Qualification Accredited

OCR
Oxford Cambridge and RSA

Examiners' report

A LEVEL

GEOLOGY

OCR Level 3 Advanced GCE in Geology

H414

For first teaching in 2017

H414/03 Summer 2025 series

Version 1

Contents

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 responses 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 Teach Cambridge.

Would you prefer a Word version?

Did you know that you can save this PDF as a Word file using Acrobat Professional?

Simply click on **File > Export to** and select **Microsoft Word**

(If you have opened this PDF in your browser you will need to save it first. Simply right click anywhere on the page and select **Save as . . .** to save the PDF. Then open the PDF in Acrobat Professional.)

If you do not have access to Acrobat Professional there are a number of **free** applications available that will also convert PDF to Word (search for PDF to Word converter).

Paper 3 series overview

Paper 3, Practical Skills in Geology, focuses on 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, e.g. line graphs, bar charts and histograms
- 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.

There is an emphasis on candidates being able to identify named minerals, rocks, sediment and fossils and being 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, any other information provided and used the stimulus material to make sure their response was appropriate • made sure their answers responded to the correct command word, e.g. did not explain when describe was asked for • referred to the materials in the insert appropriately, using scales to work out crystal sizes, referring to features shown on the compass clinometer and correctly using the map extract and keys provided • could label axes for a line graph and knew how to indicate a broken scale if appropriate for their chosen scale • showed working for the maths questions as marks are available for working even if the final answer is incorrect • structured a detailed answer for the first extended response question which effectively compared the differences between the two rocks shown in the insert in terms of composition, and texture (including crystal size) • showed an awareness in the second extended response question that strike must be determined before dip and that the compass clinometer can be held in two different positions • used terminology effectively in their responses.	• did not take account of information provided in the stem and so answered the question either wholly or partially incorrectly • confused different types of metamorphism and metamorphic textures from photographic evidence • made errors in responses when referring to different rocks, e.g. rock A or B by failing to indicate which rock they were discussing or got the letters the wrong way round. • did not put units on the axes of their graphs • were sometimes too brief with their answer thus not providing sufficient information for credit to be given • did not show working for the maths questions • did not write about the required number of issues, e.g. 3-mark questions will award marks for three distinct points, if only two points are provided the third mark is lost • did not read which factors were being kept constant in the practical question and thus could not achieve credit when asked to supply a variable which needed to be kept constant if they repeated information already provided.

Question 1 (a) (i)

1

(a) **Fig. 1.1** in the **Insert** shows a thin section photograph of a carbonate rock.

(i) Name this rock using the Dunham classification scheme.

....

.... **[1]**

This proved to be a demanding question. In fact, it was the most difficult question on the paper. Candidates saw the image of an Oolitic limestone in figure 1.1 on the insert but struggled to provide a rock name using the Dunham Scale. This suggests the Dunham Scale was poorly understood. The most common response was Oolitic limestone.

Assessment for learning

A useful classroom practical could use a variety of different limestones with the aim of getting candidates to classify them in several ways. This could include.

a) Does it have a biological or chemical origin?
b) Does it have a cement? If so, is it micrite or sparite or a combination of both?
c) What name could be given to the rock using the Dunham Scale?
d) What common name is given to this rock?

Question 1 (a) (ii)

(ii) Calculate the magnification of the thin section photograph.

Magnification = ... **[2]**

The formula for calculation of magnification was generally well know and many candidates were able to achieve full marks here. A few gained 1 mark when they provided their workings yet did not provide the correct answer, e.g. they showed accurate use of the scale to provide an actual size of 17 mm and divided it by 2 mm the scale on the image.

Question 1 (a) (iii) and (iv)

(iii) Describe the environment in which the carbonate rock in **Fig. 1.1** in the **Insert** was deposited.

....

....

....

.... **[2]**

(iv) Explain how the carbonate rock in **Fig. 1.1** in the **Insert** was formed.

....

....

....

.... **[2]**

Questions 1 (a) (iii) and 1 (a) (iv) are linked and asked candidates firstly to describe the environment of deposition and then to explain how the Oolitic limestone formed.

Many candidates knew the environment of deposition of Oolites very well and commonly achieved maximum marks here. The most popular answers were shallow marine / beach and high energy. A minority referred to climate as being tropical or sub-tropical.

However, a significant number answered Question 1 (a) (iv) in the space for part (a) (iii). They wrote about oolith nuclei being rolled around on the seabed by waves with $CaCO_3$ being precipitated out of the water around the nuclei to form concentric circles. Some then realised their error upon beginning part (a) (iv) and then repeated themselves. Only a few appear to have gone back to part (a) (iii) and changed their answer.

Most candidates gained marks from marking points 2-4 on the mark scheme; nuclei being rolled, $CaCO_3$ precipitation or cementation to form a rock. Very few commented on the chemical non-clastic origin.

Marks were generally good when this common confusion was avoided showing that these rocks are well understood.

Question 1 (b) (i)

(b) **Fig. 1.2** in the **Insert** shows a hand specimen of a metamorphic rock.

(i) Estimate the ratio of dark to light minerals in the metamorphic rock.

dark minerals: light minerals = 1: .... **[1]**

If the candidate noticed that the first part of the ratio had been completed for them, they usually obtained this mark, showing competence in estimating values from photographic evidence. Although many did not notice this information and provided responses such as 1:3 instead of writing just 3.

Question 1 (b) (ii)

(ii) Explain what the texture of the rock in **Fig. 1.2** suggests about the type and grade of metamorphism the rock has undergone.

....

....

....

.... **[2]**

Metamorphic textures were generally well-known, with many able to gain some or all the marks in this question. The proper term, foliation, was not used much and so answers tended not to refer to directed pressure forming a foliation. Banding was a more common response with the majority identifying it as gneissose banding. Very few used gneissosity. This banding was correctly identified by many as being a sign of regional metamorphism.

High grade metamorphism was also required for full marks. The most popular answer with candidates was to identify the rock as a gneiss, while a few opted for mineral segregation and fewer still coarse crystals.

Errors, when they arose, tended to be in identify the rock as a schist or the type of metamorphism as contact.

Question 1 (c)*

(c)* Use **Fig. 1.3** in the **Insert** to compare the composition and texture (including crystal size) of igneous rocks **A** and **B**.

....

....

....

