

Candidate Forename		Candidate Surname	
-------------------------------	--	------------------------------	--

Centre Number						Candidate Number				
--------------------------	--	--	--	--	--	-----------------------------	--	--	--	--

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
ADVANCED SUBSIDIARY GCE**

**G641
SCIENCE**

Remote Sensing and the Natural Environment

THURSDAY 14 JANUARY 2010: Afternoon

DURATION: 1 hour

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Question Paper

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Electronic Calculator


Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **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.**
- **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 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.**

AS SCIENCE RELATIONSHIPS SHEET

pressure = force ÷ area

**energy transferred =
mass × specific heat capacity × temperature rise**

density = mass ÷ volume

wavenumber = 1 / wavelength

speed = frequency × wavelength

energy = Planck constant × frequency

current = charge ÷ time

power = voltage × current

power loss = (current)² × resistance

BLANK PAGE

Answer ALL the questions.

- 1 (a) Scientists have worked out some of the daily energy inputs and outputs for a dairy cow. The results are shown in Fig. 1.1 opposite.**

(i) Calculate the value for the ‘other outputs’.

value = _____ MJ [1]

(ii) Suggest TWO factors that could account for ‘other outputs’.

1. _____

2. _____ [2]

(iii) The inputs and outputs for the cow illustrate the Law of Conservation of Energy.

Explain what this statement means.

_____ [2]

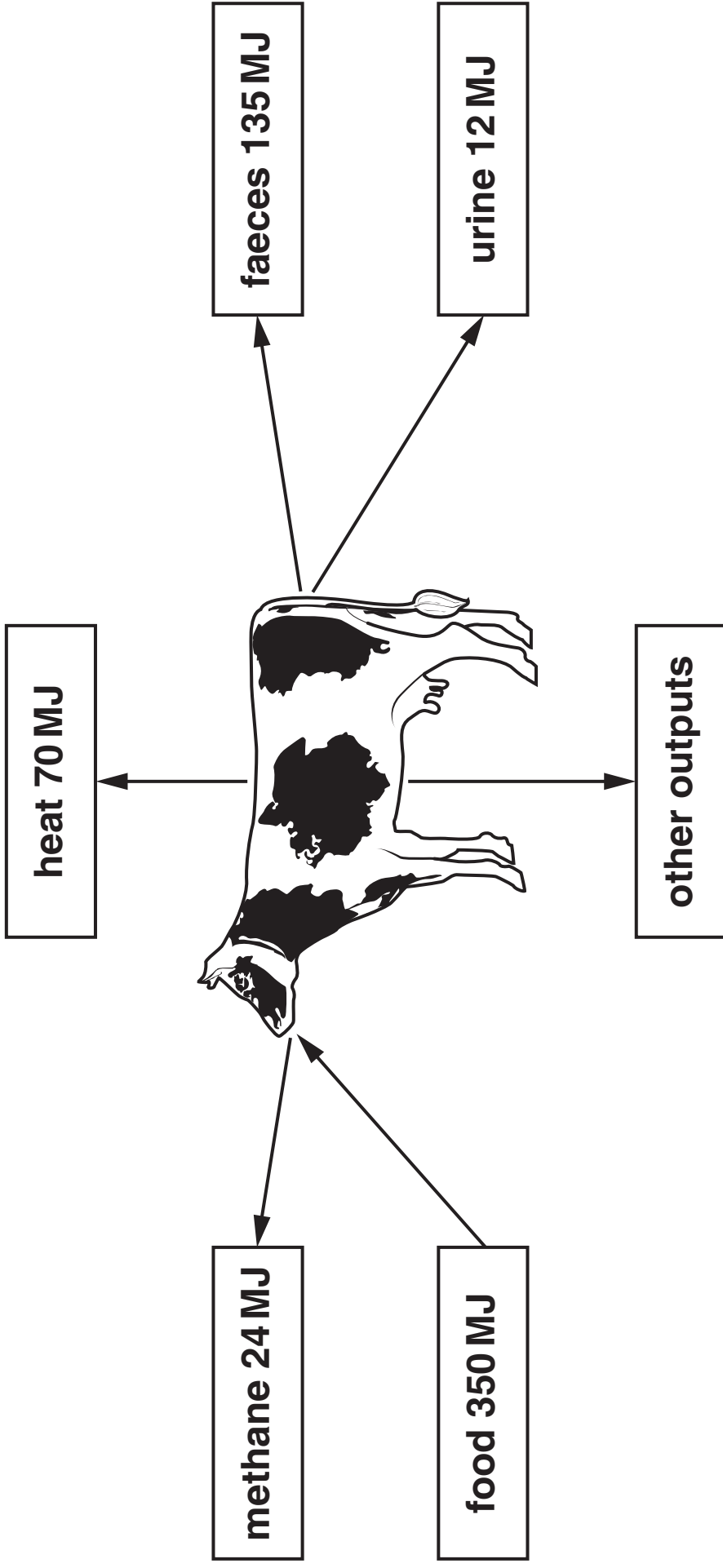


Fig. 1.1

(b) Cows have a different digestive system to humans. Before food passes into a cow's stomach, it lingers in another chamber, the rumen. In the rumen, microorganisms break down cellulose in the food anaerobically, allowing the cow to digest it.

