

**ADVANCED SUBSIDIARY GCE
 SCIENCE**

2841

Science and the Natural Environment

FRIDAY 11 JANUARY 2008

Afternoon
 Time: 1 hour

Candidates answer on the question paper.
Additional materials: 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 may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	10	
2	16	
3	16	
4	7	
5	11	
TOTAL	60	

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

Answer **all** the questions.

- 1 (a) Some students investigated the effect of light on photosynthesis.

To do this, they set up equipment to collect oxygen produced by two identical plants, A and B. At first, the plants were in the dark and then the students turned lights on.

The light for plant A was brighter than for plant B.

Fig. 1.1 shows the volume of oxygen collected from each plant from just before the lights were turned on until some time after.

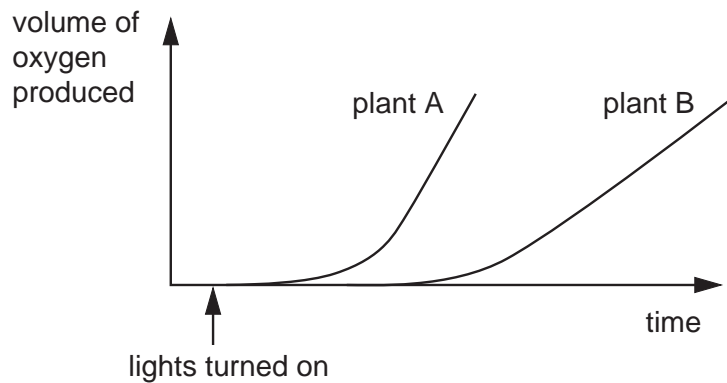


Fig. 1.1

- (i) Write a word equation for photosynthesis.

.....[2]

- (ii) State **four** deductions about the photosynthesis of the plants that can be made from the graph.

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

(b) Describe the functions of

(i) chloroplasts
.....[2]

(ii) mitochondria.....
.....[2]

[Total: 10]

2 This question is about the electromagnetic spectrum and satellite images.

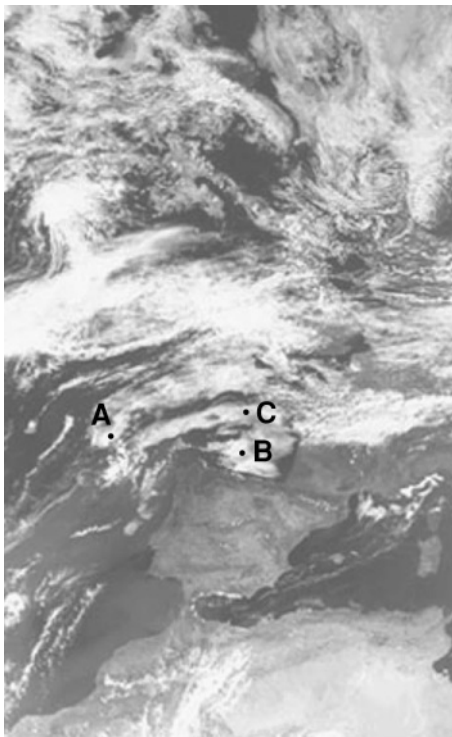
- (a) Fig. 2.1 shows part of the electromagnetic spectrum. Add labels to show the visible and infrared ranges.



Fig. 2.1

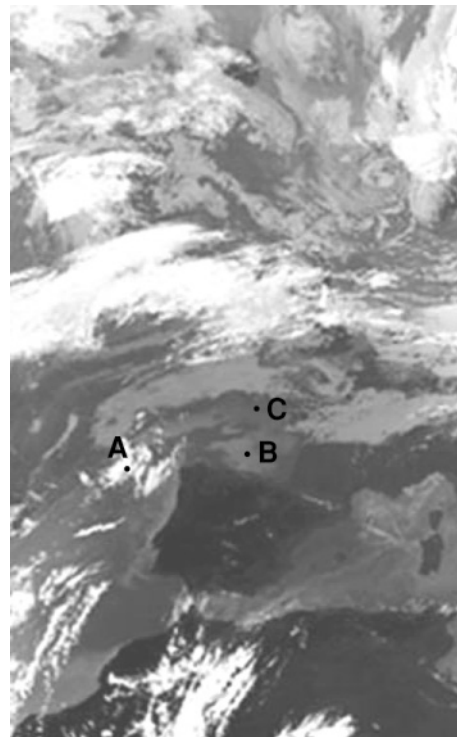
[3]

- (b) Figs. 2.2a and 2.2b show images that were produced at the same time on a summer afternoon by the same satellite. The first image is a visible light image and the second is an infrared image.



visible

Fig. 2.2a



infrared

Fig. 2.2b

Photographs © NERC Satellite Receiving Station, Dundee University, Scotland.

Electromagnetic radiation can be emitted from a variety of sources. The radiation can then be transmitted, absorbed, reflected or scattered.

