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A LEVEL

Examiners' report

GEOLOGY

H414

For first teaching in 2017

H414/03 Summer 2024 series

Version 1

Contents

Introduction 4
Paper 3 series overview 5
Question 1 (a) 7
Question 1 (b) (i) 8
Question 1 (b) (ii) 9
Question 1 (b) (iii) 10
Question 1 (c)* 11
Question 2 (a) (i) 14
Question 2 (a) (ii) 15
Question 2 (a) (iii) 15
Question 2 (a) (iv) 16
Question 2 (b) (i) 17
Question 2 (b) (ii) 18
Question 2 (b) (iii)* 18
Question 3 (a) (i) 20
Question 3 (a) (ii) 21
Question 3 (b) (i) 22
Question 3 (b) (ii) 23
Question 3 (b) (iii) 25
Question 3 (b) (iv) 26
Question 3 (b) (v) 26
Question 4 (a) 28
Question 4 (b) 29

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Paper 3 series overview

Paper 3; Practical Skills in Geology was introduced in 2019 as a replacement for the centre assessed and externally moderated coursework consisting of fieldwork or centre-based laboratory tasks and evaluative tasks. As such the focus of this paper is upon applied practical skills in relation to provided stimulus materials. Candidates will be expected to understand a range of field techniques which include:

- interpretation of rock/sediment/mineral/fossil descriptions
- ability to use fieldwork equipment such as compass clinometers
- photo interpretation including sketching to mimic
  - field sketching and labelling
  - manipulation of data such as measuring and converting scales
- construction and interpretation of Graphic logs
- plotting and interpreting a range of different types of graphs
- drawing and interpretating rose diagrams
- planning and evaluating results of laboratory experiments
- field observations
- map work to include:
  - drawing of cross sections
  - calculation of true thickness
  - interpretation of features shown on maps
  - labelling features onto maps
  - drawing conclusions from maps both coloured geological and outline problem maps
- Constructing geological histories from cross sections, photographs and maps

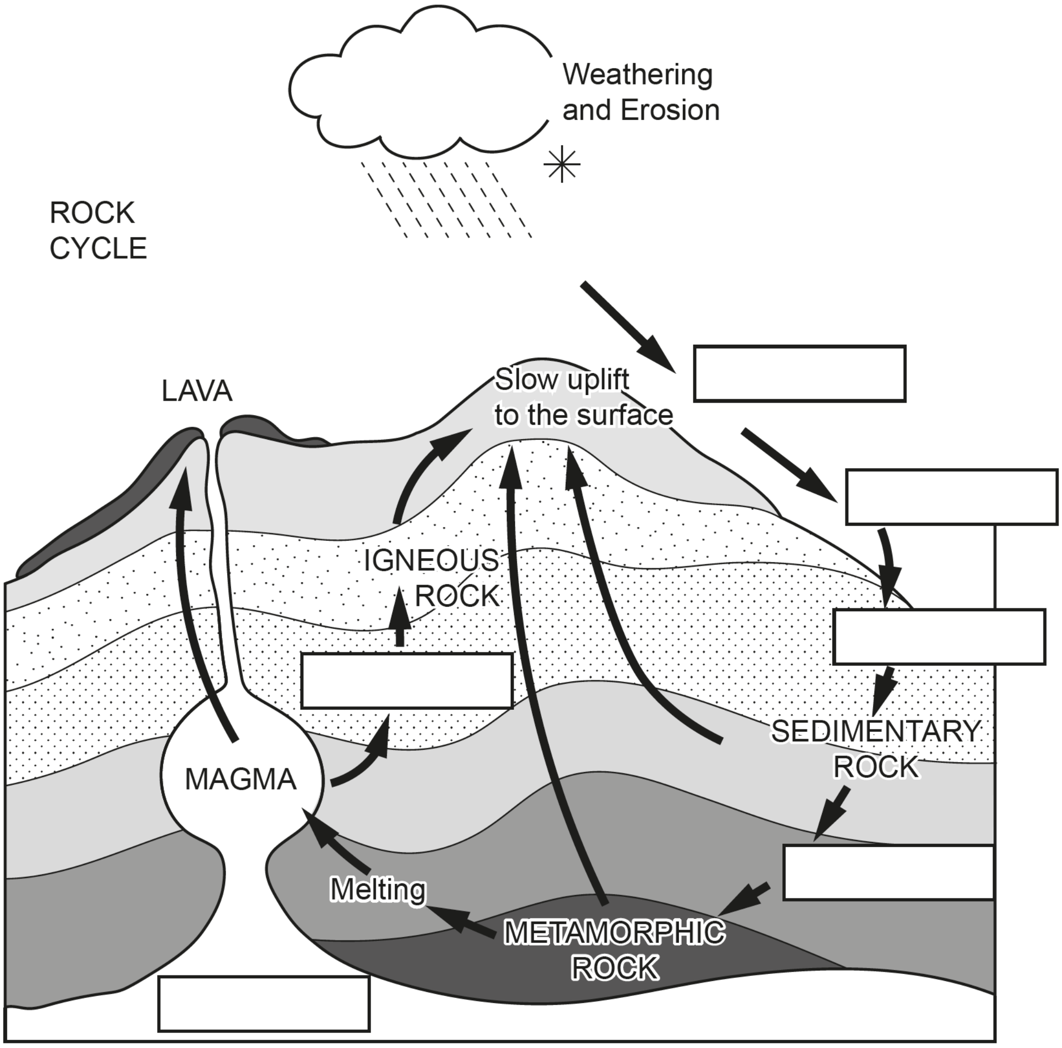
As such there will be an emphasis upon candidates being able to identify named minerals, rocks, sediment and fossils and to be aware of their diagnostic features. Theoretical knowledge will be tested as well but usually with the context of a specimen, diagram or photograph.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• carefully read the stem and any other information provided as part of the question and used stimulus material, where appropriate in answers • structured their answers to respond to the command words used e.g. Compare and contrast • showed workings for the maths questions as marks are available for workings even if the final answer is incorrect • could label axes for histograms and rose diagrams • were accurate with their labelling, plotting and drawing • for the extended prose questions provided a clear explanation of the geological history linked to detailed use of relative dating techniques and stages of the rock cycle. In the second question described formation of	• did not take account of information provided in the stem and so misidentified rocks and features pertaining to them • did not structure the extended questions as the stem outlined. Responses for example did not include required factors as outlined in the stem, usually providing just a geological history or failed to outline conditions of metamorphism • did not label rose diagrams appropriately often missing both the scale and bearings from the diagram. Others constructed incorrect types of graphs • were not precise in locating appropriate features on the cross section or in the 3 logs • described operator errors rather than shortcomings with the practical procedural process

