Surname	Centre Number	Candidate Number
Other Names		2

GCE AS/A level

1211/01

GEOLOGY – GL1
Foundation Unit

P.M. TUESDAY, 15 January 2013

1 hour

		Examiner only
1.	**16**	
2.	**16**	
3.	**16**	
4.	**12**	
Total	**60**	

1211 010001

ADDITIONAL MATERIALS

In addition to this examination paper you will need a copy of the **Mineral Data Sheet**.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that marking will take into account the use of examples and the quality of communication used in your answers.

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GL1 – FOUNDATION GEOLOGY

Answer **all** *questions.*

1. **Figure 1a** is a simplified map showing plate tectonic features of New Zealand.
Figure 1b is a simplified cross-section through the upper part of the Earth from west to east across the Kermadec Trench on **Figure 1a**.

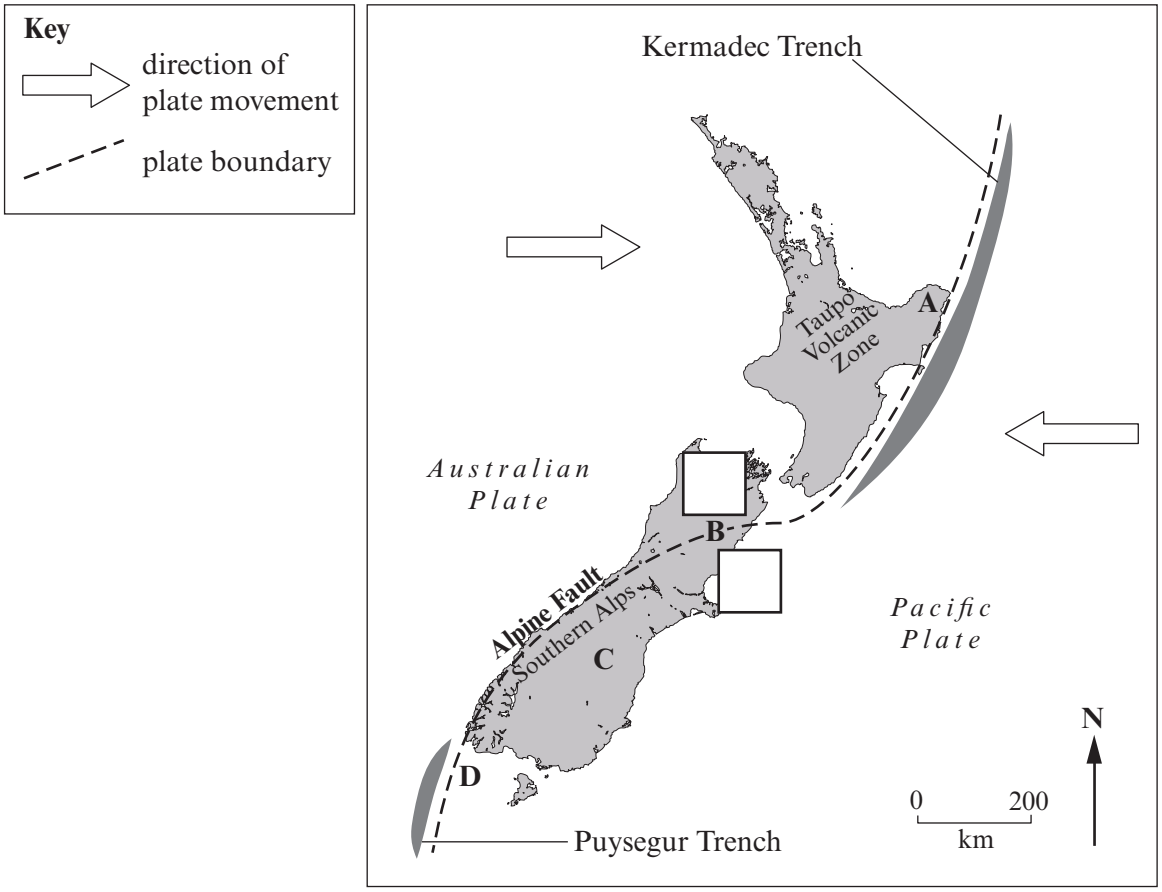

Figure 1a

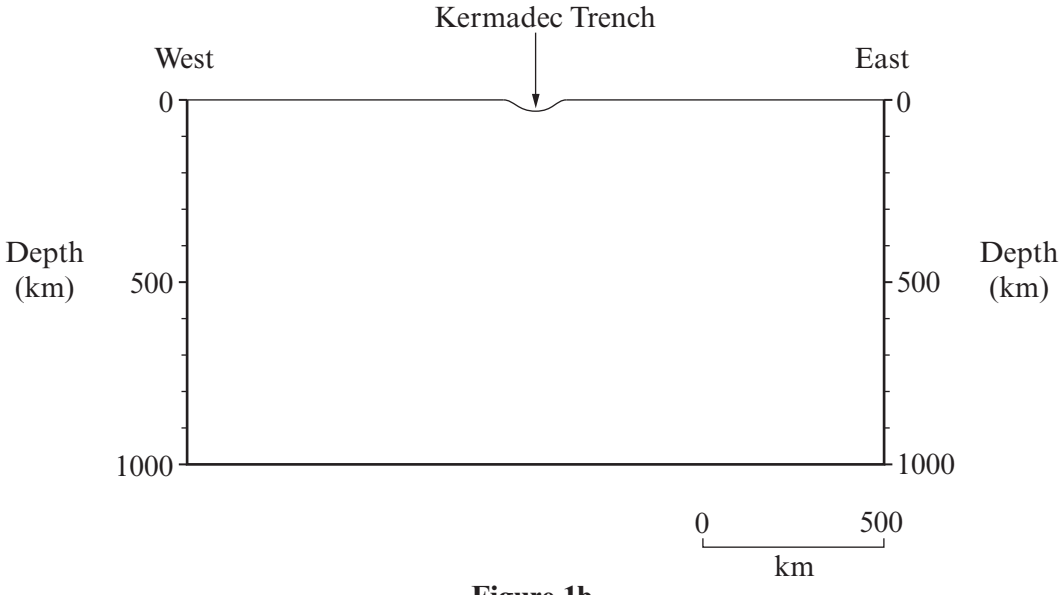

Figure 1b

Refer to **Figure 1a**.

(a) (i) State the type of plate boundary at locality **A** by placing a tick in **one** of the boxes below. [1]

Convergent ☐ Divergent ☐ Conservative ☐

(ii) Magma generated beneath the Taupo Volcanic Zone has **andesitic** composition. Explain the origin of this magma. [3]

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(b) (i) The Alpine Fault at locality **B** is a strike-slip fault with relative movement to the right (dextral). Draw an arrow in **each** of the blank boxes on **Figure 1a** to show the direction of relative plate movement either side of the fault. [1]

(ii) At locality **C** plate movement is causing the plates to be uplifted by 7-10 mm each year. Recent surveys have indicated that despite this uplift the mountains of the Southern Alps are not increasing in height. Explain the most likely reason why these mountains are not increasing in height. [2]

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(c) The plate boundary at locality **A** on **Figure 1a** is associated with a zone of earthquake foci with a maximum depth of 700 km.

(i) Mark with crosses on **Figure 1b**, the likely location of the earthquake foci. [2]

(ii) Explain the distribution of earthquake foci which you have shown on **Figure 1b**. [2]

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(iii) Explain why no earthquake foci occur deeper than 700 km. [2]

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(iv) Describe how the zone of earthquake foci at the plate boundary at locality **D** on **Figure 1a** differs from that at locality **A**. Explain the difference and state how **Figure 1a** provides evidence for your answer. [3]

Description .....

.....

Explanation .....

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Evidence .....

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16

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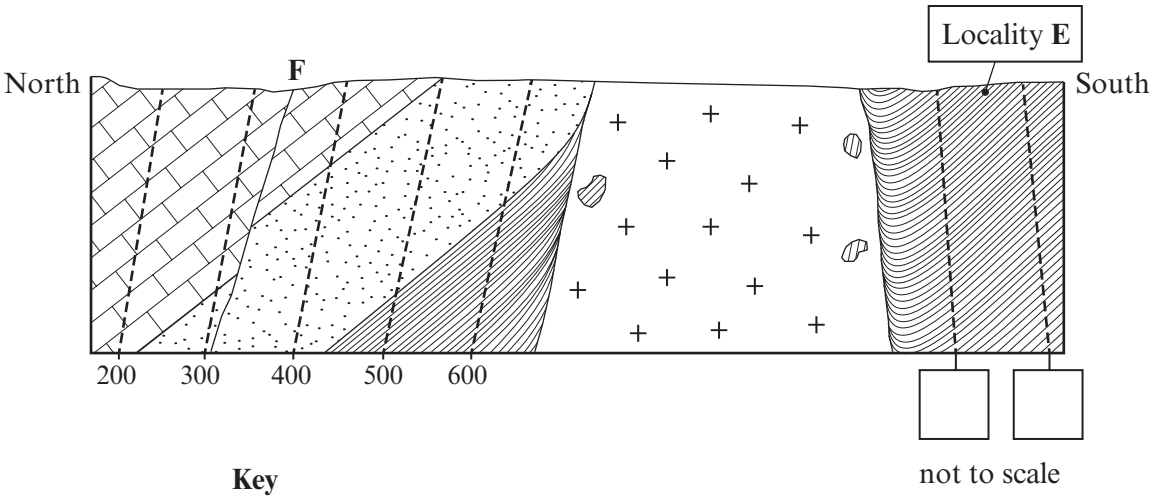
2. **Figure 2a** is a cross-section through an area surrounding a granite intrusion. The temperature to which the surrounding rocks have been heated is shown by a series of isotherms. **Figure 2b** shows rock **E**, a crystalline rock collected from locality **E** on **Figure 2a**.



Key

granite

limestone

sandstone

shale

where un-metamorphosed

isotherm (°C), (line joining points of equal temperature)

F fault

Figure 2a

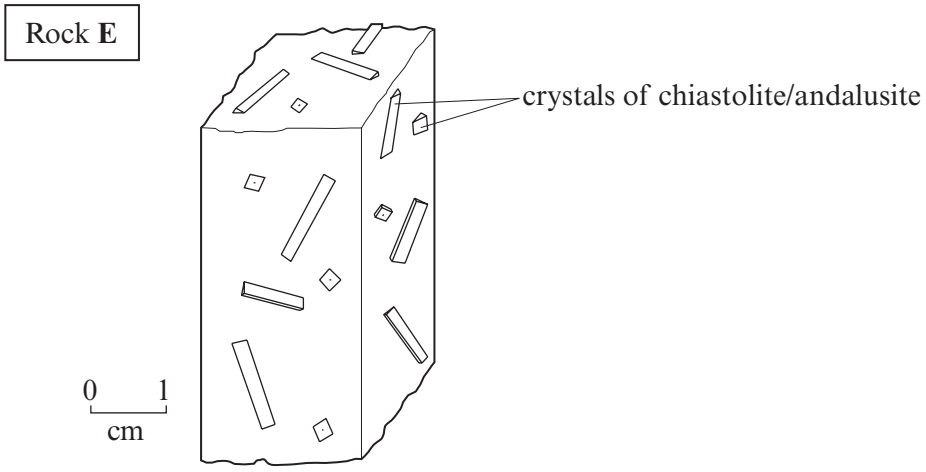


Figure 2b

Examiner only

(a) (i) The fault **F** shown in **Figure 2a** has dip-slip displacement only. Identify the type of fault (normal, reverse, thrust or strike-slip) shown in **Figure 2a**. Give a reason for your answer. [2]

Type of fault .....

Reason .....

.....

(ii) Draw and label on **Figure 2a** the axial plane trace of a fold. [1]

(iii) Describe the evidence on **Figure 2a** which indicates that the granite is younger than the surrounding rocks. [3]

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(b) (i) Record the most likely temperatures represented by each of the isotherms to the south of the granite intrusion in the blank boxes on **Figure 2a**. [1]

(ii) Metaquartzite has formed where a particular rock has been heated above 500 °C. Shade in the area on **Figure 2a** where metaquartzite is located. [2]

(c) (i) Describe the texture of crystalline rock **E** in **Figure 2b**, collected from locality **E** in **Figure 2a**. [3]

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(ii) With reference to **Figure 2a** explain the origin of the texture of rock **E**. [4]

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Turn over.

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3. **Figure 3a** is a cross-section at a cliff face. **Figure 3b** shows fossil **G** collected from locality **G** on **Figure 3a**.

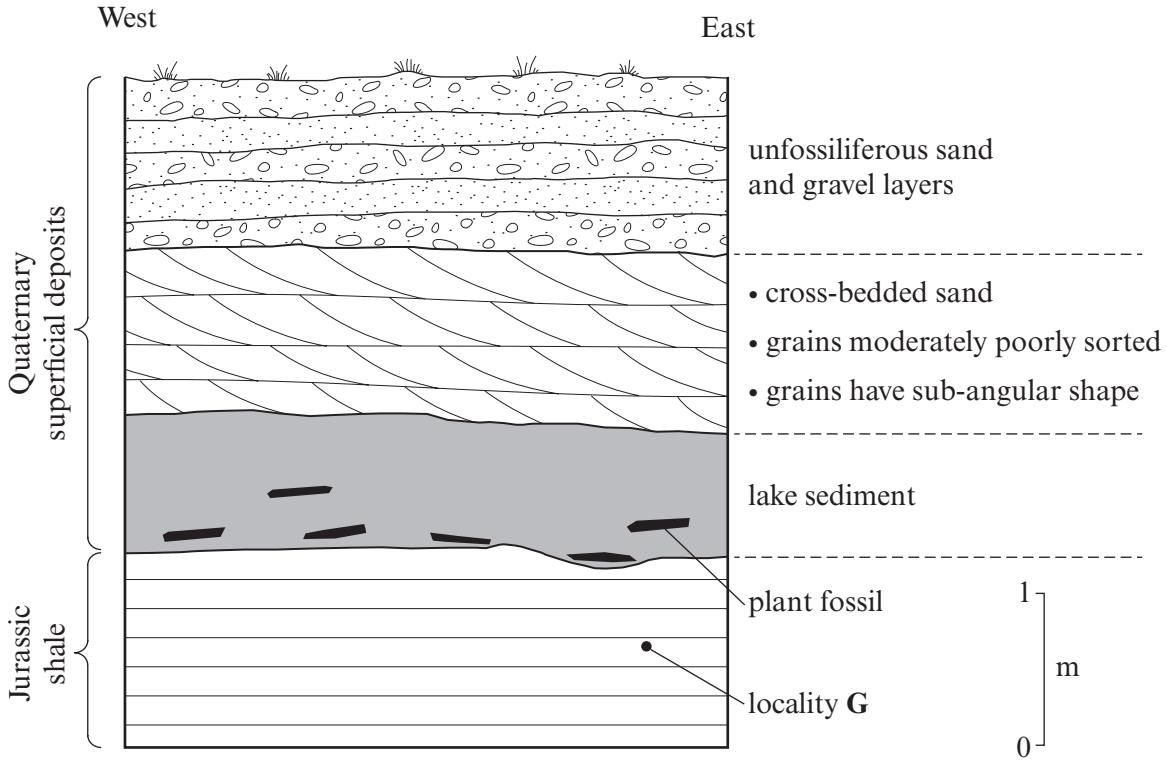

Figure 3a

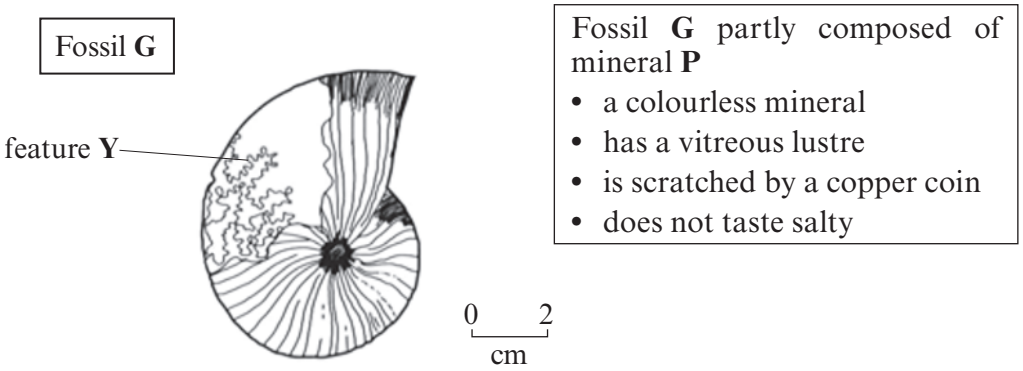

Figure 3b

Examiner only

(a) The cross-bedding on **Figure 3a** was formed during the deposition of sand under the influence of a current.

(i) With reference to the cross-bedding state the direction towards which the current appears to have been flowing. Give a reason for your answer. [2]

Direction of flow .....

Reason .....

.....

.....

(ii) With reference to the cross-bedding and the sand grains, state whether the current was more likely to have been aeolian or fluvial. Give reasons for your answer. [2]

Aeolian ☐ Fluvial ☐

Reason(s) .....

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.....

(b) Refer to **Figure 3b**.

(i) With reference to the Mineral Data Sheet identify mineral **P** from which fossil **G** is partly composed. [1]

Mineral **P** .....

