THIS IS A LEGACY SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

ADVANCED GCE

SCIENCE

Science and Global Processes

2846

OCE/11669

Candidates answer on the Question Paper

OCR Supplied Materials:
None

Other Materials Required:
- Electronic Calculator
- Ruler (cm/mm)

Wednesday 16 June 2010
Morning

Duration: 1 hour

2846

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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 **60**.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **12** pages. Any blank pages are indicated.

Examiner's Use Only:			
1			
2			
3			
4			
5			
Total			

Answer **all** the questions.

1 Seismic waves from earthquakes consist of two components, a P-wave and an S-wave.

Fig. 1.1 shows rays of each type of wave travelling from an earthquake at point **W** on the Earth's surface.

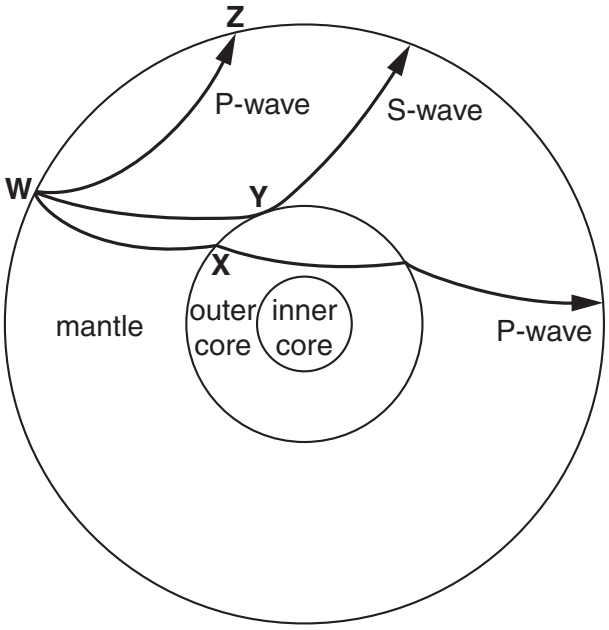


Fig. 1.1

(a) (i) Describe the difference between P-waves and S-waves.

.....

.....

.....

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

(ii) Give a reason why only P-waves are able to cross through the outer core of the Earth.

.....

.....

.....

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

(b) Name the processes occurring at

(i) point **X** ..... **[1]**

(ii) point **Y**..... **[1]**

(c) Explain what you can deduce from the diagram about the relative densities of the mantle and the outer core. Justify your answer.

.....

.....

.....

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

(d) A P-wave may travel at approximately 9000 m s^{-1} in the upper mantle. The P-wave shown travelling to point **Z** on the Earth's surface takes a route with a total distance of 3780 km.

(i) Calculate how long it takes the P-wave to travel on this route.

Give your answer to the nearest whole number of minutes. Show your working below.

length of time = ... minutes **[2]**

(ii) Suggest one reason why the P-waves may arrive significantly earlier than the answer you gave in **(i)**.

.....

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

(e) The inner core in the structure of the Earth is solid, consisting mostly of iron and nickel.

(i) Why are substances such as iron and nickel found at the **centre** of the Earth?

.....

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

(ii) Why is the inner core solid, even though the temperatures there are very high?

.....

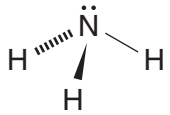
..... **[1]**

[Total: 13]

2 Ammonia (NH_3) is a simple chemical substance which has been found to be present in several objects in the solar system, including Titan, one of the moons of Saturn. Scientists suggest that there may be seas of liquid ammonia on Titan or similar objects.

(a) Both water and ammonia have higher boiling points than many other simple molecules. This can be explained by hydrogen bonding, caused by the presence of polar bonds in the molecules.

(i) Using the $\delta+$ and $\delta-$ convention, show the polarity of the bonds in the ammonia molecule below (electronegativity values: N = 3.0, H = 2.1). **[2]**



(ii) Does your diagram suggest that the ammonia molecule will possess a dipole? Explain your answer.

.....

.....

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

(iii) Draw a diagram to show how two ammonia molecules can bond to each other by forming a hydrogen bond.

[3]

(iv) Explain why the presence of hydrogen bonds increases the boiling point of a substance.

.....

.....

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

(v) Name one other type of intermolecular force that will be present in a sample of liquid ammonia.

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

(b) The ability of water to store heat is important on Earth. The storage of heat is related to the specific heat capacity of a liquid. Water has a specific heat capacity of $4.2\,J\,g^{-1}\,K^{-1}$, whereas liquid ammonia has a specific heat capacity of $4.7\,J\,g^{-1}\,K^{-1}$.

