

Science

Upper primary
Syllabus 2003

Section 2

Learning outcomes
and indicators



Papua New Guinea
Department of Education

Issued free to schools by the Department of Education

Published in 2003 by the Department of Education, Papua New Guinea

© Copyright 2003, Department of Education, Papua New Guinea

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means electronic, mechanical, photocopying, recording or otherwise without the prior written permission of the publisher.

ISBN 9980-930-43-8

Acknowledgements

The Upper Primary Science Syllabus was prepared by the Curriculum Development Division of the Department of Education and was coordinated by John Kakas.

The Science Subject Advisory Committee as well as community members, teachers, inspectors, educators and representatives from government and non-government organisations have developed this syllabus through meetings, workshops and trialing.

This document was developed with the support of the Australian Government through the Curriculum Reform Implementation Project.

Secretary's Message

The current reforms in education have been in progress since 1992. The Education Reform has emphasised community-based schooling, the use of vernacular languages in schools, the introduction of Elementary schools and the expansion of Primary schooling to grade 8 and increased access to Grades 9 and 10.

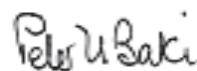
This syllabus is to be used by Upper Primary (Grades 6, 7 and 8) students in Primary schools throughout Papua New Guinea. This syllabus develops, extends, links and builds upon concepts, skills and attitudes flowing from Lower Primary (Grades 3, 4 and 5). This syllabus provides a sound foundation for further learning in the reformed school system.

Students' language abilities, already gained in their home environments and during the previous years of schooling, must be respected, built on and extended. Vernacular languages have a large part to play in our students' formative years and their first language should be used to promote a deeper understanding of difficult concepts when this is appropriate.

The study of Science encourages students to be curious and to actively search for new knowledge and understandings. Students do this by testing, playing with materials, exploring and questioning the world around them. Science education should nurture and promote an open-minded attitude to solving problems and to appreciating the opinions of others.

Papua New Guinea is unique in its biological diversity and richness of natural resources. This course of study encourages students and teachers to value and interact with their communities. Science encourages teachers to develop a student-centred approach with class activities promoting critical thinking, problem solving, and communication skills for all students.

I commend and approve this syllabus as the official curriculum for Science to be used in all Upper Primary schools throughout Papua New Guinea.



Peter M. Baki
Secretary for Education

Learning Outcomes and Indicators

Sub-strand	Grade 6	Grade 7	Grade 8
Working Scientifically	<p>6.1.1 Investigate the immediate environment and using scientific methods, organise their experiences and communicate their ideas</p>	<p>7.1.1 Critically question their understandings of the broader environment and learn to make informed decisions based on scientific methods</p>	<p>8.1.1 Identify the role of Science in the global environment and apply scientific methods to create solutions to problems</p>
Indicators All Indicators are listed as bullet points after each Outcome. The list of Indicators always begins with the following statement: 'Students will be achieving this outcome when they, for example'.	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • formulate questions to guide observations and investigations of familiar situations • conduct simple tests and describe observations • identify patterns and groupings in information to draw conclusions • cooperatively suggest possible improvements to investigations in the light of findings • describe and demonstrate how Science is used to improve our daily life 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • suggest ways of doing investigations, giving consideration to fairness • organise, improvise and use simple equipment to gather and present information • argue conclusions on the basis of collected information and personal experiences • evaluate the fairness of a test designed and carried out • explain how responsible choices are made to use Science to improve community life 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • identify factors to be considered in investigations, controls which may be needed and ways of achieving control • collect and record information as accurately as equipment permits and investigation purposes require • draw conclusions linked to the information gathered and the purpose of the investigation • review the extent to which answers are reasonable in relation to the questions asked • identify techniques and equipment used to collect information to make responsible decisions about an application of Science

