

**ADVANCED GCE****SCIENCE**

Science and Environmental Management

**2844**

Candidates answer on the Question Paper

**OCR Supplied Materials:**

None

**Other Materials Required:**

- Electronic calculator
- Ruler (cm/mm)

**Wednesday 16 June 2010**  
**Morning**

**Duration:** 1 hour 30 minutes

Candidate  
Forename

Candidate  
Surname

Centre Number

Candidate Number

**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- 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.
- Do **not** write in the bar codes.
- 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 **90**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

Examiner's Use Only:

1			
2			
3			
4			
5			
6			
<b>Total</b>			



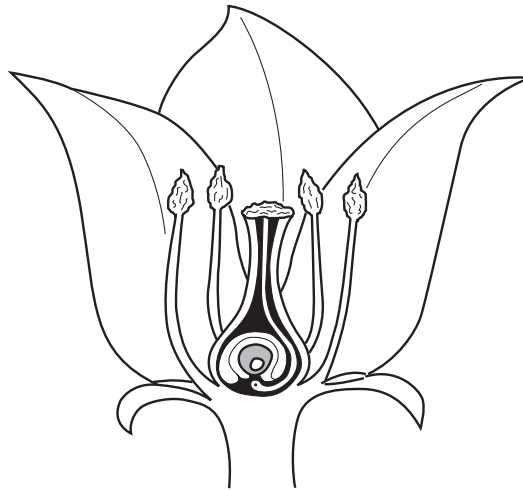
Answer **all** the questions.

- 1 Many plants are able to reproduce both sexually and asexually. For sexual reproduction to occur, a male gamete (sex cell) must fertilise an ovum.

Fig. 1.1 shows the reproductive organs of a flowering plant.

- (a) Label the following parts on the diagram.

anther	ovary	ovum	stigma	style
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**Fig. 1.1**

[5]

- (b) Pollen contains the male gametes. Where in the plant is the pollen produced?

..... [1]

- (c) In **cross-pollination**, a male gamete from one plant must be transferred to fertilise an ovum of a different plant. State two ways that this transfer may be achieved.

1. ....

.....

2. ....

..... [2]

- (d) Describe how a male gamete reaches an ovum in a **self-pollinated** flowering plant.

.....

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.....

.....

..... [3]

- (e) Cross-pollination leads to outbreeding. Plant breeders use outbreeding to introduce new genes into existing varieties of plant. Explain why this is done.

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.....

.....

..... [2]

- (f) Outbreeding can sometimes have undesirable consequences. State **one** possible undesirable consequence.

.....

..... [1]

[Total: 14]

- 2 (a) Deoxyribonucleic acid (DNA) is made up from a long chain of nucleotides, each of which consists of

- Deoxyribose (sugar)
- Phosphate group
- Base (adenine, guanine, cytosine or thymine).

Using the key in Fig. 2.1, draw a diagram to show how these components are arranged in a short section of double stranded DNA.

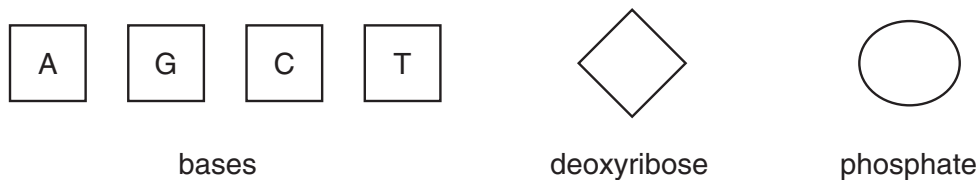


Fig. 2.1

[4]

- (b) What type of bond holds the two strands of DNA together?

..... [1]

- (c) (i) How many different amino acids are found in proteins?

..... [1]

- (ii) Explain how just **four** bases can code for all these different amino acids.

.....

.....

.....

..... [2]

(d) Ribonucleic acid (RNA) is another molecule composed of nucleotides. In RNA, the sugar is ribose instead of deoxyribose.

(i) State two ways, other than the type of sugar, in which RNA is different from DNA.

1. ....

.....

2. ....

..... [2]

(ii) Different kinds of RNA are found in a cell; two of these are transfer RNA (tRNA) and messenger RNA (mRNA). Describe how they are both involved in the synthesis of proteins.

.....

.....

.....

.....

.....

..... [4]

(e) One form of mutation causes damage to a single base in DNA. Explain how this type of mutation can result in a protein that is completely non-functional.

.....

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.....

.....

