



ADVANCED SUBSIDIARY GCE

SCIENCE

Science and the Natural Environment

G641

Candidates answer on the question paper

OCR Supplied Materials:
None

Other Materials Required:

- Electronic calculator

Thursday 21 May 2009

Afternoon

Duration: 1 hour



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**.



Where you see this icon you will be awarded marks for the quality of written communication in your answer.

This means for example you should:

- ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
- organise information clearly and coherently, using specialist vocabulary when appropriate.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	14	
2	10	
3	11	
4	11	
5	6	
6	8	
TOTAL	60	

AS SCIENCE RELATIONSHIPS SHEET

pressure = force \div area

energy transferred = mass \times specific heat capacity \times temperature rise

density = mass \div volume

wavenumber = 1 / wavelength

speed = frequency \times wavelength

energy = Planck constant \times frequency

current = charge \div time

power = voltage \times current

power loss = (current)² \times resistance

3
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 Marine ecosystems show a wide range in their productivities.

Fig. 1.1 shows some of these ecosystems and table 1.1 below gives information about them.

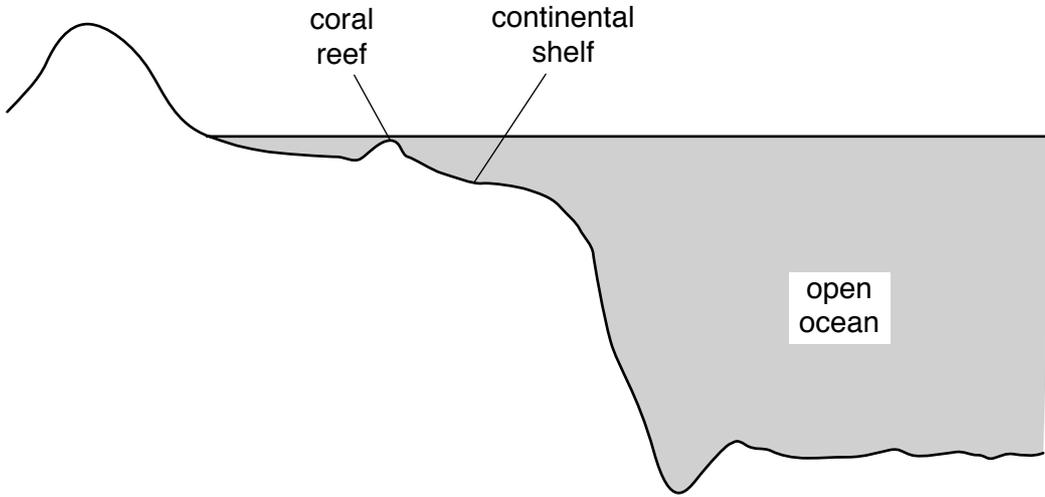


Fig. 1.1

	coral reef	continental shelf	open ocean
productivity (kg m ⁻² yr ⁻¹)	2.50	0.36	0.13
biomass (kg m ⁻²)	1.20	0.01	0.003
biodiversity	very high	quite high	variable

Table 1.1

(a) State what is meant by the term

(i) biomass
 [2]

(ii) biodiversity
 [2]

(b) (i) Using the information in table 1.1, describe how the productivity of the coral reef compares with that of the open ocean.

..... [1]

(ii) Explain the reasons for the difference.

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

(c) Coral reefs are found in tropical areas of the world, often where there are large human populations. Many of these reefs are at high risk of being destroyed.

Suggest **one** human activity that could be causing this destruction.

..... [1]

(d) Scientists are very concerned about the large scale loss of coral reefs.

Suggest why they are concerned.

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

- (e) The health of an ecosystem can be monitored by a remote satellite which picks up very near infrared (VNIR) radiation reflected from the Earth's surface, as shown in Fig. 1.2 below.

Healthy vegetation reflects VNIR strongly, whilst water absorbs VNIR strongly.

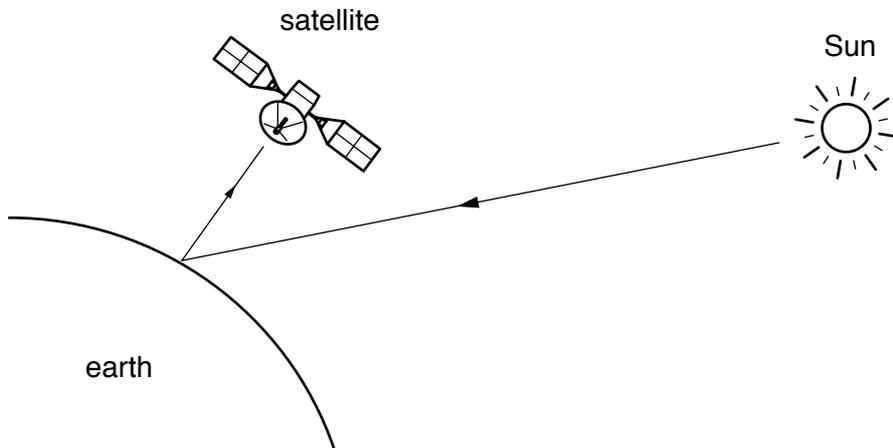


Fig. 1.2

The use of VNIR in this system means that it is able to monitor changes in rainforests better than changes in coral reefs. Use the information above to explain why.



