

Wednesday 11 January 2012 – Afternoon

AS GCE SCIENCE

G641 Remote Sensing and the Natural Environment

Candidates answer on the Question Paper.

OCR supplied materials:

None

Other materials required:

- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour




Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- 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 **60**.
- You are advised to show all the steps in any calculations.
-  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.
- This document consists of **16** pages. Any blank pages are indicated.

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

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PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

- 1 It has been proposed that an eco-rainforest such as that shown in Fig. 1.1 could be built on a landfill site in the north of England as a visitor attraction.

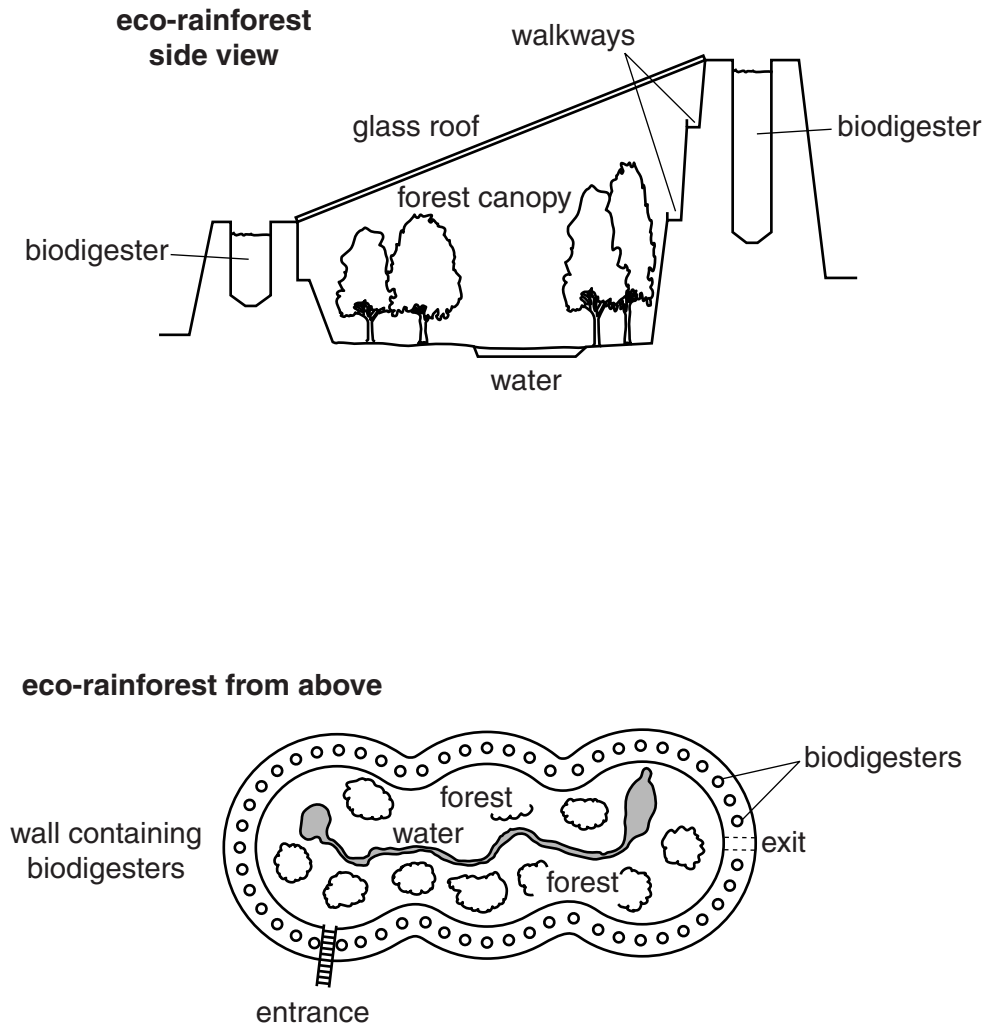


Fig. 1.1

Biodegradable household waste is placed in biodigesters in the walls of the building.

(a) (i) What is meant by the term *biodegradable*?

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

(ii) Respiration takes place in the biodigesters.
This could be aerobic or anaerobic respiration.

State the **main** difference between *aerobic* and *anaerobic* respiration.

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

(iii) Which useful gas is produced in the biodigester by **anaerobic** respiration?

