OCR
Oxford Cambridge and RSA

Thursday 7 June 2018 – Morning

A2 GCE GEOLOGY

F795/01 Evolution of Life, Earth and Climate

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour 45 minutes

* F 7 9 5 0 1 *

* 7 4 0 3 5 4 8 9 4 2 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **100**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- This document consists of **20** pages. Any blank pages are indicated.

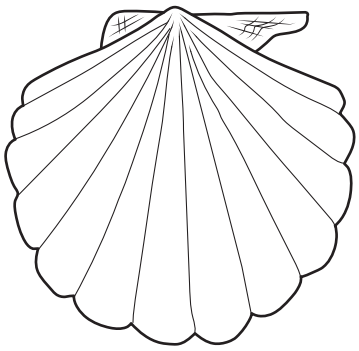
Answer **all** the questions.

1 **(a)** The table below shows morphological features found in bivalves.

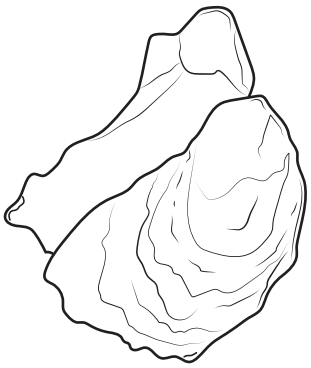
Number	Morphological feature
1	thin corrugated valves
2	shell covered in a layer of periostracum
3	larger and heavy left valve
4	irregular left valve
5	byssus
6	streamlined valves with no ribs
7	small lid-like right valve
8	ears / wings

(i) Using the numbers provided, label the morphological features listed in the table above on the appropriate diagrams of bivalves **A**, **B**, **C** and **D** below.

Bivalve A

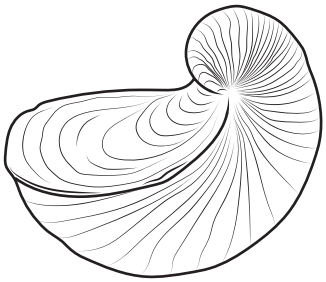


Bivalve B

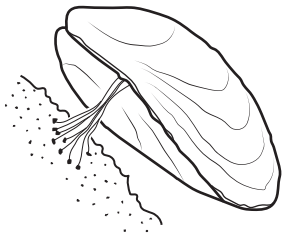


5 cm

Bivalve C



Bivalve D



[3]

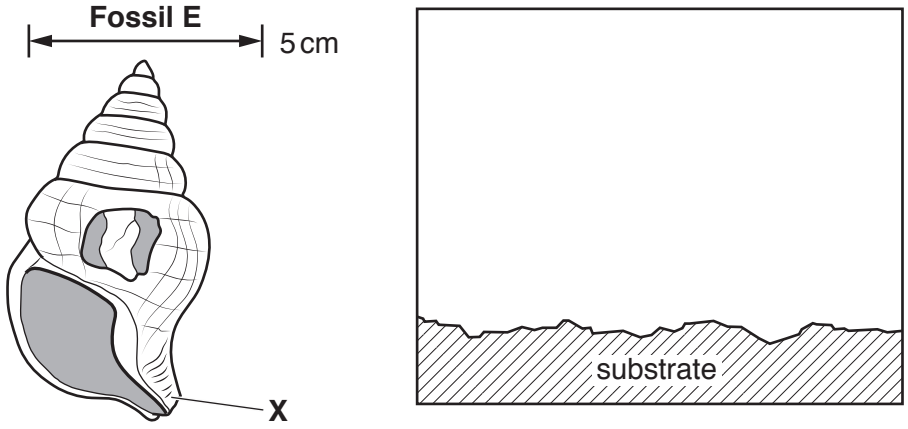
(ii) Complete the table below by matching the morphological features from the table on page 2 with the functions listed. Each feature may be used once, more than once or not at all.

Function	Feature
provides protection from acidic water in an inter-tidal environment	
allows stability for free-lying mode of life in soft substrate	
a flexible attachment to a hard substrate to suit high-energy conditions	
allows attachment by cementation to hard substrate	
provides strength with low mass to enable nektonic mode of life	
directs water currents for stability in the water column	
prevents sediment clogging respiratory system	
reduces resistance to water flow	

[4]

(iii) Which of the bivalves **A** to **D** display the expected symmetry? ..... **[1]**

(b) Below is a diagram of fossil **E**.



