OCR
Oxford Cambridge and RSA

Tuesday 16 June 2015 – 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 *

* 5 0 0 3 7 5 3 7 3 8 *

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 at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

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)** A number of fossils are described in a student's field notebook as shown in the table below.

Fossil	Description	Fossil group
A	two equivalve ribbed shells with straight hinge line extended by an ear	
B	hard, straight and bullet shaped	
C	shell coiled in a tall spire	
D	shell chambered, tightly coiled and planispiral	

(i) Complete the table above by writing in the names of the correct fossil groups. **[3]**

(ii) In the space below, draw a fully labelled diagram to show the main features of fossil **C**.

[3]

(iii) Describe the mode of life of fossil **A**.

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

(iv) Explain why fossil **D** is a good zone fossil.

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

(b) (i) Descriptions of different geological terms are given in the table below. Match each description with the correct geological term. Use only the terms provided in the list.

Each term can be used once or not at all.

absolute timescale **death assemblage** **fossil range**

life assemblage **trace fossil**

Description	Term
a collection of organisms found in a different place or position from the one they occupied in life	
fossils that preserve the activity of an organism but not the hard parts	
the time between the first appearance and extinction of a fossil group	

[2]

(ii) Explain how fossil assemblages can be used to interpret a high-energy palaeoenvironment.

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

(c) (i) Describe how an insect may be preserved in amber.

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

(ii) Describe how a mammal may be preserved in a tar pit.

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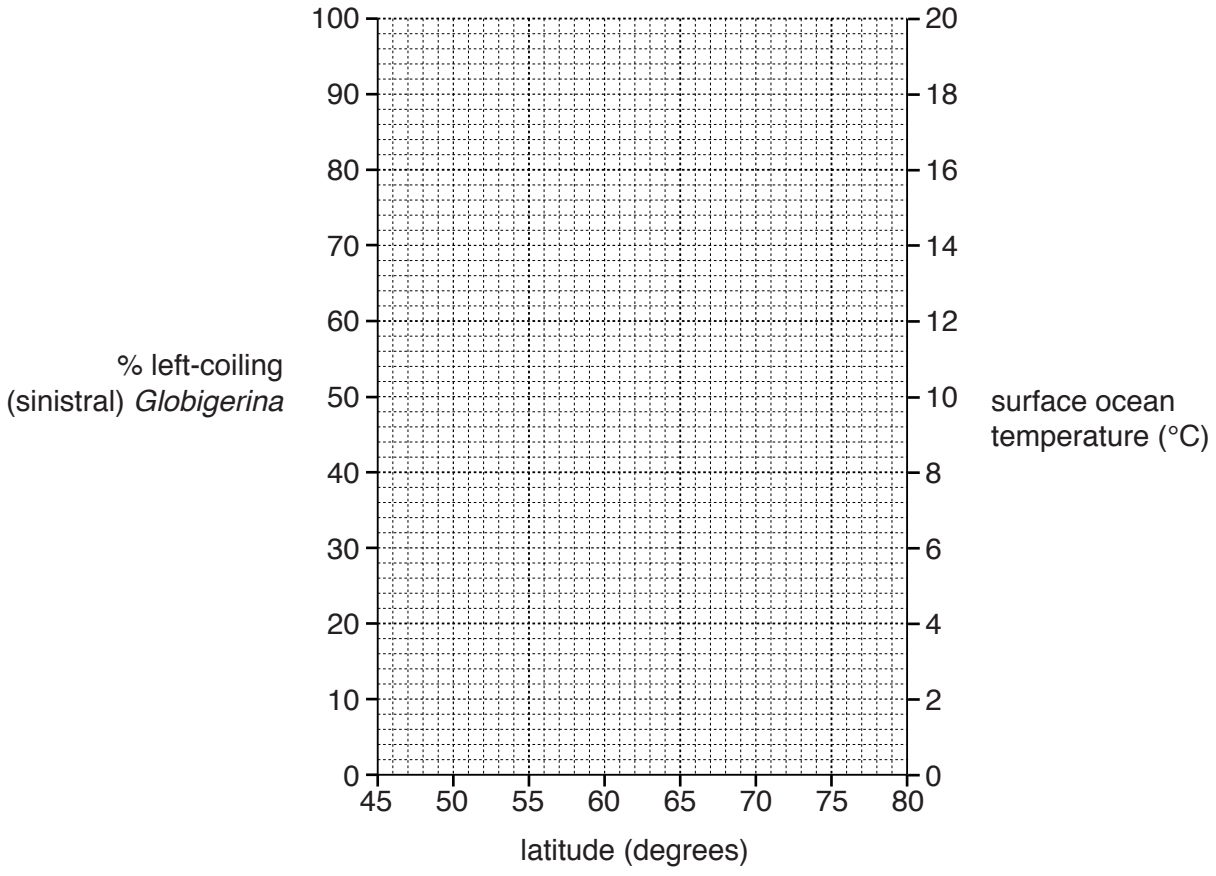
..... **[2]**

