

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE

C480U20-1



FRIDAY, 26 MAY 2023 – AFTERNOON

GEOLOGY – Component 2

Investigative Geology

1 hour 30 minutes

ADDITIONAL MATERIALS

In addition to this examination paper you will need:

- Map 1
- the Data Sheet
- a protractor
- a ruler
- a calculator.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	25	
2.	7	
3.	9	
4.	10	
5.	8	
6.	13	
7.	8	
Total	80	

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INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

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

Plain paper may be obtained from the supervisor on request.

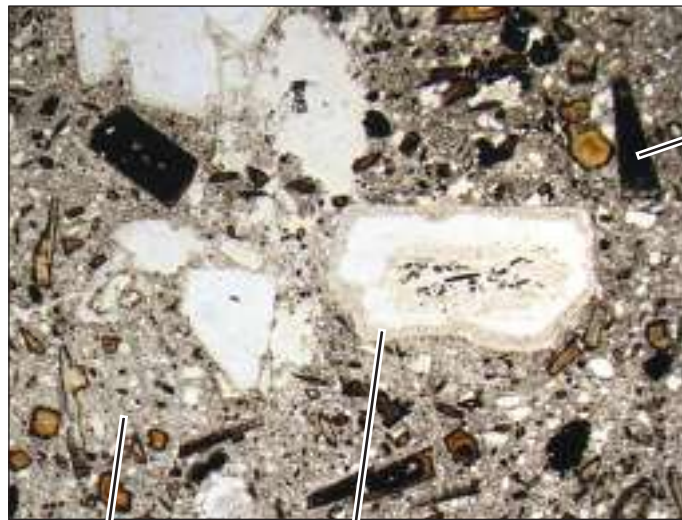
The assessment of the quality of extended response (QER) will take place in question 1(d)(ii).



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Answer **all** questions.

1. (a) **Figure 1a** shows a microscope view of igneous **Rock Unit A** at **Locality 1** on **Map 1**. **Table 1** shows the mineralogy of **Rock Unit A**.



mineral H

- black in hand specimen
- 2 cleavage planes

Mineral	Percentage of minerals in Rock Unit A
feldspar	75
mineral H	11
mica	8
quartz	6

Figure 1a

Table 1

Refer to **Figure 1a** and **Table 1**.

- (i) Using the Data Sheet, state the name of **mineral H** in **Figure 1a**. [1]

.....

- (ii) Describe the texture of **Rock Unit A**. [3]

.....

.....

.....

.....



- (iii) A student concluded that **Rock Unit A** had cooled at more than one rate of cooling. Explain the evidence for this by using **Figure 1a**. [3]

.....

.....

.....

.....

.....

- (iv) State the name of the rock forming **Rock Unit A**. [1]

.....



- (b) **Figure 1b** is a photograph of igneous structures taken from above **Rock Unit A** at **Locality 1** on **Map 1**. **Rock Unit A** is 25 m wide at **Locality 1**.



Igneous body width = 25 m

0 1
m

Figure 1b

Refer to **Figure 1b**.

- (i) State the name of the igneous structures and explain how they formed. [3]

Name

Explanation

.....

.....

.....

- (ii) Complete **Table 2** by calculating the thickness of igneous structure **P** in **Figure 1b** using the scale provided. [1]

igneous body width (m)	25
thickness of igneous structure P (cm)	.

Table 2



- (c) **Figure 1c** is a graph showing variation in width of igneous bodies, plotted against the thickness of the igneous structures.

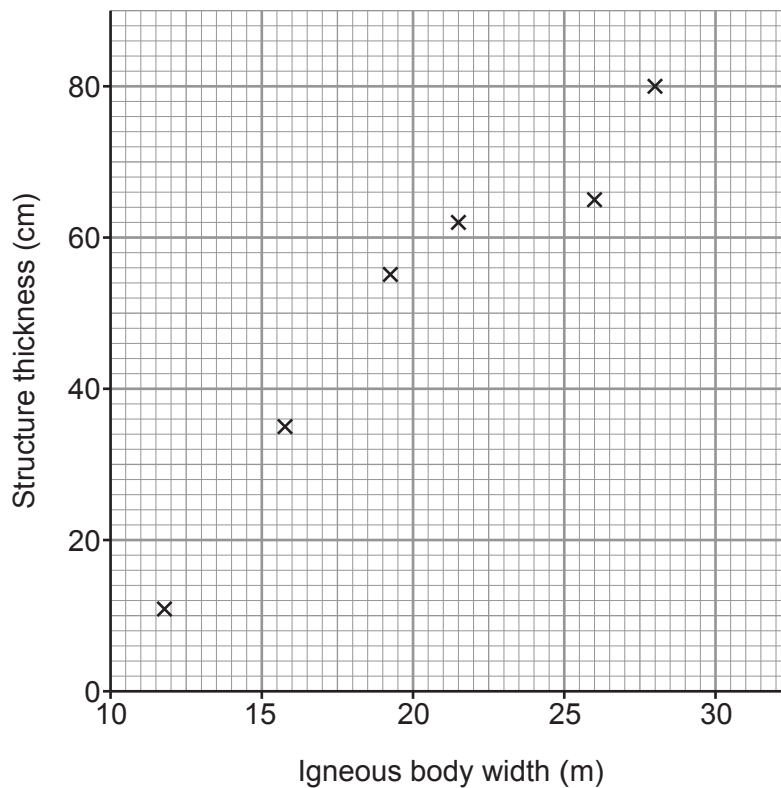


Figure 1c

Refer to **Figure 1b** and **Figure 1c**.

