



**DEPARTMENT OF
EDUCATION**

**UPPER SECONDARY
SCHOOL
CERTIFICATE
EXAMINATIONS**

GEOLOGY

Wednesday

23rd October 2013

Time allowed:

2 hours and 30 minutes

(11:00 am – 1:30 pm)

NO EXTRA TIME

(NO OTHER TIME)

Candidates are advised to
fully utilise the allocated
time

GL

INSTRUCTIONS TO CANDIDATES

(To be read by the external invigilator to all candidates)

1. The subject code for **Geology** is **8**.
2. There are **11** printed pages in the question booklet, **1** Part A electronic answer sheet and **6 printed** pages in the Part B answer booklet. There are two sections in this paper. Answer all questions.

Section A: Multiple Choice Questions - 30 marks

This section will be electronically marked.

Electronic Answer Sheet is provided. All answers to the Multiple Choice Section **MUST** be answered on this Answer Sheet.

Carefully following the instructions, fill in your Candidate Information and Subject Information.

Section B: Short Answer Questions - 70 marks

Write down your name, your school name and your 10 digit candidate number on the Section B Answer Booklet Provided.

3. You are required to only write the correct answer in the space provided.
4. Calculators may be used.
5. Answers written on the question paper will not be marked. Write answers neatly in spaces as allocated on the answer sheet. Answer **ALL** questions.
6. Answer all questions on the answer sheet. Answers on any other paper including rough work paper and the question paper **will not be marked**.
7. Enough spaces have been allocated for answers to every question. Questions must be answered in spaces as allocated. Answers all over the answer booklet may not be marked.
8. Correctional Fluid is not allowed on the answer sheet. Where you have made an error, cross out all the working and start on a new line.
9. Graphical Calculators are not permitted.

**PENALTY FOR CHEATING OR ASSISTING TO CHEAT IN
NATIONAL EXAMINATIONS IS NON-CERTIFICATION.**

DO NOT TURN OVER THE PAGE

AND DO NOT WRITE

UNTIL YOU ARE TOLD TO START.

Answer each question by shading in with HB pencil, the circle directly under the correct alternative A, B, C, D or E.

If you make a mistake, rub it out completely using an eraser rubber and shade the correct answer on the Electronic Answer Sheet.

QUESTION 1

Which subject combinations include subjects of geology only?

- | | |
|--|---|
| A. mineralogy, paleontology, ecology | B. petrography, archeology, histology |
| C. historical geology, optical mineralogy, meteorology | D. paleontology, sedimentology, petrography |

QUESTION 2

Which rock type is produced by sedimentary process?

- | | |
|-----------|--------------|
| A. slate | B. limestone |
| C. marble | D. gneiss |

QUESTION 3

Aluminum oxide and Silicon dioxide are major rock forming oxides. In which part of the earth's structure are the mostly concentrated?

- | | |
|---------------|---------------|
| A. Inner core | B. Outer core |
| C. Mantle | D. Crust |

QUESTION 4

There are two major geological processes that are involved in the formation of mountains and volcanoes. What are these processes?

- | | |
|-----------------------------|--|
| A. metamorphism and orogeny | B. earthquake activities and volcanism |
| C. orogeny and subduction | D. sedimentation and mountain building |

QUESTION 5

On the Geological Time Scale, in which era did Dinosaurs live?

- | | |
|---------------|----------------|
| A. Palaeozoic | B. Mesozoic |
| C. Cainozoic | D. Proterozoic |

QUESTION 6

The following rocks were collected for dating using fossils. Which one will not contain fossils?

- | | |
|----------------|------------------------|
| A. andesite | B. mudstone |
| C. calcarenite | D. quartzose sandstone |

QUESTION 7

Geological dating can be determined precisely with analysis of unstable isotopes. Which of the following cannot be used in this dating method?

- | | |
|----------------------------------|-------------------------------------|
| A. Potassium – 40 and Argon – 40 | B. Rubidium – 87 and Strontium – 87 |
| B. Carbon – 12 and Nitrogen – 14 | D. Uranium – 238 and Lead – 206 |

QUESTION 8

Which of the following conditions are favorable for the formation of fossils?

