

Geology

**Upper Secondary
Syllabus**



Papua New Guinea
Department of Education

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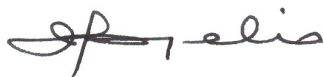
Secretary's message

This Geology syllabus is to be used by teachers of Geology to teach Upper Secondary students (Grades 11 and 12) throughout Papua New Guinea. The syllabus builds on and enhances knowledge, skills and attitudes learnt in Lower Secondary, and provides students with the opportunity to deepen their understanding of advanced geological knowledge to meet individual needs as well as local and global demands and challenges.

Since Geology is a rapidly changing field, teachers of Geology play a pivotal role by being innovative and creative, and by keeping abreast of new information that is based on scientific research and innovations in technological change.

Through the study of Geology, students consider the impact of human activities on ecosystems and the environment, as well as on individual human beings and human society, both in Papua New Guinea and globally. An understanding of Geology, and the application of this understanding, will help students to appreciate factors such as the culture, ethics, economics, power, and relationships that influence the pursuit of science, and have a significant impact on the way people live.

I commend and approve this syllabus as the official curriculum for Geology to be used in all schools with Grades 11 and 12 students throughout Papua New Guinea.



DR JOSEPH PAGELIO

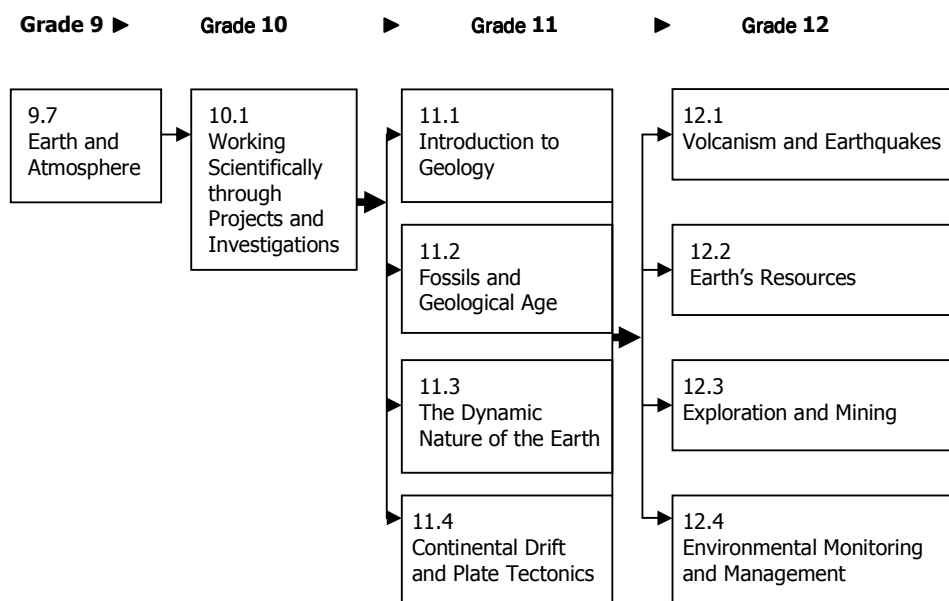
Secretary for Education

Introduction

This syllabus is based on the curriculum principles from the National Curriculum Statement. It has been designed using learning outcomes that identify the knowledge, skills, attitudes and values that all students achieve or demonstrate by the end of Grade 12. It is linked to the national curriculum learning area Science and builds on the knowledge and skills students have learnt in Grades 9 and 10. This Geology syllabus offers a number of pathways to post-secondary study and the workforce. It has specialised and general applications in both areas.

