



DEPARTMENT OF
EDUCATION

UPPER SECONDARY
SCHOOL CERTIFICATE
EXAMINATIONS

GEOLOGY

Wednesday

22 October 2014

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 subject combinations listed below includes **ALL** of the field of study in Geology?

- A. Rocks, minerals, paleontology and enthomology.
- B. Rocks, minerals, earthquakes and anthropology.
- C. Rocks, minerals, volcanoes and earth's crust.
- D. Rocks, minerals, earth's structure and meteorology.

QUESTION 2

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

- A. Slate
- B. Pumice
- C. Sandstone
- D. Granite

QUESTION 3

The core of the Earth is mostly made up of two metals.

These two metals are

- A. Aluminium and Iron.
- B. Iron and Silicon.
- C. Iron and Nickel.
- D. Nickel and Aluminium.

QUESTION 4

Which part of the Earth's crust is thinner?

- A. Oceanic
- B. Continental
- C. Volcanic arc
- D. Oxogenic

QUESTION 5

Limestone when metamorphosed forms marble.

What is the chemical formula of marble?

- A. $MgCO_3$
- B. $FeCO_3$
- C. $CaCO_3$
- D. CaO

QUESTION 6

The following rocks were collected for dating using fossils.

Which one will contain or is likely to contain fossils?

- A. Quartz B. Shale C. Granite D. Obsidian

QUESTION 7

The disappearance of life forms are known as extinctions.

The most recent extinction with reference to the Geological time scale occurred at the end of which period?

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

QUESTION 8

What are the important conditions that allows marine organisms to be more likely preserved as fossils than terrestrial (land) organisms?

- A. Oxygen + active sedimentation B. No Oxygen + active erosion
C. Oxygen + active erosion D. No Oxygen + active sedimentation

QUESTION 9

The atmosphere is one of the major Earth systems. It comprises of several important cycles.

Which of the following does **NOT** belong to the atmospheric system?

- A. Nitrogen B. Carbon C. Oxygen D. Water

QUESTION 10

The best definition for a **confined aquifer** is groundwater that lies between

- A. two permeable layers of rock.
B. two impermeable layers of rock.
C. a lower permeable rock layer and an upper impermeable rock layer.
D. a lower impermeable rock layer and an upper permeable rock layer.

QUESTION 11

What are the three (3) important agents of leaching (chemical weathering)?

- A. Water + CO₂ + HCl B. Water + CaCO₃ + HCl
C. Water + HCl + NO₂ D. Water + CO₂ + H₂CO₃

QUESTION 12

Which of the following processes is responsible for the formation of rock salt (NaCl) deposits on a beach environment?

- A. Diagenesis B. Sedimentation C. Condensation D. Evaporation

QUESTION 13

A **transform fault** is formed as a result of two tectonic plates

- A. Sliding against each other. B. Sliding past each other.
C. One sliding under another. D. One sliding above another.

QUESTION 14

Divergence of tectonic plates is one of the evidences of continental drift.

The location of divergence plates can be found at

- A. Subduction zones. B. Spreading zones.
C. Orogenic zones. D. Collision zones.

QUESTION 15

A clue on land in PNG in relation to tectonic activities is

- A. Trobriand Trough. B. New Britain Trench.
C. Ramu-Markham fault. D. Eastern Manus Basin.

QUESTION 16

The **hypocenter** of an earthquake is defined as the exact location

- A. in the subsurface of the Earth where movement occurs.
B. on the surface of the Earth where less movement is felt.
C. on the surface where a fault movement occurs.
D. on the surface where there is an aftermath of an earthquake.

QUESTION 17

One of the evidences or clues that the outer core of the Earth's structure is molten is from the passage of seismic waves.

Which of the waves listed below provides this clue?

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

QUESTION 24

Which of these gases makes crude oil become sour?

- A. CO₂ B. SO₂ C. H₂S D. CH₄

QUESTION 25

The Papuan Basin which includes the oil fields of Kutubu in the Hela and Southern Highlands Provinces of PNG are commonly stored in sandstone formations. The most important sandstone formation in the Papuan Basin is called _____ sandstone.

- A. Darai B. Imburu C. Ieru D. Toro

QUESTION 26

Which of the following processes best describes the extraction of copper from its copper minerals and ores?

