Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4250/01

GEOLOGY

Theory Paper
(Paper version of on-screen assessment)

A.M. FRIDAY, 18 May 2012

1½ hours

Examiner only		
Section	**Maximum Mark**	**Candidate Mark**
1.	**12**	
2.	**12**	
3.	**16**	
4.	**15**	
5.	**15**	
6.	**15**	
7.	**15**	
Total	**100**	

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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 2 Q13** and **Section 4 Q14**.

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

Section 1 – answer questions 1-7

Figure 1 is a geological cross section through a road cutting showing rocks affected by mountain building.

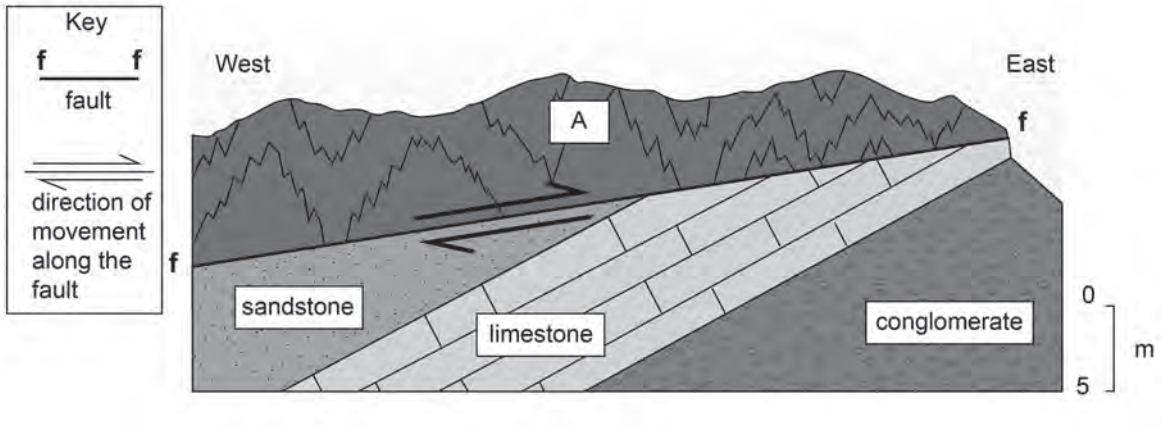

Figure 1

1. Which **three** of the following statements correctly describe the fault in **Figure 1**?
Tick (✓) only **three** boxes. [3]

dip angle is more than 45°

the apparent dip direction is west

the apparent dip direction is east

downthrow side is on the east

dip angle is less than 45°

downthrow side is on the west

2. Name the type of fault in **Figure 1**. Tick (✓) only **one** box. [1]

normal ☐

thrust ☐

strike-slip ☐

transform ☐

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

shear ☐

compression ☐

tension ☐

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Figure 2 is a microscope view of rock **A** (a regional metamorphic rock). Rock **A** is taken from the location shown in **Figure 1**.

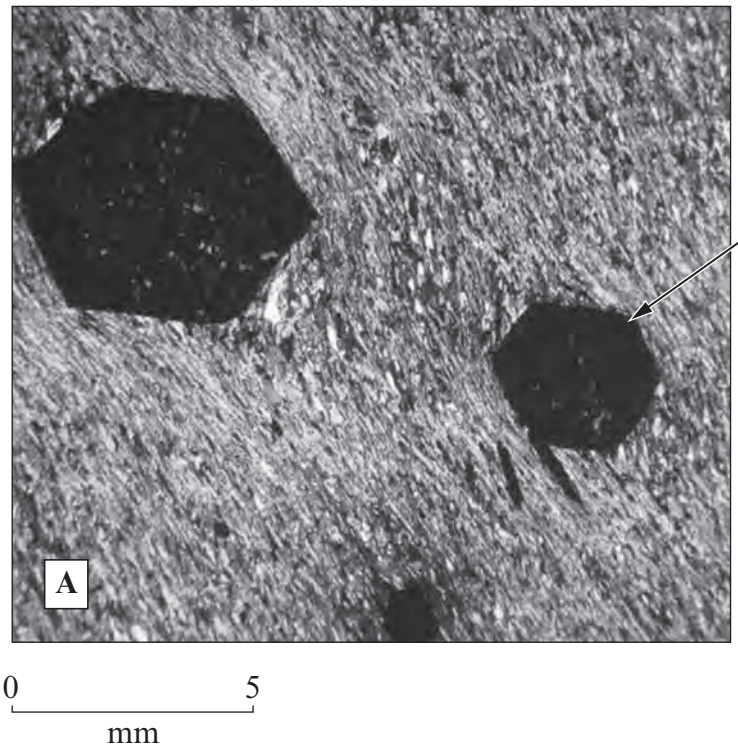

Figure 2

4. Use the **Data Sheet** to identify mineral **1** in rock **A**. Tick (✓) only **one** box. [1]

quartz ☐

feldspar ☐

mica ☐

halite ☐

calcite ☐

haematite ☐

galena ☐

garnet ☐

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

foliated	☐
poorly sorted	☐
fragmental (clastic)	☐
crystalline	☐
non-foliated	☐

6. Name rock **A**. Tick (✓) only **one** box. [1]

slate	☐
marble	☐
granite	☐
schist	☐
gabbro	☐

7. A student correctly concluded that rock **A** is the oldest in the section in **Figure 1**. State and explain the evidence which may show that this is the case. [3]

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Section 2 – answer questions 8-13

Figure 3 is a photograph of part of the coast in Devon showing details of one sedimentary deposit.