Lower Secondary Science Strands	Lower Secondary Science Units	Upper Secondary Geology Units	
4. Earth and space 1. Nature of science 3. Matter and energy <ul style="list-style-type: none"> Strands 1 and 3 have some relevance to Geology in relation to the nature of the units, interdependence and maintenance of natural processes 	Earth and Atmosphere	Introduction to Geology Fossils and Geological Age The Dynamic Nature of the Earth Continental Drift and Plate Tectonics	Volcanism and Earthquakes Earth's Resources Exploration and Mining Environmental Monitoring and Management

Overview of the study of Geology from Lower Secondary to Upper Secondary



Geology is a specialised subject that requires a high level of cognitive competency, a high level of numeracy competency and a basic level of language skills.

Assessment is an important component of teaching for learning and is integrated into the learning and teaching activities of Geology. Continuous assessment in Geology provides feedback to students and the teacher on students' progress towards achievement of the learning outcomes. It helps students improve their standards of achievement by knowing what they need to do well and where they need to improve. In Geology, teachers will gather evidence from students' work during the course of the term and use those continuous assessments to improve their teaching and students' learning. The teaching program should also include formal summative assessment of learning to gauge students' levels of achievement.

Geology is to be timetabled for 240–250 minutes per week in Grade 11 and Grade 12.

Rationale

The active land formation of Papua New Guinea indicates that the country is geologically young. It is one of the most unstable regions in the world. The geological activities have led to the formation of natural resources such as minerals, oil and natural gas. While these natural resources are contributing to the development of Papua New Guinea, their extraction does have some impacts on the lives of the people and the environment.

Human beings have always had a great influence on the earth and the environment since they came into existence; and human beings must accept responsibility for their actions on earth. This is the context within which scientifically literate geologists, including Papua New Guinean geologists, must demonstrate a sound understanding of geological principles, concepts, processes, systems and interactions, and make informed decisions.

Students' skills in problem solving, critical thinking and working cooperatively in small groups are enhanced in the study of Geology. Acquiring these skills enables students to explore various solutions to geological, environmental and other related problems. Students develop values and attributes such as flexibility, curiosity, critical reflection and respect for evidence. These help them to consider issues and implications of having respect for the environment, both living and non-living. Students are able to recognise and understand the strengths and limitations of geological techniques and technologies in the field of geoscience.

The geological knowledge and skills acquired through this course will provide students with a foundation for sustainable living in their community, further education and the workforce.

Aims

Geology aims to enable students to:

- appreciate the processes that occur inside and outside the earth
- appreciate the relationships between nature and humanity so that they can be responsible for their actions
- recognise the importance of sustaining earth resources for future generations
- appreciate the advantages and disadvantages of extracting earth resources
- contribute meaningfully to the community in which they live, using modern and traditional practices
- participate before, during and after natural disasters to reduce the impact of these disasters
- educate their communities about the impact of natural geological disasters and how to reduce the impact
- provide advice on policies that affect the resource development in their communities
- participate in and assist future developments, using past and present geological knowledge.

Strands

The study of Geology is described in the Lower Secondary Science strand 'Earth and space'.

'Earth and space' discusses concepts of strata, natural process and cycles and how the atmosphere interacts with the surface of the earth and its impact on the earth.

Our lives depend on air, water and materials from the ground. The way we live depends on our landscape, weather and climate. This strand considers a diverse range of issues related to geology and the atmosphere. It provides an opportunity for students to explore the structure of the earth and natural phenomena that bring about changes.

This strand includes the various layers of the atmosphere and the important roles they play. It looks at the nature and effect of rotations and revolutions of planets, including the earth. It also includes the active atmosphere, the effects of radiation on land and water, and related issues.

Learning outcomes

The Geology learning outcomes identify the knowledge, skills, attitudes and values all students achieve or demonstrate at the end of Grade 12. The learning outcomes for Geology are listed below.

Students can:

1. demonstrate an understanding of fundamental concepts of geology
2. design or use geological models to explain the interior and exterior activities of the earth
3. describe and explain the impact of geological events on the community and the environment
4. design and undertake investigations to solve geological problems in Papua New Guinea
5. analyse, evaluate and interpret geological data and information
6. communicate geological information in different ways
7. demonstrate an understanding of traditional geological knowledge and practices in their societies.