- A. Crushing and grinding to froth flotation to smelting and electrolysis.
B. Crushing and grinding to gravity separation to smelting and electrolysis.
C. Crushing and grinding to cyanide leaching to smelting and electrolysis.
D. Crushing and grinding to carbon-in-pulp to smelting and electrolysis.

QUESTION 27

A significant amount of gold can be present in crystals of other associated minerals and are hard to extract.

The best method to treat gold before extraction would be

- A. Solvent extraction. B. Smelting.
C. Centrifuging. D. Pressure Oxidation.

QUESTION 28

Liquefied natural gas (LNG) and liquefied petroleum gas (LPG) are hydrocarbon gases of petroleum.

What is the main difference between LNG and LPG?

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

QUESTION 29

The current environmental impact on the giant Ok Tedi copper-gold mine in the Western province initially started as

- A. dead vegetation and high sediment load.
- B. continuous physical weathering and high sediment load.
- C. acid rock drainage and high sediment load.
- D. high level of toxic metals and high sediment load.

QUESTION 30

Three Operating mines in PNG are directly dumping waste rocks and tailings into river systems.

These mines are:

- A. Ok Tedi, Porgera and Hidden Valley (Morobe).
- B. Ok Tedi, Porgera and Lihir.
- C. Ok Tedi, Lihir, and Ramu Ni-Co.
- D. Ok Tedi, Lihir and Hidden Valley.

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

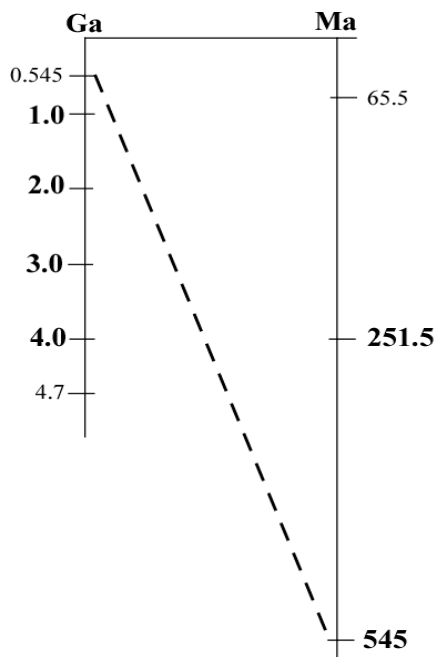
Provided below is a simplified classification of igneous rocks.

| | Felsic or Silicic | | Mafic | Ultramafic |
|---|--------------------------|--------------|--------------|--------------------------|
| <i>Coarse-grained or phaneritic. Crystals are 2 – 3mm or greater.</i> | Granite | I | II | Peridotite Pyroxenite |
| <i>Medium-grained Crystals are 0.25 – 2mm</i> | III | Microdiorite | Dolerite | |
| <i>Fine-grained or aphanitic Crystals < 0.25mm</i> | Ryolite Dacite | IV | V | |
| <i>Colour index</i> | 0 – 20 | 20 – 40 | >40 | 100 |
| <i>Quartz content</i> | >10% | 0 – 10% | 0 | 0 |
| <i>SiO₂ content</i> | 75 – 64 | 63 – 54 | 53 – 48 | 55 – 42 |

- A. Name the igneous rocks labeled as **I**, **II**, **III**, **IV** and **V** in the table above. (5)
- B. What is the general trend of SiO₂ content from felsic to ultramafic rocks? _____ (1)
- C. Which igneous rock in the table above underwent fast cooling? _____ (1)

QUESTION 32

Refer to the simplified Geological time scale from 4.7 billion years (Ga) to the present time (Ma) shown below. (Ga = billions of years, Ma = millions of years)



A. State the age ranges of the following era given below;

- i. Mesozoic (1)
- ii. Paleozoic (1)
- iii. Cenozoic (1)