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
schistosity and had an awareness of the stability of different index minerals and the conditions of metamorphism of this rock. Used terminology effectively, giving examples where appropriate • used rock and mineral names appropriately and could identify textures and crystal sizes appropriate to igneous and metamorphic rocks.	• did not show workings for the maths questions • did not write about the required number of issues e.g. two-mark questions will be awarded marks for two distinct points, if only one point is provided the second mark is lost.

Question 1 (a)

1
(a) The diagram shows the rock cycle.



Use the processes in the table to complete the rock cycle diagram.

Write the correct letter **A**–**F** in the boxes on the diagram.

A Burial, high temperatures and pressures	**B** Compaction and cementation	**C** Crystallisation of magma
D Magma forms from molten crust and mantle	**E** Sedimentation	**F** Transport

[3]

This question was generally completed to a high standard. Labels D, C F and B were most usually correctly located. Where confusion arose it usually applied to labels E and B having their positions reversed.

Question 1 (b) (i)

(b) **Fig. 1**, in the **Insert**, shows photographs of three hand specimens of igneous rock.

(i) Use the photographs to complete the table.

	Rock A	**Rock B**	**Rock C**
Crystal size (fine/medium/coarse)			Not visible
Texture			
Colour			
Rock type			

[4]

Candidates found this to be a demanding question, many struggled to use the scale to correctly identify A as a coarse-grained igneous rock. Many identified the texture of B as Porphyritic but failed to mention the two crystal sizes for the top row. Colour was generally completed to a good standard, and this was where most marks were gained. Many candidates misunderstand what was required for the final row and 'igneous' was a very common response, as was 'sedimentary' for rock B.

In general Rock C was well understood.

Assessment for learning

Regular classroom practice can help build familiarity with interpretation of specimens. This could be carried out using a range of hand specimens, photographs from previous exam series and images from the internet.

It is important to encourage candidates to read and use all the information provided, as often it will contain useful hints and tips to guide them in their response. Therefore, practical sessions could issue instructions which include vital information to help with the task being undertaken.

This can encourage candidates to read all the information and not to skim it in case vital points are missed, as happened with this question.

It would be useful to learn a table of igneous classification (e.g. on page 21 of the endorsed textbook).

Question 1 (b) (ii)

(ii) Draw a labelled sketch that is representative of Rock **B**.

Include a suitable scale.

[3]

The best responses where the ones where candidates drew the whole specimen. This made it easier for them to provide an appropriate scale and many successfully used the 5cm scale bar provided and drew an accurately proportioned rock hand specimen. Once this had been achieved it was more straightforward to draw crystals of the correct size and shape. Labelling was important and many candidates achieved full marks purely on the quality of their labelling skills. Many candidates provided good detail annotating their responses, not just providing one-word labels.

Assessment for learning

There will usually be one question on this paper where candidates are required to sketch a geological feature from a photograph. Regular practise of this skill is important to provide confidence with the sketching, labelling and drawing of a suitable scale.

A range of images can be used from OCR past paper resources as well as the internet and classroom specimens for practice. Aim to choose specimens/features where multiple things can be identified, drawn and labelled, as this can often make up for a lack of drawing skill.

OCR support

The Geology drawing skills handbook provides detailed guidance on helping students develop geological drawing skills.

Question 1 (b) (iii)

(iii) Compare and contrast the conditions of formation of Rocks **A** and **C**.

....

....

....

....

....

.... **[3]**

A significant number of candidates misidentified Rock A either as metamorphic or as a fine-grained igneous rock. It was unusual for it to be correctly identified as Gabbro or Diorite. A further mis understanding arose with speed of cooling and the size of the resulting crystals. Many candidates suggested either that the fine-grained rock had taken a long time to cool or that it had cooled plutonically because it was fine grained.

Most candidates identified Rock C as cooling very rapidly although many failed to state where it solidified. The ideal answer was to use to use the terms 'intrusive' for Rock A and 'extrusive' for Rock C.

A significant minority described Rock B.

Very few candidates recognised the need to include a comparison point. Those that did mainly suggested they were both igneous or that both had cooled from magma. The idea that both exhibited one stage of cooling was missed.

Assessment for learning

Exam technique is important as it helps candidates to maximise their chance of gaining all the marks available for a question, rather than some or even none. Candidates struggled to respond to the command words used in this question, tending to ignore the Compare part.

Classroom tasks could be used to highlight the demands of different command words ranging from low level, such as 'List' to high level such as 'Evaluate'. A clear understanding of what the command word requires can help candidates to structure their answer and gain more marks. In this case the response needed similarities as well as differences if full marks were to be achieved.

Question 1 (c)*

(c)* **Fig. 2**, in the **Insert**, shows a sketch of a cross section through an area that has been intruded by an igneous body.