Note: While all ideas and concepts in Geology are linked, the table below indicates the connections that should be highlighted most.

Learning outcomes mapped against units								
Learning outcomes	Units							
	11.1	11.2	11.3	11.4	12.1	12.2	12.3	12.4
1. Demonstrate an understanding of fundamental concepts of geology	✓	✓	✓	✓	✓	✓		
2. Design or use geological models to explain the interior and exterior activities of the earth		✓	✓	✓	✓			
3. Describe and explain the impact of geological events on the community and the environment		✓			✓		✓	✓
4. Design and undertake investigations to solve geological problems in Papua New Guinea		✓					✓	
5. Analyse, evaluate and interpret geological data and information	✓			✓	✓	✓	✓	
6. Communicate geological information in different ways	✓			✓	✓	✓	✓	✓
7. Demonstrate an understanding of traditional geological knowledge and practices in their societies					✓			✓

Unit sequence and content

Grade 11 units	Grade 12 units
<p>11.1 Introduction to Geology <i>9–10 weeks</i></p> <ul style="list-style-type: none"> • What is Geology? • Structure and composition of the earth • Earth's crust <p>11.2 Fossils and Geological Age <i>9–10 weeks</i></p> <ul style="list-style-type: none"> • Geological timescale and its divisions • Features of different time divisions • Fossils • Fossils and interpretation of geological phenomena <p>11.3 The Dynamic Nature of the Earth <i>9–10 weeks</i></p> <ul style="list-style-type: none"> • Major earth systems • Surficial processes <p>11.4 Continental Drift and Plate Tectonics <i>9–10 weeks</i></p> <ul style="list-style-type: none"> • Theory of continental drift • Plate movements and collisions 	<p>12.1 Volcanism and Earthquakes <i>9–10 weeks</i></p> <ul style="list-style-type: none"> • Volcanoes • Earthquakes <p>12.2 Earth's Resources <i>9–10 weeks</i></p> <ul style="list-style-type: none"> • Minerals and rocks • Oil and gas (fossil fuels) <p>12.3 Exploration and Mining <i>11–12 weeks</i></p> <ul style="list-style-type: none"> • Exploration and prospecting • Extraction of minerals • Processing economic mineral resources • Refining economic mineral resources • Extraction of fossil fuels • Refining fossil fuels • Transportation of minerals, oil and gas • Case study of a mine in Papua New Guinea • Management of mining activities <p>12.4 Environmental Monitoring and Management <i>7–8 weeks</i></p> <ul style="list-style-type: none"> • Risk strategies • Disaster management • Environmental impacts of mining

Grade 11 units

11.1 Introduction to Geology

9–10 weeks

Students understand that the earth has come through constant gradual changes in its lifetime. They learn how and why the geomorphologic features that are seen today are not the same as they were in the past and will not be the same in the future. They appreciate the physical nature of the slow processes that shape the earth over time.

This unit enables students to learn the basic geological concepts of the earth's formation, structures, weathering processes and rock formation.

Learning outcomes

Students can:

1. demonstrate an understanding of fundamental concepts of geology
5. analyse, evaluate and interpret geological data and information
6. communicate geological information in different ways.

To achieve these outcomes, students:

- compare and contrast layers of the earth's structure and their composition
- compare and contrast rocks by appearance—degree of weathering
- use models to explain earth structure and weathering processes
- observe and investigate major rock types and classify them according to their physical and chemical characteristics
- communicate results of investigations and observations

Content

Students acquire knowledge and skills through the learning and teaching of this content.

What is Geology?