- (i) Plot the data in **Table 2** on **Figure 1c**. [1]

- (ii) Describe the relationship between the igneous body width and the thickness of the igneous structures. [2]

.....

.....

.....

- (iii) A student concluded that the igneous structure thickness is related to the rate of cooling of an igneous body. Explain how **Figure 1c** supports this conclusion. [2]

.....

.....

.....



- (d) **Figure 1d** is a sketch map of the igneous body forming **Rock Unit A** in **box A** on **Map 1**.

Date: 15/03/2022

weather conditions: sunny and dry

Sketch map of Igneous body

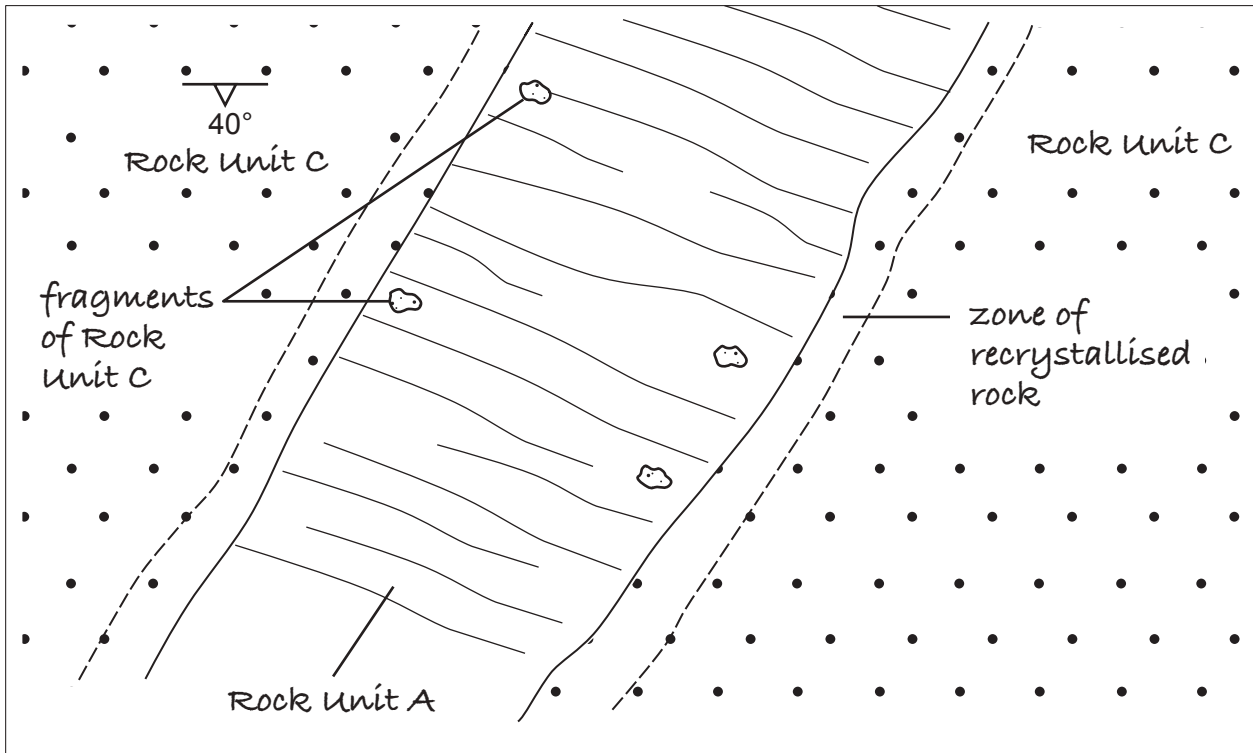


Figure 1d

- (i) State **two** important pieces of information that are missing from the sketch map shown in **Figure 1d**. [2]

1.
2.

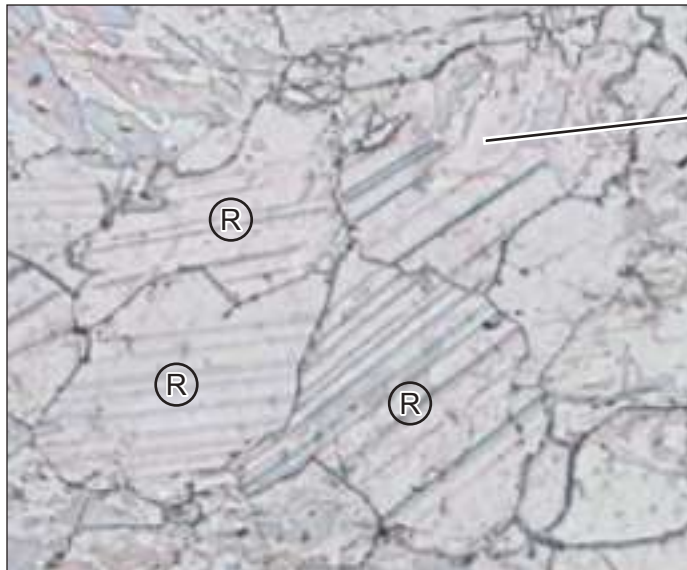


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2. **Figure 2** shows a microscope view of **Rock Unit B**, which only contains mineral **J**. It was collected from **Locality 2** on **Map 1** directly in contact with the igneous body.