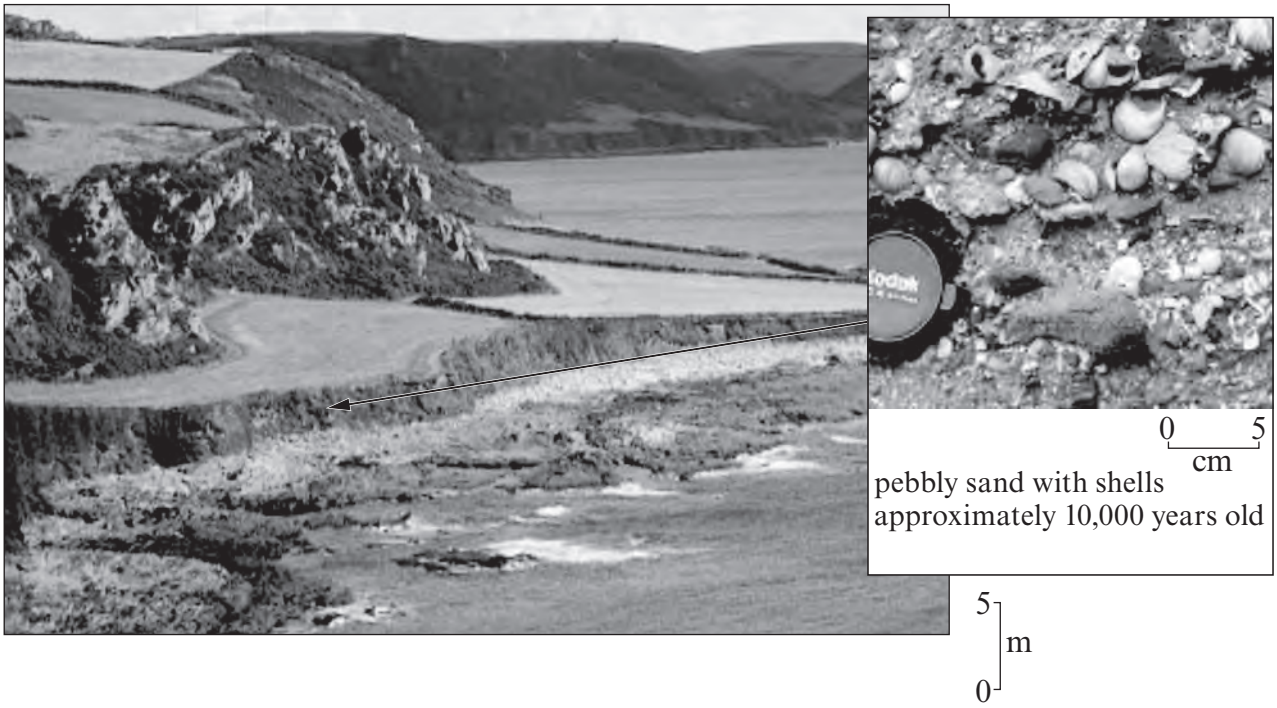

Figure 3

8. Identify the feature formed by the pebbly sand. Tick (✓) only **one** box. [1]

bay ☐

raised beach ☐

scarp ☐

headland ☐

submerged forest ☐

Figure 4 is a photograph of part of the mid-Wales coast showing details of another sedimentary deposit.

Figure 4

9. Identify the feature. Tick (✓) only **one** box. [1]

bay ☐

plateau ☐

raised beach ☐

headland ☐

submerged forest ☐

10. Explain the evidence for past sea level change in **EITHER Figure 3 OR Figure 4**. [3]

Figure ☐

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Figure 5 shows carbon dioxide concentration in the atmosphere between 1983 and 2005.

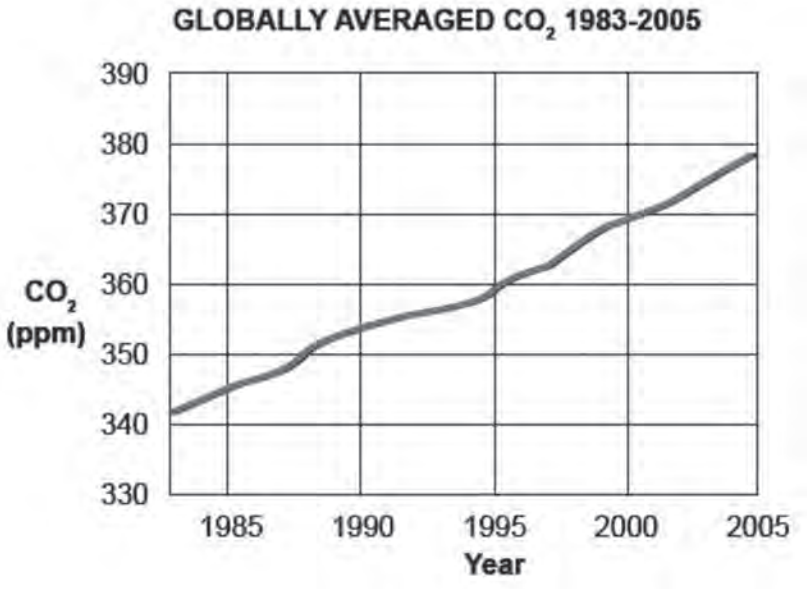

Figure 5

11. Give the trend shown by carbon dioxide concentration in the atmosphere between 1983 and 2005. Tick (✓) only **one** box. [1]

decreasing ☐

increasing ☐

no clear trend ☐

no change ☐

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12. Give **two** major sources of carbon dioxide in the atmosphere. Tick (✓) only **two** boxes. [2]

volcanic gases ☐

nuclear power stations ☐

burning of coal and oil ☐

hydroelectric power ☐

wind turbines ☐

13. Explain the links between carbon dioxide levels in the atmosphere, global warming and changes in sea level. *QWC* [4]

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Section 3 – answer questions 1-7

Figure 6 is a newspaper report of an earthquake in California in 2003.