- definition
- physical and chemical characteristics of rocks
 - elements and mineral makeup of rocks

Structure and composition of the earth

- structure of the earth
- characteristics of the earth's structure

Earth's crust

- major rock types:
 - igneous
 - metamorphic
 - sedimentary
- rock formation and cycles of the major rock types
 - physical and chemical weathering
 - erosion

Skills, attitudes and values

Attitudes and values

- comprehension and appreciation of the geology of Papua New Guinea and the Pacific
- being self-organising, reliable and responsible

Process skills

- observation and classification
- map reading
- interpretation of geological structures

General skills

- making decisions
- thinking logically and critically
- cooperating in groups
- reading for understanding
- communicating
- solving problems

11.2 Fossils and Geological Age

9–10 weeks

In this unit, students learn the divisions of the geological timescale—eras, periods and epochs—and the major fossil groups. They appreciate the gradual change of the earth's processes and systems over time. The different fossil groups are discussed and then matched with the geological timescale to show how fossils are used to determine geological age of rocks.

Learning outcomes

Students can:

1. demonstrate an understanding of fundamental concepts of geology
2. design or use geological models to explain the interior and exterior activities of the earth
3. describe and explain the impact of geological events on the community and the environment
4. design and undertake investigations to solve geological problems in Papua New Guinea.

To achieve these outcomes, students:

- carry out library research and construct a geological timescale
- study the main fossil groups, describe their formation and relative ages
- relate the fossil age to the geological timescale
- construct models to show formation of fossils
- conduct laboratory activities on fossil dating of rock samples
- visit a suitable site, investigate fossil-bearing rocks and determine the relative age of the rocks
- investigate fossil-bearing rocks and correlate different stratigraphic units.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Geological timescale and its divisions

- era
- period
- epoch

Features of different time divisions

- types of fauna and flora

Fossils

- definition of a fossil

- formation of fossils
 - conditions necessary for fossil formation
 - ways of fossil preservation
- major fossil groups

Fossils and interpretation of geological phenomena

- using fossils to determine relative ages of rocks
- fossils as indicators of the conditions of deposition
- law of superposition
- law of faunal assemblage
 - correlation of rocks and fossils in different places

Skills, attitudes and values

Attitudes and values

- comprehension and appreciation
- being self-organising, reliable and responsible
- being open-minded
- being safety conscious

Process skills

- data collection and organisation
- rock correlation
- stratigraphic correlation using fossils
- scientific reporting

General skills

- making decisions
- thinking logically and critically
- cooperating in groups
- reading for understanding
- communicating
- solving problems

11.3 The Dynamic Nature of the Earth

9–10 weeks

Students learn why the rivers continue to flow but never run out; and why the oceans receive water but never fill up. They understand how the mechanism of the atmosphere relating to other systems can affect the earth's crust.

This unit enables students to learn about major earth systems and surficial processes. These processes have geological importance on earth because of the ways in which they contribute to changing the earth's crust.

Learning outcomes

Students can:

1. demonstrate an understanding of fundamental concepts of geology
2. design or use geological models to explain the interior and exterior activities of the earth

To achieve these outcomes, students can:

- research and present findings on the earth's systems
- investigate and explain the effects of ground water
- carry out measurement of river depth, width and speed, and observe sediment sorting, grain size and sphericity
- visit a nearby cave and observe evidence of limestone leaching and the formation of stalactites and stalagmites.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Major earth systems

- composition of the three major earth systems
- atmosphere
 - nitrogen cycle
 - carbon cycle
 - water cycle
- hydrosphere
 - oceans
 - surface water
 - ground water
- lithosphere
 - section that includes the upper mantle

Surficial processes

- the water cycle
- streams and sedimentation
- ground water and its effects such as leaching
- formation of limestone caves

Skills, attitudes and values

Attitudes and values

- comprehension and appreciation
- being open-minded
- being self-organising, reliable and responsible
- being safety conscious

Process skills

- hypothesising
- observing
- accurate recording of field data
- interpreting

General skills

- making decisions
- thinking logically and critically
- cooperating in groups
- reading for understanding
- communicating
- solving problems
- being imaginative, creative and innovative

11.4 Continental Drift and Plate Tectonics

9–10 weeks

This unit enables students to learn about the theory of continental drift and the different geological features that occur on the earth's surface. Students compare and contrast the differences in the appearance of the crusts and rocks at different locations of the earth. They understand the movement of the large land masses due to spreading of the ocean floor. The unit also explains the disappearance of land masses through geological processes such as subduction.