Choose from the following list.

- carbon dioxide
- hydrogen
- methane
- oxygen

..... [1]

(iv) Suggest one **benefit** and one **problem** of this gas to the managers of the site.

benefit

problem

..... [2]

(v) Suggest how biodigesters built into the walls of the structure might affect the environment of the eco-rainforest.

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

(b) (i) The structure has a glass roof, so that it is a closed environment in a steady state.

What is meant by the term *steady state*?

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

(ii) An ecosystem is maintained in a steady state by negative feedback loops.

Describe a negative feedback loop that would exist in the eco-rainforest.

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

(c) It is proposed that visitors would enter the building at a high level. They follow a path down through the canopy to the forest floor.

Describe and explain how the nature of the light would change on the way down to the forest floor. In your answer use ideas about wavelength.

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

(d) Suggest **one** way that the food chains within the eco-rainforest would differ from those found in a natural rainforest.

.....

..... [1]

[Total: 17]

2 Radar systems use radio waves to detect water droplets in the atmosphere and so can be useful in weather forecasting.

(a) These waves have a frequency of 6×10^9 Hz.

State what is meant by *frequency*.

.....

.....

.....

..... [2]

(b) (i) When a wave hits a water droplet, it can be **refracted** and it slows down.

Complete the diagram, Fig. 2.1, to show the path of the refracted ray, drawing in the wavefronts.

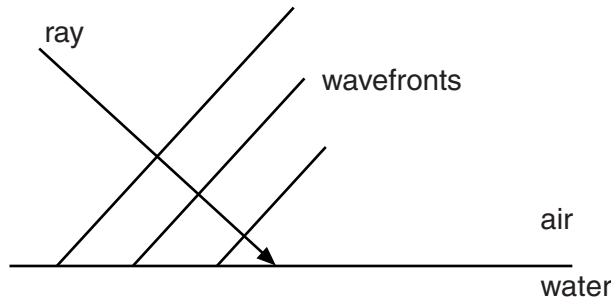


Fig. 2.1

[2]

(ii) Calculate the speed of the refracted wave in ms^{-1} .
 The wave has a frequency of 6×10^9 Hz and a wavelength of 3.75 cm.

speed = ms^{-1} [3]

(iii) The ray can also be **reflected**.

Complete the diagram, Fig. 2.2, to show the path of the reflected ray, drawing in the wavefronts.

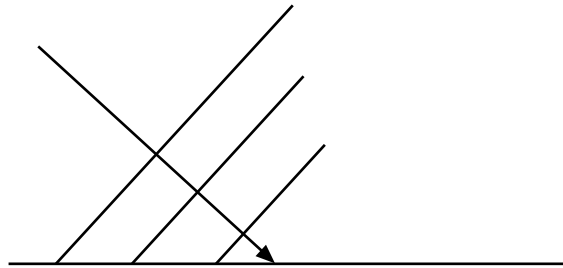


Fig. 2.2

[2]

(c) The radar beam is sent out by a large dish aerial such as that shown in Fig. 2.3.

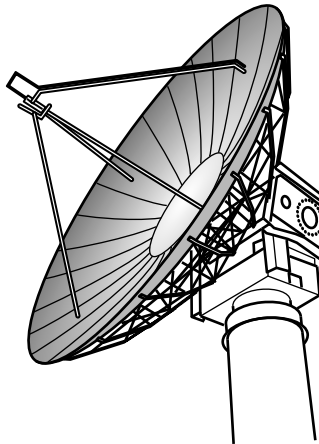


Fig. 2.3

The radio waves in the radar beam can be reflected back to the aerial by water droplets in the atmosphere.

Suggest how this helps weather monitoring.

.....

.....

.....

..... [2]

[Total: 11]

Turn over

3 Nitrate ions can cause problems for water companies.

(a) (i) Nitrate ions may get into water storage reservoirs.

Suggest where they may come from.

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

(ii) Describe and explain the problem nitrates can cause in the reservoir.



In your answer, you should use appropriate technical terms spelled correctly.

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

(b) Describe a possible impact on human health if drinking water contains high concentrations of nitrates.

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

(c) Nitrate ions can be removed from drinking water using bacteria in a process shown in Fig. 3.1.