....

....

.... **[6]**

This Level of Response question was answered by many candidates to a good standard, with approximately a quarter achieving Level 3. It was encouraging to see that candidates for this question had carefully read the stem and took care to include texture and crystal size as well as composition in their answers.

Successful candidates clearly compared rock A to rock B as there were many differences. The best responses identified rock A as mafic and then included names of minerals. The green colouration indicated olivine but many also mentioned that Ca-rich plagioclase and augite, while not visible, would also be present. A significant number attempted to name a suitable mineral for the amygdales. A large numbered included silica percentages as part of their answers.

The best comparative answers were those that then outlined the mineralogy of rock B next. B was easier as the different colours visible in the photo helped in mineral identification: K feldspar phenocrysts with a groundmass of quartz, biotite and plagioclase. A number also identified muscovite as likely to be present.

Crystal size was fine for rock A and coarse for rock B. Some candidates did not achieve a higher-level response if they were vague here, stating only simplistic comparisons such as 'larger' or 'smaller'. The difficulty with these two terms is that without a clear indicator of what size they were being compared to larger and smaller could mean a whole range of possible sizes. The best answers were where candidates who wrote about rock A having crystals too small to see, which would make the rock fine grained at <1mm in diameter, while rock B had coarse phenocrysts over 1.5 cm with a coarser groundmass over 5mm.

Texture was generally well-known with most candidates recognising rock A had a vesicular and amygdaloidal texture, while rock B was porphyritic. Most candidates who achieved a Level 3 response linked the textures to crystal size and continued to explain how the rock had formed: extrusive for rock A and intrusive via two stages of cooling to give the variety of crystal size shown in rock B. Although this was not asked for it helped to illustrate the candidates' detailed understanding of the differences between these two rocks.

A minority confused porphyroblasts for phenocrysts and granoblastic texture for groundmass.

Several candidates wrote a good response but either did not compare the two, or called all the rocks the same name, e.g. rock B throughout or reversed the descriptions of A and B. This tended to result in a lower level having to be given.

Exemplar 1

Rock A shows elongated vesicles on top face indicating rock was extrusive or formed near the surface as trapped volcanic gases exsolved leaving voids whereas B shows no vesicles suggesting it was deeper underground.
Rock A is much darker than rock B suggesting A is more mafic in composition containing Augite or Ca plagioclase whereas B is lighter with more silicic minerals such as quartz, pink colour from K feldspar & some black spots from biotite crystals.
Rock A does not have any visibly large crystals suggesting a fine crystal grain size whereas B has much larger crystals over 5mm suggesting coarse crystal grain size. Some vesicles in Rock A are infilled & show amygdales from later precipitated pore fluid minerals whereas B has no amygdales. Possible porphyritic texture on B as pink K feldspar much larger suggesting 2 cooling stages. [6]

This response is quite concise compared to some seen, however it is clear in its identification of the three required components. This candidate compares the two rocks throughout their response.

Crystal grainsize as well as using the required terms of fine and coarse, this candidate uses the scale provided to quote sizes, although they are a little conservative on their estimate of the size of the phenocrysts.

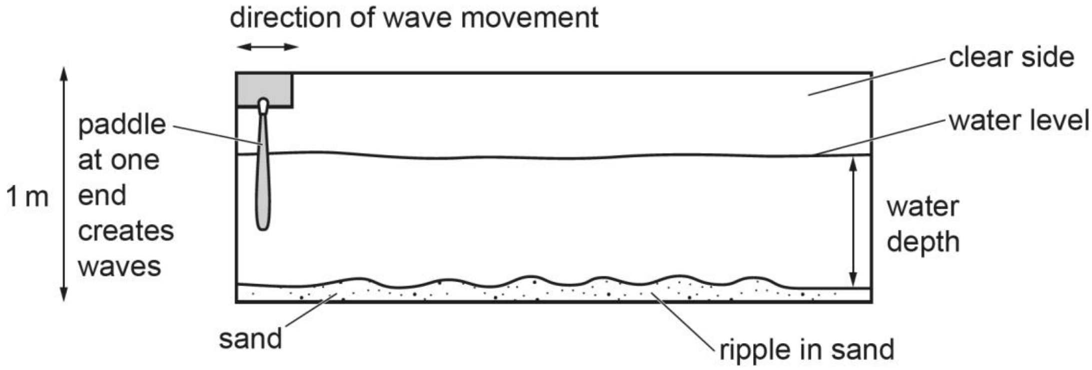
Texture: A is identified as having both vesicular and amygdaloidal texture. Elongated vesicles are also noted, and the candidate uses these textures to make additional comments about the relative origins of each rock.

Composition: the candidate comments on the colour of each and correctly identifies a mafic and silicic origin for A and B, respectively. They also name specific minerals for each.

Throughout this answer the candidate uses effective and correct terminology making this an excellent Level 3 response worthy of 6 marks.

Question 2 (a) (i)

2 Some students visited a university to use a flume tank to investigate the formation of wave ripples. The diagram shows a cross-sectional view of the flume tank.



The students decided to investigate how water depth affects the wavelength of the wave ripples.

To do this the students:

- used a paddle at one end of the flume tank to generate waves which travelled through the water and created wave ripples in the sand on the bottom of the flume tank.
- used well-sorted sand with a grain size of 0.2 mm.
- ensured that the surface of the sand was flattened before each experiment.
- ran the flume tank for 30 minutes for each of the four different water depths.
- measured the wavelength of eight wave ripples for each water depth using a ruler.

(a) The data collected by the students is shown in the table.

	Water depth			
	60 cm	**70 cm**	**80 cm**	**90 cm**
Wavelength (cm)	10.0	19.5	32.5	42.5
	11.0	19.5	31.0	45.0
	12.5	21.0	31.5	44.5
	11.0	20.5	30.0	47.0
	11.5	18.5	33.5	46.5
	12.0	22.0	29.5	45.0
	13.0	19.5	32.0	46.0
	12.5	20.0	30.5	44.5
Mean wavelength (cm)	11.69	20.06	31.31	45.13
Mean wavelength (cm) to 3 significant figures	11.7	20.1	31.3	....
Median wavelength (cm)	11.75	19.75	31.25	....

