OCR
Oxford Cambridge and RSA

Monday 16 May 2016 – Morning

AS GCE SCIENCE

G641/01 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	

Centre number						Candidate number				

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. If additional space is required, you should use the lined page(s) 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 **16** 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 A duck farm is situated near Moriches Bay on Long Island, New York, in the USA.

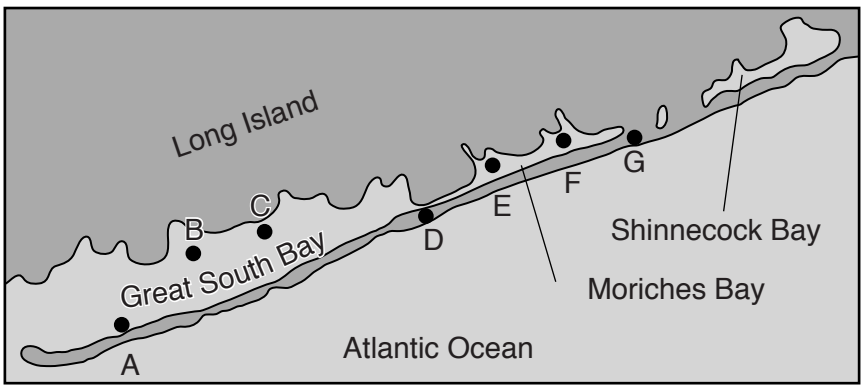

Fig. 1.1

Pollution from the duck farm adds nitrogen and phosphorus to coastal water off Long Island.

(a) Suggest the source of the nitrogen and phosphorus and how it enters the water.

.....

.....

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

Scientists wanted to compare the effects of phosphates and nitrates on plankton growth.

- Water was extracted from sites A to G (Fig. 1.1), and the water from each site was divided into three samples.
- Equal amounts of plankton were added to each sample.
- Nitrate was added to one sample, phosphate was added to the second and the third was left untreated.
- Then, they were all left to grow for the same amount of time. The results are shown in Fig. 1.2.

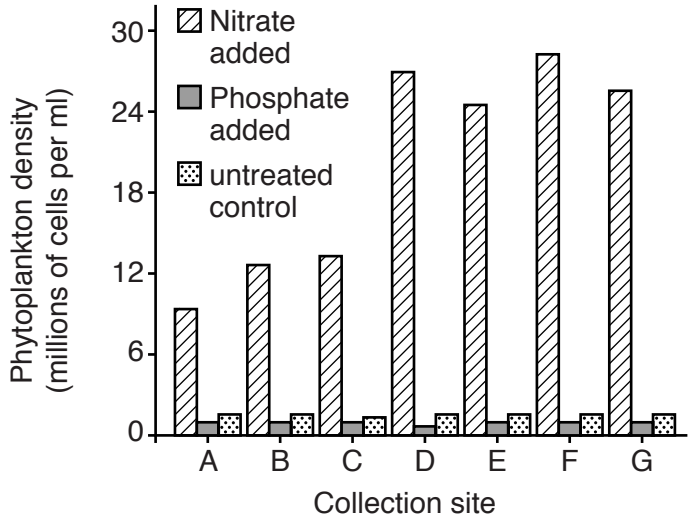

Fig. 1.2

(b) (i) Describe the patterns of plankton growth observed in this experiment.

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

(ii) Suggest how the results of this experiment would change if new duck farms substantially increase the amount of pollution in the water.

Explain your reasoning.

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

(c) (i) Atmospheric nitrogen is converted within an ecosystem into a form that plants can use to grow.

Describe how this happens.

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.....

.....

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

(ii) Name a type of molecule that the plant makes from this nitrogen.

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

[Total: 12]

2 Useful information can be obtained by using remote sensing of electromagnetic radiation.

(a) (i) Complete the following table about the properties of some electromagnetic waves by putting an X in the appropriate box:

	Infrared	**Microwave**	**Radiowave**	**Ultraviolet**	**Visible**
Has the longest wavelength					
Has the shortest wavelength					
Has the highest frequency					
Has the lowest frequency					

[2]

(ii) What property of waves is the same for all parts of the electromagnetic spectrum?

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

Digital thermal imaging cameras are used by the police searching for cannabis farms.

Fig. 2.1 is an image taken by such a camera.

