

Candidate Name	Centre Number	Candidate Number
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GCSE

4250/01

GEOLOGY

Theory Paper

(Paper version of on-screen assessment)

A.M. FRIDAY, 20 May 2011

1½ hours

Examiner only		
Question	Maximum Mark	Candidate Mark
1	22	
2	9	
3	12	
4	16	
5	11	
6	23	
7	7	
Total	100	

ADDITIONAL MATERIALS

In addition to this examination paper you will need a:

- Data Sheet;
- calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Answer **all** questions.

Write your answers in the spaces provided.

INFORMATION FOR CANDIDATES

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

You are reminded that assessment will take into account the quality of written communication used in your answers to questions 1(e) and 2(a)(ii).

Question 1

Figure 1 is a cross-section through an open pit from which a mineral deposit is being extracted.

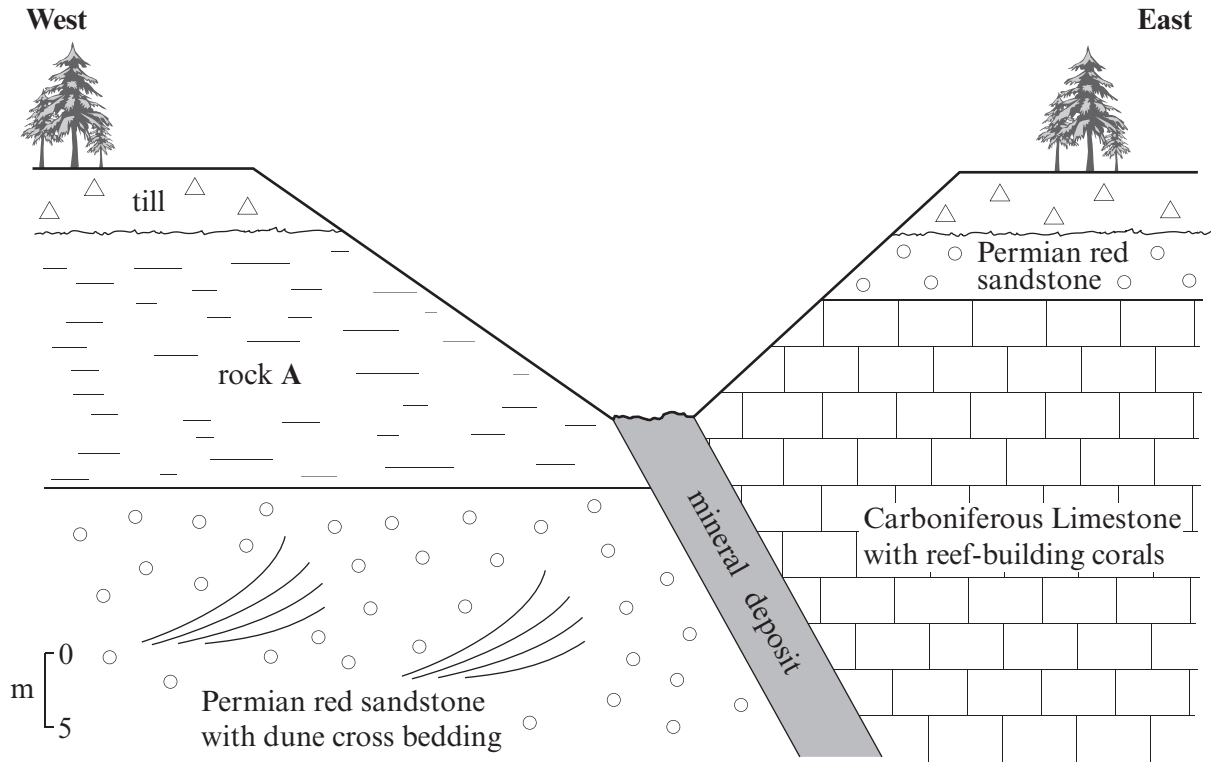
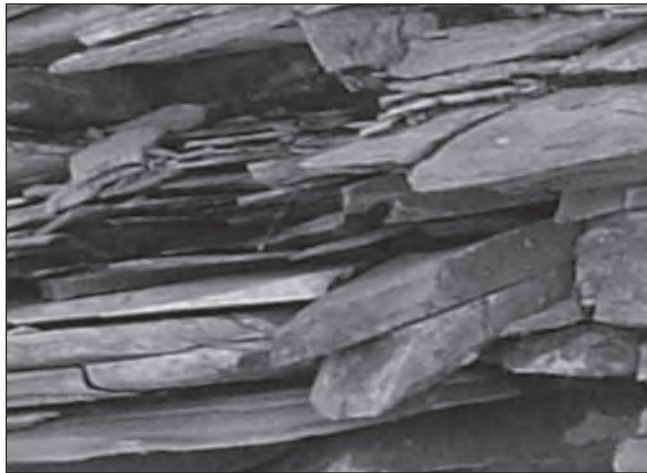


Figure 1

(a) **Figure 2** shows an enlargement of rock **A** from **Figure 1**.

Rock A. Grey, fine-grained, laminated rock



0 1
cm

Figure 2

(i) Name rock A. Tick (✓) only **one** box.

[1]

- limestone
- sandstone
- shale
- conglomerate
- breccia

Figure 3 shows a fossil specimen collected from rock A in Figure 1.

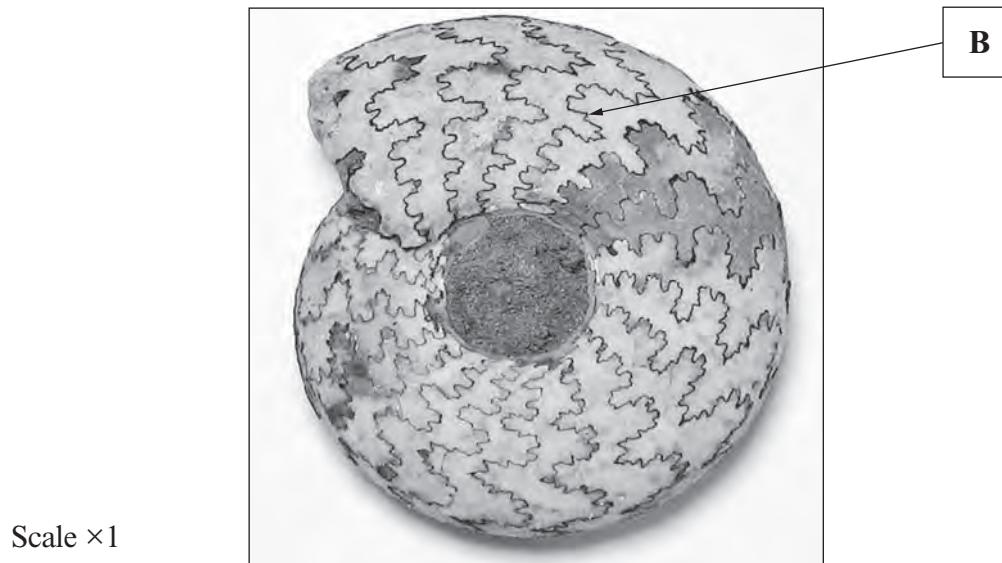


Figure 3

(ii) Name the fossil. Tick (✓) only **one** box.