(i) State the phylum and group for fossil **E**.

phylum ..... group ..... **[1]**

(ii) Label the spire and body chamber on the diagram of fossil **E**. **[1]**

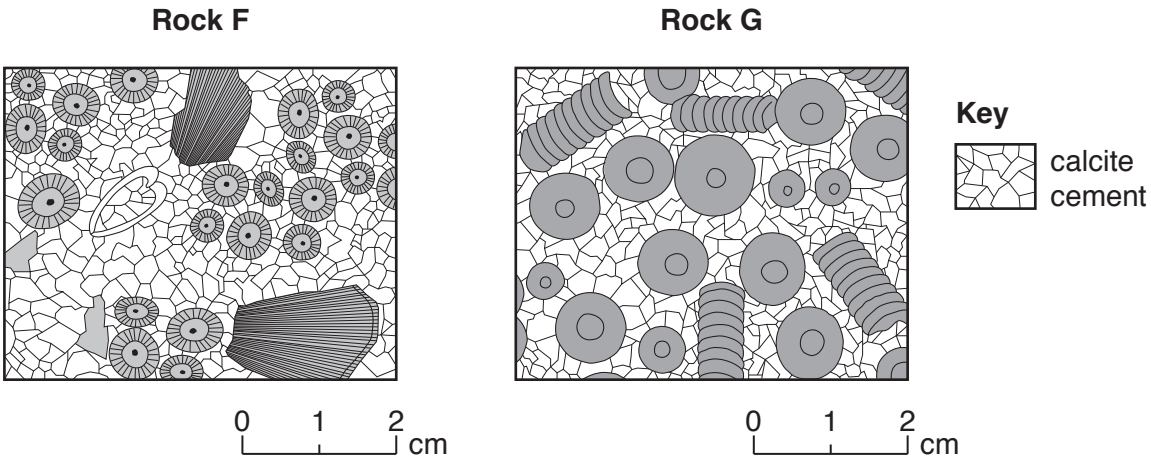
(iii) Sketch fossil **E** in **life position** in the box above. Draw and label its soft parts. **[2]**

(iv) Morphological feature **X** shown on the diagram supports a soft tissue tube common to groups in this phylum. Name this **soft tissue** tube.

..... **[1]**

[Total: 13]

2 **(a)** The diagram below shows two thin section diagrams of carbonate rocks formed around an island in the Carboniferous Period.

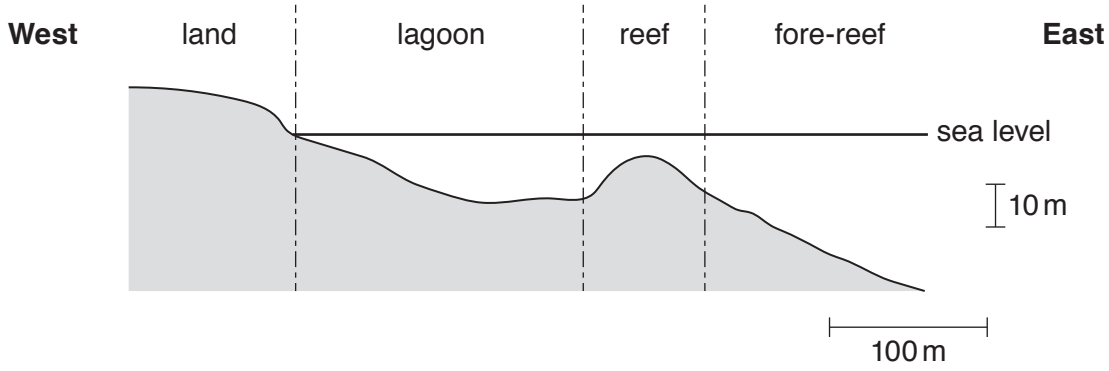


(i) Identify the fossils seen in rocks **F** and **G**.

F .....