(i) At a water depth of 90 cm:

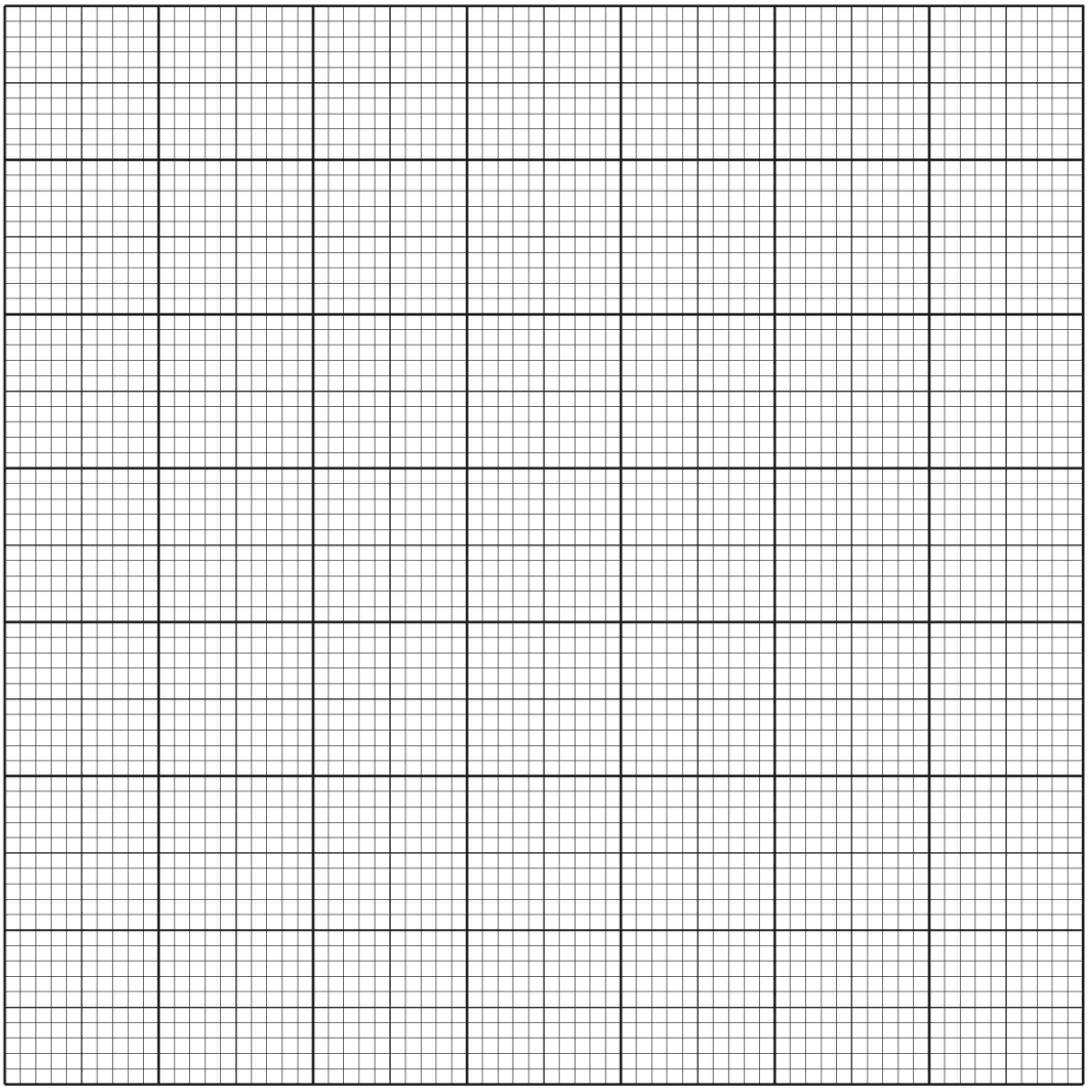
- State the mean wavelength (cm) to 3 significant figures.
- Calculate the median wavelength (cm).

Write your answers in the table. **[2]**

The calculation of mean and median was well understood with well over three quarters of candidates gaining maximum marks.

Question 2 (a) (ii)

(ii) Plot a line graph to show the relationship between **mean wavelength** and **water depth** on the grid.



[3]

The most common mark for this question was 2 of the 3 available. The reasons for dropped marks were either not drawing a line joining just the 4 points or not appropriately label in the axes.

For labelling the axes, both needed the units to be included after the title of what the axis was showing, e.g. for the x axis; Water depth (cm).

If the candidates began both of their axes at 0 and used regular intervals of increase, e.g. 0-10 for each large square, this was appropriate. A few made plotting difficult for themselves by labelling their axes increases in unusual quantities, such as increasing by 7 or 15. This meant that plotting points to the correct tolerance could become difficult. A final axis issue arose when candidates decided to begin their water depth axis at 0 but then had 60 for the next large square, then after that went up in units of 10. This produced a non-linear scale and so the mark was lost. They should have used the broken scale indicator for this axis. If the candidate placed the 60 at the origin and then increased their units by ten that was acceptable.

Most plotting fell within the allowed tolerance.

Assessment for learning

Regular practice at plotting a variety of graphs is useful, especially those with demanding scales. This can familiarise candidates with the need for accurate and sensible scale plotting and labelling, considering the data to be plotted. Their practice should include linear as well as logarithmic scales, which are commonly used when data ranges can be very large.

