OCR
RECOGNISING ACHIEVEMENT

# Tuesday 21 May 2013 – Afternoon

## AS GCE BIOLOGY

**F211/01** Cells, Exchange and Transport

*F2110601 3*

Candidates answer on the Question Paper.

**OCR supplied materials:**
- Insert (inserted)

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

**Duration:** 1 hour

*F 2 1 1 0 1*

| Candidate forename | | Candidate surname | |
|---|---|---|---|

| Centre number | | | | | | Candidate number | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

**INSTRUCTIONS TO CANDIDATES**

- The Insert will be found in the centre of 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 page 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**.
-  Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- 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.

© OCR 2013 [K/500/8550]

OCR is an exempt Charity

Answer **all** the questions.

**1** Fig. 1.1 is a diagram of a plant cell.

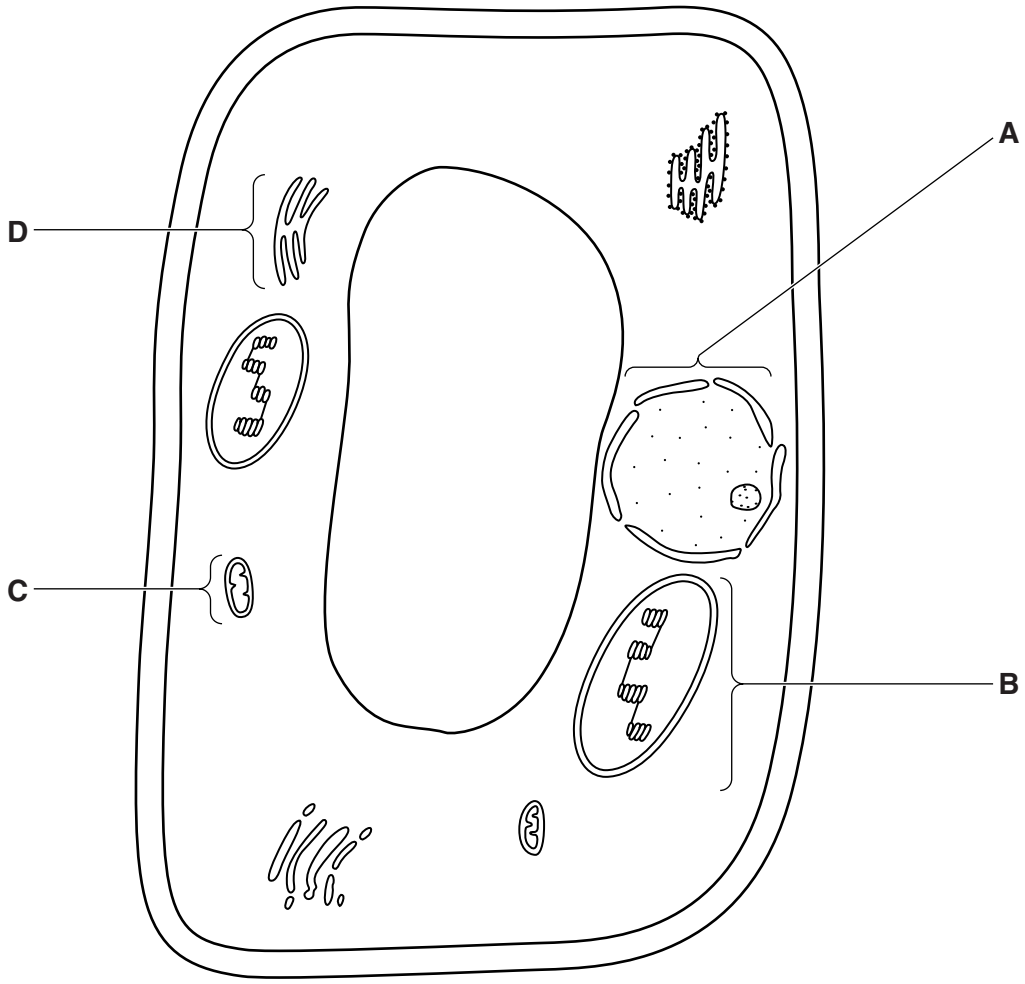



**Fig. 1.1**

**(a) (i)** Name the cell components labelled **A** and **B**.

**A** .....

**B** .....

**[2]**

**(ii)** State the **functions** of the components labelled **C** and **D**.

**C** .....

.....

.....

**D** .....

.....

.....

**[2]**

© OCR 2013

**(b)** A student suggested that the details of component **C** could be seen clearly with a very good light microscope.

Explain why the student is **not** correct.

.....

.....

.....

.....

.....

.....

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

**(c)** Staining is a process often used in microscopy.

Describe the **advantages** of staining specimens to be viewed under a microscope.

.....

.....

.....

.....

.....

