| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 2 |

# GCE A level

1074/01

## BIOLOGY – BY4

A.M. FRIDAY, 15 June 2012

1¾ hours

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1** | **14** | |
| **2** | **10** | |
| **3** | **14** | |
| **4** | **7** | |
| **5** | **13** | |
| **6** | **12** | |
| **7** | **10** | |
| **Total** | **80** | |

1074
010001

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The quality of written communication will affect the awarding of marks.

Examiner only

**1.** A student introduced a pure culture of anaerobic bacteria into a nutrient medium and recorded the numbers of bacteria per $cm^3$. The results are shown in the table.

| *Time / hours* | *Numbers of bacteria / millions per $cm^3$* |
|---|---|
| 0 | 1.0 |
| 1 | 1.0 |
| 2 | 1.0 |
| 3 | 1.2 |
| 4 | 1.8 |
| 5 | 3.5 |
| 6 | 6.9 |
| 7 | 13.8 |
| 8 | 28.0 |
| 9 | 57.0 |
| 10 | 113.8 |
| 11 | 225.0 |
| 12 | 375.0 |
| 13 | 440.0 |
| 14 | 460.0 |
| 15 | 482.0 |
| 16 | 484.0 |
| 17 | 486.0 |
| 18 | 488.0 |
| 19 | 488.0 |
| 20 | 488.0 |

*(a)* (i) Calculate the percentage increase in population size between 7 and 8 hours after introduction of the bacteria into the nutrient. Show your working. [2]

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(ii) How do you account for the low rate of population growth in the first three hours of the experiment? [2]

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(iii) The stage of rapid growth in population size is described as being exponential. What is meant by the term exponential growth? [1]

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(iv) Give **two** reasons which could lead to a decline in population growth in this culture. [2]

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*(b)* What conditions would be needed for the growth of the bacteria in the experiment? [3]

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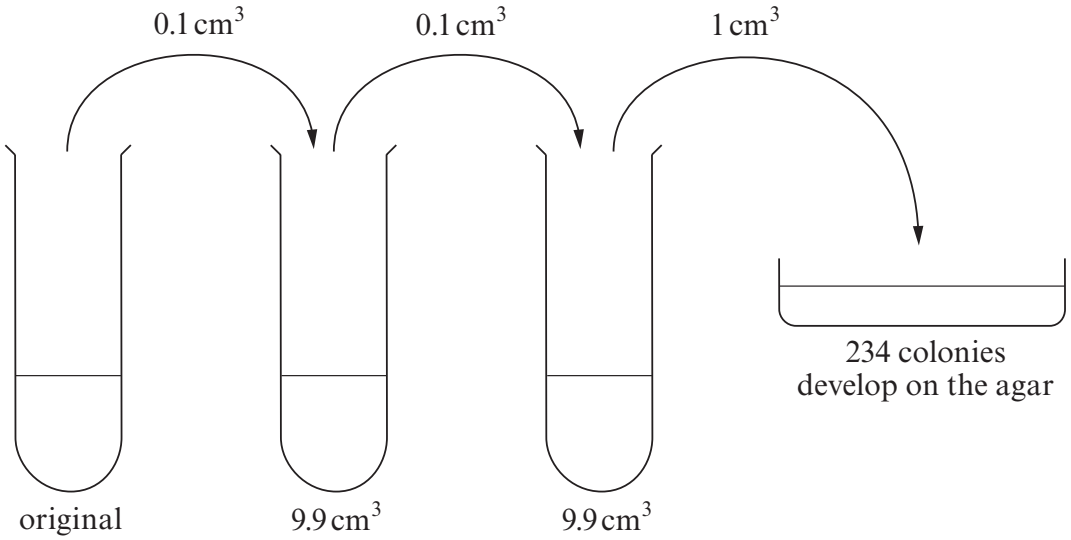
Examiner only

*(c)* The numbers of bacteria in sea water are commonly monitored. Small samples of the water are taken, diluted and plated onto nutrient agar. The diagram represents the stages of serial dilution to assess the numbers of bacteria in an original sample.




Calculate the number of bacteria per $cm^3$ in the original sample. Show your working. [2]

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*(d)* Describe **two** precautions which should be carried out to ensure aseptic conditions in **this** experiment. [2]

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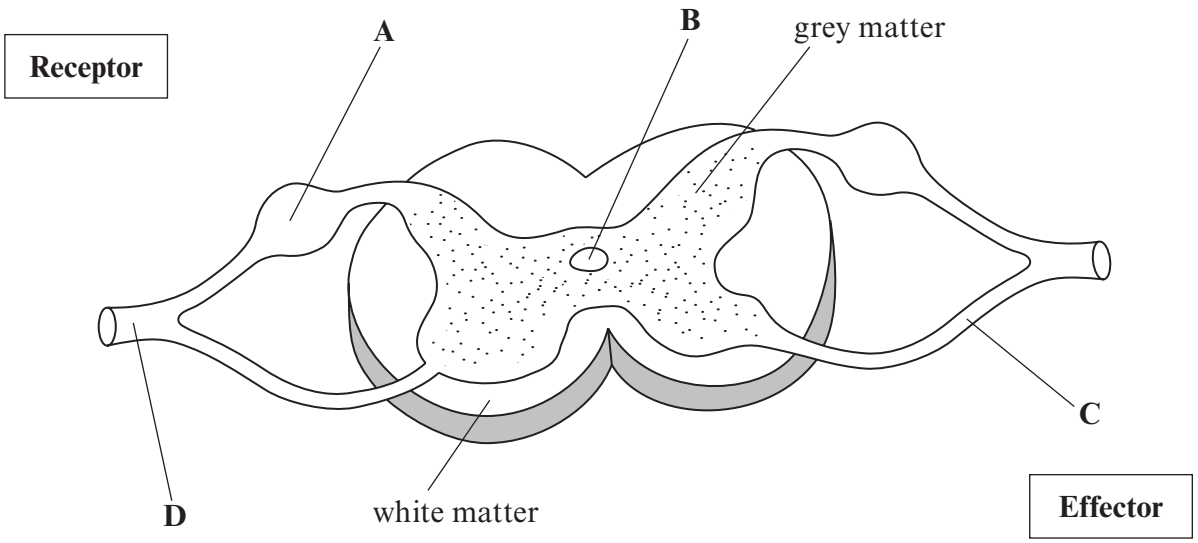
**(Total 14 marks)**

Examiner only

**2.** A diagram of a section of the spinal cord is shown.




*(a)* (i) Identify structures **A-D**. [4]

**A** .....

**B** .....

**C** .....

**D** .....

(ii) Explain why the white matter is white and the grey matter is grey. [2]

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*(b)* (i) On the diagram above, draw a **sensory neurone**, a **relay neurone** and a **motor neurone**. The sensory neurone should enter at one side of the spinal cord and the motor neurone should exit on the other side. The neurones should link the **receptor** to the **effector**. **Label** each neurone. [3]

(ii) What is the difference in **function** between an axon and a dendrite? [1]