G ..... **[1]**

(ii) The diagram below shows a modern coral reef in cross-section. The changes in water depth result in a variety of carbonate rock types. Label the diagram with arrows and letters to show the most likely positions where rocks **F** and **G** would form.



[1]

(iii) Explain why you have chosen these positions.

F .....

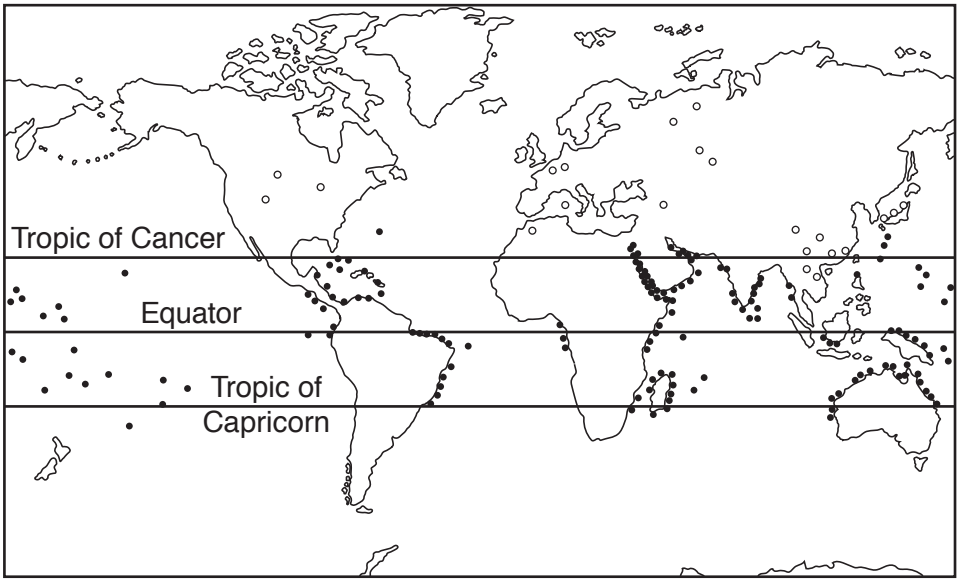
.....

G .....

.....

[2]

(b) The map below shows the distribution of modern coral reefs (solid circles) and Carboniferous coral reefs (open circles).



(i) Describe and explain the differences in the distributions of the modern and Carboniferous coral reefs.

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..... **[3]**

(ii) Describe and explain **three** environmental conditions that would allow reef-building by scleractinian corals.

1 .....

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2 .....

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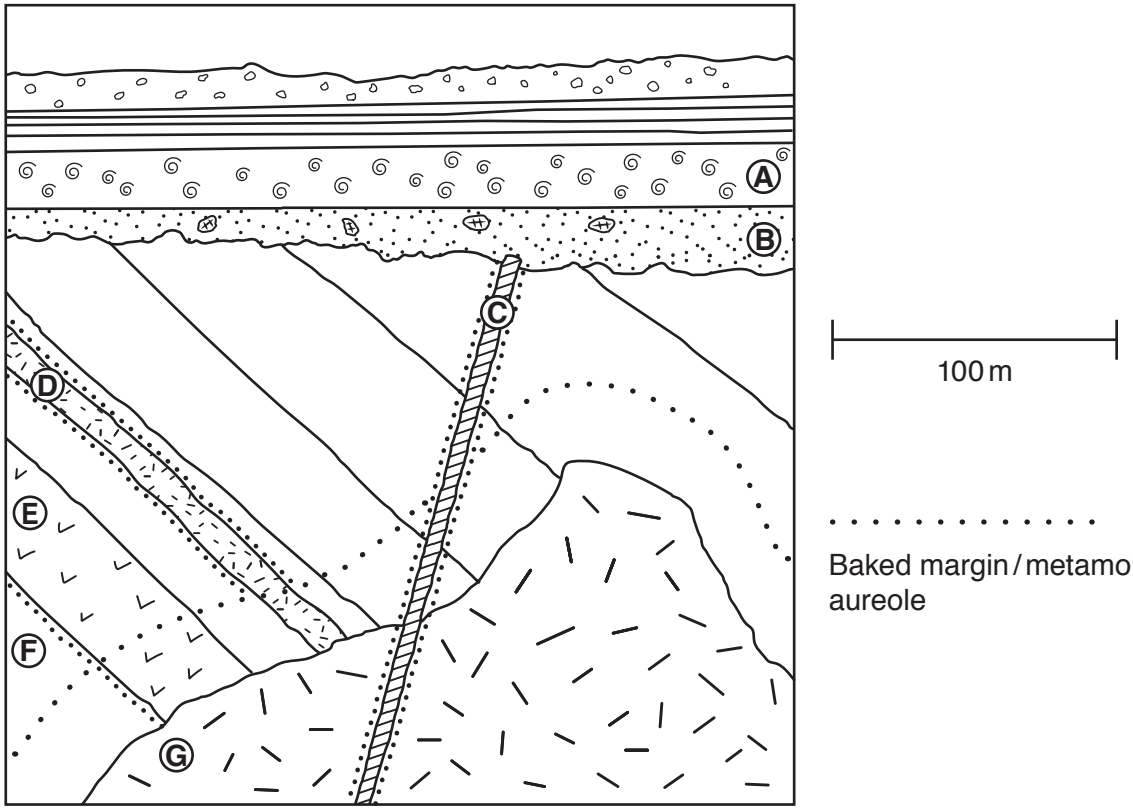
3 .....

