Surname	Centre Number	Candidate Number
Other Names		2

GCE AS/A level

1211/01

GEOLOGY - GL1

Foundation Unit

P.M. TUESDAY, 10 January 2012

1 hour

		Examiner only
1.	**15**	
2.	**15**	
3.	**16**	
4.	**14**	
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 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** shows graptolite **A**. **Figure 1b** shows *Rhabdinopora flabelliformis*, a fossil found in rocks of Ordovician age and the oldest marine, **free-floating** graptolite.

Graptolite **A**

0 1
cm

Figure 1a

Rhabdinopora flabelliformis

0 1
cm

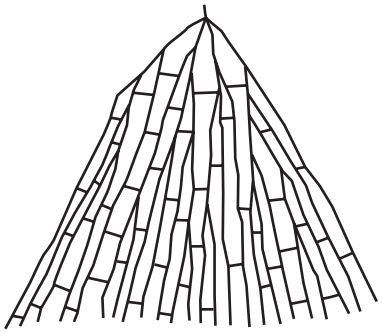

Figure 1b

(a) Describe graptolite **A** in **Figure 1a**. [3]

.....

.....

.....

(b) Using your knowledge of graptolite evolution state the most likely relative age (**younger**, **older**, **same age**) of *Rhabdinopora flabelliformis* in **Figure 1b** compared with graptolite **A** in **Figure 1a**. Give reasons for your answer. [3]

Relative age of *Rhabdinopora flabelliformis* .....

Reasons .....

.....

.....

(c) (i) Graptolites older than *Rhabdinopora flabelliformis* are thought to have been fixed to the sea-bed. Explain why this could make *Rhabdinopora flabelliformis* more suitable as a zone fossil than older graptolites. [2]

.....

.....

.....

(ii) State **two** properties of graptolites which make them suitable as zone fossils other than the one you referred to in question *(c)*(i). [2]

Property 1 .....

Property 2 .....

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Figure 1c shows the geology in a cliff section including the location from which a specimen of *Rhabdinopora flabelliformis* was collected. **Figure 1d** shows part of the Geological Column.

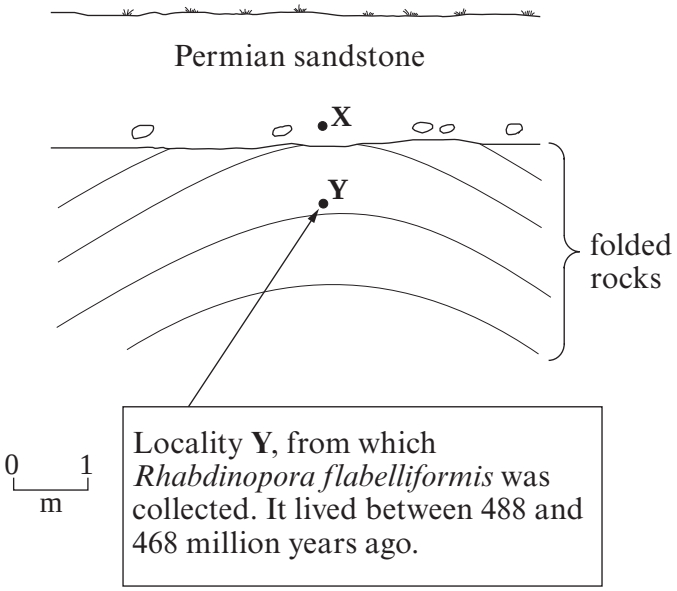

Figure 1c

Date (million years)	Period
200	
	TRIASSIC
251	
	PERMIAN
299	
	CARBONIFEROUS
359	
	DEVONIAN
416	
	SILURIAN
444	
	ORDOVICIAN
488	
	CAMBRIAN
542	

Figure 1d

(d) (i) With reference to **Figures 1c** and **1d**, calculate the **minimum** possible time interval between the deposition of the rocks at points **X** and **Y** on **Figure 1c**. Show your working. [2]

..... million years

(ii) Explain the most likely reason for the very long time interval between the deposition of the rocks at points **X** and **Y**, which are separated by only one metre. [3]

.....

.....

.....

.....

[Total 15 marks]

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Turn over.

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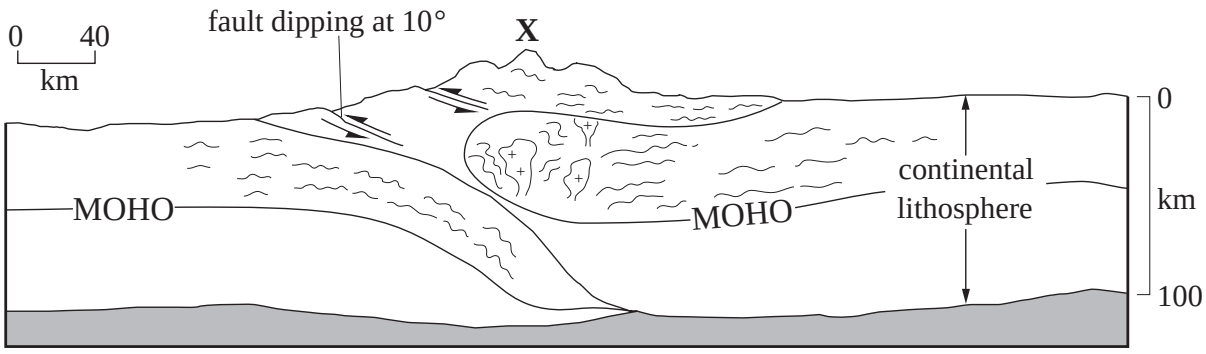
2. **Figure 2a** is a cross-section through an orogenic belt in a collision zone.



Continental collision zones occur where two plates of continental lithosphere collide. This causes the lithosphere to thicken from its original thickness of 100 km. Much of the thickening is due to movement along the faults that form because neither of the plates subducts.

Figure 2a

(a) (i) The continental lithosphere is at its maximum thickness beneath locality **X** in **Figure 2a**. State the maximum thickness of the continental lithosphere beneath locality **X**. [1]

..... km

(ii) State the percentage increase in thickness of the continental lithosphere beneath locality **X**. Use the formula below. Show your working. [2]

$$\% \text{ increase in thickness} = \frac{\text{Present day thickness} - \text{Original thickness}}{\text{Original thickness}} \times 100$$

..... %

(b) State which type of plate boundary (**convergent**, **divergent** or **conservative**) is shown in **Figure 2a**. Give a reason for your answer. [2]

Type of boundary .....

Reason .....

.....

(c) (i) State which type of fault (**normal**, **reverse**, **thrust** or **strike slip**) is shown within the orogenic belt in **Figure 2a**. Give reasons for your answer. [3]

Fault type .....

Reasons .....

.....

.....

(ii) Explain why neither of the plates is subducting at this orogenic belt. [2]

.....

.....

.....

Figure 2b is a map showing surface features associated with three plate boundaries **X**, **Y** and **Z**.

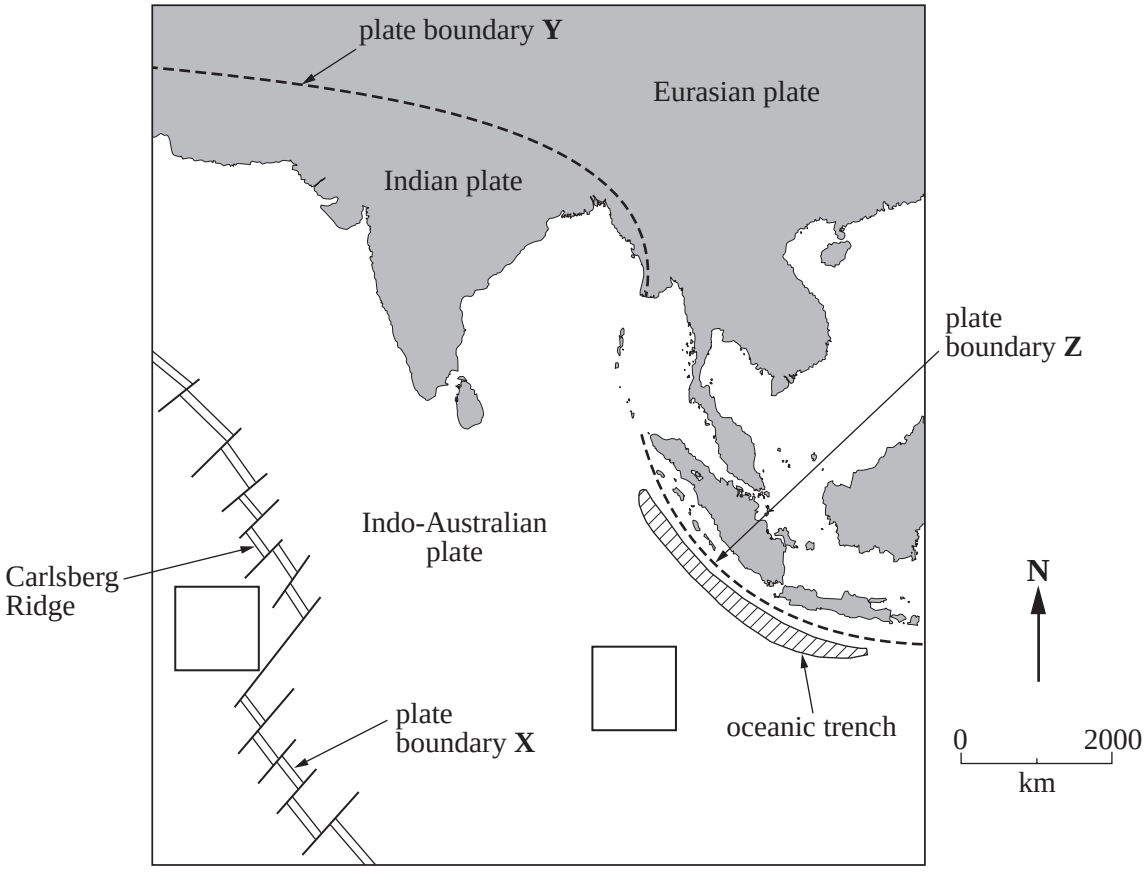


Figure 2b

Refer to **Figure 2b**.

(d) (i) Draw an arrow in both of the blank boxes to show the relative direction of plate movement at the Earth's surface at these locations. [1]

(ii) Associated with each of the plate boundaries **X**, **Y** and **Z**, the Earth's surface has been raised to form areas significantly higher than the regions surrounding them. State which **one** of the plate boundaries **X**, **Y**, or **Z**, is most likely to form the orogenic belt shown in **Figure 2a**. Justify your choice. [4]

Plate boundary .....

.....

.....

.....

.....

[Total 15 marks]

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Turn over.

Examiner only

3. **Figure 3a** is a sedimentary log through a sequence of red-coloured sedimentary rocks. **Figure 3b** is a photograph of the grains collected from rock unit **B** shown in **Figure 3a**.

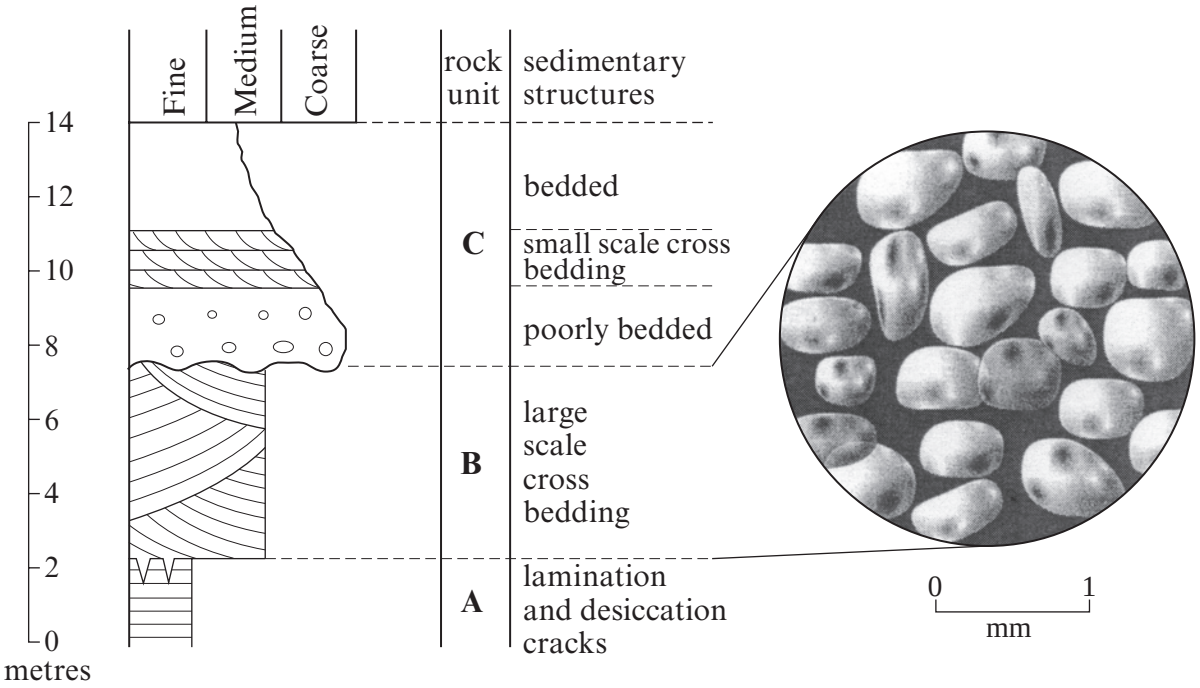


Figure 3a **Figure 3b**

(a) Name the mineral most likely to be responsible for the red colour of the sedimentary rocks shown in **Figure 3a**. You may wish to use the mineral data sheet provided. [1]

.....

(b) (i) State the thickness of rock unit **B** shown in **Figure 3a**. [1]

..... m

(ii) Describe the variation of grain size within rock unit **C** on the sedimentary log **Figure 3a**. [2]

.....

.....

.....

(iii) State which rock unit **A**, **B** or **C**, is most likely to have formed in the lowest energy conditions. Give reasons for your answer. [3]

Rock Unit .....

Reasons .....

.....

.....

Examiner only

(c) Describe the texture of the sediment in **Figure 3b** collected from rock unit **B** in **Figure 3a**. [3]

.....

.....

.....

.....

Figure 3c is a reconstruction of a desert landscape in which the rock units **A**, **B** and **C** in **Figure 3a** are thought to have been deposited. Within this landscape five environments have been identified, labelled **1-5**.