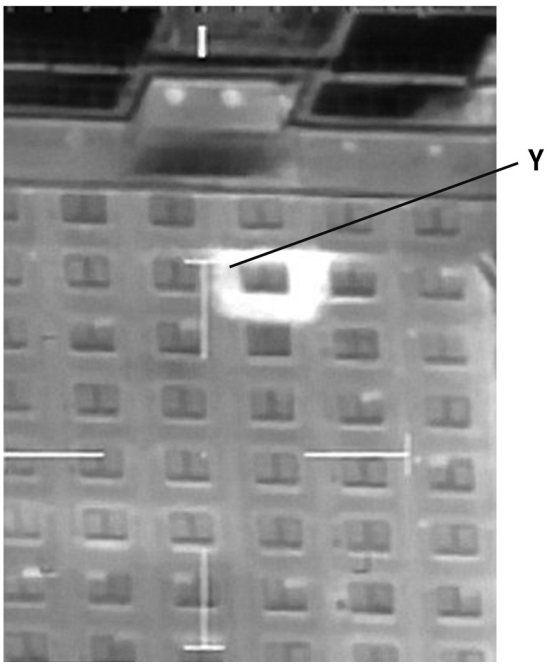

Fig. 2.1

(b) (i) What type of electromagnetic waves are detected by a thermal imaging camera?

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

(ii) Suggest and explain what information the image gives the police about the area marked **Y** on Fig. 2.1.

.....

.....

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

(iii) Describe how a thermal imaging camera produces an image that depends on the temperature of a surface.

.....

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.....

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

(c) Some electromagnetic waves, such as gamma and x-rays, can damage the human body.

Explain how they do this.

.....

.....

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

[Total: 11]

3 Light travelling into a camera passes through glass. Here it may be reflected and refracted.

(a) (i) Complete Fig. 3.1 to show the path of a ray of light when it is reflected and refracted. Clearly label the **reflected** ray and the **refracted** ray.

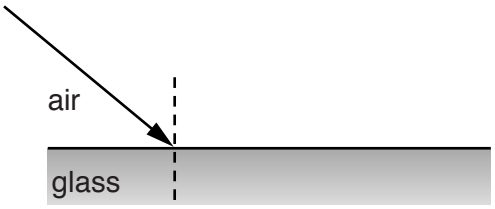

Fig. 3.1

[4]

(ii) Light may also be represented in a diagram as a series of 'wavefronts'.

The wavefront diagram for light entering glass is shown in Fig. 3.2.

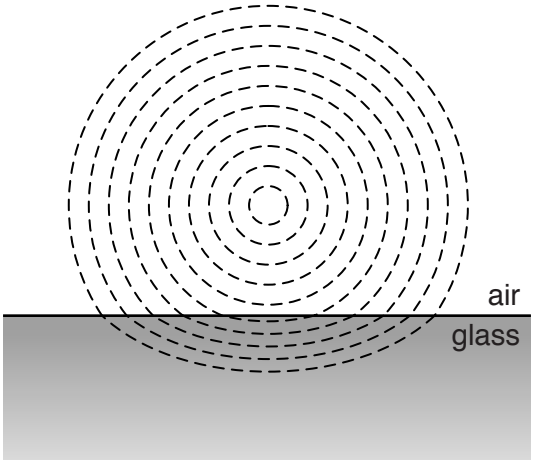

Fig. 3.2

Describe and explain the change in the wavefront pattern when the light enters the glass.

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

(b) (i) Light usually enters a camera through a small hole. This causes the light to be diffracted.

Explain what diffraction is and how it can be reduced in the camera.

You may wish to include diagrams in your answer.

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

(ii) What effect would diffraction have on the image produced?

.....

.....

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

[Total: 11]

4 All energy transfers must obey the law of conservation of energy.

(a) Explain what is meant by 'conservation of energy'.

.....

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

(b) Fig. 4.1 represents the energy flow inside a plant cell.

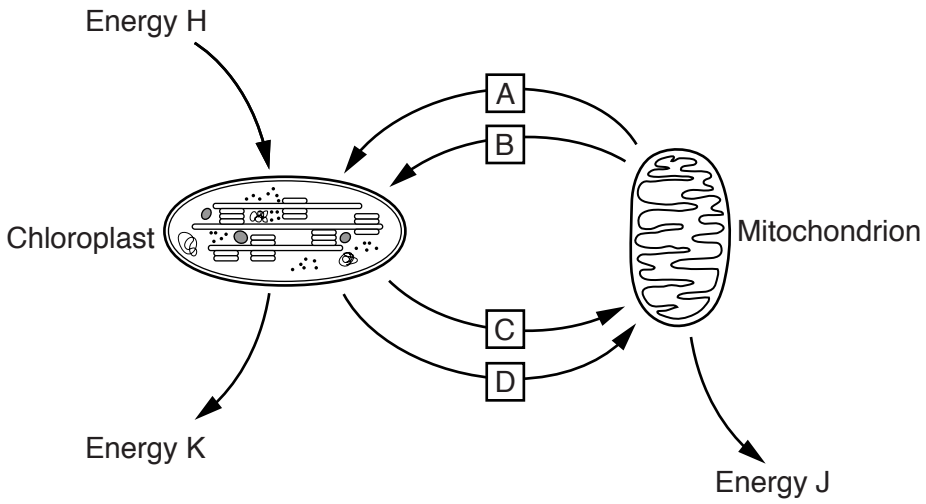

Fig. 4.1

(i) Name the chemicals A, B, C and D.