[Total: 16]

2 **(a)** *Globigerina* are planktonic foraminifera that can be found in oceanic sediments since the Eocene. The tests (shells) are composed of $CaCO_3$, are globular, and coil either to the left (sinistral) in cold water or to the right (dextral) in warmer water.

A study of modern *Globigerina* provides the following data.

Latitude in degrees	% left-coiling (sinistral) *Globigerina*	Surface ocean temperature (°C)
45	0	20
50	2	16
55	6	13
60	10	11
65	70	9
70	84	7
75	96	5
80	98	2



(i) Plot the data from the study on the graph above. Use a suitable key or labels. **[3]**

(ii) State the temperature and the latitude at which equal numbers of sinistrally and dextrally coiling foraminifera are found.

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

(iii) Explain the pattern of both of the graphs you have drawn.

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

(b) (i) Sediment accumulates at rates of from 1.5 cm to 3 cm per 1000 years in some parts of the Pacific Ocean.

Using the average rate of sedimentation, calculate the thickness, in millimetres, that can accumulate in one year.

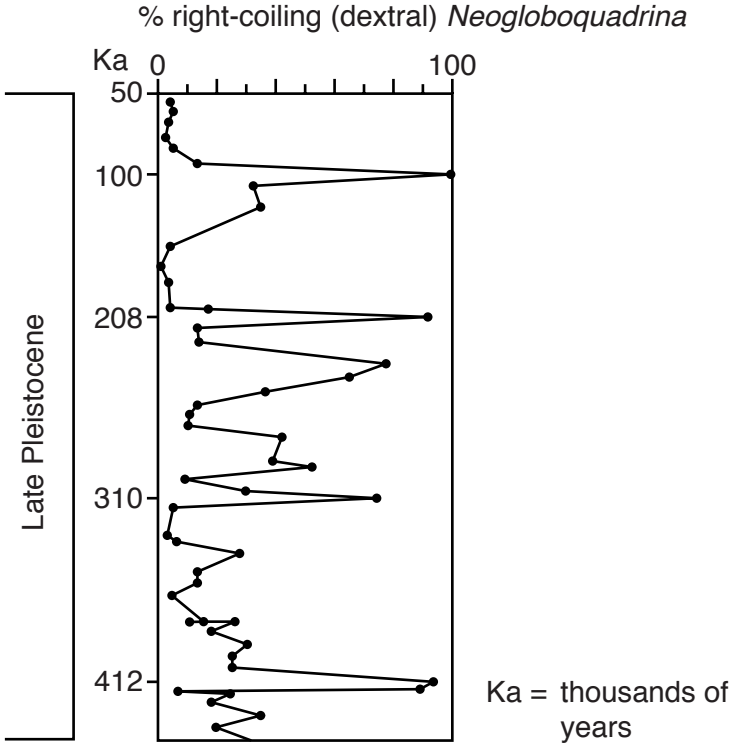
Answer = ... millimetres in one year **[1]**

(ii) Name the sediment that forms.

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

Question 2(c) begins on page 6

(c) The graph below shows the percentages of right-coiling (dextral) foraminifera of the genus *Neogloboquadrina* extracted from sediments in the northern Pacific Ocean. The coiling pattern of *Neogloboquadrina* shows the same relationship as *Globigerina* in part **(a)**.



(i) The graph shows a cyclical pattern that may be explained using Milankovitch cycles.

Circle the cycle that best fits the data given.

eccentricity **obliquity** **precession** **[1]**

(ii) Using your knowledge and evidence from the graph, explain why you chose this cycle.

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

[Total: 11]

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3 (a) (i) The table below shows a list of features that can be found in corals.

Place a tick (✓) in the correct box to indicate whether the features listed are present for the **three** different coral types (rugose, scleractinian and tabulate).