mineral J

- not scratched by a finger nail
- 3 good directions of cleavage

0 0.5
mm

Figure 2

- (a) Complete **Table 3** using the information from **Figure 2**.

[4]

name of mineral J	•
mean size of the three crystals labelled R (mm)	•
name of crystalline texture	•
name of rock in Figure 2	•

Table 3

- (b) Refer to **Figure 2** and **Locality 2** on **Map 1**. Explain how the rock in **Figure 2** formed. [3]

.....

.....

.....

.....

.....



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3. Refer to the fold on **Map 1**.

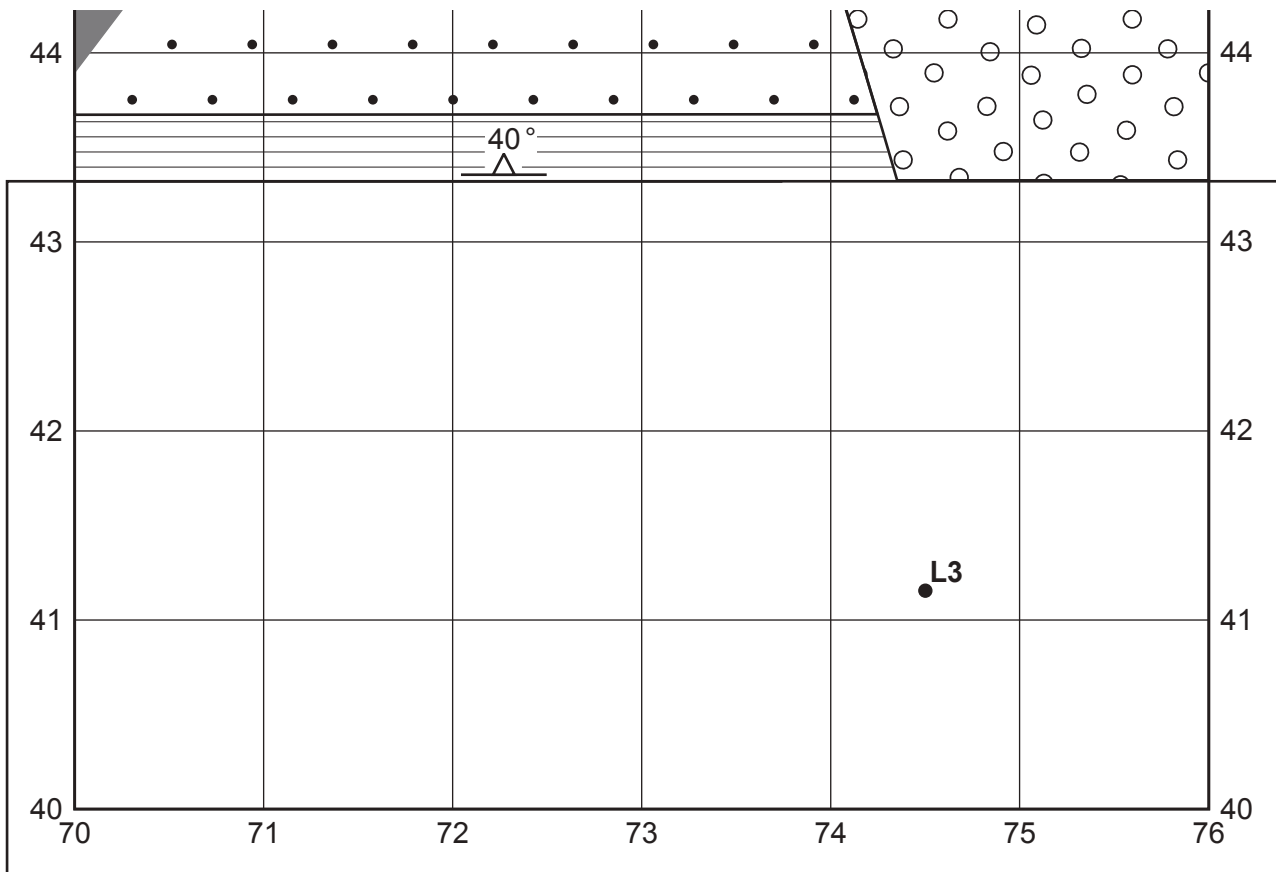
(a) Complete **Table 4** using **Map 1**.

[3]

dip angle of the limbs	•
type of fold	•
strike direction of axial plane trace	•

Table 4

(b) **Map 2** shows **Map 1** south of grid line 44. The area on **Map 2** is flat. **Table 5** shows the rocks at three points on **Map 2**.