Earthquake rocks California coast

One of the most powerful earthquakes to hit California in recent years has affected an area stretching from Los Angeles to San Francisco. Two women died when a 19th Century clock tower collapsed in the worst-hit town of Paso Robles, 300km north of LA. Power supplies to about 40,000 people were cut and more than 80 buildings were damaged in the quake, which had a magnitude of 6.5. Paso Robles suffered extensive damage, with buildings more than a century old bearing the brunt of the damage. Built in the 1880s, they were made of brick and wood and had not been reinforced to protect them from earthquakes.

"It is one of the wonders of the world to feel solid rock behave like jello"
US Geological Survey spokesperson

Earthquakes in California are not uncommon. The Northridge Earthquake in Los Angeles in 1994 measured 6.7 and left 57 people dead and 1,500 people were injured. The San Andreas fault, running through San Francisco and north of Los Angeles, marks the boundary between two great crustal masses - the Pacific tectonic plate on the west and the North American plate on the east.

Figure 6

1. Suggest a cause of the earthquake. [1]

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2. Explain how the earthquake was measured. [2]

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Figure 7 shows the plate boundaries near the west coast of North America.

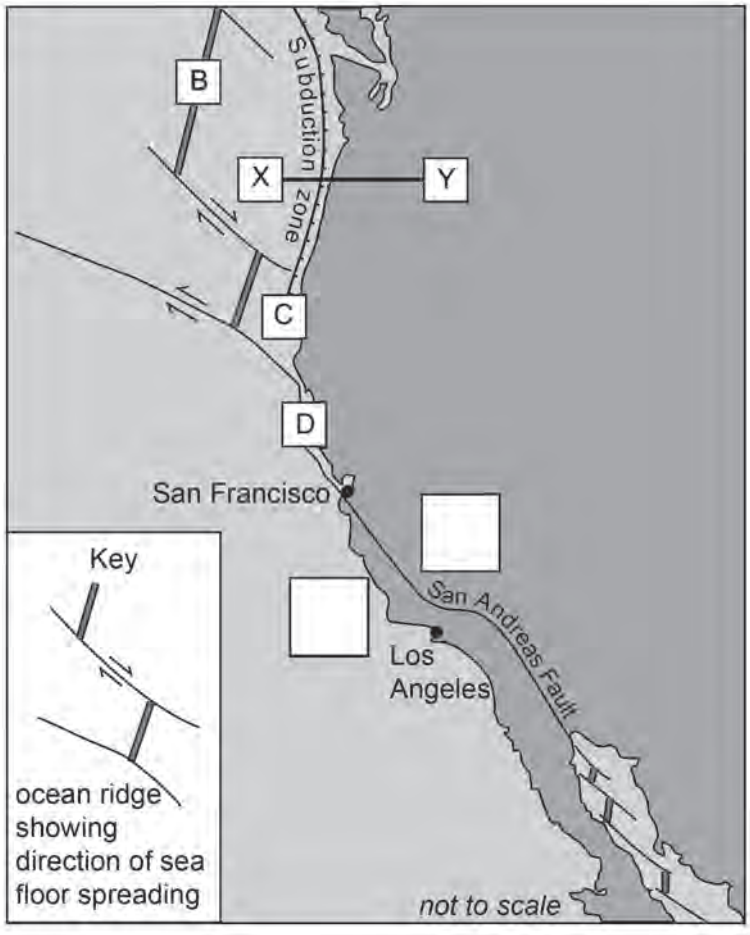

Figure 7

3. **Figure 7** shows **three** different types of plate boundary. Select which type of plate boundary is present at each of the localities, **B**, **C** and **D**. [3]

conservative
convergent (destructive) ocean-ocean
convergent (destructive) ocean-continent
convergent (destructive) continent-continent
divergent (constructive)

B .....

C .....

D .....

4. Selecting from the choice below, draw an arrow in each of the empty boxes on **Figure 7** to show the relative direction of movement on each side of the San Andreas Fault. [1]

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5. Along the line **X-Y** on **Figure 7** earthquake foci get gradually deeper towards **Y**. Explain this pattern of earthquake distribution. [3]

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6. Which **two** of the following occur at divergent (constructive) plate margins?
Tick (✓) only **two** boxes. [2]

vulcanicity and shallow focus earthquakes ☐

vulcanicity without seismic activity ☐

low heat flow ☐

vulcanicity and deep focus earthquakes ☐

deep focus earthquakes without vulcanicity ☐

high heat flow ☐

7. From the list below, select the rock usually associated with each of the following locations. [4]

slate *granite* *basalt* *gabbro* *andesite*

Erupted along a mountain chain near a convergent (destructive) ocean-continent plate margin

.....

Erupted at a divergent (constructive) plate margin

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Intruded beneath a mountain chain as a result of melting of continental crust

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Formed by recrystallisation of a shale due to heat and pressure in a mountain chain

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Section 4 – answer questions 8-14

Figure 8 is a graph showing the change in latitude of Britain through geological time.

