First name(s)

GCE A LEVEL



A480U10-1



MONDAY, 6 JUNE 2022 – AFTERNOON

GEOLOGY – A level component 1 Geological Investigations

2 hours 15 minutes

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- the Resource Sheet
- Specimens E, T and X
- · geological equipment for testing specimens
- the Mineral Data Sheet
- · a calculator
- a ruler
- a protractor

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

This paper is in 2 sections, **A** and **B**.

Section A: 30 marks. Answer both questions.

You are advised to spend about 35 minutes on this section.

Section **B**: 75 marks. Answer **all** questions. You are advised to spend about 1 hour 40 minutes on this section.

The geology is **not** designed to represent any particular area.

The Mineral Data Sheet and Map 1 and Photographs 1, 2, 3 and 4 are provided on separate resource sheets.

Three specimens, $\boldsymbol{\mathsf{E}},\,\boldsymbol{\mathsf{T}}$ and $\boldsymbol{\mathsf{X}},$ are provided for use.

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

The assessment of the quality of extended response (QER) will take place in questions 2 and 7.



	For Examiner's use only				
	Question	Maximum Mark	Mark Awarded		
Section	1.	16			
Α	2.	14			
	3.	6			
	4.	7			
	5.	10			
Section	6.	5			
В	7.	9			
	8.	6			
	9.	6			
	10.	18			
	11.	8			
	Total	105			

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Turn over.

State one geophysical prospecting technique that could be used to investigate the size of the ore body. Explain why your chosen technique is useful for this ore body. [3] Technique Explanation Figure 1b is a map showing copper concentrations in soil in parts per million (ppm) in Area A on Figure 1a. ppm

Dip direction of ore body ppm Key: Ν 1 km sampling location 134 = copper concentration in soil in parts per million (ppm)

Figure 1b



(b)

(C)

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 (i) State which sampling method was used to collect the geoche Figure 1b. Tick (✓) only one box. Cluster sampling Stratified sampling Random sampling Systematic sampling (ii) Complete Figure 1b to show the isolines representing: 50 ppm copper concentration in the soil 100 ppm copper concentration in the soil. (iii) Refer to Figures 1a and 1b. Account for the distribution of continue to the soil in Area A.	mical data shown in [1]
Cluster sampling Stratified sampling Random sampling Systematic sampling (ii) Complete Figure 1b to show the isolines representing: 50 ppm copper concentration in the soil 50 ppm copper concentration in the soil. (iii) Refer to Figures 1a and 1b. Account for the distribution of consistence of the soil in Area A.	
Stratified sampling	
Random sampling	
 Systematic sampling (ii) Complete Figure 1b to show the isolines representing: 50 ppm copper concentration in the soil 100 ppm copper concentration in the soil. (iii) Refer to Figures 1a and 1b. Account for the distribution of continue in the soil in Area A. 	
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 50 ppm copper concentration in the soil 100 ppm copper concentration in the soil. (iii) Refer to Figures 1a and 1b. Account for the distribution of continuity in the soil in Area A.	
(iii) Refer to Figures 1a and 1b . Account for the distribution of co in the soil in Area A .	[2]
	pper concentrations [3]
(iv) Evaluate the effectiveness of geochemical surveys in locating	ore bodies. [3]



2. Figure 2a and Figure 2b show photographs of structures found in a sedimentary sequence. Table 2 contains details of the beds found in the same sedimentary sequence.

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Table 2





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							Exa
				SECTION B			
				Answer all quest	ions.		
. Stud	у Мар	1 on t	he Resource Sh	neet.			
(a)	Spee	cimen	T was collected	from within the M	ap 1 area.		
	(i)	Desc	cribe how you wo	ould determine the	streak of Specimen	Г.	[1]
	(ii)	State	e the streak of S	pecimen T.			[1]
(b)	Tabl sam	e 3 sh ple of \$	ows the results t Specimen T .	that a student obta	iined when investigatir	ng the density of a	
	(i)	Com	plete Table 3 by	v calculating the de	ensity of the sample.		[1]
		Γ	Mass (a)	Volume (cm ³)	Density (a cm ⁻³)]	
		[Mass (g)	Volume (cm ³)	Density (g cm ⁻³)		
			Mass (g) 12.5	Volume (cm ³) 2.5	Density (g cm ⁻³)		
	(ii)	The r and a perce	Mass (g) 12.5 results were obta a measuring cyli entage uncertair	Volume (cm ³) 2.5 Table 3 ained using a top p nder that had a re nty created by usin	Density (g cm ⁻³) • Dan balance that had a solution of 0.25 cm ³ . Cong this equipment. Sho	a resolution of 0.1 g alculate the total w your working.	[2]
	(ii) ∎∭ IIII	The I and a perce	Mass (g) 12.5 results were obta a measuring cyli entage uncertair	Volume (cm ³) 2.5 Table 3 ained using a top p inder that had a re inder that had a re thy created by usin	Density (g cm ⁻³) • Dan balance that had a solution of 0.25 cm ³ . Cong this equipment. Sho	a resolution of 0.1 g calculate the total w your working.	.%