Learning outcomes

Students can:

1. demonstrate an understanding of fundamental concepts of geology
2. design or use geological models to explain the interior and exterior activities of the earth
5. analyse, evaluate and interpret geological data and information
6. communicate geological information in different ways.

To achieve the learning outcomes, students:

- carry out an activity on the shapes of continents
- explain why rocks of similar properties or characteristics are found in different continents
- investigate movement of continents through models
- identify and interpret geological features on geological and world maps
- construct and/or use models of plate boundaries and folding and faulting to explain the concepts
- use analogies to explain the geology of the ocean floor
- design models that demonstrate the activities of the ocean floor
- conduct a field study of different folds and faults in a quarry or road cut or river site or beach cut and discuss the sequence of geological events
- carry out a field study of any geological feature in the environment and communicate their findings
- use a geological map of Papua New Guinea and the Pacific to explain the geological history.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Theory of continental drift

- Wegener's theory
 - early clues
 - magnetic clues

Plate movements and collisions

- plate boundaries
 - world map of major plates
 - Papua New Guinea and the Pacific
- movement of plates and collisions
- major effects of movements of plates and collisions such as
 - earthquakes
 - tsunamis
 - volcanoes
- mid-ocean ridges and spreading of sea floor
- subduction and trenches
- folds and faults
 - types of folds and faults
 - formation of mountains
- overview of geology of Papua New Guinea such as:
 - geological map
 - formations
 - structures
 - rock types
- geology of Papua New Guinea and the Pacific

Skills, attitudes and values

Attitudes and values

- comprehension and appreciation
- being open-minded
- being self-organising, reliable and responsible
- being safety conscious

Process skills

- observing
- interpreting geological structures
- reconstructing geological events
- recording field data
- field sketching
- marking information on maps or aerial photographs

General skills

- making decisions
- thinking logically and critically
- cooperating in groups
- reading for understanding
- communicating
- solving problems

Grade 12 units

12.1 Volcanism and Earthquakes

9–10 weeks

Papua New Guinea, being located on the 'ring of fire', is prone to natural disasters that are related to geological activities. The 1998 Aitape tsunami, and 1994 Rabaul and 2004 Manam volcanic eruptions, are all examples of natural disasters that severely disturbed the lives of the people, particularly people who lived close to the areas affected by these events. The 2005 tsunami that swept through many parts of Asia and took thousands of lives can not be easily forgotten. The absence of early warning systems may have contributed to the loss of many lives.

This unit enables students to learn about the formation, structure and types of volcanoes. The distribution of volcanoes and their related geological activities are discussed, as are earthquakes, seismic waves and their intensities.

This unit enables students to understand how tsunami, volcanoes and earthquakes are caused. Students outline measures that need to be undertaken by people before disaster strikes. Students or a community elder can also share experiences of their traditional practices of early warning methods. Students also do research on the modern early warning systems that exist in various parts of the world and propose where these could be strategically located in Papua New Guinea.

Learning outcomes

Students can:

1. demonstrate an understanding of fundamental concepts of geology
2. design or use geological models to explain the interior and exterior activities of the earth
3. describe and explain the impact of geological events on the community and the environment
5. analyse, evaluate and interpret geological data and information
6. communicate geological information in different ways
7. demonstrate an understanding of traditional geological knowledge and practices in their societies.