(i) Which liquid will store heat more effectively? Explain your answer.

.....

.....

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

(ii) Describe one example of how the storage of heat by liquids such as water may influence the climate of a planet.

.....

.....

.....

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

(c) Frozen ammonia would sink to the bottom of an ammonia sea, exposing the surface of the sea to further cooling and eventually causing the whole sea to freeze.

This process does not happen to ice in liquid water.

Explain why water does not sink when it freezes into ice, referring to the structure and bonding in ice in your answer.

You may use a diagram in your answer.

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.....

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

[Total: 17]

3 The length of the day varies throughout the year. Fig. 3.1 shows the day length at two locations over the course of a year.

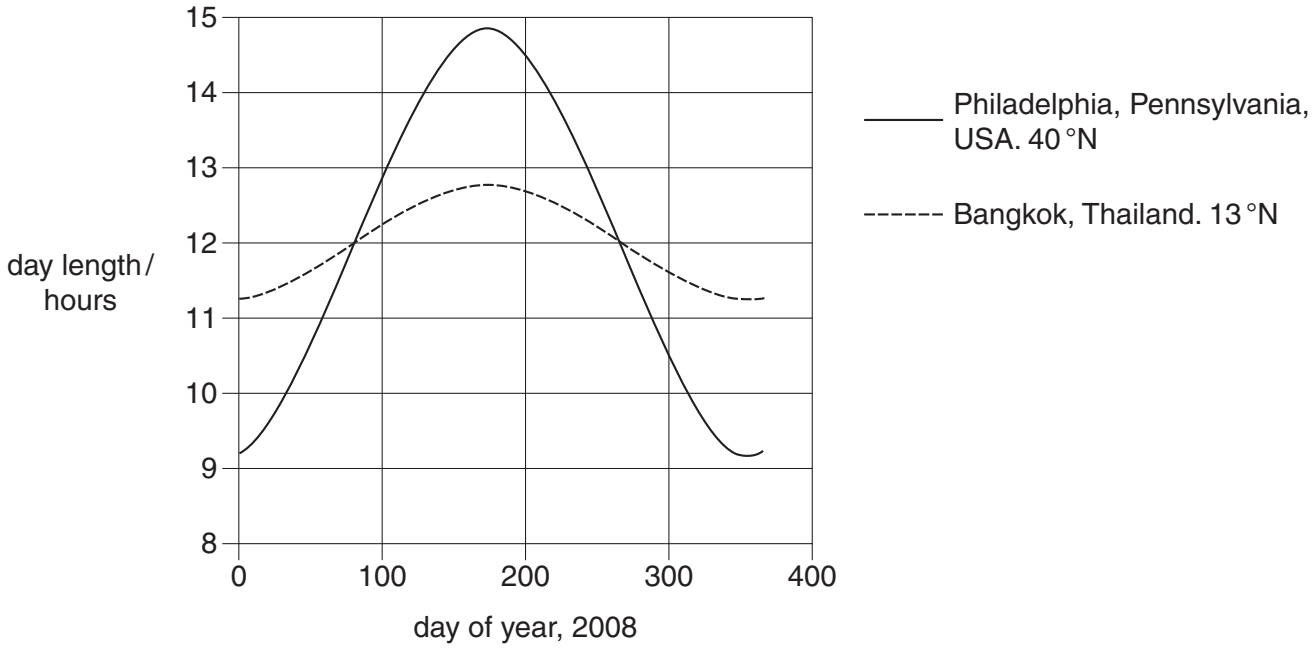

Fig. 3.1

(a) Mark and label on the graph for Philadelphia a period of the year where

(i) the day length is changing rapidly **[1]**

(ii) the day length changes very slowly. **[1]**

(iii) State in which seasons of the year these periods occur.

rapid change in day length .....

slow change in day length .....
[1]

(iv) The change in day length observed in Bangkok is much less than that observed in Philadelphia. State the reason for this difference.

.....

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

(v) On Fig. 3.1, sketch out the graph that would be expected for the day length in Sydney, Australia (40 °S). **[2]**

(b) The two curves in Fig. 3.1 are similar to the curves obtained from an object undergoing *simple harmonic motion*.

(i) Give an example of a situation in which **an object** undergoes simple harmonic motion.

.....

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

(ii) Calculate the amplitude and the period of the oscillation of day length for Philadelphia.

amplitude = ... hours

period = ... days
[2]

[Total: 9]

4 Fig. 4.1 shows the surface ocean currents in the southern part of the Pacific Ocean.

These ocean currents are affected by the positions of the continents but are also affected by other factors.

