OCR
Oxford Cambridge and RSA

Accredited

A Level Geology
H414/03 Practical skills in geology
Sample Question Paper

Date – Morning/Afternoon
Version 2.2

Time allowed: 1 hour 30 minutes

You must have:
- the Insert
- a protractor
- a ruler (cm/mm)
- a pencil

You may use:
- a scientific or graphical calculator

First name	
Last name	
Centre number	**Candidate number**

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **20** pages.

Answer **all** the questions.

1 Salt water contamination of drinking water occurs when sea water seeps into aquifers.

A student has developed a simple test to estimate the extent of the pollution in an aquifer.

Drops of a known molarity of NaC*l* solution are allowed to fall through a substance of known density, in this case sunflower oil. The time taken for the drop of solution to fall a distance of 4 cm is recorded.

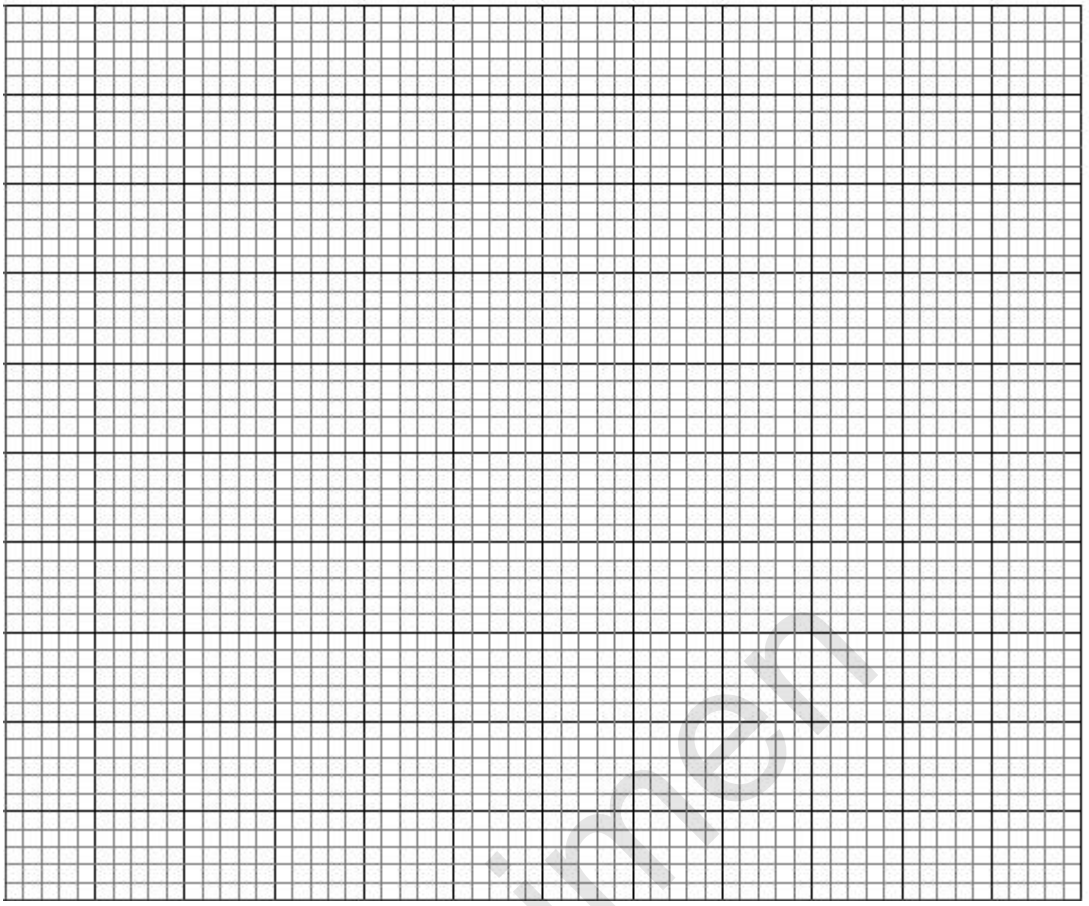
The student's results are given in **Table 1.1**.

	Drop time (seconds)					
NaC*l* solution (molarity)	**1**	**2**	**3**	**4**	**5**	**Mean**
1.225	8.09	8.56	8.65	8.58	8.08	8.39
2.500	7.54	7.22	6.26	6.22	6.08	6.66
5.000	3.65	3.66	4.15	4.56	4.25	……

Table 1.1

(a) (i) Calculate the mean drop time for the NaC*l* solution of molarity 5.000.