- | | |
|--|--|
| A. rapid deposition and reducing environment | B. high bioturbation and oxidizing environment |
| C. no bioturbation and reducing environment | D. slow deposition and oxidizing environment |

QUESTION 9

The zone below the water table is known as the

- | | |
|-------------|-------------------|
| A. Aquifer | B. Vadoze |
| C. Phreatic | D. Basin Holocene |

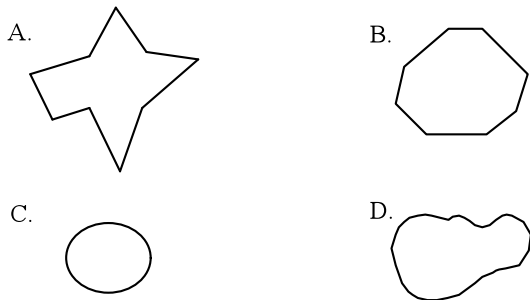
QUESTION 10

Which elements are easily leached from fresh igneous rocks when exposed to water and carbon dioxide?

- | | |
|------------------------------------|--------------------------------|
| A. potassium, aluminum and calcium | B. calcium, iron and potassium |
| C. potassium, sodium and calcium | D. sodium, iron and calcium |

QUESTION 11

Rock samples A, B, C and D were collected from a downstream sediment bank. Which rock travelled the shortest distance to the site of present deposition?

**QUESTION 12**

What kind of fault will be formed when tectonic plates are moving away from each other?

- | | |
|---------------|----------------|
| A. convergent | B. transform |
| C. divergent | D. over thrust |

QUESTION 13

After a major earthquake, a tsunami (tidal wave) may be generated. Which process would most likely generate a tsunami?

- | | |
|------------------------------|---------------------------------|
| A. tectonics movement | B. submarine landslip |
| C. change in seawater volume | D. crack in a terrestrial fault |

QUESTION 14

The epicenter of an earthquake is defined as the

- | |
|--|
| A. exact location in the subsurface of the earth where movement occurs. |
| B. exact location on the surface of the earth where most movement is felt. |
| C. exact location on the surface where a fault movement occurs. |
| D. exact location on the surface where there is an aftermath of an earthquake. |

QUESTION 15

Which of the body waves produced by an earthquake cannot travel through the outer core?

- A. Primary waves
- B. Rayleigh waves
- C. Secondary waves
- D. Love waves

QUESTION 16

The predominant eruptive components of a volcanic eruption are

- A. lava, volcanic bomb, pyroclastics and ashes.
- B. pyroclastics, lava, hot gases and boulders.
- C. lava, pyroclastics, molten sediments and superheated water.
- D. pyroclastics, lava, volcanic bomb and andesitic fragments.

QUESTION 17

Volcanic activities on the New Britain Island are best related to the

- A. rifting in the Manus Basin.
- B. transformation within the New Britain trench.
- C. divergence within the Manus Basin.
- D. convergence within the New Britain trench.

QUESTION 18

Earthquake activities are predominantly monitored using an equipment called the

- A. Ground Penetrating Radar.
- B. Global Positioning System.
- C. Seismograph.
- D. Seismogram.

QUESTION 19

Which of the following is not a volcano monitoring activity?

- A. ground deformation using tilt meters
- B. measuring gases from volcanoes
- C. measuring seismic activities
- D. measuring sea level changes

QUESTION 20

PNG mines produce copper, gold and silver. Which two mines currently produce gold and silver only?

- A. Lihir and Ok Tedi
- B. Tolukuma and Hidden Valley
- C. Ramu and Tolukuma
- D. Misima and Lihir

QUESTION 21

Mineral, gas and oil discoveries are possible through exploration to determine their occurrences and deposits. Which of the following is not related to exploration?

- A. geological mapping and sediment collection
- B. shooting seismic to determine sub surface geology
- C. conducting social mapping to identify landowners
- D. trenching and outcrop studies

QUESTION 22

Metal extractions from minerals can be done in several ways. Which activity is not related to metal refining?

- A. crushing and grinding
- B. carbon in pulp and leaching tanks
- C. fractional distillation and solvent extractions
- D. smelting and electrolysis

QUESTION 23

Oil and gas can be formed in rock formations called sandstone. Which formation below is the common reservoir sandstone formation for oil and gas in the Papuan Basin?

- A. Darai Formation
- B. Toro Formation
- C. Ievu Formation
- D. Imburu Formation

QUESTION 24

Severe environmental problems occur from waste rock dumps in Ok Tedi. Which is a major environmental concern?

