Surname	Centre Number	Candidate Number
Other Names		2

GCE AS/A level

1211/01

S16-1211-01

GEOLOGY – GL1
Foundation Unit

A.M. MONDAY, 16 May 2016

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**15**	
2.	**16**	
3.	**15**	
4.	**14**	
Total	**60**	

1211 010001

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- the Mineral Data Sheet;
- a calculator.

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 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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Answer **all** *questions.*

1. **Figure 1a** is a cliff section. **Figure 1b** is a photomicrograph view of the sandstone from locality **Y** indicated in **Figure 1a**.

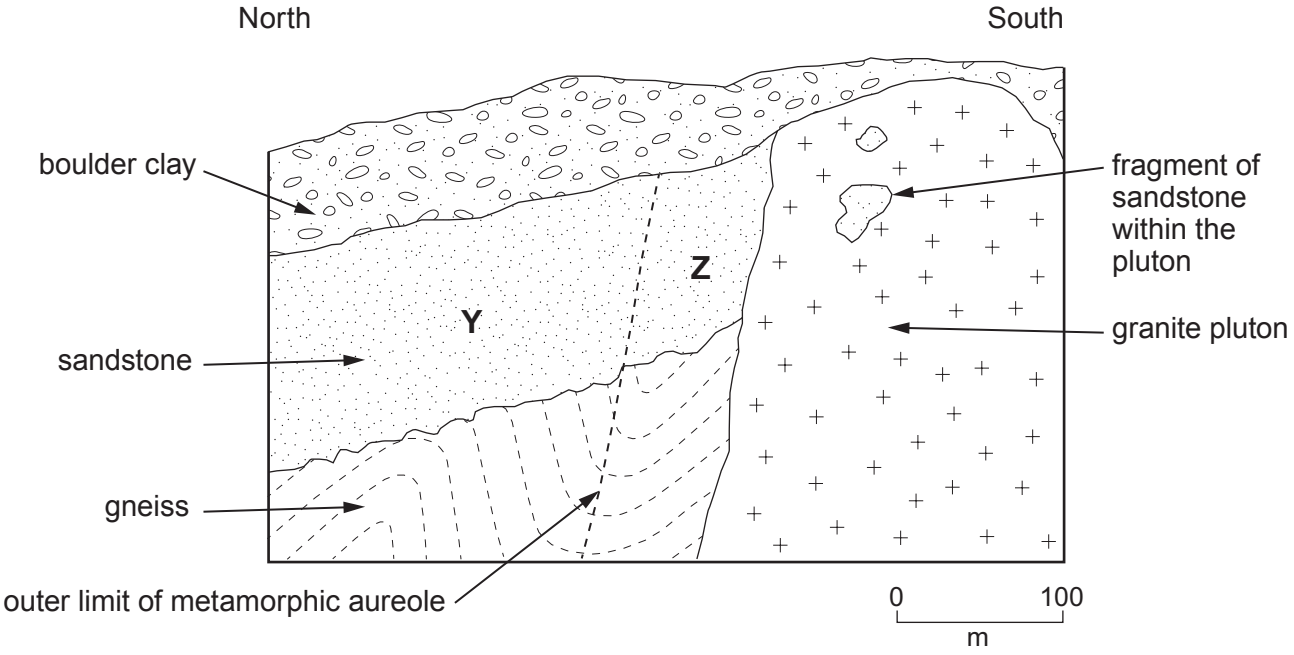

Figure 1a

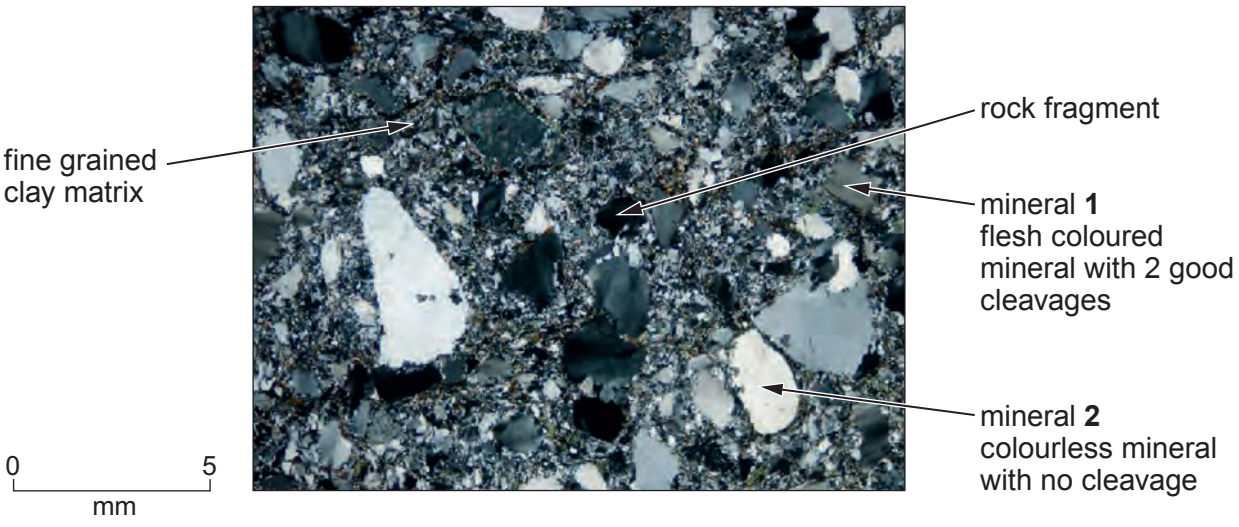

Figure 1b

Refer to **Figure 1b**.

(a) (i) With reference to the **Mineral Data Sheet**, name minerals **1** and **2** in the sandstone in **Figure 1b**. [2]

Mineral **1** .....

Mineral **2** .....

(ii) Describe the texture of the sandstone shown in **Figure 1b**. [3]

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(iii) Select from the list below the most appropriate name for the sandstone shown in **Figure 1b**.
Tick (✓) only **one** box. [1]

☐ orthoquartzite ☐ metaquartzite ☐ conglomerate ☐ greywacke ☐ breccia

(b) State **three** pieces of evidence from **Figure 1a** which suggests that the sandstone shown in **Figure 1b** could **only** have formed from the weathering and erosion of the gneiss shown in **Figure 1a**. [3]

1. .....

.....

2. .....

.....

3. .....

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(c) (i) Describe **three** likely differences between the rock within the metamorphic aureole at locality **Z** and the sandstone at locality **Y** on **Figure 1a**. [3]

Difference 1	....
Difference 2	....
Difference 3	....

(ii) Give reasons to explain the differences you have identified in part *(c)*(i) above. [3]

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2. **Figure 2a** shows time/distance curves for P and S waves. **Figure 2b** shows P and S wave velocities plotted against increasing depth into the Earth.

