

**ADVANCED SUBSIDIARY GCE
 SCIENCE**

Science and Human Activity

FRIDAY 11 JANUARY 2008

2842

Afternoon
 Time: 1 hour

Candidates answer on the question paper
Additional materials (enclosed): None

Additional materials (required):
 Electronic calculator



Candidate Forename

Candidate Surname

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You are advised to show all the steps in any calculations.
- You may use an electronic calculator.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	14	
2	15	
3	9	
4	11	
5	11	
TOTAL	60	

This document consists of **13** printed pages and **3** blank pages.

Answer **all** the questions.

1 This question is about some of the processes which produce the Earth's different climate zones.

(a) Complete Fig. 1.1 with appropriate labels in the boxes to show the climate zones at different latitudes of the Earth. [4]

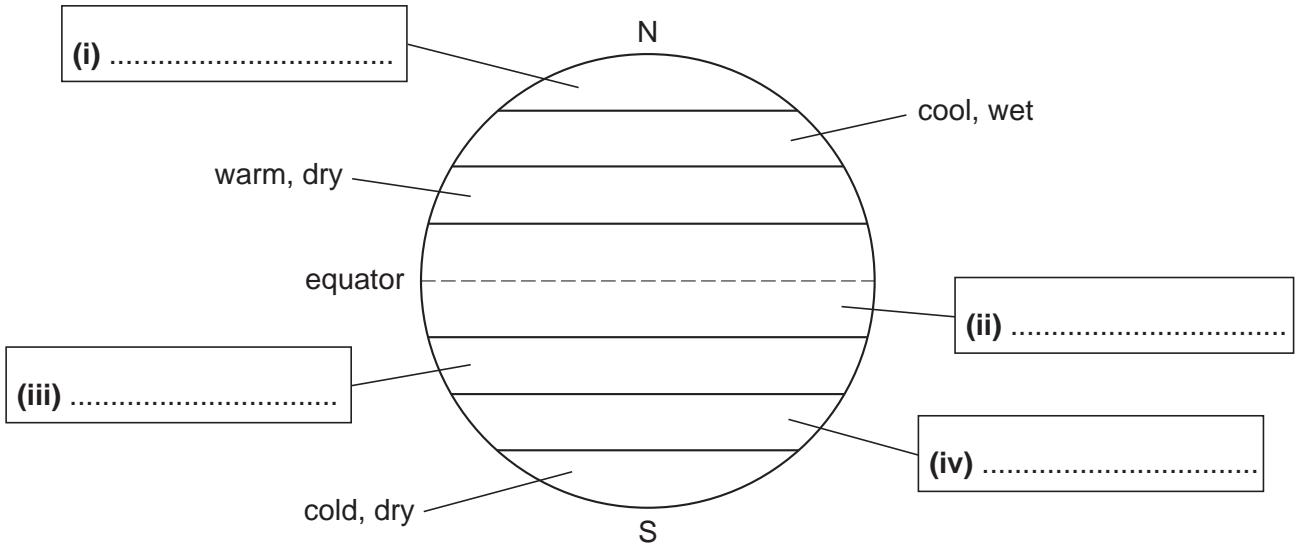


Fig. 1.1

(b) The circulation of air in the atmosphere can be used to explain the presence of these zones.

Complete the following sentences by ticking the appropriate boxes.

(i) Air rises at the equator because heating causes the air to... [1]

A	Expand and become less dense	
B	Expand and become more dense	
C	Contract and become less dense	
D	Contract and become more dense	

(ii) The air rises until it reaches the top of the...

[1]

A	Stratosphere	
B	Ionosphere	
C	Troposphere	
D	Thermosphere	

(iii) The air spreads out towards higher latitudes. Eventually it descends, which causes the air to be compressed and creates... [1]

A	A region of low pressure	
B	A region of high pressure	
C	The inter-tropical convergence zone	
D	A cyclone	

(iv) Dry climate zones, such as those shown in Fig. 1.1 are generally associated with regions of... [1]

A	Ascending air	
B	Warm air	
C	Low pressure	
D	High pressure	

- (c) The climate zones give an indication of the average climate experienced at a particular time of year. However, the weather in these zones depends on a number of factors. One of these is the surface wind direction, which in turn depends on the position of high and low pressure regions.

Between January and March 2006, the position of these pressure regions close to the UK remained relatively unchanged. Fig. 1.2 shows the typical pressure distribution during this period. The pressure is shown in millibars (mB).

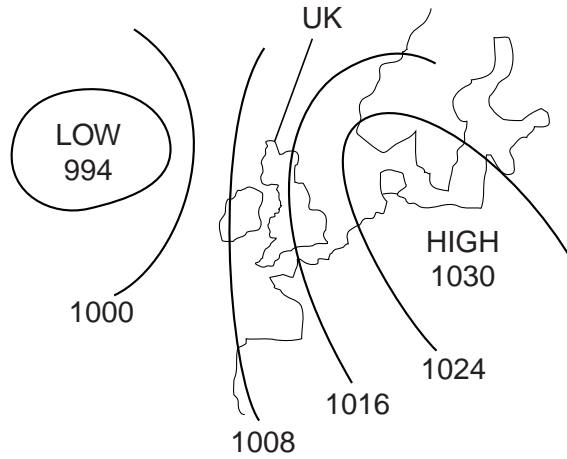


Fig. 1.2

- (i) Mark, on Fig. 1.2, an arrow to show the likely direction of the winds over the UK for this arrangement of high and low pressure regions. [1]
- (ii) Explain your answer by discussing the factors affecting wind direction.

.....

.....

.....