Record the result in **Table 1.1**. **[1]**



(ii) On the grid provided, plot a graph of the processed data given in **Table 1.1.** **[3]**

(b) The student collects water samples from two different springs (**A** and **B**).

The student wants to investigate whether the two different aquifers at the source of the two springs are contaminated by sea water.

The student allows five drops of water from the samples from springs **A** and **B** to fall the 4 cm through the sunflower oil and records the drop times.

The mean drop time for sample **A** was 7.4 seconds.
The mean drop time for sample **B** was 2.9 seconds.

Using your graph, evaluate the result for sample **A.**

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…… **[2]**

(c) Suggest **two** modifications to the practical procedure that would enable a more **accurate** estimate of the molarity of the samples. Give reasons for your answers.

1 ……..……...

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2 ……..……

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[2]

(d) The flow of fluids through aquifers is controlled by geological factors.

Describe and explain **one** factor that will decrease the flow of salt water contamination in an aquifer.

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…… **[2]**

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2 A clastic sedimentary sequence is exposed along a cliff face. An A Level student makes field observations and records measurements in a field note book. The student identifies six beds. Bed 6 is the oldest and bed 1 is the youngest.

Table 2.1 shows the field data collected from the sedimentary sequence.

Bed	Thickness (m)	Rock description	Features visible
1	0.80	Coarse sandstone at base to medium sandstone at the top of the unit. Brown colour. Dip and strike - 28/136	Graded bedding Uneven base with flute casts with current direction 090^{o}
2	0.55	Mudstone with some mica. Dark grey colour.	Finely laminated and crumbly
3	0.90	Siltstone with mica. Mid grey colour	Ripples
4	0.40	Fine sandstone with clasts of mudstone towards the top. Light grey in colour	Parallel bedded
5	1.25	Coarse sandstone at base to medium sandstone at the top of the unit. Some small pebbles at the base. Dark grey colour. Dip and strike - 25/150.	Graded bedding. Uneven base with tool marks with current direction 110^{o}
6	0.10	Mudstone with some mica. Possible cephalopod fossil, poorly preserved. Black in colour.	Finely laminated and crumbly

Table 2.1

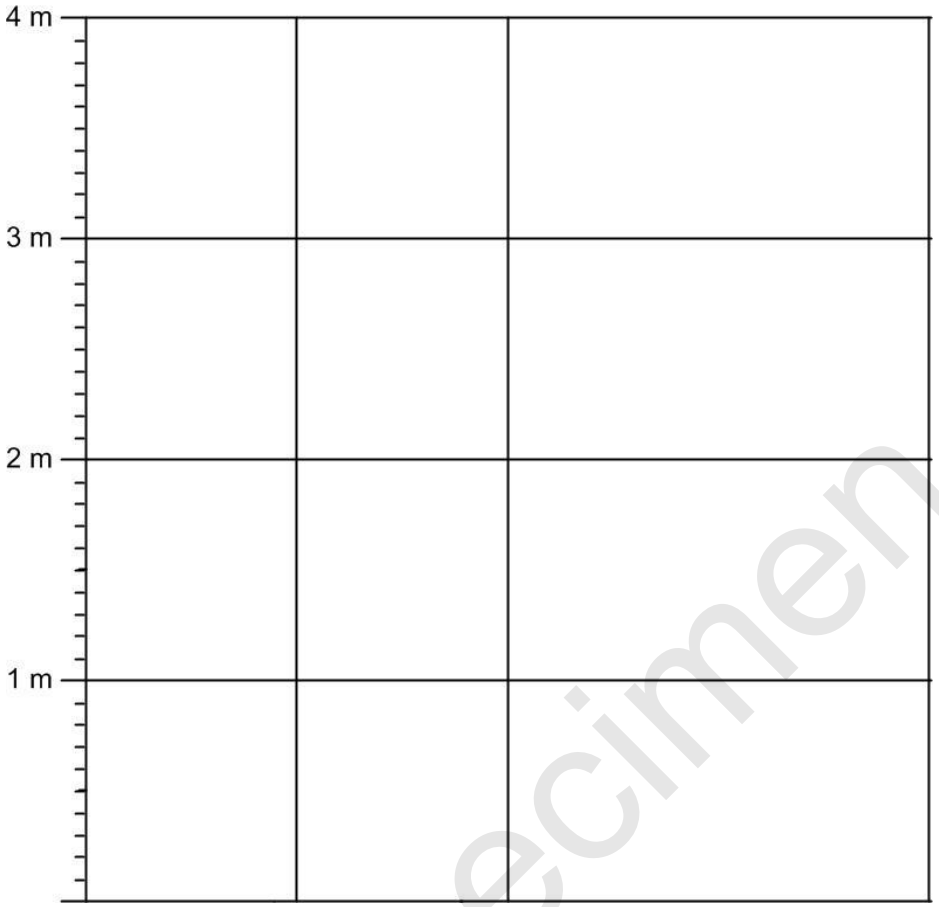
(a) The bed measurements recorded were apparent thicknesses only.

