

**Tuesday 21 May 2013 – 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

**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. 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 **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)<sup>2</sup>  $\times$  resistance

Answer **all** the questions.

1 Fig. 1.1 shows a tropical rainforest.



**Fig. 1.1**

(a) The productivity of tropical rainforests is approximately twice that of forests at higher latitudes.

(i) State what is meant by the term *productivity* in this context.

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

(ii) Give a possible unit for productivity.

..... [1]

(iii) Suggest **two** reasons why tropical rainforests are more productive than those at higher latitudes.

1 .....  
2 ..... [2]

(b) Tropical rainforests cover 7% of the Earth's surface, yet they contain an estimated 50% of the world's species.

(i) What term is used to describe the number of different species in an area?

..... [1]

(ii) Suggest how the structure of a tropical rainforest leads to a greater number of species.

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

(iii) State **two** reasons why scientists are worried about the loss of tropical rainforest.

1 .....  
2 ..... [2]

(c) The bamboo lemur (Fig. 1.2) lives in the rainforest in Madagascar.



Fig. 1.2

The lemur only eats bamboo, which contains toxic cyanides.

In a single day, it can easily eat twelve times the dose of cyanides that would kill other mammals.

Suggest how this characteristic has evolved in bamboo lemurs.

.....

.....

.....

.....

.....

.....

..... [4]

**[Total: 14]**



(b) At best, plants can only manage to absorb about 5% of the sunlight reaching their leaves.

(i) Suggest a reason for this.

..... [1]

(ii) Even less of the Sun's energy will actually be **stored** by the plant as starch.

If 110J of light energy hits a plant's leaves, then typically the plant will only store about 0.30J.

Calculate the percentage of the Sun's light energy stored in the plant.

Give your answer to **two significant figures**.

answer = ..... % [1]

(iii) Suggest **two** ways that the plant could use the energy that is not being stored as starch.

1 .....

2 .....

[2]

(c) The products of photosynthesis can be converted into biofuels by processes involving anaerobic respiration.

(i) State **two** essential conditions for anaerobic respiration to work successfully.

1 .....

2 .....

[2]

(ii) Name a fuel that could be produced in this way.

..... [1]

[Total: 12]

3 The human eye and a camera can both focus and detect light waves to form an image.

(a) Fig. 3.1 shows the formation of an image in a digital camera.

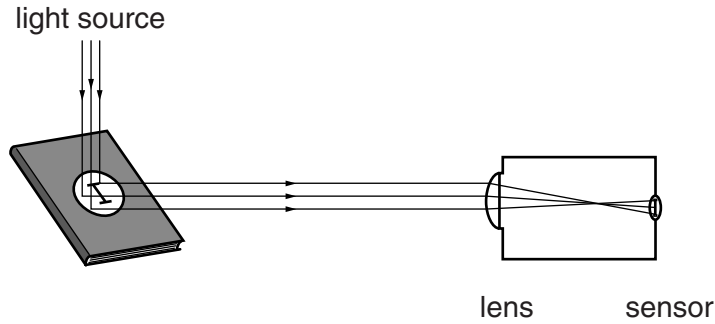


Fig. 3.1

Use words from the box to complete the paragraph below.

Each word should **only** be used once or not at all.

<b>absorbed</b>	<b>chemical</b>	<b>diffracted</b>	<b>electrical</b>
<b>reflected</b>	<b>refracted</b>	<b>scattered</b>	

Light falls onto an object. If the object has a shiny surface, much of the light is ..... If the object has a rough surface, some of the light is ..... by the dark pigments in the object and some of it is .....  
Entering the camera, the light is ..... by the lens, causing it to be focused on the back of the camera. In a digital camera, the light is absorbed by sensors, which transfers light energy into ..... energy.