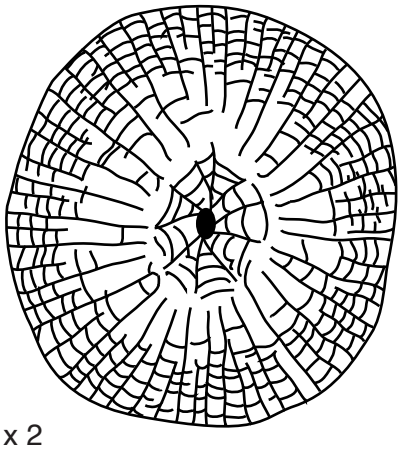
	Type of coral		
Feature	**Rugose**	**Scleractinian**	**Tabulate**
tabulae			
columella			
major septa at six points radially			
many small corallites			

[4]

(ii) The cross-section diagram below shows fossil **E**, a coral.

Fully label the diagram using information from the table above and your own knowledge.

fossil **E**



x 2

[3]

(b) Describe **one** advantage of corals living colonially.

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

(c) Corals in the past are assumed to have had the same mode of life as those alive today.

Explain why most modern reef-building corals need to live in:

high-energy conditions .....

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shallow-water conditions .....

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[2]

(d) **(i)** Describe how crinoidal limestone forms.

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

(ii) Describe how chalk forms.

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

[Total: 14]

4 Read the following case study about an important fossil assemblage.

Case Study – The Chengjiang Lagerstatten
The Chengjiang Shales in China is one of the most important fossil sites in the world. Mudstone is exposed which has yielded many exceptionally preserved soft-bodied organisms dating back approximately 525 million years.

This formation lies just above the Precambrian–Cambrian boundary, and is older than the Burgess Shale. The Chengjiang Shales represent a window into the ecosystems that existed at the time of the 'Cambrian Explosion'. The Cambrian Explosion was a time when many animals were evolving and diversifying over a short time interval.

The great diversity of organisms with soft tissues preserved at Chengjiang includes algae, sponges, worms, arthropods and hemichordates. There are also many 'problematic fossils', which do not fit into our current understanding and classification of organisms.

(a) (i) Using information from the case study and your own knowledge, describe and explain how evolution occurred during the Cambrian explosion.

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

(ii) Describe and explain the environmental conditions needed for exceptional preservation to occur in both the Chengjiang and Burgess Shales.

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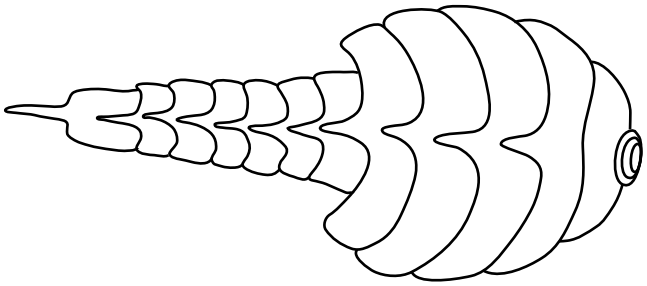
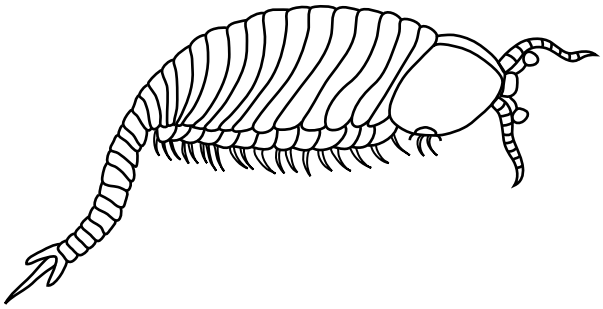
..... **[3]**

(iii) The fossils are preserved as aluminosilicates (clays) and haematite. State the term that describes this type of preservation.

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

(b) The diagrams below show reconstructions of two 'problematic fossils', **F** and **G**, found in the Chengjiang Shales.

Fossil F	**Fossil G**
	
Guangweicaris sp. x 0.5	*Fuxianhuia* sp. x 0.5

(i) Which of the fossil groups that you have studied do these fossils most closely resemble? Describe **two** morphological features that would allow us to classify these fossils.

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

(ii) Explain the significance of the 'problematic fossils' found in all exceptionally preserved deposits.

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

(c) Trace fossils, in particular those of burrowing organisms, are found in sediments from the Chengjiang and Burgess Shales. Explain what this may mean in evolutionary terms.