Explain how the information shown in **Fig. 2** provides evidence for the processes of the rock cycle. You should refer to relative dating principles and structure your answer to start with the earliest event.

....

....

....

....

....

.... **[6]**

This Level of Response question gave candidates a chance to show a range of knowledge across three topics, including working out a geological history, application of relative dating techniques and an understanding of the rock cycle. Candidates tended to answer to a good level, many wrote detailed responses showing a high level of understanding. A significant number continued their answer onto extra paper. The task had three components integrated into it, this provided candidates with different ways to structure their answers. Most chose to focus on the geological history, with reference being made to relative dating techniques and rock cycle processes as they progressed through the history. Strong responses included comments about the law of superposition as they described the order of deposition of the lower series of sedimentary rocks, followed by compaction, cementation and diagenesis then the law of original horizontality to indicate titling. They mentioned intrusion of magma and crystallisation as it cooled, recrystallisation in the metamorphic aureole and the law of cross cutting relationships and law of included fragments. Followed by awareness of uplift and erosion before the younger series of rocks was deposited.

A smaller number described the sections separately.

Many candidates scored well here showing a high level of knowledge and interpretation of the diagram stimulus material.

There were virtually no 'No Response' answers and nearly all candidates were awarded marks for this question.

Exemplar 1

- First the sediments of O → F were deposited horizontally (law of original horizontality), with O first, then M, etc.
- Beds E and N are the same bed, because they have the same dip and I can draw an imaginary line at that dip to connect them and they are the same rock type
- Then these beds were folded so they are no longer horizontal
- Then a melt intruded ~~the granite~~, causing some bedrock to break off forming xenoliths
- We know the granite intruded after the beds were laid due to the law of included fragments, eg. I must have been deposited and lithified first to be included in the granite
- The hot magma ~~formed~~ recrystallised the surrounding country rock with its high heat (contact metamorphism) forming a baked margin in the country rock
- The cold country rock ~~chill~~ cooled the outside of the intrusion forming a chilled margin
- After the granite cooled, the surface was eroded
- Then beds D → A (in that order) were deposited, forming an unconformity
- D must be younger than the granite because: law of included fragments and the law of superposition (D is on top of the granite so as long as all the beds haven't been **[6]**

Extra answer space if required.

overturned D must be younger

Order of events : Deposition of O, → M → K → J → G → E and N → L → I → H → F

: Folding

: Igneous Intrusion

: Erosion

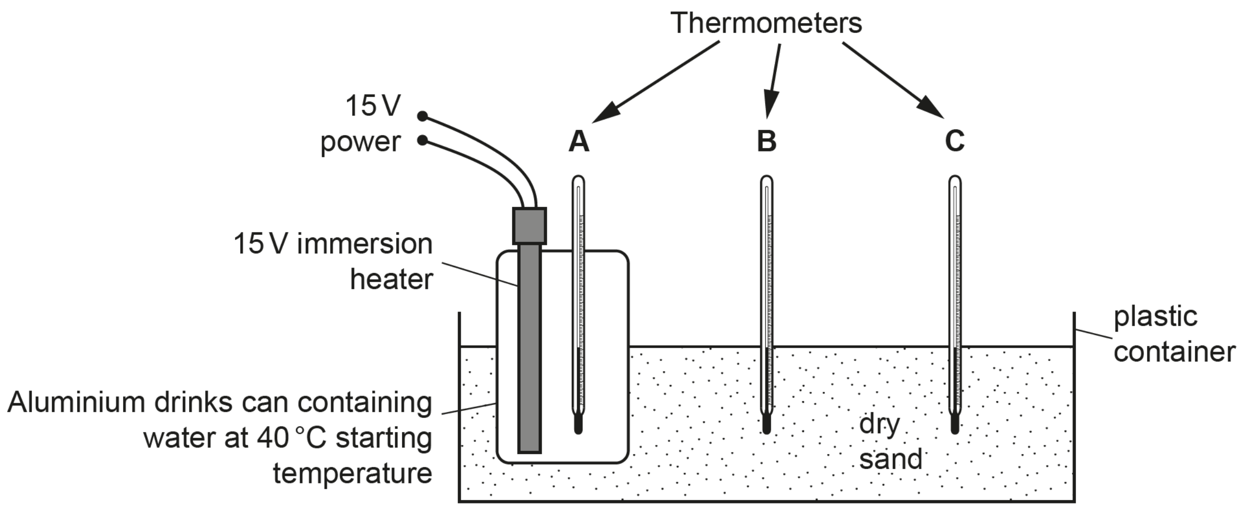
: Deposition of D → C → B → A

Exemplar 1 shows a typical Level 3 response. It outlines a correct geological sequence of the lower series of sedimentary rocks at the start and links rock formation to the law of original horizontality. It recognises that folding came next followed by intrusion creating xenoliths, with reference to the law of included fragments. There is reference to the country rocks being recrystallised and a chilled margin forming in the granite. Erosion of these older rocks occurred forming pebbles of granite which were incorporated into rock D and the law of included fragments is named. The last part of the history is correctly identified as forming unconformably on top of this erosion surface according to the law of superposition. Finally, a clear sequence of events is shown as a list.

This response gives the correct sequence and uses relative dating. At first appearance the rock cycle is not implicitly quoted, however upon closer inspection there are many rock cycle processes correctly identified in the correct place such as deposition, intrusion, recrystallisation, cooling of magma, erosion returning to deposition. This is a very god example of a top-level response.

Question 2 (a) (i)

2 A student carried out a practical exercise to simulate contact metamorphism. The diagram shows how their experiment was set up.



The experiment ran for 15 minutes. The temperature of each thermometer was recorded every 3 minutes. The results are shown in the table.