Strand: LIVING THINGS

Sub-strand	Grade 6	Grade 7	Grade 8
Nature of Living Things	6.2.1 Identify the basic structure of living things that allow them to function in their environment	7.2.1 Identify and compare the basic structure of living things and how they allow them to function in their environment	8.2.1 Describe and explain the processes of reproduction in living things and how the environment influences these processes
Indicators	<p>Students will be achieving this outcome when they for example</p> <ul style="list-style-type: none"> • identify many sources of information on the similarities and differences of plant and animal cells and communicate these to others • identify several sources of information to construct a model of a plant and animal cell, cell wall, nucleus, cell membrane, cytoplasm • identify and communicate the similarities and differences in cell structure • identify and describe the functions of sense organs and make comparisons with other living things • discuss in small groups the value of having senses • make comparisons between human senses and those of other animals and discuss • identify features of living things that can be used to classify them into groups 	<p>Students will be achieving this outcome when they for example</p> <ul style="list-style-type: none"> • make comparisons between the body coverings of animals and explain how these structures are suited to the environment in which they live • use a field study data to draw conclusions about the structure and function of body coverings • investigate the structures and general function of the digestive system and make comparisons with other animals • using labelled illustrations or models to show the movement of food through the digestive system and the changes that take place • research using a variety of sources, the differences and similarities between digestive systems of different animals and present their findings using a model or poster 	<p>Students will be achieving this outcome when they for example</p> <ul style="list-style-type: none"> • identify patterns of reproduction in living things • draw the stages of reproduction • write about the sequence of events in internal and external fertilisation processes • research and produce charts contrasting and comparing sexual reproductive structures of a variety of living things from various habitats • collect and analyse information on reproductive processes and formulate conclusions as to why living things reproduce differently in different environments • describe the interrelationship between the environment and the processes in living things

Sub-strand	Grade 6	Grade 7	Grade 8
Ecology, Relationships and Interactions	6.2.2 Using a diagram, describe how energy moves through the living and the non-living community	7.2.2 Interpret and discuss relationships that exist in a community, using a food web to show the human activity in that community	8.2.2 Draw conclusions regarding the effects of excessive use of non-biodegradable materials on food webs
Indicators	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • observe and collect data and make some generalisation regarding relationships between plants and animals in the local area • construct a food chain correctly using arrows to show the relationship between plants and animals 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • construct a food web and identify the relationship between the plants and animals • research issues for a debate to show that human activity has an impact on the environment: over-hunting, over-fishing, use of fertilisers, introduced species 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • design and conduct a fair test to distinguish the differences between biodegradable and non-biodegradable substances: plastics, glass, metals, wood, strings, cloth • research information from a variety of sources and complete a table classifying materials as being biodegradable or non-biodegradable • conduct a survey and communicate their findings in such a way as it raise community awareness regarding the wise use of non-biodegradable materials

Strand: SCIENCE IN THE HOME

Sub-strand	Grade 6	Grade 7	Grade 8
Learning about Substances	6.3.1 Identify and organise common substances into groups according to physical properties	7.3.1 Explain the structure and behaviour of matter in terms of the particles from which it is made	8.3.1 Conduct investigations and use collected data to identify patterns in the physical interactions of substances
Indicators	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • collect materials and show that substances can be classified into groups, solids, liquids and gases • identify and describe the structure and functions of household substances and explain their importance: detergents, food items, other solutions 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • construct simple particle models to explain the behaviour of matter • present information in a scientific way concerning the structure and behaviour of matter 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • compare properties of different materials in terms of hardness, weight, size, and communicate their findings to others • design models of materials and test their interactions against each other: model canoe, log, stone, paper boat on water • discuss and link structures of materials to their ability to float or sink in water

Sub-strand	Grade 6	Grade 7	Grade 8
Learning about Substances	6.3.2 Conduct practical investigations into the nature of mixtures and communicate their findings in a scientific way, using available materials	7.3.2 Compare the properties of materials before and after physical and chemical changes and identify patterns in the types of changes that take place in the materials used	8.3.2 Identify and collect basic and acidic substances found in nature and use this data to elaborate on how these can be used to benefit the community
Indicators	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • collect substances and classify them into two groups: those that will mix and those that will not mix • describe the characteristics of a solution, make inferences and conduct investigations on how solutions can be separated: sugar in water, salt in water • describe the characteristics of a suspension, make inferences and conduct investigations on how substances can be separated: such as by decanting 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • design and conduct simple experiments that demonstrate physical and chemical changes • using information collected from experiments to explain the nature of changes in matter • write simple word equations to describe chemical changes 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • communicate to others the properties of acids and bases • identify familiar basic and acidic substances within the community and their uses • design simple tests that classify unknown substances as acids or bases using plant dyes