Key

	Rock Unit A
	Rock Unit B
	Rock Unit C
	Rock Unit F

	Dip of bed
	Locality number

0 100
m



Map 2



Grid reference	Rock Unit
753418	boundary of Rock Unit F
758405	boundary of Rock Unit F
745412	L3 : middle of sill

Table 5

Refer to **Map 2**.

- (i) Using the grid references provided in **Table 5**, plot the boundary of **Rock Unit F** on **Map 2**. [1]
- (ii) At **Locality 3, L3**, there is a sill which is:
- composed of **Rock Unit A**
 - 50 m wide
 - striking E–W
 - older than **Rock Unit F**

Draw the sill on **Map 2**. [3]

- (iii) Refer to **Map 1**. Complete the southern boundary of **Rock Unit B** on **Map 2**. [2]



4. **Figure 4** is a photograph of mineral **M** collected from outside the area of **Map 1**.



Figure 4

- (a) (i) Complete **Table 6** which refers to tests most useful for identifying mineral **M**. [4]

You may wish to use the Data Sheet.

Test name	Description of test	Result of test
streak	rub mineral on the streak plate	scratches the streak plate
•	observe mineral in natural light	red
•	look for regular planes of weakness	•
lustre	•	glassy

Table 6

- (ii) State the name of mineral **M**. [1]

.....



- (b) (i) The density of mineral **M** is 4.2 g cm^{-3} . Using the data in **Figure 4**, calculate the volume of mineral **M**. Show your working. [2]

Formula for density is: $d = \frac{m}{v}$

d = density	m = mass	v = volume
-------------	----------	------------

..... cm^3

- (ii) Give **one** reason why it may be difficult to accurately calculate the volume of mineral **M** using measurements taken with a ruler. [1]

.....

- (iii) Explain how placing mineral **M** in a measuring cylinder partially filled with water could be used as a more accurate method to calculate the volume of mineral **M**. [2]

.....



5. **Figure 5a** is a photograph of folded sedimentary rocks in an area outside of **Map 1**.

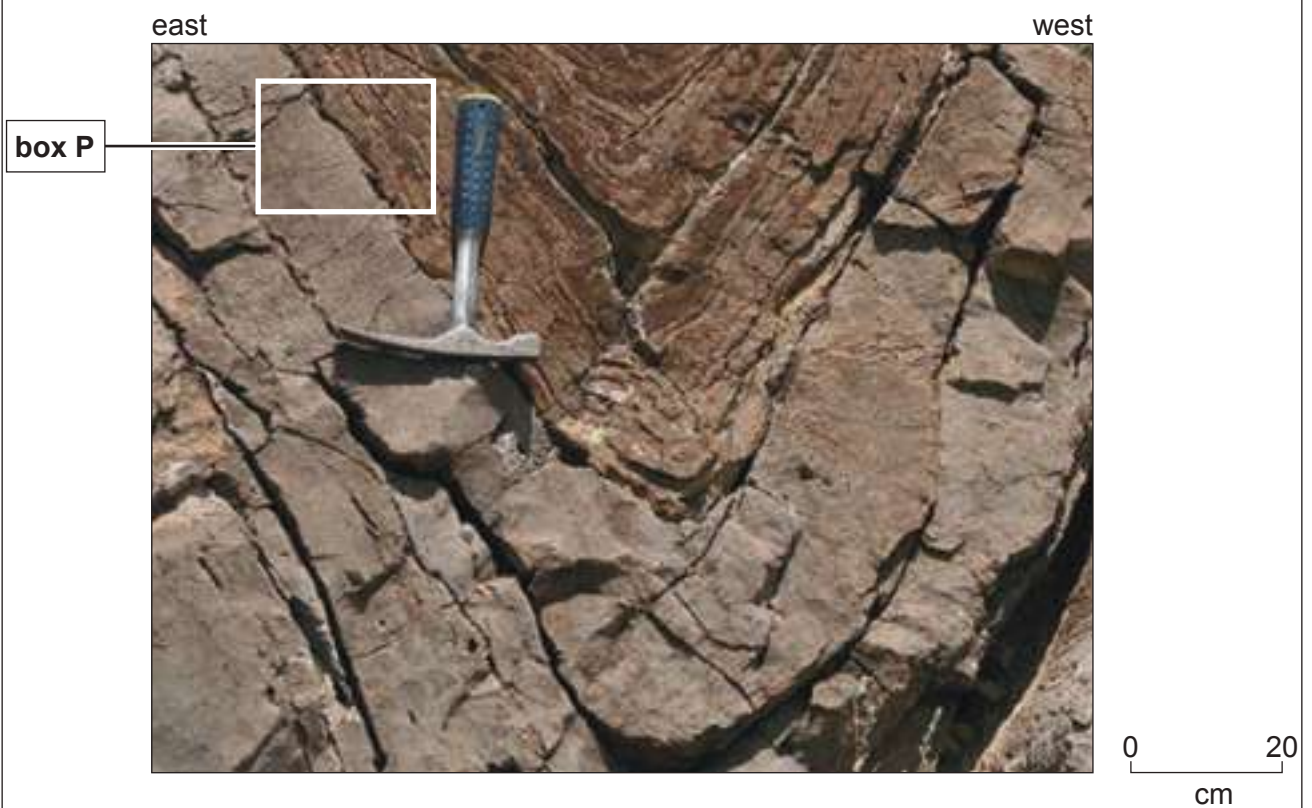


Figure 5a



(a) Refer to **Figure 5a**.

(i) In **Figure 5b**, draw to scale the main geological features shown in **Figure 5a**. [4]

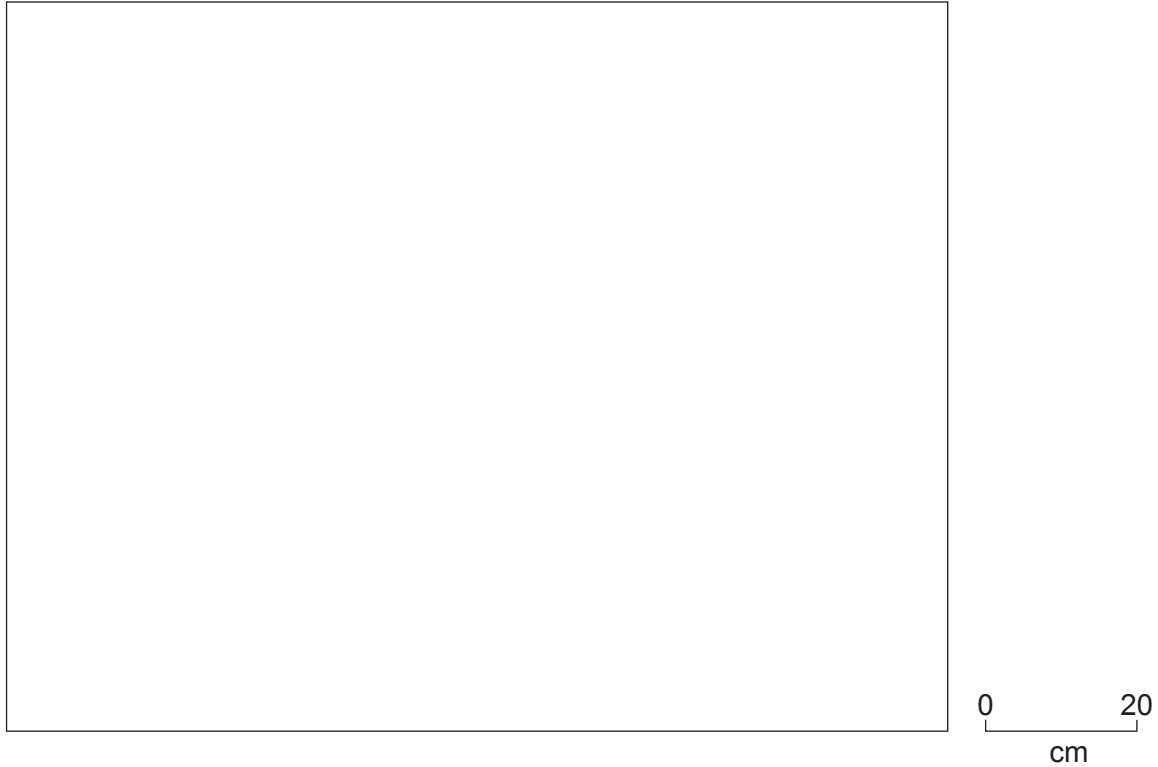


Figure 5b

(ii) State the angle of dip of the bedding plane in **box P** on **Figure 5a**. [1]

.....°

(b) Refer to **Map 1** and **Figure 5a**. State **one** difference and **two** similarities between the fold on **Map 1** and the fold in **Figure 5a**. [3]

Difference

.....

Similarity 1

.....

Similarity 2

.....



6. **Figure 6a** is a partly completed sedimentary log recorded in an area outside of **Map 1**. **Table 7** describes the sedimentary characteristics of the rocks within beds 1–6 of the sedimentary log.

(a) Complete **Figure 6a** by adding beds 3, 4 and 5 using the descriptions in **Table 7**. [4]

Bed number	Description
6	1 m thick bed of shale
5	4 m thick bed with an erosional base; it has a coarse-grained conglomerate at the base, grading upwards to a medium-grained sandstone
4	2 m thick bed of marine sandstone
3	2 m thick bed of conglomerate; it has a mean grain size of 5 mm, is well rounded and poorly sorted
2	1 m thick bed of marine sandstone with an erosional base
1	2 m thick bed of shale