Time (minutes)	Temperature (°C)		
	Thermometer A	Thermometer B	Thermometer C
0	42	19	19
3	42	20	19
6	43	21	19
9	46	23	19
12	50	24	19
15	54	25	20

(a)
(i) Use the data in the table to calculate the percentage change in temperature in Thermometer **A** between 0 and 15 minutes. Give your answer to **2** significant figures.

= .... % **[2]**

Many candidates found this question straightforward with many achieving full marks. The equation required was generally quite well-known. Errors where they occurred, arose due to the wrong number being used as the denominator, when the two numbers in the numerator part of the equation were reversed or when candidates forgot to multiply their answer by 100.

It is important for candidates to show their working as a mark can still be awarded for correct procedures.

Question 2 (a) (ii)

(ii) Thermometers **B** and **C** are 10 cm apart. Calculate the change in temperature per cm of sand between Thermometers **B** and **C** at 15 minutes.

= .... $°C\,cm^{-1}$ **[2]**

This was another question where candidates performed well, with most candidates providing the correct answer.

Question 2 (a) (iii)

(iii) Suggest how **and** why the transfer of heat might be different if wet sand was used instead of dry sand in the experiment.

....

....

....

.... **[2]**

Heat transfer and the impact that water in pore spaces can have on it was poorly understood. Many candidates did not realise that heat transfer would be quicker and did not score any marks on this question. Likewise, few knew that water is a more efficient conductor of heat than air and that this can aid the heat transfer.

Assessment for learning

Many candidates only made one point in their answer thus it would not be possible to score more than one mark. Raising awareness of exam technique and looking at how many marks are available can help candidates realise that they need to write two valid points to be able to access maximum marks.

Question 2 (a) (iv)

(iv) Identify **three** problems that may affect the accuracy of this experiment.

1 ....

....

2 ....

....

3 ....

....

[3]

Many candidates misunderstood what this question was asking and instead of writing about procedural errors, in the way the experiment had been set up (e.g. difficulties in ensuring that all the thermometers were buried to the same depth), wrote about potential operator errors (such as not repeating the experiment).

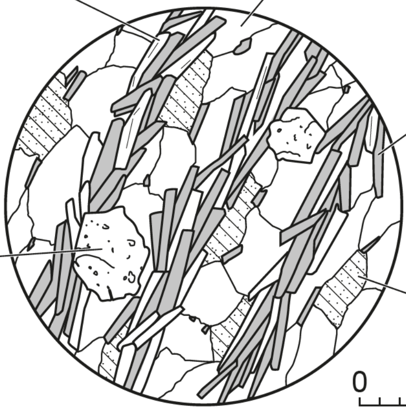
The layout of the response points encouraged most candidates to provide three responses, allowing them to have the opportunity to achieve maximum marks.

Assessment for learning

Whenever a classroom experiment is set up, for example for a PAG assessment, candidates could be set a task asking them to explain what problems might affect the accuracy of the experiment. A separate task could also be asked for them to outline what operator errors could occur. Thereby raising awareness of the difference between them.

Question 2 (b) (i)

(b) The thin section diagram shows a metamorphic rock.



(i) Describe the metamorphic fabrics shown in the thin section diagram.

....

....

....

.... **[2]**

The diagram was well understood, most candidates recognised that this showed a regional metamorphic fabric. Several responses were possible including schistosity, foliation and aligned micas; all of which were popular choices. A common source of error was to identify gneissosity or gneissose banding. This was incorrect as the dark minerals here were only micas, rather than micas and mafic minerals, also the banding in gneisses is usually more irregular.

The second mark was awarded for recognition of a porphyroblastic texture or the presence of garnet porphyroblasts, this was a little less known, a minority of candidates used the igneous term porphyritic instead.

Question 2 (b) (ii)

(ii) **Circle** the rock type which most closely identifies with the thin section diagram.

gneiss	**metaquartzite**	**marble**
schist	**slate**	**phyllite**

[1]

Candidates who recognised schistosity or foliation usually achieved the correct answer of schist here. Whilst those who had opted for gneissosity in Question 2 (b) (i) nearly always got this question wrong. A small minority opted for other choices.

Question 2 (b) (iii)*

(iii)* Explain how the mineralogy and texture shown in the thin section diagram indicates the conditions of metamorphism.

....

....

....

....

....

.... **[6]**

Many candidates showed a good understanding of how metamorphic textures can indicate the conditions of metamorphism and the majority recognised that this thin section represented a regionally metamorphosed rock. A significant number could write about the role of pressure in forming the alignment. Higher level responses tended to develop the idea that foliation formed perpendicular to the direction of pressure. A few were able to accurately indicate pressure amounts or depths at which the metamorphism most likely occurred.

The idea that increasing temperature can change the mineralogy was generally well-known. The term 'index minerals' was not always used but was still shown to be understood. Many recognised that garnet is the index mineral for medium grade and signifies medium temperatures. A few higher-level responses quoted accurate temperature ranges. Other higher-level responses included comments that the rock had to be medium grade as kyanite and sillimanite were not present.

Other responses correctly indicated the condition of formation as being at a destructive plate margin or as greenschist facies.

Some candidates were less sure of this topic but were able to make use of the thin section labels and were able to provide some relevant points and as a result accessed some marks. There were very few 'No Response' answers for this question.

Exemplar 2

The mineralogy and texture indicate an intermediate level of regional metamorphism, with high pressure and ~~att~~ relatively low temperature (but still above 200°C as below this is the conditions for diagenesis.) This is indicated by the presence of low level metamorphic index minerals – biotite ~~an~~ – and intermed-iate level index minerals – garnet. The ~~t~~ schistocity within the sample indicates that there must have been enough pressure to align platy minerals and form the charac-teristic light and dark bands of schist. However the lack of high ~~pres~~ grade index minerals e.g. kyanite or siliminite indicates that the temperature and pressure **[6]**

Extra answer space if required.

conditions were not high enough for high grade metamorphism. The garnet porphyroblasts indicate a high enough pressure for recrystalis-ation and growth of garnet.