(i) Use the diagram to suggest a gas produced by these anaerobic microorganisms.

_____ [1]

(ii) State ONE advantage and ONE disadvantage to the microorganism of anaerobic respiration.

advantage _____

disadvantage _____

_____ [2]

(c) (i) A significant proportion of the cow's energy intake is lost as faeces.

Calculate the percentage of energy lost in this way.

percentage = _____ % [2]

(ii) Explain ONE way the farmer could use the faeces so that they are not wasted.

[2]

(d) In Britain, cows are fed mostly on grass, whereas in other countries, they may be fed on grain, like wheat.

Explain why some people think that feeding grain to cattle is a poor way to feed an increasing world population.

[3]

[Total: 15]

2 Tropical rainforests are the most productive ecosystems on Earth.

Fig. 2.1 shows the percentage of light intensity and humidity at different heights.

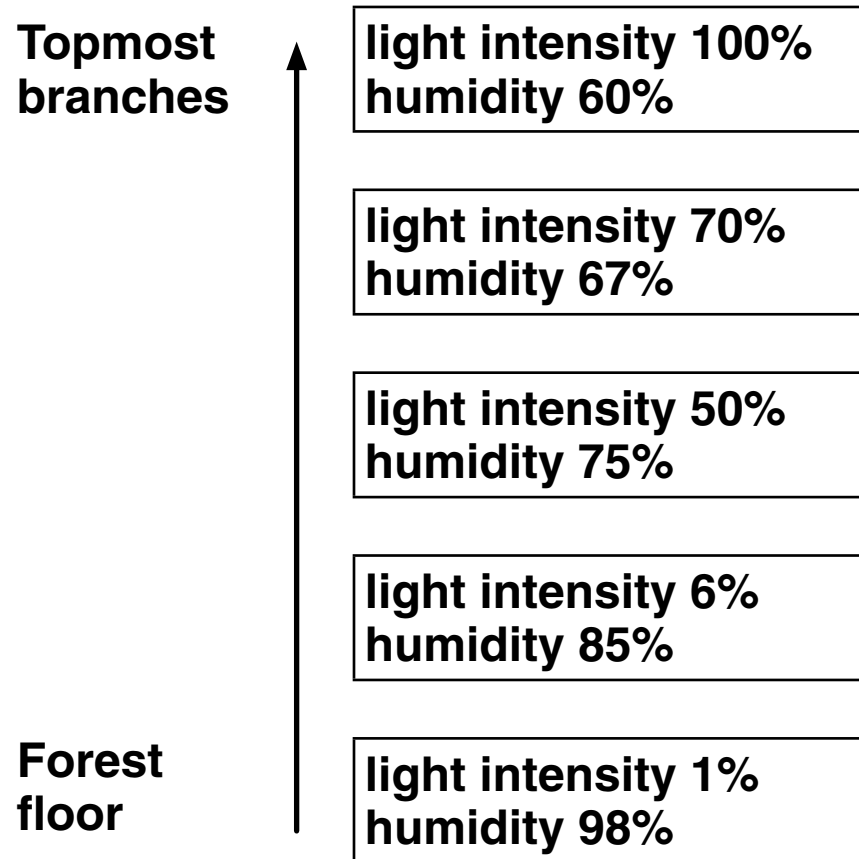


Fig. 2.1

(a) State what is meant by the term productivity.

[2]

(b) State TWO environmental factors which help to make tropical rainforest the most productive ecosystem.

1. _____

2. _____ [2]

(c) Suggest why each of the following factors changes as the distance from the forest floor increases.

light intensity _____

humidity _____

_____ [2]

(d) The chlorophyll in leaves absorbs some of the wavelengths of visible light. Describe and explain how the nature of the light nearer to the forest floor would differ from the sunlight above the trees.

_____ [3]

(e) Large areas of tropical rainforest are threatened by human activity.

Explain why we should be concerned about the loss of rainforest.

[5]

[Total: 14]

3 Nitrogen is an important nutrient element which is recycled in living systems.

Fig. 3.1 shows the major parts of the nitrogen cycle for a natural ecosystem.

