OCR
RECOGNISING ACHIEVEMENT

ADVANCED GCE

BIOLOGY

F214

Communication, Homeostasis and Energy

F215690111

Candidates answer on the question paper.

OCR supplied materials:
- Insert (inserted)

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

Wednesday 22 June 2011
Morning

Duration: 1 hour

F214

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. Pencil may be used for graphs and diagrams only.
- 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.
- Answer **all** the questions.
- 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.

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Answer **all** the questions.

1 **(a)** The nervous system is made up of a number of different types of neurone, which transmit electrical impulses.

Complete the table below by stating **three** differences in the structure of motor and sensory neurones.

motor neurone	sensory neurone

[3]

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(b) Complete the following passage, using the most appropriate term(s) in each case.

When an impulse is not passing along a neurone, a resting potential of .....mV is established. When the neurone is stimulated, it causes ..... of the cell surface membrane. This will not generate an action potential unless it is large enough to exceed the ....

A neurone will either conduct an action potential or not; this is described as the ..... - ..... - ..... law.

Action potentials all have the same ..... . The only way in which the intensity of a stimulus can be interpreted is by the ..... of the action potential. **[6]**

[Total: 9]

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2 A student carried out an experiment to investigate the effect of light intensity on the rate of photosynthesis in an aquatic plant, using the apparatus shown in Fig. 2.1.

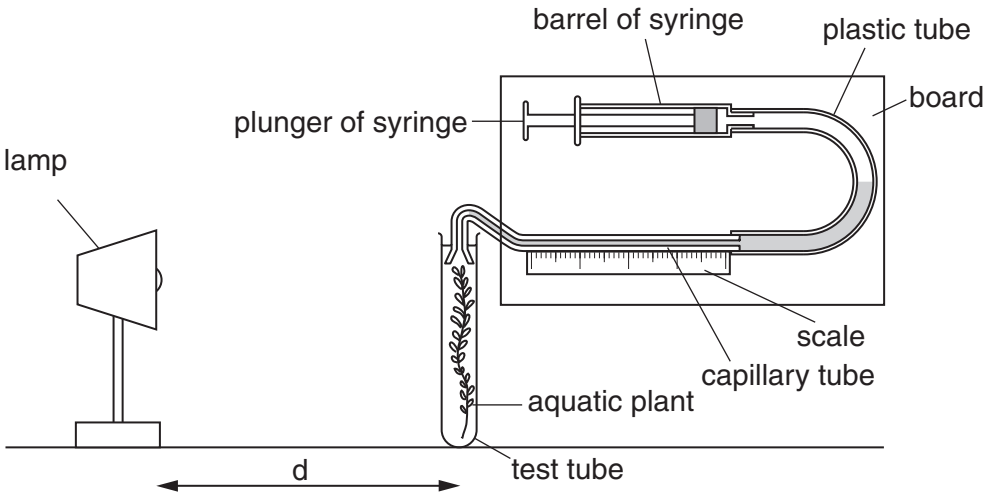


Fig. 2.1

The student decided to measure the rate of photosynthesis by measuring the gas produced over a five minute period. The gas collected in the capillary tube.

After five minutes, the length of the bubble was measured along the scale.

The light intensity was varied by altering the distance (d) between the lamp and the photosynthesising plant.

The student prepared Table 2.1 to calculate the light intensity.

Table 2.1

distance (d) from lamp to plant (cm)	light intensity $\left(\frac{1}{d^2}\right)$
4	0.0625
8	0.0156
12	0.0069
16	0.0039
20	0.0025
24	
60	0.0003

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(a) (i) Calculate the light intensity when the lamp was 24 cm from the plant.

Show your working.

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

(ii) The length of the gas bubble was measured (in mm).

State what additional information would be required to calculate the **volume** of gas produced.

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.....

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

(iii) Suggest how the student supplied the aquatic plant with a source of carbon dioxide.

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

(b) Certain assumptions are made when using the apparatus shown in Fig. 2.1 to measure the rate of photosynthesis.

(i) One of these assumptions is that all of the oxygen produced by the plant during photosynthesis is collected.

Suggest why not all of the oxygen produced by the plant is collected.

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

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(ii) Another assumption is that all of the gas collected is oxygen.