[1]

graptolite

ammonite

goniatite

coral

trilobite

(iii) Identify the part of the fossil labelled **B** by circling the correct term from the following list. [1]

stipe

leaf

thecae

suture line

cell

(iv) Rock A in Figure 1 is Jurassic in age. Give **one** explanation for deciding upon this age for rock A. [1]

.....

.....

(v) State the most likely environment of deposition of rock A. Tick (✓) only **one** box. [1]

formed by the evaporation of sea water

deposited from ice melt

deposited by a river

deposited as wind-formed dunes

marine deposition

(b) **Figure 4** shows a field sketch of the till in **Figure 1**.

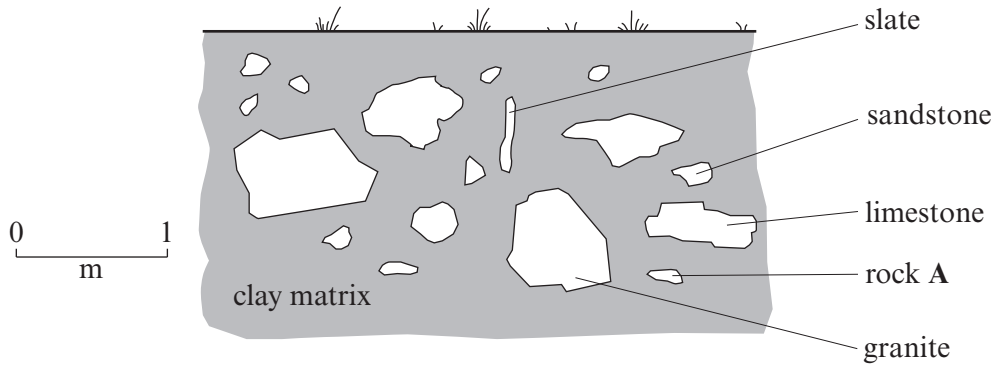


Figure 4

(i) Using the **Data Sheet**, describe the grain shape of the granite boulder in the till. Tick (✓) only **two** boxes. [2]

- rounded
- subrounded
- angular
- high sphericity
- low sphericity

(ii) State the most likely agent of transport for the till. Tick (✓) only **one** box. [1]

sea

wind

river

gravity

ice

(iii) Name **two** fragments in the till that have been transported from outside the area shown in **Figure 1**. Tick (✓) only **two** boxes. [1]

sandstone

slate

limestone

granite

rock A

(c) **Figure 1** demonstrates that a fault was involved in the formation of the mineral deposit.

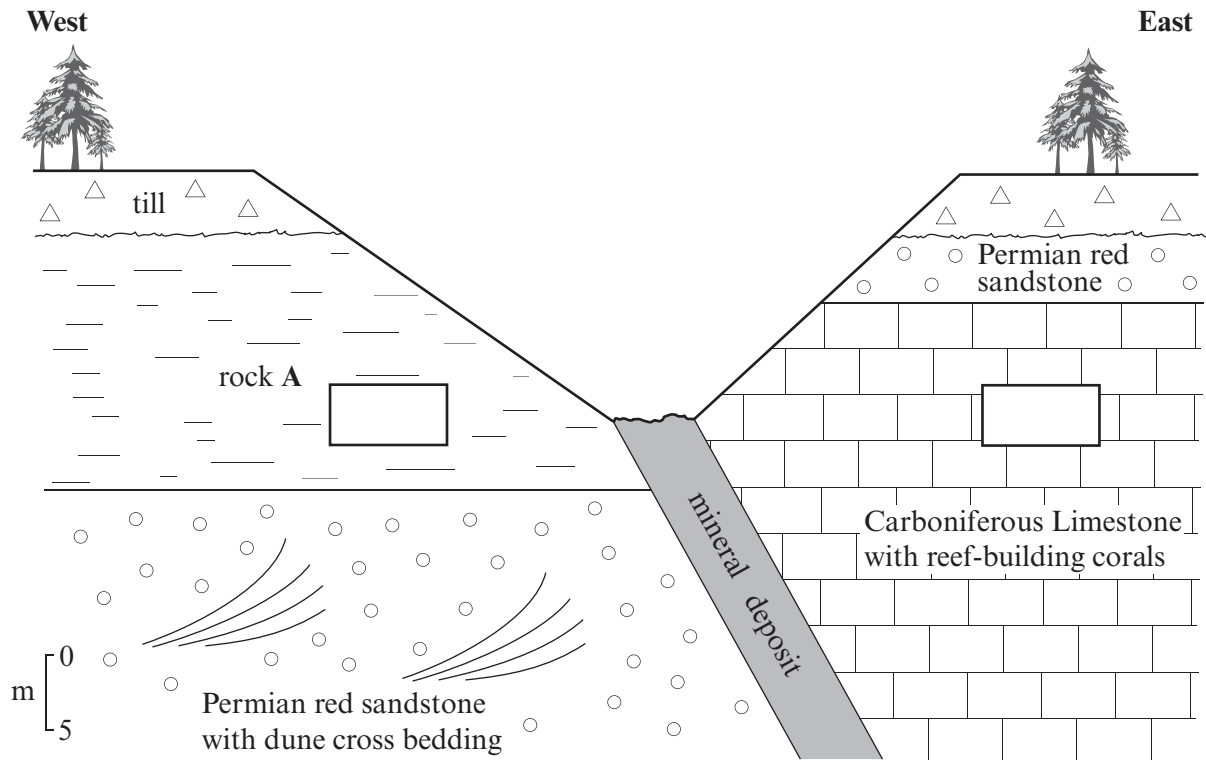


Figure 1

- (i) Draw arrows in the boxes on **Figure 1** to indicate the downthrow and upthrow sides of the fault. [1]
- (ii) Name the type of fault in **Figure 1**. Tick (✓) only **one** box. [1]

- normal fault
- reverse fault
- thrust fault
- strike-slip fault
- transform fault

- (iii) State the main type of tectonic stress involved in the formation of the fault. Tick (✓) only **one** box. [1]

- shear
- tension
- compression

- (d) (i) **Table 1** shows the properties of the metal ore and gangue mineral found in the mineral deposit in **Figure 1**.