..... **[3]**

[Total: 10]

3 Study the cross-section below which shows a succession of rock units. Some of the rock units have been radiometrically dated and some contain fossils.



(a) (i) Which igneous rock, **C**, **D**, **E** or **G**, is the oldest? ..... **[1]**

(ii) Fully explain the evidence for your choice.

.....

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..... **[2]**

(iii) State the name of the relative dating principle you used to make your decision.

..... **[1]**

(b) (i) Explain why ^{40}K -^{40}Ar dating of the coarse crystalline rock **G** produced an age **younger** than the same sample analysed using the ^{87}Rb -^{87}Sr method.

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..... **[2]**

(ii) Explain why samples of rock **G** taken from different areas give a variety of ages when analysed using the ^{87}Rb -^{87}Sr method even though the experimental error was small.

.....

.....

.....

..... **[2]**

(c) (i) Rock unit **F** consists of dark shales containing graptolites. What is the possible age range for this rock unit?

..... **[1]**

(ii) Igneous rock **C** was dated at 170 Ma and rock unit **B** contains some trilobite fossils. Explain why this is surprising.

.....

..... **[1]**

(iii) What name is given to this type of anomalous fossil? Explain how it is preserved.

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..... **[2]**

(d) Fossil foraminifera from rock unit **A** were analysed for their oxygen isotope ratios. Explain the mechanism that alters the oxygen isotope ratios **and** describe how they would show that the rocks were laid down in a warmer climate than that of the present day.

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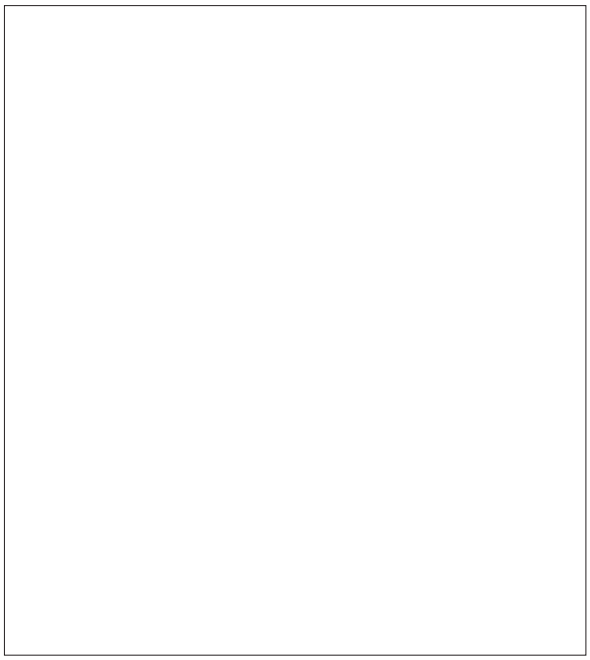
..... **[4]**