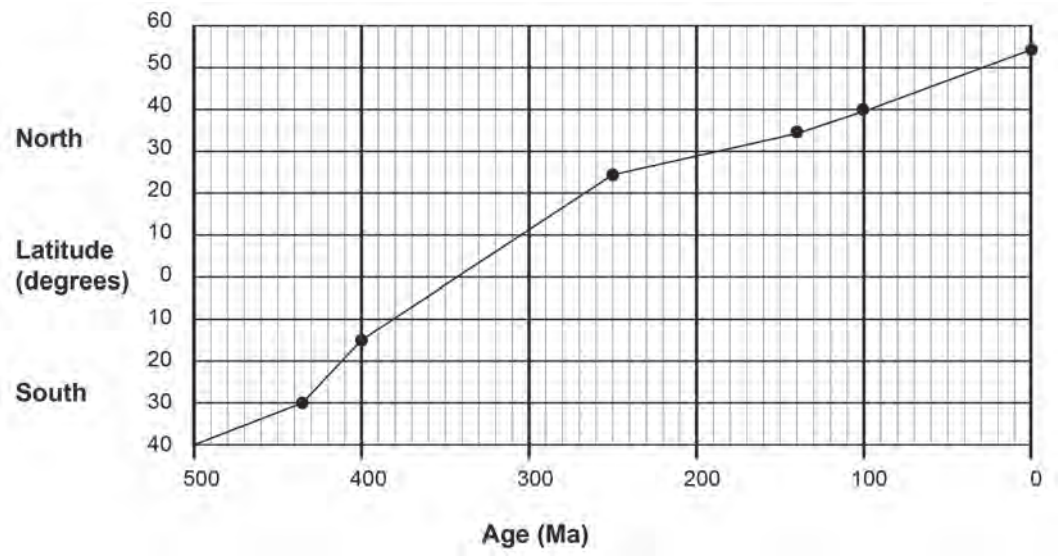

Figure 8

8. Using **Figure 8** and the **Data Sheet**, state which **two** of the following statements correctly describe the drift of Britain through geological time. Tick (✓) only **two** boxes. [2]

the rate of drift was constant ☐

the rate of drift was more rapid between 450 Ma and 250 Ma ☐

drift was away from the north Pole during the Mesozoic ☐

drift was away from the equator during the Devonian ☐

the rate of drift slowed during the Mesozoic and Tertiary ☐

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9. During which **Period** did Britain cross the equator? Tick (✓) only **one** box. [1]

Carboniferous	Palaeozoic	Permian	Devonian	Triassic
☐	☐	☐	☐	☐

10. Which **one** of the following lines of evidence does **NOT** support continental drift? Tick (✓) only **one** box. [1]

palaeomagnetism	☐
mass extinction	☐
fossil distributions	☐
age of the ocean floor	☐
jigsaw pattern fit of continents	☐

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Figure 9 shows a specimen of a fossil reef-building coral collected from a limestone which was deposited 345 million years ago.

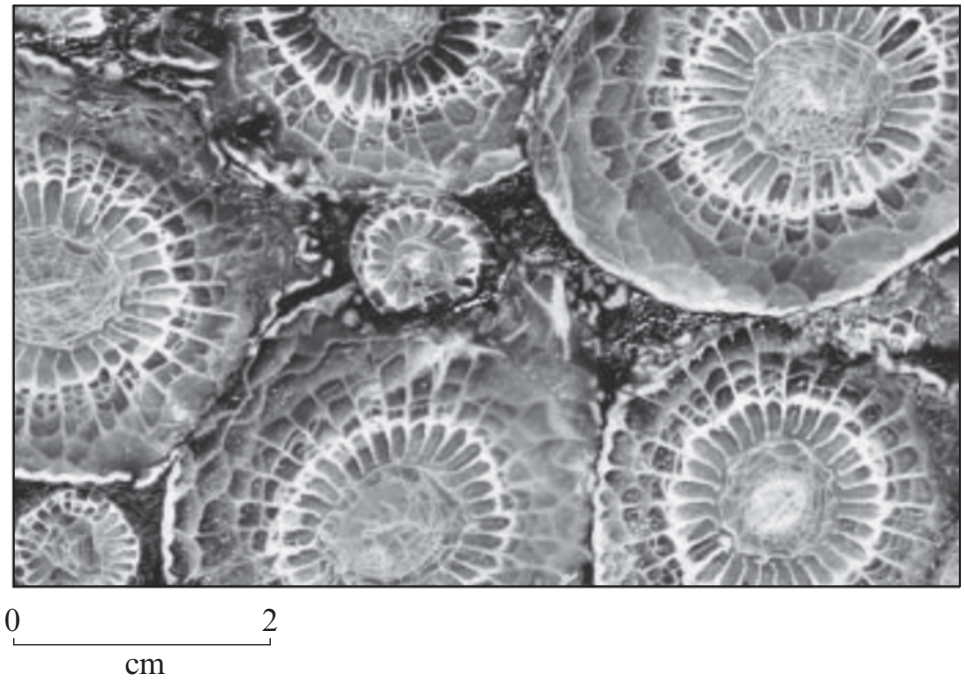

Figure 9

11. Give **two** observations which aid its identification as a reef-building coral.
Tick (✓) only **two** boxes. [2]

radial symmetry ☐

presence of a suture line ☐

presence of stipe ☐

presence of thecae ☐

bilateral symmetry ☐

many individuals in a colony ☐

12. The presence of fossil corals enables the environment of deposition to be determined by comparison with corals living today. State the principle on which this is based.
Tick (✓) only **one** box. [1]

superposition of strata ☐

uniformitarianism ☐

cross-cutting relationships ☐

lateral continuity ☐

original horizontality ☐

13. Complete **Table 1** by ticking the most suitable conditions for living reef-building corals.
Tick (✓) only **one** box in each row across. [4]

Conditions		(✓)		(✓)		(✓)
Temperature of water	hot (32 °C-36 °C)		warm (25 °C-29 °C)		cold (10 °C-15 °C)	
Salinity	high (6%)		fresh water (0%)		normal (3-4%)	
Depth of water	shallow (1-50 m)		medium (70-100 m)		deep (>100 m)	
Range of latitude	polar (60 °N-90 °N)		tropical and semitropical (30 °N-30 °S)		temperate (40 °N-60 °N)	

Table 1

14. Coal deposits were formed in Britain 310 million years ago. Suggest the environment of deposition at that time using evidence provided by the coal deposits. *QWC* [4]

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Section 5 – answer questions 1-8

Figure 10 is a geological cross section showing the Channel Tunnel.