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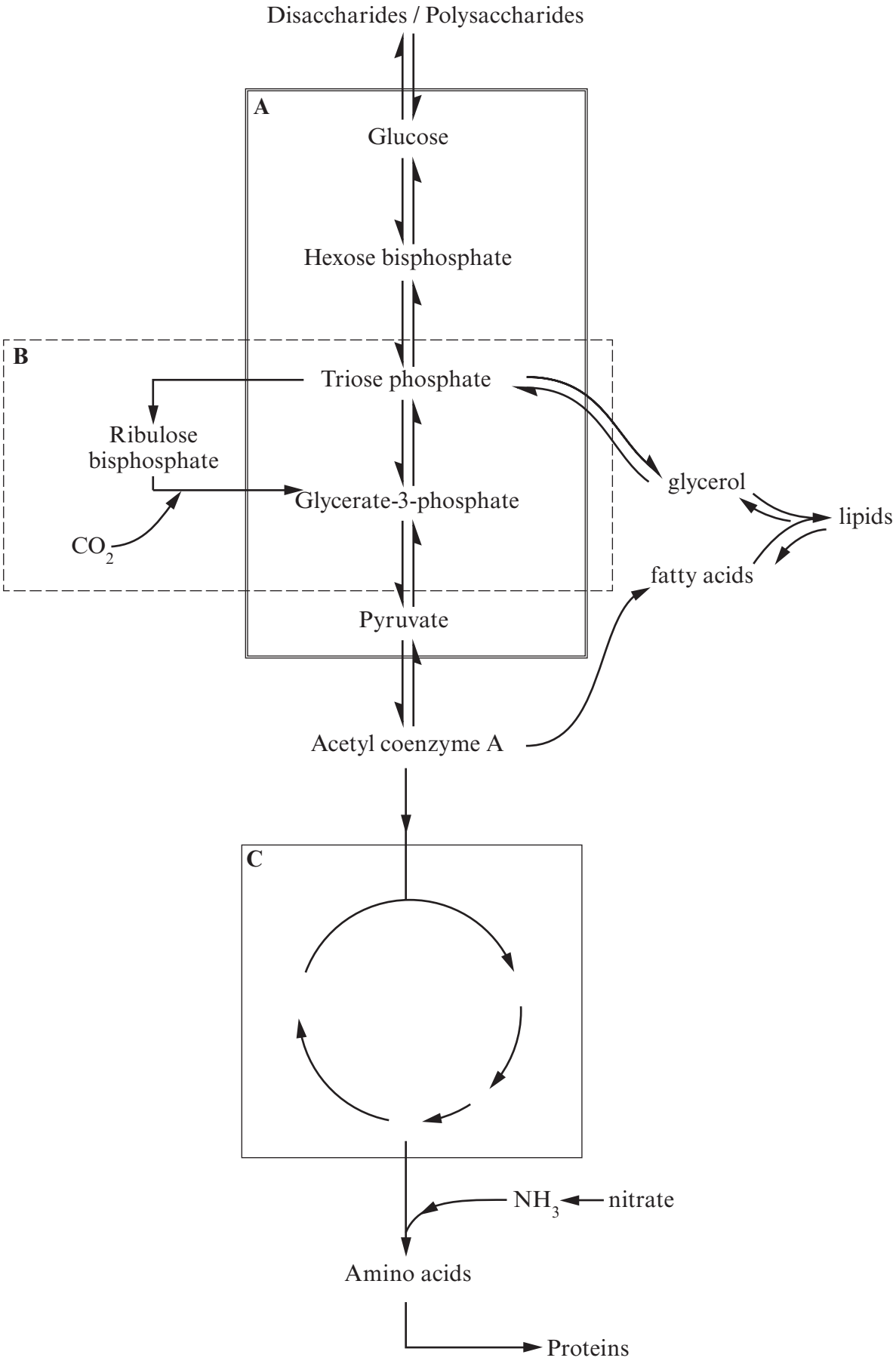
**(Total 10 marks)**

Examiner only

**3.** Some of the metabolic pathways which take place in plant cells are shown in the following diagram.



Examiner only

*(a)* (i) State the names of the processes in the boxes labelled **A**, **B** and **C**. [3]

**A** .....

**B** .....

**C** .....

(ii) Explain how it is possible for the three metabolic pathways (**A**, **B** and **C**) to take place independently of each other in the same cell. [3]

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(iii) A series of reactions which are essential for process **B** to continue are not shown. Complete the following sentences describing this series of reactions: [4]

A series of reactions which are light ..... take place in the ..... of the chloroplasts. These reactions produce ..... and ..... which are needed for process **B** to continue.

*(b)* Explain why photosynthesis is essential for the survival of animals on this planet. [2]

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*(c)* (i) Plant cells also need nitrate ions to synthesise amino acids State **one** *other* use of nitrates in plants. [1]

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(ii) Why is magnesium required by plant cells? [1]

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**(Total 14 marks)**

Examiner only

**4.** *(a)* Define what is meant by the term *photoperiodism*. [1]

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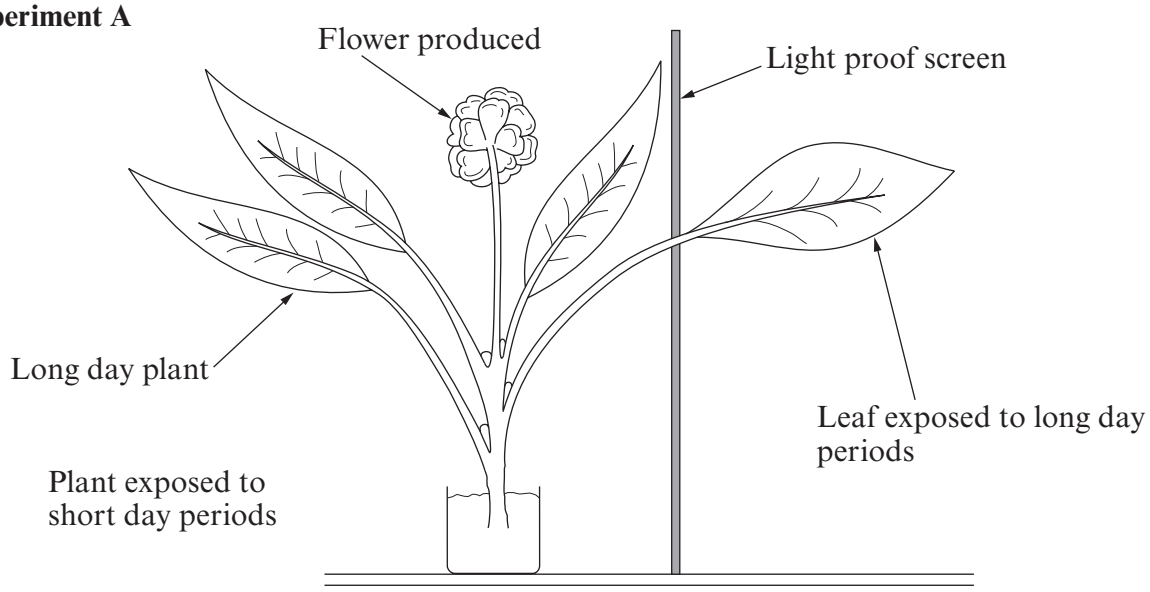
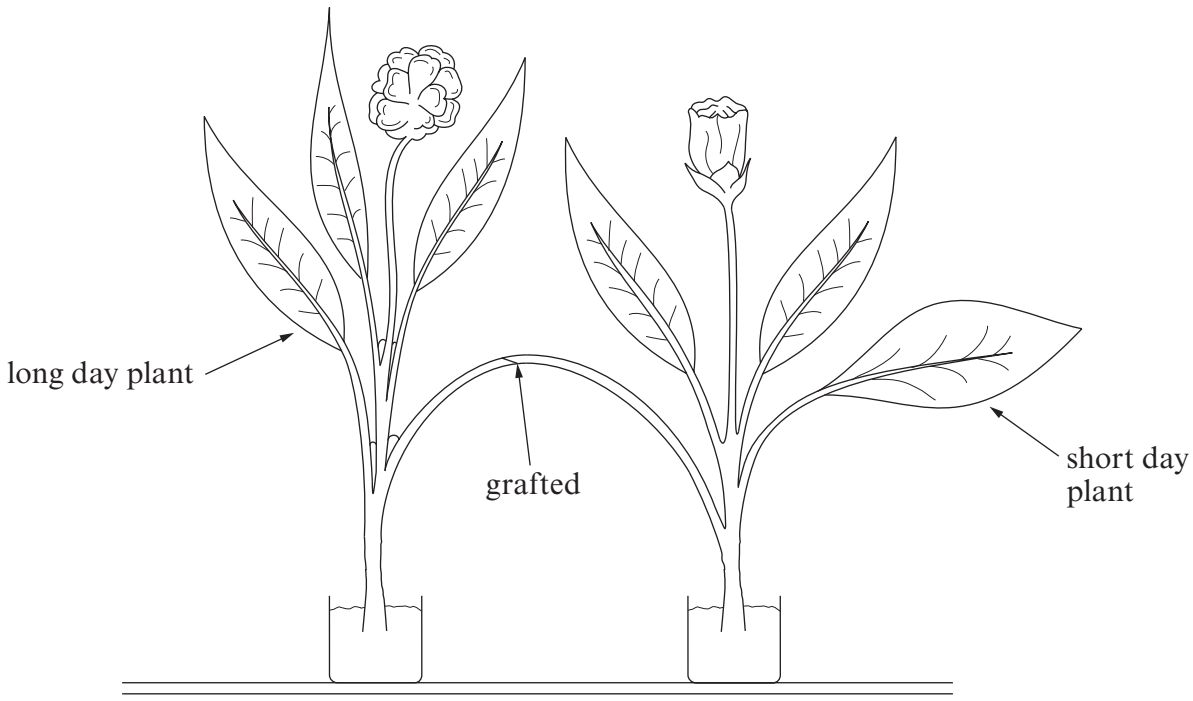
*(b)* The diagrams show two experiments to study photoperiodism in plants and the effect it has on flowering.
Long day plants only flower if the daylength exceeds a critical value.
Short day plants flower only if daylength is less than a critical value.