	Hardness	Streak	Cleavage
metal ore	2½	grey	breaks into cubes
gangue mineral	7	none	none

Table 1

Use the **Data Sheet** to identify the metal ore and gangue mineral. [2]

metal ore

gangue mineral

- (ii) The mineral deposit in **Figure 1** is a hydrothermal vein. Explain how a hydrothermal vein forms. [3]

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.....

- (iii) 25,000 tonnes of mineral deposit were extracted, from which 1,000 tonnes of metal ore were separated. Calculate the percentage of metal ore in the deposit. [1]

.....

.....

Percentage of metal ore = %

- (e) Describe the evidence in **Figure 1** that the latitude of Britain has changed between the Carboniferous and the present day. Pay attention to spelling and grammar, use suitable terms and make sure your answer is well organised. [3]

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Question 2

(a) **Figures 5 and 6** show a photograph and cross-section across Ingleborough.

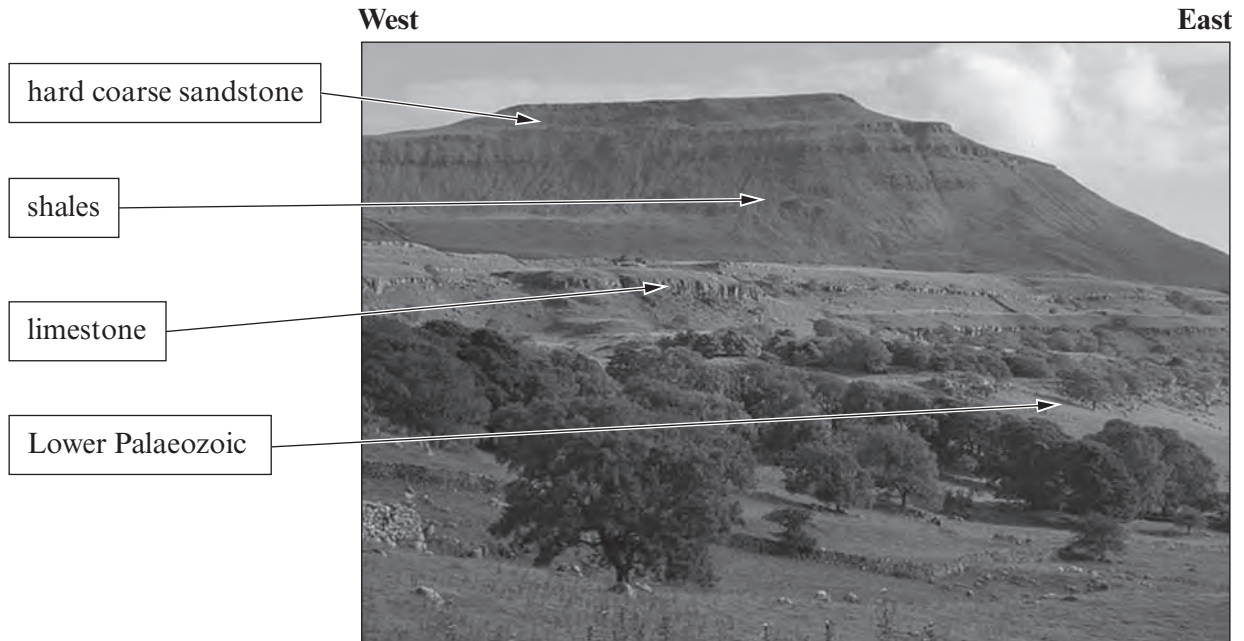


Figure 5

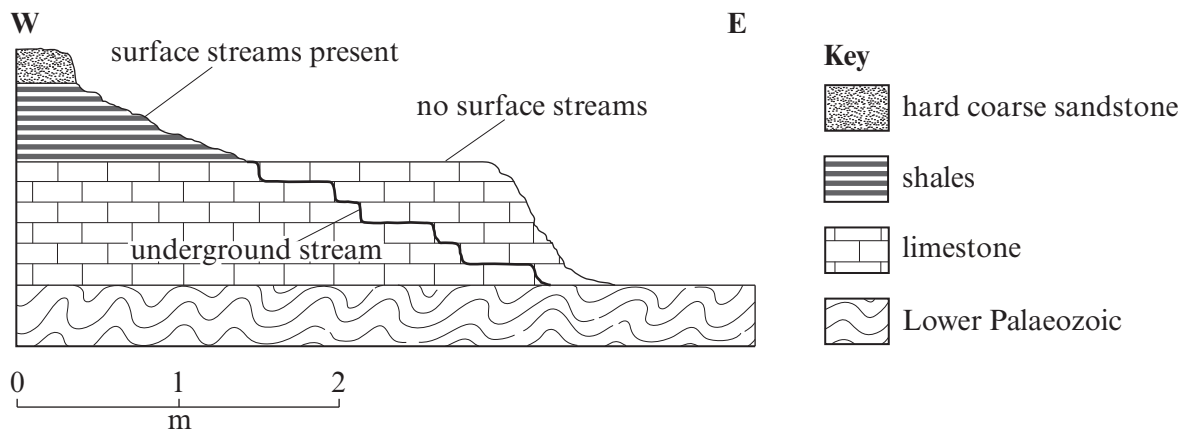


Figure 6

(i) State the dip of the bedding. Tick (✓) only **one** box.

[1]

- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| dips to the west at 45° | horizontal | dips to the east at 20° | dips to the west at 20° | vertical |

- (ii) Describe how the geology of the area has influenced the land forms. Pay attention to spelling and grammar, use suitable terms and make sure your answer is well organised. [3]

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- (iii) The base of the limestone is an unconformity. Describe the order of events which led to the formation of this structure by writing each of the following events in its correct position (1-4) in the following table. [2]

erosion

deposition of the Lower Palaeozoic

deposition of the limestone, shales and sandstone

folding and uplift

youngest	↑	5	uplift and erosion
		4	
		3	
		2	
oldest		1	

- (b) **Figure 7** is a photograph of the surface of the limestone shown in **Figure 6**. This characteristic landform is produced by weathering.



0 1
m

Figure 7

- (i) Name the main weathering process responsible for the formation of this surface. Tick (✓) only **one** box. [1]

physical

chemical

biological

- (ii) Describe the weathering process that has produced this landform. [2]

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Question 3

(a) **Figure 8** is a cross-section across a mid-ocean ridge.

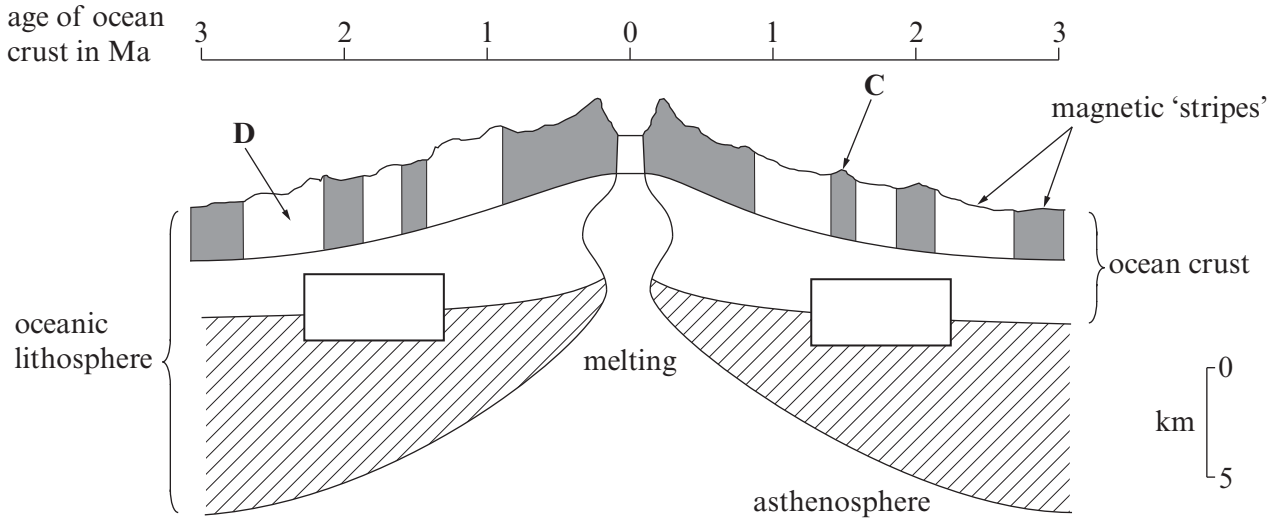


Figure 8

(i) State the age of the ocean crust at **C**.

[1]

million years

(ii) Name an igneous rock you would expect to find near the surface at **D**. Tick (✓) only **one** box.

[1]

turbidite

granite

gabbro

breccia

basalt

(iii) Draw arrows in the boxes on **Figure 8** to show the direction of plate movement each side of the mid-ocean ridge. [1]

(iv) Name the type of plate margin shown in **Figure 8**. Tick (✓) only **one** box. [1]

- convergent (destructive, oceanic-oceanic)
- conservative
- convergent (destructive, oceanic-continental)
- divergent (constructive)
- convergent (destructive, continental-continental)

(v) Which **two** of the following statements correctly describe the lithosphere? Tick (✓) only **two** boxes. [2]

- only crust
- crust and upper mantle
- cold, rigid solid
- weak, partially molten
- only mantle
- hot, weak solid

(vi) Describe **one** piece of evidence from **Figure 8** which can be used to support the theory of sea floor spreading. [3]

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.....

.....

(b) **Figure 9** is a photograph of structures found in the crust at **D** on **Figure 8**.



Figure 9

(i) Name the structure at **D**. Tick (✓) only **one** box.

[1]

columnar jointing

pillow lavas

dyke

ripple marks

graded bedding

(ii) Explain how these structures form.

[2]

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Question 4

(a) **Figure 10** is a partly completed diagram of the rock cycle.

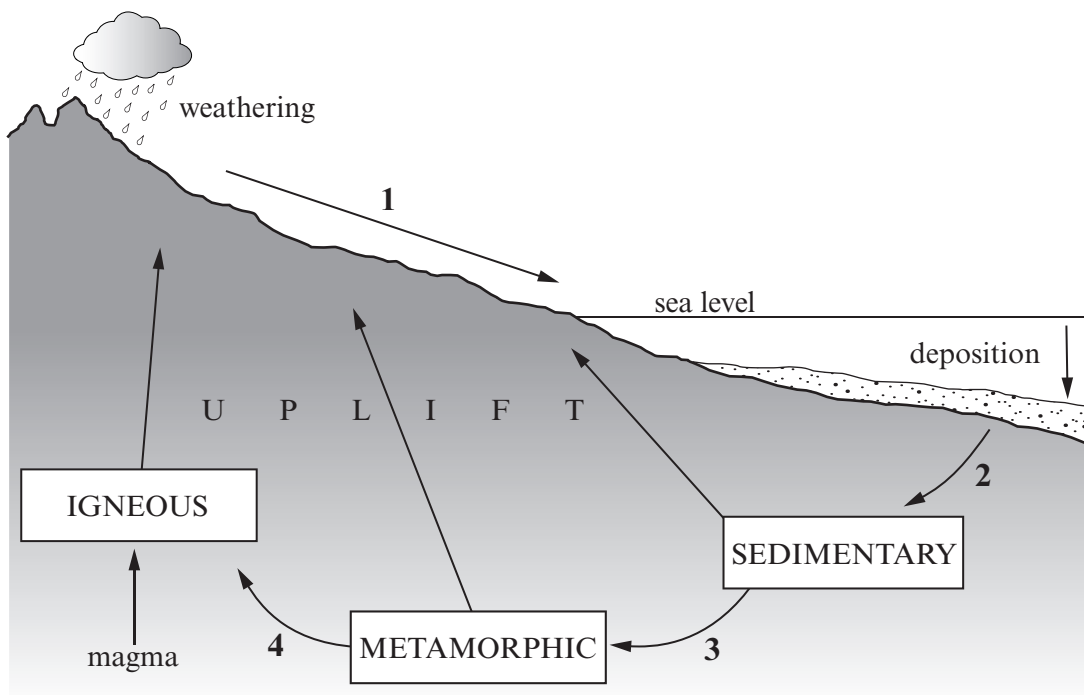


Figure 10

Table 2 states two processes of the rock cycle. Write in the numbers **1, 2, 3 or 4** from **Figure 10** against the correct process. [2]

Process	Number
melting	
transport and erosion	

Table 2

(b) **Figure 11** shows rock **E** which is from one of the major rock groups in the rock cycle.

Rock **E**

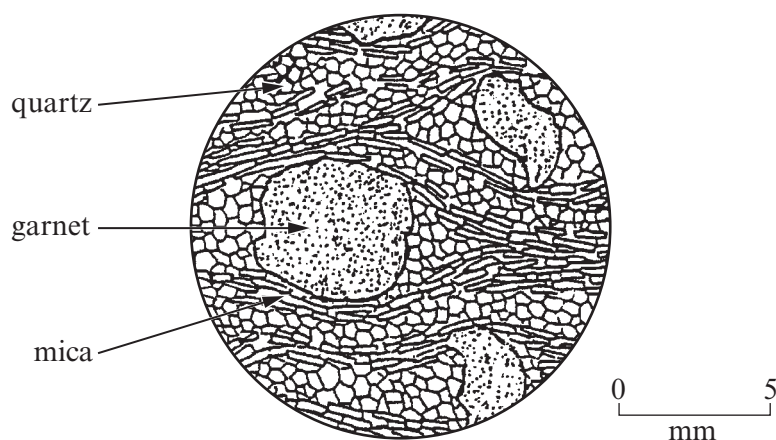


Figure 11

(i) Give **two** observations which apply to rock **E**. Tick (✓) only **two** boxes. [2]

- fragmental (clastic)
- foliated
- random crystal orientation
- does not react with hydrochloric acid
- poorly sorted

(ii) Name the major rock group to which rock **E** belongs. Tick (✓) only **one** box. [1]

- igneous
- metamorphic
- sedimentary

(iii) Describe the origin of the garnet in rock **E**. Tick (✓) only **one** box.

[1]

crystallisation from a melt

weathered from a rock, transported and deposited

crystallisation as a cement

recrystallisation

precipitation due to evaporation

(iv) Circle the correct name of rock **E**.

[1]

marble *slate* *sandstone* *schist* *granite*

(c) **Figure 12** is a map showing an igneous body and a polished section of rock **F** collected from the centre of the igneous body.

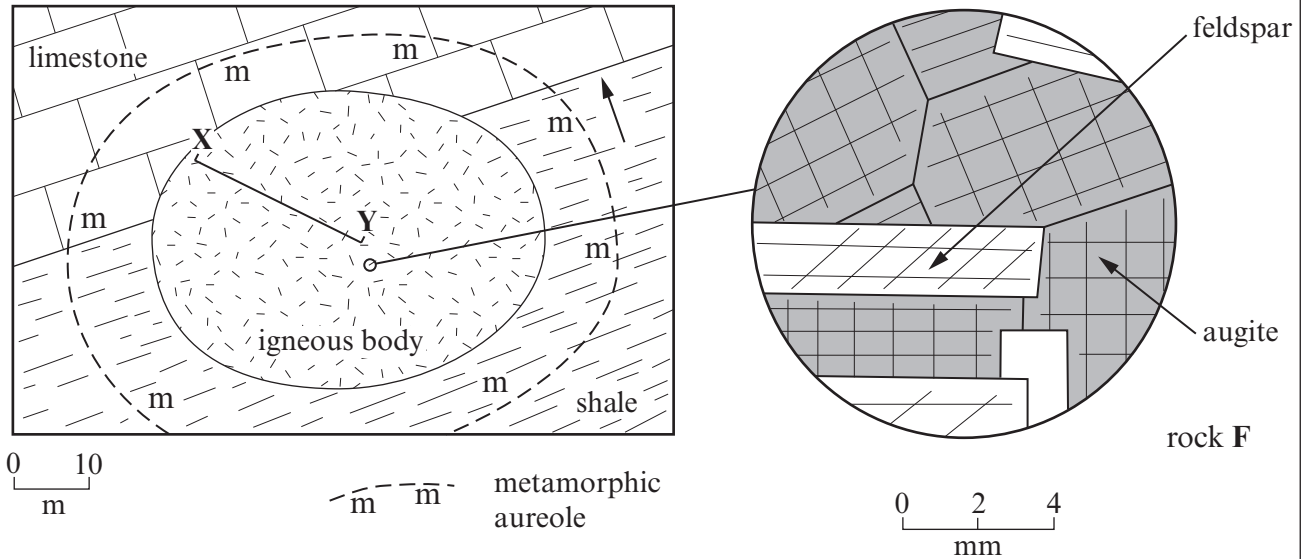


Figure 12

(i) Which **three** of the following statements correctly describe the igneous body? Tick (✓) **three** boxes only. [3]

- dyke
- cuts through the bedding
- pluton
- extrusive
- intrusive
- parallel to the bedding

(ii) Circle the correct name of rock **F**. [1]