- (i) On the visible satellite image, label a point **P** where strong reflection is taking place. [1]
- (ii) On the visible satellite image, label a point **Q** where strong absorption is taking place. [1]
- (iii) Infrared images can be produced 24 hours per day. Visible images cannot. Explain this difference in terms of behaviour of electromagnetic radiation.

.....

[2]

- (iv) Describe how scattering affects a beam of visible light passing through a cloud.

.....

[2]

(c) Fig. 2.2b is a negative infrared image which shows hot areas as dark.

- (i) Negative infrared images show high cloud as white or bright grey. However, they are not good at distinguishing low cloud from the land below. Suggest why.

.....
[1]

- (ii) Complete this table of information about the clouds at points **A**, **B** and **C** in Figs. 2.2a and 2.2b.

location	appearance of cloud in visible image (Fig. 2.2a)	appearance of cloud in infrared image (Fig. 2.2b)	height of cloud
A	white	white	high
B	white		
C		background grey	

[2]

6

(d) The wavelength used to produce an infrared image is 1×10^{-5} m.

The speed of the radiation is 3×10^8 ms⁻¹.

Use the equation $c = \lambda f$ to calculate the frequency of the radiation.

frequency = unit [4]

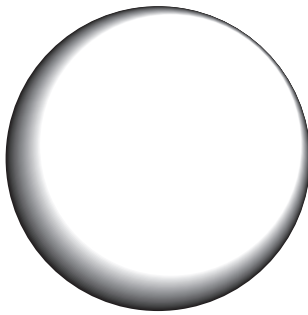
[Total: 16]

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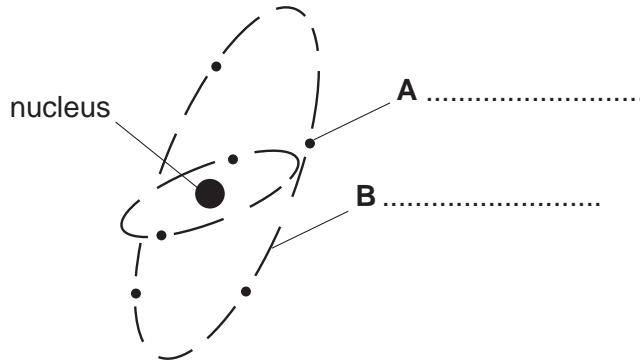
TURN TO PAGE 8 FOR QUESTION 3

3 Scientists use models to predict how systems might behave. Two of the models of atoms used today are shown in Figs. 3.1 and 3.2.



model 1, a simple ball

Fig. 3.1



model 2, showing internal structure

Fig. 3.2

- (a) (i) Complete labels **A** and **B** to name the features that they show. [2]
 (ii) Model 1 is simpler than model 2. Suggest **one** reason why scientists use two models.

.....
[1]

(b) Fig. 3.3 represents a nucleus of a deuterium atom.



Fig. 3.3

- (i) In Fig. 3.3, what does p stand for?[1]
 (ii) What does n stand for?[1]

(c) Deuterium is an isotope of hydrogen which we can write in symbols as ${}^2_1\text{H}$.

Another isotope of hydrogen is ${}^1_1\text{H}$. Sketch a representation of a nucleus of this isotope.

[1]

(d) A uranium nucleus can experience alpha-emission or nuclear fission. Complete Fig. 3.4 to show these processes.