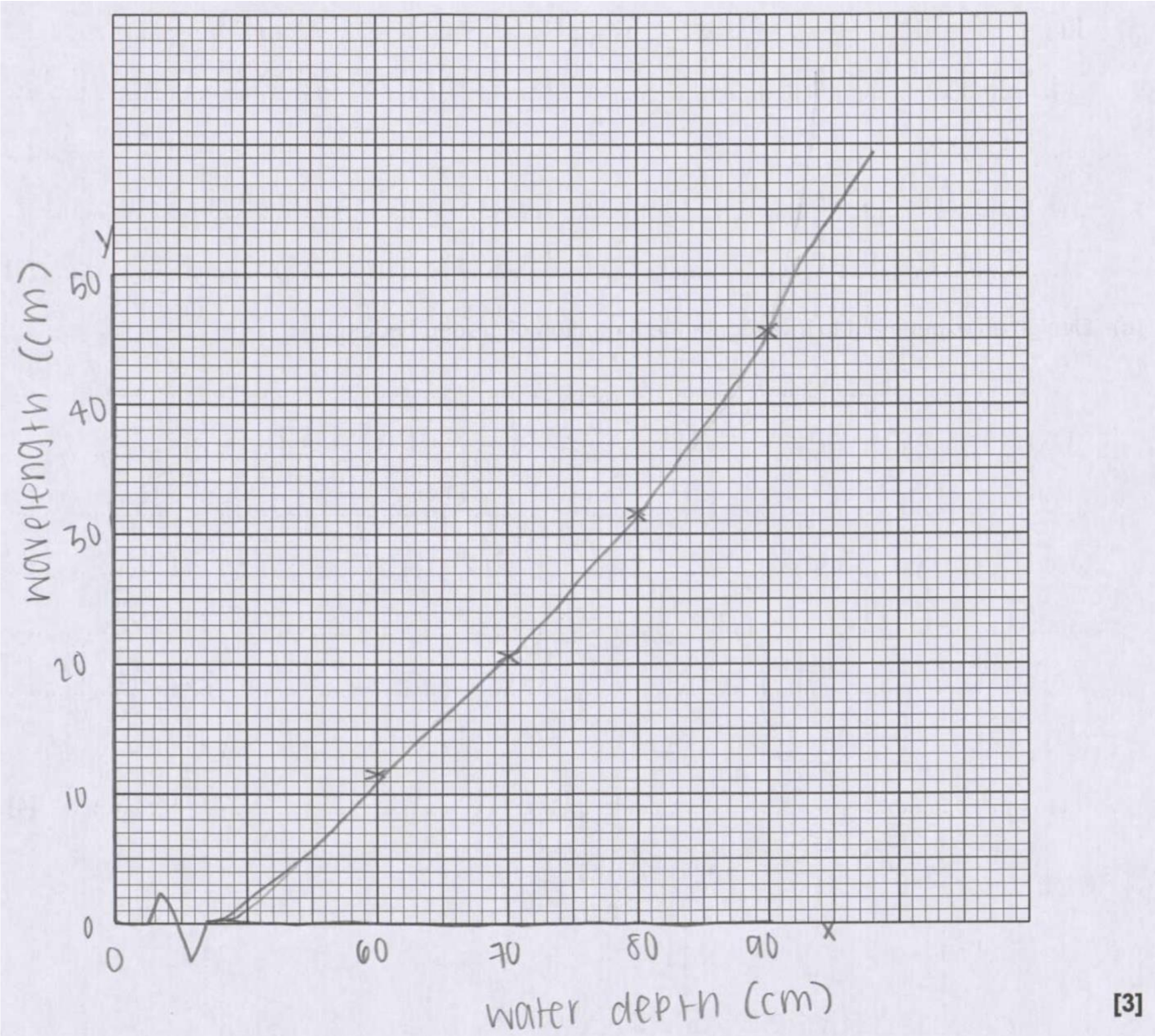
Familiarity with the differences between bar graphs, histograms and line graphs can be practised as well as candidates learning when and when not to draw a line through points (line graph) or a best fit line (scatter graphs)

Data can be generated in-house or the past exam papers on Teach Cambridge can also be used.

If the centre taught Geology in the previous qualification, the centre-based task and evaluative task papers frequently had data plotting questions, which can provide valuable practice opportunities.

A selection of tasks from the previous qualification are available on Teach Cambridge, under Practical endorsement → Legacy coursework tasks.

Exemplar 2



This candidate has achieved 2 out of the 3 available marks and has produced a good clear graph.

The first mark is for their axes. The x axis shows a very clear broken scale. Both axes are fully labelled to include the units and a sensible scale has been chosen which means the candidate can easily and accurately plot the required points.

The second mark is for their plotting of points which fall within the allowable tolerance.

They did not achieve the third mark, as their line graph extends beyond the four plotted points and there is no information on what the wavelength would be at water depths less than 60 cm, so the line should only join the four plotted points.

Question 2 (a) (iii)

(iii) Describe the relationship between mean wavelength and water depth.

....

.... **[1]**

Nearly all candidates realised that there was a positive correlation: that as ripple length increased so did water depth. A few wrote just that they were directly proportional, however this did not explain that both were increasing, which was the required element.

Question 2 (a) (iv)

(iv) Suggest **one** variable that must be controlled when performing this series of experiments.

....

.... **[1]**

The most common response was related to keeping the speed of the paddle constant. A few mentioned keeping the same volume, mass or depth of sand.

A large number of repeated parameters which had been stated in the stem as being kept constant so no credit could be given.

Question 2 (b)

(b) The students went on a field trip to the outcrop of Jurassic sandstones shown in **Fig. 2.1** in the **Insert**.

Suggest how ripple marks on the sandstone bedding planes, such as those shown in **Fig. 2.1**, could be used to interpret the environment of deposition.

....

....

....

....

....

.... **[3]**

This question performed well and most achieved 2 or more marks.

As the photo showed ripples from a distance and it wasn't completely clear what type of ripple was present candidates were allowed two ways of answering this question.

Firstly, they could write theoretically about how ripples could be used and what they tell us about how they formed, e.g. they could say ripples could be asymmetric or symmetrical, then they could progress to outline what this would tell us about energy levels, current directions and environments of formation. Candidates who chose this option produced some good, detailed answers taking time to outline the formation of both shapes of ripples.

The alternative way to answer this question was for the candidate to name what type of ripple they thought was shown in the photo; as the photo was not a close up, either ripple shape was allowed and so the second and third mark then became dependent of what shape they had chosen.

Slightly more chose the first option and it was encouraging to see that this topic was understood to a high level.

Question 2 (c)

(c) Design an experiment to investigate the formation of graded bedding.

....

....

....

....

....

.... **[4]**

It was encouraging to see how many candidates a good knowledge had of planning a practical experiment. Most chose to use a clear container, filled with water, to which was added a mixture of sediment with grain sizes from coarse to fine. Most then referenced shaking the container or creating a current, then allowing the mixture to settle. The final mark was achieved by stating the result they were looking for: coarser grains settling first to the bottom with finer grains on top.