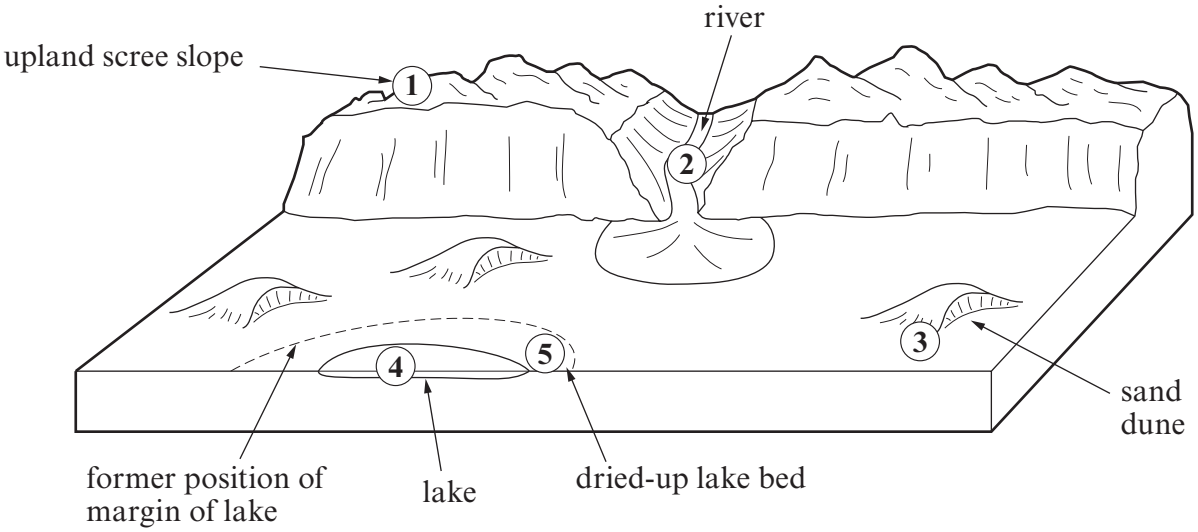


Figure 3c

(d) Complete **Table 3** to identify in which of the environments **1-5** each of the rock units **A**, **B** and **C** is most likely to have been deposited. Using **Figures 3a** and **3b** explain the evidence for the environment of deposition. [6]

Rock Unit	Environment of deposition (**1-5**)	Explanation of evidence
C		
B		
A	**5**	

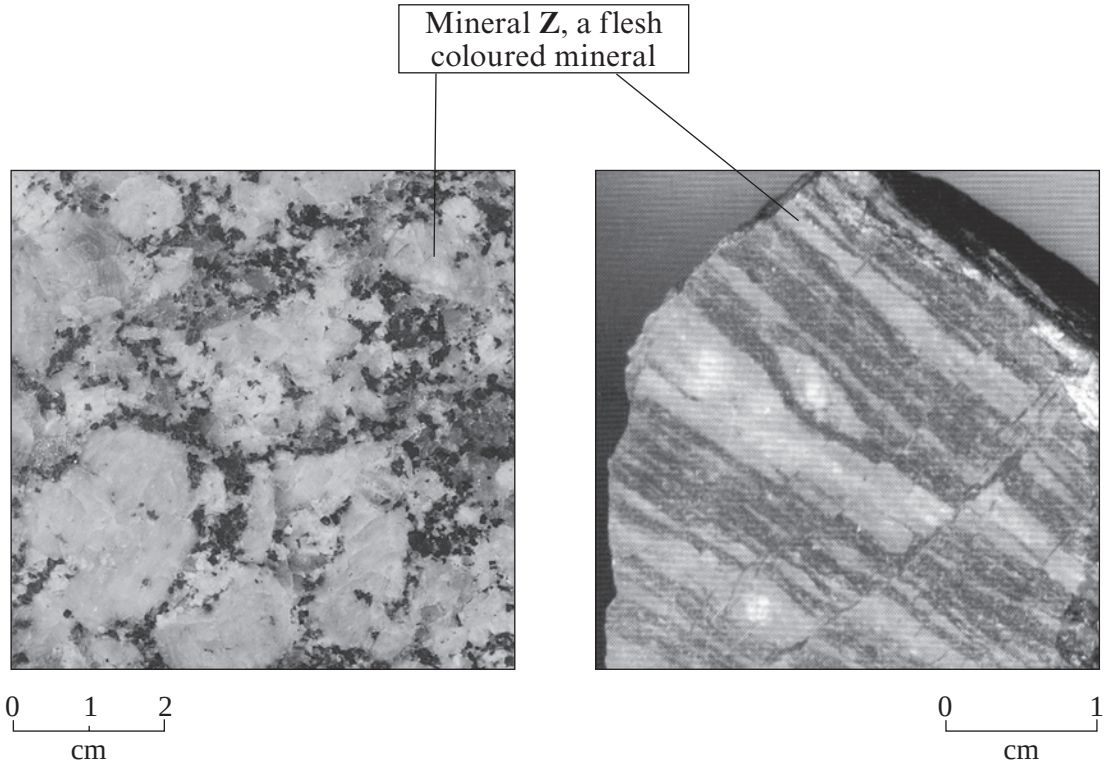
Table 3

[Total 16 marks]

Turn over.