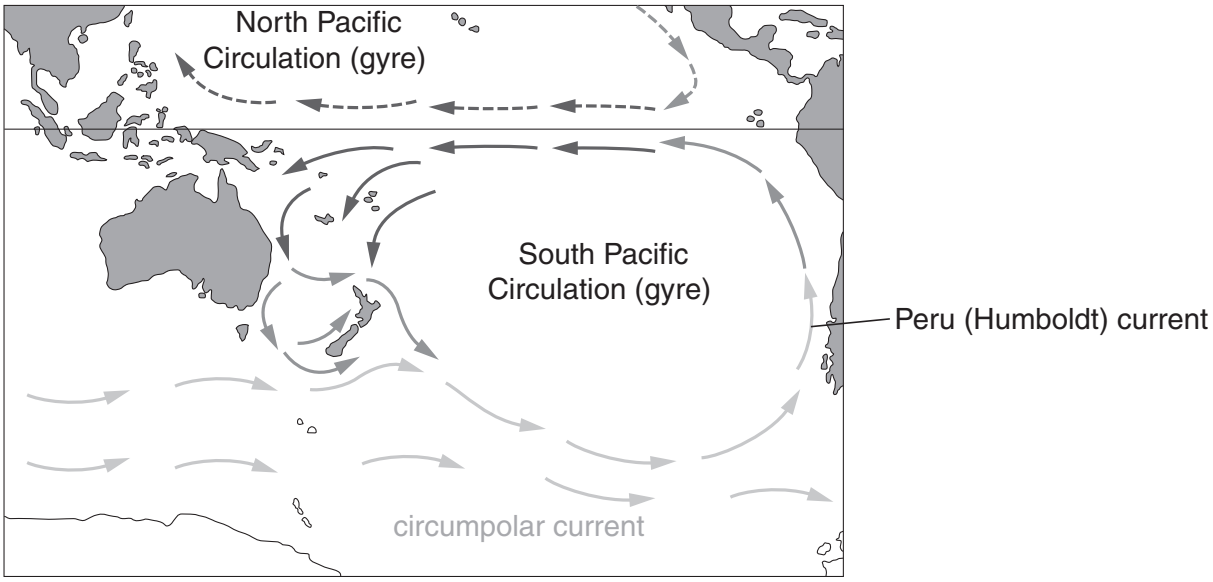

Fig. 4.1

(a) (i) State **two** factors, other than the positions of the continents, that influence the direction of ocean currents.

.....

.....

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

(ii) The Peru or Humboldt current is described as a cold current.

Suggest why it is a cold current.

.....

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

(b) The ocean currents are disrupted when an *El Niño* event occurs.

(i) Describe the changes that occur to the ocean currents during an *El Niño* event.

.....

.....

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

(ii) State one other effect, apart from ocean circulation, which may be noticed during an *El Niño* event.

.....

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

(c) The ocean circulation system also involves deep water currents and vertical movement, not shown on Fig. 4.1.

The vertical movement of sea water is driven by the sinking of water in a small number of places around the world.

(i) Label one place on Fig. 4.1 where sinking of sea water is likely to occur. **[1]**

(ii) Describe why water sinks in this region.

.....

.....

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.....

.....

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

[Total: 11]

5 Copper is a metal and is a good conductor of electricity.

This property can be accounted for by the structure and bonding in the metal.

One way of representing the structure of a metal is shown in Fig. 5.1.

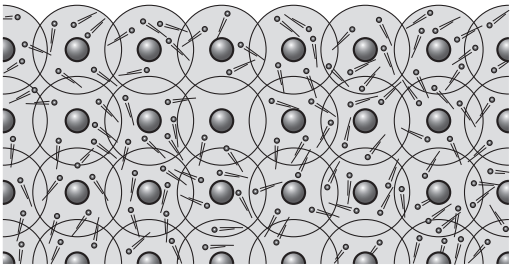

Fig. 5.1

(a) (i) Describe the key features of a metallic structure, adding suitable labels to the diagram above.

.....

.....

.....

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

(ii) Explain why metals have a high electrical conductivity.

.....

.....

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

(b) Copper(I) chloride, CuC*l*, contains Cu^+ and Cl^- ions. It has a giant ionic structure.

(i) Draw a diagram to show the giant ionic structure of CuC*l*, clearly labelling the particles.

[3]

(ii) Copper(I) chloride does not conduct an electric current when solid but does conduct when molten. Explain these properties in terms of the structure and bonding in copper(I) chloride.

.....

.....

.....

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

[Total: 10]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE