OCR
Oxford Cambridge and RSA

Tuesday 19 May 2015 – Afternoon

AS GCE SCIENCE

G641/01 Remote Sensing and the Natural Environment

Candidates answer on the Question Paper.

OCR supplied materials:
- Insert (inserted)

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The Insert will be found inside this document.
- 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. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- 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 **20** pages. Any blank pages are indicated.

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 = $(\text{current})^2$ × resistance

voltage = current × resistance

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Answer **all** the questions.

1 Fig. 1.1 is a diagram showing some of the structures in a typical animal cell.

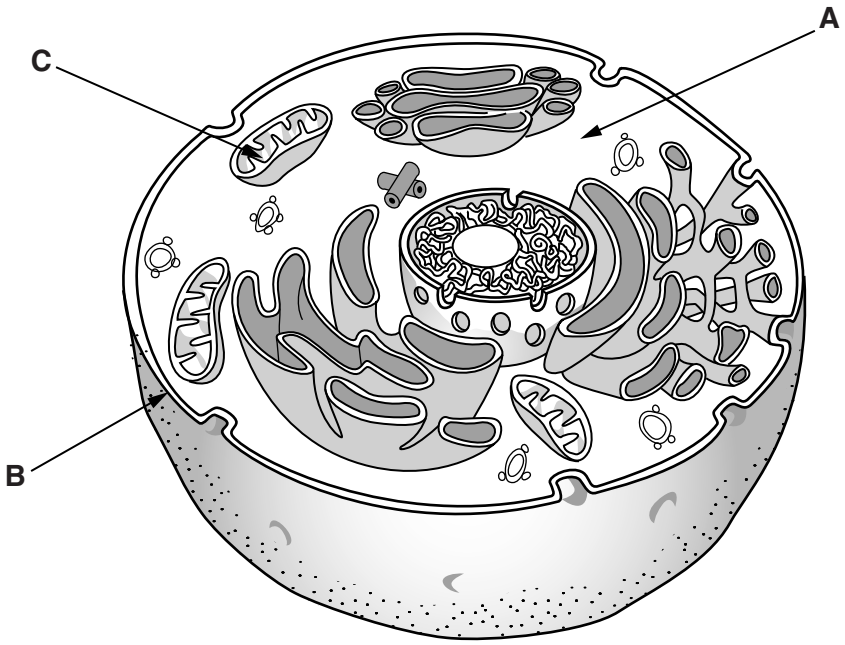

Fig. 1.1

(a) Name structures **A**, **B** and **C**. Select a name from the list below.

chloroplast **cytoplasm** **endoplasmic reticulum** **mitochondrion**

nucleus **plasma membrane** **ribosome**

Structures	Name
A	
B	
C	

[3]

(b) (i) Energy is released in the cell by the breakdown of glucose molecules during respiration to produce ATP.

Complete Table 1.1 to compare the processes of aerobic and anaerobic respiration in an animal cell.

Type of respiration	Where it happens in the cell	Products (other than ATP)	Number of ATP molecules produced per molecule of glucose respired
Aerobic	.....	..... and	.....
Anaerobic	.....	..... and	.....

Table 1.1

[4]

(ii) Suggest **one** use of ATP in an animal cell.

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

(c) Describe how glucose molecules enter the cell to take part in respiration.

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

[Total: 10]

2 Sugar beet is a crop grown in the UK to provide sugar for food and industry.

A field of sugar beet

The health of a sugar beet crop can be monitored remotely by sensors on a satellite.

The sensors detect electromagnetic radiation. The information collected is relayed back to Earth and used to produce a graph, as shown in Fig. 2.1.

Reflectance is a measure of how much electromagnetic radiation is reflected by the crop.