To achieve the learning outcomes, students:

- describe how tsunami, volcanoes and earthquakes are caused
- construct and/or use models of volcanoes to demonstrate how they erupt
- use geological and world maps to interpret geological features
- use geological data to interpret intensity of earthquakes
- determine the focus and epicentre of earthquakes through calculation of available data
- develop a case study of an area affected by volcanic eruptions or earthquakes

- discuss, write and report on traditional knowledge and practices of predicting natural disasters related to geological activities.
- explain strategic measures to deal with the effects of disasters
- visit a geological feature related to volcanoes or earthquakes and explain how it formed.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Volcanoes

- formation of volcanoes
- structure of volcanoes
- types of volcanoes
- distribution of volcanoes worldwide
- signs and warnings of an erupting volcano
- volcanic activities and ejecta
- effects of volcanoes such as
 - land formations
 - lava flows
 - ravines and crevasses
- effects on communities and environments
- traditional knowledge and practices of volcanic activities
- effects of volcanic activity in Papua New Guinea such as Rabaul, Madang, Kimbe and so on

Earthquakes

- earthquakes
- wave types and epicentre
- strength of the earthquakes
 - measurement of earth movements
 - seismograph
 - the Richter scale
- geological effects of earthquakes such as
 - subsidence
 - uplift
 - landslides
 - tsunamis
 - ravines and crevasses
- effects on communities and environments
- traditional knowledge and practices of earthquake activities
- effects of earthquake activity in Papua New Guinea such as Aitape and Rabaul.

Skills, attitudes and values

Attitudes and values

- comprehension and appreciation
- being open-minded
- being self-organising, reliable and responsible
- being safety conscious

Process skills

- observing
- analysing
- interpreting geological structures and features
- recording field findings
- field sketching

General skills

- making decisions
- thinking logically and critically
- cooperating in groups
- reading for understanding
- communicating
- solving problems

12.2 Earth's Resources

9–10 weeks

Resources such as oil, gas and minerals are very important. Papua New Guinea is rich in natural resources such as minerals, oil and gas. While it takes a very long time for these resources to be formed, the rates of extraction and depletion of these resources are very fast. The unit enables students to identify the different types of earth resources and explain how these are formed and used.

Learning outcomes

Students can:

1. demonstrate an understanding of fundamental concepts of geology
5. analyse, evaluate and interpret geological data and information
6. communicate geological information in different ways

To achieve the learning outcomes, students:

- interpret geological maps to determine locations of minerals
- use samples and charts of minerals to identify mineral types
- use simple tests to identify mineral types
- explain how earth's resources were formed
- demonstrate understanding of the importance and uses of resources

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Minerals and rocks

- minerals of economic importance such as
 - gold, silver, lead, copper, nickel, zinc and so on
- location of minerals in Papua New Guinea
- simple model of mineral formation
- examples of mineral ores such as bauxite (aluminium), azurite, malachite (copper), galena (lead)
- uses of minerals and rocks
- simple tests to identify minerals

Oil and gas (fossil fuels)

- formation of crude oil and gas
- characteristics of crude oil
- characteristics of natural gas
- location of major oil and gas fields in the world

- location of oil and gas fields in Papua New Guinea
- importance of crude oil and gas
- uses of crude oil and gas.

Skills

Attitudes and values

- comprehension and appreciation
- being open-minded
- being self-organising, reliable and responsible
- being safety conscious

Process skills

- classifying
- analysis and synthesis of geological information
- interpreting geological data
- interpreting geological maps

General skills

- making decisions
- thinking logically and critically
- cooperating in groups
- reading for understanding
- communicating
- solving problems

12.3 Exploration and Mining

11–12 weeks

Prospecting for mineral ores and exploration for oil and gas are the first steps to harnessing earth resources. Mining and processing are the next steps. This unit enables students to understand the processes involved in prospecting, exploration, mining and processing. Natural resources are not normally ready to be used straight from the ground. Ore minerals, crude oil and natural gas are processed before they can be used.