..... [3]

[Total: 17]

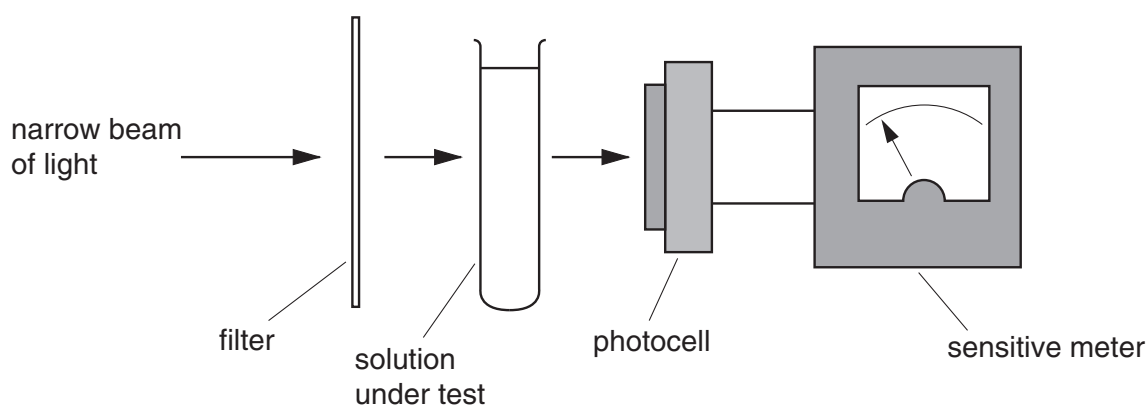
- 3** A company producing the metal nickel was ordered to stop dumping untreated waste into the rivers of Siberia by the end of 2007. However, testing of the river water in 2008, revealed that the company had continued to release the pollution.

**(a)** Suggest three factors scientists would have to take into account when taking water samples in 2008 so that their results could be compared with the previous year.

1. ....
2. ....
3. .... **[3]**

**(b)** Nickel compounds are green in solution. One way of analysing the nickel content of the water would be to use a colorimeter.

The principal parts of a colorimeter are shown in Fig. 3.1.



**Fig. 3.1**

**(i)** Briefly explain how the colorimeter works and suggest a colour for the filter.

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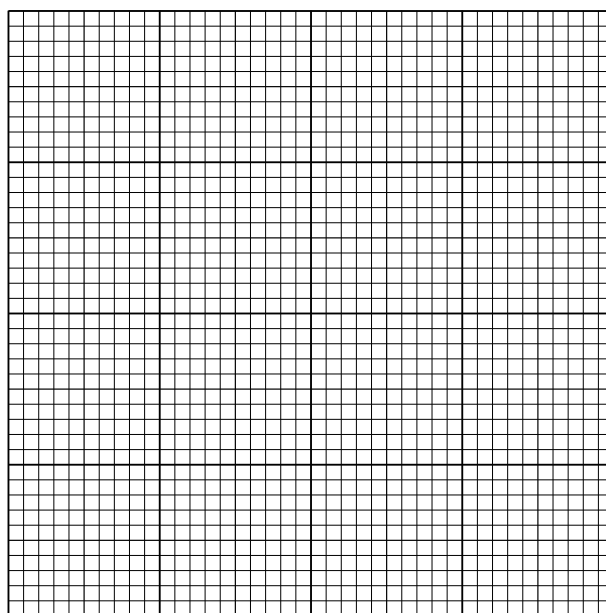
colour of filter ..... **[4]**

- (ii) Before the concentration of nickel in a sample of river water can be found using a colorimeter, a calibration graph has to be drawn. A set of such data for one colorimeter is given in the Table 3.1.

**Table 3.1**

concentration of nickel in solution / $10^{-6}\text{ g dm}^{-3}$	absorbance
0	0.05
100	0.11
200	0.20
300	0.25
400	0.32

Plot these data on the grid below and draw a straight line calibration graph for this colorimeter. Use the vertical axis for absorbance.



[3]

- (iii) One particular water sample had an absorbance of 0.22 when this colorimeter was used.

Use your calibration graph to estimate the nickel concentration in this sample. Show on your graph how you obtained your answer.

..... [2]

(c) Atomic emission spectroscopy is another technique that can be used to measure the concentration of nickel in a water sample.

(i) In what physical state must the sample be before it can be analysed by atomic emission spectroscopy?

..... [1]

(ii) Atomic emission spectroscopy relies on the fact that the nickel atoms give out particular frequencies of light when provided with energy.

Explain why this happens.

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

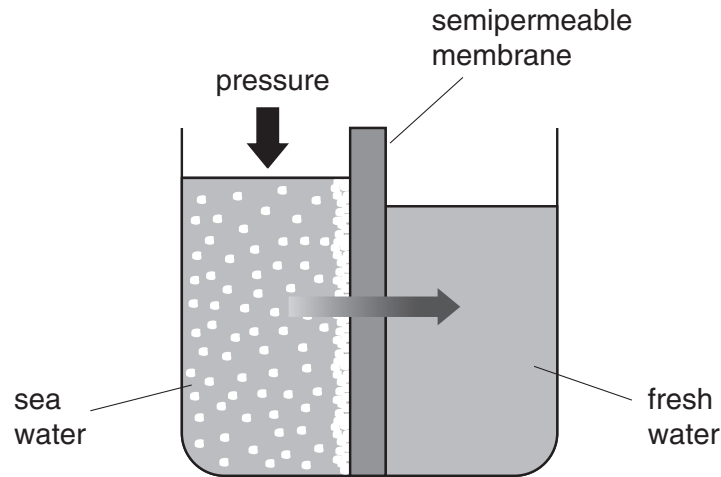
[Total: 18]



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- 4 Reverse osmosis can be used to purify sea water to make it suitable for drinking. Fig. 4.1 is a diagram to show the principle of reverse osmosis.