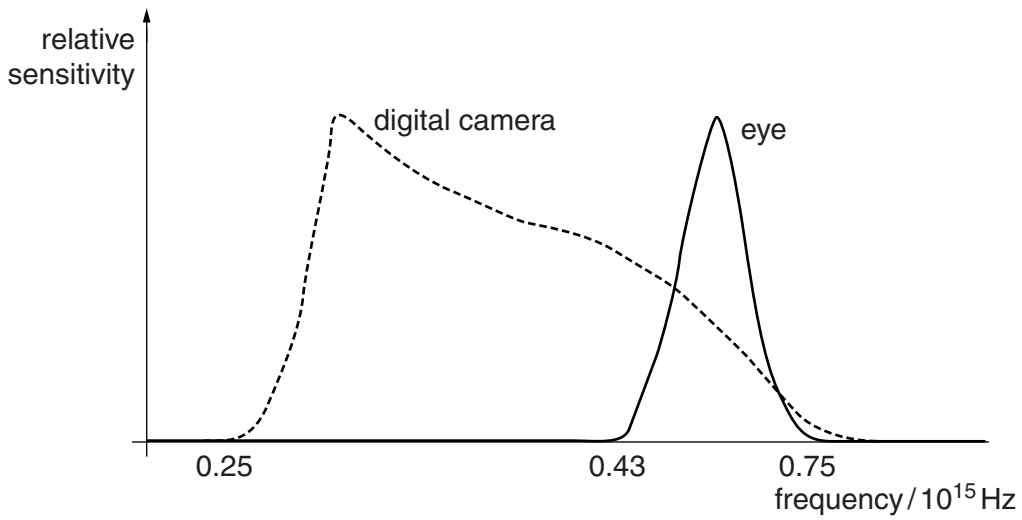
[3]

(b) Describe how the structure of the human eye allows light to be detected.

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



- (c) Fig. 3.2 shows the frequency of the radiation detected by the sensors in a digital camera and the human eye.



**Fig. 3.2**

Describe the difference in sensitivities between the two sensors, suggesting the types of radiation involved.

..... [3]

- (d) Photographers sometimes insert coloured filters in front of the camera lens to prevent some light reaching the sensors.

Suggest the colour of a filter to remove red light.

..... [1]

[Total: 10]

4 It has been estimated that global wheat demand will increase by 40% by the year 2020. A greater use of nitrogen fertilisers will be needed to meet this demand.

(a) State **one** use of nitrogen absorbed by the wheat plant.

..... [1]

(b) Ammonia is used to make nitrogen fertilisers. It is produced industrially using the Haber process.

(i) Describe the Haber process.

You should include:

- names of reactants
- reaction conditions.

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

(ii) Suggest **two** reasons why the Haber process is currently an expensive way to make a nitrogen fertiliser.

1 .....

.....

2 .....

.....

[2]

- (c) A cheaper alternative to synthetic nitrogen fertilisers is to spread manure and compost on the soil.

Explain how manure and compost are converted into chemicals that a plant root can absorb.



*In your answer you should make clear how the steps in the process are sequenced.*

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[4]

- (d) The nitrogen content of the soil can also be increased by growing a crop of beans.

Explain how growing beans increases the nitrogen content of the soil.

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[3]

- (e) Explain how the use of any types of fertiliser can cause problems for nearby rivers.

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[3]

[Total: 17]

Turn over

**12**  
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**PLEASE DO NOT WRITE ON THIS PAGE**

- 5 (a) (i) Electromagnetic radiation from the Sun can be harnessed using two different types of solar panel: photovoltaic (PV) panels, which generate electricity and solar water heating panels. PV panels can typically harness 15% (their efficiency) of the Sun's energy.

Typically the Sun's rays have a power intensity of  $1400\text{Wm}^{-2}$ . A student calculated the power produced by a  $4\text{m}^2$  solar water heating panel was 3360 Watts.

Use the equation below to determine which system is more efficient:

$$\text{efficiency} = (\text{power output}/\text{power input}) \times 100$$

..... is more efficient. [3]

- (ii) Despite the fact that photovoltaic panels cost more than solar water heating panels, some people still choose to install photovoltaic panels. Suggest a reason why.

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

- (b) Describe how the atmosphere interferes with the passage of light through it.

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

[Total: 7]

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.

A large rectangular area with a solid vertical line on the left side and horizontal dotted lines extending across the page, providing space for writing answers.

Handwriting practice lines consisting of a solid vertical margin line on the left and horizontal dotted lines forming a grid for writing.

A large rectangular area with a vertical line on the left and horizontal dotted lines, intended for writing answers.



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