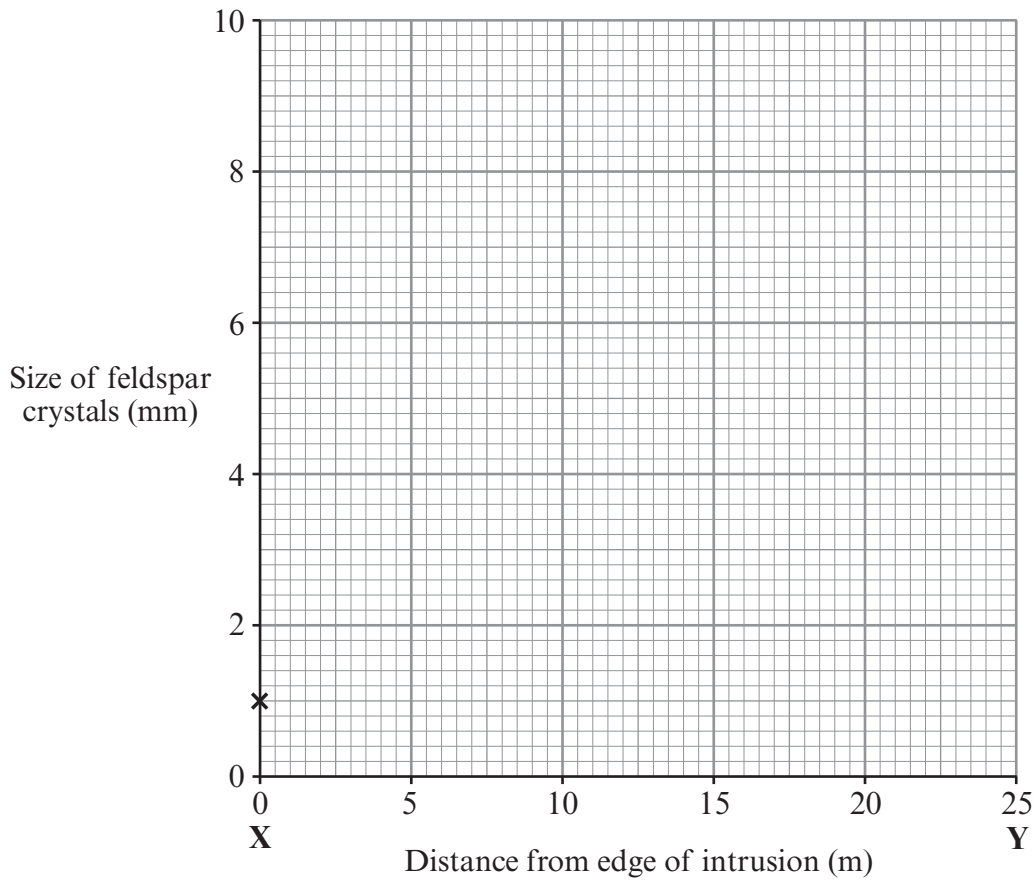
granite gabbro basalt breccia schist

- (iii) A survey was carried out to measure the size of the feldspar crystals in rock **F** from the edge of the igneous body to the centre in **Figure 12**. The survey line (**X–Y**) is shown on **Figure 12**. The results of the survey are shown in **Table 3**.

Distance from edge of intrusion (m)	0 (X)	5	10	17.5	20	25 (Y)
Size of feldspar crystals (mm)	1	4	7.5	8	9	9.5

Table 3

Plot the data shown in **Table 3** on the graph below. The first point has already been plotted for you. [3]



- (iv) **Describe** how the crystals change in size along the survey line and **explain** the change in crystal size. [2]

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Question 5

- (a) **Figure 13** is a map showing the location of the Indian Ocean earthquake on 29th December 2004 and the travel times for the resulting tsunami.

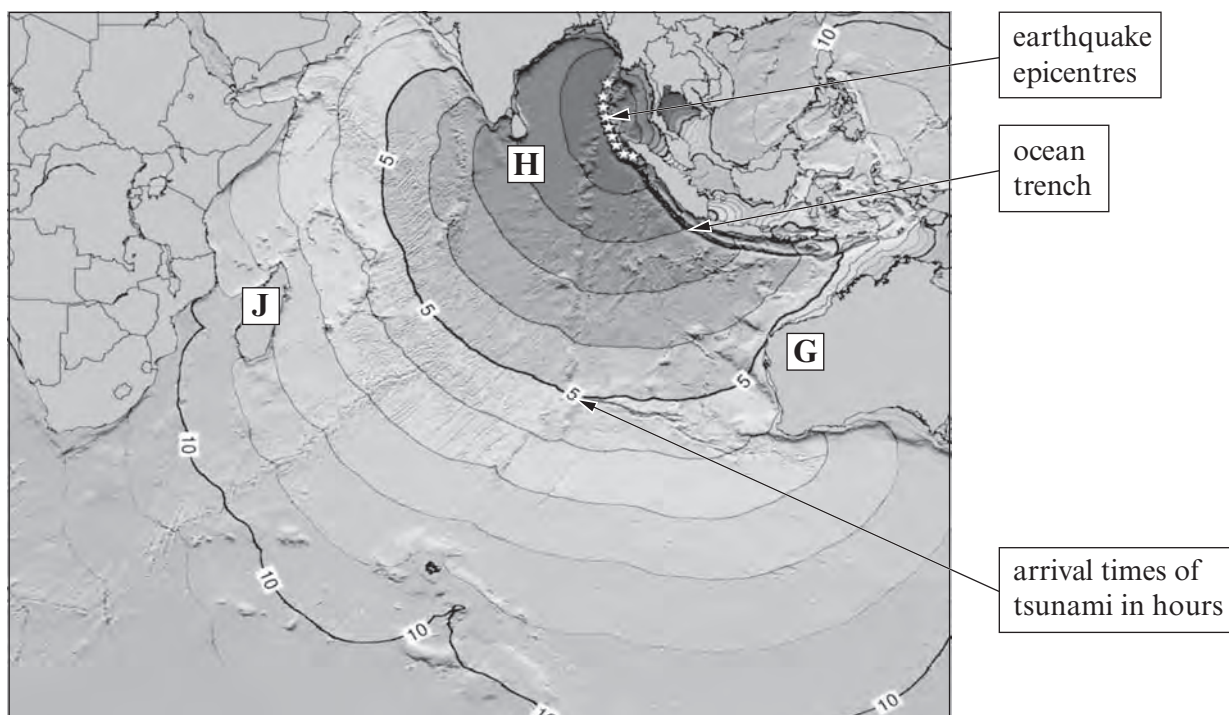


Figure 13

- (i) State why an earthquake occurred at this location. Tick (✓) only **two** boxes. [2]

- sea-floor spreading
- convergent plate margin (destructive, oceanic-continental)
- divergent plate margin
- subduction
- conservative plate margin
- transform fault
- convergent plate margin (destructive, oceanic-oceanic)

- (ii) The tsunami took 5 hours to reach Australia (G). State how long the tsunami took to reach Sri Lanka (H) to the nearest hour. [1]

hours

- (iii) The island of Madagascar (J) is 6,000 km from the earthquake epicentre. Calculate the speed of the tsunami across the Indian Ocean. [2]

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.....
.....

Speed = km per hour

(b) **Figure 14** shows the behaviour of a tsunami as it reaches shallow water.

