. The pictures in the Learner's Book show the result. This is a very good demonstration of the expansion and contraction of a gas (in this case, the air inside Bottle B and Bottle C).	Page 56

Processes and skills	Resources	Teacher's support notes	Learner's Book
Plan and carry out an experiment to illustrate that a metal wire conducts heat.	Piece of metal wire, candle, drawing pins, blocks of wood	**Activity 10** If you can get enough materials, then several groups can do this at the same time. If not, organize one group to do it while the class observes. Set up the activity as shown in the illustration. Secure the drawing pins to the wire, spaced at 2 cm intervals. Hold them steady until the candle wax has hardened. Set the burning candle between the blocks of wood. The heat from the candle flame must not help the wax to melt. The point of the investigation is to illustrate that heat travels along the wire by conduction. The drawing pin nearest the candle flame drops off first; then the others drop off, one after the other. Ensure that learners do not touch the hot wire. Allow learners to discuss their observations. Ask them to make drawings of the 'before' and 'after' situations.	Page 57
Investigate transfer of heat between materials.	Dishes, bottles, bottle of milk	**Spoons in iced (very cold water) and hot water** Do not simply rely on the illustration in the book. Arrange for groups to do this experiment. They will then experience that the metal spoon becomes warm in hot water and becomes cold in iced or cold water. In this hands-on way, the notion of heat transfer is acquired.	Page 58
Identify and list good and bad conductors of heat.	Range of materials	**Heat conductors** Collect examples of materials that are good and poor conductors of heat, for example a metal teaspoon or piece of steel wire is a good conductor. Poor conductors are plastic, rubber, foam, cork. Use situations that learners know about. Why is an Esky used to store fresh fish in ice? What material is in the walls of the Esky?	Page 60

Processes and skills	Resources	Teacher's support notes	Learner's Book
Investigate the effect of conduction of heat in solid materials.	Pieces of copper and steel wire of same thickness and length, wooden blocks, heat source	**Activity 14** For this activity to work properly, the two pieces of wire (or rod)—copper and steel—must be of the same length and thickness. Place the heat source (small stove or fire) behind the wood block. Heat must not radiate towards the wire. The wooden block prevents that. The only heat the copper and steel wires get is the flame on the tips of the wires. The point is to show that the copper conducts heat faster than the steel. The drawing pin falls from the copper wire first because the wax melts more quickly than on the steel.	Page 60
		Activity 17 This activity is a good illustration of how heat energy flows into a jar of water. The Sun's heat energy moves through the atmosphere by radiation.	Page 61
		Chapter review The activities in this chapter have tried to give experiences of heat on the move. Read the *Primary Science Encyclopedia* pages to understand fully how heat can flow from a hot item to a cold item in one of three ways—conduction, convection or radiation.	Page 63
Draw conclusion and explain terms on the concept map.		Go through the chapter review. Use the concept map and go through all the items. Refer back to the appropriate pages of the Learner's Book.	Pages 62–63

Processes and skills	Resources	Teacher's support notes	Learner's Book
		Assessment Give learners the following item as an assessment for this chapter. Here are two groups of phrases. Column 1 has the beginnings of sentences. Column 2 has the ends of the sentences. Match the groups in Columns 1 and 2 to form five correct sentences. Write out the sentences.	

Column 1	Column 2
1 When water is heated	by convection currents
2 Winds are caused	it expands
3 Heat moves in liquids	ocean currents
4 Dust particles are carried upwards	by currents of warm air
5 Heat from the Sun causes	by convection

Activities and assessment answers

Activity 1 (page 48)

- Pot A
- The Sun is a source of heat energy.
- Pot A
- We are testing to determine the result of a source of heat versus no source of heat.

Heat and temperature (page 49)

- Heat is a form of energy. It is energy that particles of matter have because of their movement.
- Temperature is a measure of the hotness or coldness of something.

Activity 2 (page 49)

- Yes
- Yes
- No, Pot B will take in more heat energy to reach boiling point.

Activity 4 (page 52)

The illustrations show five different types of thermometer. The learners can read all the temperatures. The readings are:

- digital thermometer: 38˚C
- clinical thermometer: 37˚C
- temperature colour indicator: all six temperatures: 35˚C, 36˚C, 37˚C, 38˚C, 39˚C, 40˚C
- brown thermometer: 23˚C
- blue thermometer: 10˚C.

Hotter to colder to same (page 57)

- If a metal teaspoon is left in a glass of hot water it will become hot.

Activity 10 (page 57)

- The droplet of wax that will melt last is the one at the end of the wire.
- Yes, the wire will get too hot to hold.

Hotter to colder to same (page 58)

- If a metal teaspoon is left in a glass of cold water it will become cold.

Activity 11 (page 58)

- Yes
- The warm milk will become cold.

Activity 12 (page 59)

- Warm smoke rises upwards so it is better for a person to crawl on the floor in a smoke-filled room to avoid breathing smoke into the lungs.
- The warm liquid rises in the pipes at the rear of the fridge. A valve makes the liquid expand. The liquid changes to vapour. To change to vapour, the liquid takes in heat. It takes the heat from the freezer section. So the section cools to freezing point.

Good or poor (page 59)

- No, the plastic teaspoon is a poor conductor.

Activity 13 (page 59)

- The person will feel the heat through the wire.
- Yes

Activity 15 (page 61)

The can with only air surrounding it will lose heat most quickly.

Activity 17 (page 61)

Radiation

Chapter 4 Push and pull

Strand: Energy and Change

Suggested periods: 16 (4 weeks)

Sub-strand statement

A force is a push or pull. When force is applied to an object, it acts on the object by changing shape, direction and/or movement. The movement of an object depends on the size of the force acting on it. The greater the force, the greater the speed of the object.

Learning outcomes

Learners should:

- recognize and give examples of different types of forces (K)
- recognize that when things change in shape, begin to move or stop, or change direction, forces are acting on them (K)
- understand that the movement of an object depends on the size and direction of the forces acting on it (by using simple elastic and wind-powered devices) (U)
- recognize that the greater the speed of an object, the greater the force and time taken to stop it (K)
- know that vehicles moving on a road or boats moving in water need time to slow down and stop (K)
- understand that a machine makes it easier to apply a force (U)
- know that levers are one kind of machine (K)
- know that some levers magnify forces; others magnify movement (K)
- recognize that friction is a force that opposes motion (U)
- appreciate that friction can be an advantage or a disadvantage. (V)

Indicators

Learners should be able to:

- identify three different types of forces that indicate changes in shape, movement and stopping

- describe the movement of a kite in terms of size and direction of the force acting on the kite
- compare and contrast the different speeds of three moving objects; contrast the forces required to stop them
- demonstrate, in a practical way, that a moving toy truck needs time to slow down and stop
- recognize that a heavy object exerts a greater force than a light object when both move at the same speed
- identify examples of levers in everyday life, for example crowbar, fishing rod, broom, tongs
- identify examples of levers in the human body
- give examples of situations where friction is an advantage and where it is a disadvantage.