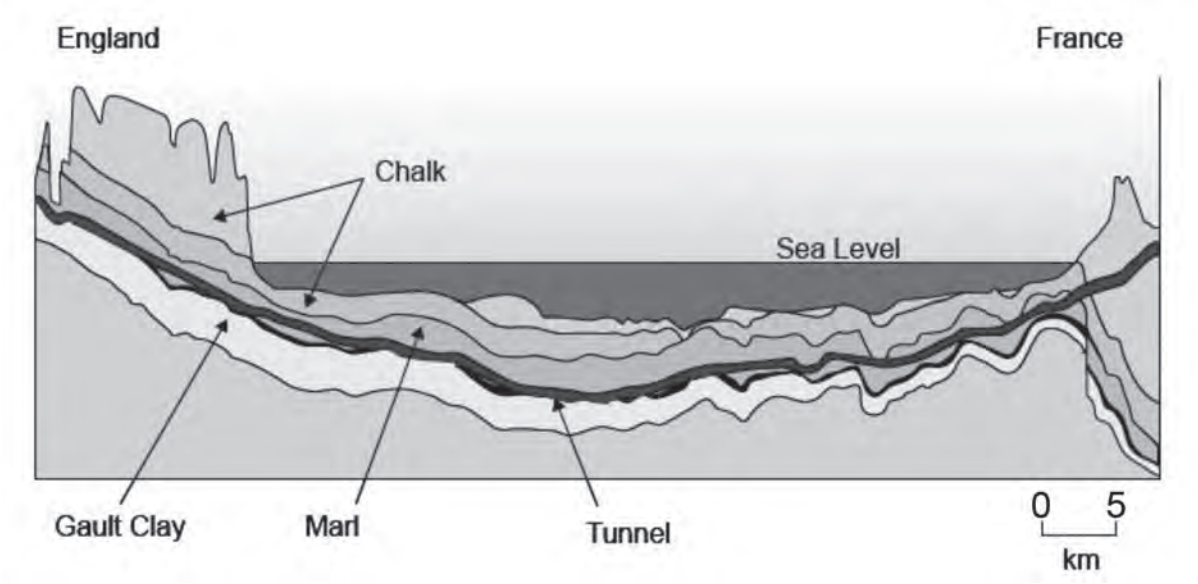

Figure 10

The Channel Tunnel is the second longest rail tunnel in the world at over 50 km. The geology was investigated using seismic survey (which was more effective over the sea) and boreholes (mainly on land). Most of the tunnel was bored through the Marl - a carbonate mud-rock which was an ideal tunnelling material.

1. Describe the major structure shown in **Figure 10**. Tick (✓) only **one** box. [1]

anticline	horizontal beds	syncline	unconformity	dipping beds
☐	☐	☐	☐	☐

2. Why was this structure an advantage when constructing the tunnel? [2]

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3. State why the Marl was considered to be an ideal tunnelling material.
Tick (✓) only **two** boxes. [2]

hard crystalline rock	high porosity	soft rock	presence of carbonate	impermeable	well jointed
☐	☐	☐	☐	☐	☐

4. Why was a combination of seismic survey and boreholes used to investigate the geology prior to tunnelling? [3]

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5. Which of the following shown in **Figure 10** would **NOT** have caused problems during tunnel construction. Tick (✓) only **one** box. [1]

faulting	☐
minor folding	☐
constant thickness of the Marl	☐
anticline in France	☐
possible landslip on the England side	☐

Figure 11 is a photograph of a landfill site.

Figure 11

6. State **two** environmental problems caused by landfill. Tick (✓) only **two** boxes. [2]

pollution of aquifers	☐
complete decomposition of the waste	☐
methane production	☐
landslides	☐
making use of empty quarries	☐

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7. State and explain **one** possible use of the black plastic sheets in **Figure 11**. [3]

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8. State which **one** of the following would be most relevant to the planning and monitoring of waste disposal. Tick (✓) only **one** box. [1]

restoration of polluted soils	☐
testing for potentially polluted water	☐
investigating the stability of bedrock	☐
reviewing work of peers	☐
magnetic survey	☐

Section 6 – answer questions 9-16

Figure 12 shows a student field sketch of the geology of a cliff face.