**Experiment A**




**Experiment B**

Both plants exposed to long days. Flowering in both species takes place but ONLY if vascular bundles are successfully connected in the graft.



Examiner only

(i) What conclusions can be made from the results of experiment **A**? [2]

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(ii) Suggest a suitable control for this experiment. [1]

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*(c)* What conclusions can be made from experiment **B**? [3]

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**(Total 7 marks)**

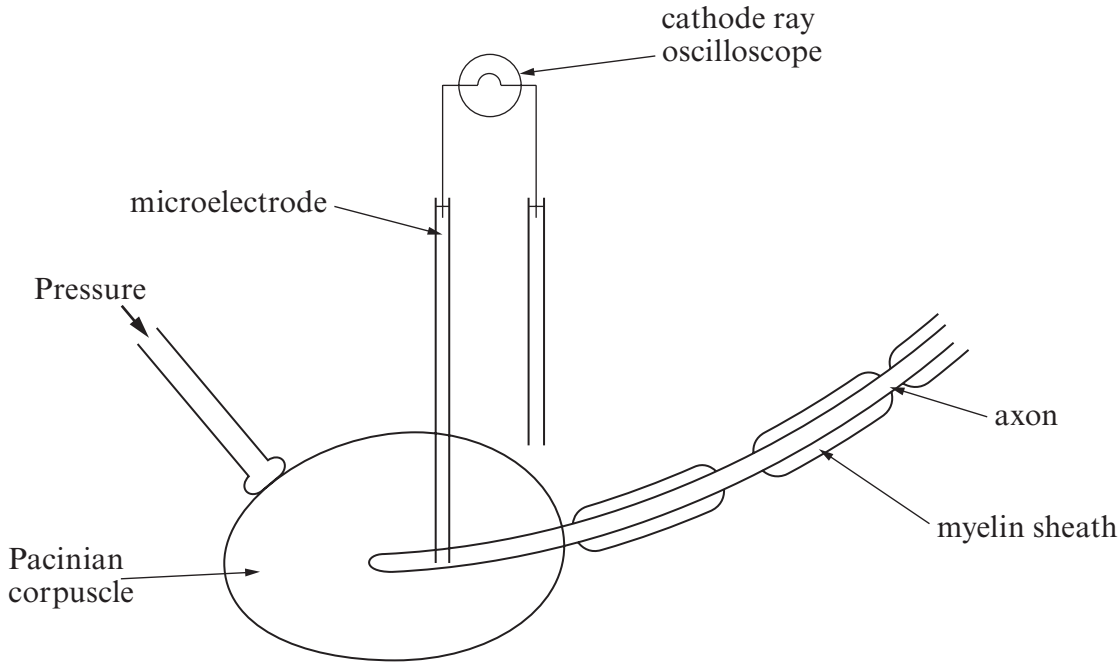




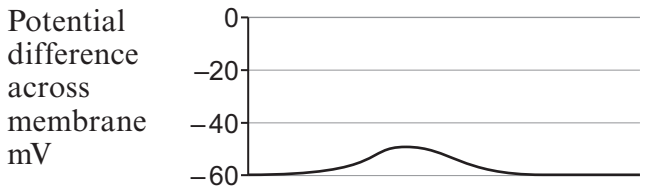
**Turn over.**

Examiner only

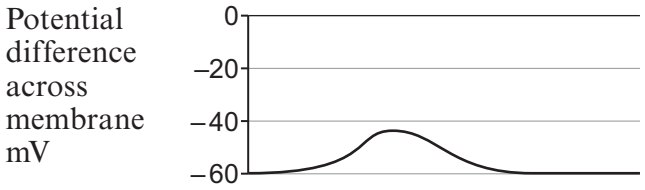
**5.** Pacinian corpuscles are receptors found in the skin and consist of a **single sensory neurone** surrounded by connective tissue. They respond to changes in pressure.
The Pacinian corpuscle was stimulated and the electrical activity across the membrane of the sensory neurone was recorded using a microelectrode as shown.



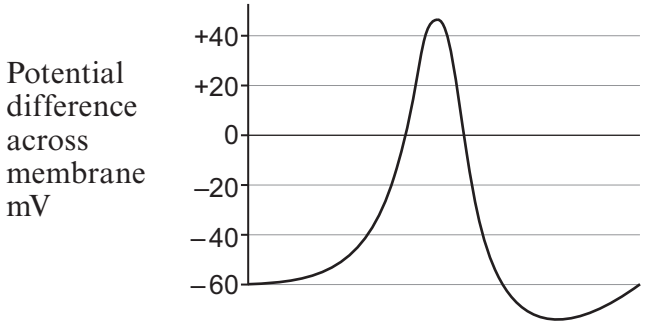

Oscilloscope readings




Light pressure




Medium pressure




Heavy pressure

Examiner only

*(a)* (i) Explain the change in potential difference shown by the microelectrode after light pressure was applied. [3]

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(ii) Explain the change in potential difference across the membrane shown by the microelectrode when heavy pressure was applied. [6]

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**Turn over.**

Examiner only

*(b)* Many chemical substances affect the transmission of the nerve impulse across the synapse.
Suggest **two** ways by which excitatory drugs could change activity at the synapse and **two** ways by which chemicals could inhibit activity at the synapse. [4]

Possible mode of activity of excitatory drugs:

1 .....