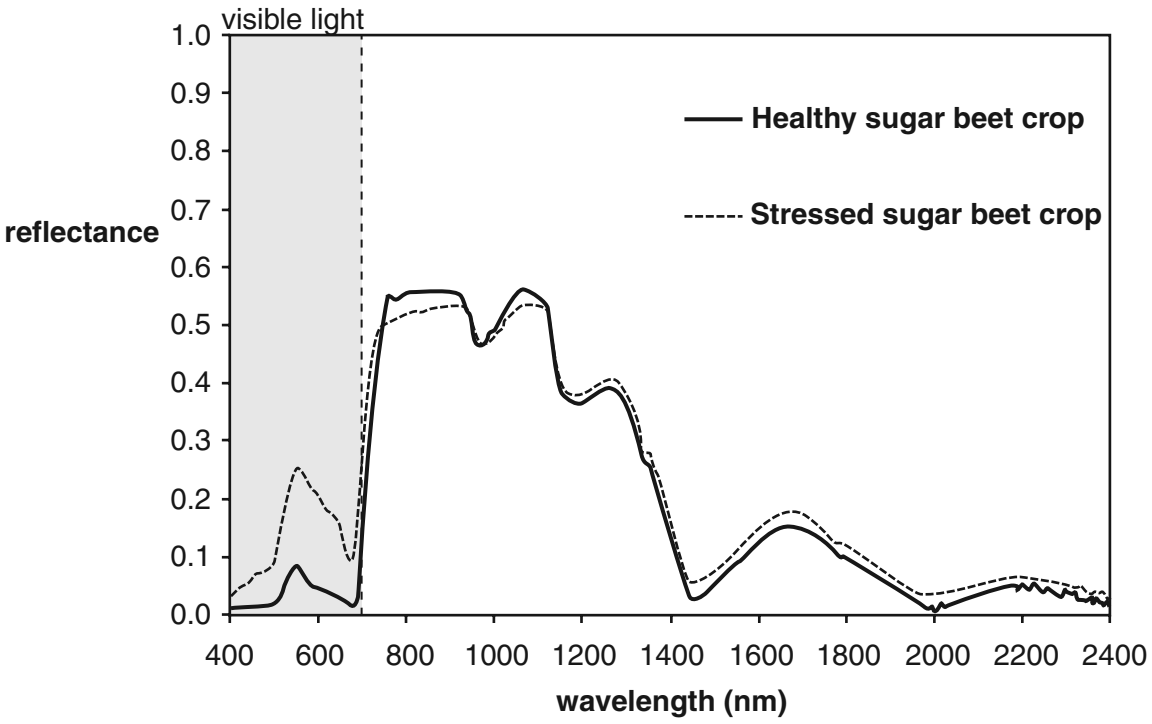

Fig. 2.1

(a) What is the source of the electromagnetic radiation?

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

(b) Suggest how the sugar beet crop might have become stressed.

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

(c) Visible light has wavelengths of 400–700 nm.

State the name given to the part of the spectrum with wavelengths between 700 and 2400 nm.

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

(d) **(i)** Using Fig. 2.1, describe how the reflectance of healthy sugar beet changes for wavelengths between 400 and 1400 nm.

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

(ii) Using Fig. 2.1, suggest how reflectance for wavelengths between 400 and 1400 nm can be used to determine if the crop is healthy or stressed.

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

Image removed due to third party copyright restrictions

A sugar beet plant

(e) The sugar produced by the sugar beet plant is stored in its tap root underground.

Describe how the plant produces sugar.

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

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..... **[5]**

[Total: 13]

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Question 3 begins on page 10

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3 The Arctic Charr is a species of fish usually found in colder regions in the Northern Hemisphere. Some of this species became stranded in lakes in the Lake District in the north of England (shown in Fig. 3.1) as the ice retreated towards the North Pole at the end of the last Ice Age.

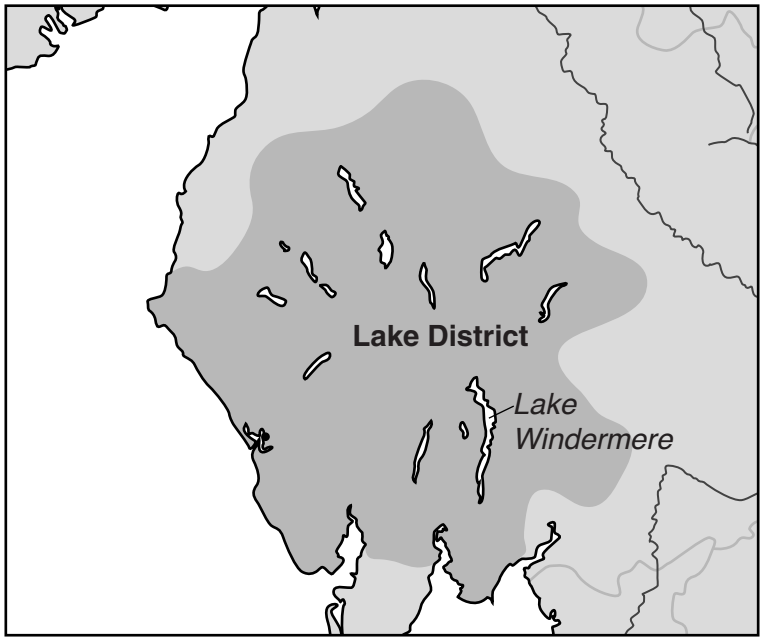

Fig. 3.1

(a) The populations of fish in the individual lakes show significant differences in characteristics – for example, when they lay their eggs. The fish are unable to move between the lakes.

Explain how these differences may have arisen.

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

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..... **[5]**

(b) Arctic Charr are commonly found further north than the Lake District, but their numbers in the Lake District have declined since the 1980s, even in the cleanest waters.