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

**[Total: 8]**

© OCR 2013

**2** In an experiment to measure the rate of diffusion, a student placed cubes of agar jelly containing an indicator into dilute hydrochloric acid. The indicator changes from pink to colourless in acidic conditions.

The student used cubes of different sizes and recorded the time taken for the pink colour of each cube to disappear completely.

The student's results are recorded in Table 2.1.

| **Length of side of cube (mm)** | **Surface area of cube ($mm^2$)** | **Volume of cube ($mm^3$)** | **Surface area to volume ratio** | **Time taken for pink colour to disappear (s)** | **Rate of diffusion ($mm\,s^{-1}$)** |
|---|---|---|---|---|---|
| 2 | 24 | 8 | 3.0:1 | 50 | 0.020 |
| 5 | 150 | 125 | 1.2:1 | 120 | 0.021 |
| 10 | 600 | 1 000 | | 300 | 0.017 |
| 20 | 2 400 | 8 000 | 0.3:1 | 700 | 0.014 |
| 30 | 5 400 | 27 000 | 0.2:1 | 1 200 | 0.013 |

**Table 2.1**

**(a) (i)** Calculate the surface area to volume ratio of the cube with 10 mm sides.

Show your working.

Answer = ..... **[2]**

**(ii)** **Using the data in Table 2.1**, describe the relationship between the rate of diffusion and the surface area to volume ratio.

.....

.....

.....

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

© OCR 2013

**(iii)** Explain the significance of the relationship between rate of diffusion and the surface area to volume ratio for large plants.

.....

.....

.....

.....

.....

.....

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

**(b)** Another student used the same raw data obtained in the experiment but calculated a different rate of diffusion for each cube. This student's results are shown in Table 2.2.

| Length of side of cube (mm) | Time taken for pink colour to disappear (s) | Rate of diffusion ($mm\,s^{-1}$) |
|---|---|---|
| 2 | 50 | 0.040 |
| 5 | 120 | 0.042 |
| 10 | 300 | 0.033 |
| 20 | 700 | 0.029 |
| 30 | 1200 | 0.025 |

**Table 2.2**

In this student's table, the calculation of the rate of diffusion is incorrect.

**(i)** Suggest the method used to calculate the rate of diffusion in Table 2.2.

.....

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

**(ii)** State why the method in **(b)(i)** is **not** correct.

.....

.....

.....

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

© OCR 2013

**(c)** In mammals, the lungs are adapted to enable efficient gaseous exchange.

The table below lists some of the adaptations of the lungs.

Complete the table explaining how each adaptation improves efficiency of gaseous exchange.

| Adaptation | How this adaptation improves efficiency of gaseous exchange |
|---|---|
| squamous epithelium | ..... ..... ..... |
| large number of alveoli | ..... ..... ..... |
| good blood supply | ..... ..... ..... |
| good ventilation | ..... ..... ..... |

**[4]**

**[Total: 12]**

© OCR 2013

**BLANK PAGE**

**Question 3 begins on page 8**

**PLEASE DO NOT WRITE ON THIS PAGE**

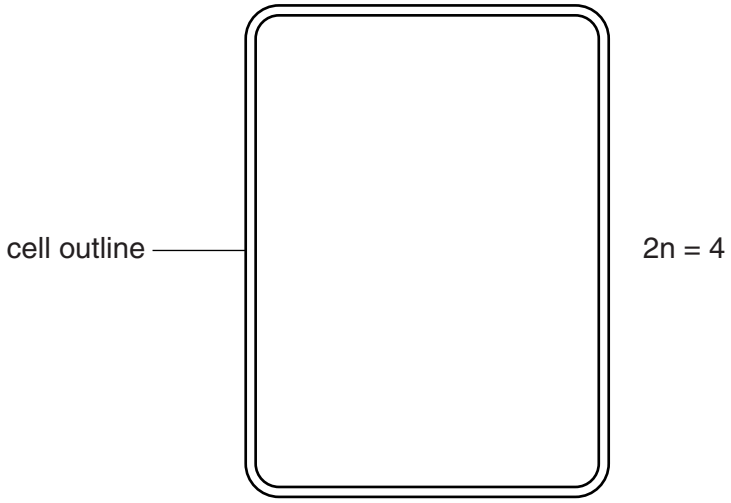
© OCR 2013

**3 (a) (i)** Name the type of nuclear division that occurs in plant growth.

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

**(ii)** Draw the **chromosomes** within the cell outline below as they would appear during **metaphase** of nuclear division.

Assume the diploid number of chromosomes is **four**.

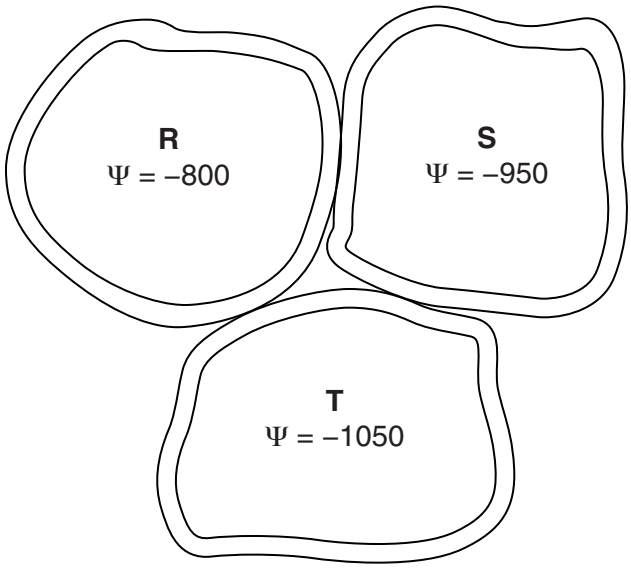



**[2]**

**(iii)** Cytokinesis follows nuclear division. After cytokinesis, the cells elongate due to water uptake by osmosis.

Fig. 3.1 shows three plant cells. The value shown in each cell refers to the water potential, Ψ, in kPa.

**Draw arrows on Fig. 3.1** below to show the movement of water between cells **R**, **S** and **T**.




**[2]**

**Fig. 3.1**

© OCR 2013

**(b)** Fig. 3.2, **on the insert**, shows the stump of a tree with new branches growing from the stump.

New growth in a stem or trunk comes from the **cambium**, which is situated between the xylem and phloem tissues.

Explain why the new branches in Fig. 3.2 are seen growing from a position just under the bark of the cut surface.

.....

.....

.....

.....

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

**(c)** Name **one** other location where growth occurs in a plant.

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

**(d)** Look at the areas labelled **L** on Fig. 3.2. These are areas of loosely packed cells in the bark called lenticels. Lenticels allow gases to diffuse into the living tissues of the trunk.

Suggest why lenticels are essential to the survival of large multicellular plants **and** explain why similar structures are not found in large multicellular animals.

.....

.....

.....

.....

.....