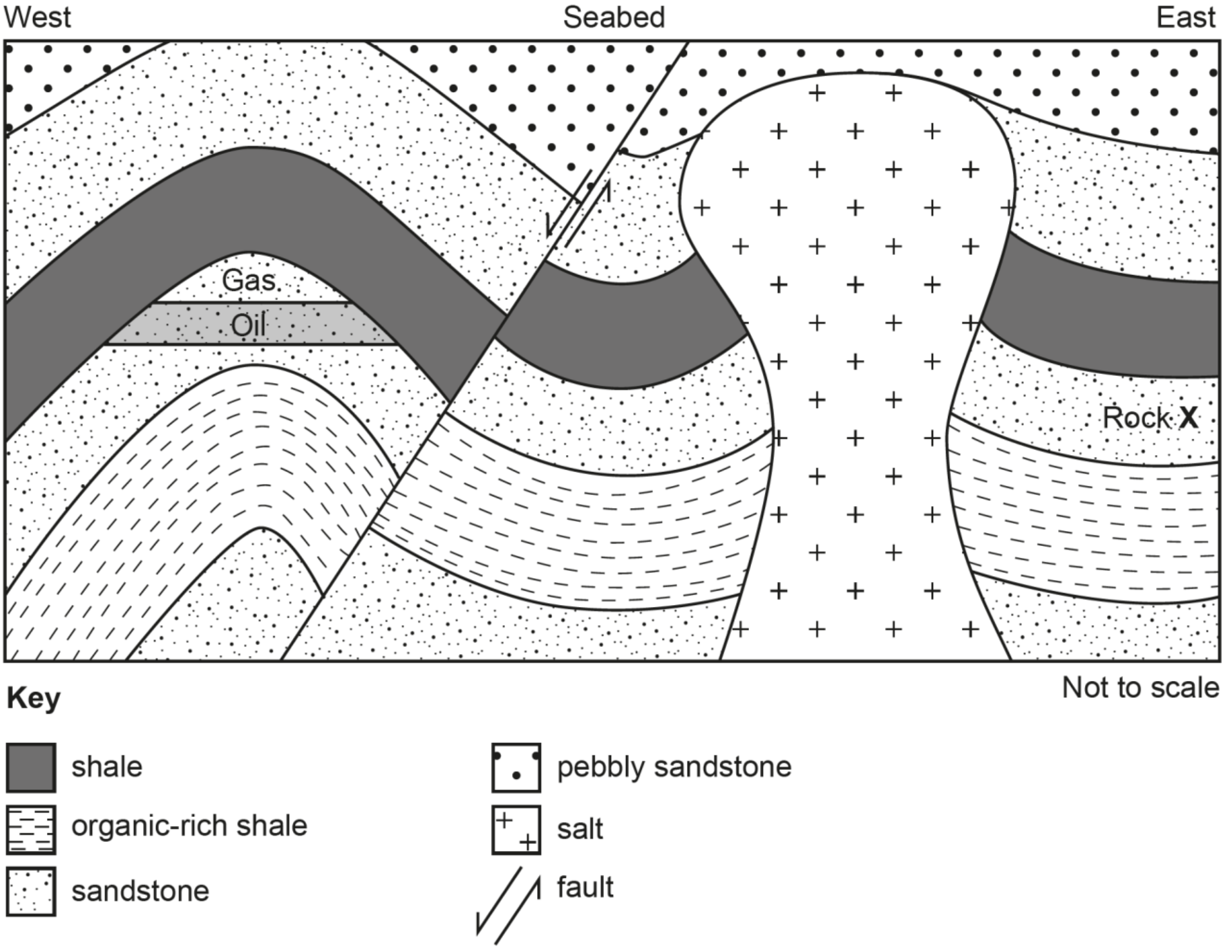
A few did not gain marks by writing about denser minerals sinking first. As the idea of graded bedding is linked to grain size it was necessary to have the terms denoting the relative size of the fragments. Density would be misleading as smaller sized fragments of galena would sink faster than coarser grains of mica.

Some candidates designed an experiment which showed lateral grain size change along a gradient such as along a river profile. Marks could be given but as the concept of upwards fining was required these candidates were not able to gain all of the marks.

Question 3 (a) (i)

3

(a) The diagram shows a cross-section in the North Sea across oil and gas-bearing strata and the location of one area of oil and gas.



(i) Explain why oil and gas are found at the location shown on the diagram.

....

....

....

....

....

.... **[3]**

There was good understanding of the idea that oil and gas form in the organic rich shale, get stored in the sandstone and are stopped from rising by the higher shale and anticline fold. What was not so well-known were the technical terms source rock, reservoir rock, cap rock and anticline trap.

By producing detailed answers referencing the sandstone being permeable and able to hold the oil/gas, the shale being impermeable and blocking the upward movement, or the fold bending the shale around to stop the upward migration, marks could still be gained. Almost two thirds of candidates achieved 2 or 3 marks in this question.

The idea of the oil/gas having a lower buoyancy / lower density than the surrounding rocks or the concept of hydraulic gradients allowing the hydrocarbons to rise was less well-known.

Question 3 (a) (ii)

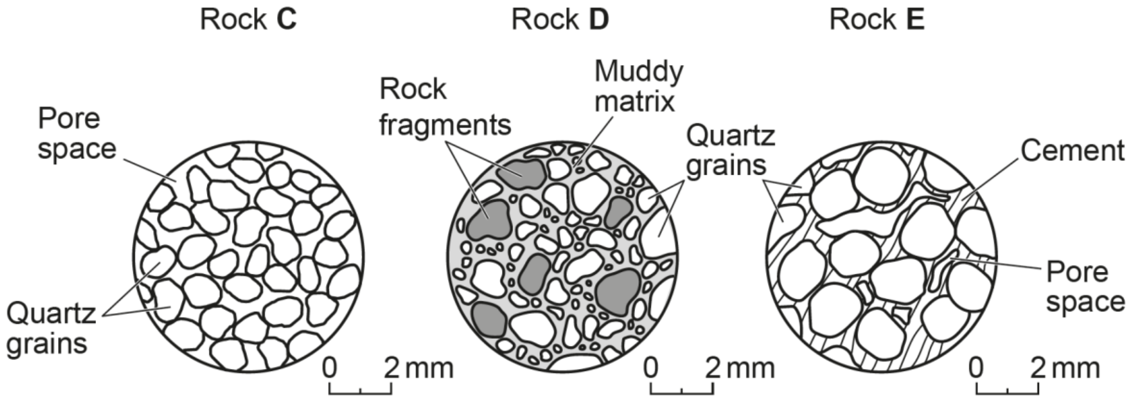
(ii) Draw on the diagram the positions where oil and gas may be found in **two** different geological situations. Label the names of these **two** different types of structural traps. **[2]**

Candidates found it difficult to draw an accurate representation of where the oil and gas formed. Over a third of students did not gain either of the marks for this question.

The main difficulty was that candidates often struggled to show that gas would sit above the oil and that the base of the oil would form a flat straight line. Many drew a curved deposit. The salt dome trap was often mislabelled at the crest of the salt and the fault trap in the lower deposit of the sandstone below the source rock.

Question 3 (b) (i)

(b) The thin section sketches show three different sedimentary rocks **C**, **D** and **E**.



(i) Explain why the porosity of the three sedimentary rocks **C**, **D** and **E** will vary.

....

....

....

....

....

.... **[3]**

Candidates used the three thin section diagrams effectively in this question with about three quarters gaining 2 or 3 marks. There was good understanding especially of rocks D and E with comments about D having a low porosity due to the muddy matrix or angular grains infilling pore spaces being the most popular. Rock E was also recognised as having lower porosity due to the cement infilling many of the pore spaces.

While rock C was recognised as being the most porous of the three, candidates often did not give a reason for this.

Question 3 (b) (ii)

(ii) Suggest which of the sedimentary rocks (**C**, **D** or **E**) is most likely to be Rock **X** on the cross-section diagram. Explain your answer.

....

.... **[1]**

Many candidates correctly identified rock C as being the best reservoir rock capable of storing hydrocarbons in the large amount of pore space.

Question 3 (b) (iii)

(iii) Suggest which of the sedimentary rocks (**C**, **D** or **E**) has been transported the shortest distance. Explain your answer.

....

....

....

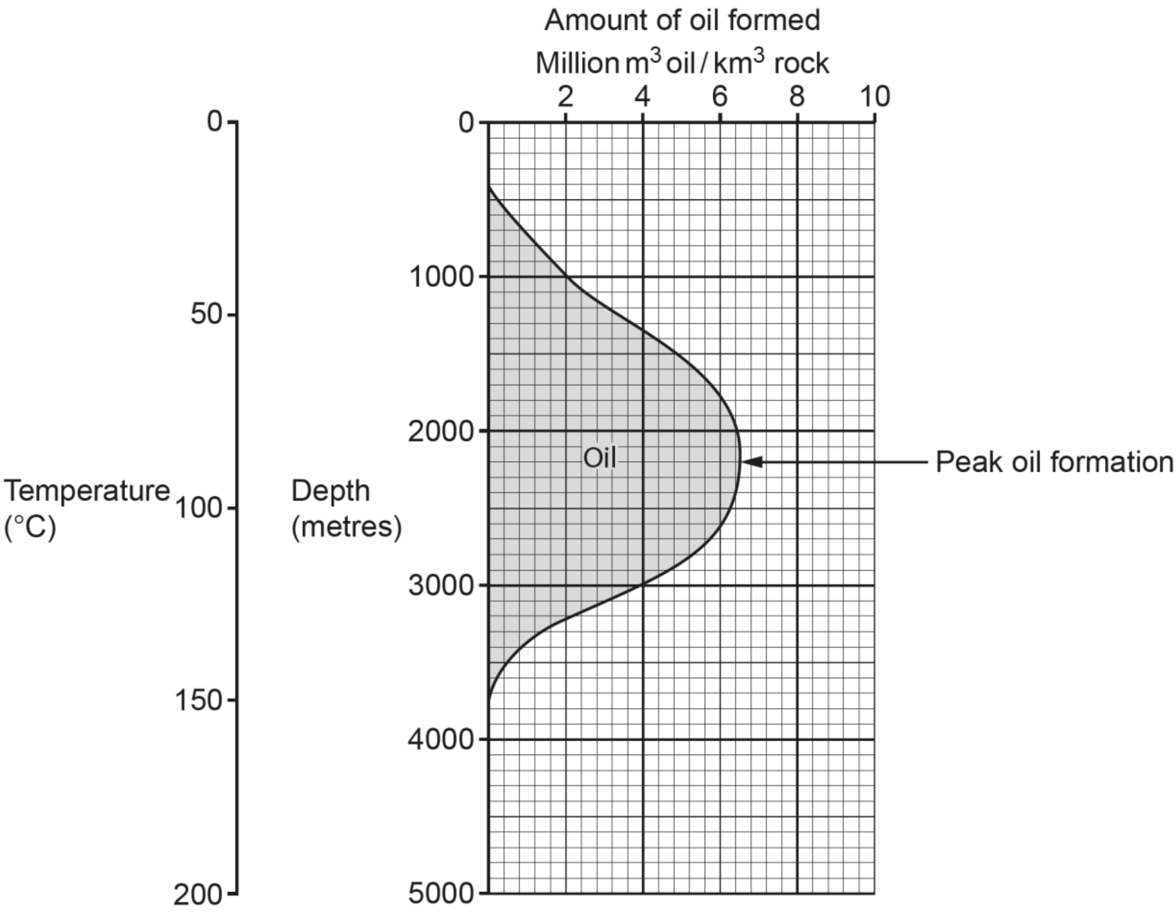
.... **[2]**

While most candidates correctly identified rock D for this response, over half did not score any marks. The main reason was a tendency to repeat the stem, e.g. rock D had the most angular grains so had the least transport or rock D had rock fragments within it so had short transport.

This was an explain question and so a higher-level response was needed. The first mark was for reference to texture, such as angular grains indicating less attrition/abrasion/erosion had occurred. The second mark was for an awareness of the mineralogical composition of the rock, indicating low levels of erosion as the rock fragments had not had time to break down into their component minerals.

Question 3 (c) (i)

(c) The graph shows the **oil window** in a sedimentary basin.



(i) The geothermal gradient is the rate of change of temperature (ΔT) with depth (ΔZ). Calculate the geothermal gradient in this sedimentary basin. State the units.

Use the formula: geothermal gradient = $\frac{\Delta T}{\Delta Z}$

Where:
ΔT = change in temperature
ΔZ = change in depth

Geothermal gradient = ... Unit = ... **[2]**

This year mathematical questions were attempted to a much more successful level. Over half of the candidates achieved full marks on this question.

