Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4250/01

GEOLOGY

Theory Paper
(Paper version of on-screen assessment)

A.M. THURSDAY, 16 May 2013

1½ hours

For Examiner's use only		
Section	**Maximum Mark**	**Candidate Mark**
1.	**18**	
2.	**16**	
3.	**15**	
4.	**18**	
5.	**11**	
6.	**14**	
7.	**8**	
Total	**100**	

4250
010001

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 alongside each question.

You are reminded that assessment will take into account the quality of written communication (*QWC*) used in your answers to **Section 1 Q10** and **Section 5 Q4**.

Examiner only

Answer **all** *questions in each section.*

Section 1 – answer questions 1-11

Figure 1 is a geological map. Sandstone is the **youngest** sedimentary rock on the map.

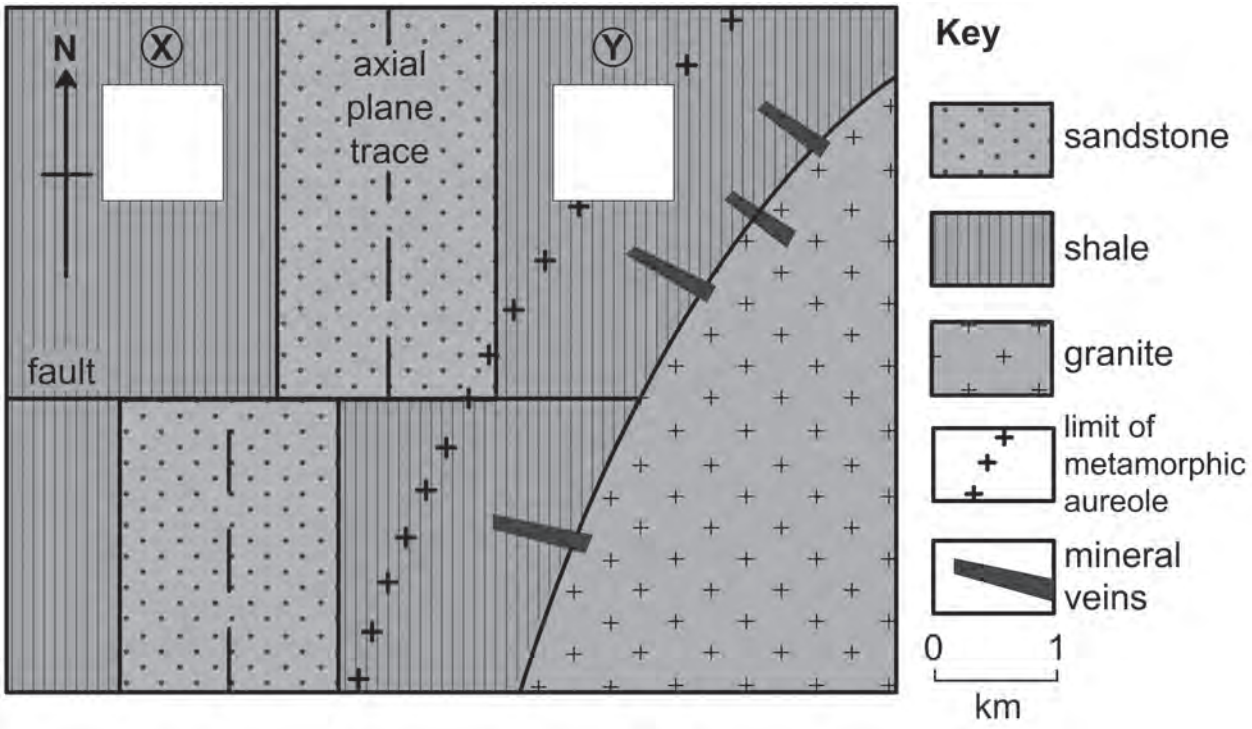

Figure 1

1. Selecting from the choice below, draw arrows in the empty boxes on **Figure 1** to show the dip directions of the beds at locations **X** and **Y**. [1]

2. Name the structure formed by the dipping sedimentary rocks between locations **X** and **Y**. Tick (✓) only **one** box. [1]

unconformity ☐

anticline ☐

dyke ☐

syncline ☐

parallel dipping beds ☐

Examiner only

3. Identify the type of fault on **Figure 1**. Tick (✓) only **one** box. [1]

normal ☐

reverse ☐

strike slip ☐

thrust ☐

transform ☐

4. Explain how you identified the type of fault. [2]

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5. Name the main tectonic stress involved in the formation of the fault. Tick (✓) only **one** box. [1]

shear ☐

compression ☐

tension ☐

Examiner only

6. List the relative ages of the following features in **Figure 1** by writing each of them in their correct position in **Table 1**. [2]

granite intrusion

structure in the sedimentary rocks

fault

mineral veins

Table 1

7. Name the most appropriate method which could be used to determine the relative ages of the granite intrusion, the structure in the sedimentary rocks, the fault and mineral veins in **Figure 1**. Tick (✓) only **one** box. [1]

original horizontality ☐

superposition of strata ☐

lateral continuity ☐

included fragments ☐

cross-cutting relationships ☐

Examiner only

Figure 2 is a photograph of a specimen taken from one of the mineral veins in **Figure 1** showing two minerals (**A** and **B**).

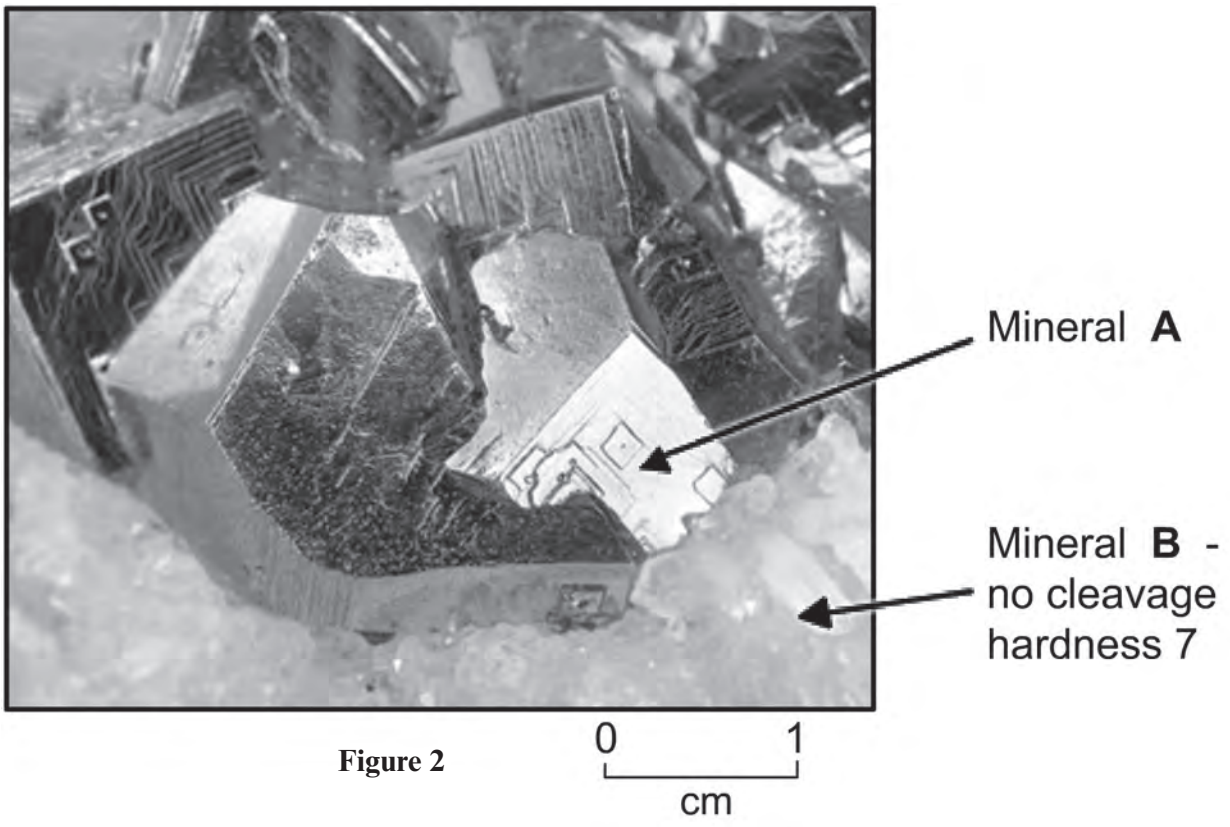

Figure 2

8. The mineral veins have been mined for lead (Mineral **A**). Name the ore mineral in which this metal occurs. Tick (✓) only **one** box. [1]

halite	☐
galena	☐
haematite	☐
diamond	☐
gold	☐

Turn over.