Exemplar 2 is a Level 3 response; it is succinct and strong on the index minerals to be expected in a medium grade regionally metamorphosed rock. It names biotite as a low-grade index mineral and garnet as being the indicator for medium grade, as well as noting the absence of kyanite and sillimanite at higher grades. It also quotes some values for temperature, although it is slightly on the low side and comments that garnets need quite high pressure to form.

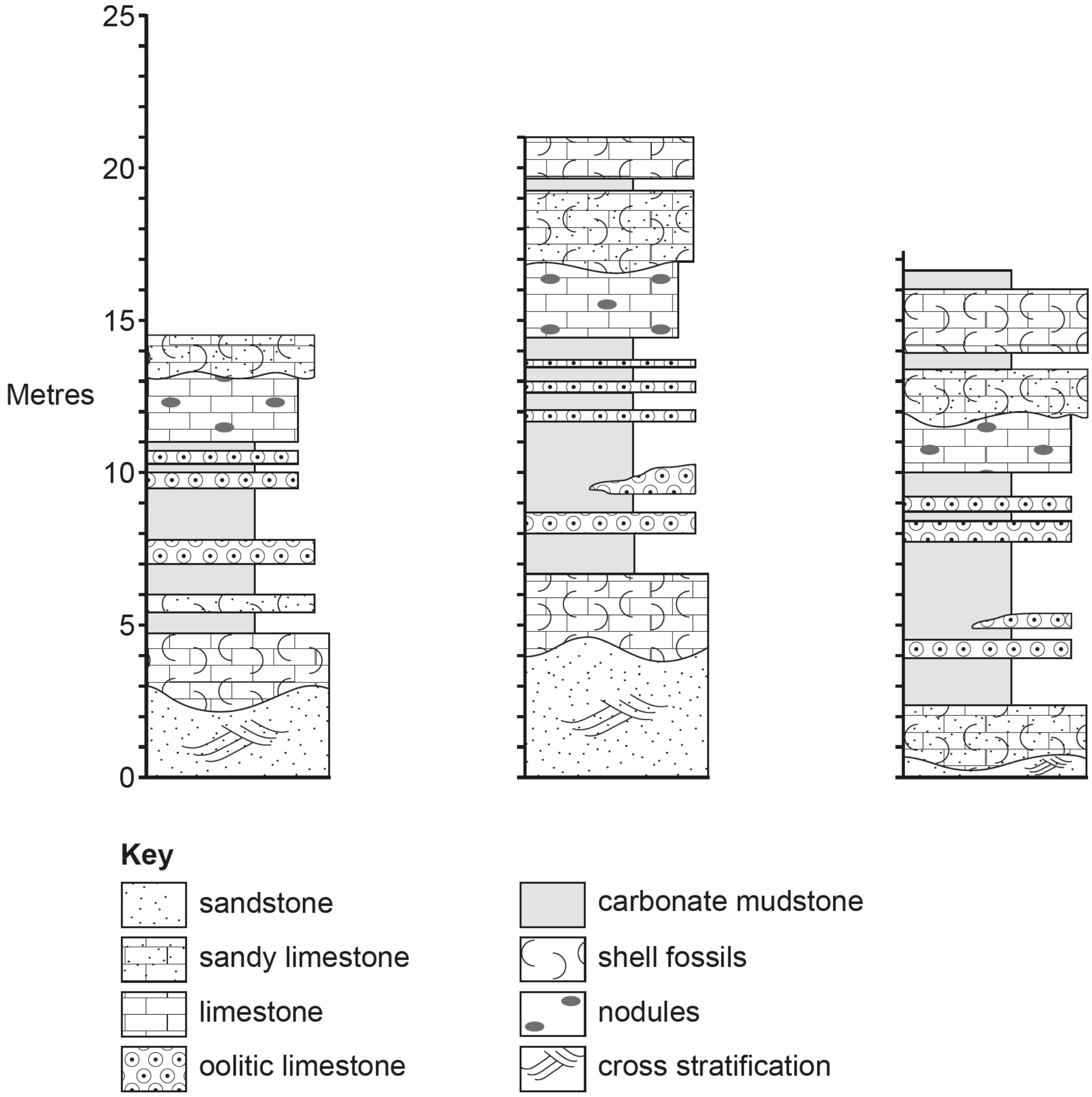
Porphyroblastic and schistose textures are recognised with the comment that the pressure was high enough to align the micas and form the light and dark banding common in schists.

It does not state that the foliation is perpendicular to the pressure but there is still enough covered in this response to firmly place it in the top level.

Question 3 (a) (i)

3

(a) The diagram shows summary sedimentary logs taken by a student through part of the cyclic Upper Jurassic sequence in the UK.



(i) Draw **three** lines between each of these sequences to correlate them using lithostratigraphic methods.

[2]

Many candidates found this a demanding question and struggled to identify the key lithostratigraphic indicator beds. A minority drew lines for most beds instead of providing the three lines asked for in the question.

The most easily identified correlation points were the bases of the two shelly limestones and base of the nodular limestone. A significant number of candidates identified the correct beds but did not draw their lines correctly, with many drawing lines from the middle of these beds rather than at the base. The lines need to connect to the correct bed junction on all three logs.

A small number of candidates correctly identified the correct junctions but only drew a short line across the log and did not join it to the corresponding junction on the other two logs. Therefore, the mark could not be awarded.

Question 3 (a) (ii)

(ii) The rocks were correlated using biostratigraphy and it was noted that this did **not** match the lithostratigraphic correlation. Explain the reasons why this could occur.