Suggest a reason for this decline in numbers.

.....

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

(c) The decline in fish numbers has been particularly large in Lake Windermere, which has had untreated sewage, rich in phosphates, discharged into it.

(i) Explain why the presence of the untreated sewage could result in fewer Arctic Charr.

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

(ii) Phosphate ions are absorbed by plants.

State **one** use of the phosphate ion in a plant cell.

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

[Total: 11]

4 Fig. 4.1 shows a grey-scale satellite image of a lake in the USA. Charge-coupled devices (CCDs) on the satellite are used to detect electromagnetic radiation.

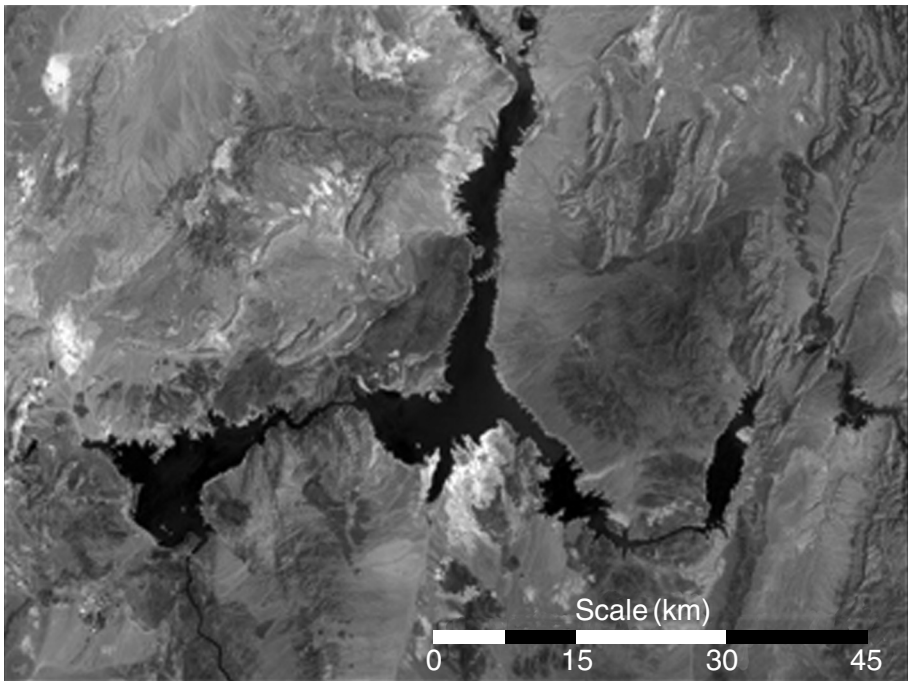

Fig. 4.1

(a) Describe how the information received by the CCDs is relayed to Earth and displayed as an image.

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

(b) Satellites may also be used to produce 'false colour composite images', which combine information from sensors detecting three different wavebands of electromagnetic radiation.

Fig. 4.2, **on the insert**, shows a false colour image of an area of land jutting into the sea. The land is almost entirely covered in vegetation.

(i) Use information from Fig. 4.2 and knowledge you have gained from your studies, to complete Table 4.1 below:

Feature	**Reflection of Band 1 (green light) displayed as blue**	**Reflection of Band 2 (blue light) displayed as green**	**Reflection of Band 3 (near infrared) displayed as red**	**Colour it appears on image**
Sediment	High	Low	Low	Blue
Clear water	Low			
Vegetation		Low		
Bare ground				

Table 4.1

[3]

(ii) Explain why snow would appear white on this image.

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

(c) Electromagnetic radiation transfers energy using waves, as shown in Fig. 4.3.

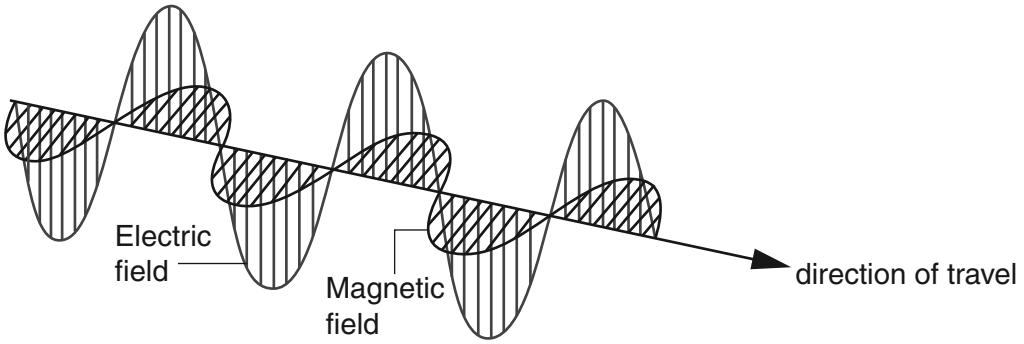

Fig. 4.3

(i) Clearly label **one** wavelength on Fig. 4.3. **[1]**

(ii) State what is meant by the term *frequency*.