Students understand the roles of government, resource developer and resource owner in resource development. We need policies to guide us in using these resources so they sustain our livelihood in a global market economy, and to reduce environmental impacts on our societies.

Learning outcomes

Students can:

3. describe and explain the impact of geological events on the community and the environment
4. design and undertake investigations to solve geological problems in Papua New Guinea
5. analyse, evaluate and interpret geological data and information
6. communicate geological information in different ways.

To achieve these learning outcomes, students:

- describe the methods involved in prospecting, exploration, mining and refining
- state the different types of exploration and mining activities
- evaluate an existing agreement between various stakeholders involved in resource development and apply it to their context
- discuss some landowner issues relating to exploration and mining activities
- list some environmental issues relating to mining activities
- describe how earth resources are extracted and processed for use
- review existing resource management policies, provide a critique from a resource owner's viewpoint and offer alternatives
- visit a sea or land or forest habitat and study the impacts of mining activities.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Exploration and prospecting

- historical methods

- prospecting
- examples of discoveries in Papua New Guinea
- methods of exploration
 - surface observation
 - geochemical and geophysical methods
 - remote sensing
- licensing of prospectors
- location of mine sites in Papua New Guinea

Extraction of minerals

- types of mines such as
 - open cut (copper, gold, limestone)
 - underground (gold)
 - underwater (copper, lead, gold)
 - alluvial (gold)

Processing economic mineral resources

- crushing
- washing
- concentrating such as gravity and floatation

Refining economic mineral resources

- smelting
- electrolysis

Extraction of fossil fuels

- oil drilling
 - offshore
 - onshore
- gas extraction

Refining fossil fuels

- distillation
- fractional distillation

Transportation of minerals, oil and gas

- Feasible, safe ways to transport materials such as
 - slurry in pipes
 - concentrate
 - oil tankers
 - oil pipelines
 - gas tankers or pipelines for liquefied petroleum gas (LPG)

Case study of a mine in Papua New Guinea

- location
- how and when minerals discovered
- type of minerals and extraction methods used
- environmental impact
- importance of the mine to Papua New Guinea

Management of mining activities

- policies on managing resources

Skills, attitudes and values

Attitudes and values

- comprehension and appreciation
- being open-minded
- being self-organising, reliable and responsible
- being safety conscious

Process skills

- observing
- recording of geological data
- analysis and synthesis
- interpretation

General skills

- making decisions
- thinking logically and critically
- cooperating in groups
- reading for understanding
- communicating
- solving problems

12.4 Environmental Monitoring and Management

7–8 weeks

In this unit, students understand the relationship between human beings and the environment and how it should remain cordial to reduce risks of natural disasters. Students formulate strategies for monitoring and managing risks to reduce loss of property and lives. Students devise management structures and list resources for managing the aftermath of a natural disaster or effects of human activities on the environment.

Learning outcomes

Students can:

3. describe and explain the impact of geological events on the community and the environment
6. communicate geological information in different ways
7. demonstrate an understanding of traditional geological knowledge and practices in their societies.

To achieve these outcomes, students:

- identify risk strategies for specific natural disasters
- devise a management structure for managing the aftermath of disaster
- describe the traditional practices for risk strategies and management
- put in place a simple evacuation plan for a geological disaster.

Content

Students acquire knowledge and skills through the learning and teaching of this content.