..... [3]

- (d) Changes occur in the volume of gases, such as air when there are alterations in the pressure or temperature of the environment.

At a height of 200m above the equator the temperature of the air is about 300K. A small balloon containing gas with volume 10dm^3 travels from the equator to the Arctic, where the temperature at the same height is 240K.

Calculate the new volume of the gas in the balloon (assume that the pressure remains constant). Show your working.

new volume = dm^3 [2]

[Total: 14]

2 Over the last twenty years China has become one of the largest producers of pollutant gases. For example it is now the world's largest producer of sulphur dioxide (SO₂). This contributes to the formation of acid rain.

(a) One of the reasons for the large increase in sulphur dioxide production is the fact that China uses coal as its main energy source.

(i) Explain how the burning of coal produces sulphur dioxide emissions.

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

(ii) Describe two **different** environmental effects which are likely to be observed in China as a result of the acid rain caused by sulphur dioxide emissions.

1.
.....
2.
..... [4]

3 In recent years some homes have been fitted with small wind turbines. These use energy from the wind and convert it into useful energy which can be used to drive domestic appliances.

(a) Complete this phrase to describe the energy transformation which occurs when a wind turbine is used to provide useful energy.

from energy to energy [1]

(b) (i) The power output of a wind turbine can be calculated:

$$\text{power output} = \frac{\text{energy transferred}}{\text{time}}$$

A small domestic wind turbine has a power output of 4000W. Calculate the maximum amount of energy transferred into a useful form if the turbine is run for 2 hours.

energy transferred = unit [4]

(ii) This electrical energy can be used to do work.

Work is defined by the equation:

$$\text{work} = \text{force} \times \text{distance}$$

Calculate the distance moved by a weight of $4 \times 10^5 \text{ N}$ if $8 \times 10^6 \text{ J}$ of work is done against gravity.

distance moved = m [2]

(c) There is a large amount of wind energy available in Britain. Suggest and describe **two** reasons why, apart from cost, the use of domestic wind turbines is unlikely to provide more than a small fraction of Britain's energy requirements.

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

[Total: 9]

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- 4 (a) This question is about a chemical called acrylamide, which is used to make poly(acrylamide). It can also be formed in some cooked foods. There are concerns about the possible dangers of acrylamide to human health.

The structural formulas of acrylamide and polyacrylamide are shown in Fig. 4.1.

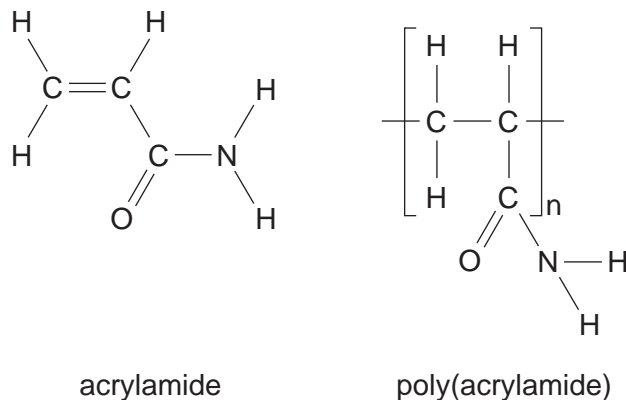


Fig. 4.1

- (i) Acrylamide contains a structural feature, also found in alkenes, which enables the molecule to form polymers.

Circle this structural feature on Fig. 4.1. [1]

- (ii) Circle the **two** words which describe the reaction of acrylamide to form poly(acrylamide).

addition condensation polymerisation oxidation reduction [2]

- (b) Poly(acrylamide) is a transparent solid which is able to absorb water. One use of this is in contact lenses. Lenses made from poly(acrylamide) have largely replaced those made from glass.

Suggest **one** way, apart from cost, in which polymers, such as poly(acrylamide), might be an improvement over glass.

.....
 [1]

(c) Recently, acrylamide has been found in some cooked food. It is thought that it is formed naturally from chemical reactions in food.

It may be formed from reactions between an amino acid, asparagine, and a sugar molecule.

(i) Give the name of a sugar molecule which may be present in food.

..... [1]

(ii) State a role of sugar molecules in human metabolism.

..... [1]

(iii) Name the type of molecule which is made up of amino acids.

..... [1]

(iv) Suggest a type of food likely to be a good dietary source of amino acids.

..... [1]

(d) Acrylamide can be toxic. It has been associated with some cancers and may also cause paralysis.

Outline how epidemiological studies could be carried out to investigate the toxic effect of acrylamide.

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

[Total: 11]

5 This question is about the some of the processes involved in the production, cooking or storage of foods.

(a) Some reactions during cooking only occur at temperatures above 120°C.

Explain, in terms of collision theory, why some chemical reactions occur only at high temperatures.

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

(b) Some reactions involved in food production involve enzymes.

(i) State what is meant by the term *enzyme*.

..... [1]

(ii) Enzymes are not normally involved in cooking processes because of the high temperatures. Explain, in terms of their structure, why enzymes cannot operate at high temperatures.

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

- (c) Many of the ways of storing food rely on the fact that the enzymes present in spoilage organisms, such as bacteria, can be prevented from working in certain conditions.

Pickling, for example, makes use of the fact that enzymes do not work effectively in acidic conditions.

- (i) Use ideas about the structure of enzymes to suggest an explanation of the effect of pickling.

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

- (ii) State **one** other factor, apart from temperature and pH, which affects the activity of an enzyme.

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

- (d) The production of many foods relies on the use of enzymes, for example in bread-making.

Describe a chemical process which is important in the making of bread and which requires the use of an enzyme.

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

[Total: 11]

END OF QUESTION PAPER

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