 Photograph 1, on the Resource Sheet, shows a sample of Rock Unit F collected from Locality I on Map 1. Specimen X was collected from Rock Unit F at Locality II on Map 1.

(a) Complete **Table 4** to show the characteristics of **Rock Unit F** and **Specimen X**. You may wish to refer to the Mineral Data Sheet and use the equipment provided. [6]

	Photograph 1	Specimen X
Crystalline Texture (yes/no)	•	•
Mean size of crystals/grains (mm)	•	0.5
Composition	Calcite	Diagnostic test and result • Conclusion/composition •
Name of Rock	•	•

Table 4

(b) Complete **Table 5** to show the angle and direction of dip at **Localities I** and **II** on **Map 1**. [2]

	Locality I	Locality II				
Angle of dip	• •	• •				
Direction of dip		• •				
Table 5 (c) Suggest why there is a difference in the dip of Rock Unit F at these two localities. [2]						



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Examiner only Refer to Figure 6. For the student's investigation state: (a) The independent variable [1] (i) **Two** variables that need to be controlled (kept the same) [2] (ii) 1. _____ 2. _____ State two steps that the student has taken to maximise the transfer of thermal energy (b) from the hot water to the sand. [2] 1. 2. _____





7.	Photograph 2 on the Resource Sheet shows an exposure of Rock Unit H at Locality III on Map 1 . Photograph 3 on the Resource Sheet shows a close-up of a bedding plane surface within Rock Unit H at Locality III on Map 1 .	
	Plan a field investigation to determine the past geological processes that have happened at Locality III in Photographs 2 and 3 . For each of the observations you would make:	
	 state the observation give reasons for the observation describe the technique you would use to make the observation. 	
	You may wish to use an annotated diagram(s). [9 QER]	



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Refe	r to Photograph 4 and Map 1.	
(a)	Describe the outcrop pattern of Rock Unit B on Map 1 .	[2]
(b)	State the name of the rock forming Rock Unit B .	[1]
(c)	A student concluded that	
	"Rock Unit B is the product of a lava flow".	[2]





9.





Examiner only A student concluded that the folds to the **north-east** of **Fault F1** on **Map 1** represent: (b) "A series of open, non-plunging, isoclinal folds which show east-west crustal shortening." [4] Evaluate this statement with reference to Map 1. 18



A resources company is dredging gravel from Localities IV and V on Map 1. Table 7 shows information about the clast lithology of a sample of 100 clasts collected from Localities IV and V. Figure 11 shows two box and whisker plots to show the variation in clast size at Localities IV and V.

Clast lithology	Locality IV	Locality V
igneous granitic	35	5
igneous basaltic	5	27
sedimentary carbonate	33	9
sedimentary non-carbonate	21	54
metamorphic	6	5
Total	100	100







(a)	Refer to Table 7. The resources company intended to test the hypothesis that
	"the clasts at the two localities were derived from different sources".
	Suggest the most suitable statistical test to use by ticking one of the boxes below. Give a reason for your answer. Tick (\checkmark) only one box. [2]
	Spearman's Rank
	Chi-squared
	Mann-Whitney U test
(b)	Refer to Figure 11 . Compare the degree of sorting shown by the samples from Localities IV and V . Explain the evidence for your answer. [2]
• • • • • • • •	
(c)	Using evidence from Map 1 , Table 7 and Figure 11 , suggest why there is a difference between the samples collected from Localities IV and V with regards to:
(C)	Using evidence from Map 1 , Table 7 and Figure 11 , suggest why there is a difference between the samples collected from Localities IV and V with regards to: • clast size • clast lithology. [4]
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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.	Examine only



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Acknowledgements Figure 2a Figure 2b https://www.flickr.com/photos/royluck/5203527666 https://www.researchgate.net/figure/Origin-of-



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