Analysis of the gas collected reveals that it has the following composition:

- oxygen 50%
- nitrogen 44%
- carbon dioxide 6%

Suggest a reason for the presence of nitrogen in the gas collected.

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

(iii) Comment on the percentage of carbon dioxide present in the gas collected and give reasons for this figure.

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

(c) Some aquatic photosynthetic organisms, for example seaweeds, contain pigments such as fucoxanthin and phycoerythrin, in addition to chlorophyll. These pigments give seaweeds a brown or red colour and are produced in larger quantities in those seaweeds that live in deeper water.

Suggest why the presence of these pigments is an advantage to seaweeds that live in deeper water.

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

[Total: 12]

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QUESTION 3 STARTS ON PAGE 8

PLEASE DO NOT WRITE ON THIS PAGE

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3 Fatigue is a symptom of some medical conditions. One feature of fatigue is extreme tiredness, due to a lack of energy.

Medical conditions that have fatigue as a characteristic symptom include Type 2 diabetes, certain heart conditions, chronic fatigue syndrome (CFS) and emphysema.

(a) Explain how emphysema could result in fatigue.

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

(b) In Type 2 diabetes, the target cells do not respond correctly to the insulin produced when there is an increase in blood glucose concentration.

Suggest why fatigue may occur in a person with Type 2 diabetes who is **not** taking medication.

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

(c) Certain heart conditions result in a weak and irregular heart beat.

Suggest how a weak and irregular heart beat could result in fatigue.

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

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(d) Chronic fatigue syndrome (CFS) is a condition in which symptoms vary from individual to individual.

It is thought that a number of different malfunctioning processes can contribute to this condition in an individual.

CFS can affect every system in the body and is identified by symptoms that include fatigue, muscle weakness and aching muscles.

(i) It has been suggested that, in the cells of people with CFS, pyruvate may not be transferred into the mitochondria efficiently.

Outline the consequences of an inefficient transfer of pyruvate into mitochondria and link this to the symptoms of CFS stated above.

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

(ii) Some people with CFS overproduce T lymphocytes and associated cytokines. Despite this, the specific immune response is poor in these people, resulting in an increased susceptibility to infection.

Suggest a reason for the poor specific immune response in people with CFS.

.....

.....

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

[Total: 10]

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4 **(a)** The pancreas is an unusual gland as it is both an endocrine and an exocrine gland.

Fig. 4.1, **on the insert**, shows a group of cells in the pancreas.

(i) State the name given to the group of cells labelled **X**.

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

(ii) Describe the different ways in which the pancreas acts as both an endocrine and an exocrine gland.



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

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

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(b) One particular type of cell in the pancreas is responsible for secreting insulin. The various events involved in the secretion of insulin are listed below.

A	Glucose is phosphorylated and metabolised to produce ATP
B	Potassium channels open, allowing potassium ions to diffuse out of the cell
C	The change in voltage across the membrane causes calcium channels to open
D	Glucose enters the cell
E	The movement of ions results in a potential difference across the cell surface membrane of –70 mV
F	Calcium ions diffuse into the cell
G	The presence of extra ATP causes the potassium channels to close
H	The membrane potential changes to –30 mV
J	The calcium ions cause the vesicles to fuse with the membrane and release insulin

Complete the following list by placing the events in the correct order.

B ..... **E** .... **J** ..... **[4]**

(c) **(i)** State **two** advantages of treating **Type 1** diabetes by using insulin that has been produced by genetically modified bacteria rather than insulin that has been extracted from pigs.

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

(ii) A potential treatment for Type 1 diabetes is the use of stem cells.

State an advantage of this form of treatment compared to treatment using insulin.

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

[Total: 13]

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5 **(a)** Fig. 5.1 is a drawing representing a vertical section through a mammalian kidney.

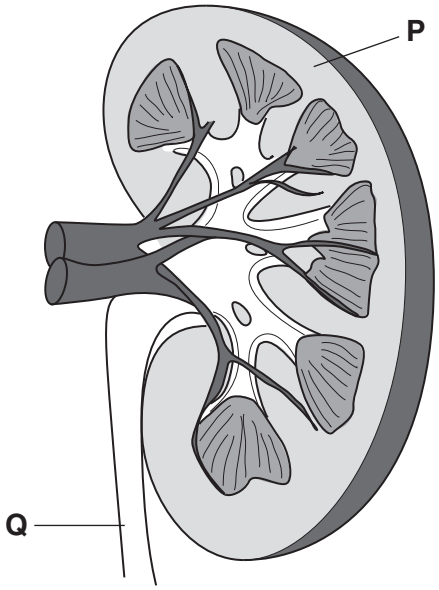


Fig. 5.1

Name the region **P** and the structure **Q**.