Calculate the true thickness of bed 5, in cm, if the average angle of dip along the section is 25°.

thickness of bed = …… cm **[2]**

(b) (i) Using the data in **Table 2.1**, plot a graphic log to show the information in the table. Choose an appropriate scale for your plot.

Provide a key next to your graphic log to help you with your answer.



[5]

(ii) Using evidence from the field observations in the table, deduce the environment of deposition for this sequence of sedimentary rocks.

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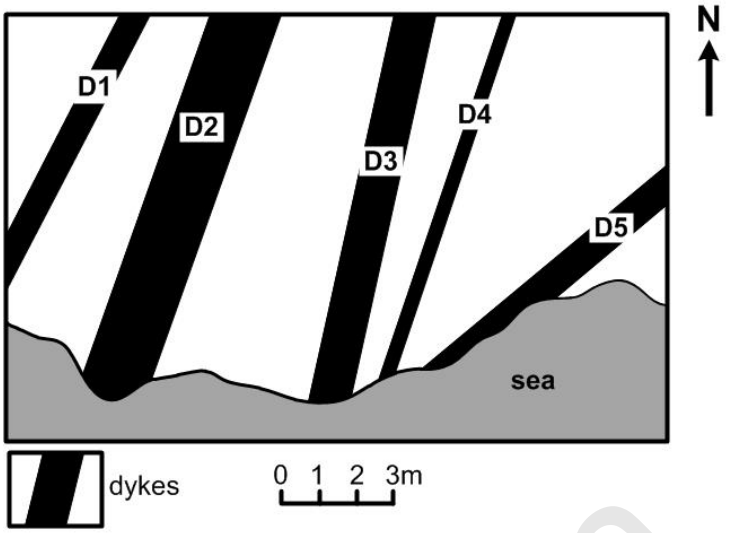
…… **[3]**

(iii) Give the name for the technique outlined above for determining the origin of the rocks.

…… **[1]**

3 The simplified geological map below shows a small area of a beach on a Scottish island. This shows a number of discordant intrusions in the form of vertical dykes.



The table shows data about these intrusions.

Dyke	Width of dyke (mm)	Orientation	Average SiO_2 (%)
D1	500	027°	49.2
D2	1800	020°	46.6
D3	1000	013°	45.9
D4	400	018°	48.4
D5	800	045°	61.7

(a) Use these data to calculate the total crustal extension caused by the intrusion of all the dykes.

total crustal extension = …… % **[2]**

(b) Name **two** processes that could have caused the different compositions of the dykes and explain how each process affects the composition of the magma.

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2 ……

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[2]

(c) Describe how you could take an orientation on a dyke using a compass clinometer.

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……**[2]**

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4 This question is about the photograph in **Fig. 4.1**.

Fig. 4.1

(a) Discuss the stress regime under which the geological structure shown in **Fig. 4.1** formed in terms of principal stresses**.**

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…… **[2]**

(b) Calculate the magnification of the photograph in **Fig. 4.1**.

magnification = ……**[2]**

5 A geology student is collecting data on the rock types and geological structures present on a small Scottish island.

There are various types of metamorphic rocks and some small silicic igneous intrusions on the island. The metamorphic rocks cover most of the island. There is evidence that there has been more than one phase of metamorphism.

(a) The following photographs were taken on the island.

Describe the processes that caused the metamorphic fabrics shown in the photographs to form.

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…….. **[3]**

(b)* The geology student designed an investigation to test the hypothesis that there is more than one phase of metamorphism on the island. They carried out stratified sampling and field measurements of each rock type in proportion to its cover on the island (psammitic 45%, pelitic 25%, carbonate 20% and igneous 10%). The student mapped the isograds from chlorite to biotite, and biotite to garnet zones using the *Photo Guide to Minerals* to confirm their mineral identification. Where possible the student measured dip and strike of the country rock and finally they carried out a detailed transect across the exposed contact between the country rock and the largest intrusion, in the bed of a stream.

Evaluate the method that the geology student has used.

Suggest modifications to this method that would enable you to gain more accurate data. Assume that you have access to the standard equipment available to a student in a school or field study centre.