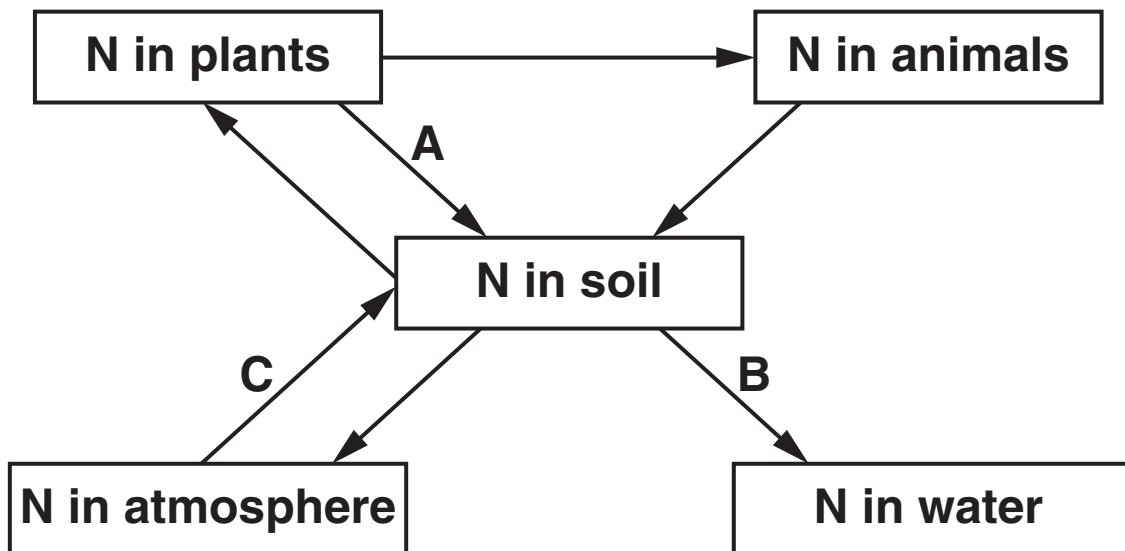


Fig. 3.1

(a) State the name of each process, A, B and C.



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

A _____

B _____

C _____ **[3]**

(b) An undisturbed ecosystem is in a steady state.

(i) What is meant by the term steady state?

[2]

(ii) Name the mechanism that keeps an ecosystem in a steady state.

[1]

(iii) Human activity can upset the steady state of an ecosystem. Using Fig. 3.1, describe the changes which will occur in the ecosystem to restore a steady state if a bag of nitrogen fertiliser is spilt onto the soil.

[3]

(c) The Haber process is used to make chemicals involved in the production of nitrogen fertiliser.

(i) Write a word equation for the chemical reaction that occurs in the Haber process.

_____ [2]

(ii) The raw materials for the Haber process are relatively cheap, yet the production of fertiliser is expensive.

Explain why this is so.

_____ [3]

[Total: 14]

- 4 The astronomer Sir William Herschel, working in 1800, directed sunlight through a glass prism to create a spectrum as in Fig. 4.1.

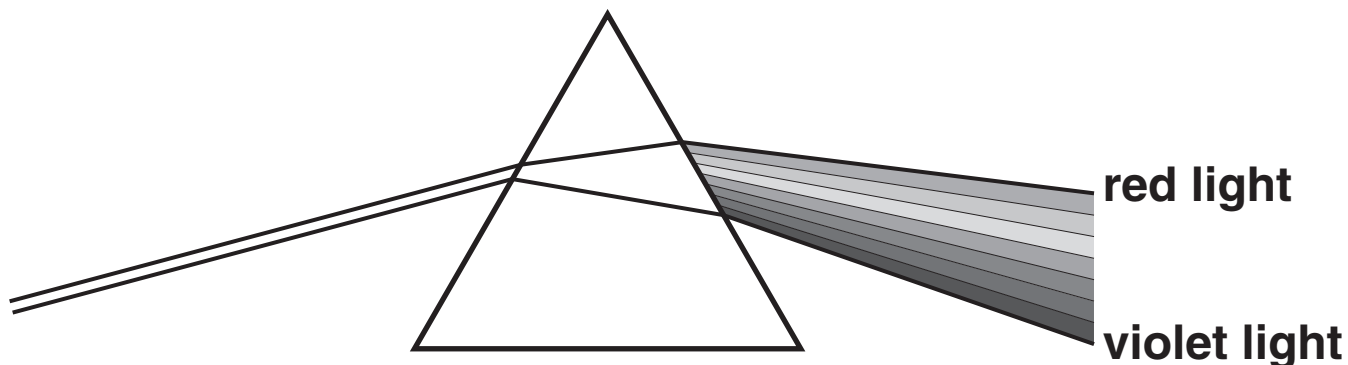


Fig. 4.1

- (a) Complete the following statements about red and violet light by ticking the appropriate boxes.