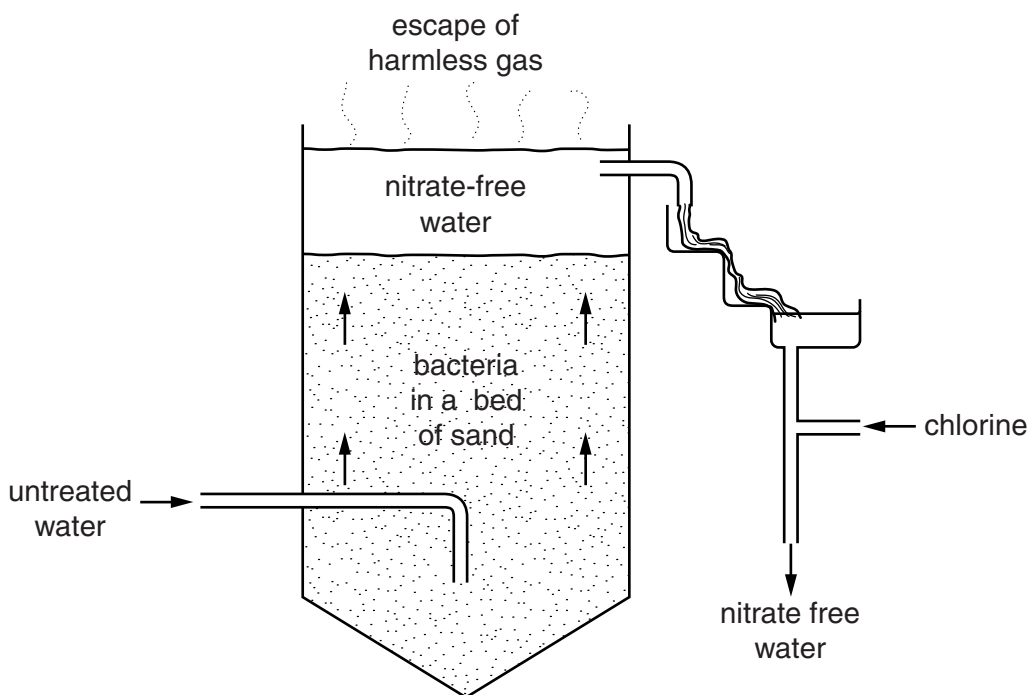


Fig. 3.1

This process is called ‘microbiological denitrification’.

(i) Suggest the name of the harmless gas produced in the denitrification process.

..... [1]

(ii) Suggest why chlorine is added at the end of the process.

.....
 [1]

(d) Denitrification can also occur naturally in an ecosystem.

(i) What sort of soil conditions favour natural denitrification?

.....
 [1]

(ii) Why can denitrification be a problem to farmers?

.....
 [1]

[Total: 10]

(b) Fig. 4.2 shows a picture of a chameleon, a type of lizard which lives in Africa. Chameleons feed on locusts, locusts eat vegetation. Chameleons are the prey of snakes.

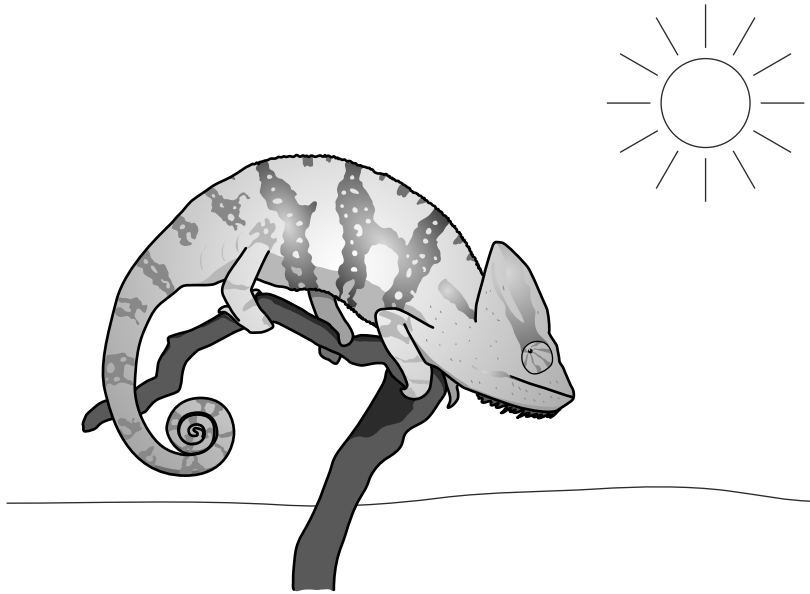


Fig. 4.2

(i) Construct a food chain to show the flow of energy through the ecosystem.