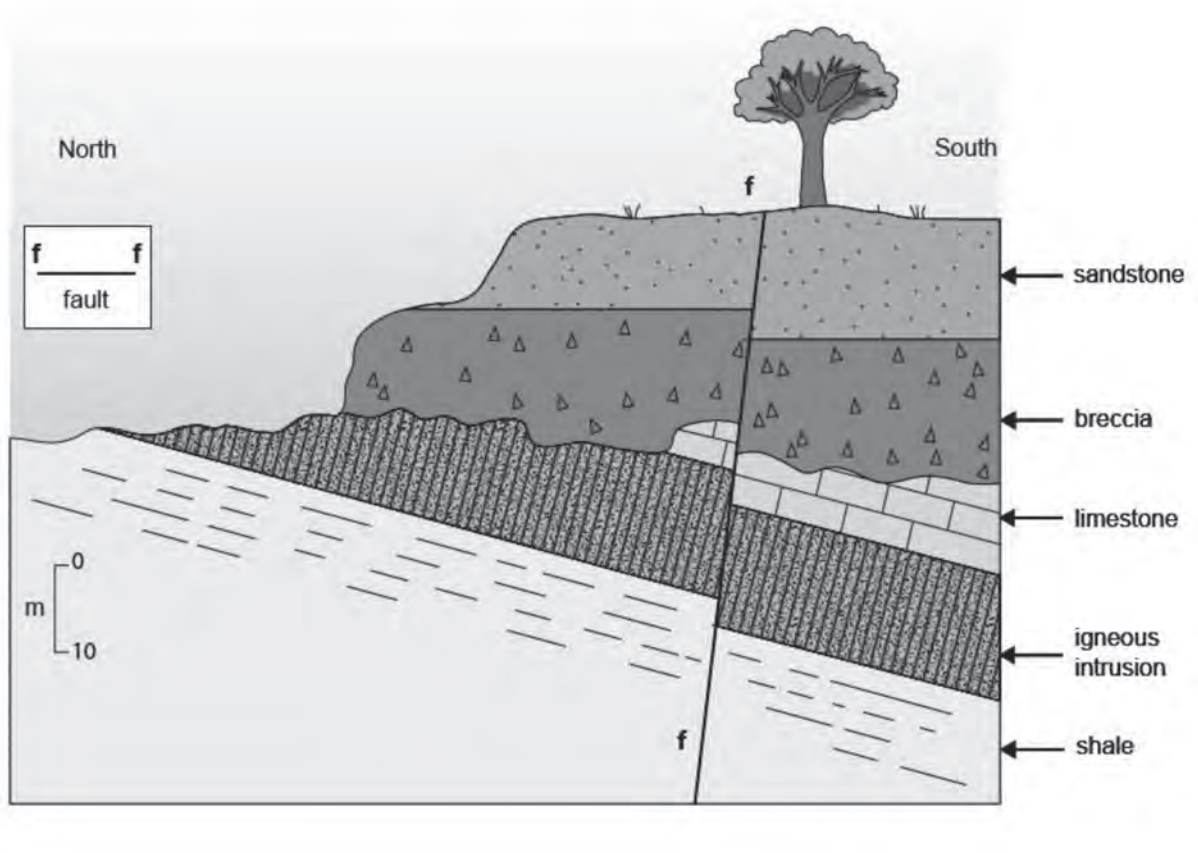

Figure 12

Figure 13 is a microscope view of a rock collected from the igneous intrusion in **Figure 12**.

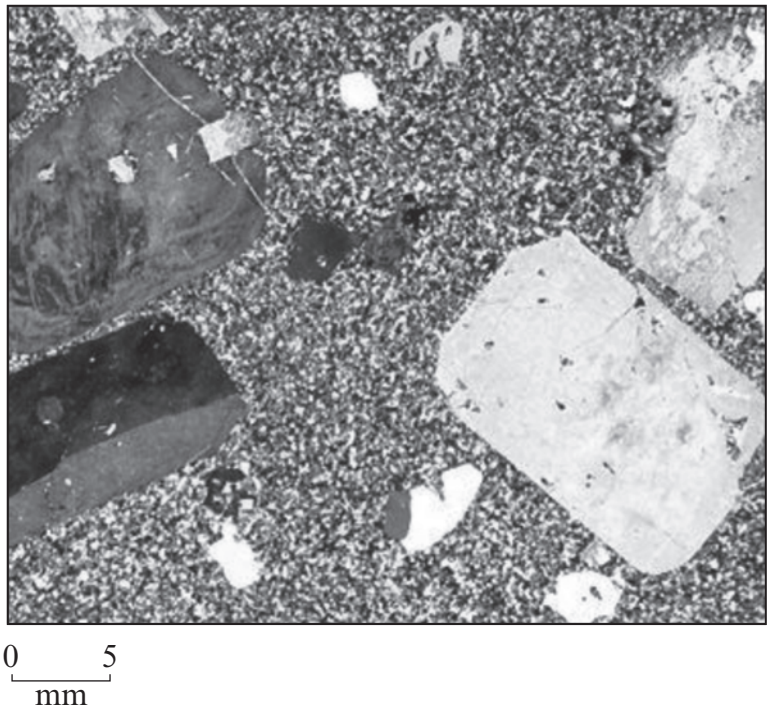

Figure 13

9. Describe the texture of this rock. Tick (✓) only **one** box. [1]

fragmental (clastic)	random crystal orientation	poorly sorted	aligned crystal orientation	foliated
☐	☐	☐	☐	☐

10. The igneous rock in **Figure 13** has both coarse and fine crystals. Explain how this texture formed. Tick (✓) only **three** boxes. [3]

coarse crystals were formed by recrystallisation	☐
coarse crystals formed by slow cooling at depth	☐
fine crystals were formed as a cement from pore waters	☐
fine crystals formed by rapid cooling near the surface	☐
coarse crystals were formed from hydrothermal fluids	☐
coarse and fine crystals formed from a melt	☐
fine crystals formed by slow cooling near the surface	☐

Figure 14 shows the structures found in the igneous intrusion in **Figure 12**.

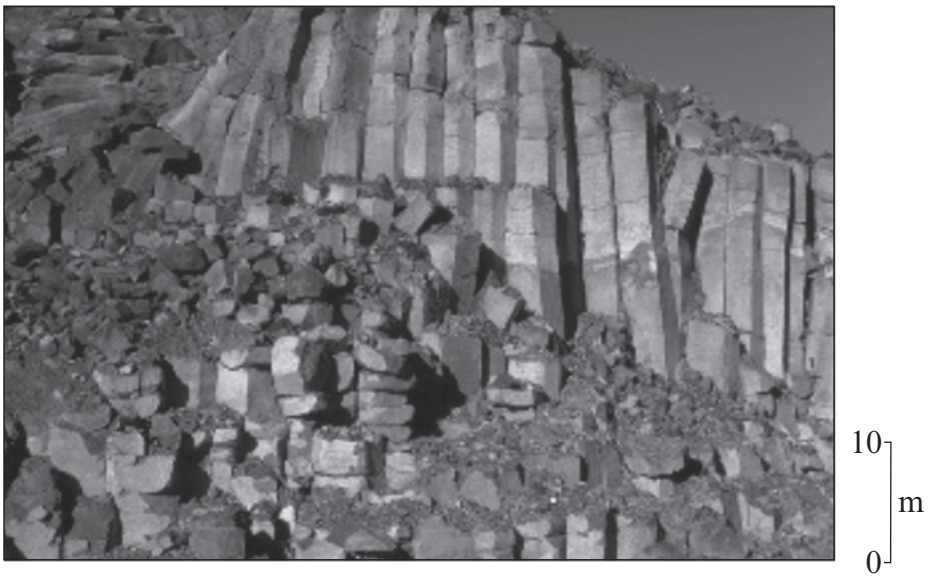

Figure 14

11. Name the structure in **Figure 14**. Tick (✓) only **one** box. [1]

faults	desiccation cracks	pillows	columnar jointing	chilled margin
☐	☐	☐	☐	☐

12. Explain how this structure forms. [2]

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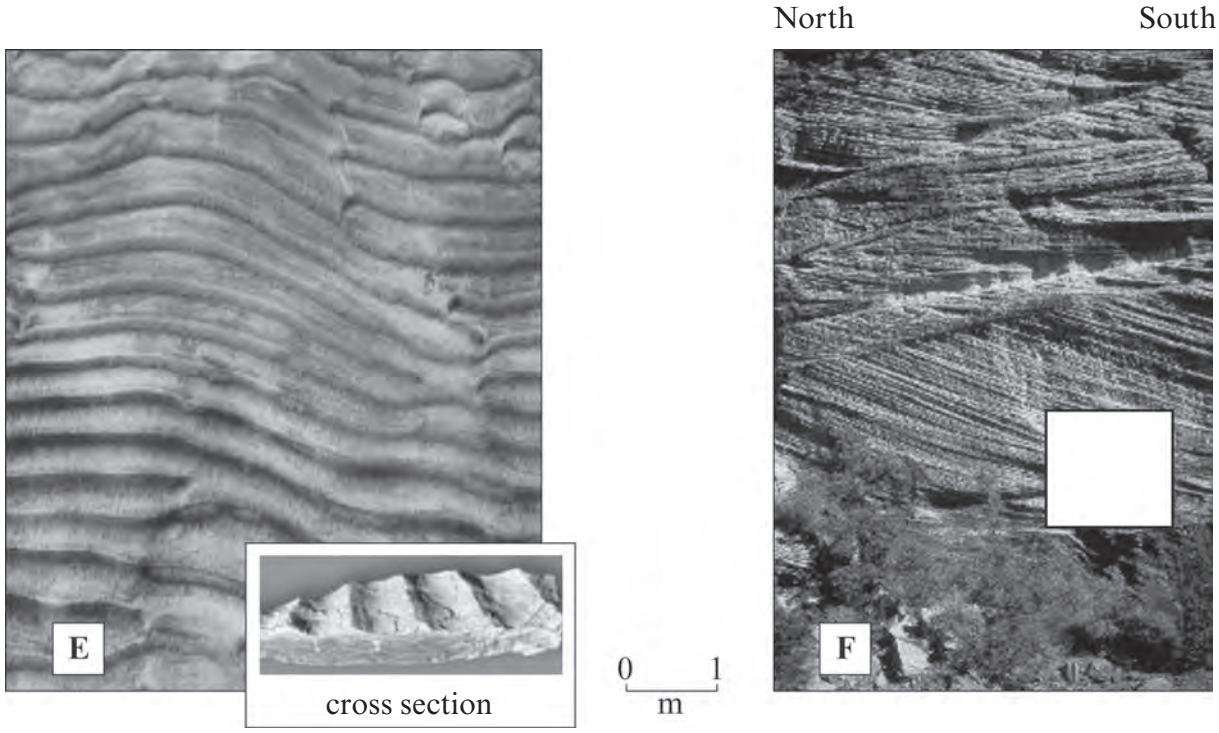
13. Which **two** of the following correctly describe the igneous intrusion in **Figure 12**?
Tick (✓) only **two** boxes. [2]

cuts through the bedding	plateau	dyke	sill	parallel to the bedding	pluton
☐	☐	☐	☐	☐	☐

Figure 15 shows two sedimentary structures (**E** and **F**) present in the sandstone in **Figure 12**.



Surface view and cross section of structure **E**

Cross section of structure **F**

Figure 15

14. From the list below, select the names of sedimentary structures **E** and **F**. [2]

graded bedding *cross bedding* *desiccation cracks* *trace fossils* *ripple marks*

E .....

F .....

15. Selecting from the choice below, draw an arrow in the empty box on the cross section of structure **F** above to show the current direction at the time of deposition. [1]

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16. Describe the order of events which led to the geology shown in **Figure 12** by writing each of the following events in their correct position (**1-6**) in **Table 2**.

[3]

deposition of breccia and sandstone

intrusion of igneous body

faulting

deposition of shale

deposition of limestone

uplift, tilting and erosion

youngest

oldest

7	uplift and erosion
6	
5	
4	
3	
2	
1	

Table 2

Section 7 – answer questions 1-9

Figure 16 is a photograph of a landscape common in upland Britain.

Figure 16

1. Describe the shape of the valley cross section. [1]

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2. Which **one** of the following agents was mainly involved in shaping the valley?
Tick (✓) only **one** box. [1]

river	sea	wind	gravity	ice
☐	☐	☐	☐	☐

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3. Which **one** of the following processes was mainly responsible for the erosion of the valley? Tick (✓) only **one** box. [1]

attrition	traction	saltation	solution	abrasion	suspension
☐	☐	☐	☐	☐	☐

4. Name the main weathering process responsible for the formation of the scree. Tick (✓) only **one** box. [1]

chemical	physical	biological
☐	☐	☐

5. Describe the weathering process that produced the scree. [3]

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Figure 17 shows microscope views of two rocks (**G** and **H**).