Risk strategies

- disaster committee
- early warning systems
- awareness
- evacuation measures
- suitable management structures

Disaster management

- counselling
- relief supplies
- finance of services
- restoration
- traditional management practices

Environmental impacts of mining

- destruction of habitats, land and sea
- pollution
 - air
 - water
 - soil
- policies on environmental management of mining activities
 - environmental impact studies
 - responsibility for impacts of mines
 - restoring the environment after the closure of mines

Skills, attitudes and values

Attitudes and values

- comprehension and appreciation
- being open-minded
- being self-organising, reliable and responsible
- being safety conscious

Process skills

- observing
- interpreting data
- reconstructing geological events
- recording field data
- marking information on a disaster map
- planning, management and reporting

General skills

- making decisions
- thinking logically and critically
- cooperating in groups
- reading for understanding
- communicating
- solving problems

Assessment components, weightings and tasks

The internal assessment mark for Geology is to be based on the Grades 11 and 12 syllabus only. Final assessment should be based on a range and balance of assessment instruments. One task may be used to assess several components. The components, weightings and tasks for Grades 11 and 12 units are detailed below.

Components, weighting and tasks for Grade 11

Component	Weighting	Tasks
Written tests	150	These may include multiple-choice items, short answers and extended responses, data interpretation, graphical skills, calculations
Practical tests on basic skills	50	Testing the ability of students doing simple geological lab tests and presentation of reports Doing simple research reports and presentation Simple calculations
Practical investigative skills	100	Practical work competency and some ratings given on presentation and communication
Marks	300	

Components, weighting and tasks for Grade 12

Component	Weighting	Tasks
Written tests	150	These may include multiple-choice items, short answers, essays and extended responses Statistical interpretation, graphical skills, calculations
Practical tests on basic skills	50	Testing the ability of students doing simple Geology techniques such as observation, interpretation, analysing results and writing conclusions
Practical investigative skills	100	Practical work competency and some ratings given on presentation and communication based appropriate research methodologies
Marks	300	

Assessment and certification

Assessment and reporting practices described here are detailed further in the *National Assessment and Reporting Policy for Papua New Guinea* (2003) and in other support materials produced by the Department of Education.

Assessment

The main purpose of assessment is to improve student learning.

Assessment needs to be *for* learning as well as *of* learning. It is used to evaluate and improve learning and teaching, report achievement and provide feedback to students on their progress.

Assessment measures students' achievement of learning outcomes as described in the syllabus. It is the ongoing process of identifying, gathering and interpreting information about students' achievement of the learning outcomes.

Teaching and learning using an outcomes approach requires teachers to plan their teaching and assess learner performance in relation to outcomes, using criteria derived from those outcomes. Assessment involves focusing less on whether a learner has 'passed' or 'failed' and more on what outcomes a learner has achieved and in which areas further support is required.

Assessment in Geology

A student's achievement in Geology at the end of Grade 12 will be assessed against the learning outcomes. Assessment of student progress towards achieving these learning outcomes is cumulative throughout Grades 11 and 12.

It is important that teachers plan the learning and teaching sequence so that there is a balanced spread of assessment during the year. Some tasks, such as investigations or case studies, can be designed so that they are completed over a period of time rather than at the end of the unit. Other tasks can be done immediately the relevant section of the unit or topic has been covered.

Assessment for certification

A student's overall achievement in Geology will be both internally and externally assessed. The final mark awarded to each student will be a combination of the internal assessment mark provided by the school and the examination mark.

Internal assessment

Internal assessment provides a measure of a student's achievement based on a wider range of syllabus content and outcomes than may be covered by the external examination alone. For Geology the internal assessment marks

will provide a summation of each student's achievements in Grades 11 and 12. The assessment tasks used to determine the internal assessment mark must comply with the components, weightings and types of tasks specified in the tables on page 26. A variety of tasks gives students the opportunity to demonstrate all the learning outcomes in different ways to improve the validity and reliability of the assessment.

All schools must meet the requirements for internal assessment as specified in the *Grade 12 Assessment, Examination and Certification Handbook*.

Recording

All schools must meet the requirements for maintaining and submitting student records as specified in the *Grade 12 Assessment, Examination and Certification Handbook*.

Certification

Candidates will be awarded the national certificate only if they meet all requirements for internal and external assessment. Eligibility rules for the award of certificates are specified in the *Grade 12 Assessment, Examination and Certification Handbook*.