[2]

(ii) Typically, only about 10% of the food eaten by a chameleon will be converted to body mass.

Calculate the number of locusts a chameleon will need to eat to increase its mass by 12g.

1 locust has a mass of 2g.

number of locusts = [1]

(iii) State two ways that the energy not converted to body mass may be used.

1.

.....

2.

..... [2]

- (c) A chameleon can change the colour of its skin almost at will. Unlike mammals, they cannot maintain a steady body temperature.

The side-striped chameleon lives at high altitude in East Africa where the nights are cold. As dawn breaks, it turns itself sideways to the sun and changes its body colour to black. Within only a few minutes it changes back to its normal bright green daytime colour.

- (i) Explain why the chameleon changes its colour to black.

.....

.....

.....

.....

.....

.....

..... [3]

- (ii) Suggest one reason the chameleon changes back to green.

.....

..... [1]

[Total: 14]

5 This question is about carbon dioxide gas (CO₂) in the atmosphere.

(a) State two processes that increase the concentration of carbon dioxide in the atmosphere.



In your answer, you should use appropriate technical terms spelled correctly.

- 1.
- 2. [2]

(b) Fig. 5.1 shows the average monthly concentration of carbon dioxide in the atmosphere above Hawaii, which is in the northern hemisphere.

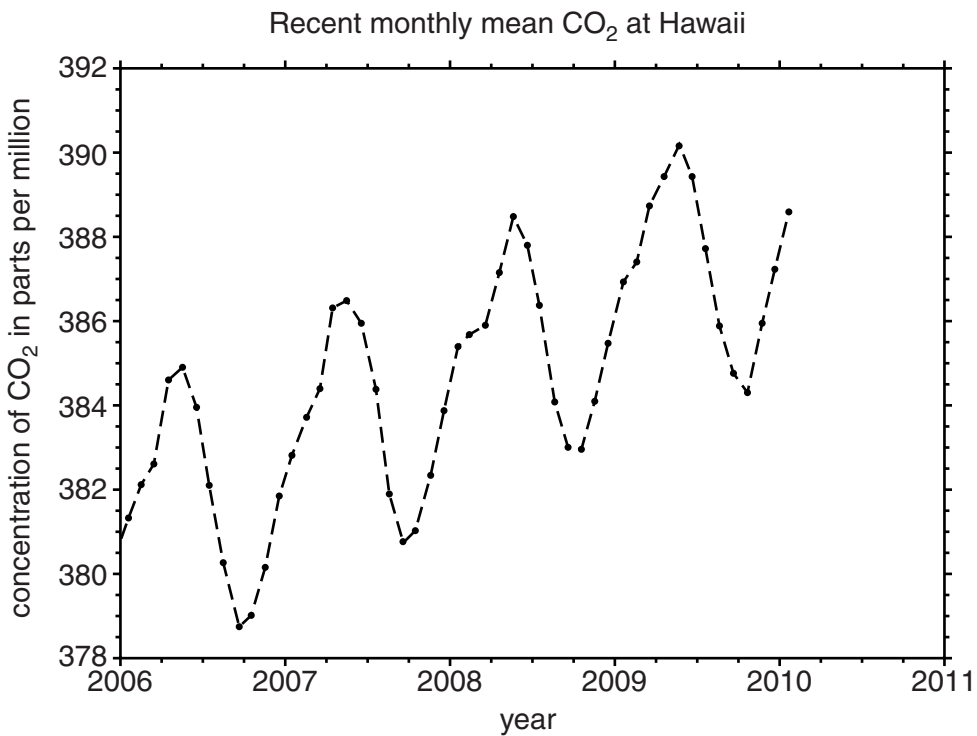


Fig. 5.1

(i) Describe how the carbon dioxide concentration changes over time.

-
-
-
-
-
-
- [3]

(ii) Explain this pattern.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

END OF QUESTION PAPER



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