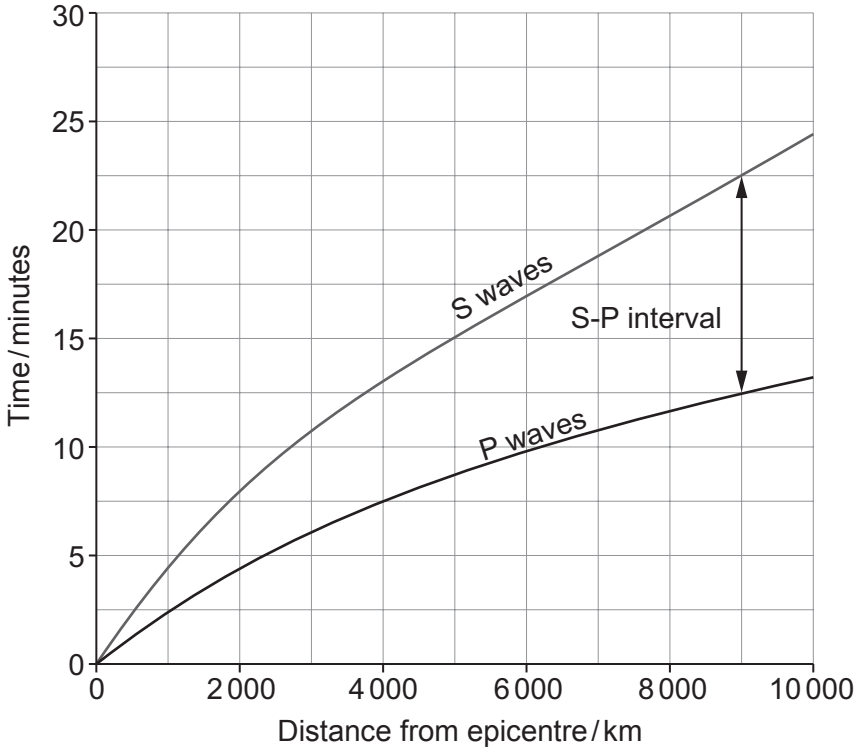

Figure 2a

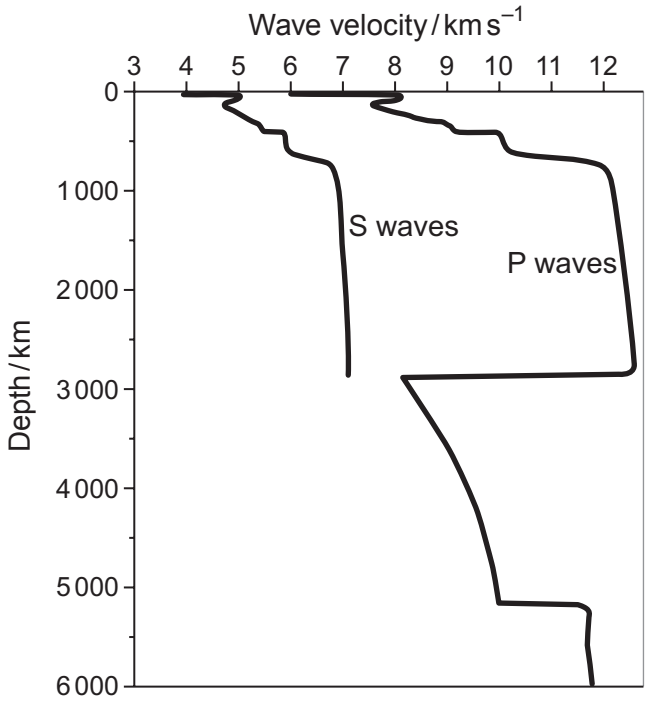

Figure 2b

Refer to **Figures 2a** and **2b**.

(a) (i) State which of the two seismic waves, P or S, travels the fastest. ..... [1]

(ii) An S wave was recorded arriving at a seismic station 22.5 minutes after an earthquake.

State the distance between the epicentre and the seismic station. [1]

.....

(b) (i) Describe how the velocity of P waves changes from the Earth's surface down to a depth of 670 km. [3]

.....

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.....

(ii) State the effect of each of the following rock properties on the velocity of P waves. Tick (✓) only **one** box in each case. [2]

Rock Property	Increase in velocity	Decrease in velocity	No change
increase in the density of rocks			
increase in the rigidity (incompressibility) of rocks			

(iii) Refer to **Figure 2b**. Draw **three** lines onto **Figure 2b** to represent each of the following boundaries within the Earth. Label each boundary clearly on **Figure 2b**. [3]

- lithosphere/asthenosphere boundary
- mantle/outer core boundary
- outer core/inner core boundary

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(c) (i) Using **Figure 2b** describe what happens to P waves and S waves at a depth of 2900 km. [3]

P waves .....