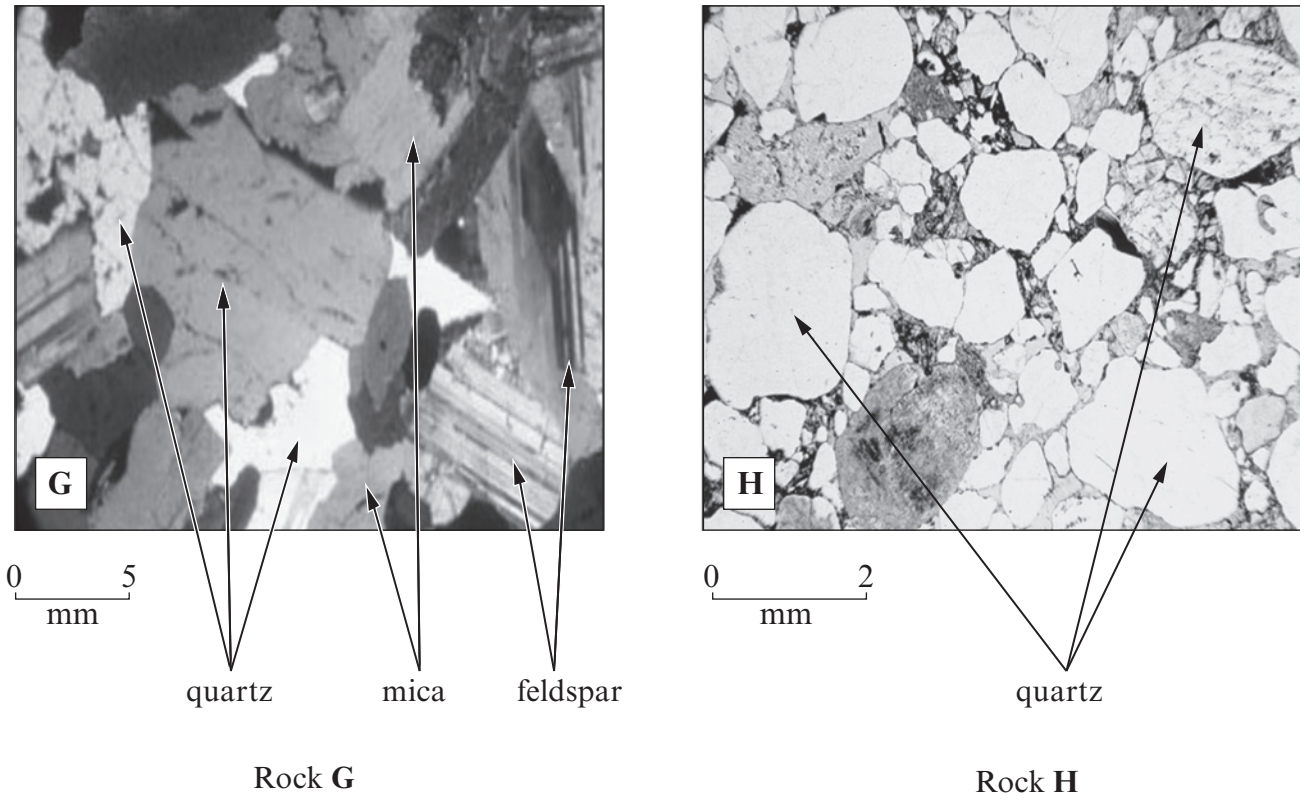

Figure 17

6. Describe the texture of Rock **H**. Tick (✓) only **three** boxes. [3]

medium grained	fragmental (clastic)	well sorted	angular grains	coarse grained	poorly sorted	well compacted
☐	☐	☐	☐	☐	☐	☐

7. Name rock **G**. Tick (✓) only **one** box. [1]

gabbro	basalt	granite	breccia	andesite
☐	☐	☐	☐	☐

Rock **H** was formed by the weathering and erosion of Rock **G**.

8. Explain why rock **H** contains quartz. [2]

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9. Explain why rock **H** does not contain any feldspar. [2]

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GCSE

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GEOLOGY
DATA SHEET

A.M. FRIDAY, 18 May 2012

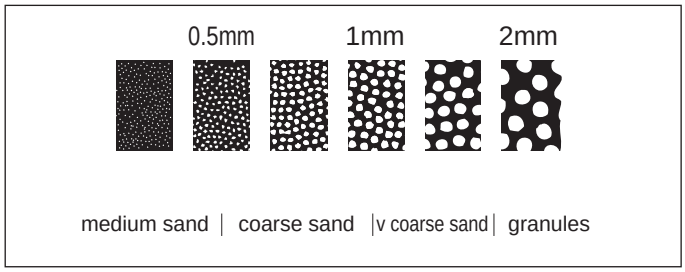
Physical properties of minerals in hand specimen

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

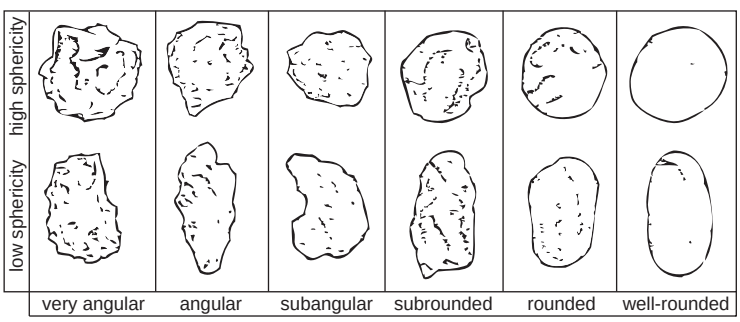
Mohs' scale of hardness

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