(ii) Identify feature **Y** on fossil **G**. [1]

.....

(iii) Identify the fossil group (goniatite, ceratite or ammonite) to which fossil **G** belongs. Give a reason for your choice. [2]

Goniatite ☐ Ceratite ☐ Ammonite ☐

Reason .....

.....

Examiner only

(c) Refer to **Table 3a** which gives information about the ^{14}C dating technique.

^{14}C dating uses the ratio of ^{14}C to non-radioactive carbon. While an organism is alive, the ratio in the organism remains the same as the ratio in the atmosphere. However, once an organism dies, the ratio in the organism steadily declines compared with that in the atmosphere.

Table 3a

(i) Explain why the ratio of ^{14}C to non-radioactive carbon in living organisms remains the same as that in the atmosphere. [1]

.....

.....

(ii) Explain why the ratio of ^{14}C to non-radioactive carbon declines in a fossil over time. [3]

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(iii) The plant fossils in **Figure 3a** contain only ¼ of the proportion of ^{14}C in the present atmosphere. The half-life of ^{14}C is 5730 years. Calculate the age of the plant fossils. Show your working. [2]

..... years

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(iv) Complete **Table 3b** to indicate the suitability of ^{14}C dating for determining the age of the sand and gravel layers on **Figure 3a** and fossil **G**. In **each** case give a reason for your choice. [2]

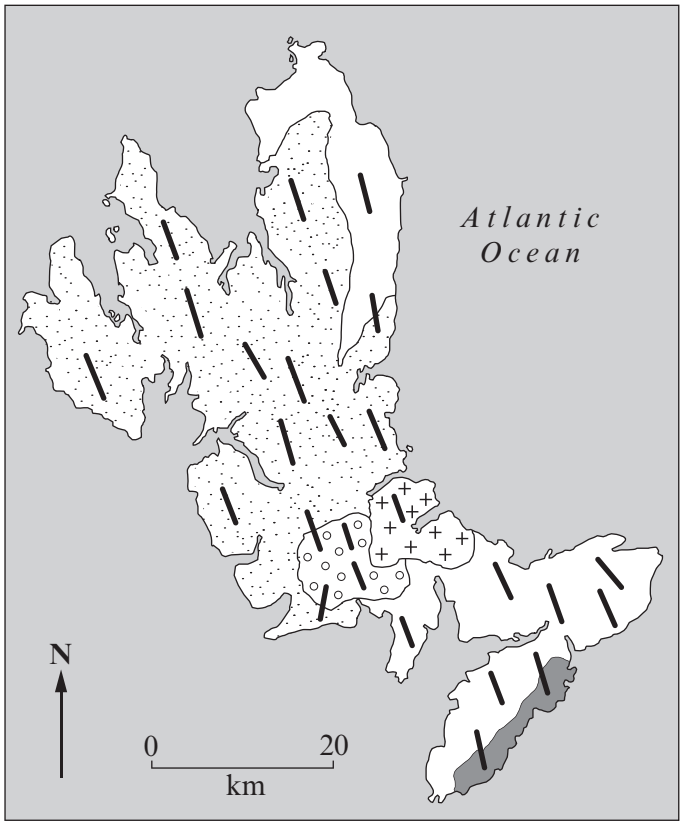
	Suitable for dating by ^{14}C method? Yes/No	Reason
the unfossiliferous Quaternary sand and gravel layers		•
fossil **G** in Jurassic shale		•

Table 3b

16

Examiner only

4. **Figure 4a** is a simplified geological map of the Isle of Skye. **Figure 4b** is a photomicrograph of rock **H**.



Key (not in order of age)

	gneiss (Precambrian)	
	mafic lavas (Tertiary)	
	silicic pluton (Tertiary)	
	mafic pluton (Tertiary)	
	discordant bodies of dolerite (Tertiary)	
	other rocks	

Figure 4a

Rock **H**

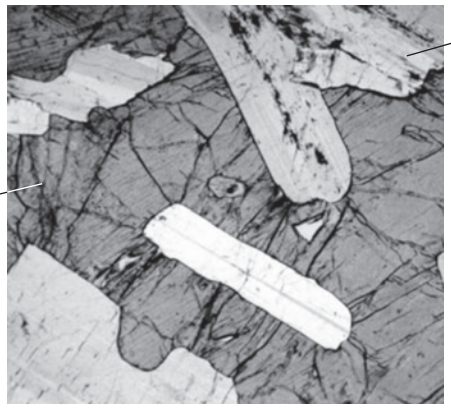


Figure 4b

Source: www.earthscienceeducation.com

Examiner only

(a) Identify the type of igneous body (pluton, dyke, sill or lava flow) formed by the **dolerite** on **Figure 4a**. [1]

Igneous body .....

(b) (i) With reference to the **key**, state the relative age of the gneiss compared with the silicic pluton in **Figure 4a**. Give a reason for your answer. [1]

Relative age of the gneiss .....

Reason .....

.....

(ii) Relative age can be determined using the law of cross-cutting relationships. Explain the meaning of this statement using **one** example from **Figure 4a**. [2]

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(c) (i) Describe the texture of rock **H** in **Figure 4b**. [3]

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(ii) With reference to the Mineral Data Sheet, identify mineral **X** in **Figure 4b**. [1]

Mineral **X** .....

(d) Indicate, by placing a tick in **one** of the blank boxes alongside the **key** in **Figure 4a**, the most likely rock formation represented by rock **H**. Give reasons for your choice. [4]

Reasons .....

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END OF PAPER

GCE AS/A level

1211/01-A

GEOLOGY
MINERAL DATA SHEET FOR USE WITH GL1

January 2013

Name	Cleavage/Fracture	Hardness	Density g cm^{-3}	Streak	Lustre	Colour	Other diagnostic properties
Quartz RF	*none/conchoidal	7	2.65	scratches streak plate	vitreous	colourless, milky but variable	hexagonal prisms terminated by pyramids
Orthoclase Feldspar RF	*2 good, 90	*6	2.6	scratches streak plate	vitreous	flesh, pink, white	*simple twin
Plagioclase Feldspar RF	*2 good, 90	*6	2.7	scratches streak plate	vitreous	creamy-white, grey, colourless	*repeated multiple twin
Muscovite Mica RF	*1 perfect (basal)	*2.5	2.7-3.1	white	pearly	colourless or pale yellow, green or brown	*flaky
Biotite Mica RF	*1 perfect (basal)	*2.5-3	2.7-3.1	white	pearly	brown/black	*flaky
Hornblende RF	*2 good, 60/120	*5-6	3.0-3.5	scratches streak plate	vitreous	black, dark green	prismatic crystals
Augite RF	*2 good, 90	*5-6	3.2-3.5	scratches streak plate	vitreous	greenish black	prismatic crystals
Olivine RF	none/conchoidal	*6-7	3.2-4.3	scratches streak plate	vitreous	*olive green	
Chiastolite/ Andalusite	poor 1/ uneven fracture	7.5	3.1-3.3	scratches streak plate	vitreous	pearly grey/pink	needle crystals with square x-sections, black centre
Garnet	none	*6.5-7.5	3.5-4.3	scratches streak plate	vitreous	red/brown	*12 sided crystals - each face rhomb shaped
Chlorite	1 good (basal)	*2	2.6-2.9	white	pearly	green	fibrous/flaky as massive, tabular crystals
Calcite RF	*3 good, not at 90, perfect rhombs	*3	2.71	white	vitreous	colourless, white, tints	*effervesces with 0.5M HCl, rhombic shape
Fluorite	*4 good, parallel to octahedron	*4	3.0-3.2	white	vitreous	colourless purple/green/yellow	fluoresces in uv light, cubic or octahedral crystals
Halite	3 good, 90 cubic	*2.5	2.2	white	vitreous	colourless, white, often stained	*salty taste cubic crystals, often stained
Gypsum	1 good (basal)	*1.5-2	2.3	white	silky, pearly	colourless, white, often stained	fibrous or twinned crystals
Barites	2 good, 90	*3-3.5	*4.5	white	vitreous, resinous	white, pink	bladed crystals
Chalcopyrite	poor/conchoidal	4	4.2	*black	metallic	bronze yellow	*tarnished to peacock colours
Pyrite	none/conchoidal	*6	5.0	*greenish black	metallic	brass yellow	crystals often striated cubes
Galena	*3 good, 90 cubic	*2.5	*7.5	*lead grey	metallic	lead grey	cubic crystals
Haematite	poor/subconchoidal	*5.5-6.5	4.9-5.3	*cherry red	metallic-dull	red/black skin/steel grey	kidney shaped masses, fibrous

* - Useful property for diagnosis RF - Common rock-forming mineral

This table should not be memorised.
Marks in the examinations will be awarded for description of the outcomes of tests on minerals and, on some occasions, identification from test results.