....

....

....

.... **[2]**

A significant number of candidates did not understand this question, their answers were most commonly explaining what lithostratigraphy/biostratigraphy was and not linking it to the question

Those who scored marks on this question showed that derived fossil and diachronism were the most understood concepts. A few wrote about lateral variation. A number did not remember the correct terminology but through determined and detailed explaining of what they meant were able to score marks without using technical terms. This is to be encouraged as it demonstrates that knowledge gains marks even if correct terminology has been forgotten.

Assessment for learning

Basin deposition can be a complex topic and making linkages about lateral facies change across an area can be a difficult concept to grasp.

One useful way to illustrate lateral facies change is to use a cross-section diagram of a prograding delta, showing different layers of rock forming in the three zones of the delta. Different beds can be shaded in different colours. As the delta progrades, continuous deposition of sedimentary rocks occurs but the actual position where each rock forms moves sideways. By constructing several stages of a prograding delta, a clear pattern of distinct rocks forming in different positions over time becomes clearer. These rocks illustrate diachronism.

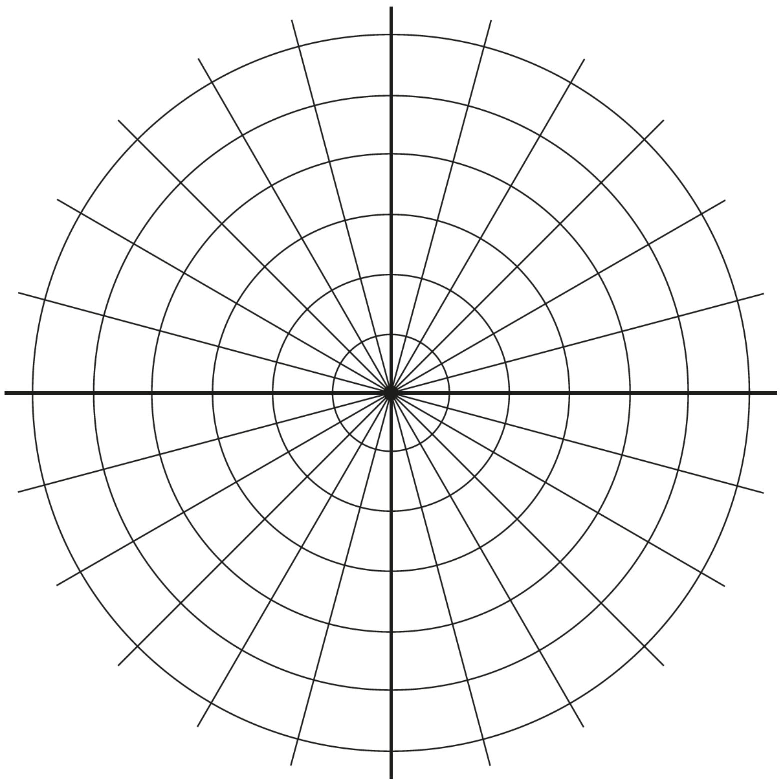
Question 3 (b) (i)

(b) Field data was collected from some Lower Jurassic rocks containing belemnite fossils. **Fig. 3**, in the **Insert**, shows part of a bedding surface containing belemnites.

Students measured the long-axis orientation of 135 belemnites on this bedding surface. The data is recorded in the table.

Orientation (°)	Frequency
001–015	0
016–030	0
031–045	5
046–060	32
061–075	60
076–090	20
091–105	10
106–120	8
121–135	0
136–150	0
151–165	0
166–180	0

(i) Plot the results from the table on the rose diagram outline.



[2]

The data for this task was all provided in the table above with clear three figure orientations and frequencies shown.

Whilst many candidates were able to draw a graph of the correct shape, many did not put any axes onto their diagrams, thus rendering them incorrect. If there are no orientations plotted and no scale for the frequencies is given (essentially a Y axis of a graph) then marks cannot be awarded as the graph is incorrect, as it is not possible to ascertain if the candidates understood where to plot the points.

The best responses showed three figure orientations for the whole range of the data plotted and used one of the vertical spokes of the circle, usually the north line, to label the y axis scale.

Assessment for learning

Regular practice of plotting rose diagrams can be useful as it can cement understating of how to accurately label the graph as well as reinforcing the idea of how orientations can relate to the main compass points. Good practise is for candidates to use three figure values for orientations as is also encouraged in recording strike readings, where strike readings are three figures' orientations from north.

Question 3 (b) (ii)

(ii) State the palaeocurrent direction you have plotted on your rose diagram.

Explain how your rose diagram **and Fig. 3**, in the **Insert**, could provide information about the palaeocurrents.

....

....

....

.... **[2]**

Candidates found this to be quite a demanding question, many provided only part of the detail, which was required, which was insufficient to gain any credit. There is a requirement for the use of compass points to be quoted in answers relating to current direction. As the orientations had already been given to the candidates in the previous question, there would be no value in simply getting them to repeat the three figure numbers here. Candidates were required to convert the values into a compass reading and recognise the current direction of ENE or WSW.

The second mark was for a comment regarding the energy of the current causing the alignment of the belemnites or a description of how the Belemnites were positioned. The concept of the belemites just being aligned was insufficient, they had to demonstrate that they understood the way in which they were orientated.

Assessment for learning

Regular practise of converting orientations into compass bearings is to be encouraged. Use of past OCR papers, including legacy Evaluative and Centre Based task exercises can help with providing examples to use.