B. What are the two periods between end of Paleozoic and beginning of Mesozoic eras? (*full marks for correct spelling*)

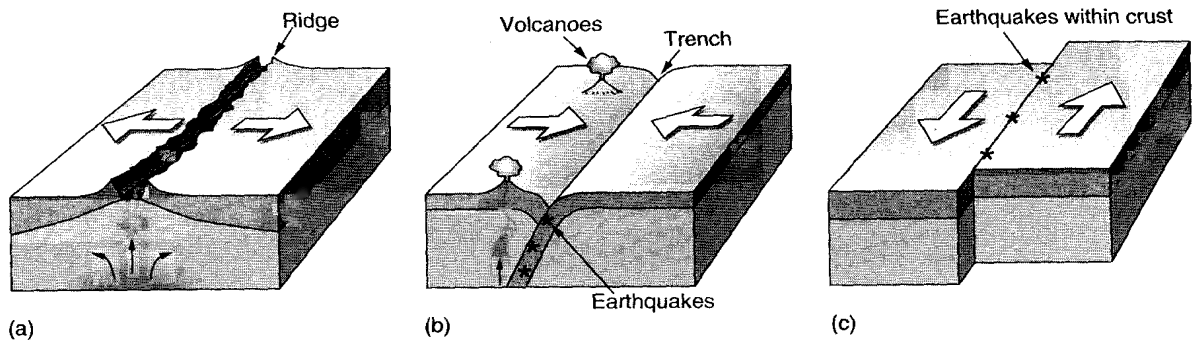
_____ (i) _____ and _____ (ii) _____ (2)

C. In reference to B. above, name the important geological event that occurred.

_____ (i) _____ _____ (ii) _____ (2)

QUESTION 33

Refer to the diagrams below, which show some of the movements of the Earth's crust.



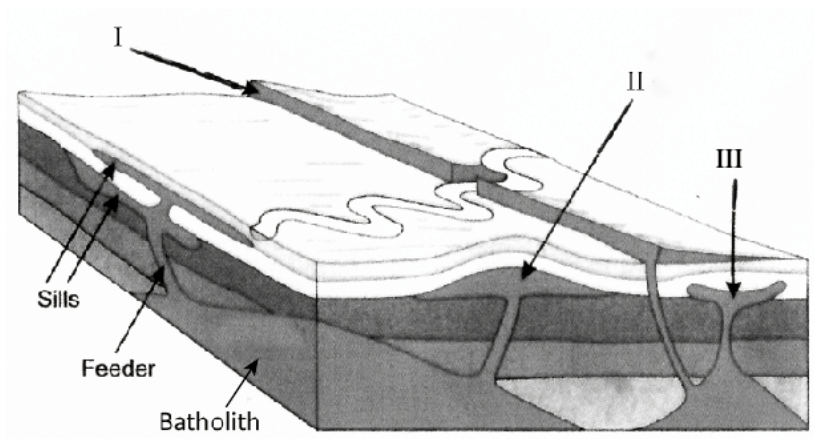
A. Complete the table below regarding the diagrams above. (6)

| | | | |
|---------------------------|-------------------------------------|------------------------------------|--|
| Type of Margin | (a) I | (b) Convergent | (c) II |
| Motion | III | IV | Lateral sliding |
| Effect | Constructive Lithosphere created | Destructive Lithosphere created | Conservative Lithosphere neither created nor destroyed |
| Topography | Ridge/Rift | Trench | No major effect |
| Volcanic activity? | V | Yes | VI |

B. Which movement in the diagrams above is dominated by submarine volcanoes? (1)

QUESTION 34

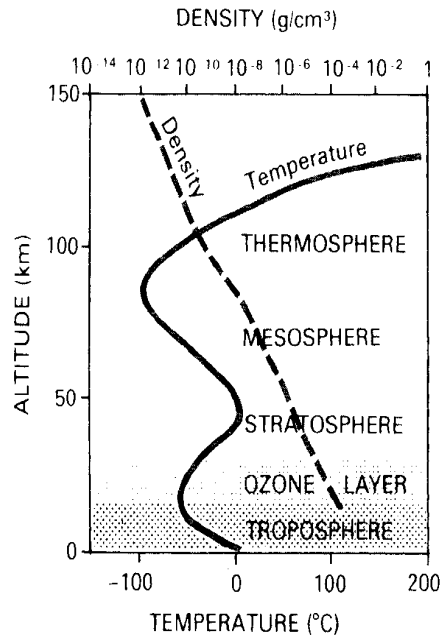
Refer to the diagram below, which shows igneous rock structures.