Examiner only

4. **Figure 4** shows photographs of two crystalline rocks **A** and **B**. They both have very similar mineral content and approximately 25% of each rock is composed of quartz.



Rock A **Rock B**

Figure 4a

Refer to **Figure 4a**.

(a) (i) Describe the texture of the crystalline rock **A**. [3]

.....

.....

.....

.....

(ii) Name rock **A**. [1]

.....

Examiner only

(b) (i) Describe **two** ways in which the texture of rock **B** differs from that of rock **A**. [2]

1 .....

.....

2 .....

.....

(ii) Describe the likely conditions of formation of rock **B**. [3]

.....

.....

.....

.....

Turn over.

Examiner only

(c) **Figure 4b** is a geological map of the area where rocks **A** and **B** are exposed.

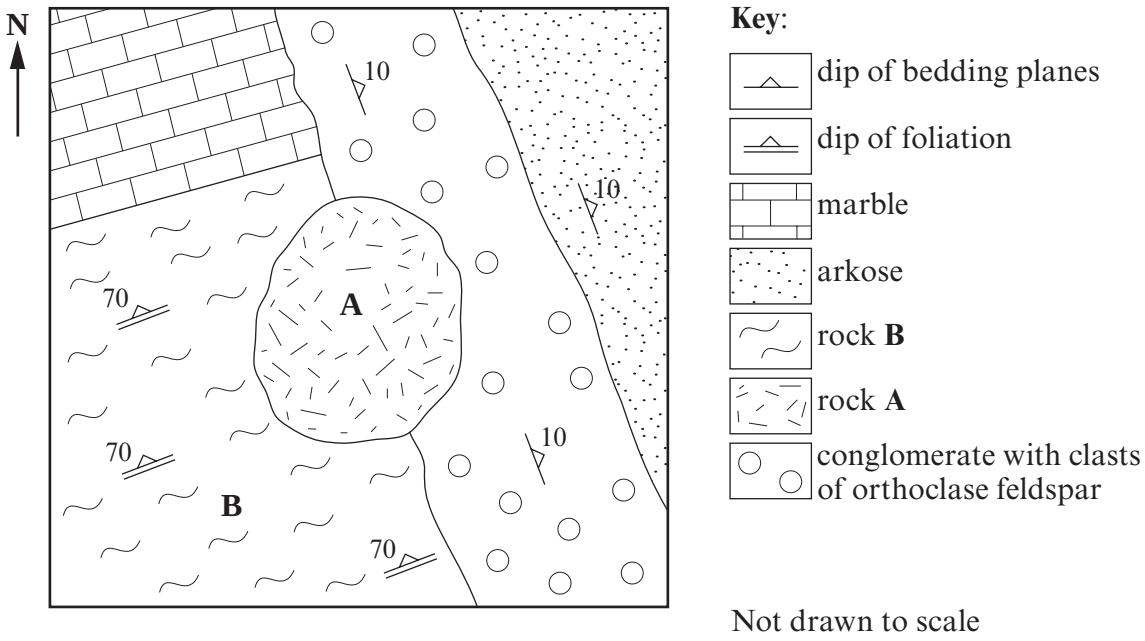


Figure 4b

(i) State the type of igneous body (**pluton**, **dyke**, **sill** or **lava flow**) shown in **Figure 4b** from which rock **A** was collected. [1]

.....

(ii) The conglomerate on **Figure 4b** contains clasts of orthoclase feldspar which have come from one of the following rocks:

rock A **rock B** **marble** **arkose**

Refer to **Figures 4a** and **4b** and the mineral data sheet. State from which **one** of the four rocks listed above the orthoclase feldspar clasts in the conglomerate are most likely to have come. Give reasons for your answer. [4]

Rock .....

Reasons .....

.....

.....

.....

[Total 14 marks]

WJEC
CBAC

GCE AS/A level

1211/01-A

GEOLOGY

MINERAL DATA SHEET FOR USE WITH GL1

January 2012

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 pyrmaids
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 <u>not</u> 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.