.....

S waves .....

.....

(ii) Explain why these changes to P waves and S waves occur at a depth of 2900 km. [3]

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3. **Figure 3a** is a cross-section at a cliff face showing the true dip of the beds. **Figure 3b** shows fossils found in the Jurassic limestone in **Figure 3a**. **Figure 3c** shows the detail of one fossil from **Figure 3b** where the outer shell has been removed.

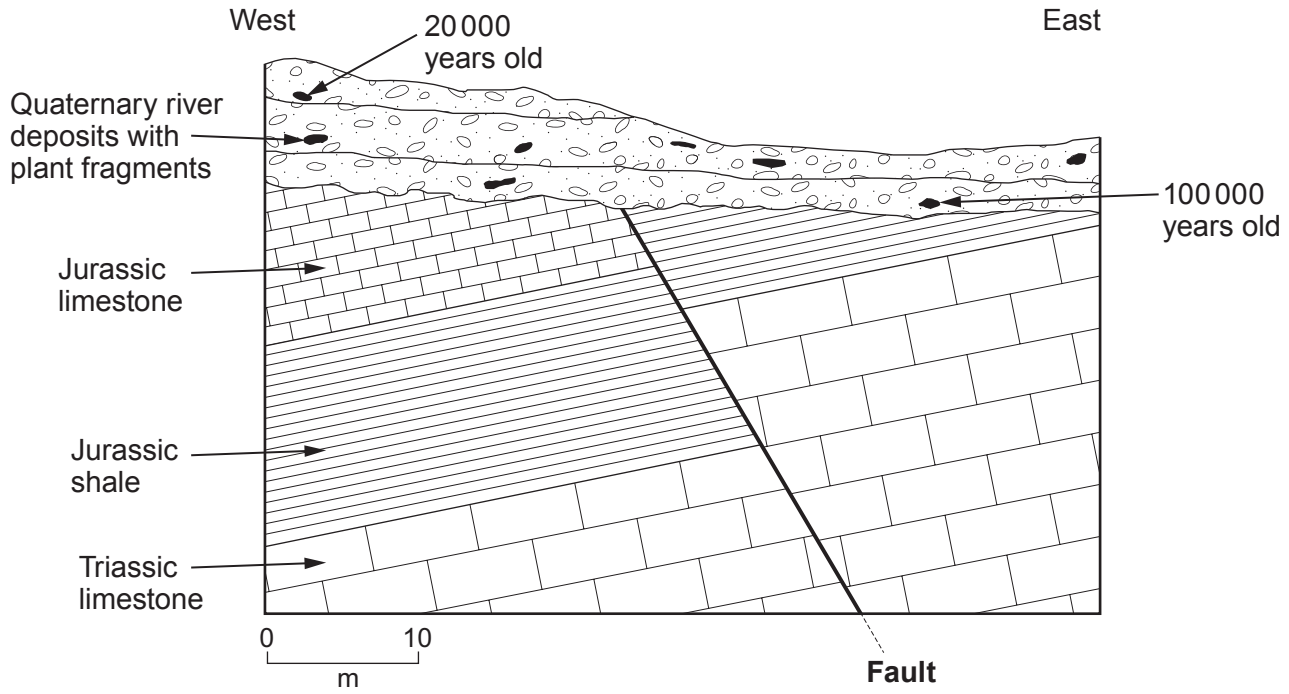

Figure 3a

Figure 3b

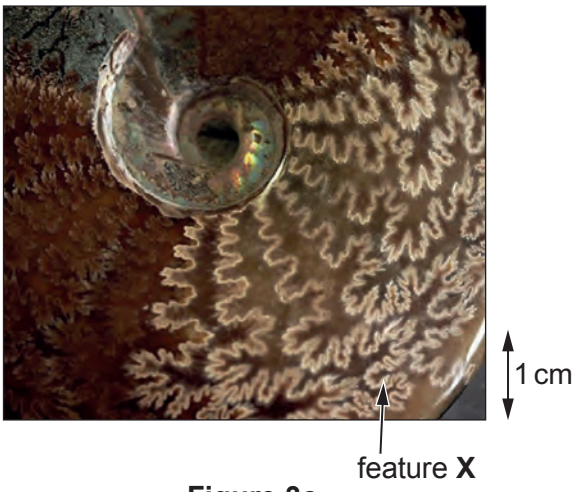

Figure 3c

(a) (i) State the dip direction and angle of dip of the Jurassic shale shown in **Figure 3a**. [2]

Dip direction ..... *Dip angle* ..... degrees

(ii) Explain **one** piece of evidence in **Figure 3a** which confirms that the rock sequence has not been overturned. [2]

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(b) Name the type of fault shown in **Figure 3a** and give **one** reason for your answer. [2]

Type of fault .....

Reason .....

.....

(c) (i) Name the morphological feature **X** labelled on the fossil shown in **Figure 3c**. [1]

.....

(ii) Identify the fossil group to which the fossils shown in **Figures 3b** and **3c** belong and state **one** reason to support your answer. [2]

Fossil group .....

Reason .....

.....

(iii) The fossils shown in **Figure 3b** could be either a life assemblage or death assemblage. Using **Figure 3b** and your knowledge describe and explain the evidence for the type of assemblage shown in **Figure 3b**. [4]

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(d) Assess the usefulness of carbon-14 dating in obtaining absolute ages for the Quaternary plant fragments in **Figure 3a**. [2]

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Turn over.

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4. **Figure 4a** is a block diagram of a folded sequence of sandstones and shales.

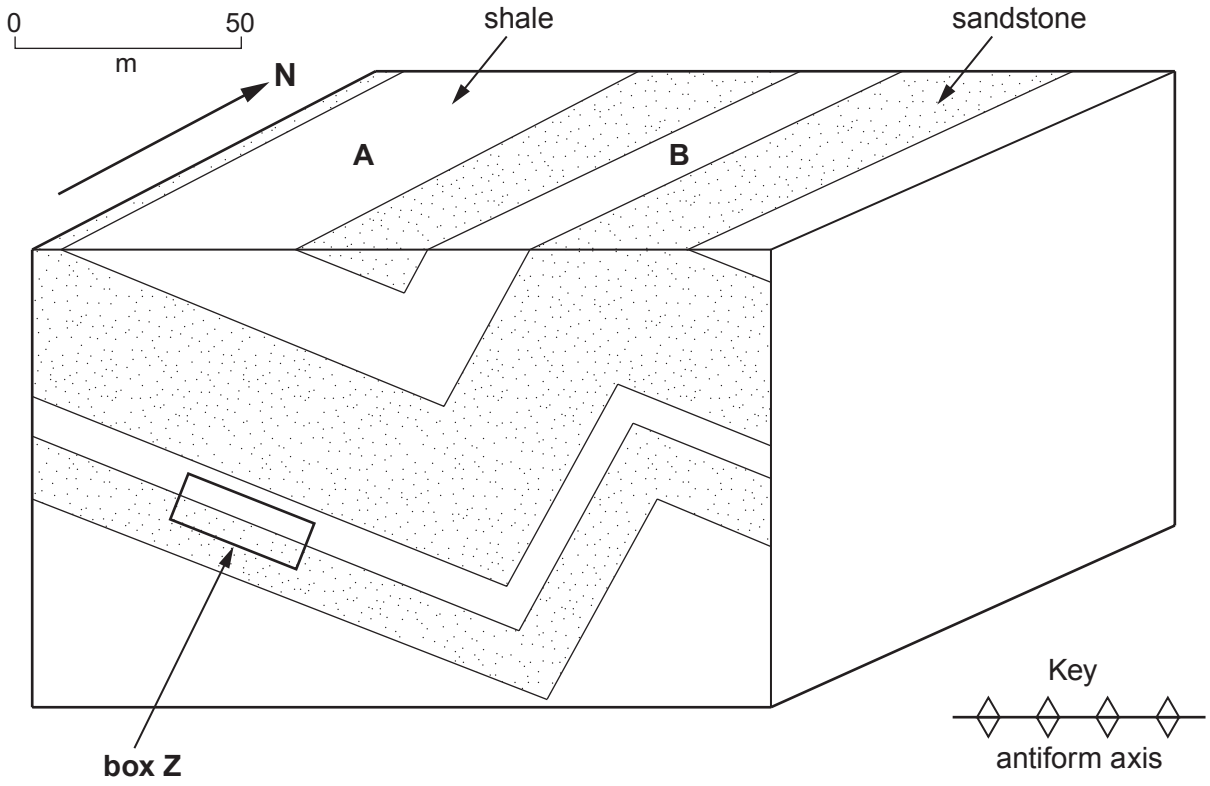

Figure 4a

(a) (i) Indicate clearly on **Figure 4a** the position of a fold axis and axial plane trace of an antiform using the symbol shown in the key. [2]

(ii) Explain why the bed of shale shown in **Figure 4a** has a wider outcrop at **A** than at **B**. [2]

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(iii) Draw in the geological boundaries on the east side of the block diagram shown in **Figure 4a**. [1]

Examiner only

(b) Describe the nature of the folding shown in **Figure 4a**. You may wish to refer to strike and dip values, type of folds, axial planes, limb lengths and fold symmetry. [4]

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(c) **Figure 4b** is an enlargement of **box Z** from **Figure 4a** and shows the junction between a sandstone and shale bed in more detail.