P .....

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

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(b) (i) Each kidney contains approximately one million nephrons. Each section of a kidney nephron is adapted to perform its function effectively.

Describe the features of the **glomerulus** and **Bowman's capsule** that allow them to perform their function effectively.

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

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

(ii) Nephritis is a condition in which the tissue of the glomerulus and proximal convoluted tubule becomes inflamed and damaged.

Suggest **two** differences in the composition of the urine of a person with nephritis when compared to the urine of a person with healthy kidneys.

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

QUESTION 5(c) STARTS ON PAGE 14

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(c) Caffeine is a mild diuretic. Caffeine prevents the introduction of additional aquaporins into the wall of the collecting duct of the nephron and therefore additional water is not removed from the urine.

Aquaporins are channels in the cell surface membrane that allow water molecules to pass through.

Fig. 5.2 represents an aquaporin.

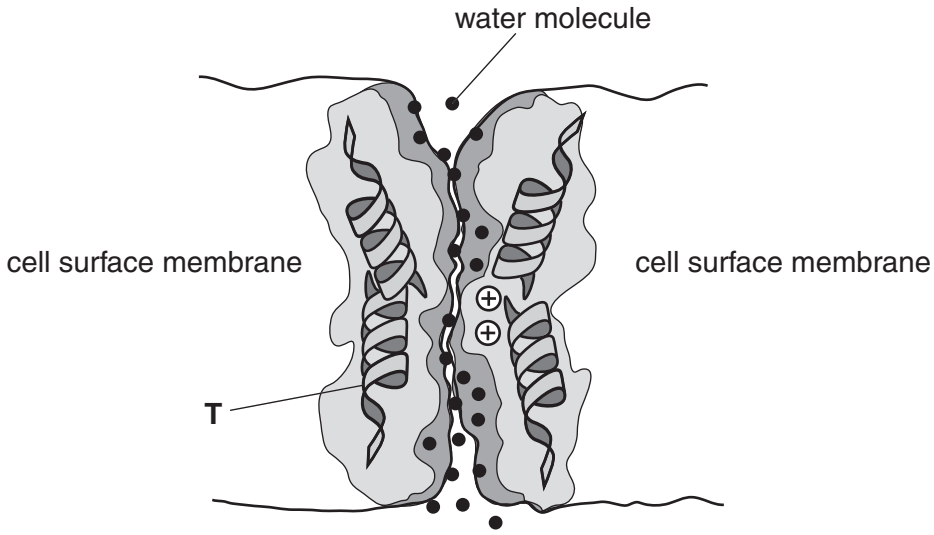


Fig. 5.2

(i) Identify the type of molecule labelled **T**.

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

(ii) The aquaporin allows water to travel from the collecting duct into the surrounding tissues but prevents the passage of ions such as sodium ions and potassium ions.

With reference to Fig.5.2, suggest **two** ways in which the structure of this aquaporin prevents the passage of ions.

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

[Total: 11]

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6 **(a)** State the **precise** location where each of the following biochemical processes take place:

(i) the production of glucocorticoids in the body

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

(ii) chemiosmosis within an animal cell.

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

(b) Name the mechanism or process that is being described in each of the following statements.

(i) *A person breathes in air that is high in carbon dioxide. This produces a high concentration of carbon dioxide in the blood. This increased concentration is detected by receptors, resulting in the person breathing more rapidly. In turn, more carbon dioxide enters the blood causing the breathing to be even more rapid.*

The mechanism being described is:

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

(ii) *Light strikes a molecule of chlorophyll a in photosystem I, providing it with enough energy so that it loses an electron. This electron is passed along a series of electron carriers and then returns to a molecule of chlorophyll a in photosystem I. As the electron loses energy, ATP is formed.*

The process being described is:

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

(iii) *As an animal needs to respond to changes in the external and internal environment, communication between cells takes place within the body to coordinate the activities of different organs.*

The mechanism being described is:

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

[Total: 5]

END OF QUESTION PAPER

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ADDITIONAL PAGE

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

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