[6]

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Additional answer space if required

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6 The 1 : 50 000 geological map excerpt (Wells) should be used for this question.

(a) In terms of engineering geology, analyse and evaluate the position of the Cheddar Reservoir shown on the map.

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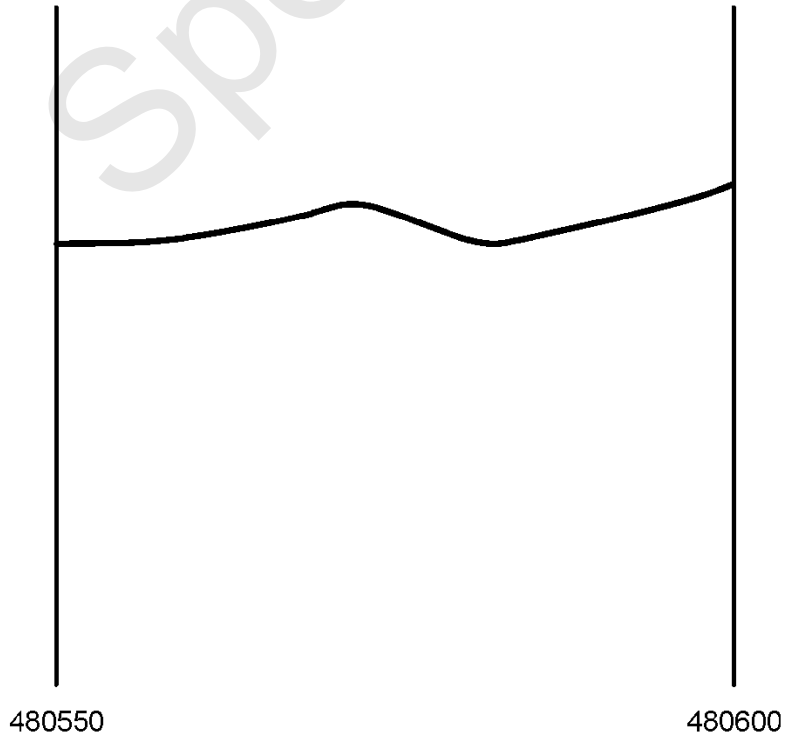
…… **[4]**

(b) On the topographic sketch profile below, draw and clearly label a cross-section from grid reference 480550 to 480600. Use symbols to show the same rock types on your cross-section.

Do **not** use coloured pencils or highlighters.

[7]



(c)* A mining company have applied for planning permission to site a quarry in the Hotwells Limestone, at grid reference 485535. The overall size of the quarry would cover around 2 km^2.

Analyse the potential geohazards that may occur around the area of extraction.

Conclude whether you think that this quarry should be given planning permission for limestone extraction. **[6]**

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Additional answer space if required.

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(d) Geologists believe that there is extensive mineralization in the Black Rock Limestone which underlies the Dolomitic Conglomerate at grid reference 515540. They plan to drill an excavation borehole to intersect with the top of the Black Rock Limestone.

Calculate the depth to which the borehole must be drilled.

depth of borehole = …… m **[3]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following page(s). The question number(s) must be clearly shown in the margin.

OCR
Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

A Level Geology

H414/03 Practical skills in geology

SAMPLE MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 60

This document consists of 20 pages

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit.

3. Log-in to RM assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM assessor 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM assessor messaging system.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor comments box is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. Do not use the comments box for any other reason.
   If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:
Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative geological content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and geological content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.
Once the level is located, award the higher or lower mark:
The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.
The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.
In summary:
The skills and geological content determines the level.
The communication statement determines the mark within a level.

Level of response questions on this paper are **5b** and **6c**.

11. **Annotations**

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

12. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

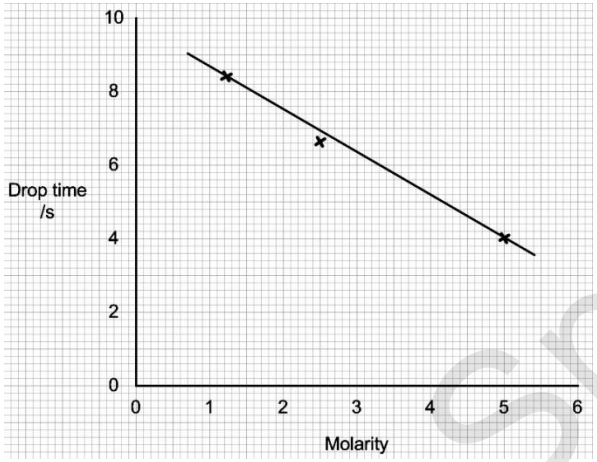
You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