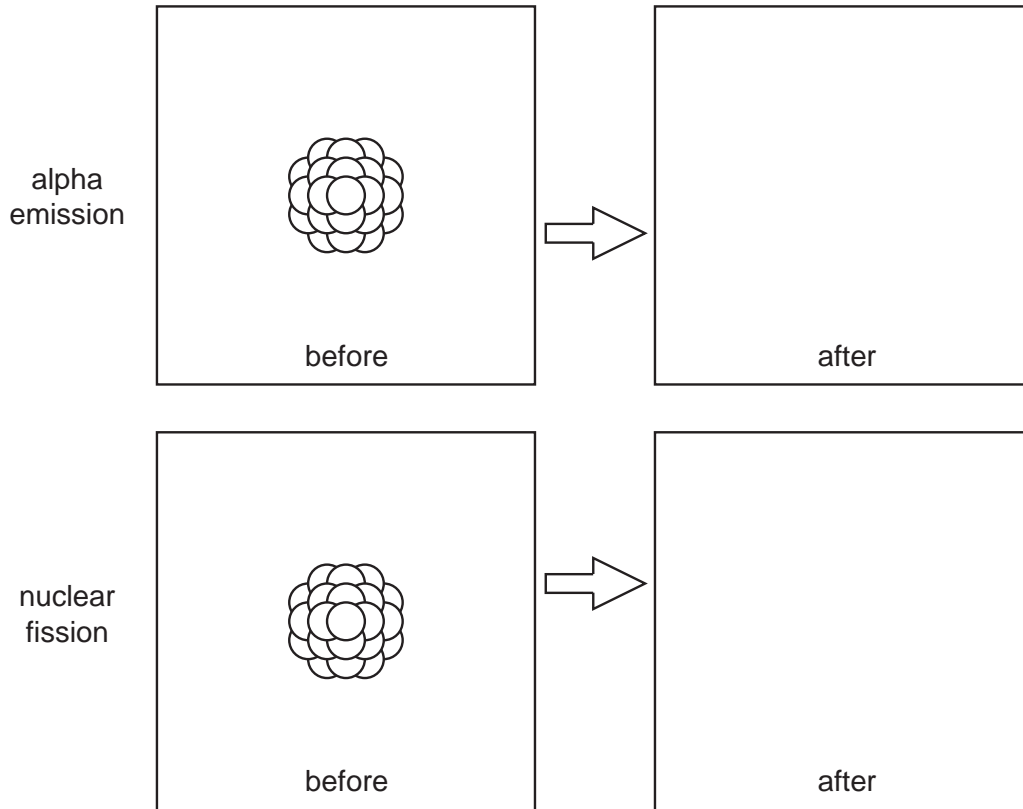


Fig. 3.4

[6]

(e) Nuclear fission makes an important contribution to electricity generation. Explain why the products of nuclear fission can also be an environmental hazard.

.....

.....

.....

.....

.....

.....[4]

[Total: 16]

4 Fig. 4.1 represents development of a new species of bird, **B**, from an initial species **A**. One difference is that members of species **B** have longer beaks.

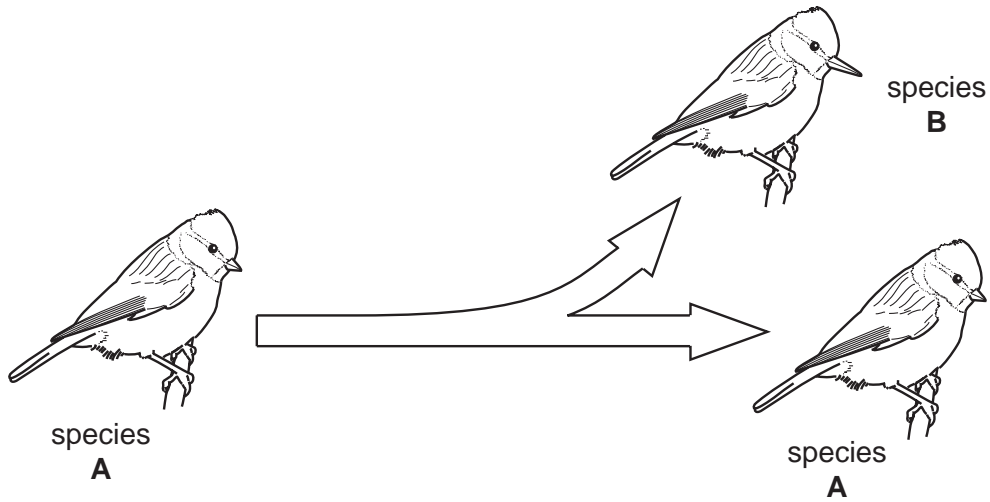


Fig. 4.1

(a) What is the name for the development of a new species?

.....[1]

(b) Some birds from species **A** and some from species **B** are captured and kept together in a large cage. They nest and have chicks.

(i) Tick a box next to the statement that best describes the chicks.

All of the chicks have long beaks.

All of the chicks have short beaks.

There is a mixture of chicks, some with long beaks and some with short beaks.

The chick population has a continuous range of beak lengths.

[1]

(ii) Explain your answer.

.....
[1]

- (c) Charles Darwin wrote: 'In the struggle for survival, the fittest win out at the expense of their rivals.'

Suggest what Darwin meant by 'fittest'.

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

- (d) It can be said that species **A** 'evolves' into species **B**. Does that mean that species **B** is more 'advanced' than species **A**? Justify your answer.

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

- (e) (i) What name did Darwin give to the **process** by which some individuals in a particular environment survive and breed and other individuals do not, resulting in change in a species?

.....[1]

- (ii) Suggest **one** factor that may have been involved in the evolution of species **B** from species **A**.

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

[Total: 7]

- 5 (a) Fig. 5.1 shows a food web in a forest ecosystem.

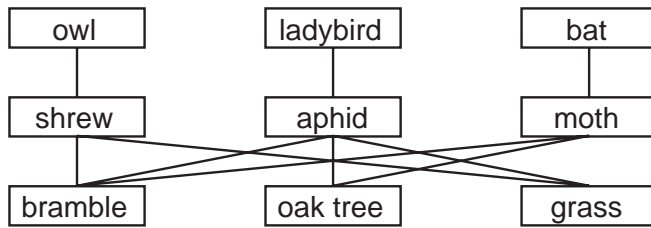


Fig. 5.1

- (i) Use Fig. 5.1 to identify and label a food chain. [1]
- (ii) Use Fig. 5.1 to identify and name three trophic levels. [3]

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Copyright Acknowledgements:

Fig. 2.2a and 2.2b NERC Satellite Receiving Station, Dundee University, Scotland. <http://www.sat.dundee.ac.uk/>

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