- A. High basicity
- B. High acidity
- C. High levels of lime
- D. High levels of copper

QUESTION 25

Before mining and petroleum developments occur, impacts of waste disposal are an important concern. What kind of study must be undertaken before the development can take place?

- A. Impact Assessment Study
- B. Contamination Monitoring Study
- C. Environmental Baseline Study
- D. Quality Control Study

QUESTION 26

What are the main natural processes that are responsible for waste rock contamination into river systems?

- A. weathering and expansion
- B. weathering and dissolution
- C. weathering and pressure
- D. weathering and precipitation

QUESTION 27

What would be the best method of monitoring the progression of continuous environmental pollution from a mine?

- A. collect samples and analyses every six months
- B. real time analytical stations
- C. after a change in the environment is obvious then sample and analyses
- D. use physical parameters such as intensity of color of water

QUESTION 28

Which term is best used to mean rebuilding the environment after closure of mining activities?

- A. reconstruction
- B. rehabilitation
- C. regeneration
- D. rehabilitation

QUESTION 29

Large, steep sided and explosive volcanoes are known as _____ volcanoes.

- A. Shield
- B. Composite
- C. Submarine
- D. Intercontinental

Impacts due to mine wastes are the responsibility of mining companies. If you notice anything odd regarding mine wastes, what should you do?

- A. Ignore it because the company will take responsibility for it.
- B. Report to the company and alert the authorities in the Department of Environment and Conservation.
- C. Report it to the Police.
- D. Report it to the Court and Justice Department.

SECTION B: SHORT ANSWERS

(QUESTIONS 31 to 40)

7 MARKS EACH

Write the answers to **ALL** the Questions on the spaces provided in the Section B Answer Booklet.

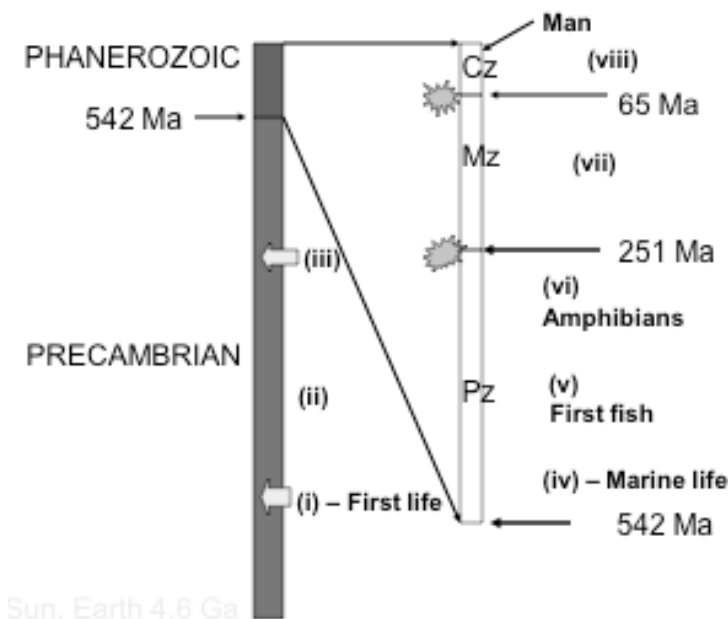
QUESTION 31

The table below contains a simplified classification of sediments and sedimentary rocks

Clast size	Sediment	Rock name		Calcareous equivalent
>2 mm	(i)	Conglomerate Breccia if clast are angular		(iv)
0.625 to 2 mm	Sand	(ii)		calcareous or calcareous sandstone
0.004 to 0.625 mm	Silt	Siltstone	(iii)	(v)
>0.004 mm	Clay	Claystone		

- a) What is the sediment name for (i) ? (1 mark)
- b) What are the rock names for (ii) and (iii)? (2 marks)
- c) What are the calcareous equivalent of (iv) and (v)? (2 marks)
- d) From the sedimentary rocks given in the table, which rock would contain more water? (1 mark)
- e) From the sedimentary rocks given in the table, which rock is commonly used in glass making? (1 mark)

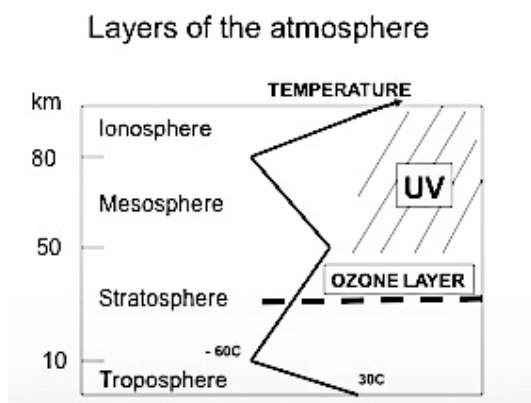
Shown is a simplified geological time scale from the Pre-Cambrian to the Present. MA = Millions of years. Pz = Paleozoics, MZ = Mesozoic, Cz = Cainozoic



- The first life on earth occurred at (i) as indicated on the time scale. What were the atmospheric conditions in regard to oxygen in the periods (ii) and (iii) respectively? (2 marks)
- The first marine life occurred at (iv), what happened at (v) and (vi) respectively? (2 marks)
- Amphibians evolved in (vi). What classes of organisms evolved in (vii) and (viii) respectively? (2 marks)
- A major event took place at 251 Ma and repeated at 65Ma. This event is known as _____ (1 mark)

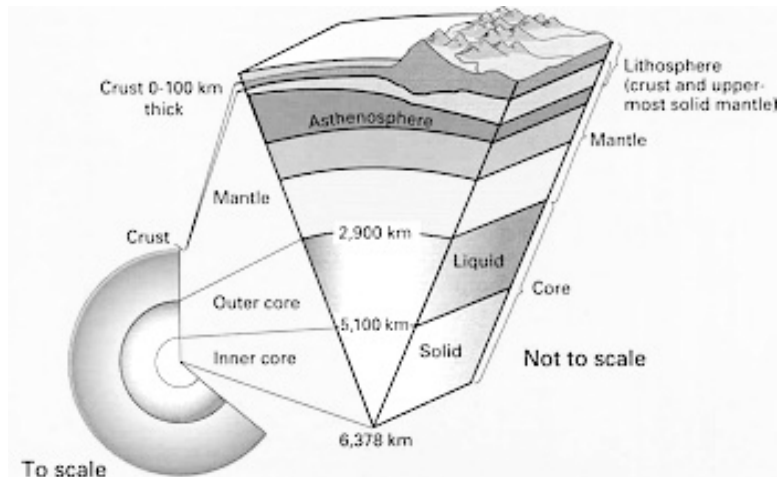
QUESTION 33

Below is a simplified diagram of the layering of the earth's atmosphere. The y-axis indicates height above the earth's surface and the y-axis indicates the temperature.



- Carbon dioxide, nitrogen dioxide and water occur in which layer of the atmosphere? (1mark)
- Name the layer that has ionized gases that reflect radio waves. (1mark)
- The ozone layer acts like a blanket over the earth and protects it from ultra violet (U.V) radiation. Destruction of the ozone causes _____ of the layer and contributes to _____. (2marks)
- What two layers have temperatures decreasing with height? (2mark)
- Name at least one factor responsible for the layering of the atmosphere. (1 mark)

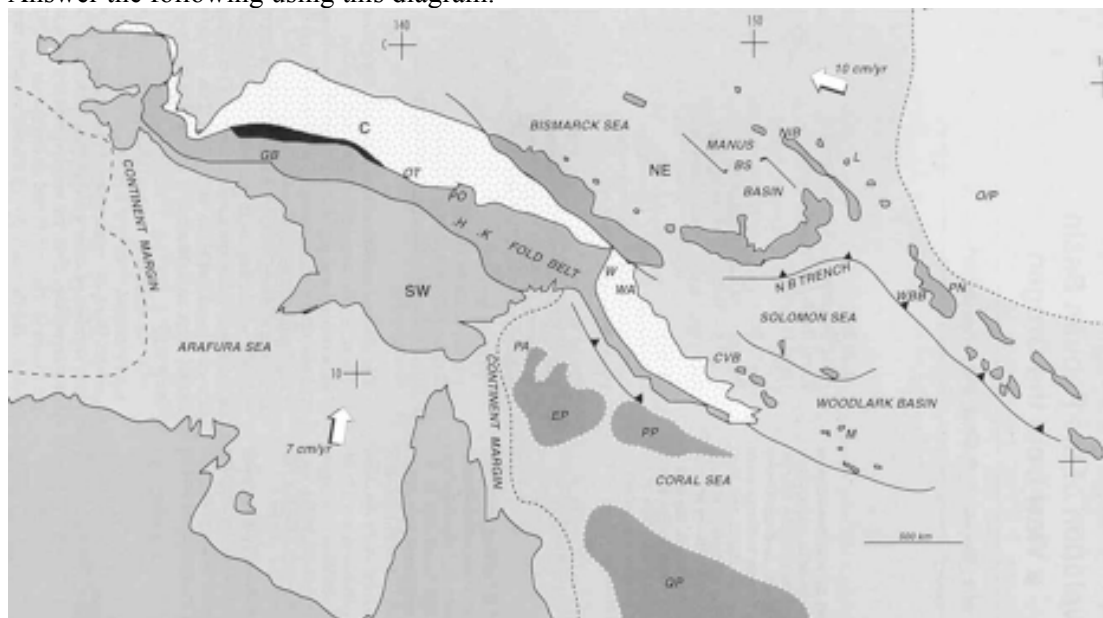
Use the diagram of the structure of the earth to answer the following questions.



- List two main differences in the physical characteristics of the lithosphere and the asthenosphere. (2 marks)
- What physical evidence indicates that the outer core is liquid (1 mark)
- List two major elements contained in the inner core. (2 marks)
- Name the two most dominant metal oxides of the earth's crust. (2 marks)

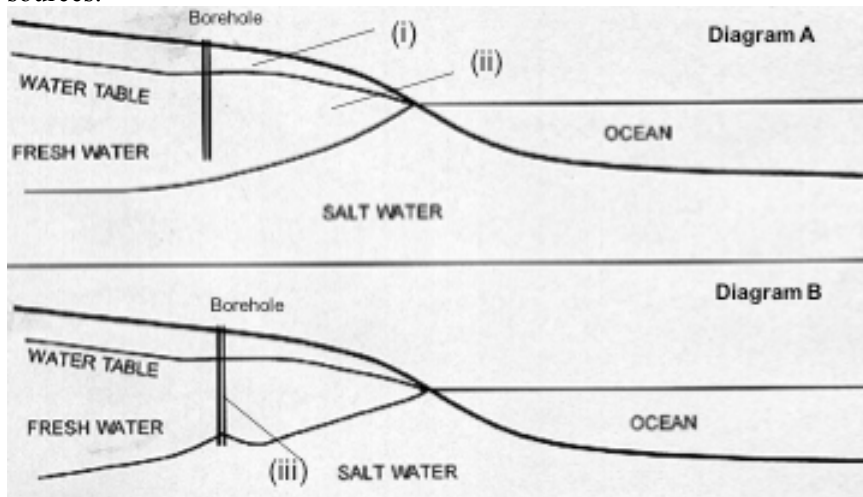
QUESTION 35

The map below shows the major tectonic features of the PNG – Solomon Islands Region. Answer the following using this diagram.



- What tectonic process took place between Australia and PNG before coming to the present geological setting? (1 mark)
- Name two major earth resource found within the fold belt. (2marks)
- What two rock types are commonly found on the islands of New Britain and New Ireland? (2marks)
- The New Britain Trench (NB Trench on map) is an important geological structure. It contributes to two important geological activities. What are these two activities? (2marks)

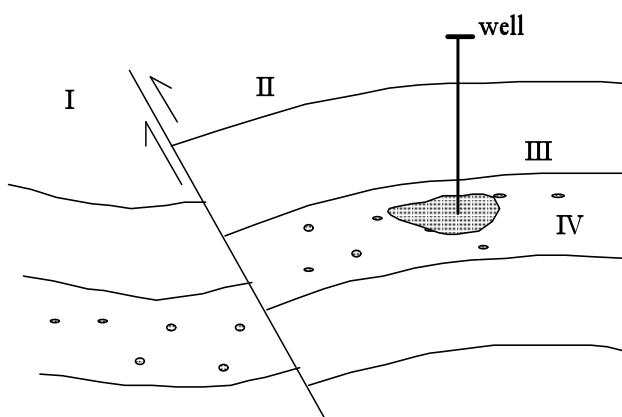
The diagram below shows a generalized underground water system. The vertical lines boreholes for groundwater sources.



- The layer labeled (i) is known as _____ . (1 mark)
- The layer labeled (ii) is known as _____ . (1 mark)
- Surface water passing through from layer (i) into layer (ii) is done through a process known as _____. (1 mark)
- Label (iii) in the diagram shows what happens if freshwater is over-pumped. State two things that could occur. (2 marks)
- The fresh water contained as a reservoir within such ground water systems are known as _____. (1 mark)

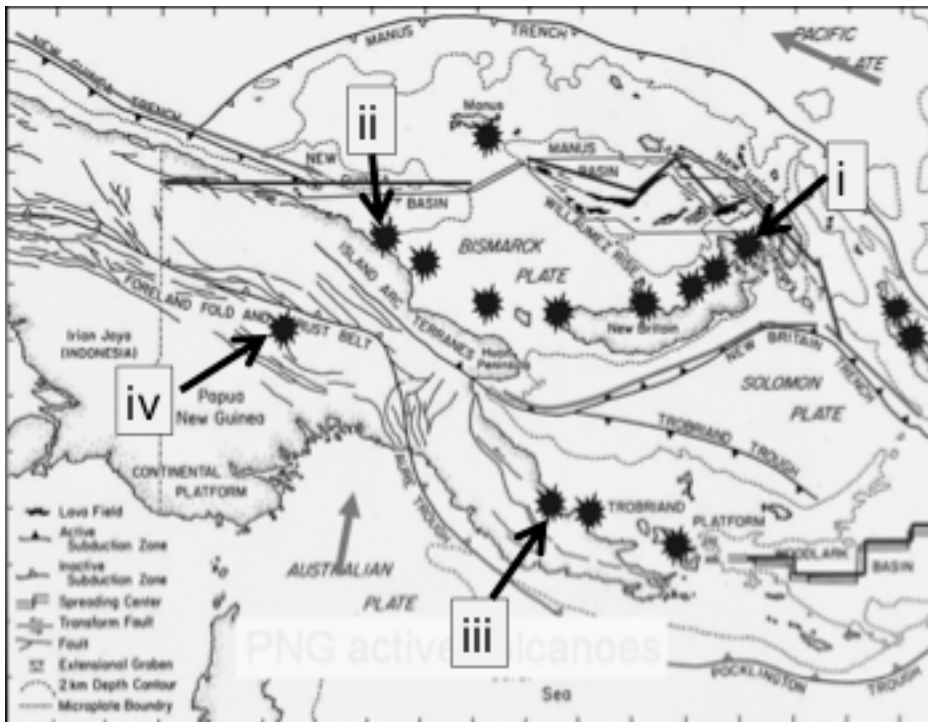
QUESTION 37

The diagram below shows a typical structure that contains oil and gas. A well is drilled and oil is discovered.



- What kind of fault is indicated in (I)? (1mark)
- Name the part of the structure labeled (II) (1mark)
- The rock units labeled (III) and (IV) are generally referred to as _____ and _____ respectively. (2marks)
- Give two examples of types of rock units that can make up (III) above. (1mark)
- Give an example of one oil field and one gas field in PNG. (2marks)

The diagram below shows the active and dormant volcanoes in PNG. The structures, tectonics and directions of major plate movements are also included. Use these to answer the questions below.



- a) Name the volcanoes numbered (i) and (ii). (2 marks)
- b) Which of the volcanoes in (A) erupted in 1996? (1 mark)
- c) Name the dormant volcanoes labeled (iii) and (iv). (2 marks)
- d) List at least two methods of monitoring volcanic eruptions. (2 marks)

QUESTION 39

After a Mining Lease or Special Mining Lease is granted by the Government to the developing company, the Company starts mining for the metals of interest. Gold is one of these metals and a major metal export of Papua New Guinea.

- a) Name the largest gold mine in PNG? (1 mark)
- b) When was the largest gold mine stated in (a) started gold production? (1 mark)
- c) Gold bearing minerals are closely associated with metallic (i) _____ and (ii) _____ minerals. (2 marks)
- d) Pressure oxidation treatment is applied to treat gold bearing mineral. What is the common name given to this class of gold bearing ores? (2 marks)
- e) Mercury can be used to collect gold. These type of gold are known as _____ gold. (1mark)

Any mining activities have a direct environmental impact which affects terrestrial and aquatic ecosystems including human beings. The mining companies involved generally incorporate measures of reduction of these environmental impacts.

