DEPARTMENT OF EDUCATION

UPPER SECONDARY SCHOOL CERTIFICATE EXAMINATIONS

GEOLOGY

Wednesday

28 October 2015

Time allowed:

2 hours and 30 minutes

(11:00 am – 1:30 pm)

NO EXTRA TIME

(NO OTHER TIME)

Candidates are advised to fully utilize 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 **15 printed** pages in the question booklet and **6 printed** pages in the answer booklet. There are two parts in this paper. Answer all questions.

   Part A: Multiple Choice Questions - 30 marks
   This section will be electronically marked.
   All answers to the Multiple Choice Part MUST be answered on the ELECTRONIC ANSWER SHEET provided.

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

   Part B: Short Answer Questions - 70 marks
   Write down your name, your school name and your 10-digit candidate number on the Part B Answer Sheet provided.
3. You are required to write the correct answer in the space provided.
4. Answers written on the question paper will not be marked. Write answers neatly in spaces as allocated on the answer sheet. Answer **ALL** questions.
5. Answer all questions on the answer sheet. Answers on any other paper including rough work paper and the question paper **will not be marked**
6. ALL working must be shown step by step to get full marks. Students may lose marks for writing down final answers only.
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.

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.

PART A: MULTIPLE CHOICE (QUESTIONS 1 to 30) 30 MARKS

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

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 of the following terms describe the structure of the earth?

A. Crust, mantle, core, lithosphere

B. Mantle, crust, asthenosphere, stratosphere

C. Mantle, crust, mesosphere, troposphere

D. Core, crust, mantle, thermosphere

QUESTION 2

Which of the following rocks below is produced by a metamorphic process?

A. Sandstone B. Gneiss C. Gabbro D. Agglomerate

QUESTION 3

Which of the minerals below is a Sulphide mineral?

A. Magnetite B. Calcite C. Chalcopyrite D. Limonite

QUESTION 4

Which of the following best describes the inner and outer core of the earth?

A. Inner core is molten, outer core is solid

B. Both inner core and outer are molten

C. Both inner core and outer core are solid

D. Inner core is solid, outer core is molten

QUESTION 5

Which of the rock types given below is likely to contain fossils?

A. Shale B. Tephra C. Granite D. Agglomerate

QUESTION 6

Most of the gold and copper deposits in PNG were formed in the Miocene.

Name the era, the epoch Miocene belongs?

A. Mesozoic B. Paleozoic C. Cainozoic D. Pre Cambrian

QUESTION 7

Extinctions refer to the disappearance of life forms in Earth's history. With reference to the Geological Time Scale, at the end of which period did the most recent extinction occur?

A. Jurassic B. Triassic C. Cretaceous D. Paleocene

QUESTION 8

Which conditions below will best allow organisms to be preserved as fossils?

A. Oxygen + active sedimentation

B. No Oxygen + active erosion

C. Oxygen + active erosion

D. No Oxygen + active sedimentation

QUESTION 9

What two major factors mostly control the layering of the atmosphere?

A. Density and volume

B. Density and temperature

C. Density and solar winds

D. Density and mass

QUESTION 10

What is the term given to the upper part of the ground water system where water exists but does not fill all available pore spaces?

A. Vadoze B. Phreatic C. Water table D. Saturation zone

QUESTION 11

Name the three major agents of chemical weathering (leaching).

A. CO_2 + Water + H_2CO_3 B. Water + CO_2 + NO_2

C. HCl + Water + $CaCO_3$ D. NO_2 + Water + HCl

QUESTION 12

Which of the following best describes movement on a normal fault?

A. One block slides past another

B. Displaces one block upward and over the other

C. Displaces one block downward and away from the other

D. Displaces one block downward and under the other

QUESTION 13

Mountain building is one of the evidences of continental drift.

In which zones given below would mountains be found?

A. Spreading zones

B. Transform fault zones

C. Transcurrent fault zones

D. Orogenic zones

QUESTION 14

An offshore evidence of a tectonic activity in PNG is _____.

A. Ramu-Markham Fault

B. Papuan Fold Belt

C. New Britain Trench

D. New Guinea Trust Belt

QUESTION 15

The epicenter of an earthquake is defined as the exact location

A. in the subsurface of the earth where movement occurs.

B. on the surface directly above the earthquake focus.

C. on the surface of the earth where no movement occurs.

D. in the subsurface of the earth where no movement occurs.

QUESTION 16

Which of the following earthquake waves cannot travel through the outer core?

A. Primary (P) waves

B. Love waves

C. Rayleigh waves

D. Secondary (S) waves

QUESTION 17

Which of the following are not the direct products of volcanic activities?

A. Extrusive rocks and pumice
B. Obsidian and volcanic rocks
C. Lava and pyroclastic rocks
D. Plutonic and granitic rocks

QUESTION 18

Volcanoes which are small, steeper and comprise both lava and pyroclastic materials are called _____.

A. Cinder cones
B. Composite volcanoes
C. Shield volcanoes
D. Tuff cones

QUESTION 19

Which of the following statement is true?

A. Aluminium is extracted from bauxite
B. Copper is extracted from galena
C. Gold is extracted from malachite
D. Lead is extracted from chalcopyrite

QUESTION 20

The Ramu laterite deposit in Madang Province produces Nickel, Cobalt and Chromium whose chemical formulae are

A. Ne, Ce and Cr respectively
B. Ni, Co and Cr respectively
C. Ni, Co and Cm respectively
D. Ni, Cb and Cr respectively

QUESTION 21

Which region of the world produces the bulk of the world oil?

A. North Africa
B. North Atlantic
C. Middle East
D. North Sea

QUESTION 22

Oil and gas are contained within rock units called reservoirs that have good permeability and porosity.

Which of the following rock types given below is a good reservoir of oil and gas?

A. Limestone
B. Conglomerate
C. Mudstone
D. Sandstone

QUESTION 23

Which of the PNG mines given below produce gold as the principal product?

A. Tolukuma and Hidden Valley
B. Tolukuma and Ramu
C. Lihir and Porgera
D. Hidden Valley and Ramu

QUESTION 24

Which of the following best describes the major process used in the refining of fossil fuels (Crude oil)?

A. Condensation and Evaporation
B. Fractional Distillation and Condensation
C. Condensation and Transpiration
D. Condensation and Sublimation

QUESTION 25

Which of the activities below best outlines some prospecting and exploration for mineral and petroleum occurrences?

A. Collection of samples and rocks
B. Field geological mapping
C. Seismic shooting and drilling
D. All of the above

QUESTION 26

Outline the main difference between liquefied natural gas (LNG) and liquefied petroleum gas (LPG).

A. LNG contains gases that are not present in LPG
B. LNG are mostly cooking gases and LPG are industrial gases
C. LNG contains industrial gases and LPG contain cooking gases
D. LNG is naturally extracted and refined while LPG is obtained from crude oil

QUESTION 27

Some mines in PNG are directly dumping waste rock and mill tailings into river systems. Two operating mines involved in this practice are

A. Porgera and Hidden Valley
B. Porgera and Lihir
C. Lihir and OK Tedi
D. Lihir and Ramu

QUESTION 28

The current environmental impact in the OK Tedi mine in the Western Province can be best described as

A. high sediment load
B. continuous physical weathering
C. Acid rock drainage
D. All of the above

QUESTION 29

Before mining and petroleum developments occur, impacts of waste disposal are important concerns and studied.

What is the name of this study?

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

QUESTION 30

Which of the following terms mean rebuilding the environment after closure of a mining activity?

A. Rehabitation
B. Rehabilitation
C. Regeneration
D. Reconstruction

PART B: SHORT ANSWERS (QUESTIONS 31 to 40) 70 MARKS

For each Question, work out the answers for each question and write the answer in the space provided in the ANSWER BOOKLET.

QUESTION 31

The table below shows a simplified classification of sediments, sedimentary rocks and their calcareous equivalent. Use the table to answer the questions.

CLAST SIZE	**SEDIMENT NAME**	**ROCK NAME**		**CALCAREOUS EQUIVALENT**
> 2 mm	gravel	conglomerate, breccia if clasts are angular		calcirudite or calcareous conglomerate
0.625 to 2 mm	(I)	sandstone		(IV)
0.004 to 0.625 mm	silt	(III)	mudstone	marl or calcareous mudstone
< 0.004 mm	(II)	claystone		

A). What are the sediment names for (I) and (II)? 2 marks

B). What are the rock names for (III) and (IV)? 2 marks

C). From the sedimentary rocks given in the table, which would absorb and contain more water? 2 marks