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2 .....

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Possible mode of activity of inhibitory chemicals.

1 .....

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2 .....

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**(Total 13 marks)**

Examiner only

**6.** Complete the following using appropriate scientific terms.

The general name given to glands which produce hormones are ..... glands. Hormones are involved in the maintenance of a constant internal environment, this is referred to as ..... . If there is a move away from the norm or set point a corrective procedure takes place which returns it to the norm and this is referred to as ..... .

Osmoreceptors in the ..... of the brain constantly monitor the ..... of the blood.

ADH is a hormone that is produced in specialised nerve cells and it is then stored in the ..... .

If there is a need for the body to conserve water a nerve impulse causes the release of ADH into the ..... which transports it to the target organ.

ADH acts on the cells of the ..... where it attaches to ..... on the membrane of these cells. This causes protein channels to open and water passes through these channels by ..... into the ..... of the medulla and then into the blood. A small volume of concentrated ..... is produced.

**(Total 12 marks)**

Examiner only

**7.** Answer **one** of the following questions.

Any diagrams included in your answers must be fully annotated.

**Either,** *(a)* Describe how the structure of the different regions of the nephron and associated blood supply are adapted to their function. [10]

**Or** *(b)* Write an account outlining the similarities and differences in the ways that mitochondria and chloroplasts generate a proton gradient and synthesise ATP. (Diagrams alone are insufficient). [10]

Examiner only

Examiner only

**(Total 10 marks)**