.....

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

(iii) The wavelength of green light is 5.1×10^{-7} m.

Calculate the frequency of green light to **two significant figures**.

Speed of light = $3.0 \times 10^{8}\,m\,s^{-1}$

frequency ..... units ..... **[3]**

(d) Images may be distorted by diffraction.

Explain what is meant by *diffraction*.

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

[Total: 17]

Question 5 begins on page 16

5 This question is about the productivity of different ecosystems.

(a) State what the term *productivity of an ecosystem* means.

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

(b) Fig. 5.1 shows the productivity of some ecosystems.

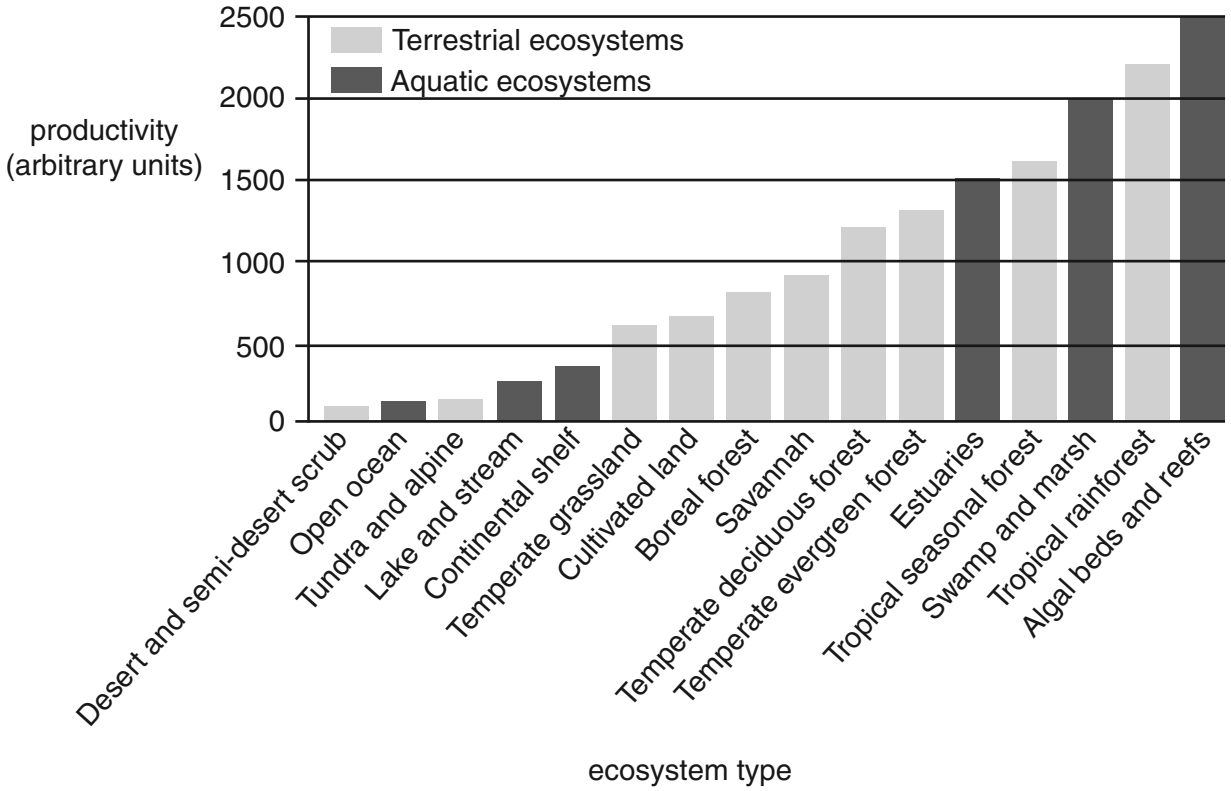

Fig. 5.1

(i) Suggest **two** factors that limit the productivity of the following ecosystems:

Desert and semi-desert scrub

1 .....

2 .....

Open ocean

1 .....

2 .....

[2]

(ii) In Fig. 5.1, the open ocean has a low productivity. However, it makes the greatest contribution to the Earth's total productivity.

Suggest why.

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

(c) Scientists believe that the increase in carbon dioxide in the atmosphere is causing the Earth's atmosphere to warm up.

Discuss the effect that an increase in carbon dioxide and a warmer atmosphere may have on the productivity of ecosystems.

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

[Total: 9]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.