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

**[Total: 10]**

© OCR 2013

**4** Fig. 4.1 shows the oxygen dissociation curves for fetal haemoglobin (**A**) and adult haemoglobin (**B**).

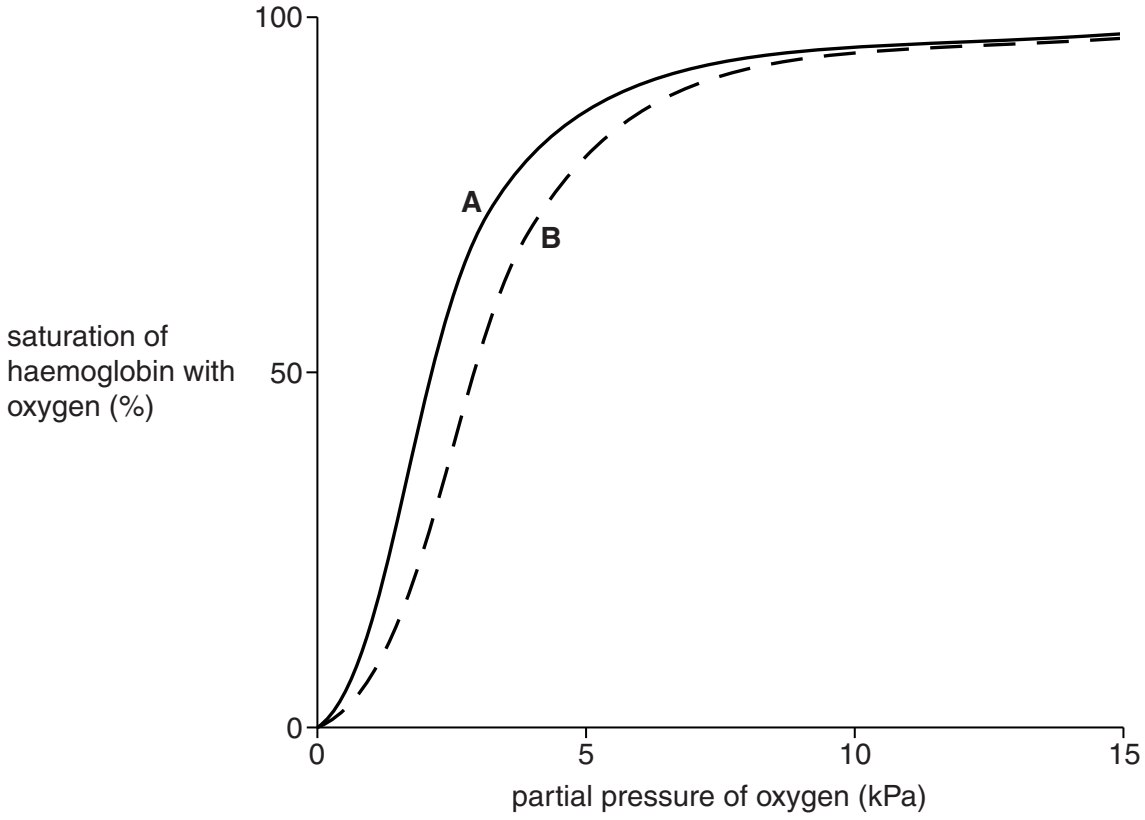



**Fig. 4.1**

**(a) (i)** Curve **A** represents fetal haemoglobin.

Explain why the fetal haemoglobin curve is to the left of the adult haemoglobin curve.

.....

.....

.....

.....

.....

.....

.....

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

© OCR 2013

**(ii)** Sickle cell anaemia is an inherited disorder in which haemoglobin crystallises when the partial pressure of oxygen ($pO_2$) is low. The red blood cells change shape and oxygen transport is disrupted.

Treatment with drugs, such as hydroxyurea, can stimulate adults to produce fetal haemoglobin rather than adult haemoglobin.

Suggest why this treatment might be of benefit to adults with sickle cell anaemia.

.....

.....

.....

.....

.....

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

**(b)** Describe **and** explain how substances that are dissolved in the blood plasma, such as oxygen or glucose, **enter the tissue fluid** from the capillaries.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

**[Total: 9]**

© OCR 2013

**5** Membranes are found both at the surface of cells and within cells.

**(a)** State **two** functions of membranes **within** cells.

.....

.....

.....

.....

.....

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

**(b)** Describe the arrangement and functions of **two** named components of a cell surface membrane.



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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

© OCR 2013

**(c) (i)** Which component of a cell membrane becomes more fluid as temperature increases?

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

**(ii)** Which component of a cell membrane denatures as temperature increases?

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

**(iii)** Liver cells contain membrane-bound organelles called peroxisomes. These organelles contain catalase, an enzyme that breaks down hydrogen peroxide to release oxygen gas.

A student carried out an investigation on catalase using the following procedure:

- two identical sized cubes were cut from a piece of fresh liver
- one cube was frozen overnight and then defrosted
- the other cube was stored in the refrigerator
- both cubes were returned to room temperature and were placed in separate test tubes containing equal volumes of 2% hydrogen peroxide solution.

The student observed that the cube of liver that had been frozen and defrosted, bubbled significantly more than the cube that had been refrigerated.

Suggest an explanation for this result.

.....

.....

.....

.....

.....

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

**[Total: 11]**

© OCR 2013

**6** **(a)** Distinguish between the term *transpiration* and the *transpiration stream*.

.....

.....

.....

.....

.....

.....

.....

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

**(b)** Xerophytes are plants that are adapted to living in dry conditions.

The lists below describe four general features of leaves. From each list, select the leaf that belongs to a xerophyte.

Place a tick (✓) in the correct box. The first one has been done for you.

**Presence of hairs on leaves**

| | | |
|---|---|---|
| Leaf **A** | no | |
| Leaf **B** | yes | ✓ |
| Leaf **C** | no | |

**Mean number of stomata ($cm^{-2}$)**

| | | |
|---|---|---|
| Leaf **D** | 30 000 | |
| Leaf **E** | 23 000 | |
| Leaf **F** | 13 000 | |

**Mean surface area of one leaf ($cm^2$)**

| | | |
|---|---|---|
| Leaf **G** | 0.2 | |
| Leaf **H** | 10.0 | |
| Leaf **I** | 23.0 | |

**Thickness of cuticle (μm)**

| | | |
|---|---|---|
| Leaf **J** | 4.25 | |
| Leaf **K** | 8.50 | |
| Leaf **L** | 2.00 | |

**[3]**

© OCR 2013

**(c)** The transport system of multicellular plants consists of xylem and phloem tissue.

The table below contrasts the structure and roles of xylem and phloem.

Complete the table using the most appropriate word or words.

| Xylem | Phloem |
|---|---|
| xylem transports water and<br><br>..... | phloem transports assimilates such as<br><br>..... |
| <br><br>..... | sieve tubes contain perforated cross walls |
| xylem vessel walls are impregnated with<br><br>..... | sieve tube walls have no additional support |
| xylem vessel walls contain<br><br>.....<br><br>that allow water to pass into adjacent vessels | there are many gaps in the cell walls between companion cells and sieve tube elements called<br><br>..... |

**[4]**

**[Total: 10]**

**END OF QUESTION PAPER**

© OCR 2013

## ADDITIONAL ANSWER SPACE

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

OCR
RECOGNISING ACHIEVEMENT

**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 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.

© OCR 2013