Edexcel GCE

Biology

Biology (Human)

Advanced

Unit Test 4C Core and Option
Human Health and Fitness

Monday 16 June 2003 – Morning

Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Ruler	Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, the paper reference, your signature, surname and initials. The paper reference is shown above.
Check that you have the booklet for the correct unit and option.
Answer ALL NINE questions in the spaces provided in this booklet.
Your answer to Question 5 should be written on the lined pages. If you need to use additional answer sheets, attach them loosely but securely inside this booklet.
Show all the steps in any calculations and state the units. Calculators may be used.
Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for the individual questions and parts of questions are shown in round brackets: e.g. **(2)**.
The total mark for this question paper is 70.

Advice to Candidates

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.

N 1 5 2 0 1 A

Turn over

Edexcel
Success through qualifications

1. Explain the meaning of each of the following terms:

(a) Metabolic pathway

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(2)

(b) Homeostasis

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(2)

(Total 4 marks)

Q1

2. The diagram below shows the neurones involved in a spinal reflex arc.

Receptor

Portion of spinal cord

Sensory neurone

Neurone X

Effector (motor) neurone

Synaptic cleft
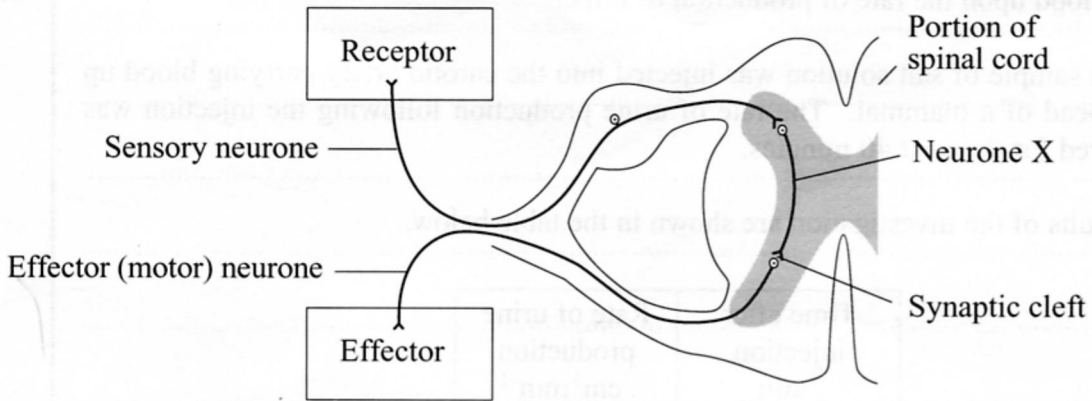
Effector

(a) Name neurone X.

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(1)

(b) Explain the significance of this neurone in a reflex arc.

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(2)

(c) Describe how an action potential is produced in the effector neurone, following the diffusion of transmitter substance across the synaptic cleft.

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(4)

(Total 7 marks)

Q2

3. An investigation was carried out to assess the effect of changes in the salt concentration of the blood upon the rate of production of urine.

A small sample of salt solution was injected into the carotid artery carrying blood up to the head of a mammal. The rate of urine production following the injection was monitored for the next 40 minutes.

The results of the investigation are shown in the table below.

Time after injection /min	Rate of urine production /cm³ min⁻¹
0	7.0
5	1.1
10	0.6
15	1.0
20	1.5
25	2.2
30	2.4
35	3.1
40	4.2

(a) Describe the effect of the injection of salt solution on the rate of urine production.

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(3)

(b) Explain why the injection had this effect.

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(4)

(c) The investigation was repeated by injecting a small sample of the salt solution into
the jugular vein carrying blood back from the head of the mammal. No change in
the rate of urine production was detected. Suggest a reason for this.

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(2)

(Total 9 marks)

Q3

4. In an investigation, groups of cells from the islets of Langerhans were separated from some fresh pancreatic tissue. Each group of cells was kept in a bathing solution similar to blood plasma. Each solution contained a different concentration of glucose.