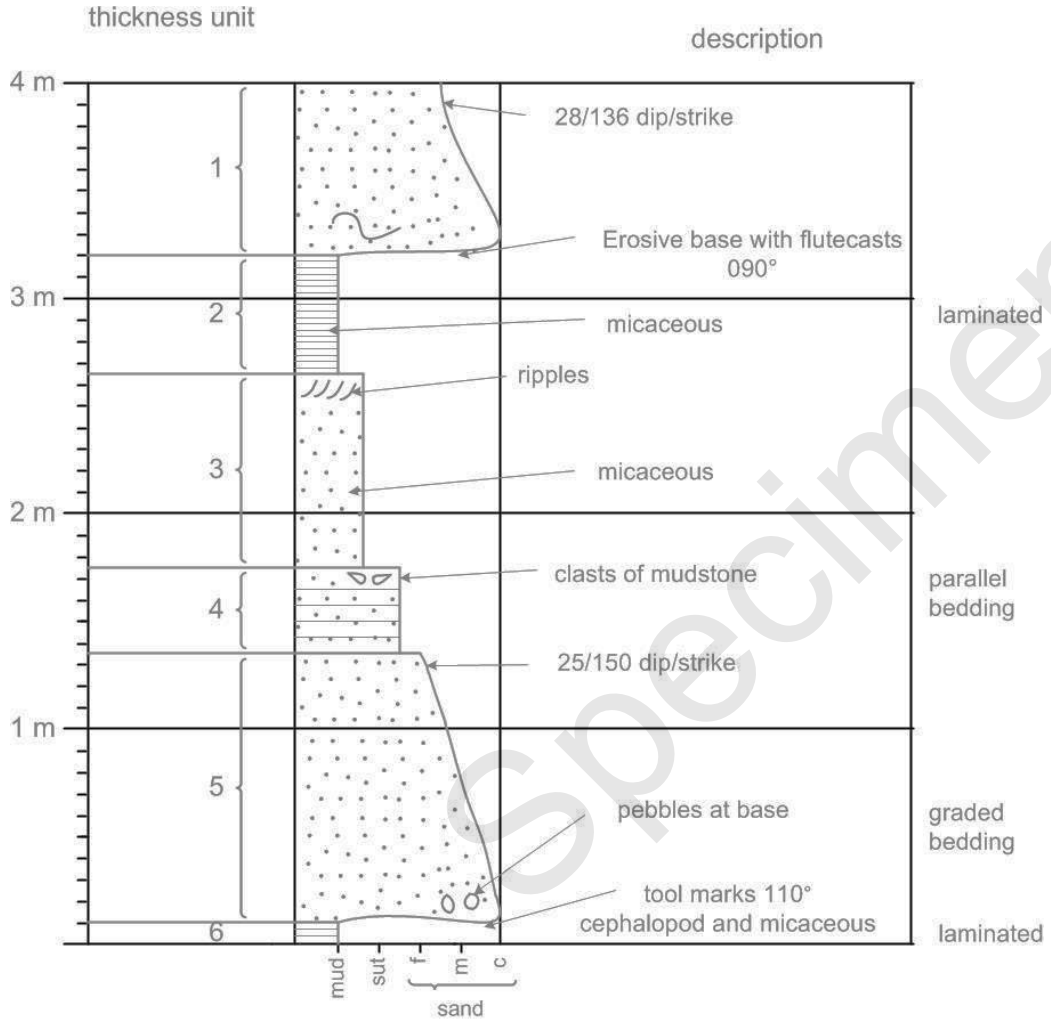
The breakdown of Assessment Objectives for GCE Geology:

	Assessment Objective
AO1	**Demonstrate knowledge and understanding of geological ideas, skills and techniques**
AO1.1a	Demonstrate knowledge of geological ideas
AO1.1b	Demonstrate knowledge of geological skills and techniques
AO1.1c	Demonstrate understanding of geological ideas
AO1.1d	Demonstrate understanding of geological skills and techniques
AO2	**Apply knowledge and understanding of geological ideas, skills and techniques**
AO2.1a	Apply knowledge and understanding of geological ideas
AO2.1b	Apply knowledge and understanding of geological skills and techniques
AO3	**Analyse, interpret and evaluate geological information, ideas and evidence to make judgements, draw conclusions, and develop and refine practical design and procedures**
AO3.1a	Analyse geological information, ideas and evidence
AO3.1b	Interpret geological information, ideas and evidence
AO3.1c	Evaluate geological information, ideas and evidence
AO3.1d	Make judgements
AO3.1e	Draw conclusions
AO3.1f	Develop and refine practical design and procedures