(i) Red light has ...

a longer wavelength than violet light	<input type="checkbox"/>
a shorter wavelength than violet light	<input type="checkbox"/>
the same wavelength as violet light	<input type="checkbox"/>

[1]

(ii) Red light ...

travels faster than violet light in air	<input type="checkbox"/>
travels slower than violet light in air	<input type="checkbox"/>
travels at the same speed as violet light in air	<input type="checkbox"/>

[1]

(b) He placed glass thermometers with blackened bulbs in the different coloured regions of the spectrum and took their temperatures as in Fig. 4.2.

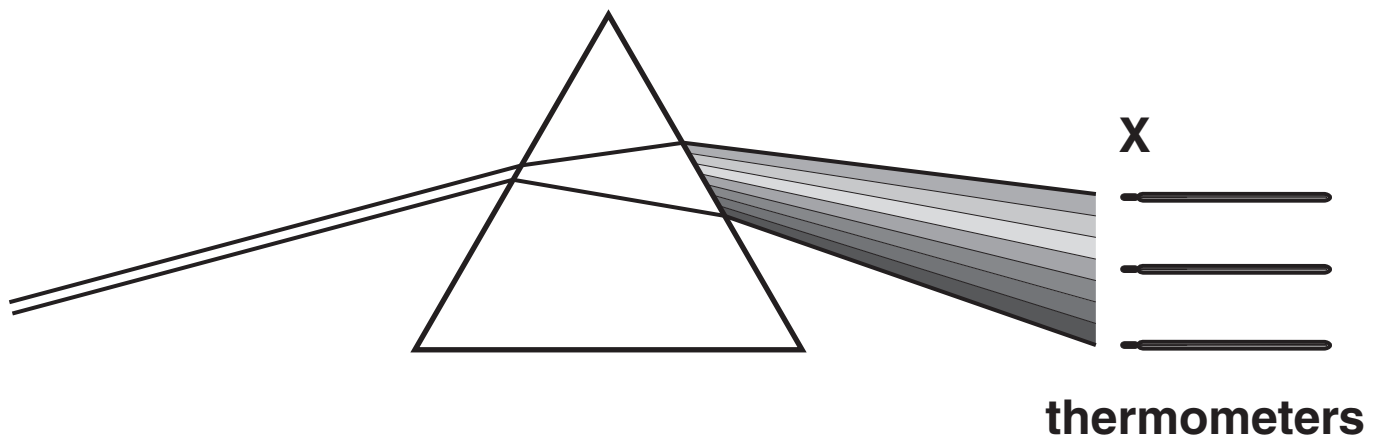


Fig. 4.2

Explain how painting the bulbs of the thermometers black gives more accurate results.

[2]

- (c) Some students recently repeated his experiment and obtained the following results after 10 seconds.

colour of light	temperature °C
blue	26
yellow	28
red	30

- (i) What relationship appears to exist between the wavelength of the light and its warming effect?

_____ [1]

- (ii) Suggest TWO reasons why the results may not have been very accurate.

You can assume that the students were competent at reading thermometers.

_____ [2]

- (d) Herschel found that the temperature recorded by a thermometer placed at position X on Fig. 4.2, was even higher than the others. He concluded that he had discovered 'invisible light'.

What is this part of the spectrum called?

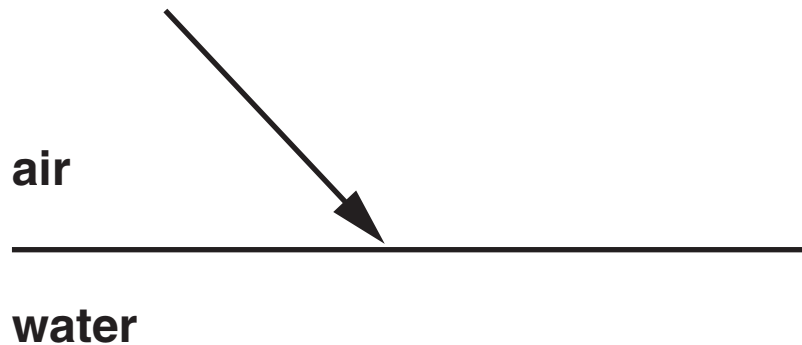
_____ [1]

(e) Light is bent when it passes from air into water.

(i) What is the name of this process?

_____ [1]

(ii) Complete the diagram below to show how a ray of light behaves when it enters the water.



[1]

(iii) What happens to the wavelength of the light when it enters the water?

_____ [1]

[Total: 11]

5 The Earth can be monitored from space using satellites which detect electromagnetic radiation.

(a) Describe ONE use of a remotely sensed image.

_____ [1]

(b) The information needed to produce the image of Australia in Fig. 5.1 is gathered using a sensor, for example a charge-coupled device (CCD).



Fig. 5.1

Describe how the information is used to create an image.

[3]

(c) State TWO ways in which the atmosphere can limit the quality of the image obtained.



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

[2]

[Total: 6]

END OF QUESTION PAPER

BLANK PAGE

BLANK 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 1GE.

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.