Processes and skills	Resources	Teacher's support notes	Learner's Book
Identify different forces as push or pull. Experience forces during different activities. Classify forces.	*Primary Science Encyclopedia* (Pearson), pages 138–144	**Force** Learners experience applying a force, for example, 'push' by moving a chair away from them and 'pull' by moving a chair towards them. Feel how the force is applied. Differentiate a push force and a pull force, by experience. Some activities involve one force, a push or pull, while some involve both types of force. Do a range of other simple force application tasks and identify which type of force is being applied.	Page 65
Compare results of different actions. Experience change of shape.	Sponge, clay, paper	Ensure that learners experience the situations as shown in the Learner's Book. These establish that there is a change in the status of objects —change in position, shape, direction—when a force is applied.	Pages 68–69
Observe consequences of physical actions on things.	Suitcase (or box with wheels)	**Activity 2** Make sure learners perform the actions as shown in the pictures on the page of the Learner's Book.	Page 69
Demonstrate whether work is done or not done.		**Activity 4** Ensure learners apply forces to objects, to find out if work is done or not.	Page 71
Experience what happens when a force is applied.	*Primary Science Encyclopedia* (Pearson), page 153	Learners observe simple machines that make work easier.	
Use a pulley to raise a flag and identify it as a simple machine.	*Primary Science Encyclopedia* (Pearson), pages 160–161 Scissors, bush knife, wheelbarrow, gears on bicycle	A pulley is used to raise the flag. This can be improvized if the school does not have a flagpole with a pulley. Put a rope over a short length of bamboo branch pushed onto the end of a tree branch. Pass a rope over the bamboo, tie a stone to one end of the rope, and pull down on the other end. The moving bamboo section acts as a pulley. *Note: In science, the expression 'work is done' is used when an object moves from one position to another as a result of force being applied to it.*	

Processes and skills	Resources	Teacher's support notes	Learner's Book
Identify type 1, 2, or 3 levers; name some parts of the body which act as levers and identify which type.	*Primary Science Encyclopedia* (Pearson), pages 138–149, 152–161	**Levers** For the activities on levers, try to have as many of the tools shown as possible (for example, callipers on bicycle brakes move around the pivot). Do plenty of investigations of tools, so that learners recognize the categories of lever by practical experience. Improvize the tongs for the hot stones (in the mumu fire) by cutting a strip of bamboo, heating it in the middle and then bending it over to make a pair of tongs.	Page 72
Experiment with levers of different lengths.	*Primary Science Encyclopedia* (Pearson), pages 156–157	**Activity 5** Make sure learners use sticks of different lengths to find out which length of lever makes work easier.	Page 72
Observe what happens to a large load when a small effort is applied. Use a seesaw to model the simple lever: Load—pivot—effort.		**Activity 6** Set up a simple seesaw with a wooden plank on a log pivot. Experiment with learners sitting at different distances from the pivot. How can a small learner balance a large learner?	
		Activity 8 Make wall charts of the three types of lever: effort—pivot—load; effort—load—pivot; pivot—effort—load.	Page 74

Processes and skills	Resources	Teacher's support notes	Learner's Book
		Levers in humans Identify body joints which act as levers— elbow joint, ankle . In the Learner's Book, page 75 shows the elbow and arm. This is a Type 3 lever (Piv-E-L). The pulling force upwards, exerted by the biceps muscle, acts between the pivot and the load. The ankle is a Type 2 lever. When a person raises the foot upward from the toes, the pivot is at the toes. The load is the downward weight of the body. The calf muscle pulls upwards (effort) behind the ankle point: Piv-L-E.	Page 75
Experiment with spring forces. Identify objects that have springs in them and record their uses.	Spring balance (as in fish market), rubber bands, pieces of rubber tubing	**Elastic spring force** Provide rubber bands or any pieces of rubber strip (from inner tubes) that can stretch. Learners observe the effects of the stretching force when applied to the rubber bands. Learners record the uses of the springs in the objects they have listed and identify the types of force used in the springs. *Note: The elastic property of a material allows it to stretch, and then recover its original shape and size. The distance between the atoms of the material increases, then decreases again.* *For elastic materials, the material extends as the load increases. But at some stage, the elastic limit of the material is reached. Before that limit, the material regains its original shape when the force is released. A spring also extends as the load increases. This is why the spring is good for measuring weight. The scale is marked off in regular weight intervals, as the load increases. This works so long as the spring does not extend beyond its elastic limit.*	Page 76

Processes and skills	Resources	Teacher's support notes	Learner's Book
Investigate instances of frictional force.	Toy car, shoes or boots, various objects that can be pulled across surfaces	**Activity 11** Groups investigate various toy cars (those they make from wire are fine) moving forwards, then slowing down and eventually stopping. Learners should pull their wire trucks on different surfaces, to experience differing frictions. Investigate a wide range of applications of friction (where we actually use friction to benefit us): brake blocks on a bicycle, brake shoes on a car or truck. Investigate situations where friction is a disadvantage: pulling a canoe up onto a beach (rolling the canoe on logs reduces the friction), climbing a steep, muddy path, cutting wood with a steel saw (the blade gets hot).	Page 77
Explain scientific terms.		**Chapter review** Go through the chapter review and refer back to the appropriate pages of the Learner's Book. Use the concept map on page 79 to summarize the idea of a force. Make the 'Types of lever' table as a chart and display it with the lever chart you made earlier.	Page 79
		Assessment Give learners revision questions 2, 3 and 4 as the assessment event for this chapter.	Page 81

Activities and assessment answers

Activity 1 (page 66)

Types of force being used:

- Push:
  - pressing the keys on a mobile phone
  - squeezing grated coconut
  - rolling a ball of clay
  - closing a door.
- Pull:
  - picking up your school bag from the floor
  - pulling a toy truck
  - raising a flag on a flagpole.
- Push/pull:
  - ringing a school bell
  - using bicycle pedals to ride
  - striking a match
  - opening a drink can
  - opening and closing a box
  - opening and closing a drawer.
- The speed of the object will not change if the boy walks at the same speed.
- Yes, the suitcase will be easier to pull and will move faster if the boy's sister helps him.
- No, the suitcase won't be easier to pull and it will move more slowly if the boy's younger brother sits on it.
- The suitcase will move very fast.
- The suitcase will move very fast, but may overturn.

Activity 2 (page 69)

You can change the shape of:

a a ball of clay by squeezing and kneading
b a sponge by squeezing it with the hands
c a sheet of paper by folding
d a rubber band by stretching it
e a shoe box by stepping on it

f a drink can by squeezing it with the hands using either a small or big force.

Activity 4 (page 71)

Work is not done when you push hard against a brick wall because you do not cause movement to the brick wall. You lose energy, but you don't cause movement to the wall.

Levers (page 72)

- Yes, using a lever.

Activity 6 (page 72)

- No, you and your father cannot sit at the same distance if you want to lift your father.
- Your father should sit near the pivot.
- You should sit far from the pivot in order to lift him.

Activity 7 (page 73)

- No, it is too heavy to lift using only the hand.
- Yes, the lever makes it easier to raise the stack of books because the force applied is a large distance from the fulcrum.

Activity 8 (page 74)

Lever	Is the effort greater than the load?	Which type of lever is it? Type 1, Type 2 or Type 3
Scissors	No	Type 1
Tongs	No	Type 3
Pliers	No	Type 1
Broom	Yes	Type 3
Bottle opener	Yes	Type 1

Levers in humans (page 75)

The arm is a Type 3 lever.

Elastic spring force (page 76)

The rubber stretches because it is an elastic material.

Activity 10 (page 77)

Objects with springs	Use of the spring
Motor vehicle	Supports the weight of the vehicle; the spring contracts as the load increases
Bicycle saddle	Supports the weight of the person; as above
Market scale	Stretches when an item is on the pan; as above
Mattress	Supports the body of the person on the bed; as above

Activity 11 (page 77)

When you take a step the foot grips the ground because of friction.

Frictional force (page 78)

- No, you cannot use your pencil to write on paper without friction.
- Yes, your feet will slip off the pedals of your bicycle without friction.
- Yes, a bicycle's tyres will slip without friction.
- No, we cannot drill holes without friction.

Chapter revision (page 81)

1 **a** lever, greater handles
  b arms, movement, large
2 A
3 D
4 A
5 Friction can be a problem because it wears down things and produces heat. It is also a necessary force because it enables us to do things like writing on paper, drilling a hole, climbing a steep, slippery path, brake when we cycle or drive.

Chapter 5 Exploring water

Strand: Natural and Processed Materials

Suggested periods: 30 (6 weeks)

Sub-strand statement

Water is essential to life. Water can be found in the three states of matter—solid, liquid and gas. The properties of water in the three states are important for the process called the water cycle. Industrial waste material often causes water pollution. This can damage water resources and the living things in water.

Learning outcomes

Learners should:

- recognize that water can exist in three interchangeable states of matter—solid, liquid, gas (K)
- understand the role of condensation and evaporation in the water cycle (U)
- recognize the importance of the water cycle in nature (K)
- be aware of the impact of pollution on water resources. (A/V)

Indicators

Learners should be able to:

- describe the importance of water to life
- differentiate between the processes of condensation and evaporation in the water cycle
- investigate the effects of heat gain and heat loss on liquid water
- state the importance of water recycling in nature
- identify two visible impacts of pollution on water resources.

Processes and skills	Resources	Teacher's support notes	Learner's Book
Explore the three states of water, solid (ice), liquid (water) and gas (water vapour).	*Primary Science Encyclopedia* (Pearson), pages 71–74 Situation near the school or in school	**States of water** Help learners to experience and describe different states of water in the environment: • touching an ice cube (solid) in the refrigerator (if available) • swimming in water or river (liquid) • watching a boiling pot of water (the water vapour rises up and changes to clouds of steam). Help learners to conclude that the different states of water are the result of heat loss or heat gain. Ensure that learners look at changes of state in water (solid, liquid and gas) and connect the changes to heat.	Page 84
Plan an observation and investigation of states of water	Ice, stove and pot	**From water to water vapour and back** All you need for this activity is a pot of water on the fire. Even if you do not have a thermometer, the observation questions can be answered. Ask learners why the water in the pot disappears if left boiling for a long time. Lots of heat is put into the water. The liquid changes to a gas at a certain temperature. In this situation the temperature is maintained for a long time and so all the water changes state from liquid to gas. It goes into the atmosphere as a gas.	Page 86
Investigate and observe the effect of heat gain and heat loss on water.	Stove, stand for pot, thermometer (if possible)	**Evaporation and condensation** The observations in the earlier activities are necessary to help learners note the difference between evaporation and condensation. The conditions for the two processes—heat loss, (condensation) and heat gain (evaporation)—should emerge from the observations.	Page 87

Processes and skills	Resources	Teacher's support notes	Learner's Book
Demonstrate awareness of freezing point and identify pattern of freezing and melting. Observe and describe the process of freezing and melting.	Ice	**From ice to water and back** The enlarged pictures of the temperature readings are shown in case it is not possible to have a thermometer for use. Learners observe changes from solid to liquid.	Page 88
		If you cannot get ice, you have to use the charts on pages 88 and 89 for 'think' experiments, and answer the questions. This activity shows that the ice and the water stay at 0°C as the ice melts. More and more heat is taken in from the atmosphere. The heat is used to change the state from solid to liquid. When all the ice has changed state, the temperature of the liquid water then rises (as shown in the final picture). It is now at room temperature (just over 30°C). Ice cubes float in liquid water.	
		Activity 2 Liquid water increases in volume when it freezes and changes to ice. That is why ice will burst out of the bottle cap if a full bottle of water is put into the freezer.	Page 90
		Activity 3 All three states of water are in used in Activity 2. The coloured ice melts then the pools of water evaporate as water vapour. Then coloured material is left behind as powder on the sheet of paper.	Page 91
Use a concept map to summarize key ideas.		**Concept map** Go through the concept map. Highlight the states of matter and the process of change between the states. Learners should make their own concept map as a simple diagram. Teachers should do a wall chart for the classroom.	Page 92

Processes and skills	Resources	Teacher's support notes	Learner's Book
Identify water features on the world map.	Wall map of the world or globe *(A blow-up globe and an atlas was sent to all schools by the Education Resource Unit)*	**Water on the move** Locate the water features—oceans, huge lakes, large rivers. Note where Solomon Islands is on the largest ocean. Use groups for discussion and record their ideas as a summary. Explain different sources of water on Earth.	Page 93
Observe, investigate and describe the water cycle in the environment. Note water levels at different times.	Field trip to a nearby river or ocean, dam or wetland; potholes on the road	**A closer look at the water cycle** This activity and the double-page diagram of the natural water cycle on pages 96–97 come to life for learners when they do a field trip. Use the table from Activity 5 on page 95 as the recording tool for the field trip. Review the field trip by using the double-page spread.	Page 94–97
Explain terms scientifically and relate to nature at work.		**Activity 4** Allow learners to make appropriate conclusions by completing the table on how the water cycle works. Explain the pattern of changes in the water cycle diagram. Follow the step by step process, as in Activity 3	Pages 94
	Clear plastic bag, glass jar, tape	**Activity 6** Conduct the experiment using a clear plastic cup and bag, as instructed. Use a small amount of water. The point is to show that the water vapour condenses at the top of the plastic bag. If the Sun's rays are too strong it will not condense. Move the plastic bag after an hour in the Sun. A cooler place will help the vapour to condense.	Pages 98
Plan and set up the closed system water cycle in the jar.	Materials as in Learner's Book, page 99	**Activity 7** To make sure the Sun's rays shine on the growing plant in the glass jar, remove the lid. Find a small green plant and dig it up. Keep its roots together as you put it into the soil in the jar. Cover it by stretching a piece of transparent plastic paper over the top of the jar. Use an elastic band to tighten it.	Page 99

Processes and skills	Resources	Teacher's support notes	Learner's Book
Observe the processes of the water cycle.		**Observe condensation and evaporation in life** Condensation: Ask learners to make early morning observations at home. They could come earlier to school and make the observation together as a class. Evaporation: Fill a cup/bottle of water with water to a certain point/brim. Allow the cup/bottle of water to stand in direct sunlight and observe the water level at the end of the school day. Help learners to make inferences from their observations.	Page 100
Identify uses of water in real situations. Identify places of water scarcity in the Solomon Islands. Investigate water supply problems in towns.		**No water, no life** Learners identify the uses of water and why it is important for our wellbeing. Bring these pages to life by going out and identifying the range of uses of water in real life. Clarify that most of the water-saving ideas apply to people who live in towns. In Honiara, for example, it is good to discuss why there are water shortages. There is plenty of water in the supply dam, but the problems are to do with the system for piping it to houses.	Page 100
		Learners locate islands in the Solomons where water is scarce during some of the year. What do people do? Learners observe water usage at home and keep a record. Allow them to devise a plan for smart water use. Put emphasis on the importance of family members saving water. Ask learners some questions on water usage such as: • What do you use most of the water for? • Who in the family uses most of the water? • Which part of the day do you use most of the water? • How much is the water bill? • How many containers of water are carried from the creek each week by a family who live some distance from water, and do not have tap supply or a storage tank? • What is the main reason why many families in villages and on the edges of towns do not have a water collection and storage system?	Pages 100–102

Processes and skills	Resources	Teacher's support notes	Learner's Book
Locate water pollution sites; collect and classify rubbish. Adopt a creek and clean it up. Identify ways of reducing source pollution.		**Water pollution** Learners identify different ways that water is polluted. It is very important that learners go out to check on areas where people pollute creeks and rivers. One of the worst examples in the country is the Mataniko River at Honiara. Discuss why people throw their waste into waterways. Locate a small creek in a residential area. Study the types of refuse thrown into it. Categorise the waste. Ask learners to think about what has to happen to stop this behaviour. What do people in villages do with their waste? Think of the pig problem in town areas. Ask learners to think about how water pollution affects living things. Discuss the illustration on page 104. Ask learners to think of examples of harmful materials that they see in their own environments. Water pollution can be reduced if people are more aware of using substances carefully and disposing of waste materials properly. This is why we consider pollution in science lessons now. When purchasing items from shops, we must select things that can rot or break down easily so that they do not cause pollution. Plastics are a serious problem in our creeks. Find locations to illustrate the pollutants given in the table on page 105. Try to show the effects that are listed in the table. Many village schools can observe the effects of upstream logging on the rivers and creeks nearby.	Pages 104–105
Observe amount of water used, and water wastage.	Graduated jug (in ml), watch or clock	**Activity 10** Encourage learners to accurately record how much water they can save at home. Learners can try to calculate the amount of water used in their homes daily and weekly.	Page 106
		Activity 11 For the term desalination refer to the glossary and Activity 11. Which islands in the Solomon Islands might find desalination useful? (Tikopia, Bellona, Santa Cruz, Gizo) Why?	Page 106

Processes and skills	Resources	Teacher's support notes	Learner's Book
		Chapter review Discuss the concept map and answer the questions in the chapter review. Go through all the items. Refer back to the appropriate pages in the Learner's Book.	Page 107–109
		Assessment For each of these questions, choose the correct answer from the two options given. **1** What occurs when water is cooled and changes to ice? Freezing or melting? **2** What is the freezing point of water? 100°C or 0°C? **3** What causes freezing to occur? Heat gain or heat loss?	

Activities and assessment answers

States of water page (page 84)

Heat loss (cooling) or heat gain (heating) is needed to change water from one state to another.

From water to water vapour and back (page 86)

- Yes, it is 32°C.
- Yes
- Yes
- Yes
- Yes
- The hot water vapour cools and changes into liquid.
- Yes, it is 100°C.

From ice to water and back (page 88)

- Yes, it is 0°C.
- Yes. The temperature is 0°C.
- Yes. The temperature is 0°C.
- Yes. The temperature is 0°C.
- Yes. The temperature is 32°C (room temperature).

Activity 2 (page 90)

- Ice cubes float in water.
- The water in the bottle changes to ice (solid) and expands (so it increases in volume).

Activity 3 (page 91)

Possible prediction: The coloured ice cubes will melt and disperse/spread their different colours on the plastic.

a Solid

b Yes, the ice melts. It became a liquid.

c Yes. It became a gas.

d Three states of matter.

Water on the move (page 93)

- Most of the world is covered with water.

A closer look at the water cycle (page 94)

- The Sun's energy drives the natural water cycle.

Activity 6 (page 98)

The plant in the model does not need to be watered because there is water within the closed water cycle model. The water in the jar does not evaporate out of the jar. It evaporates and condenses within the jar so water is not lost. It circulates in the jar. There is also some transpiration from the leaves of the plant.

Observe condensation and evaporation in life (page 100)

Some possible observations:

Observation	What is it?	Why?
Liquid hangs on glass in the early morning	Condensation	The air cools and water vapour condenses into droplets of water.
Vapour rises up from a plant leaf	Transpiration from the leaf, then evaporation	Water vapour evaporates into the air as gas because of heat.

- Adults do this to ensure that the body cools down from a higher temperature to the normal body temperature.
- This is because the sweat acts as a cooling system, due to the body generating heat from muscle activity.
- You feel cold because your body is losing heat as the water evaporates from your body.

No water, no life (page 100)

- Water comes from living things, from the ground, from rivers and seas, and from the air around us.
- Yes.
- We should be.

Why water is essential (page 101)

- Plants cannot make their own food without water.
- Yes, they need water for life.
- No, processes of life cannot continue without water.
- Plants grow in warm and rainy places.
- Warm and rainy places.
- Without water, life will not exist.

Save water (page 102)

Islands in the Solomons where water is scarce:

- Atoll islands (Ontong Java, Sikaiana in Malaita Outer islands)
- Artificial islands (Sulufou and Lau islands in Malaita)
- Reef islands (Temotu Province)
- Bellona (Renbel Province).

Activity 9 (page 103)

Water-saving ways:

- washing cooking utensils in the creek or in a basin (not using a running tap)
- bathing in the creek
- saving money and installing a gutter and tank water catchment system.

Water pollution (page 104)

Examples of the way humans cause water pollution:

- aeroplanes spraying pesticides across land and water sources
- oil spills from ships
- rubbish thrown into waterways
- sewage disposed of in creeks and in the sea
- fertilizers leached from land into rivers and lakes
- household detergents flowing into drainage systems
- industrial waste such as poisonous dyes, heavy metals (for example chrome and mercury) and acids ending up in waterways.

Activity 10 (page 106)

Make a table like the one on page 57 so that learners can use it to record their data. Ask them to find a tap near their homes that is dripping. For example, if 50 millilitres collects in the jug in a 10-minute period, then 300 millilitres will collect in one hour (50 millilitres × 6 = 300 millilitres). So 7200 millilitres will collect in 24 hours. This is 7.2 litres.

Day of week	Amount of water collected in one hour (ml)	Amount of water drip per day (ml) (multiply the hour quantity by 24)
Monday	300 ml	7200 ml (7.2 Litres)
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		
Sunday		
Total water lost in one week		_____ millimetres _____ litres

Activity 11 (page 106)

Desalination is a possibility for some places in Solomon Islands. However, the technology to do this has to be put in place.

Chapter 6 Farming

Strand: Farming

Suggested periods: 25 (5 weeks)

Sub-strand statement

Selecting a suitable site for gardening or animal husbandry is essential for successful farming. The choice of what to grow and raise depends on the site selected. Selection of good planting materials and healthy animals ensures productivity.

Learning outcomes

Learners should:

- know essential characteristics of suitable sites for farming (K)
- identify reasons for growing crops and raising animals (K)
- know the three local techniques of gardening and the two ways of rearing animals (K)
- recognize good planting materials and healthy animals for raising (K)
- appreciate that healthy plants and animal products are the output of a successful farm. (V)

Indicators

Learners should be able to:

- state three characteristics of a suitable site for farming
- give a reason why it is important to make gardens and raise animals
- list three gardening methods (raised beds, ridges, mounds) and two types of animal rearing (free range and enclosed)
- identify the three types of vegetative propagation
- propagate food crops by sowing seeds
- prepare seed boxes, and planting-out plots
- transplant seedlings
- recommend food crops grown and raised locally.

Processes and skills	Resources	Teacher's support notes	Learner's Book
Explore and locate sites for gardening; identify crops grown, collect data and share ideas.		**Activity 1** Prepare for this garden visit. Identify the garden before the lesson. Arrange with the owner so they can answer questions from learners. Record information, using the table in the Learner's Book. Discuss and compare each group's information. Most things will be similar. Identify things from each group that are different. Discuss whether this survey would collect similar information if the class did it in other gardens in the area.	Page 111
Identify and observe soil constituents.	Glass jars; soil from a garden	**Activity 2** Learners do a drawing of the layers of particles in the jar and label each one.	Page 112
Observe soil particle size.		**Looking at soil** Bring examples of the substances that show particle size (grain of rice, sugar, salt, chalk, dust, Milo or milk powder). Ensure that learners look at the actual size of the particles in the jar and feel the examples. Ask learners some questions such as: **a** Which soil particle sank to the bottom first? (gravel) **b** Which soil particle is the lightest? (clay) **c** Put these soil particles in order from the lightest to the heaviest. (clay, silt, fine sand, rough sand, gravel)	Page 112
Identify and list examples of organic matter.		**Organic material in soil** Refer back to the investigation in Activity 2. Ask questions such as: **a** What did you find at the surface of the water? (pieces of dead leaves, sticks, insects, parts of dead small animals) **b** Does the water appear to be cleaner after settling? (yes)	Page 113

Processes and skills	Resources	Teacher's support notes	Learner's Book
Sort organic and inorganic matter in soil.		**Activity 3** Before the activity identify an area near the school with good soil. Learners should work in groups and each group should draw up a table like the one in the Learner's Book. Explain to learners the term organic matter. The pictures in the Learner's Book give examples of organic matter. The main point is that material from a living thing or from a living thing that is now dead is organic matter.	Page 113
Identify factors for a good gardening site.		**Activity 4** There are very important things to consider if healthy crops are going to be produced. Record the responses to the questions on page 115. Discuss the responses as a whole class. This is excellent preparation for Activity 5.	Page 115
		Activity 5 Take learners outside to a nearby area. Use the questions on page 115 of the Learner's Book to locate an area that will be good for gardening.	Page 116
Identify vegetables from pictures.		**Ways of getting food** Some learners will not have access to some of the vegetables mentioned. The pictures on pages 116–117 of the Learner's Book enable them to see the variety of produce available in town markets.	Pages 116–117
		Activity 6 Most Solomon Islands people live at or near the coast. They grow crops, hunt and fish for food. Discuss how many town people do this. Many town people buy all their food at markets.	Page 117

Processes and skills	Resources	Teacher's support notes	Learner's Book
Use a simple questionnaire to learn about a garden.	Local garden near the school area	**Activity 7** This second visit to the local garden helps to focus learners on what they will grow in their own vegetable plots. Learners must record their responses. Identify specific learners who will ask each of the questions.	Page 120
Identify a garden site near the school. Use simple equipment or tools to make a garden.	Area near the school grounds Common gardening tools	**Activity 8** This garden plot project takes Year 4 learners through the whole growing process from seeds to harvesting new vegetables. Note that groups will need to do work on their plots outside science lesson time. The nature of the work ought to motivate learners to want to do this. Identify a good site for this garden project in cooperation with head teacher and the local people. Plan ahead and get the equipment or tools needed before the work begins. The head teacher should agree to use school grant or school fund money. The school community should help. Introduce the essential tools to learners before they use them. Do not worry if all tools shown on page 121 of the Learner's Book are not available.	Pages 121–122
Carry out the activities to follow the stages of making a vegetable garden.		**Planning chart** Help learners to follow the arrows and read the labels on the planning chart. This is a simple flow chart. Learners should be aware that tasks should be done on time in order to meet the target time for harvesting. The periods on the chart are estimates; the actual periods will probably be different.	Page 122
Identify vegetables to grow during the garden project.		**Activity 9** Refer to pictures of the common fruits and vegetables. Ensure that learners choose the vegetables they want to grow in their own plot. In Year 4, choose the most common and easiest vegetables to grow (tomatoes, peppers, pac choi, shallots). Concentrate on growing from seed only in Year 4. In Year 5, the garden project will focus on vegetative propagation (cuttings, stems, tubers).	Page 123

Processes and skills	Resources	Teacher's support notes	Learner's Book
Identify materials for the soil mixture.		**Activity 10** Make sure all necessary materials are available. Use a net to strain the soil to remove stones, and pieces of plastic/glass/metal from the mixture. Fine strained soils are mixed with chicken, pig or cow manure and fine coconut fibre.	Page 124–125
Make seed boxes. Make a watering can by punching holes in the base of a tin or plastic container.	Nails, pieces of wood, tins, plastic containers	**Making the seed boxes** Organize the pieces of timber, nails and tools before this series of lessons. Some timber can be collected but nails must be bought. Teachers should make a seed box as a model. Then show how one is made. Ask each group to make one.It may be necessary to get help from adults if you need to make a lot of seed boxes. **Planting the seeds** Finally, plant the seeds in the seed boxes. Fill the boxes to half depth with fine soil. Demonstrate the correct way to sow very small seeds. First, make two or three furrows in the fine soil with a stick. Sow the seeds thinly by shaking them from two fingers. Then cover the seeds in the furrows by pouring some very fine soil over the furrows. Pat the soil down with a piece of wood. Sprinkle water gently over the box.	
Identify the strong seedlings to be thinned.	Banana leaves, sago palm or coconut midribs, disposable plastic cups	**Seedling thinning stage** Organize groups of learners to do the thinning, as described on page 125 of the Learner's Book. About two or three weeks after thinning, the strong seedlings can be moved into seedling growing cups. Growing cups give each seedling its own growing place. The pictures in the Learner's Book show both the bush material growing cup and the plastic one. A whole class of learners can easily make a lot of banana leaf seedling cups. This is a cost-free way to get many cups. Also the seedling in the cup can be transplanted directly into the ground. Use a small pointed stick to loosen the seedling in the soil of the seed box. Hold the seedling inside a cup with one hand, while dropping some fine soil into the cup with the other hand. Squeeze the soil gently round the seedling. Water carefully.	

Processes and skills	Resources	Teacher's support notes	Learner's Book
		Activity 11 Make sure there are enough soil beds for all the seedlings ready to be transplanted. You may need to ask parents to help prepare the growing beds. If the garden plot is new, the area will have to be cleared and it may be difficult for young Year 4 learners. Page 126 shows simple ridges of cultivated soil, with seedlings planted out.	Page 126
Identify and use common garden tools. Follow steps to transplant seedlings.	Garden area near the school	**Activity 12** Ensure learners actually do their own planting. Show learners how to use a small trowel or stick to make the planting hole. If the seedling cup is a banana leaf one, learners can simply drop the cup into the hole without disturbing the seedling. If the seedling cup is plastic, turn the cup upside down and tap the bottom of the cup until the seedling and soil slip out together. Then drop it into the planting hole. Finally, press around the planting hole to make the seedling secure. Water gently.	Page 127
Apply correct procedures for weeding and watering seedlings.	Watering cans made from different materials, for example fish tins, plastic containers	**Activity 13** Ensure that garden tools are handled properly by learners in order to avoid accidents. In the garden site pupils water and weed the bed for their own group. Go to the garden plot at a particular time each day (perhaps at morning break time). Learners will want to have healthy vegetables to harvest.	Page 128
Carry out simple vegetable harvesting and storage techniques.	Garden tools	**Harvesting** Learners should develop the skill of selecting the mature plants for harvesting. Use a trowel to dig gently underneath the mature plants. Lever upwards and pull the plant out with the other hand. Show learners how to organize storage. Put the harvested plants into sacks, set them in shade and spray gently with water. Make decisions with learners about what to do with harvested plants. Learners can take them for their families in alphabetical order, as the plants are harvested. They could also sell some for class funds.	

<table>
<tr><th>Processes and skills</th><th>Resources</th><th>Teacher's support notes</th><th>Learner's Book</th></tr>
<tr><td>Use questionnaires to find out about village pig areas and chicken-rearing houses.

Identify materials used to make a village chicken house.</td><td>Village pig area and chicken-rearing area</td><td>Activity 14
Arrange a visit with a local chicken farmer. Try to see some different designs of chicken houses. Learners should see that the village chicken houses are made mainly of bush materials as in the picture on page 129 of the Learner's Book.
Ask each learner to make a questionnaire sheet. Draw three columns on a page (see below). Write out the question number, and the question in the first two columns.
<table><tr><th>Question number</th><th>Question</th><th>Response</th></tr><tr><td>1</td><td>Are the chickens being reared for eggs or meat?</td><td></td></tr><tr><td>2</td><td></td><td></td></tr><tr><td>3</td><td></td><td></td></tr></table>Ensure that learners complete the questionnaire during the visit. After the visit, collect all the information the class has collected in column 3 of the questionnaire. Ask learners to write a short story about the visit and draw their picture of the chicken farm.</td><td>Pages 128–129</td></tr>
<tr><td>Identify materials used to make the pig house.

Compare types of pig-rearing areas.</td><td>Local village pig areas near the school area</td><td>Activity 15
Arrange the visit before the lesson date. Learners draw up the questionnaire sheet before the visit as they did for the chicken questionnaire.
Ask each group to complete one questionnaire with one learner in each group acting as recorder for the group. Group members should ask questions in turn and give the answers to the recorder.
For a class record, make a model of the pig house using bamboo rods, sago pith and sago leaf.</td><td>Page 130</td></tr>
</table>

Processes and skills	Resources	Teacher's support notes	Learner's Book
Identify the different types of planting materials.	Planting materials from local gardens	**Planting materials** Go out and see real examples of planting materials that are already planted in the soil (seedlings, cuttings, suckers, stems) and an example of layering as illustrated on pages 133–135 of the Learner's Book.	Page 133–135
	Banana and ginger plants growing	Go outside and observe banana and gingerplants closely. Make sure learners are aware of the idea that the shoots of the underground stem become the suckers. Later on, the sucker is removed to be planted on its own.	
Observe the branch-layering technique as a way of propagating new plants. This work on vegetative propagation methods (asexual plant reproduction) is to make Year 4 learners aware of these techniques after doing their seed project.	Mango tree	Take learners to a nearby mango tree. Show how to do the layering. You should do an actual layering example a couple of weeks before this series of lessons. Learners observe what has happened on the branch. See pictures on page 135 of the Learner's Book.	

Processes and skills	Resources	Teacher's support notes	Learner's Book
		Assessment Use this item as the assessment event for this chapter. Column 1 of the table shows a list of vegetables. In column 2, learners write which method would be used to cultivate more of that particular vegetable. Choose the method from cutting, seed, sucker and layering.	

Food types	Cultivation method
Kumara	
Cassava	
Taro	
Tomato	
Pac choi (Chinese cabbage)	
Spring onion (shallots)	
Green pepper	
Ginger	
Slippery cabbage (hibiscus cabbage)	
Mango	
Banana	
Bean	

Activities and assessment answers

Activity 1 (page 111)

1 Possible answers: slippery cabbage, banana, potato, cassava, sugar cane,beans/tomatoes, yam, taro.

2 Yes or no. If, yes give an approximate distance, for example 15 meters.

3 Refer to the three options given in the Learner's Book.

4–7 Answers will vary according to the location.

Activity 5 (page 116)

The learners will have to work in groups. Look at all the crops planted in the garden to answer questions in the Learner's Book. The answers to the questions will depend on each group's observation.

Activities 7, 14 and 15 (pages 120, 128 and 130)

Answers to the questions in these activities will come from the farmers during the visits.

Assessment

Food types	Cultivation method
Kumara	Cutting
Cassava	Cutting
Taro	Sucker
Tomato	Seed
Pac choi (Chinese cabbage)	Seed
Spring onion (shallots)	Seed
Green pepper	Sucker
Ginger	Sucker
Slippery cabbage (hibiscus cabbage)	Cutting
Mango	Layering
Banana	Sucker
Bean	Seed

Chapter 7 The stars, the Earth and the cycle of time

Strand: Earth and Beyond

Suggested periods: 25 (5 weeks)

Sub-strand statement

The Earth, Moon and Sun exist in space. The Universe is everything that exists in space. There are billions of stars in the Universe. There are collections of stars called galaxies. The stars are so far away that they appear to be at the same distance from us. They seem to be on the inside of a huge bowl. The Earth rotates anti-clockwise on its own axis once in 24 hours. The axis is an imaginary line through the centre of the Earth from the North Pole to the South Pole. The passage of time in a day is related to the spin of the Earth on its axis.

Learning outcomes

Learners should:

- know that the Earth is a sphere (K)
- appreciate that the Earth is one object in the Universe (V)
- understand that the stars are in space, at huge distances from the Earth (U)
- know that groups of stars appear to make patterns in the night sky because they are so far away; they are at different distances from the Earth (K)
- identify the North and South Poles using a globe and the axis of the Earth (K)
- understand that the rotation of the Earth in relation to the Sun causes day and night (U)
- know that the Earth takes 24 hours to make one complete rotation (K)
- appreciate that part of the world to the east starts the day before those in the west because of the Earth's spin on its axis. (V)

Indicators

Learners should be able to:

- identify some patterns that stars make in the night sky
- make a model to record patterns of stars that they observe in the night sky
- identify a few of the common groups of stars in the southern night sky
- use a globe to identify the North Pole, South Pole and the axis of the Earth
- illustrate day and night by using a simple model, for example a ball and a torch, to explain the rotation of the Earth
- describe the rotation of the Earth in relation to the length of an Earth day—24 hours.

Processes and skills	Resources	Teacher's support notes	Learner's Book
Observe the sky at night and record star patterns. Make a model of star patterns in the night sky.	*Primary Science Encyclopedia* (Pearson), pages 82–83 Sheets of paper, marker pens, umbrella, Blutack	**Activity 1** Prepare for this lesson by doing a star map as an example so that you can show learners what they will be trying to do at home. Then ask learners to arrange to do their observations with adults at night-time. Learners should try to record on paper the star patterns that their older relatives can name in their own language. Have an umbrella ready to mark the model of the night sky. Choose the best patterns to cut out and stick to the inside of the umbrella, as in the illustration on page 137.	Page 137
		Learners from different language groups should give their special names for the star patterns and tell the stories they have heard from the adults. List all the named star patterns and draw them on the chalkboard.	Page 138
	Balloons, newspapers, paste	**Activity 2** The best paste is the white powder paste. Make it by mixing the powder with water. Then tear newspaper sheets into small pieces and mix the pieces with the paste. This makes a mixture that will stick to the outside of an inflated balloon. If you have a magnifying lens, show how it makes small things bigger. This helps to explain the telescope. Draw some continent outlines on the surface of a newspaper ball. This sphere is a model of Earth.	Page 139
Observe a ship approaching land from open sea and record its progress by drawing the changing shape.	Ball	**Activity 3** If the school is near the coast, arrange to be at a wharf when an inter-island ship is due to arrive. Observe what happens as the ship approaches land. Record what is observed when it first appears on the horizon and then later as it comes closer to land. Use question and answer to establish the idea of the ship moving on the curved surface of Earth. Demonstrate this by taping a small object (a piece of stick or a toy boat) to the surface of a ball. Support the ball on a table some distance from those who are observing (use a small section of a bamboo to support the ball). Slowly rotate the ball so that the object comes into view. This situation is a model of the shop coming towards shore. It shows how an observer perceives an object moving on the surface of a sphere.	Page 140

Processes and skills	Resources	Teacher's support notes	Learner's Book
Plan for the outdoor observation of the Sun at different times during the day. Identify day and night-time activities.		**Activity 4** Take learners outside the class in the morning, at midday and in the late afternoon. Observe how the Sun appears to move from east to west. List activities that people do in the morning (when the Sun rises in the east), at midday, and again when the Sun sets (evening). Some activities done in towns will be different from those in rural areas.	Page 141
Improvize a model of day and night on the Earth.	Lemon fruit, sharp stick, torch	**Activity 5** Establish learners' own understanding of why there is day and night by asking some questions. This torch and ball activity works well if it is done in a dark place. Find a room (for example a storeroom) that does not have much light. Cover the windows if necessary. Pushing the stick through the lemon fruit allows the fruit to spin. The stick is an axis for the lemon fruit. In this way, it is easy to observe that one half of the fruit has light for half of a spin. It does not get light for the second half of the spin. The dark half of the ball represents night-time; the bright half of the ball represents daytime. Use questions to clarify the point of this activity. • How do we get day and night on Earth? • What does the torch represent? • What does Earth do each day?	Page 142

Processes and skills	Resources	Teacher's support notes	Learner's Book
Analyze the effects of the Earth's rotation and draw conclusions.		**An Earth day** Use the lemon fruit on a stick to illustrate the idea of an axis. (Refer to the glossary.) **Rotation of Earth** Use the rotation model to illustrate the idea of one full day. Rotate the Earth model. Learners rotate the Earth model and observe as Solomon Islands moves into light. This is 06:00 hours. When the torch light shines directly on the Solomon Islands dot, it is 12:00 hours—mid-day. When the Solomon Islands dot is moving out of the light, it is 18:00 hours—six o'clock in the evening. From 18:00 hours to 24:00 hours (mid-night), followed by the period from mid-night to 06:00 again, is another half-day. 24:00 hours and 00:00 hours are the same time —the end of one day and the beginning of the next day. The point of this activity is to emphasize that one day is 24 hours from 00:00 (mid-night), through 12:00 (mid-day) to 24:00 (mid-night again).	Page 143
Model day and night in the Solomon Islands using torchlight and ball on a stick.		**Activity 6** Use the materials used in Activity 5 for this activity. Make sure learners observe what happens to the Solomon Islands dot, as the model spins. Ask thinking questions such as: • Is it daytime or night-time in Solomon Islands? • When Solomon Islands comes back into the light, what is the time?	Page 146
Explain terms scientifically.		**Activity 7** Ask learners to copy out the paragraph and fill in the blanks with words from the list.	Page 147

Processes and skills	Resources	Teacher's support notes	Learner's Book
		Chapter review Go through the chapter review. Refer back to the appropriate pages of the Learner's Book. Clarify the fact that the day is the unit of time, based on Earth's rotation. This natural period is divided into 24 hours so that we can plan activities. The hours are our artificial units.	Page 148
		Assessment Give learners revision questions 1 and 2 as the assessment event for this chapter.	Page 149

Activities and assessment answers

Activity 1 (page 137)

When you look at the sky at night, you'll see:

- the moon (sometimes, not always)
- the stars (some are bright, others are dim; some are in groups, others are scattered; some twinkle)
- some bright planets that do not twinkle.

Activity 3 (page 140)

You can see only the prow of the ship first. As it moves towards shore, the central section of the ship appears, then the stern.

Activity 5 (page 142)

- When you spin the ball on the stick, different sides of the ball move in and out of the light as it spins.
- Half of the ball.
- One dot.

An Earth day (page 143)

- When the model spins, the dot (Solomon Islands) moves from darkness to light and then from light to darkness.
- The dark area of the globe is night-time. The bright part of the globe is daytime.

Activity 7 (page 147)

Spins, night, day, direction, start

Chapter revision (page 148)

1 A

2 B and D

Appendix: Glossary for Learner's Book

Word	Meaning
A	
alcohol	colourless liquid contained in drinks such as beer and wine
ancient	something from a time long ago; very old
astronaut	a person who travels in a spacecraft
atmosphere	air that surrounds and protects the Earth
axis	imaginary line that runs through the centre of a planet, for example the Earth, and which the planet spins around
B	
bacteria	microscopic (very, very small) living things—some bacteria cause diseases
beak	hard, pointed outer part of a bird's mouth
boil	to heat a liquid until it becomes so hot that it changes state to vapour
boiling point	the temperature at which a liquid boils and changes to gas
brittle	hard and easily broken
C	
condensation	the way in which gas or vapour changes into a liquid
conduction	the movement of heat or electricity through a substance
conserve	for living things, to keep a species in existence
consumer	organism that depends on plants and other organisms for food
contract	reduce in size when cooled
convection	movement of heat through liquids or gases
cultivate	to use land to grow crops on
current	flow of heat energy, in the process of convection
curved	something shaped like part of a circle or sphere