Sub-strand	Grade 6	Grade 7	Grade 8
Using Energy in the Home	6.3.3 Identify and describe the sources and the types of energy	7.3.3 Investigate how energy changes from one form to another	8.3.3 Apply their knowledge about energy to investigate electrical and heat energy in the home
Indicators	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> investigate and identify the types of energy sources in the home collect information that demonstrate that energy can change from one form to another identify and describe specific examples of energy transformation in their area such as burning wood, hydro electricity, lanterns, flash lights construct a simple model that illustrates energy transformation such as the water wheel identify and explain how simple machines can be used in homes and community to do work identify the five different types of simple machines: levers, pulleys, axle incline planes and gears 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> identify forms of energy including sound and heat and describe the effects and characteristics of these different forms prepare a written report on the advantages and the disadvantages of friction discuss and draw posters of how people apply different methods of using heat in different places such as in homes, factories, stores, gardens and workplace. identify and make recommendations on how simple machines can make life easier through community field study construct a field survey questionnaire which addresses the need for simple machines to do work 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> analyse findings from surveys and make recommendations on how machines can be used to do work identify and explain real life situations in the community where methods of applying and controlling heat are used to improve the living standard select and produce a plan to demonstrate practical application of using and controlling heat design, construct and test simple models of electrical circuits sketc multiple designs of simple electrical circuits and construct and test these designs and communicate their results evaluate results and make alterations based on their findings conduct investigations on simple machines to establish the efficiency of the machine as a tool to do work

Sub-strand	Grade 6	Grade 7	Grade 8
Using Energy in the Home	<p>6.3.4 Identify and describe the nature of force as being a push or a pull</p> <p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • design an experiment to demonstrate that a force can be either a push or a pull and that forces will make objects move • list and describe different types of forces, pull, push, gravity • explain how forces change our motion when we move • apply forces to an object to make it move and change direction • demonstrate and talk about how they transfer energy to a ball or balloon or a model car to make it move and change direction • draw a picture of forces in action such as a during a tug-of-war, hoisting a flag, pulling up an anchor, a person walking, flying a kite, levering a stone, catching a fish on a line, firing an arrow or spear and label the forces involved as a pull or a push 	<p>7.3.4 Investigate how we use force in everyday life</p> <p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • make a list of forces that act around you during the day and night • design an investigation to find out how forces can be used to slow an objects motion • investigate and identify forces that slow things down • investigate and identify forces that speed things up • use a rope with two groups of students to investigate balanced and unbalanced forces 	<p>8.3.4 Apply their knowledge about force to investigate simple machines</p> <p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • demonstrate their understandings of simple machines by problem solving relating to the mechanical advantage of simple machines • investigate and describe how forces are applied in a simple machine such as a bicycle or hoop in order to make it move and change direction • show how a lever can be applied to move a heavy object and explain the forces involved • find out how some forces are measured • calculate the force by using an appropriate instrument and by applying a simple formula such as $Work = Force \times Distance$

Sub-strand	Grade 6	Grade 7	Grade 8
Using Energy in the Home	6.3.5 Identify and explain how simple machines can be used in homes and the community to do work	7.3.5 Identify and make recommendations on how simple machines can make life easier through community field study	8.3.5 Conduct investigations on simple machines and use problem solving skills to establish the efficiency of the machine as a tool to do work
Indicators	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • identify the five different types of simple machines: levers, pulleys, axle and gear • elaborate on how each simple machine is used to do work 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • construct a field survey questionnaire which addresses the need for simple machines to do work • analyse findings from surveys and make recommendations on how machines can be used to do work 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • demonstrate their understanding of simple machines by solving problem relating to the mechanical advantage of simple machines