You should ensure that your explanation is clear with correct spelling and punctuation.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 14]

- 2 (a) State what is meant by the term *diffraction*.

.....
 [2]

- (b) Fig. 2.1 shows water waves in a ripple tank approaching a narrow gap, the size of which is approximately the same as the wavelength of the waves.

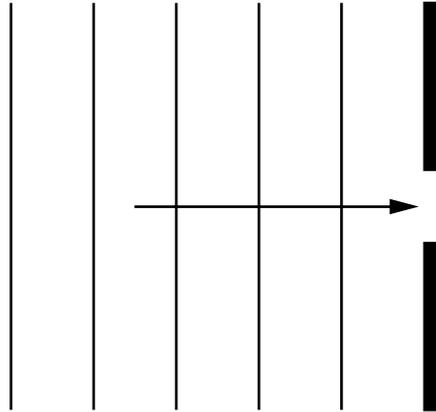


Fig. 2.1

- (i) On Fig. 2.1, draw the pattern of the wavefronts emerging from the gap. [2]
- (ii) On Fig. 2.2 below, show how the pattern of wavefronts emerging from the gap would change if the size of the gap is significantly increased. [1]

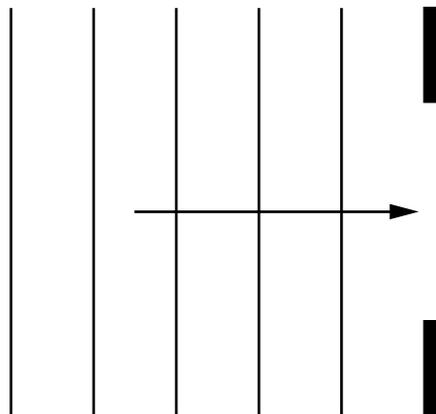
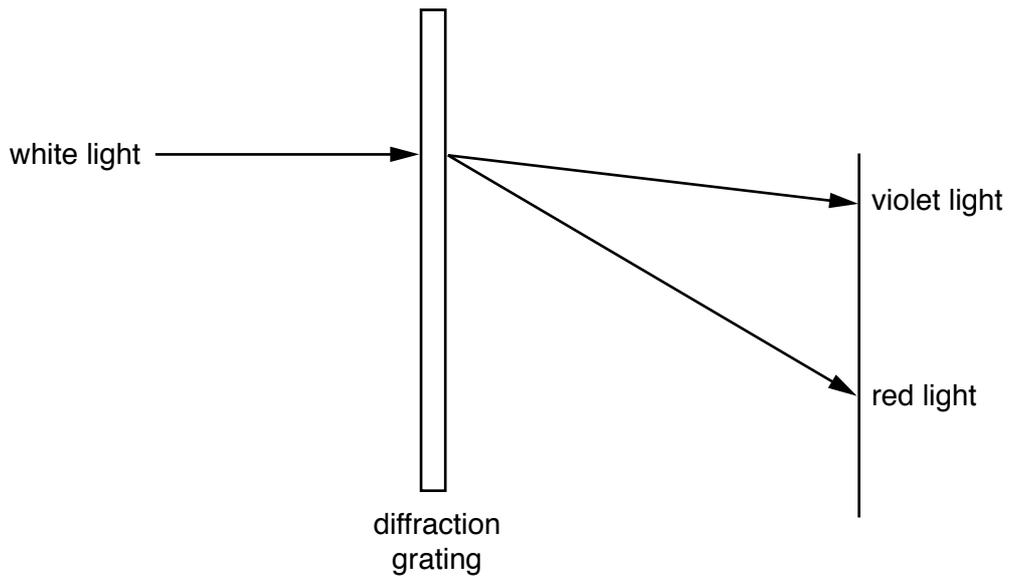


Fig. 2.2

(c) When light passes through a diffraction grating, it is split into its component colours.



State **one** way in which the waves that make up the red light differ from those that are violet.
 [1]

(d) Coloured light can be detected in the eye.

Fill in the gaps in the following passage which describes this process.