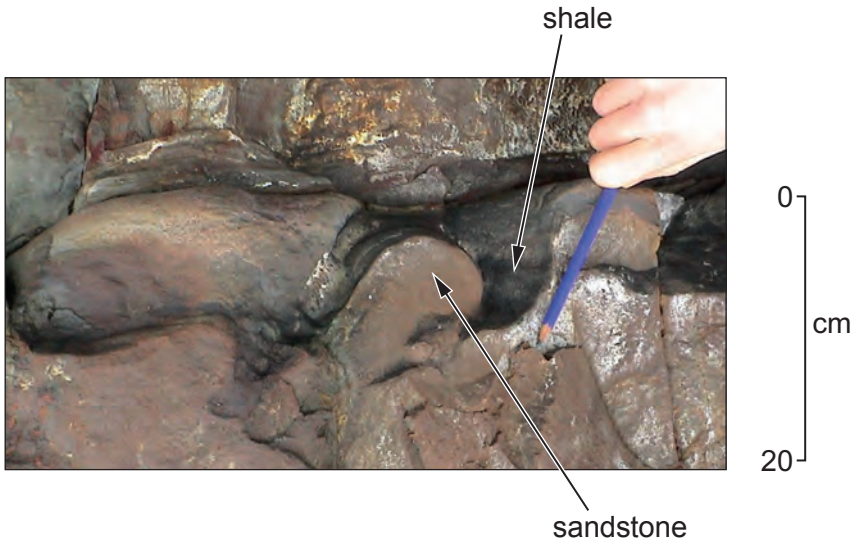

Figure 4b

(i) Name the sedimentary structure(s) shown in **Figure 4b** and briefly explain how they have been formed. [3]

Name of structure(s) .....

Explanation of formation .....

.....

.....

(ii) Explain how the sedimentary structure(s) shown in **Figure 4b** can be used to establish the relative ages of the beds shown in **Figure 4a**. [2]

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GCE AS/A level

1211/01-A

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S16-1211-01A

GEOLOGY

MINERAL DATA SHEET FOR USE WITH GL1 AND GL2a

April/May 2016

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.