Table 7

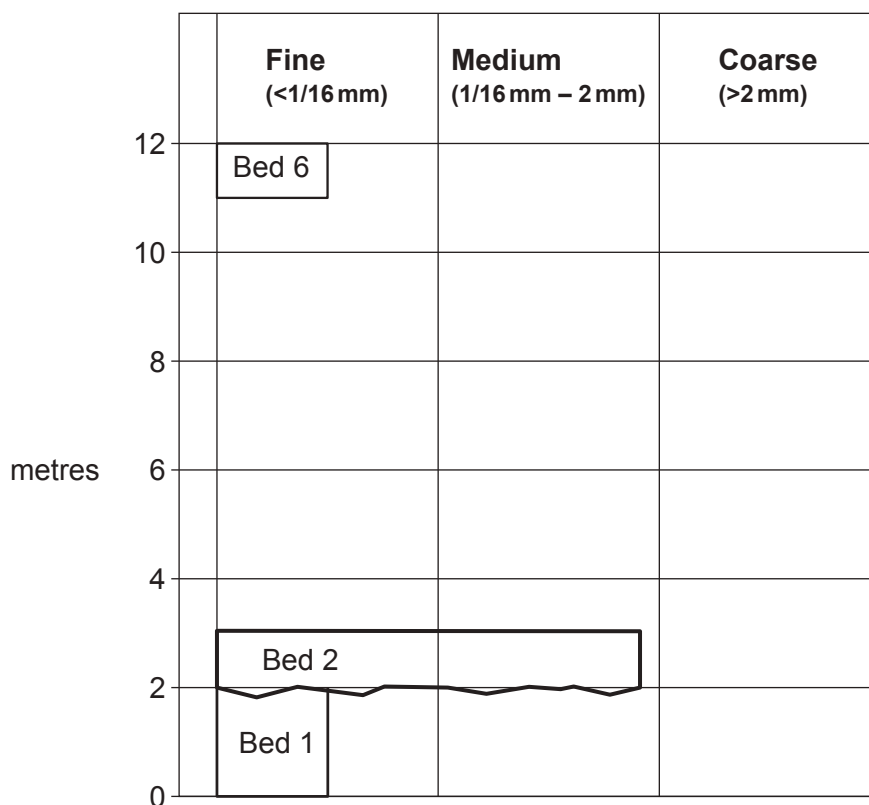


Figure 6a



- (b) (i) Using the information in **Table 7**, complete **Figure 6b** to show the texture of the conglomerate in bed **3**. [3]

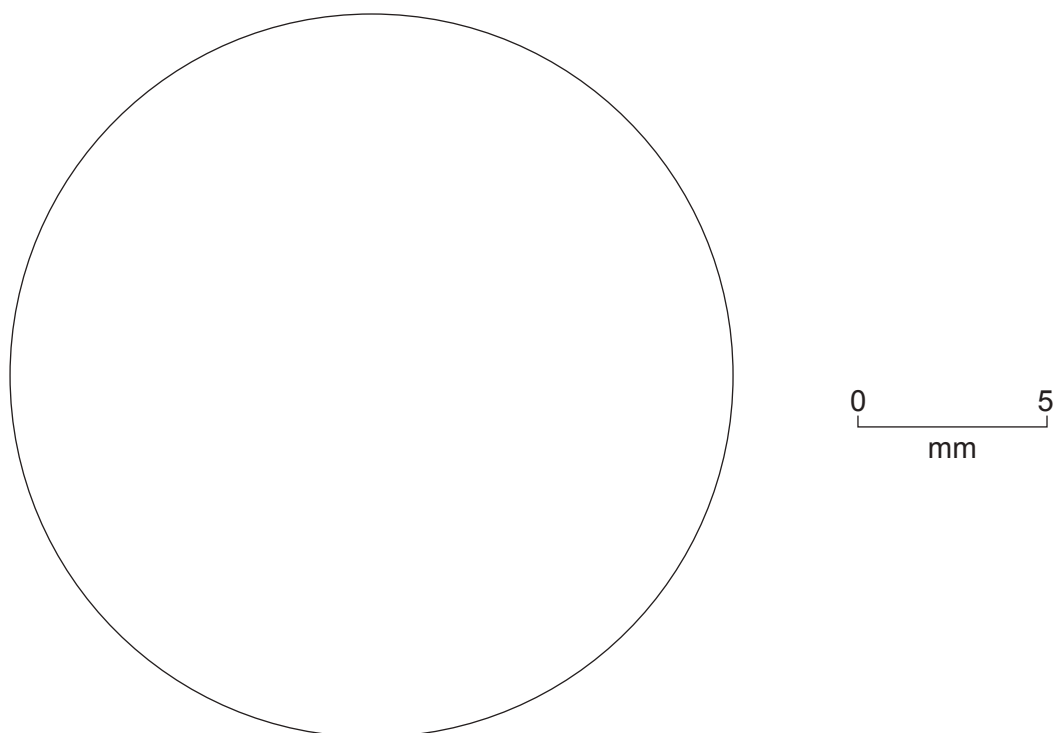


Figure 6b

- (ii) Describe **one** erosional process which has resulted in the grains in bed **3** becoming well-rounded. [2]

.....

.....

.....

- (c) Explain how the change in the size of the grains from bed **1** to bed **2** is related to the energy of the environments in which the two beds were deposited. [2]

.....

.....

.....

.....



- (d) **Figure 6c** is a photograph of a fossil found in bed **6** in **Table 7**.