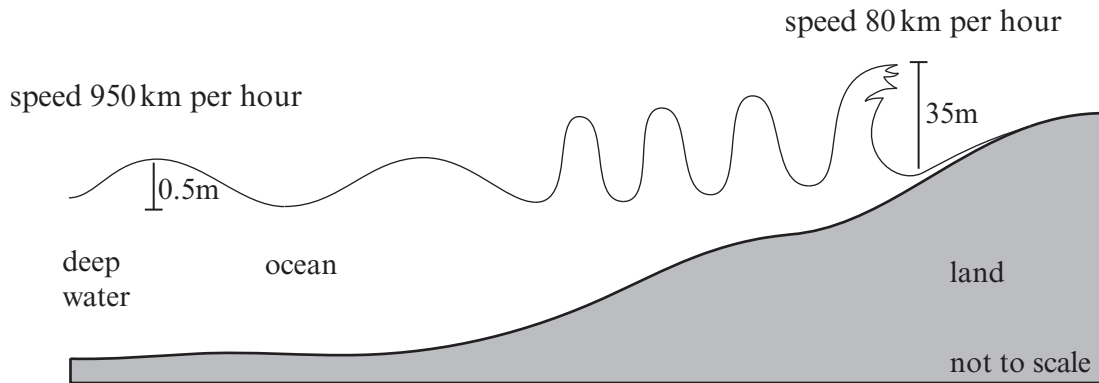


Figure 14

(i) Using **Figure 14**, choose words from the list below to complete the following sentences. [2]

- high speed small low speed large*

In deep ocean water the tsunami waves form crests, barely noticeable and harmless, which travel at In shallow water near coastlines, a tsunami travels at but forms waves.

(ii) Give **one** reason why tsunamis are difficult to detect in deep water. [1]

.....

(iii) The Indian Ocean tsunami killed 230,000 people in 14 countries. If a similar tsunami happened in this region again, suggest how such a loss of life could be prevented. [3]

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Question 6

(a) **Figure 15** is a graph showing the permeability and porosity of different rock types.

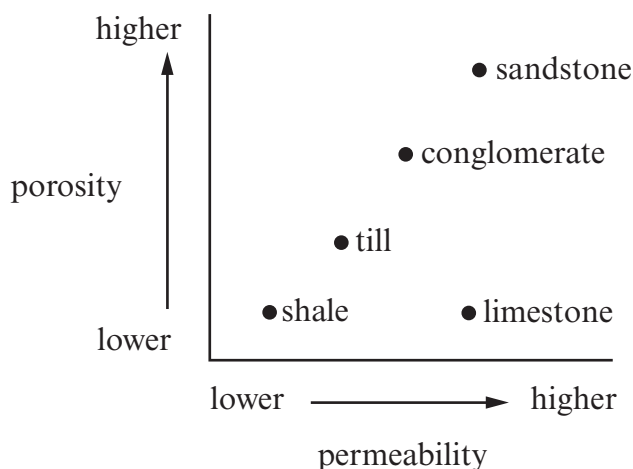


Figure 15

(i) State which rock has the highest porosity. Tick (✓) only **one** box. [1]

- limestone
- conglomerate
- shale
- sandstone
- till

(ii) Using **Figure 15**, choose words/phrases from the list below to complete the following sentences. [5]

- stores fluids sandstone shale aquifer*
limestone liner allows fluids to pass through

A rock is porous if it
 is a rock with a high porosity and permeability and therefore makes a good
 is a rock with a low permeability and makes a good
 for a landfill site.

- (b) **Figure 16** is a sketch cross-section through a reservoir and dam. Since its construction a lot of water has been lost through leakage from the reservoir.

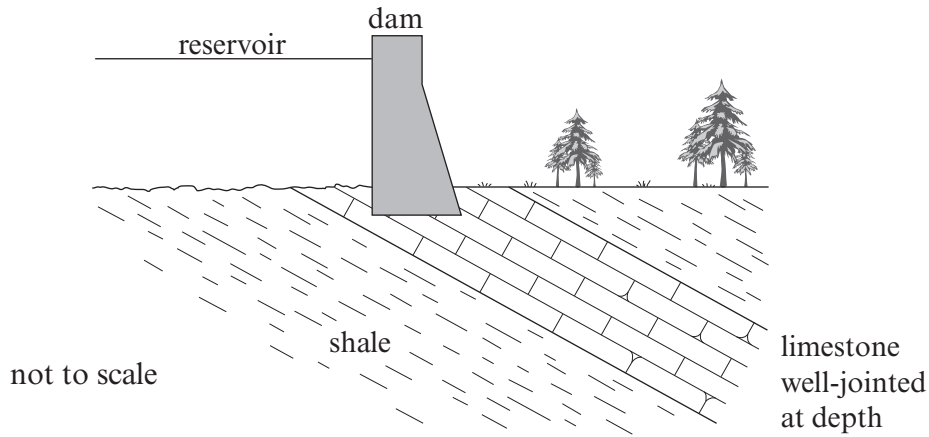


Figure 16

- (i) State **two** geological factors that might have been the reason for building the dam at this site. [2]

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.....

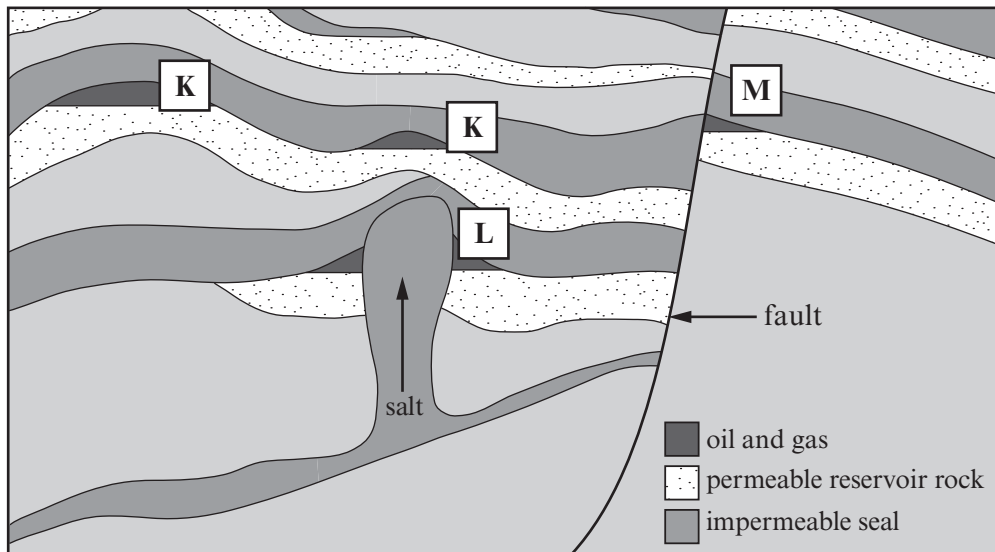
- (ii) Explain why water is likely to leak out of the reservoir underneath the dam. [2]

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.....