A .....

B .....

C .....

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

(ii) Name the forms of energy H and J.

H .....

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

(iii) The energy labelled K is stored in the plant.

Suggest in what form the energy is stored.

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

(c) A caterpillar took in 460 kJ of energy by eating some of a plant. Of this, 216 kJ are excreted.

(i) Calculate the percentage of the energy taken in that was lost by excretion.
Give your answer to 2 significant figures.

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

(ii) Suggest **two** other ways that the remaining energy is used by the caterpillar.

1 .....

2 .....
[2]

(d) Energy is ultimately recycled in an ecosystem by decomposers.

(i) Name a decomposer. .....**[1]**

(ii) In some circumstances, decomposers are unable to thrive.

Suggest **one** such circumstance and describe how the ecosystem might be affected as a result.

.....

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

[Total: 14]

5 Costa Rica is a small country in Central America.

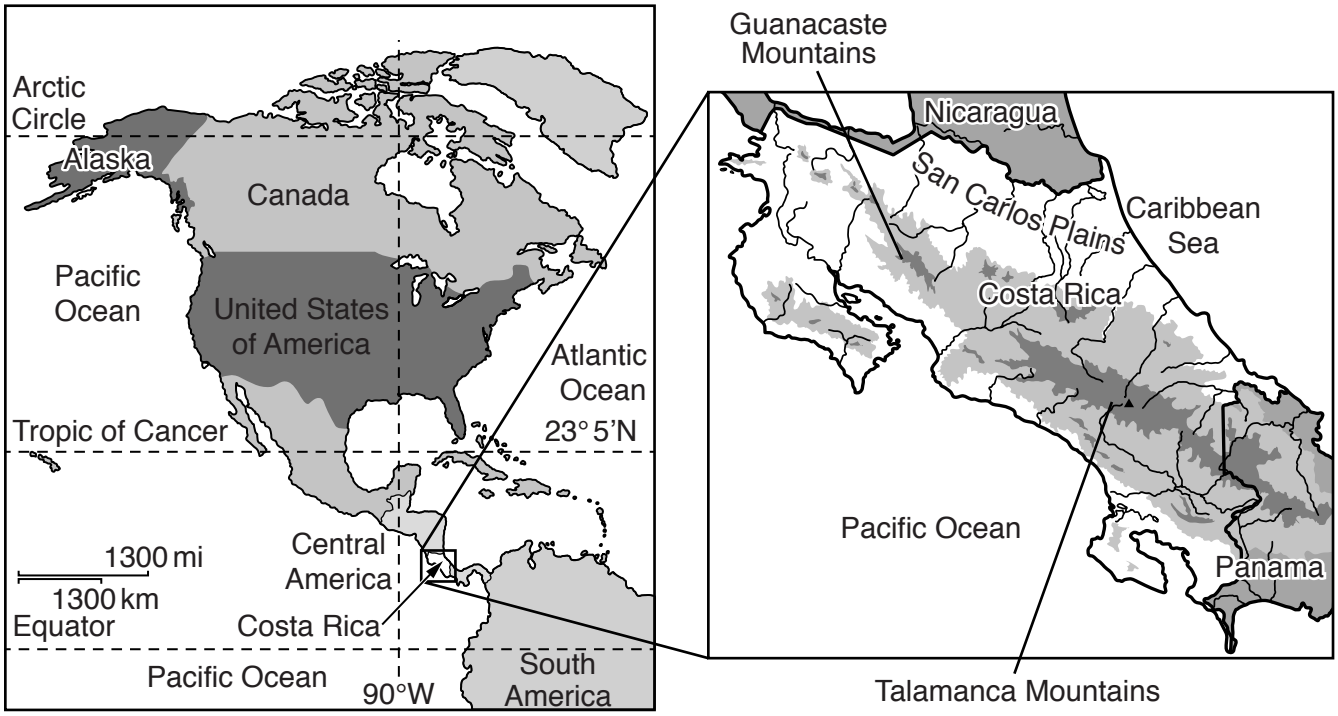

Fig. 5.1

(a) Rainforest is dominant in some parts of Costa Rica.

Suggest **three** reasons why this is so.

1 .....

2 .....

3 .....

[3]

(b) Despite its small size, Costa Rica possesses over 5% of the world's total biodiversity.

(i) What is meant by the term 'biodiversity'?

.....

.....

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

(ii) Costa Rica supports about 165 times as many life forms as similar sized countries elsewhere in the world.

Use Fig. 5.1 to suggest why so many different life forms have developed there.

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

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

(c) Costa Rica's rich biodiversity is vulnerable to some human activities.

Suggest an example of one such activity and how it could impact on the life forms in Costa Rica.

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

[Total: 12]

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 margin(s).