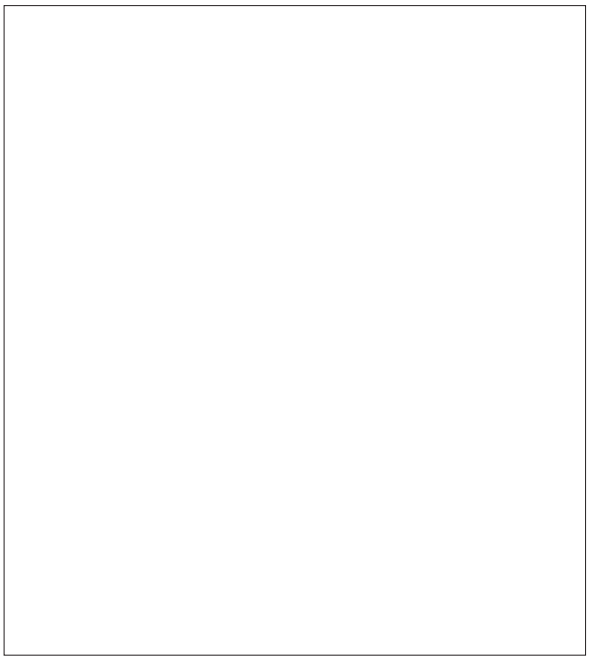
(e) Pelagic trilobites could be either planktonic or nektonic.

(i) In the boxes below, draw and fully label an example of each type of trilobite.

planktonic



nektonic



[6]

(ii) Compare and explain the differences in the eye adaptations of the two types of trilobites you have drawn.

.....

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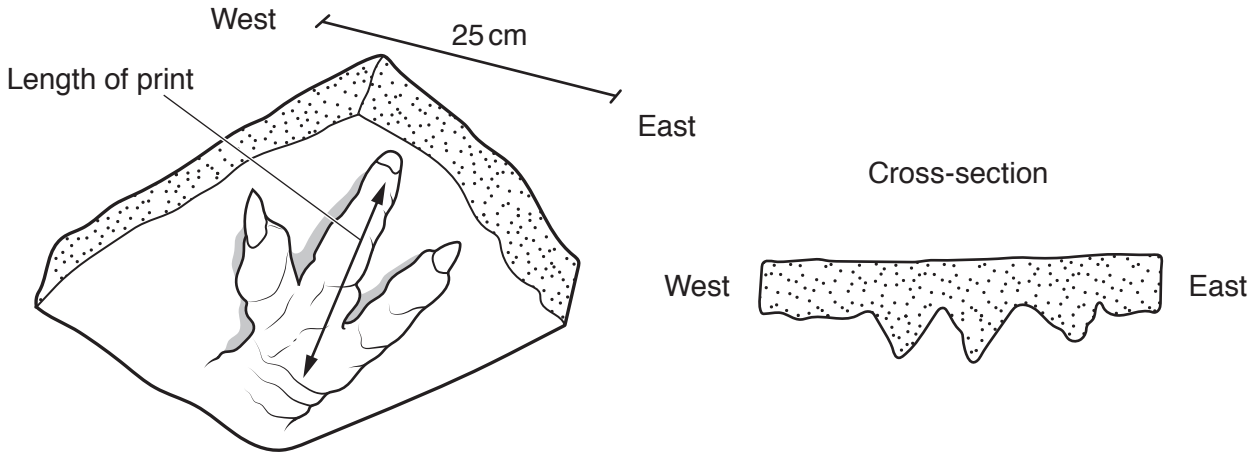
..... **[2]**

(iii) In what kind of environment are pelagic trilobites mostly likely to have lived?

..... **[1]**

[Total: 25]

4 **(a)** The diagram below shows a trace fossil made by a dinosaur.



(i) Name and explain the processes that formed this trace fossil.

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.....

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.....

..... **[3]**

(ii) Name a group of dinosaurs that could have made this trace fossil.

..... **[1]**

(b) Using dinosaur track analysis it is possible to work out how fast the animal that left the footprints was travelling.