Examiner only

9. Mineral **B** is also found within the vein. Using the **Data Sheet**, identify the white mineral in **Figure 2**. Tick (✓) only **one** box. [1]

quartz ☐

feldspar ☐

mica ☐

halite ☐

calcite ☐

haematite ☐

galena ☐

garnet ☐

10. Describe the most likely origin of the mineral veins in **Figures 1** and **2**. *QWC* [4]

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Table 2 shows methods of prospecting and extraction of valuable reserves.

A	geochemical analysis of soil and underground mining
B	seismic survey and boreholes
C	geological mapping and quarrying
D	geochemical analysis of river sediment and dredging
E	magnetic survey and surface mining

Table 2

11. Match each reserve with the **most appropriate** method of prospecting/extraction. [3]

A	geochemical analysis of soil and underground mining
B	seismic survey and boreholes
C	geological mapping and quarrying
D	geochemical analysis of river sediment and dredging
E	magnetic survey and surface mining

concealed iron ore

limestone

oil

Examiner only

Section 2 – answer questions 12-19

Figure 3 shows the rocks and some of the processes that are linked in the rock cycle.

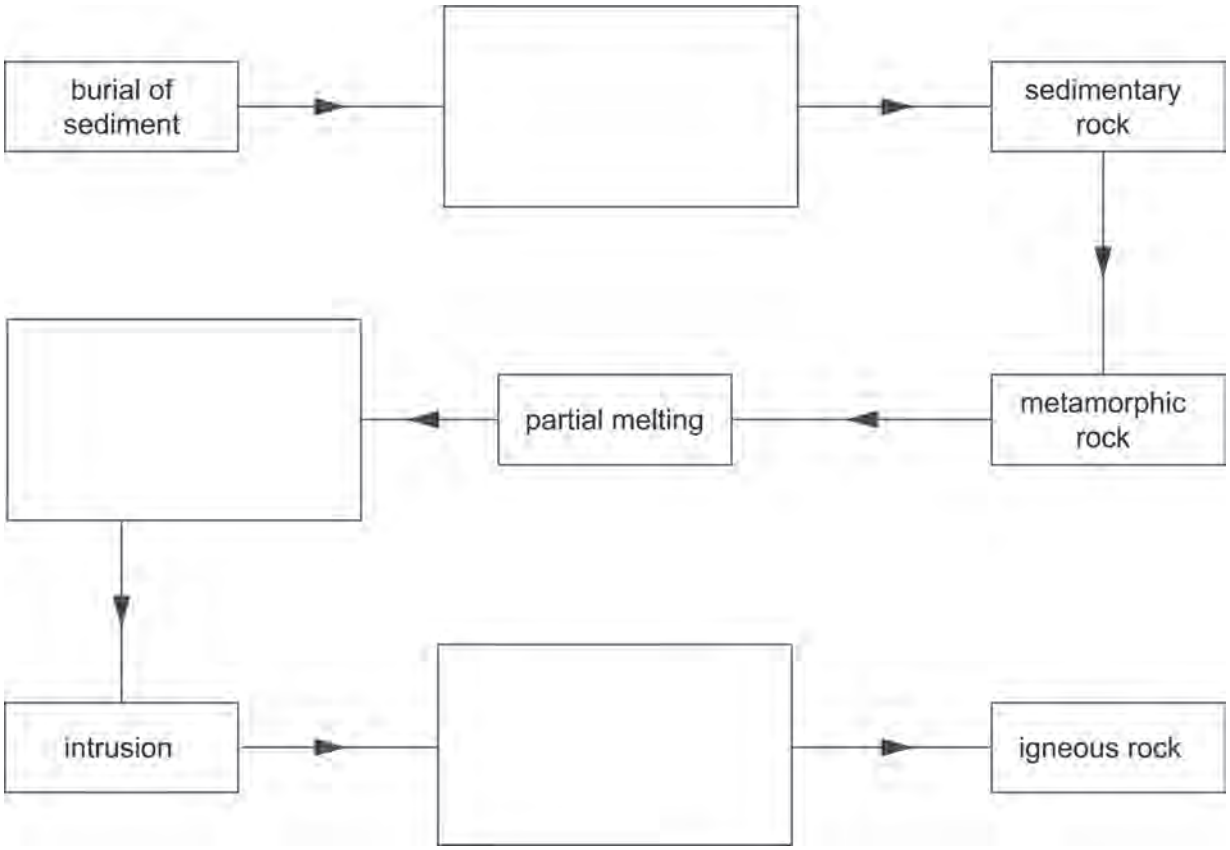

Figure 3

12. Complete the cycle by selecting, from the list below, the most suitable process for each empty box in **Figure 3**. [3]

deposition of sediment

cooling and crystallisation of magma

magma collects

crystallisation as cement from pore waters

weathering and erosion

transport of sediment

recrystallisation

Examiner only

Figure 4 shows different types of sediment transport in a river.

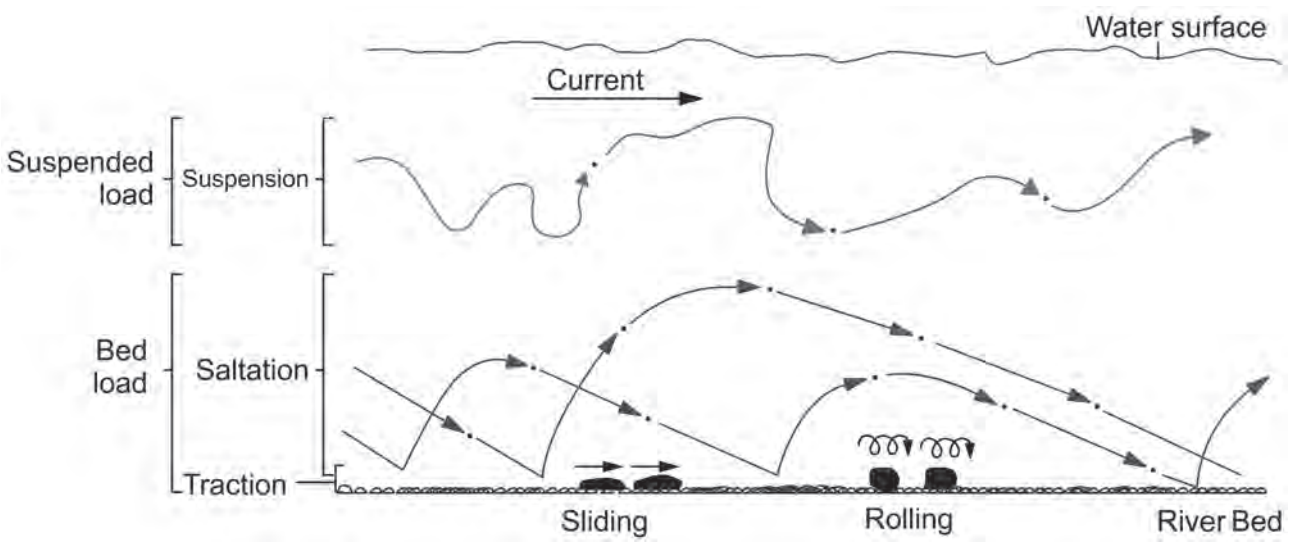

Figure 4

13. Use **Figure 4** to identify **one** *incorrect* statement. Tick (✓) only **one** box. [1]

saltation is the transport of material by bouncing ☐

bed load consists of the smallest grains moved by traction ☐

dissolved material transported in solution is invisible ☐

the suspended load does not touch the river bed during transport ☐

traction causes abrasion of the river bed ☐

14. Describe and explain **one** difference between sediment transported by ice and by water. [3]

Difference .....

Explanation .....

.....

.....

Examiner only

Figure 5 shows microscopic views of two rocks (**C** and **D**) linked by processes in the rock cycle.

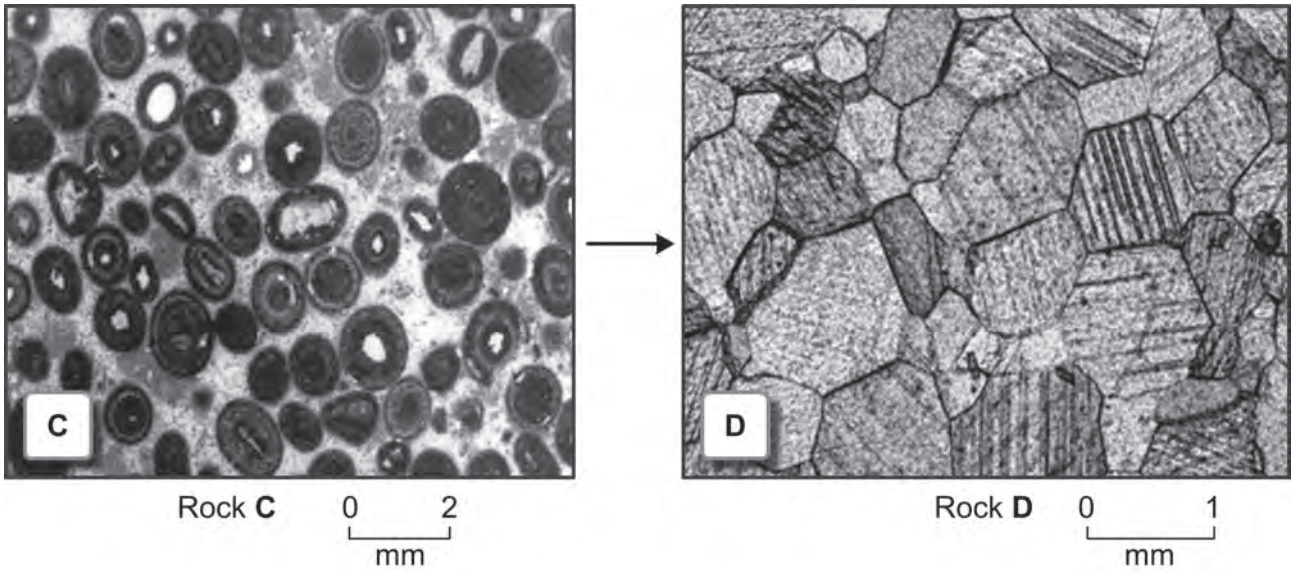

Figure 5

15. Describe the grains of rock **C**. Tick (✓) only **two** boxes. [2]

fine-grained ☐

rounded ☐

crystalline ☐

medium-grained ☐

angular ☐

poorly sorted ☐

Examiner only

16. Describe the texture of rock **D**. Tick (✓) only **two** boxes. [2]

crystalline	☐
foliated	☐
non-foliated	☐
well sorted	☐
fragmental (clastic)	☐
schistose texture	☐

17. Rocks **C** and **D** in **Figure 5** are both composed of the same mineral which effervesces with dilute hydrochloric acid. Name this mineral. Tick (✓) only **one** box. [1]

galena	☐
halite	☐
calcite	☐
quartz	☐
feldspar	☐

Examiner only

18. Which process in the rock cycle links rocks **C** and **D** in **Figure 5**. Tick (✓) only **one** box. [1]

erosion	☐
melting	☐
deposition	☐
metamorphism	☐
uplift	☐

Figure 6 shows a microscopic view of metamorphic rock **E**.

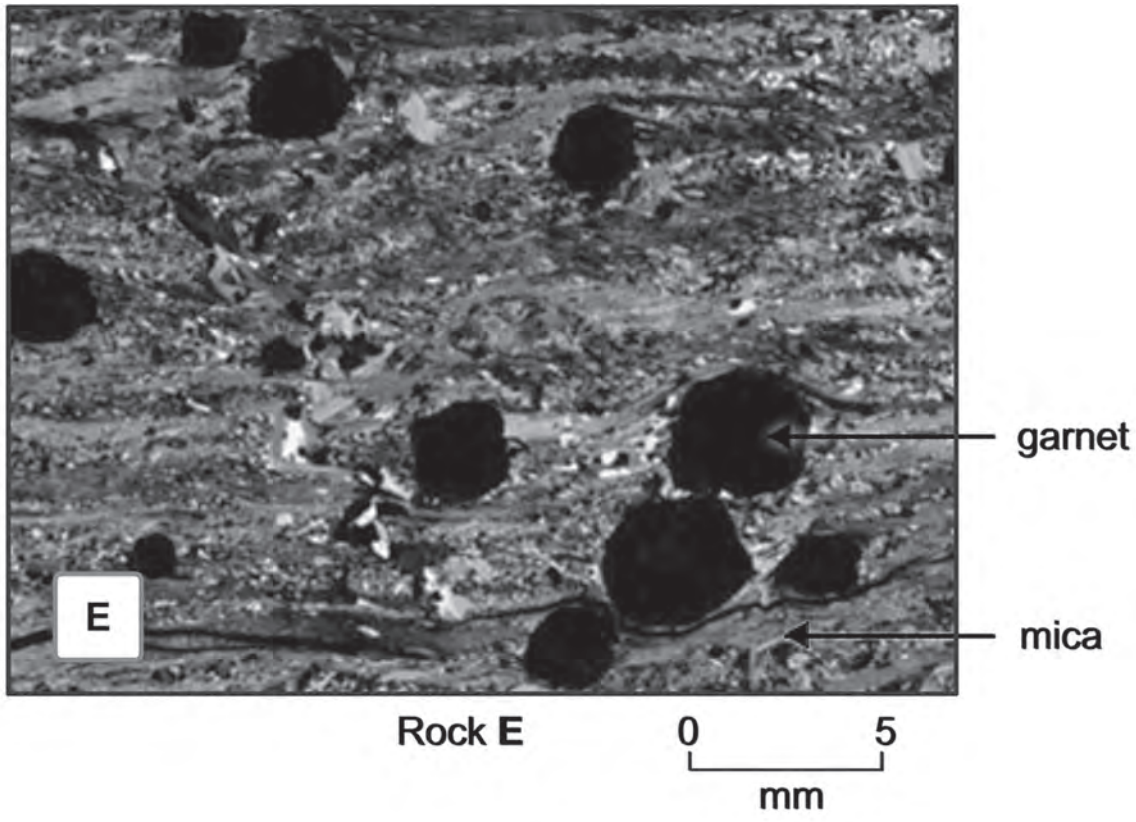

Figure 6

Examiner only

Figure 7 shows four different temperature and pressure conditions (**1-4**).

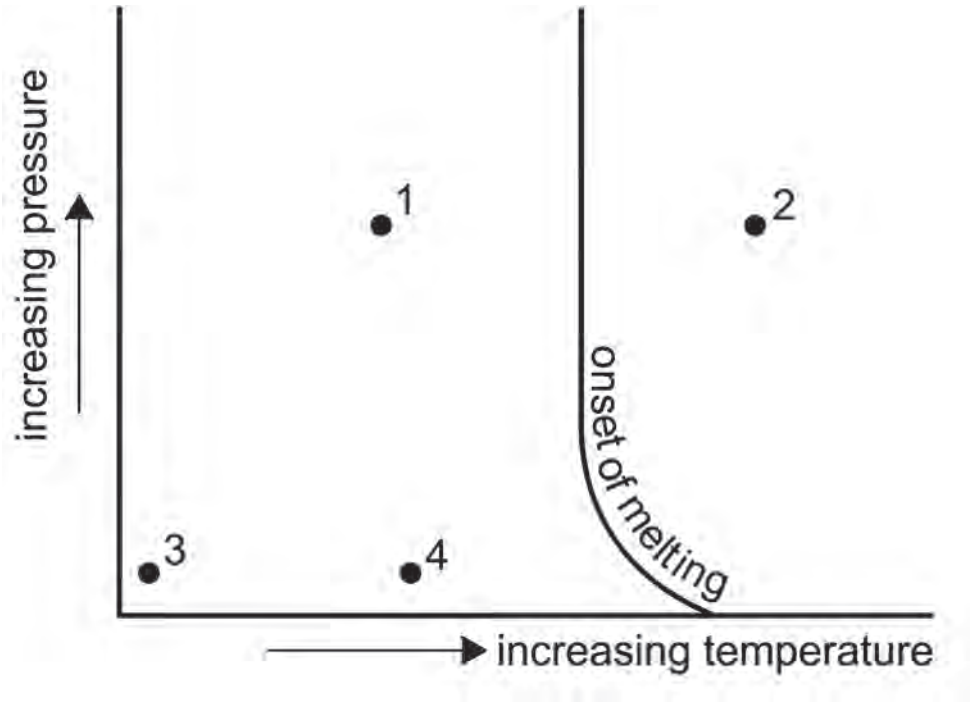

Figure 7

19. Select which pressure and temperature conditions (**1-4**) are likely to have affected rock **E** and explain your answer. [3]

Circle your answer.

1 **2** **3** **4**

Explanation .....

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Examiner only

Section 3 – answer questions 1-5

Figure 8 is a sedimentary log of a cliff face sketched by a student.

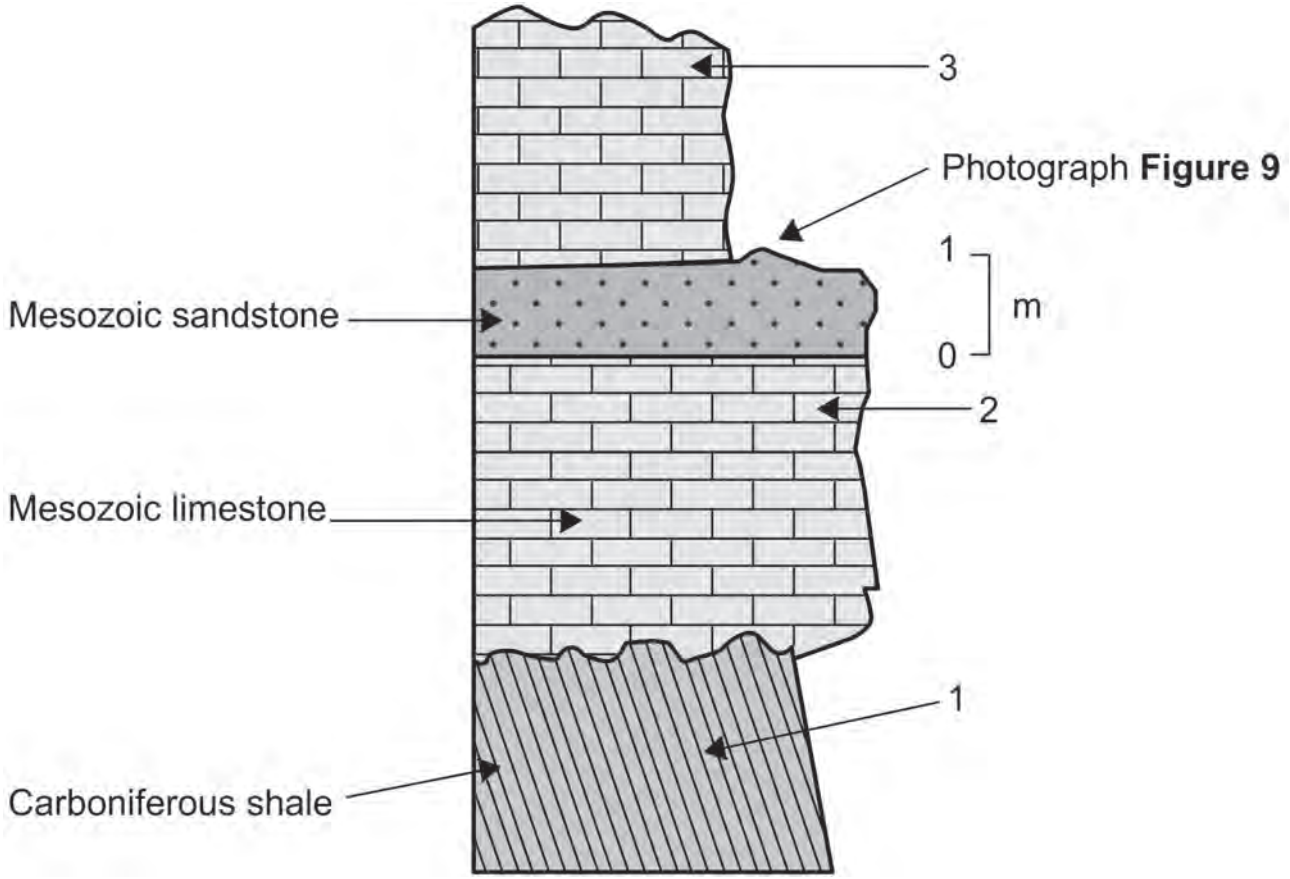


Figure 8

Examiner only

Figure 9 is a photograph taken at the location shown on **Figure 8**.

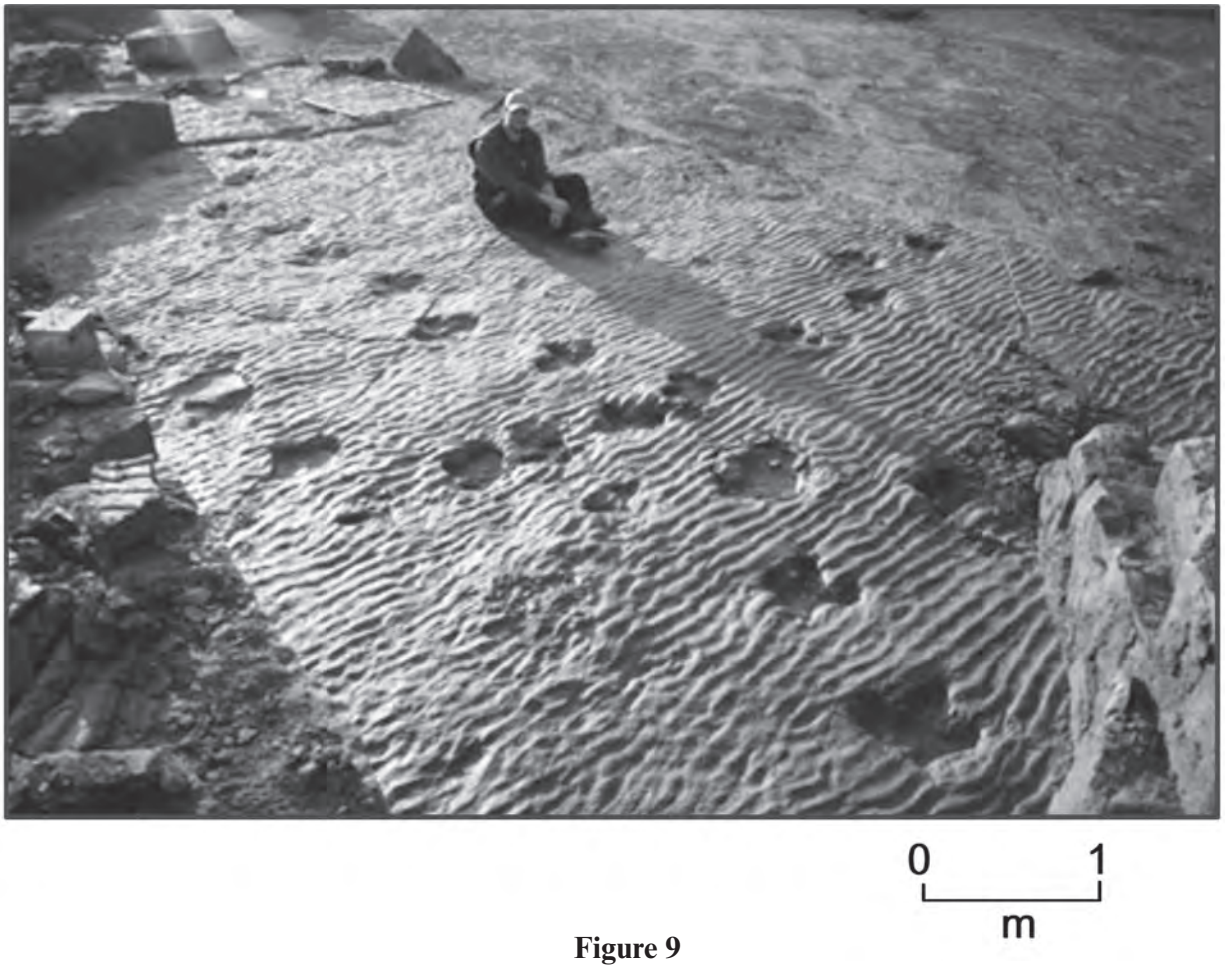


Figure 9

1. Identify the features on the bedding plane surface in **Figure 9**. Tick (✓) only **two** boxes. [2]

trace fossils ☐

cross bedding ☐

ripple marks ☐

burrows ☐

plants ☐

desiccation cracks ☐

Examiner only

2. Using **Figure 9** suggest, with reasons, an environment of deposition for the sedimentary rocks at this location. [3]

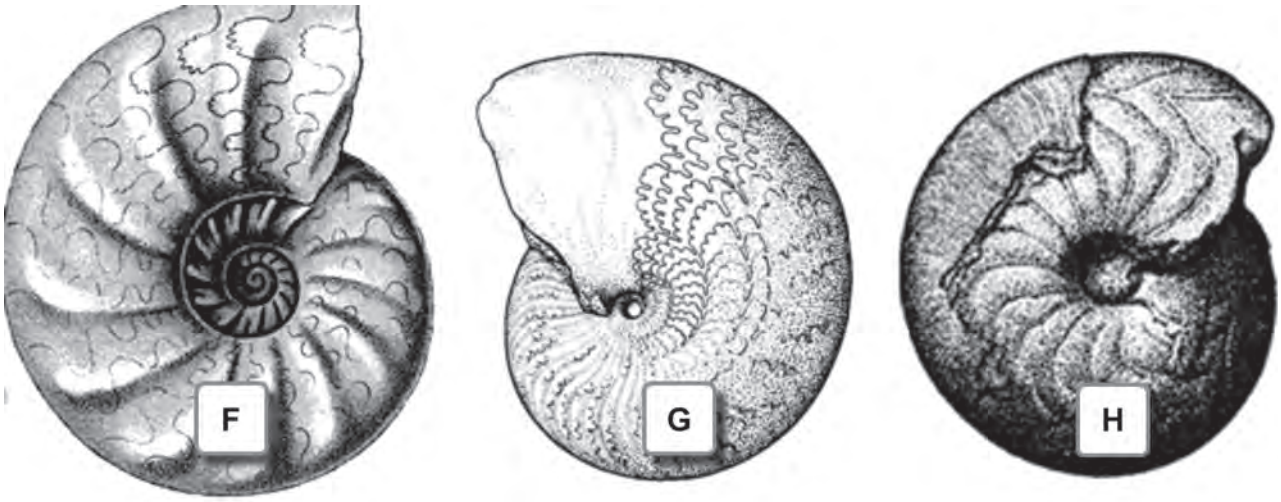
Environment .....

Reasons .....

.....

.....

Figure 10 shows three cephalopods **F**, **G** and **H** collected from the cliff in **Figure 8**.



Scale all × 1

Figure 10

3. Which of the cephalopods (**F**, **G** or **H**) is an **ammonite**? Give a reason for your answer. [3]

Circle your answer.

F **G** **H**

Reason .....

.....

.....

Examiner only

4. Draw a line between each fossil (**F**, **G** and **H**) in **Figure 10** and its most likely location (**1**, **2** or **3**) on **Figure 8**. Give a reason for your answer. [5]

F	**1**
G	**2**
H	**3**

Reason .....

.....

.....

5. Explain how **one** fossil group can be used to indicate that Britain was located at or close to the equator during the Upper Palaeozoic. [2]

Fossil group .....

Explanation .....

.....

Turn over.

Examiner only

Section 4 – answer questions 6-11

Figure 11 is a cross section through part of the Indian Ocean.

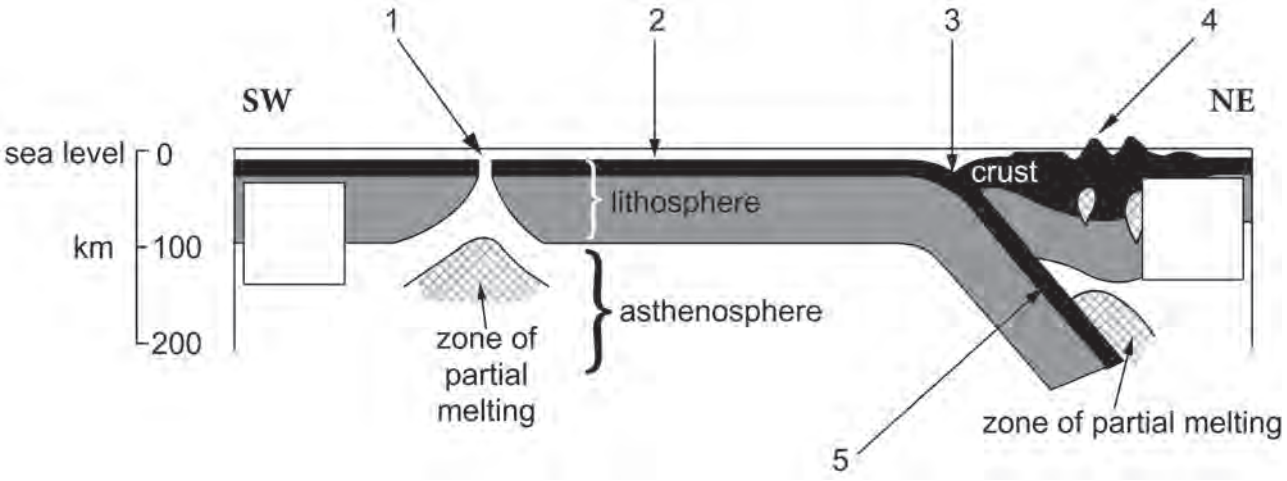


Figure 11

6. Complete **Table 3** by matching the location numbers in **Figure 11** with the correct descriptions. [5]

Description	Location number
volcanic island arc	
subduction zone / Benioff zone	
constructive plate margin	
ocean trench	
abyssal plain	

Table 3

7. Selecting from the choice below, draw arrows in the empty boxes on **Figure 11** to show the direction of plate movement at those locations. [1]

8. Turbidites are most likely to be deposited at which location on **Figure 11**?
Tick (✓) only **one** box. [1]

1	2	3	4	5
☐	☐	☐	☐	☐

Examiner only

9. The ocean crust is made up of different rock types and structures. Draw a line between the rock type or structure and the process that forms it. [4]

pillow lavas of basalt	slow crystallisation of magma
black shale	volcanic eruption on the sea floor
gabbro	intrusion along vertical cracks in the crust
dykes of medium-grained rock	deposition of organic mud

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

crust and upper mantle	☐
convection currents present	☐
only mantle rock	☐
weak solid	☐
rigid solid	☐
partially molten	☐

Examiner only

11. Partial melting at the two zones shown on **Figure 11** results in magmas of different compositions. State the compositions of the magmas and explain why they are different. [5]

Magma below location 1 .....

Magma below location 4 .....

Explanation .....

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.....

Examiner only

Section 5 – answer questions 1-4

Figure 12 illustrates some volcanic hazards.

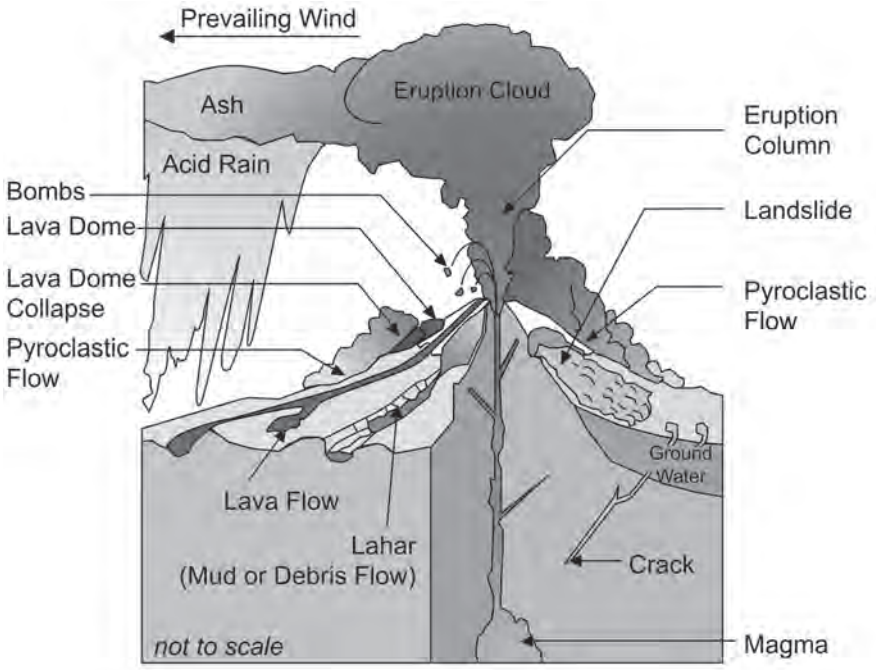

Figure 12

1. Select from the list below, the volcanic hazards that match the descriptions in **Table 4**. [5]

lava flow pyroclastic flow ash lahar (mud or debris flow)

landslide eruption column acid rain

fast moving slurries of rock, mud and water that flow down river valleys burying people and destroying buildings in their path	`
small fragments blasted into the air which can collect on roofs of houses leading to collapse and cause death by choking	
molten flows which bury and burn everything in their path, deaths are uncommon because most move slowly enough that people can move out of the way easily	
downhill movements of rock which can bury and destroy buildings in their path	
high speed avalanches of hot rock, gas and ash which are lethal, burying, burning and suffocating everything in their path	

Table 4

Examiner only

Figure 13 is a photograph of a volcanic eruption.

Figure 13

2. Using **Figure 12** and **Table 4**, identify the volcanic hazard in **Figure 13**. Tick (✓) only **one** box. [1]

lava flow	☐
pyroclastic flow	☐
ash	☐
lahar (mud or debris flow)	☐
landslide	☐
eruption column	☐
acid rain	☐

Examiner only

3. Which of the following factors **increases** the risk from a geological hazard? Tick (✓) only **one** box. [1]

advanced education system ☐

efficient communications ☐

developed economy ☐

high population density ☐

advanced building regulations ☐

4. Describe **two** types of monitoring which are useful for the short term prediction of volcanic eruptions. *QWC* [4]

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Examiner only

Section 6 – answer questions 5-14

Figure 14 is a graph showing the number of forms of life (families) preserved in the fossil record and five major extinctions (**L-Q**) in the past 550 Ma.

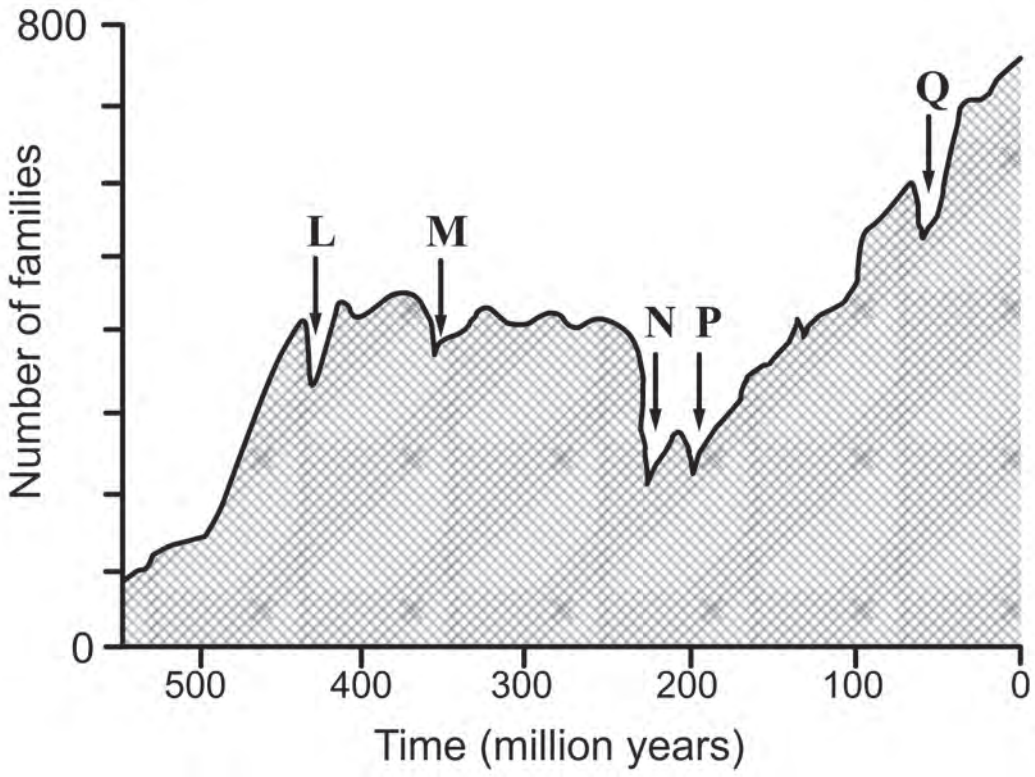

Figure 14

5. At which major extinction event did the greatest number of families become extinct? Tick (✓) only **one** box. [1]

L ☐ **M** ☐ **N** ☐ **P** ☐ **Q** ☐

6. Using the **Data Sheet** and **Figure 14**, name the boundary at which the greatest number of families became extinct. Tick (✓) only **one** box. [1]

Triassic-Jurassic ☐

Cretaceous-Palaeogene ☐

Permo-Triassic ☐

Ordovician-Silurian ☐

Late Devonian ☐

Examiner only

7. Which of the mass extinctions in **Figure 14** is known as the K/T mass extinction? Tick (✓) only **one** box. [1]

L ☐ **M** ☐ **N** ☐ **P** ☐ **Q** ☐

8. Using your knowledge and the **Data Sheet**, name **two** fossil groups that became extinct at the K/T boundary. Tick (✓) only **two** boxes. [2]

graptolites ☐

ammonites ☐

dinosaurs ☐

birds ☐

corals ☐

mammals ☐

9. Describe **one** possible cause of a mass extinction event. [2]

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.....

.....

10. Give an approximate age for the origin of life on Earth. Tick (✓) only **one** box. [1]

2 500 Ma ☐

4 500 Ma ☐

3 500 Ma ☐

5 000 years ☐

500 Ma ☐

Examiner only

11. Describe **one** scientific theory for the origin of life on Earth. [2]

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Figure 15 is an article describing the Burgess Shale.

> The **Burgess Shale Formation**, a fine-grained black shale located in Canada, is one of the world's most famous fossil finds. At 505 million years old it is one of the earliest fossil beds containing the imprints of soft parts. The animal life preserved in the Burgess Shale is important as it preserves an abundance of soft-bodied life forms (that is, animals lacking shells) that represent an explosion of evolutionary activity early in the history of life on Earth. Prior to this 'explosion', the world's seas were inhabited by simple life-forms, such as jellyfish and sponges. But around the time of the Burgess Shale, an abundance of new, bigger and more complex life forms appeared. Given its importance for the history of life on Earth, the Burgess Shale quarry has been designated a World Heritage Site.

Figure 15

12. Use **Figure 15** and the **Data sheet** to state the **period** of the 'explosive evolution'.
Tick (✓) only **one** box. [1]

Silurian ☐

Palaeogene ☐

Palaeozoic ☐

Cambrian ☐

Ordovician ☐

Examiner only

Figure 16 shows one of the most abundant fossils found in the Burgess Shale.

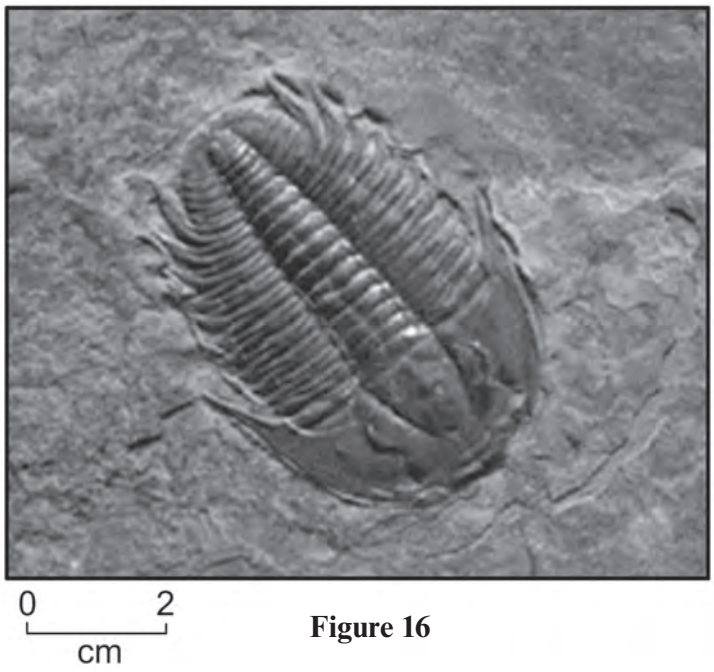


Figure 16

13. Name the group to which this fossil belongs. Tick (✓) only **one** box. [1]

trilobite ☐

graptolite ☐

coral ☐

vertebrate ☐

trace fossil ☐

14. Suggest **two** reasons why the fossils of the Burgess Shale are so well preserved. [2]

1. .....

.....

2. .....

.....

14

Section 7 – answer questions 1-3

Figure 18 is a geological cross section showing the proposed site for a reservoir.

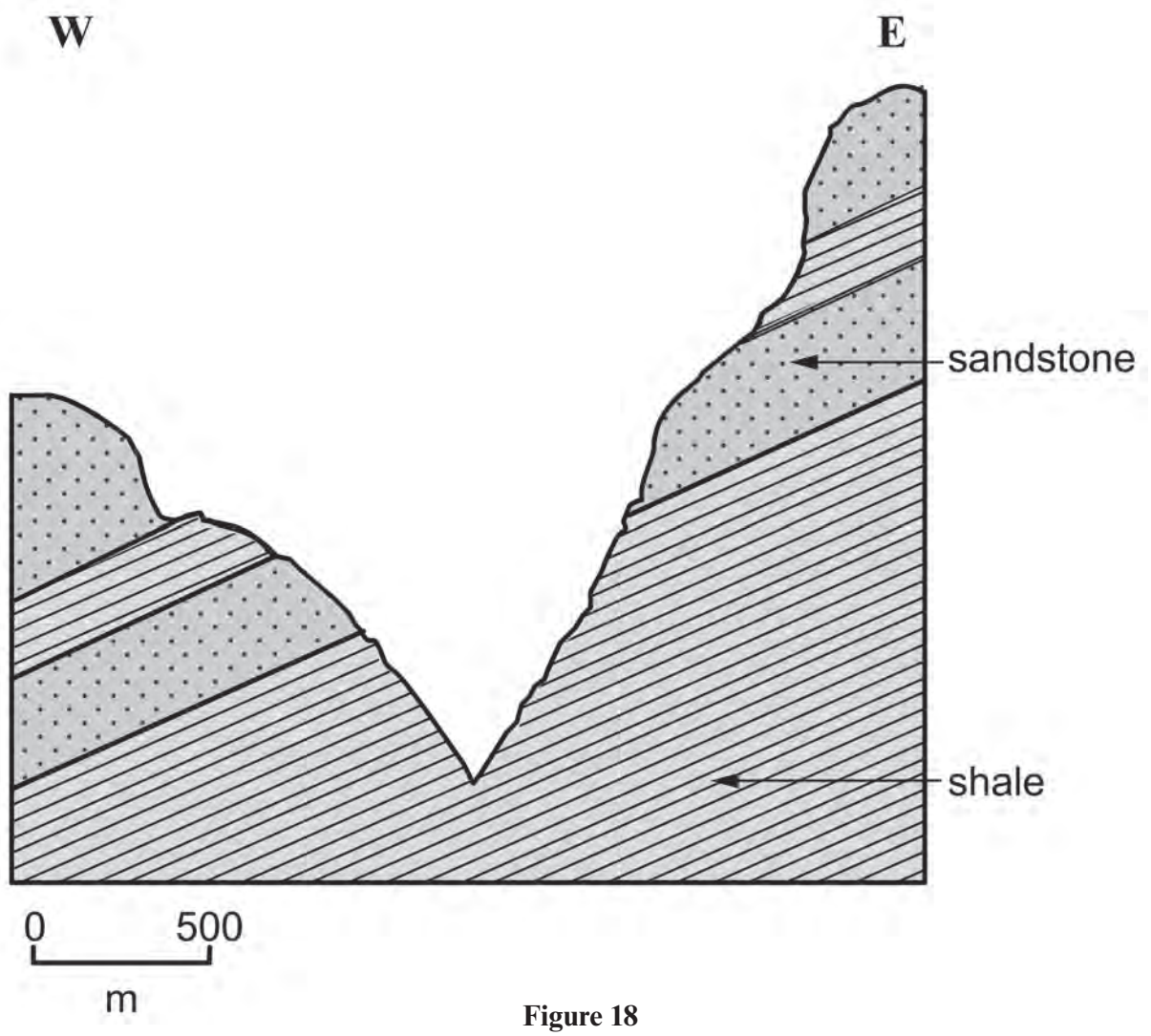


Figure 18

Examiner only

1. Which of the following statements about the site are **false**? Tick (✓) only **two** boxes. [2]

sandstone is permeable allowing water to pass through ☐

the v-shaped valley has been formed by glaciation ☐

sandstone has a high porosity ☐

shale is impermeable and has a low porosity ☐

shale is a suitable base rock for the reservoir ☐

jointing decreases the permeability of a rock ☐

the v-shaped valley forms an ideal site for a reservoir ☐

2. Which of the following statements about possible landslides in the area of the reservoir are **false**? Tick (✓) only **two** boxes. [2]