0 1
cm

Figure 6c

Using evidence from both the fossil and the rock, describe the most likely environment in which bed **6** was deposited. Give reasons for your answer. [2]

Evidence from the fossil

.....
.....

Evidence from the rock

.....
.....



7. **Figure 7a** is a photograph of part of fossil **F** collected from **Rock Unit F** on **Map 1**.



Figure 7a

- (a) (i) Complete **Figure 7b** below by drawing the suture line between points **C** and **D** in **Figure 7a**. [2]

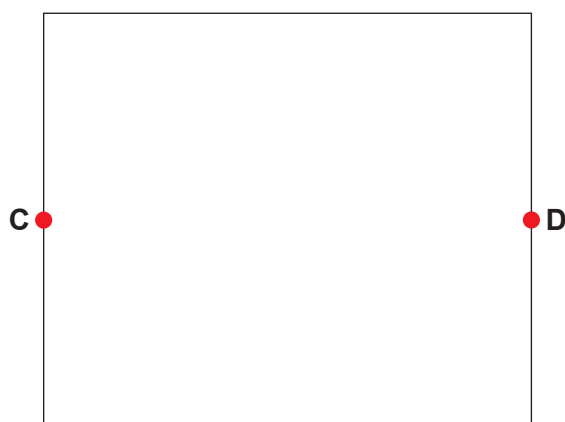


Figure 7b

- (ii) State the type of the fossil cephalopod shown in **Figure 7a**. Give **one** reason for your answer. [2]

Type

Reason

.....



(b) **Figure 7c** shows two photographs of fossil **G** collected from **Rock Unit G** on **Map 1**.



0 1
cm



0 5
mm

Figure 7c

State the type of fossil cephalopod shown in **Figure 7c**.

[1]



(c) **Figure 7d** is a simplified geological cross-section along line **X–Y** on **Map 1**.

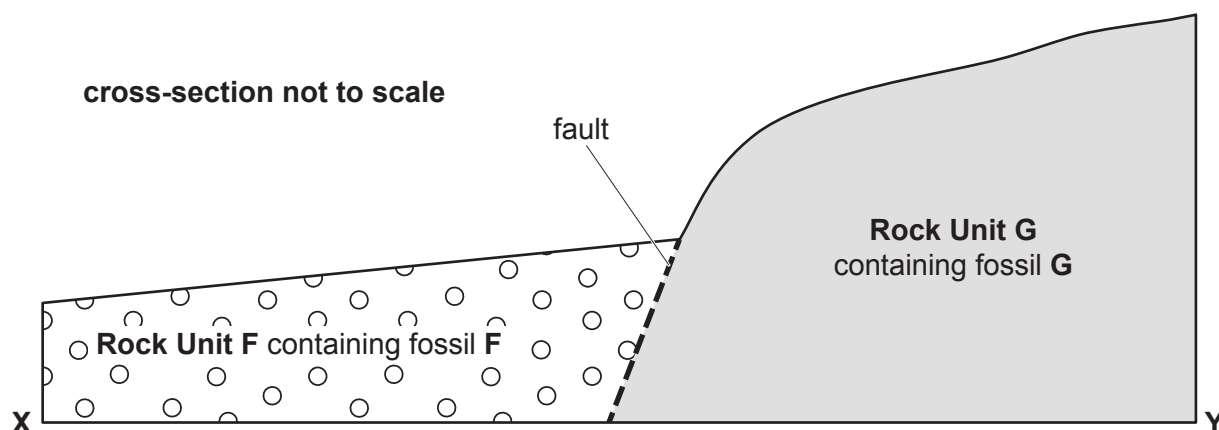


Figure 7d

Explain the evidence from fossil **F** and fossil **G** that suggests that the fault in **Figure 7d** is a normal fault. [3]

.....

.....

.....

.....

.....

END OF PAPER



[illegible]

Acknowledgements:

Figure 1a <https://www.alexstrekeisen.it/immagini/>

Figure 1b <https://www.researchgate.net/figure/>

Figure 2a <https://www.mdpi.com/2076-3417/11/13/6163/htm>

Figure 5a <https://geologypics.com/190711-18/>

Figure 6c <https://www.burgess-shale.bc.ca/burgess-shale-hikes/>

Figure 7a https://www.fossilsdirect.co.uk/gallery_details.cfm?prodref=AMM3067

Figure 7c <https://www.geoed.co.uk/products/>



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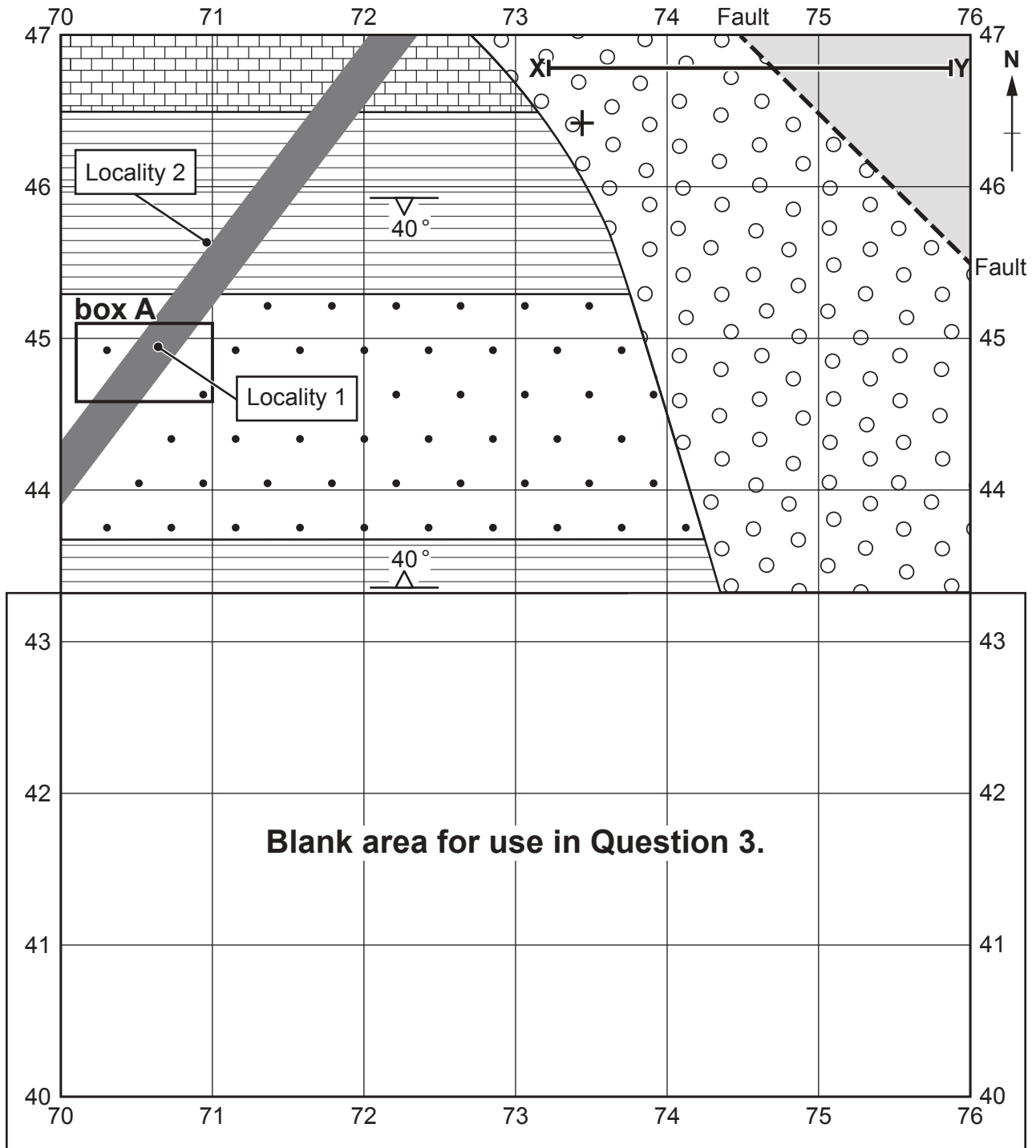


FRIDAY, 26 MAY 2023 – AFTERNOON

GEOLOGY – Component 2
Investigative Geology

MAP EXTRACT

Map 1



The rock units are not in order of age.

Their ornament is not necessarily representative of rock type.



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FRIDAY, 26 MAY 2023 – AFTERNOON

GEOLOGY – Component 2

DATA SHEET

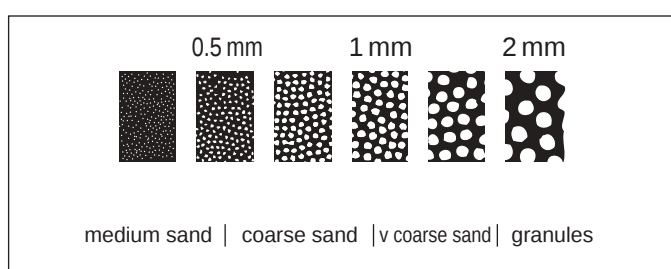
Physical properties of minerals in hand specimen

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
Augite	5½	black	scratches streak plate	glassy	2 good
Olivine	6½	green	scratches streak plate	glassy	none
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	scratches streak plate	glassy	none

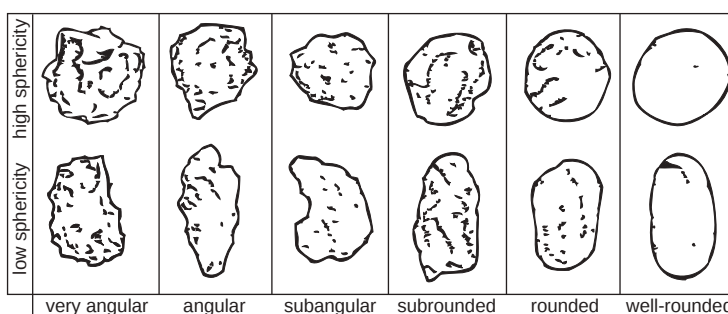
Mohs scale of hardness

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

Grain size scale



Grain shape and sphericity scale



Geological ranges of vertebrates