D

deforestation	clearing of natural forests by burning or cutting
desalination	removal of salt from sea water
desert	large sand-covered area of land where very little rain falls
detergent	substance that removes dirt
direction	route that a person or thing moves along
dispersal	action or process of dispersing something
distance	amount of space between two places

E

ecosystem	area in which a network of organisms interact with each other and with their environment
elastic	material that can stretch when force is applied, and then go back to its original shape
energy	ability to do work
environment	surroundings and conditions in which people, animals and plants live
erosion	washing away of soil by rain due to human activities on the land
evaporation	process of changing a liquid into vapour or gas
expand	materials taking up extra space due to heat gain
extinct	in relation to living things, a species which no longer exists on Earth

F

fertilization	fusing of a sperm to an ovum in living things
fertilizer	natural substance or chemical added to soil to make it more fertile
float	to stay at rest or move on the surface of a liquid
force	push or pull or twist that can cause movement or change in shape in something
forest	large area of land covered with trees
freezing	way in which liquids change into solid
freezing point	temperature at which a liquid changes into solid

fuel	source of heat energy such as firewood or oil
fungus	plant-like organism without flowers, leaves or green colouring such as a mushroom

G

gas	substance like air that is neither liquid nor solid
germinate	when a seed starts to grow
germinator	person who germinates plants
globe	ball-shaped object with the land masses and oceans marked on it

H

habitat	place where an animal or plant naturally lives or grows
harvest	cutting and gathering of crops
hatch	when an egg breaks open and a chick or reptile comes out
heat	hotness or warmth of something
heredity	inheritance of characteristics of parents by offspring
horizon	imaginary line in the distance where the sky and land or sea seem to meet

I

imagine	to have a picture of something in your mind
insect	small creature with six legs, no backbone and usually with wings such as butterflies, flies, beetles
instrument	tool used to help to do work
insulator	material that reduces or stops the flow of heat
intercourse	sexual act of mating between a male and a female
invent	make or think of something for the first time
irrigation	supplying of water to land or crops by constructed channels or pipes

L

lake	large area of fresh water with land all around it
lever	bar on a pivot used to lift a heavy object
liquid	any substance that flows such as water

M

magnifier	device that makes things appear larger
mangrove	trees found in tropical fresh and saltwater swamps
manure	dung or animal waste used as a fertilizer
melting	way in which a solid changes to liquid
mercury	very heavy liquid also used in thermometer
model	small-scale representation of a real thing or system
moss	small plant that forms a soft covering on stones in damp places

N

natural	made by nature and not by humans
nectar	sugary liquid found in the flowers of some plants

O

observe	to watch somebody or something carefully
oceans	great masses of salt water that surround the continents
oil	smooth, thick liquid fuel that provides heat energy when burned
opossum	small nocturnal tree-dwelling marsupial with dense fur, a long snout and a hairless prehensile tail
orbital path	path or line that an object takes as it moves around another object
organic	description of vegetables that are grown without using chemicals or pesticides
organic matter	material that is from a living thing or from a living thing that is now dead
organisms	any living thing of one of the five kingdoms—animal, plant, fungus, protist, moneran
ovary	the organs that produce eggs in female animals

P

particle	very small piece or amount of a substance
pattern	arrangement of lines, shapes or colours
pesticide	chemical substance used to kill pests such as insects

pivot	point or pin on which something rests and about which it can turn
plantation	large area of land where a single crop is grown such as coconut, oil palm or cocoa
poisonous	harmful substance that can kill people, animal or plants
pollen	fine yellow powder on the male part of the flower that fertilizes the female part of a flower
pollination	transfer of pollen grains to stigmas of flowering plants
pollutant	substance such as waste chemical that damages the water and living things in it
pollution	polluting (to make dirty) the water, air or atmosphere
population	group of the same type of organisms living and reproducing in the same place at the same time
portraying	make a picture of somebody or something
producer	an organism that makes its own food—all plants are producers
prow	front part of a boat

R

radiation	movement of heat through space such as the movement of heat from the Sun to the Earth
rainforest	tropical forest with tall trees in which it rains a lot
reforestation	planting trees to replace those that are cut down
reproduce	living things producing offspring
rotation	movement of an object around a fixed point

S

scene	place where an event or activity happens
scientist	somebody who studies science
sense	the natural organs of living things which enable them to detect things in their environment
sewage	human waste produced by people
sexual	method of reproduction by living things whereby male and female sex cells join to form a new organism
shiver	contracting of the body muscles to produce heat
sink	to drop beneath the surface of a liquid

skeleton	framework of bones in a human or animal body
slatted	fence or floor that has a structure of parallel pieces
slaughter	to kill animals for food
solid	state of matter with a definite shape that is not easy to change
sperm	male cell
sphere	round shape like a ball
straw	dried stalks of grain
substance	matter of a specific chemical composition
sweat	moisture that is given off by the body through the skin

T

technology	practical use of scientific knowledge to do work and solve technical problems
telescope	tube-shaped instrument with lenses that you look through with one eye
temperature	measure of how hot or cold an object is
testes	two male sex glands
thermometer	instrument used for measuring temperature
tilted	to slope or lean so that one side is higher than the other
troughs	long, narrow container for food and water for animals

U

universe	whole of everything that exists, including the Earth, Sun, planets and all the stars in the space

V

vegetable	plant that is grown to be eaten
vegetation	plant life

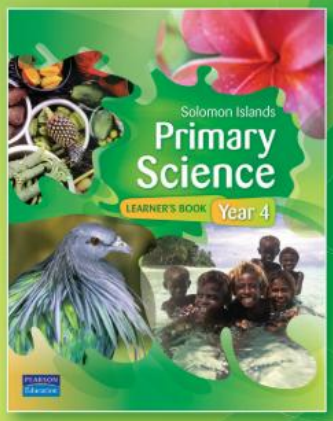
W

water cycle	system of water circulation in nature
water vapour	gas state of water
wax	solid substance made from fat or oil that becomes soft and sticky when heated
weather	condition of the atmosphere at a particular time or place

Solomon Islands

Primary Science

TEACHER'S BOOK Year 4



This *Solomon Islands Primary Science Teacher's Guide, Year 4* is the teacher support material for the *Solomon Islands Primary Science Learner's Book, Year 4*.

The teacher's guide supports the chapters of the learner's book— 'Organisms and their environment', 'Cycle of life', 'Heat', 'Push and pull', 'Exploring water', 'Farming' and 'The stars, the Earth and the cycle of time'. The support notes for each chapter are presented in a standard format. Each section has:

- processes and skills
- resources
- teacher's support notes
- learner's book references
- answers to the activities and assessment items.

The Solomon Islands Primary Science Teacher's Guide, Year 4 is part of a new series of materials for Solomon Islands Primary Science for Years 1 to 6. This series was developed as part of the Solomon Islands school curriculum reform during 2005 to 2012. The teacher's guide will help teachers to give learners the opportunity to learn from their environment. It supports teachers in the organization of learners' hands-on investigations of the physical and living world.

Throughout this teacher's guide there are page references to a primary science encyclopedia, *Explore Science*, where teachers can find background information on each chapter of the learner's book. The encyclopedia accompanies this teacher's guide.

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