Question			Answer	Marks	AO element	Guidance
1	(a)	(i)	4.05 ✓	1	1.1d	
	(a)	(ii)	axes: labels correct **AND** unit on *y*-axis **AND** sensible scales used ✓ **ALL** points plotted correctly ✓ line of best fit included ✓  	3	2.1b x 3	**DO NOT ALLOW** mark if axes are reversed
	(b)		Uses graph to determine molarity of sample **A** (= 2) ✓ But, can't be sure that pollutant is NaC*l* / density may be related to other pollutants (**AW**) ✓	2	3.1a 3.1c	**ALLOW ECF** from line of best fit drawn in part **(a)** **ALLOW** correct examples of other pollutants which may harm life

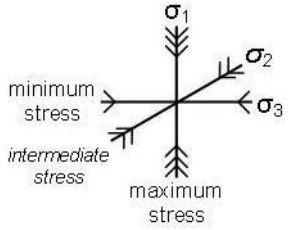
Question			Answer	Marks	AO element	Guidance
	(c)		***Any two from*** • Increase number of known molarities tested to improve confidence in calibration curve (**AW**) • Determine drop times for known solutions of lower/higher molarity, so that the line of best fit can be extended / so that molarity for sample **B** can be confirmed • Standardise drop sizes as different sized drops will affect fall rate • Perform all tests at the same temperature, as this affects viscosity of fluids ✓✓	**2**	**3.1f x 2**	**ALLOW** suitable correct additions to equipment in context for one mark
	(d)		**Description**: increase in cement in the pore spaces **/** increase in clay content of pore spaces **/** decrease in clast size ✓ **Explanation**: reduces the connectivity of pore spaces and so reduces movement of water through the aquifer (permeability) ✓ **OR** **Description**: extraction of water from a well ✓ **Explanation**: reduces water flow in the aquifer as water concentration gradient is more stable (water does not flow towards the well) ✓ **OR** **Description**: decrease in hydrostatic pressure ✓ **Explanation**: may reduce the flow of water in an aquifer ✓	**2**	**1.1a** **1.1c**	
			TOTAL	**10**		

Question			Answer	Marks	AO element	Guidance
2	(a)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 113 (cm) award 2 marks** $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$ true thickness = $\cos 25° \times 125 = 0.906 \times 125$ (cm) ✓ = 113 (cm) ✓	**2**	**2.1b × 2**	**ALLOW** 113.3 (cm) **ALLOW** 1.13 m **OR** 1.133 m, **MUST** include units
	(b)	**(i)**	Suitable scale chosen on *x*-axis, from fine grained to coarse grained **AND** key provided is clear ✓ Thickness of beds plotted correctly on *y*-axis. ✓ Grain sizes plotted showing differences from base to top of the units for beds 1 and 5 **AND** Grain size plotted correctly for beds 2, 3, 4 and 6 ✓ Graded bedding, ripples, laminated, parallel beds indicated correctly in the six beds **AND** Rip up clasts drawn and labelled in bed 4 **OR** position of fossil indicated in bed 6 ✓ Palaeocurrent data / dips and strikes indicated in correct beds **OR** Flute casts / tool marks labelled at the base of bed 1 and bed 5 ✓ (*see example log on next page*)	**5**	**1.1d** **2.1b × 4**	**ALLOW** if unconventional symbols are used to gain marks as long as they are qualified **ALLOW** one plotting error for grain size to gain mark **ALLOW** one omission of sedimentary structures to gain mark **ALLOW** symbols rather than labels to be used to gain mark **ALLOW** one piece of numerical data to be omitted to gain mark

Question	Answer	Marks	AO element	Guidance
				

Question			Answer	Marks	AO element	Guidance
		(ii)	Describes rapid deposition **OR** describes turbidite deposit formed ✓ Evidence for rapid high energy deposition, from either erosive base / tool marks / flute casts / rip up clasts / ripples ✓ Cycles indicate waning current from base to top of unit (Bouma unit A to E) ✓	**3**	**3.1e** **3.1b × 2**	**ALLOW** alternative wording for rapid deposition, including Bouma sequence
		(iii)	facies analysis / analysis of facies (**AW**) ✓	**1**	**1.1b**	**DO NOT ALLOW** basin analysis
			TOTAL	**11**		