a landslide is more likely on the west side of the reservoir ☐

alternating layers of shale and sandstone make a landslide more likely ☐

a landslide is more likely on the east side of the reservoir ☐

water may collect at the top of a shale layer causing a landslide ☐

a long period of drought decreases the risk of a landslide ☐

the steep angle of dip of the beds makes a landslide less likely ☐

Examiner only

Figure 19 shows different methods of stabilising a road cutting.

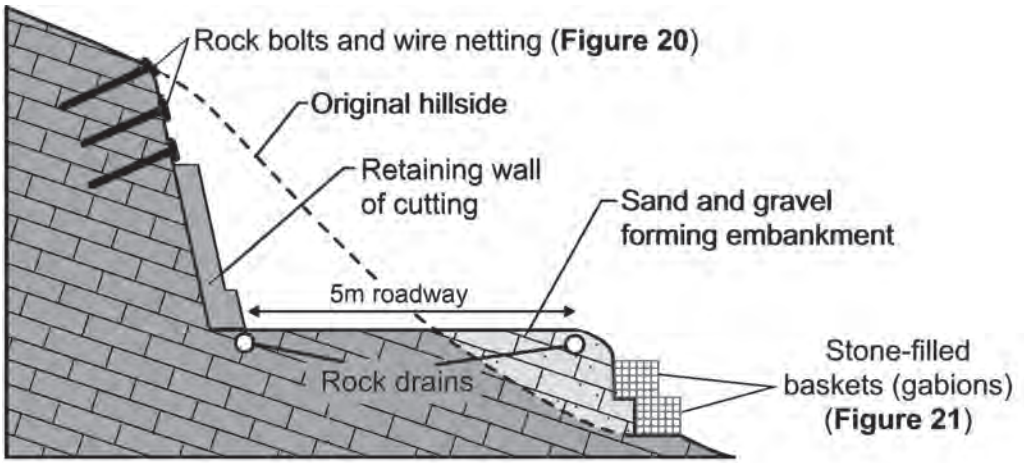


Figure 19

Figures 20 and **21** are photographs of the rock bolts and wire netting and stone-filled baskets (gabions).

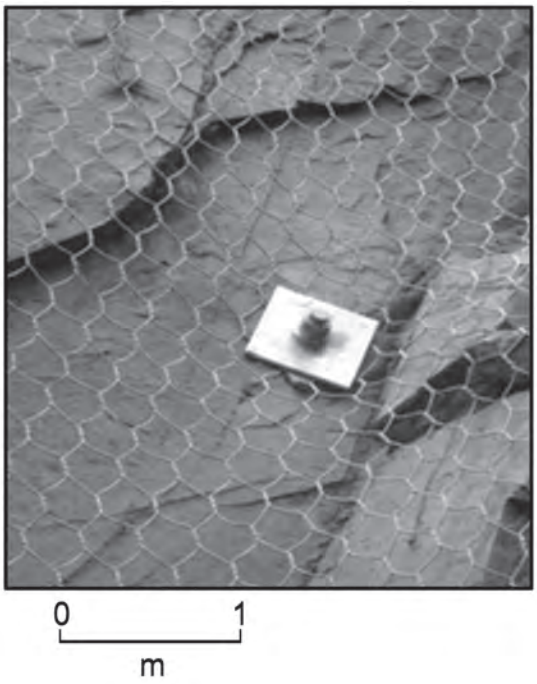


Figure 20 - rock bolts and wire netting

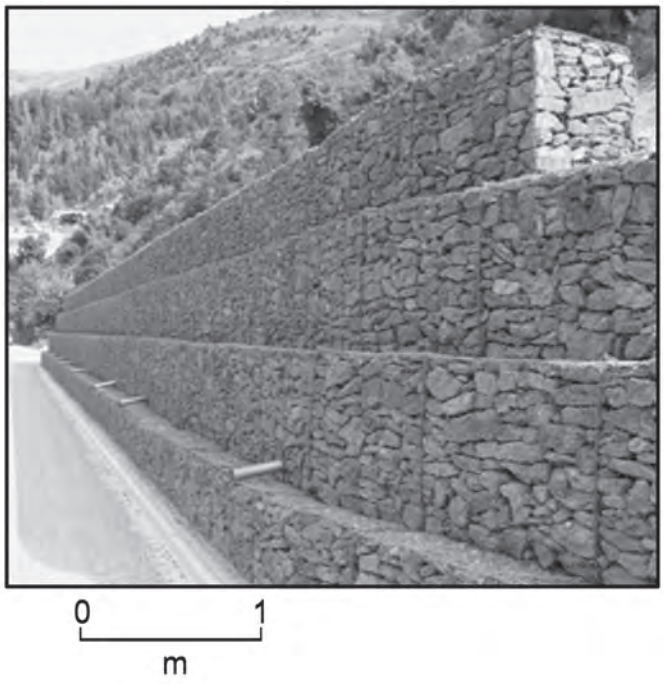


Figure 21 - stone-filled baskets (gabions)

3. Explain the use of the rock bolts and wire netting and stone-filled baskets (gabions) in the situation shown in **Figure 19**. [4]

Rock bolts and wire netting .....

.....

Stone-filled baskets (gabions) .....

.....

.....

END OF PAPER

GCSE

4250/01-A

GEOLOGY
DATA SHEET

A.M. THURSDAY, 16 May 2013

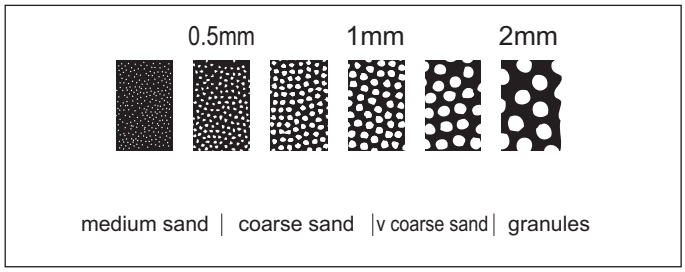
Physical properties of minerals in hand specimen

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

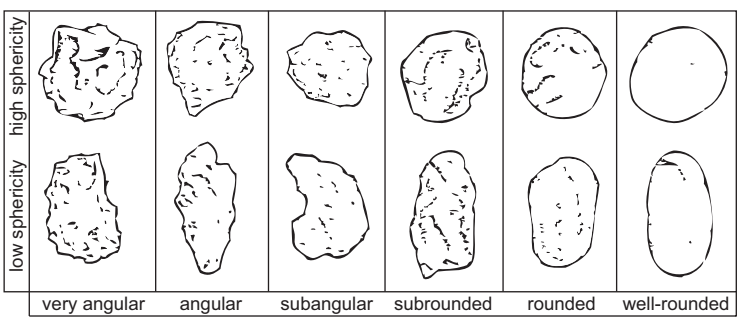
Mohs' scale of hardness

Mineral/ hardness		*Common equivalent*
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