Use the words from the list. You may use each word once, more than once or not at all.

blue	cones	diffracts	green	optic nerve	purple
red	reflects	refracts	retina	rods	yellow

The eye contains a lens made up of a dense fluid. This light to form a detailed image on the There are two sorts of light sensitive cells. The cells that respond to the whole frequency range of visible light are called The others, which respond to particular frequencies, are called They are most sensitive to the three colours, and [4]

[Total: 10]

3 Nitrates are produced in soil when microbes break down waste organic matter (humus).

Fig. 3.1 shows how much is produced over the course of a year.

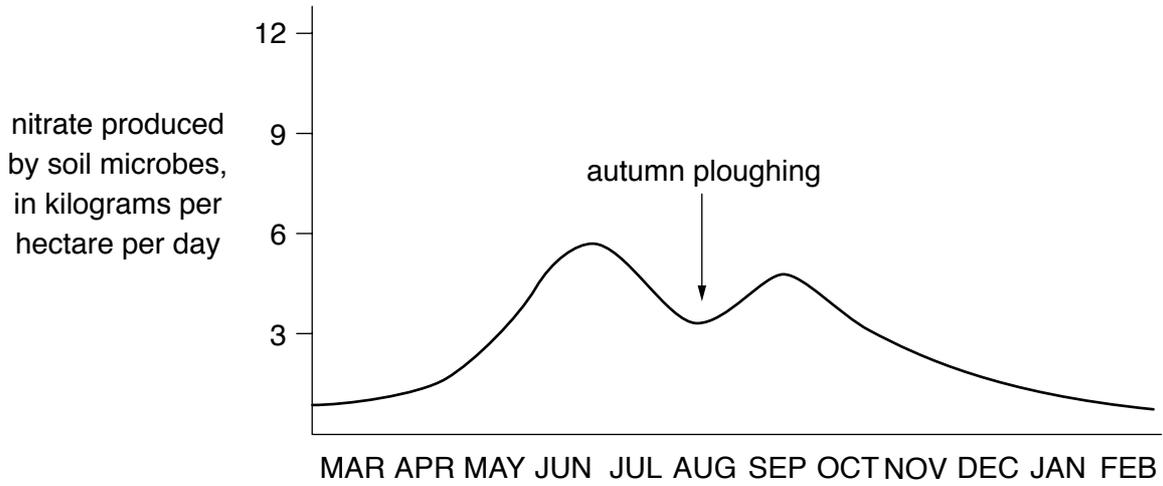


Fig. 3.1

(a) (i) Use the graph to describe the change in nitrate production throughout the year.

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

(ii) Suggest a reason for the change in nitrate production between March and June.

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

(b) State **one** use of the nitrogen absorbed by plants.

..... [1]

(c) Fertilisers can be added to the soil to improve crop yield. Use the information in Fig. 3.2 below to answer the following questions.

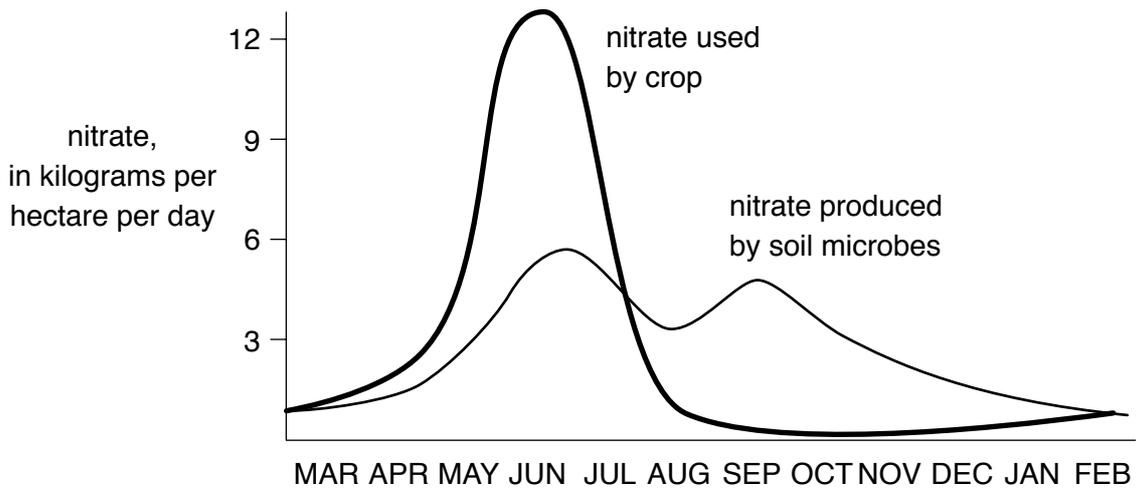


Fig. 3.2

(i) Use the graph to explain why fertilisers are first applied in March.

.....
 [1]

(ii) When would it **not** be necessary to apply fertiliser?

..... [1]

(d) (i) What is most likely to happen to any fertiliser **not** used by plants?