The easiest way for candidates to gain the answer of 0.04 °C m^{-1} or 40 °C km^{-1} was to use the equation of 200/500, in this case the maximum temperature and depth shown.

Many candidates chose a more complicated way to work out the gradient with many opting to take two different points along the shaded zone and working out the difference before carrying out the division. Marks were given for correct working out of the values from the graph in this case.

Question 3 (c) (ii)

(ii) Complete the sentence about peak oil formation. Use an option from the list.
decrease
increase
remain the same

The depth of peak oil formation would .... in a sedimentary basin with a higher geothermal gradient. **[1]**

This is a newer style of question format of this paper, and the vast majority of candidate successfully identified that the missing word was decrease.

Question 3 (d)

(d) Outline **one** ethical issue associated with the extraction of oil and gas.

....

.... **[1]**

Most candidates were able to provide an appropriate answer for the ethical issues. A wide variety of answers gained marks; many opted for oil spill pollution affecting land or water ecosystems and a number referenced fracking chemicals and general habitat destruction. Other answers focused on the disruption at the site of the extraction removing habitats to build the facility.

A few candidates were a little too vague by just stating 'harm to the environment', but most provided a good, detailed response.

As the question asked about extraction, candidates who wrote about air pollution from the combustion of oil and gas did not gain marks.

Question 4 (a)*

4

(a)* Using **Fig. 4.1** in the **Insert**, explain how to use a compass clinometer to measure the dip and strike of a bedding plane.

....

....

....

....

....

.... **[6]**

Candidates found this to be a demanding Level of Response question. The mostly commonly given mark was 3, followed closely by 2 out of the 6 available. Most candidates achieved one of these marks but only few achieved a Level 3 response. The image from the insert was used well with most candidates referencing the dials and compass points.

The main problem was that many candidates began their answer by writing about how they would find the dip. Many appeared to know where the dip was just by looking at the rock or by running water down the face of the rock. There were many references to using the left- or right-hand rules to indicate directions of dip with very few giving the scientific requirement of establishing the direction of strike first.

Strike was correctly identified as lying perpendicular to the dip, but this was often outlined as the last stage after a dip amount had been measured. Many did not state that strike must be recorded as a three-figure number and dip as two, and even fewer were aware that a compass direction was needed for the dip direction.

There was good knowledge of setting the equipment into clinometer mode, with reference made to setting the dial east-west. However, few stated that there is a protractor inside the dial which is activated when the clinometer is set to E-W and held vertically on the rock with the long edge in contact with the rock surface. A few knew they had to rotate the clinometer until the hanging needle showed a reading of 0 dip and that this was called the strike.

Many knew that a chalk line had to be drawn along the strike but in many cases the strike was not measured. Candidates struggled to explain that any bearing from north must be read with the compass held horizontally, not flat to the rock surface, for the north arrow to swing freely. Many knew that the dial had to be turned to match the large green arrow to the north reading and many referenced sayings such as 'put Fred in his bed.' A number of candidates could read the strike accurately at this point.

A large number knew to draw a chalk line at 90 degrees from the first chalk line to indicate dip (using the right- or left-hand rule) Only a few clearly stated that the compass clinometer must then be reset to E-W and again be held vertically with the long edge on the rock pointing down dip.

Most knew how to read the dip on a sloping surface.

The final stage is to revert to holding the compass horizontally, not flat, along the direction of dip and once the north arrow has settled again turn the dial to read off a compass direction for the dip direction, e.g. NW (although a bearing would also work at this point).

Misconception

?

Measurement of strike and dip should be practised. The ideal opportunity is always while on fieldwork as candidates can get a hands-on experience of using the compass clinometer in a real geological situation.

However, time on fieldwork can be limited and some centres have large numbers of students, so this may make practice with advice and support from the teacher difficult in the short amount of time available, especially as many sites may be on the schedule for each day.

Therefore, classroom practice of how to take these measurements can be a sound place to start. Candidates can work individually, in pairs, or in small groups, depending on the number of clinometers a centre has available. Each candidate should have the opportunity to carry out the measurements themselves and not just watch someone else do them. Sloping surfaces can be mimicked in the classroom, or outside spaces can be used such as outside grounds. If a surface is not completely flat a clipboard can be placed over the surface to smooth it.

While on the fieldtrip each candidate could be required to perform an assessed strike and dip measurement. This could be factored into the trip as part of the practicals carried out.

Exemplar 3

Set the compass-clinometer into clinometer mode by aligning the bezel West-East. Using the clinometer arrow, find a level surface on the bedding plane by holding the clinometer ~~up~~ upright with the arrow pointing straight down. Once this level is found, mark it with chalk. ~~Using~~ Set the compass-clinometer horizontal against this chalk line and align the ~~ref~~ arrow on the bezel with the North compass arrow and take the compass reading at the top of the compass as the strike, record as three figures*. Using the left-hand rule, find the dip direction, which is 90° from the strike direction. Set the compass-clinometer into clinometer mode again by aligning West-East on the bezel. [6]

Extra answer space if required

Hold the clinometer horizontally upright against the ~~be~~ dip of the bedding plane and use the clinometer arrow to record the dip of the bedding plane as two figures. *from North

This response was given a Level 2 and 4 marks. There are some good coherent sections, but other sections are omitted.

It begins with setting up the equipment correctly to clinometer mode and placing it vertically onto the rock. There is an awareness about finding a line of 0 dip / horizontal surface. They are clear about holding the clinometer upright with the clinometer needle swinging freely. They then describe holding the compass horizontal and twisting the bezel to find the strike bearing from north.

The candidate continues to describe how to find the direction of dip and resets their equipment to clinometer mode. They make a contradictory statement about holding the clinometer 'horizontally upright' but then proceed to find out the dip angle. They do not take any readings for dip direction.

This is a good Level 2 response as much is coherent and these stages could easily be followed by another using this as a guide. However, the instruction are not complete and so cannot achieve a Level 3.

Question 4 (b) (i)

(b) The geological map excerpt (Carrick) **Fig. 4.2** in the **Insert**, should be used for this question.

(i) On the topographic sketch profile below, draw and label a cross-section of the solid geology from grid reference 238007 in the West to 259990 in the East. These grid references have been marked in yellow on the map.