OCR support

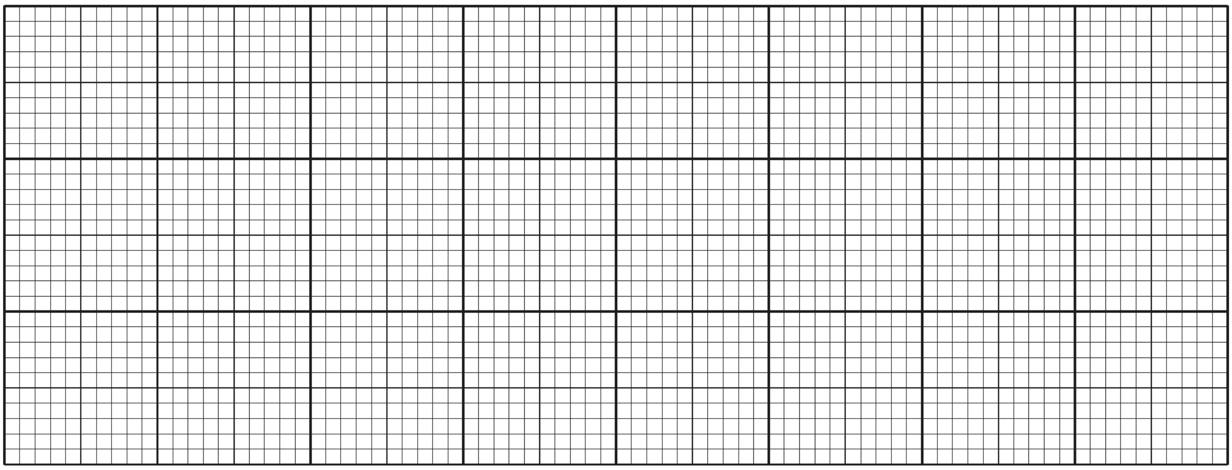
The legacy coursework tasks can be found in Teach Cambridge.

Question 3 (b) (iii)

(iii) Students also measured the long axis length of the same 135 belemnite fossils on the bedding surface in **Fig. 3**, in the **Insert**. Their results are shown in the table.

Length (mm)	Frequency
0–10	0
11–20	0
21–30	0
31–40	5
41–50	15
51–60	17
61–70	37
71–80	48
81–90	13
91–100	0

Plot a histogram of the results from the table on the grid.



[3]

Histograms were well known, candidates tended to score well on this question. However, about a fifth of candidates plotted the wrong type of graph, most usually a line graph and there were a few 'No Response' answers to this question.

The most common reason why candidates did not achieve full marks for this question was incomplete labelling of the graph axes. The y axis should be labelled 'Frequency' and the x axis 'Length in mm'. The units are important and were needed for the axes mark to be awarded.

Question 3 (b) (iv)

(iv) Describe the frequency distribution shown on your graph.

....

.... **[1]**

This question resulted in most candidates not gaining any marks. This was because most misinterpreted what was being asked. The question wanted a recognition that the graph was skewed, however nearly all the candidates described the size of belemnites which was an interpretation, rather than a description of the shape of the graph they had produced.

Misconception

Candidates need to have a greater awareness of how to describe the shape of a graph, using terms such as skewed, normal distribution, right/left skew and positive/negative skew. Practise with this skill in classroom exercises will help build familiarity.

Question 3 (b) (v)

(v) Use the rose diagram **and** frequency distribution graph you have plotted to describe the likely palaeoenvironment at the time of deposition of this rock unit.

....

....

....

....

....

.... **[4]**

This question was worded to encourage candidates to structure their answer to include their observations from the rose diagram and histogram. Most were able to write in good detail with many using up the extra space at the base of the page or on a continuation sheet. However, many did not respond fully to the guidance in the question, so there were many candidates who did not refer to the rock shown in the photo, the rose diagram or histogram. This therefore reduced the marks they could achieve.

A lot of candidates understood that the presence of belemnites indicated a marine environment, although a significant minority thought they were freshwater organisms and that it was a river environment. This error was compounded by the presence of a uni-directional current, which caused many to write about fluvial environments. Those who referred to the rose diagram made the connection about the uni-directional current, which in a marine environment would suggest a turbidity current.

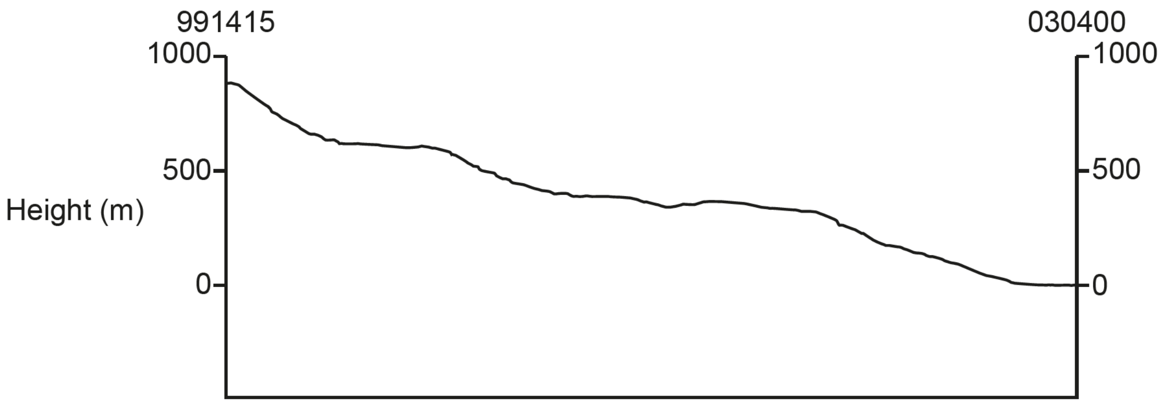
Strong responses explained that there had to be some energy present as the belemnites preserved were not only aligned but were large. This suggested that smaller ones may have been too light to have been deposited. A number also recognised that the rock the belemnites had been deposited in was fine grained. Therefore, it could not have been deposited during the high energy part of the turbidite/Bouma sequence, which was represented here, but as energy was falling. Otherwise, the belemnites would have been ore broken up.