..... [1]

(ii) Explain the effect it has on the environment.

.....
 [2]

[Total: 11]

- 4 Some remote sensing satellites, such as those that take aerial photographs, detect visible light. Others detect radar (a form of microwave radiation).

Table 4.1 shows the wavelengths of these types of radiation.

Table 4.1

type of radiation	wavelength
visible light	$5 \times 10^{-7} \text{ m}$
radar	$5 \times 10^{-2} \text{ m}$

- (a) (i) Complete Table 4.2, below, to show the original source of the different types of radiation used in remote sensing.

Table 4.2

type of radiation used in remote sensing	produced by the sun	produced by the satellite
visible		
VNIR	✓	
radar		

[1]

- (ii) Calculate how many times greater the wavelength of a radar wave is than a light wave.

number of times greater = [2]

- (iii) State **two** ways in which the use of radar would be more helpful than the use of visible light.

.....
 [2]

(b) From a website, you can download free images that are made up of 1000 pixels, or you can buy the same image made up of 4800 pixels.

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

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

(ii) Why is a 4800 pixel image preferable to a 1000 pixel image?

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

(iii) Satellite images are often *grey-scale* images. Describe how digital information is converted into a grey-scale image.

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

[Total: 11]

- 6 A student decided to investigate the metabolic rate of woodlice. He collected some woodlice from the school grounds, along with some of the soil where he found them. He put four of them in a small beaker together with the soil, so they would feel at home, and covered it with gauze.

He then set up the apparatus as shown in Fig. 6.1 below.

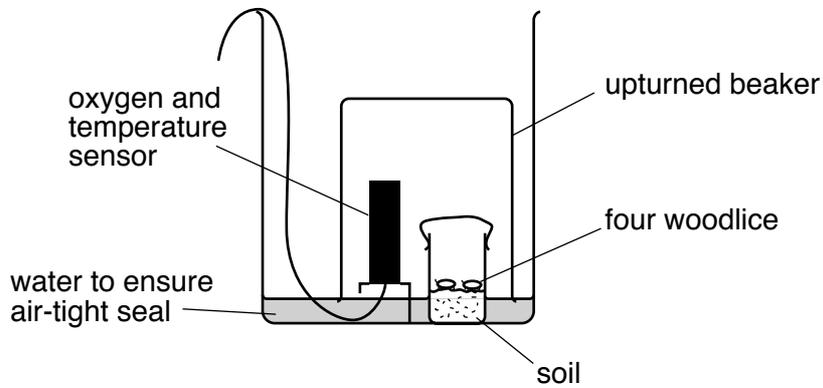
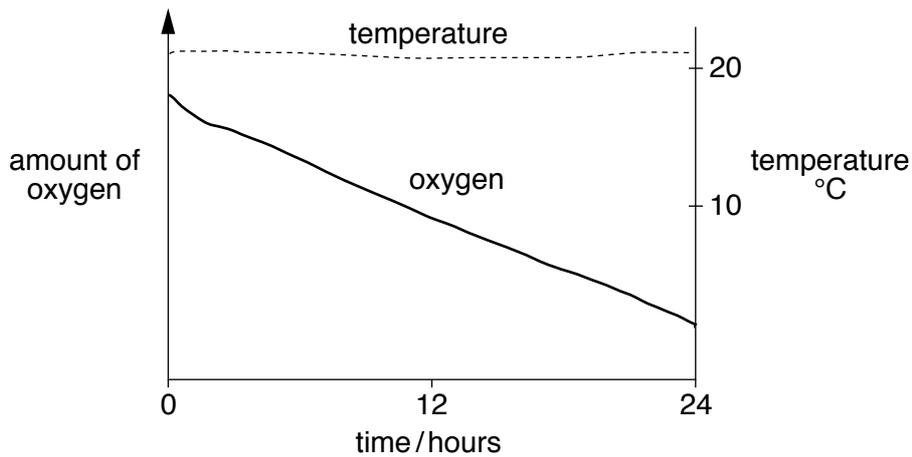


Fig. 6.1

Over a period of 24 hours, he measured the amount of oxygen in the upturned beaker and the temperature. The results were plotted on a graph.



- (a) The woodlice were using the oxygen for respiration. Write a word equation for respiration.

..... [2]

- (b) The student hoped to calculate the metabolic rate of the woodlice using the amount of oxygen they had consumed.

Explain why the presence of the soil made his estimation of the metabolic rate unreliable.

.....
 [2]

(c) He was disappointed that the temperature did not rise as he had expected.

(i) State why he expected a rise in temperature.

..... [1]

(ii) Explain how the design of the experiment might have prevented an observable temperature rise.

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

(iii) Suggest **one** modification to the design of his experiment that could improve his results.

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

[Total: 8]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1PB.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.