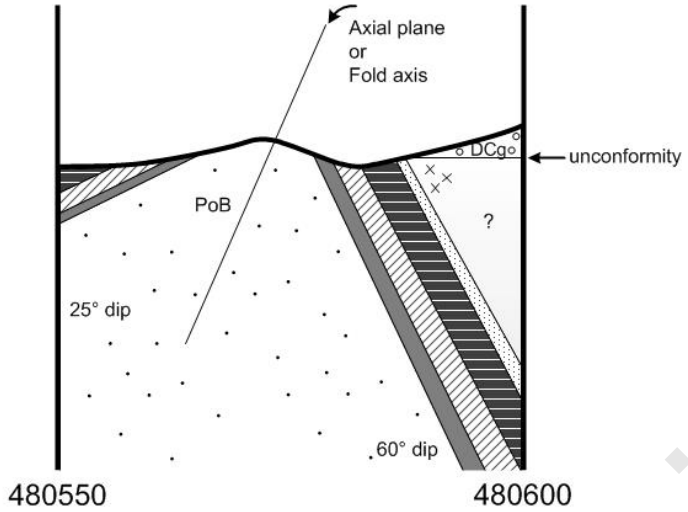
Question			Answer	Marks	AO element	Guidance
3	(a)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 31.6(%) award 2 marks** max distance measured of crust (from top left to land edge on rhs) = 100 mm actual width of crust = (3 m / 16 mm) × 100 mm = 18.75 m **AND** width of dykes (from table) = 4500 mm **OR** 4.5 m **AND** original width of crust = 18.75 – 4.5 = 14.25 m ✓ crustal extension = $\frac{4.5}{14.25}$ × 100% = 31.6(%) ✓	**2**	**2.1b × 2**	**ALLOW** if alternative width of crust was measured and indicated on the map (e.g. from D1 to D5) if correctly calculated **ALLOW ECF** **ALLOW** 2 SF to calculator display, correctly rounded
	(b)		***Any two from*** • assimilation; melting of different compositions of rocks into the magma chamber (e.g. assimilation of felsic rocks will cause an increase in SiO_2 in the magma) • differentiation; magma separates into layers based on density • fractionation; removal of dense crystals or early formed minerals from the magma • increase of SiO_2 in magma explained using Bowen's reaction series – changing composition due to crystallisation in a magma chamber ✓✓	**2**	**2.1a x 2**	**ALLOW** only if explanations given for the processes described, do not simply allow processes unqualified (e.g. assimilation)
	(c)		measure orientation of dyke using compass part of the compass clinometer ✓ take strike / trend along length of dyke along a horizontal line ✓	**2**	**1.1b** **1.1d**	**ALLOW** if trend / strike is discussed instead of orientation throughout
			TOTAL	**6**		

Question			Answer	Marks	AO element	Guidance
4	(a)		maximum stress (σ_1) is vertical ✓ the minimum stress (σ_3) is horizontal across the plain of the photo ✓	2	2.1a × 2	**ALLOW** annotated diagram  The identification of the intermediate stress/ σ_2 (in the fault plane) is **NOT** required
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = ×0.25 award 2 marks** magnification = $\frac{2.5}{10}$ ✓ = ×0.25 ✓	2	1.1b x 2	First mark awarded for evidence of correct working.
			TOTAL	4		

Question			Answer	Marks	AO element	Guidance
5	(a)		directional stress / pressure during metamorphism / folding / mountain building ✓ ***Any two from*** • schistosity minerals grow / recrystallise due to effect of stress / pressure • boudinage form by necking during extension of competent rock • recumbent folds form during compression when folds overlap • refolding is evidence of more than one phase of compression during mountain building ✓✓	**3**	**1.1a x 1** **2.1a x 2**	
	(b)*		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Gives detailed evaluation and judgement on method provided. **AND** Proposes relevant refinements and additions to practical procedure that allow identification of multiple phases of metamorphism **AND** wider conclusions re geological environment or history. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Gives evaluation and judgement on method provided. **AND** Proposes relevant refinements and additions to practical procedure that allow identification of more than one phase of metamorphism **OR** wider conclusions re geological environment or history.	**6**	**3.1c × 2** **3.1d × 1** **3.1f × 3**	**AO3.1c – Evaluate given method** • sampling strategy poor as undersamples pelitic rocks which are most informative, other types less useful for identifying multiple phases • only index minerals within rock samples identified • photo guides are ambiguous in the absence of a systematic key • other minerals would show evidence for multiple phases (garnet with trails / rims / inclusions / shadows) • transect across contact is good • if silicic intrusion after regional metamorphism may not be hot enough to produce contact metamorphism • method does not provide detail of cleavage and jointing • method does not provide details of geological structures or location of samples taken

Question			Answer	Marks	AO element	Guidance
			There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence. **Level 1 (1–2 marks)** Some identification of shortcomings in method provided. **AND** Attempt at increase in data collection for identification of contact and regional metamorphism **OR** wider conclusions, which may lack detail. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.			**AO3.1d – Make judgement on method** • method is poor • insufficient data to enable a conclusion for more than one phase of metamorphism • no data to allow conclusions on geological structures / phases of folding / orogenic history **AO3.1f – Develop and refine practical procedure** • refine selection criteria for stratified sampling to increase pelitic rocks • record additional data on minerals in rock samples / collect samples to observe/test in the lab • systematic approach to identifying minerals using a classification scheme / key, and tests • record measurements of geological structures (e.g. trends, folds, dips, cleavage, lineations, crenulations) using compass clinometer • record locations • propose systematic approach to research (e.g. classification of minerals, approach to sampling, identification of structures allowing multiple phases of metamorphism and folding to be concluded)
			TOTAL	**9**		

Question			Answer	Marks	AO element	Guidance
6	(a)		Overall evaluation that position of reservoir is not ideal ✓ *Supporting analysis – any 3 from the following list:* • reservoir is sited on drift deposits (Quaternary head and estuarine alluvial), which lack structure and strength • limestone beneath drift deposits is jointed meaning water could leak from the reservoir • beneath limestones and drift there is the Old Red Sandstone Series, which have high porosity – water from limestones could migrate into these • large fault to the east of the reservoir may extend under the drift deposits, placing dam at risk of collapse due to earthquakes • unknown what lies beneath drift deposits to the south of the reservoir, potential hidden dangers **OR** requirement for expensive investigation ✓✓✓	**4**	**3.1c** **3.1a × 3**	**ALLOW** one mark maximum for a general discussion of leakage or subsidence from the reservoir without specific links to geological reasons
	(b)		Symbols used to show same rock type (key not necessary) ✓ Southern limb dipping 25º ✓ Northern limb dipping 60º ✓ Asymmetric anticline with correct number of beds plotted ✓ Axial plane **OR** fold axis labelled ✓ Position of unconformity marked to the north, plotted as horizontal or near horizontal beds ✓ Extrapolated beds under the unconformity in the north drawn or uncertainty shown (e.g. uses question mark) ✓ (*See sample cross-section on next page*)	**7**	**1.1d** **2.1b × 2** **3.1a** **2.1b** **3.1b × 2**	Dips on limbs are marked in terms of accuracy ±5º **ALLOW** one bed to be missed in the anticline to still gain the mark

Question			Answer	Marks	AO element	Guidance
						
	(c)*		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Gives reasoned conclusion based on identification of relevant features from the map and evaluation of risk, linking to detailed application of understanding of geological hazards relating to faults **AND** dipping beds, including the effect of water. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Gives conclusion based on identification of relevant features from the map and linking to application of understanding of geological	**6**	**2.1a × 2** **3.1a × 1** **3.1c × 2** **3.1e × 1**	**AO3.1a – Analyse geological information on map** • Faults / dipping beds near site identified **AO2.1a – Apply understanding of geological hazards** • Cross cutting / multiple faults are linked with earthquakes / indication of tectonic stress • Dipping beds identified as geohazard as slope failure may occur • Identification of water as a potential issue in mining relating to swelling clays

Question			Answer	Marks	AO element	Guidance
			hazards relating to faults **AND** dipping beds. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Identifies faulting **OR** dipping beds as potential hazard with some link to understanding. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.			**AO3.1c – Evaluate geological information, ideas and evidence** • Moderate risk of movement along faults, if blasting occurs in the quarry • Dipping strata may be lubricated along boundaries causing slope failure during extraction **AO3.1e – Draw conclusions** Gives geological reasons why the quarry should or should not be allowed planning permission, matched with reasoned observations
	(d)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 149.9 (m) OR 150 (m) award 3 marks** distance measured on map = 17 mm 1 mm = 50 m 17 × 50 = 850 m ✓ $\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$ depth = tan 10° × 850 m ✓ = 149.9 (m) **OR** 150 (m) ✓	**3**	**2.1b × 3**	Use of tan rule may be inferred from method or correct answer.
			TOTAL	**20**		

Summary of updates

Date	Version	Change
January 2019	2.1	Minor accessibility changes to the paper: i) Additional answer lines linked to Level of Response questions ii) One addition to the rubric clarifying the general rule that working should be shown for any calculation questions
July 2019	2.2	Minor typographical amends - Mark scheme (Question 2a)