Several candidates opted for a deltaic environment, which was acceptable if they were clear about it being the marine part of a delta such as the delta front or pro delta. If candidates just wrote delta that was not specific enough.

Question 4 (a)

4 The 1:50 000 geological map excerpt (the Isle of Arran), in the **Insert**, should be used for this question.

(a) On the topographic sketch, draw and clearly label a cross section from grid reference 991415 in the West to 030400 in the East.



[5]

The cross section this year produced reasonable responses with many candidates able to identify the four faults along the section line and the difference in dip of the Devonian and Permian rocks. The intrusion was identified and drawn, usually with a steep angle/irregular contact, although a significant number plotted it at the same angle as the Cambrian beds next to it. A few labelled the metamorphic aureole but many drew symbols suggesting they had recognised the position of the aureole but failed to label it.

Marks were often lost due to lack of labelling, e.g. as mentioned before the aureole and often the faults were drawn but not labelled. The naming of the beds was problematic, so the mark scheme allowed for candidates to label the beds using the codes from the map e.g. cG, DCNS or the names taken from the ley, e.g. Garvock Group, Brodick Beds or the rock types described in the key e.g. for the BRLB Brodick beds Sandstone and Breccias. This enabled more to gain the labelling of 3 or more rock types mark, M1.

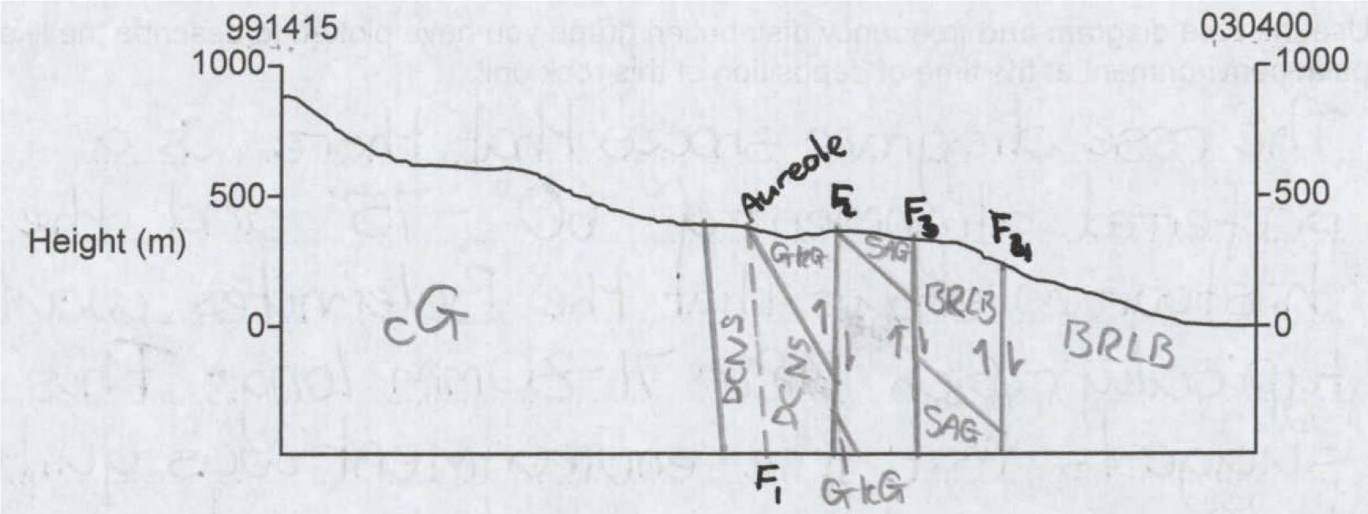
About a fifth of candidates are still finding cross sections very demanding and did not achieve any marks on this question.

Assessment for learning

Cross sections will keep being tested on this paper; therefore it is important for candidates to have had practise at completing them.

For candidates who struggle with this concept and to visualise the geology of a cross section, simple steps can still be taken to gain marks. Plotting of faults with downthrows indicated by a tick or slanting fault lines together with labelling of all the faults will achieve a mark. Drawing of igneous intrusions with steep/irregular contacts will gain a mark, as will correct labelling of rock names. So, it is possible for lower achieving candidates to be able to access marks without being able to draw all the correct geology, especially the complicated bed positions within fault complexes.

Exemplar 3



Exemplar 3 shows a cross section which gained maximum marks, it is clear and easy to see the features drawn. All the rocks are clearly labelled including within the fault complex, showing the downthrow very effectively. The four faults are labelled, the granite contact is steep, and the dip is correct for the SAG beds. The only thing which could be clearer is the position of the metamorphic aureole but as the 5 marks had already been awarded this becomes irrelevant.

Question 4 (b)

(b) Coal measures are present in the north east of the map (grid reference 022412). Suggest **two** geological problems that could affect the extraction of coal in this area.

1 ....

....

2 ....

....

[2]

This question was a challenge for many candidates with some common errors being made, which resulted in over half of the candidates not gaining any marks. The most common loss of marks was due to insufficient detail being provided, e.g. many opted to write about faults being present in the mine. If the command word had been 'state what could cause issues with mining on this area' then faults would be correct. However, they were required to suggest problems which could occur. Faults are a problem as they can move the coal beds making it more difficult to mine, being lines of weakness can allow water ingress or the mining activities could reactivate faults as rock is removed.

There were several potential answers, a few opted for the angle of dip and the difficulties this could cause with stability for extraction and use of machinery. Very few opted for other reasons such as coal measures are not all coal therefore it may not be economic, there was limestone under the coal and cavities in the limestone may cause subsidence in the mine.

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