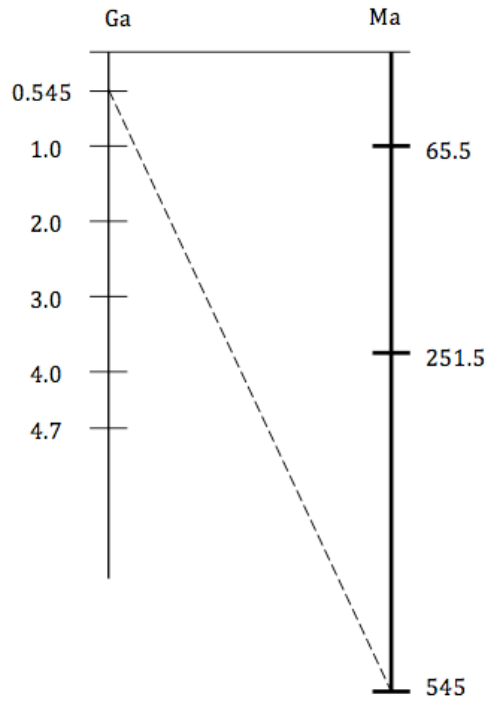
D). From the sedimentary rocks given in the table, which rock is commonly used in glass making? 1 mark

QUESTION 32

Below is a simplified Geological Time scale from 4.7 billion years (Ga) to the present time (Ma).

Ga = Billions of years, Ma = Millions of years

Use the diagram to answer the questions.



A) The time from 545 million years to the present is known as Phanerozoic and includes the following eras; Paleozoic, Mesozoic and Cainozoic.

State the age ranges of these eras.

(i) Paleozoic _____. 1 mark

(ii) Mesozoic _____. 1 mark

(iii) Cainozoic _____. 1 mark

B) Name any two periods in the Mesozoic era. 2 marks

C) In which period with reference to (B) did dinosaurs live? 1 mark

D) Name the period before the dinosaurs lived. 1 mark

QUESTION 33

After all the necessary permits are approved, the mining activity proceeds. This involves extraction, processing and refining of economic minerals. There are several ways of mining.

A) Name the two most common methods of mining apart from alluvial mining. 2 marks

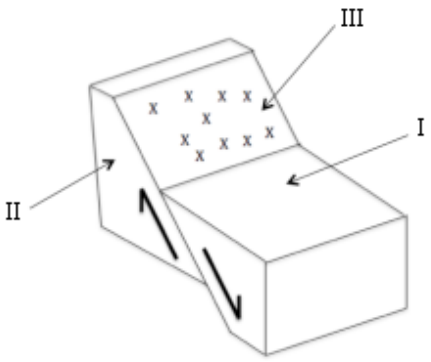
B) In a gold mine such as Lihir, the ore is blasted, rock fragments are crushed and milled. Explain why this is done? 2 marks

C) Lihir is an open-cut mine which has a deep-sea waste disposal system. Name two other mines in PNG that have the same system. 2 marks

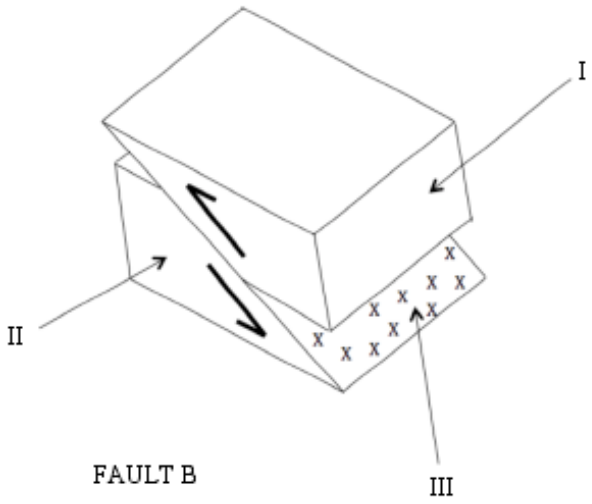
D) Name the final product that is sold by Lihir to international buyers. 1 mark

QUESTION 34

Shown in the diagram below are two main fault types labelled A and B. The arrows show the principal direction of movement. Use the diagrams to answer the questions.



FAULT A



FAULT B

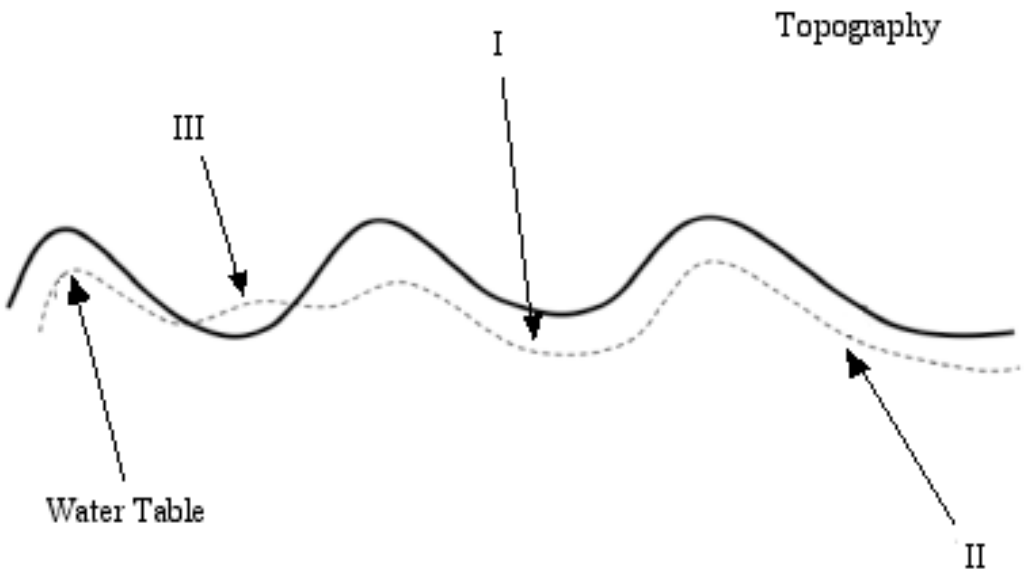
A) Name the fault labelled A and B. 2 marks

B) Give the correct name for the fault component labelled I. 1 mark

C) Give the correct name for the fault component labelled II. 2 marks

D) Give the correct name for the fault component labelled III. 2 marks

QUESTION 35



The diagram above is a simplified profile of a ground water system.

A) Name the zones labelled I and II. 2 marks

B) What can be found at location III? 1 mark

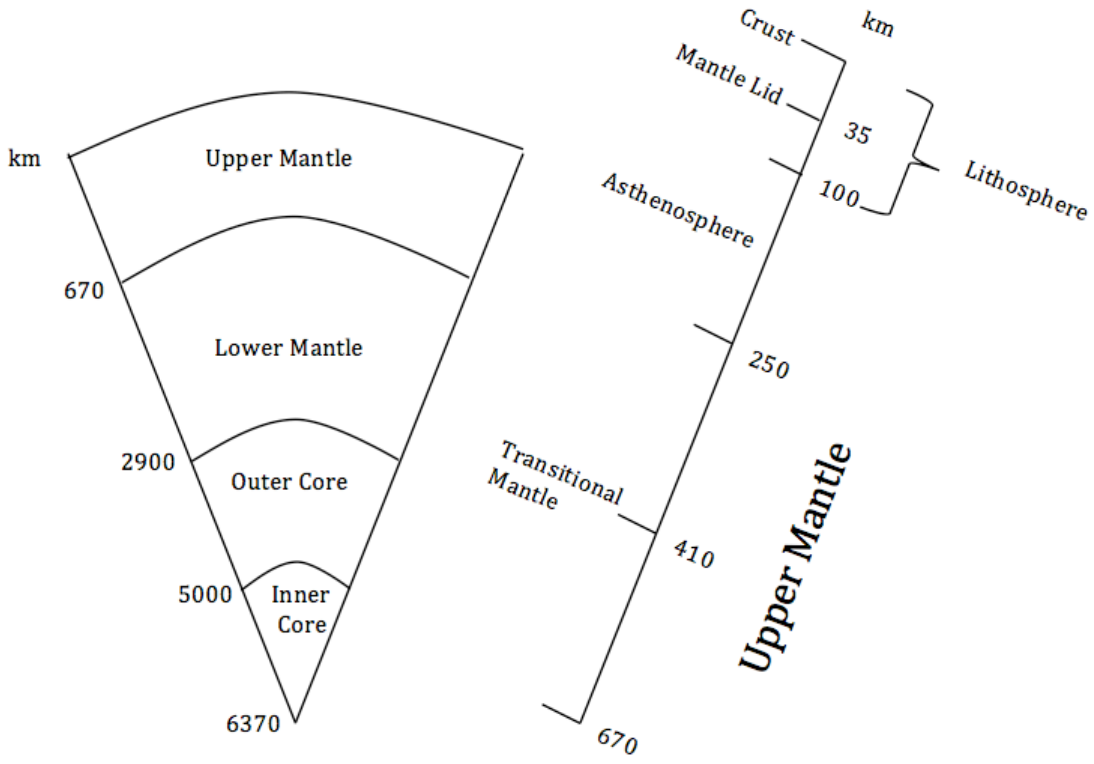
C) Areas where water is collected into the ground water system are known as _____. 2 marks

D) A layer of rock that is porous and permeable and water saturated is called _____. 1 mark

E) What will happen to a water table if ground water is excessively pumped out of a well? 1 mark

QUESTION 36

The diagram below shows the main divisions of the earth's structure. Use the diagram to answer the questions.



A) What two elements make up the inner core? 2 marks

B) Mantle is mostly composed of ___(i)_____and _____(ii)_____. 2 marks

C) There are discontinuities within the mantle at 410 km and 670 km caused by mineral phase transitions. What physical evidence reveals this? 1 mark

D) The lithosphere is composed of ___(i)_____and _____(ii)_____. 2 marks

QUESTION 37

Extrusive igneous rocks (volcanic) are of two types; either lavas or pyroclastic (fragmented) rocks. A pyroclastic deposit can also be called as tephra deposit.

The table below shows a simplified classification of the pyroclastic deposit based on grain size.

Use the table to answer the questions.

GRAIN SIZE (mm)	PYROCLASTIC DEPOSITS	
	UNCONSOLIDATED TEPHRA	CONSOLIDATED PYROCLASTIC ROCK
> 64	block tephra bomb tephra	pyroclastic breccia agglomerate if bombs present
2 – 64	_____(I)_____	lapilli tuff or lapilli stone
0.0625 - 2	coarse ash	_____(II)_____
< 0.0625	_____(III)_____	fine tuff

A). Name the pyroclastic deposits labelled as I, II and III. 3 marks

B). What type of volcanic eruption produces lava? 1 mark

C). What type of volcanic eruption produces pyroclastic rocks? 1 mark

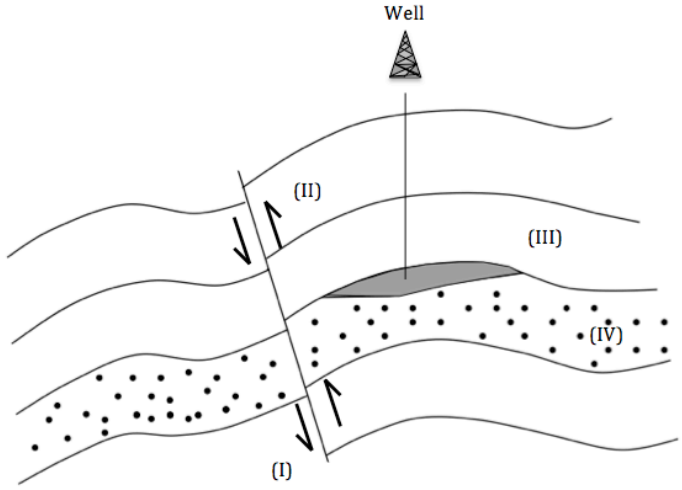
D). What is the name given for an erupted block that is still fluid at the time of eruption? 1 mark

E). What is the term for an erupted block that is solid at the time of eruption? 1 mark

QUESTION 38

The diagram below shows a typical structure that can contain oil and gas. A well is drilled into the structure and oil is discovered.

Use the diagram to answer the questions.



A) What type of fault is indicated by (I)? _____. 1 mark

B) Name the part of the structure labelled (II). _____. 1 mark

C) The rock units labelled (III) and (IV) are generally referred to as _____ and _____. 2 marks

D) Give one example of rock type labelled (III). _____. 1 mark

E) Give two examples of rock type labelled (IV). _____ and _____ 2 marks

QUESTION 39

Various types of mining tenements (Licences or Leases) are issued to companies under the Mining Act. Some of these are Exploration Licence (EL), Mining Lease (ML), Special Mining Lease (SML) and Alluvial Mining Lease (AML).

A) Which of the above is generally used by PNG citizens for small-scale mining activities? 1 mark

B) Which licence can be granted for a term of 40 years and maybe extended? 1 mark

C) Which licence can be granted for a term not exceeding 20 years and maybe extended? 1 mark

D) Which licence is granted for a term not exceeding 2 years and may be extended for periods up to 2 years? 1 mark

E) Name two mines in the SML and one in the ML category that are operating in PNG. 3 marks

SML: _____

ML: _____

QUESTION 40

If we live on a plate boundary, life can give us a "bumpy ride". This year it might be earthquakes or landslides or tsunamis. Next year it might be volcanoe eruption. We cannot prevent these natural disasters. However, we can prepare for them, understand them and minimize their effects.

A) What is the name of the scale used to measure the magnitude of an earthquake? 1 mark

B) Earthquake intensity is a measure of the effect of an earthquake as felt at the earth's surface and decreases with distance from the epicenter. Is this statement True or False? 1 mark

C) A tsunami occurred in Aitape (North Coast of PNG) sometimes in the past and caused a lot of destruction and loss of lives. In which year did that occur? 1 mark

D) List at least two warning signs of a tsunami. 2 marks

E) In what years did the destructive volcanic eruptions of Rabaul (Vulcan) and Manam Island occur respectively? Rabaul: _____ , Manam: _____. 2 marks

END OF EXAMINATION

GEOLOGY

PART B – ANSWER BOOKLET

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

Year		Province		School			Candidate No		
1	5								

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
PART B			
QUESTION 31			
QUESTION 32			
QUESTION 33			
QUESTION 34			
QUESTION 35			
QUESTION 36			
QUESTION 37			
QUESTION 38			
QUESTION 39			
QUESTION 40			
FINAL TOTAL	/70		

START YOUR WORK ON THE NEXT PAGE

Question 31	**Marks per Qs.**	**Marker 1**	**Marker 2**
A. I. _____	1		
II. _____	1		
B. III. _____	1		
IV. _____	1		
C. _____	2		
D. _____	1		
For Markers Use Only **Q 31 Total**			

Question 32	**Marks per Qs.**	**Marker 1**	**Marker 2**
A. i. Paleozoic = _____	1		
ii. Mesozoic = _____	1		
iii. Cainozoic = _____	1		
B. i. _____			
ii. _____	2		
C. _____	1		
D. _____	1		
For Markers Use Only **Q 32 Total**			

Question 33	**Marks per Qs.**	**Marker 1**	**Marker 2**
A. I. _____	2		
II. _____			
B. _____	2		
C. I. _____	2		
II. _____			
D. _____	1		
For Markers Use Only **Q 33 Total**			

Question 34	**Marks per Qs.**	**Marker 1**	**Marker 2**
A. Fault A = _____	2		
Fault B = _____			
B. I = _____	1		
C. II = _____	2		
D. III = _____	2		
For Markers Use Only **Q 34 Total**			

Question 35	**Marks per Qs.**	**Marker 1**	**Marker 2**
A. I = _____	2		
II = _____			
B. _____	1		
_____			
C. _____	2		
D. _____	1		
E. _____	1		
For Markers Use Only **Q 35 Total**			

Question 36	**Marks per Qs.**	**Marker 1**	**Marker 2**
A. (i) _____	2		
(ii) _____			
B. (i) _____ and (ii) _____	2		
C. _____	1		
D. (i) _____ and (ii) _____	2		
For Markers Use Only **Q 36 Total**			

Question 37	**Marks per Qs.**	**Marker 1**	**Marker 2**
A. I = _____	3		
II = _____			
III = _____			
B. _____	1		
C. _____	1		
D. _____	1		
E. _____	1		
For Markers Use Only **Q 37 Total**			

Question 38	**Marks per Qs.**	**Marker 1**	**Marker 2**
A. I = _____	1		
B. II = _____	1		
C. III = _____	2		
IV = _____			
D. Rock Type III =_____	1		
E. Rock Type IV= _____ and _____	2		
For Markers Use Only **Q 38 Total**			

Question 39	**Marks per Qs.**	**Marker 1**	**Marker 2**
A. _____	1		
B. _____	1		
C. _____	1		
D. _____	1		
E. SML = _____ and _____ ML = _____	3		
For Markers Use Only **Q 39 Total**			

Question 40	**Marks per Qs.**	**Marker 1**	**Marker 2**
A. _____	1		
B. _____	1		
C. _____	1		
D. I _____ II _____	2		
E. Rabaul = _____ Manam = _____	2		
For Markers Use Only **Q 40 Total**			