[5]

Candidates performed better on this cross-section question compared to last year's, with the most common mark being 3 out of 5 followed by 2 marks. Last year the most common was 2 out of 5 followed by a 0 mark.

Most cross sections were well labelled with rock names or codes taken directly from the map or the key. Plotting of the dips in the NW section of the map were generally accurate with several beds plotted showing that the rocks NW of the fault were conformable to each other.

The rocks to the southeast were more complicated as they had been overturned, however a good proportion of candidates plotted them correctly at 85 degrees. A few opted for 90 degrees which was within the tolerance. A small number were possibly confused by the symbol for overturned beds and plotted the dip going in the wrong direction as a result.

The fault and the unconformable series in the SE corner were generally less understood and were often not marked onto the cross-section.

A final marking point was given if candidates drew in or labelled the position of the two coal seams in bed LSC. As the key showed the coal beds as a much less well-defined line than on the map and indicated mineral veins as a bold line both options were allowed, as it was felt that many candidates had effectively used the key and should not be penalised for the key not matching the thickness of the coal seams on the map extract.

Assessment for learning

Maps and cross-section plotting are a key skill and one that centres can expect candidates to keep being tested on.

Labelling of rocks and accurate plotting of dips has much improved. It would be useful for centres to spend class time practising the drawing of cross sections. The following are commonly required:

a) Labelling of rock names
b) Accurately using a protractor to plot dip of beds
c) Accurate plotting and naming of faults as well as indicating their angle and the direction of downthrow
d) If there is more than one fault, the offset position of the beds affected by the faults is important
e) Fold axes; if the fold is an anticline, dotted lines above the section can be useful to show which beds have eroded away
f) Unconformable series of rocks as indicated by different dip amounts and directions
g) Other geological features shown on the map and indicated on the key, e.g. mineral veins.

Question 4 (b) (ii)

(ii) Use **Fig. 4.2** in the **Insert** to calculate the maximum true thickness of the Silurian Protovirgularia Grits (PRO).

Maximum true thickness of Silurian Protovirgularia Grits (PRO) = ... m **[2]**

This maths question was more demanding for candidates as there was some uncertainty about the equation to be used. Most candidates attempted it but many did not gain any credit.

One of the reasons candidates found this difficult is that they used the wrong equation to work out the true thickness. Many candidates may also have misread the stem, for many quoted a lower thickness than the maximum and thus generated a value which was too small even if they used the correct equation.

The first stage was to measure the maximum thickness of the bed, which was 8 mm. This carried the first mark. Once they had the correct outcrop width, they could use the following equation to work out the true thickness:

True thickness = outcrop width × sine (dip angle)

Question 4 (b) (iii)

(iii) The Silurian Drumyork Flags (DYF) are overturned at grid reference 244993.

Describe **one** piece of fossil evidence that you would look for in the field to confirm that these sandstones are overturned. You may use a labelled diagram to explain your answer.

....

....

....

.... **[2]**

This question also proved to be difficult for candidates. The main reason for wrong answers was that a significant number wrote about sedimentary structures and how they can be used to tell way up, not the fossil evidence as asked for in the question.

Of those who did write about fossil evidence there were two common errors.

A significant number wrote about footprints being preserved, however land-based animals had not evolved in the Silurian, they evolved later. The age was reiterated in the stem, so it was a case of candidates misinterpreting what was required.

The other common error was for candidates to choose inappropriate fossils. Some used ammonoids and outlined their evolution, other graptolites. As these were pelagic organisms they would not have had a distinct way up. Additionally, ammonites had not evolved by this time.

The most successful candidates were those who chose burrows and drew images of burrows in life position and showed the overturned versions which were clearly not possible. A small number wrote about geopetal structures and fossils in life position, but these required more careful choice and detailed explanations.

Supporting you

Teach Cambridge

Make sure you visit our secure website **Teach Cambridge** to find the full range of resources and support for the subjects you teach. This includes secure materials such as set assignments and exemplars, online and on-demand training.

Don't have access? If your school or college teaches any OCR qualifications, please contact your exams officer. You can forward them this link to help get you started.

Reviews of marking

If any of your students' results are not as expected, you may wish to consider one of our post-results services. For full information about the options available visit the OCR website.

Access to Scripts

We've made it easier for Exams Officers to download copies of your candidates' completed papers or 'scripts'. Your centre can use these scripts to decide whether to request a review of marking and to support teaching and learning.

Our free, on-demand service, Access to Scripts is available via our single sign-on service, My Cambridge. Step-by-step instructions are on our website.

Keep up-to-date

We send a monthly bulletin to tell you about important updates. You can also sign up for your subject specific updates. If you haven't already, sign up here.

OCR Professional Development

Attend one of our popular professional development courses to hear directly from a senior assessor or drop in to a Q&A session. Most of our courses are delivered live via an online platform, so you can attend from any location.

Please find details for all our courses for your subject on **Teach Cambridge**. You'll also find links to our online courses on NEA marking and support.

Signed up for ExamBuilder?

ExamBuilder is the exam paper builder platform for a range of our qualifications. Find out more.

Free for all OCR centres with an Interchange account, it allows unlimited users per centre. We require an Interchange username to verify your centre's users for ExamBuilder.

If you do not have an Interchange account, please contact your centre administrator (usually the Exams Officer) to request a username.

Once you have an Interchange username, use the form on this page to sign up for ExamBuilder, or ask an existing user at your centre to create an ExamBuilder account for you.

Active Results

Review students' exam performance with our free online results analysis tool. It is available for all GCSEs, AS and A Levels and Cambridge Nationals (examined units only).

Find out more.

Tell us what you think

Your feedback plays an important role in how we develop, market, support and resource qualifications now and into the future. We want you and your students to enjoy and get the best out of our qualifications and resources, but to do that we need your honest opinions to tell us whether we're on the right track or not.

You can email your thoughts to resources.feedback@ocr.org.uk or visit our feedback page to learn more about how you can help us improve our resources.

Designing and testing in collaboration with you and your students

Helping young people develop an ethical view of the world

Equality, diversity, inclusion and belonging (EDIB) are part of everything we do

---

Contact the team at:

01223 553998

ocr.org.uk

To stay up to date with all the relevant news about our qualifications, register for email updates at ocr.org.uk/updates

Visit our Online Support Centre at support.ocr.org.uk