**Fig. 4.1**

- (a) Suggest two constituents of sea water that would need to be removed to make it drinkable.

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

- (b) Using Fig. 4.1, explain how reverse osmosis can be used to purify sea water.

.....

.....

.....

.....

.....

.....

.....

..... [5]

- (c) State two applications of reverse osmosis, other than in the production of drinking water.

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

(d) Water moves in and out of cells in plant roots by the process of osmosis.

- (i) Describe how water moves in and out of cells. Use ideas about the movement of particles in your answer.

.....

.....

.....

.....

..... [3]

- (ii) Under what conditions would there be a net movement of water molecules into the root cell?

.....

..... [1]

- (iii) What happens to the appearance of a plant if there is insufficient water in the soil?

.....

..... [1]

- (iv) State two ways that plants adapt to cope with water stress.

1. ....

.....

2. ....

..... [2]

(e) Wheat is a crop that is not well adapted to grow in dry areas.

- (i) Suggest why wheat is sometimes grown in hot, dry countries, instead of better adapted crops.

.....

..... [1]

- (ii) Suggest **two** strategies a farmer might adopt to increase the yield of the wheat under these conditions.

.....

.....

..... [2]

[Total: 18]

Turn over

- 5 (a)** Foods made from genetically modified (GM) crops are becoming more available worldwide. Many people are uneasy about the safety of such crops.

Explain in outline:

- How genetically modified crops are produced
- What environmental problems may arise from growing GM crops
- What advantages GM crops have to offer

In this question, four marks are available for the quality of written communication.

[8]

### Quality of Written Communication [4]

- (b) GM crops and foods are perceived to have a risk attached to them.

What factors are normally taken into account when estimating the risk of a potentially harmful substance or activity?

.....

.....

..... [2]

[Total: 14]

6 Fig. 6.1 is a diagram of a section through a leaf.

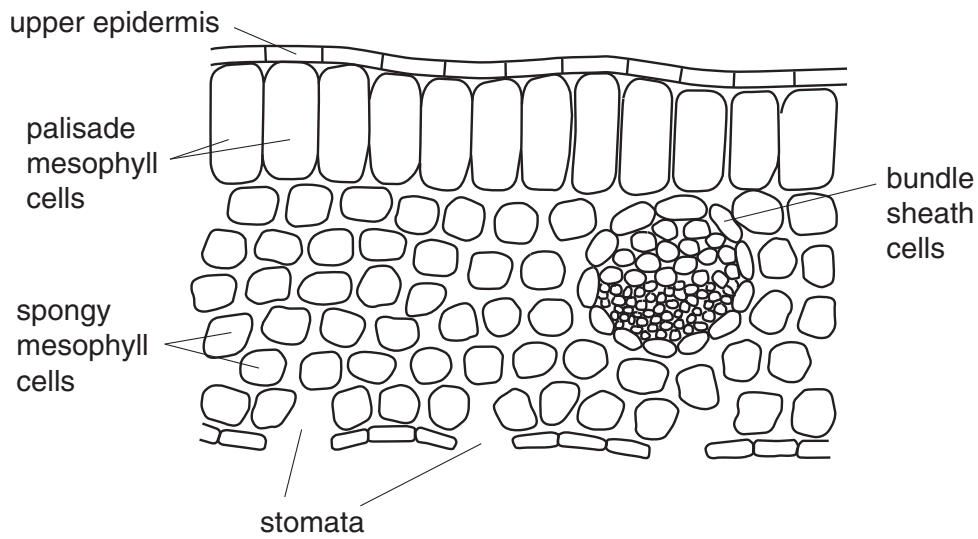


Fig. 6.1

(a) In **photosynthesis**, what is the role of

(i) palisade mesophyll cells

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

(ii) stomata

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

(iii) ribulose biphosphate?

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

(b) Under conditions of high light intensity, the rate of photosynthesis is high and oxygen builds up in the photosynthetic cells of the leaf.

Explain why the build up of oxygen can lead to a reduction in efficiency of photosynthesis.

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

- (c) Most plants photosynthesise by the C3 pathway. However, some plants that grow in conditions of high light intensity photosynthesise by the C4 pathway, in which a 4 carbon intermediate is formed.

Describe the C4 pathway. Explain how it leads to more efficient photosynthesis in conditions of high light intensity.

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.....

.....

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..... [4]

[Total: 9]

**END OF QUESTION PAPER**

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