- A. Name the structures labeled I, II and III in the diagram. (3)
- B. What is another name for a **Batholith** as shown in the diagram? _____ . (1)
- C. If these igneous rock structures come in contact with limestone, they will produce marble. This process is known as _____. (1)
- D. Small intrusives (igneous rocks) of 1 – 2 km across are known as _____ (i) _____ while intrusions that does not show on the surface but are almost parallel to bedding are known as _____ (ii) _____. (2)

QUESTION 35

Refer to the figure below, which shows the variation in the temperature and density in the Earth's atmosphere.



- A. In which layer of the atmosphere does absorption (taking in) of ultraviolet (UV) radiation take place? _____ (1)

- B. Which layer can you find charged ions and free electrons? _____ (1)

- C. The gases N₂, chlorofluorocarbons (CFC), CO₂, H₂O, O₃, O₂ are atmospheric gases. State three of these gases which will not be found in the stratosphere.
 - i. _____ (1)
 - ii. _____ (1)
 - iii. _____ (1)

- D. Complete the statement below by filling in the missing words.

As the volume of the atmosphere increases, the density _____(i)_____ and mixing of air within the troposphere and ozone causes _____(ii)_____ in temperature. (2)

QUESTION 36

Water absorbed into the land surface is called groundwater. Groundwater percolates downward until progress is arrested by impermeable rock.

- A. The upper and lower zones of a groundwater system are called _____(i)_____ and _____(ii)_____ respectively. (2)
- B. The interface between the two zones mentioned in A. above is _____. (1)
- C. A layer of rock that is porous and permeable and water saturated is called a/an _____. (1)
- D. Areas where water is collected into the groundwater system are known as _____(i)_____ _____(ii)_____. (2)
- E. The impermeable layers bounding the layer mentioned in C. above are called _____. (1)

QUESTION 37

PNG will be the first country in the world to develop deep sea mining.

- A. Where is the location of this deep sea mining? _____ (1)
- B. The economical minerals will be mined under the sea or on the sea floor by the method of _____(i)_____ and _____(ii)_____ onto the sea surface facilities before processing. (2)
- C. The environmental impact of this type of mining is thought to be extensive. The main reason being that, the economical minerals and waste rocks extracted will use seawater as _____(i)_____ disposal and _____(ii)_____ would be widely distributed. (2)
- D. The physiochemical environment of the formation and deposition of these undersea mineral resources are anoxic conditions. This means an environment of _____(i)_____ _____(ii)_____. (2)

QUESTION 38

Liquefied natural gas (LNG) for export is produced from a processing plant on the coast near Port Moresby. Crude oil is also produced and sold from PNG oilfields located in the Highlands. A small proportion of the crude oil is refined for local use.

- A. The first gas is conditioned and piped to the coast from four (4) oil and gas fields. Name three (3) of these fields.
- i. _____ (1)
- ii. _____ (1)
- iii. _____ (1)
- B. The yellow liquid part of LNG is known as _____(i)_____ and give an example of a hydrocarbon stated in (i) above _____(ii)_____. (2)
- C. Most of the crude oil is exported at an exporting terminal located in the Gulf of Papua called _____ terminal. (1)
- D. Some of the crude oil is refined at an oil refinery located near Port Moresby at _____ refinery. (1)

QUESTION 39

Fill in the blank spaces with the appropriate terms in regard to the development of a mine.

- A. When a company or an individual applies for a particular area for economical mineral investigations, an authorization must be obtained from the Government known as; _____(i)_____ _____(ii)_____. (2)
- B. If the investigation finds economical mineral reserves with more than 20 years lifetime of mining, another authorization must be obtained which is known as _____(i)_____ _____(ii)_____ lease. (2)
- C. The final authorization before mining can proceed is _____(i)_____ _____(ii)_____ contract. (2)
- D. When you pan for gold along a river sand bank, what kind of gold deposit is it? _____ (1)

QUESTION 40

The Ramu Ni-Co Mine is located in the Madang Province. This mine produces nickel, cobalt and chromite (chromium bearing mineral). These minerals are formed by weathering processes over millions of years.

- A. The risks involved are associated with the waste rocks dumping within selected areas near the mine site.

Which major river system within these areas will be affected?

_____ (1)

- B. The processed ore finally shipped out of Basamuk wharf is in the form of a

_____ (1)

- C. The final products of B. above will be further refined and two main products of commercial value will be obtained.

These are; _____ (i) _____ and _____ (ii) _____ (iii) _____. (3)

- D. The tailings at Basamuk refinery uses DSTP method of disposal.

What does DSTP stand for?

_____ (2)

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 | 4 | | | | | | | | |

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 |
|--|--|-----------------|-----------------|
| <p>A. I. _____</p> <p>II. _____</p> <p>III. _____</p> <p>IV. _____</p> <p>V. _____</p> <p>B. _____</p> <p>C. _____</p> | <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> | | |
| For Markers Use Only | Q 31 Total | | |

| Question 32 | Marks per Qs. | Marker 1 | Marker 2 |
|--|---|-----------------|-----------------|
| <p>A. i. _____</p> <p>ii. _____</p> <p>iii. _____</p> <p>B. i. _____</p> <p>ii. _____</p> <p>C. i. _____ ii. _____</p> | <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p> | | |
| For Markers Use Only | Q 32 Total | | |

| Question 33 | Marks per Qs. | Marker 1 | Marker 2 |
|---|--|-----------------|-----------------|
| <p>A. I. _____</p> <p>II. _____</p> <p>III. _____</p> <p>IV. _____</p> <p>V. _____</p> <p>VI. _____</p> <p>B. _____</p> | <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> | | |
| For Markers Use Only | Q 33 Total | | |

| Question 34 | Marks per Qs. | Marker 1 | Marker 2 |
|---|--|-----------------|-----------------|
| <p>A. I. _____</p> <p>II. _____</p> <p>III. _____</p> <p>B. _____</p> <p>C. _____</p> <p>D. i. _____</p> <p>ii. _____</p> | <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> | | |
| For Markers Use Only | Q 34 Total | | |

| Question 35 | Marks per Qs. | Marker 1 | Marker 2 |
|-----------------------------|----------------------|-----------------|-----------------|
| A. _____ | 1 | | |
| B. _____ | 1 | | |
| C. i. _____ | 1 | | |
| ii. _____ | 1 | | |
| iii. _____ | 1 | | |
| D. (i) _____ | 1 | | |
| (ii) _____ | 1 | | |
| For Markers Use Only | Q 35 Total | | |

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

| Question 37 | Marks per Qs. | Marker 1 | Marker 2 |
|-----------------------------|----------------------|-----------------|-----------------|
| A. _____ | 1 | | |
| B. (i) _____ | 1 | | |
| (ii) _____ | 1 | | |
| C. (i) _____ | 1 | | |
| (ii) _____ | 1 | | |
| D. (i) _____ (ii) _____ | 2 | | |
| For Markers Use Only | Q 37 Total | | |

| Question 38 | Marks per Qs. | Marker 1 | Marker 2 |
|-----------------------------|----------------------|-----------------|-----------------|
| A. i. _____ | 1 | | |
| ii. _____ | 1 | | |
| iii. _____ | 1 | | |
| B. (i) _____ | 1 | | |
| (ii) _____ | 1 | | |
| C. _____ | 1 | | |
| D. _____ | 1 | | |
| For Markers Use Only | Q 38 Total | | |

| Question 39 | Marks per Qs. | Marker 1 | Marker 2 |
|-----------------------------|----------------------|-----------------|-----------------|
| A. (i) _____ (ii) _____ | 2 | | |
| B. (i) _____ (ii) _____ | 2 | | |
| C. (i) _____ (ii) _____ | 2 | | |
| D. _____ | 1 | | |
| For Markers Use Only | Q 39 Total | | |

| Question 40 | Marks per Qs. | Marker 1 | Marker 2 |
|---|----------------------|-----------------|-----------------|
| A. _____ | 1 | | |
| B. _____ | 1 | | |
| C. (i) _____ and (ii) _____ (iii) _____ | 3 | | |
| D. _____ | 2 | | |
| For Markers Use Only | Q 40 Total | | |