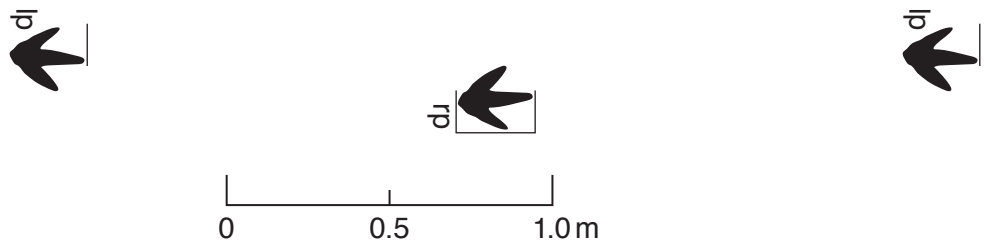
(i) Use the scale to determine the actual length of the 'print' marked on the diagram above. The length of the footprint is 20% of the leg length.

Use this information to calculate the length of the dinosaur leg.

Leg length = ... m **[1]**

(ii) The distance between the same point on the 'print' of consecutive right or left feet gives the stride length of the dinosaur.

Use the scale on the trackway diagram below to determine the stride length of the dinosaur.



Stride length = ... m **[1]**

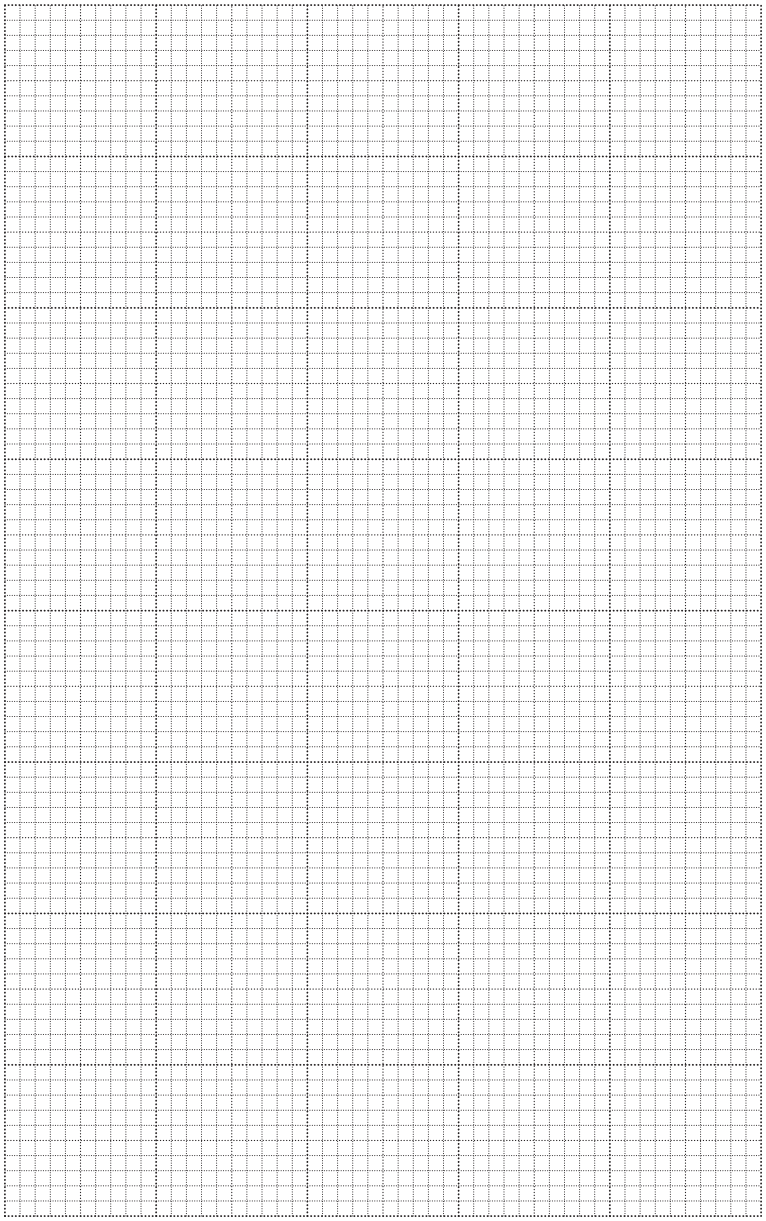
(c) The length of stride can be used to find the actual speed of the dinosaur. The method relies on experimental data collected from mammals to compensate for the size of the animal and uses two dimensionless variables:

- the relative stride (which is the stride divided by the leg length)
- the dimensionless speed.