.....

(c) **Figure 17** is a cross-section showing the position of oil and gas traps (**K**, **L** and **M**).



not to scale

Figure 17

(i) Circle the name of the type of trap for those labelled **K** and **L**. [2]

K *fault* *syncline* *unconformity* *salt dome* *anticline*

L *fault* *syncline* *unconformity* *salt dome* *anticline*

(ii) From the following list, select the **two** most suitable techniques for detecting the structures (**K**, **L** and **M**) containing oil and gas in **Figure 17**. Tick (✓) only **two** boxes. [2]

magnetic survey

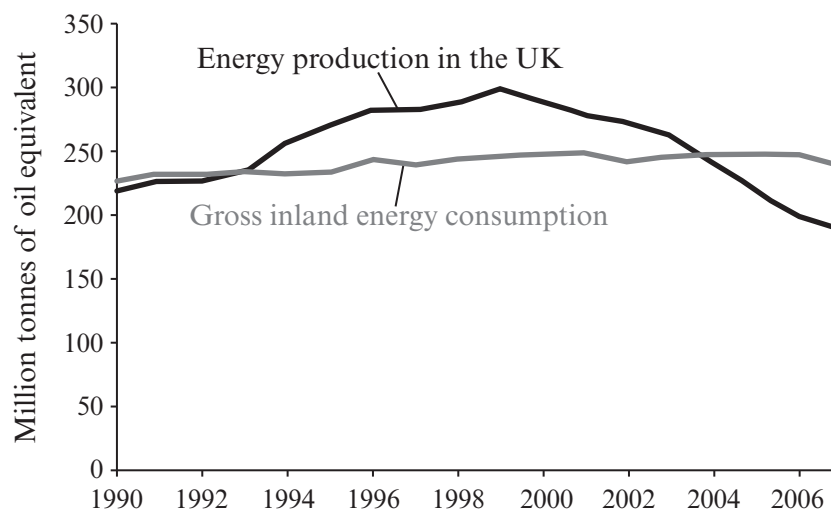
seismic survey

geological mapping

geochemical survey

geotechnical survey

- (d) **Figure 18** is graph showing energy production and consumption in the United Kingdom in recent years.



Source: DECC

Figure 18

- (i) Give **one** year in which Britain has produced **less** energy than required. [1]

- (ii) Give **one** year in which Britain has produced **more** energy than required. [1]

- (iii) State which of the following are **renewable** energy resources. Tick (✓) only **two** boxes. [2]

gas

geothermal

oil

wind

nuclear

- (iv) State which of the following energy resources are not major sources of carbon dioxide in the atmosphere. Tick (✓) only **two** boxes. [2]

hydroelectric

coal

oil

nuclear

gas

- (v) Describe **two** disadvantages of using nuclear power to generate electricity. [3]

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.....

.....

Question 7

(a) Using the **Data Sheet**,

(i) Name the Period when fish first evolved. [1]

.....

(ii) Name the **oldest** Period in which all the fossil vertebrates are present. [1]

.....

(iii) Complete the following table by listing the order of vertebrate evolution. [1]

birds *fish* *reptiles* *mammals* *amphibians*

youngest oldest	↑	5	
		4	
		3	
		2	
		1	

(iv) State the age in millions of years of the Cretaceous-Tertiary mass extinction. [1]

 million years

(b) Describe the evidence that suggests that the Cretaceous-Tertiary (**K-T**) extinction event was caused by a large meteorite impact. [3]

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GCSE

4250/01-A

**GEOLOGY
DATA SHEET**

A.M. FRIDAY, 20 May 2011

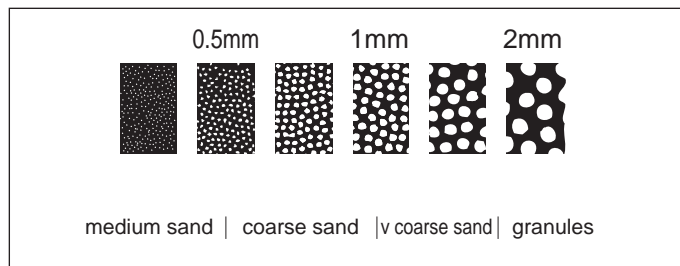
Minerals

Name	Hardness (Mohs' Scale)	Typical Colour	Streak	Lustre	Cleavage (number of directions)
Quartz	7	colourless or white	scratches streak plate	glassy	none
Feldspar	6	white	scratches streak plate	pearly to glassy	2 good
Mica	2½	silvery or brown	white	pearly to glassy	1 good
Halite	2½	white	white	glassy	3 good
Calcite	3	white	white	glassy	3 good
Haematite	5½	black or red-brown	red-brown	metallic or dull	none
Galena	2½	grey	grey	metallic	3 good
Garnet	7	red	white	glassy	none

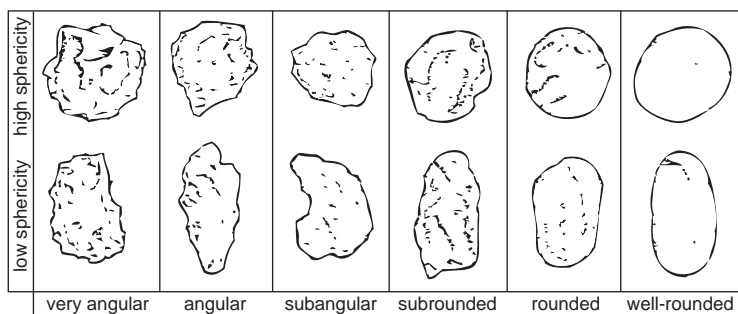
Mohs' Scale of hardness

<i>Mineral hardness</i>	<i>Common equivalent</i>
Diamond 10	
Corundum 9	
Topaz 8	
Quartz 7	
Orthoclase feldspar 6	← steel pin
Apatite 5	
Fluorite 4	← copper coin
Calcite 3	← finger nail
Gypsum 2	
Talc 1	

Grain size scale



Grain shape and sphericity scale



Geological ranges of vertebrates