Strand: EARTH AND BEYOND

Sub-strand	Grade 6	Grade 7	Grade 8
Our Earth and its Origin	<p>6.4.1 Investigate the earth's structure and describe the formation, composition and the cycling of rocks</p>	<p>7.4.1 Collect data of sedimentation process and observe the presence of fossils to explain the living past, using a variety of sources including first hand experiences</p>	<p>8.4.1 Demonstrate the formation of igneous and metamorphic rocks and relate findings about the properties of rocks to the ways they are used</p>
Indicators	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • tell, listen to and collate stories in small groups about the earth's formation and illustrate their understandings as stories, poems, posters, role plays • make a model of the earth's structure, labelling the three main layers and describe the physical structure of each layer, crust, mantle and core • investigate the formation of rock and soil using a simple model of soil erosion and explain the rock cycle 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • use a variety of activities to demonstrate the formation of layers in the process of sedimentation • use a variety of activities to demonstrate the formation of fossils in sedimentary rocks • describe in general terms how evidence is obtained for determining the formation of rocks • collect natural samples, one sample per group • discuss similarities and differences using their model samples with the natural samples to draw generalisation about the living past 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • collect and describe the texture of stone tools and other rocks and draw conclusions as to why tools are made using these rocks and not other rocks • distinguish in general terms between sedimentary, igneous and metamorphic rocks on the basis of their formation and composition • demonstrate the formation of igneous and metamorphic rocks using simple experiments and observations in previous activities

Sub-strand	Grade 6	Grade 7	Grade 8
Space Exploration	<p>6.4.2 Identify and describe familiar events such as star patterns and moon phases</p>	<p>7.4.2 Investigate the interactions between the earth, moon and sun</p>	<p>8.4.2 Collect information about human exploration into space</p>
Indicators	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • tell stories from personal experiences or use guest speakers to demonstrate an understanding of the star patterns and the moon phases and relate these experiences to daily activities • observe and keep a record of the different phases of the moon in the lunar circle over a period of time • explain how these events influence their daily lives 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • design a scaled diagram of the solar system and identify distances and relationships between the components of the solar system • make a model of the solar system using given measurements and compare distances and sizes • using prior knowledge and data collected, demonstrate the position of the earth, moon and sun in explaining the tides • describe the observable effects of relative movements of planets, moon, sun and stars 	<p>Students will be achieving this outcome when they, for example</p> <ul style="list-style-type: none"> • research information and write reports on space exploration and communicate understandings to others • design and make models of spaceships to explain their roles in space travels and communication • make a simple telescope and describe its purpose • design ways to demonstrate information about human exploration, such as models

Anderton, John (1988) *Fundamental Science for Melanesia*, Book 1. Longman, Cheshire

Anderton, John (1988) *Fundamental Science for Melanesia*, Book 2. Longman, Cheshire

Byers A, Students A. & Laine C. (1994) *The Science Teacher's Handbook, Ideas and Activities for every Classroom*. Heinemann

Jakab, Cheryl (1999) *Earth and Beyond, Activities for thinking scientists*, Book 1. Macmillan, Melbourne

Jakab, Cheryl (1999) *Earth and Beyond, Activities for thinking scientists*, Book 2. Macmillan, Melbourne

Jakab, Cheryl (1999) *Earth and Beyond, Activities for thinking scientists*, Book 3. Macmillan, Melbourne

NDOE (1999) *Reproductive and Sexual Health*, Supplementary Text, UNFPA and Department of Education, PNG.

QSCC (1999) *Science Years 1 to 10 Syllabus*, Queensland School Curriculum Council, Brisbane

QSCC (1999) *Science Years 1 to 10*. Queensland School Curriculum Council (1999) *Science Years 1 to 10*, Statement of Content for Education Queensland Schools, (1999)

QSCC (2000) *Science Years 1 to 10 Source Book*. Queensland School Curriculum Council, Brisbane