The table below shows experimental data of relative stride and dimensionless speed.

Relative stride	Dimensionless speed
0.80	0.1
1.50	0.6
2.50	1.7
4.00	2.8
5.20	3.8
5.80	4.3
7.60	5.8
9.20	7.1

(i) Plot the data from the table on the grid below. Draw a straight line of best fit.



[3]

(ii) A *Tyrannosaurus rex* with a **leg length of 2.5 metres** had a **relative stride of 3.2**. Use the line of best fit on your graph to determine the dimensionless speed of this dinosaur.

Use the formula below to calculate the actual speed of the dinosaur. Show your working.

actual speed = dimensionless speed $\times$ $\sqrt{(\text{leg length} \times \mathbf{g})}$
g is $10\,m/s^2$.

actual speed ..... m/s **[3]**

[Total: 12]

5 **(a)** Explain **two** ways in which early amphibians were adapted to a terrestrial mode of life.

1 .....

.....

2 .....

..... **[2]**

(b) **(i)** Describe the characteristic hip bone arrangement and mouth parts typical of **Ornithischian** dinosaurs.

.....

.....

.....

..... **[2]**

(ii) What possible function, other than for defence, could the bony armour plates exhibited by some Ornithischian dinosaurs have had?

.....

..... **[1]**

(iii) Suggest how the stance **and** hand adaptations of *Iguanodon* suited its inferred mode of life.

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..... **[2]**

(c) (i) From the exceptional preservation of a specimen in the Solnhofen Limestone we know that *Archaeopteryx* had feathers. Such delicate, organic material is usually destroyed by currents, bacteria or scavengers. Explain **three** environmental conditions that prevented the destruction and decay of the feathers in this case.

1 .....

.....

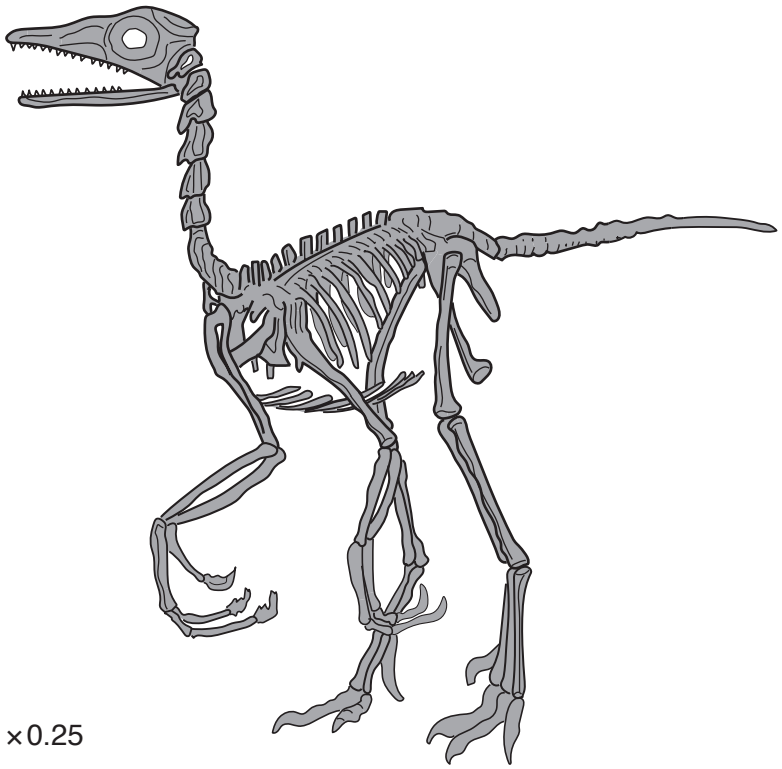
2 .....

.....

3 .....

..... **[3]**

(ii) *Archaeopteryx* has been described as a transition between non-feathered dinosaurs and modern birds. Label **four** morphological features shown on the diagram below adding either (bird) or (dinosaur) to your labels.



×0.25

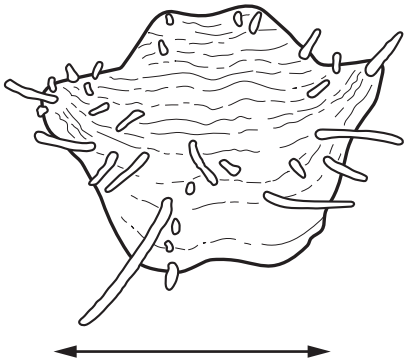
[4]

[Total: 14]

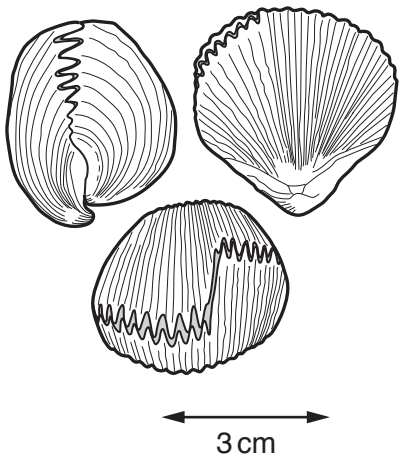
6 **(a)** Ancient brachiopods lived in a variety of marine environments. They tended to be smaller in deeper water.

(i) Match **two** of the brachiopods shown below to the modes of life listed. Explain your reason for each choice.

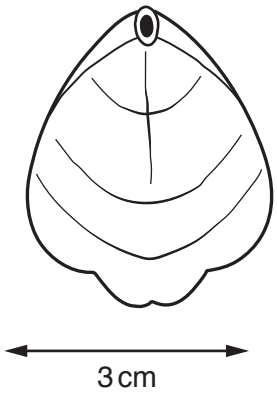
Fossil H



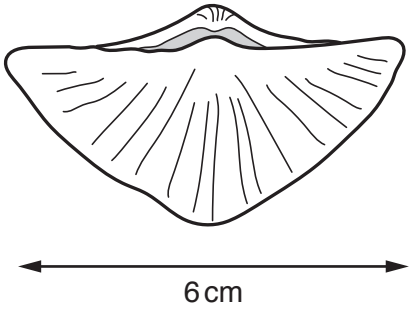
Fossil J



Fossil K



Fossil L



1 Shallow marine environment .....

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..... **[2]**

2 Muddy marine environment .....

.....

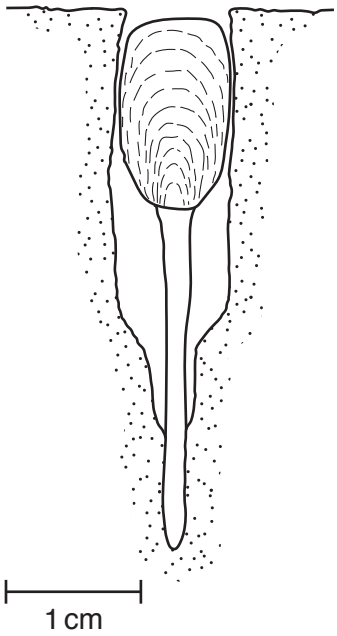
.....

..... **[2]**

(ii) The diagram below shows *Lingula*, an extant infaunal brachiopod. It anchors itself at the top of a burrow in **the intertidal zone**. Using evidence from the diagram, describe how it survives in this environment.

.....

..... **[1]**



(iii) Give **two** other pieces of morphological evidence shown on the diagram that suggest *Lingula* has an infaunal mode of life.

1 .....

.....

.....

2 .....

.....

..... **[1]**

[Total: 6]

7 Describe the Earth's changing climate in terms of icehouse-greenhouse cycles since the Late Precambrian and explain the link to mass extinction events.

You should structure your answer so the climate events are clearly linked to mass extinctions.

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.....

.....

..... **[10]**

8 Graptolites evolved rapidly through the Lower Palaeozoic making them excellent zone fossils. Describe the changes in morphology as graptolites evolved. You may use diagrams.

You should structure your answer to describe the oldest graptolites first.

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..... **[10]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

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