- a) A common rock type used to minimize impacts of sulfide waste rocks into river systems is _____ . (1mark)
- b) Name two mines in PNG that directly dump mine tailings into the sea. (2mark)
- c) Name two mines in PNG that directly dump mine tailings into river systems. (2marks)
- d) The measures or strategies used to minimize environmental impacts are known as: _____ (1mark)
- e) Toxic heavy metals build up within the food web of aquatic ecosystem. Such metal build up are known as _____ toxins. (1mark).

END OF EXAMINATION

GEOLOGY

SECTION B – ANSWER BOOKLET

Write your name, province and school codes and your candidate number correctly and clearly in the spaces provided below.

Year		Province		School			Candidate		
1	3								

Candidate Name: _____

School Name: _____

ANSWERS WRITTEN ON THE QUESTION PAPER OR ANY OTHER PAPER WILL NOT BE MARKED.

WRITE ANSWERS NEATLY IN THE SPACES PROVIDED IN THIS ANSWER BOOKLET

FOR MARKERS USE ONLY

	Score	Markers' Initials	
		Marker 1	Marker 2
SECTION B			
QUESTION 31			
QUESTION 32			
QUESTION 33			
QUESTION 34			
QUESTION 35			
QUESTION 36			
QUESTION 37			
QUESTION 38			
QUESTION 39			
QUESTION 40			
	70		

START YOUR WORK ON THE NEXT PAGE

SECTION B - ANSWERS

Write your answer in the space provided below. Your answers must be clear and precise.

QUESTION 31	Mark/Q	Marker 1	Marker 2
a) _____	1		
b) _____ and _____	2		
c) _____ and _____	2		
d) _____	1		
e) _____	1		
For Markers Use Only	Q 31 Total		

QUESTION 32	Mark/Q	Marker 1	Marker 2
a) atmospheric condition at period (ii) _____ atmospheric condition at period (iii) _____	2		
b) occurrence at (v) _____ occurrence at (vi) _____	2		
c) class of organism at (vii) _____ class of organism at (viii) _____	2		
d) _____	1		
For Markers Use Only	Q 32 Total		

QUESTION 33	Mark/Q	Marker 1	Marker 2
<p>a) _____</p> <p>b) _____</p> <p>c) The ozone layer acts like a blanket over the earth and protects it from ultra violet (U.V) radiation. Distraction of the ozone causes _____ of the layer and contributes to _____.</p> <p>d) _____ and _____</p> <p>e) _____</p>	1		
	1		
	2		
	2		
	1		
For Markers Use Only	Q 33 Total		

QUESTION 34	Mark/Q	Marker 1	Marker 2
<p>a) (i) _____</p>			
<p>(ii) _____</p>	2		
<p>b) _____</p>	1		
<p>c) (i) _____</p>			
<p>(ii) _____</p>	2		
<p>d) (i) _____</p>			
<p>(ii) _____</p>	2		
For Markers Use Only	Q 34 Total		

QUESTION 35	Mark/Q	Marker 1	Marker 2
a) _____	1		
b) _____ and _____	2		
c) _____ and _____	2		
d) (i) _____	2		
(ii) _____			
For Markers Use Only Q 35 Total			

QUESTION 36	Mark/Q	Marker 1	Marker 2
a) _____	1		
b) _____	1		
c) _____	1		
d) (i) _____	2		
(ii) _____	1		
e) _____			
For Markers Use Only Q 36 Total			

QUESTION 37	Mark/Q	Marker 1	Marker 2
a) _____	1		
b) _____	1		
c) _____ and _____	2		
d) (i) _____			
(ii) _____	2		
d) _____	1		
For Markers Use Only Q 37 Total			

QUESTION 38	Mark/Q	Marker 1	Marker 2
a) (i) _____ (ii) _____	2		
b) _____	1		
c) (i) _____ (ii) _____	2		
d) (i) _____			
(ii) _____	2		
For Markers Use Only Q 38 Total			

QUESTION 39	Mark/Q	Marker 1	Marker 2
a) _____	1		
b) _____	1		
c) _____ and _____	2		
d) (i) _____			
(ii) _____	2		
d) _____	1		
For Markers Use Only Q 39 Total			

QUESTION 40	Mark/Q	Marker 1	Marker 2
a) _____	1		
b) _____ and _____	1		
c) _____ and _____	2		
d) _____			
e) _____			
For Markers Use Only Q 40 Total			