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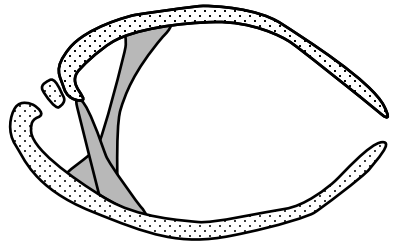
..... **[1]**

[Total: 12]

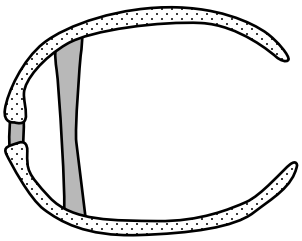
5 **(a)** Below are cross-section diagrams of fossils **H** and **J,** showing the positions of some internal structures as they would have been when they were alive.

Fossil H



x 1

Fossil J



x 1

(i) Label the following morphological features on the relevant diagram(s):

- adductor muscle
- diductor muscle
- ligament. **[3]**

(ii) Clearly label the brachial valve on the correct diagram above. **[1]**

(b) **(i)** Compare the methods of shell opening in bivalves and brachiopods.

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

(ii) Compare how bivalves and brachiopods get the oxygen needed for respiration.

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

(c) Brachiopods evolved to inhabit many different environments. Describe and explain **two** morphological adaptations of brachiopods to living in each of the following conditions:

attached in turbulent waters .....

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free-lying in quiet waters .....

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[4]

(d) **(i)** Bivalves also evolved to inhabit many different environments. In the space below, draw labelled diagrams of the hard parts of a deep-burrowing bivalve, adapted to living in soft sediment.

internal view	external view

[2]

(ii) Explain **two** morphological adaptations of a deep-burrowing bivalve.

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

[Total: 16]

6 **(a)** The early amphibians (tetrapods) were the first known organisms to be adapted to living on land. They are thought to have evolved from lobe-finned fish.

(i) When did amphibians first evolve?

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

(ii) Describe and explain how the modified swim bladder allowed lobe-finned fish to venture out of the water and onto land.

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

(iii) Describe and explain how fleshy fins with a bone structure like a hand allowed lobe-finned fish to venture out of the water and onto land.

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

(iv) State **four** different morphological features that are similar between lobe-finned fish and early amphibians.

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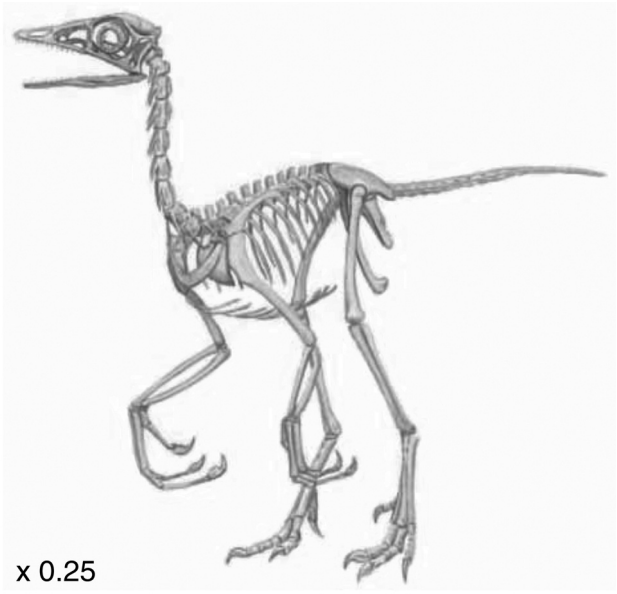
..... **[2]**

(b) Study the diagram of *Archaeopteryx* below.



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(i) List **two** morphological features displayed by *Archaeopteryx* that are considered reptilian and **two** morphological features that are considered avian (from birds).

	Reptilian features	Avian features
1		
2		

[2]

(ii) *Archaeopteryx* laid amniotic eggs. Explain why the development of a hard outer shell on the amniotic egg benefited the developing embryo.

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

[Total: 11]

7 Describe how geologists can date rocks in the field using **three** relative dating methods. You **must** use labelled diagrams to illustrate each method.

You should include which are the oldest and youngest rocks for each method.

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

[Total: 10]

8 Describe and explain the morphological adaptations of trilobites living below the sediment surface (infaunal) and the morphological adaptations of trilobites living in the surface layers of the ocean (nektonic and planktonic).

You should match each morphological adaptation to one explanation. Diagrams are not required in this answer.

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

[Total: 10]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

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