The quantity of insulin released from the cells after 1 minute was measured. The results of this investigation are shown in the graph below.
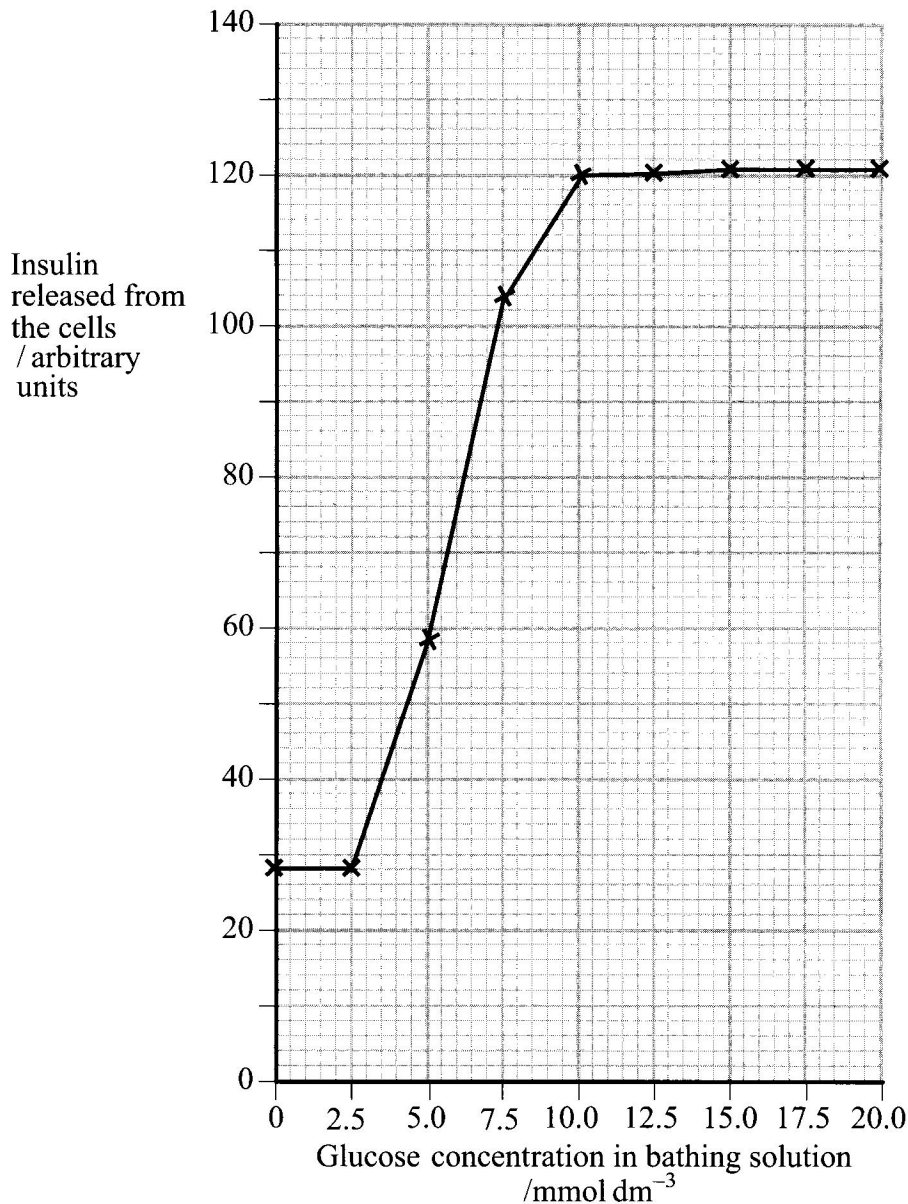
(a) Describe the effect on the release of insulin from the cells when the glucose concentration is increased above 2.5 mmol dm^{-3}.

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(2)

(b) Suggest what these results indicate about the way in which changes in blood glucose levels are detected.

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(2)

(c) Suggest why there is no change in the release of insulin from the cells when the glucose concentration is below 2.5 mmol dm^{-3}.

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(1)

(d) The normal concentration of glucose in the blood is about 5.0 mmol dm^{-3}. With reference to the graph, and to your own knowledge of how insulin functions, explain how a blood glucose concentration of 7.5 mmol dm^{-3} would be brought down to normal in the body of a mammal.

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(3)

(e) Name two hormones, other than insulin, that affect blood glucose levels in mammals.

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(2)

Q4

(Total 10 marks)

5. Give an account of the anaerobic respiration of glucose by yeast.

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(Total 10 marks)

Q5

6. Distinguish between each of the following pairs of terms.

(a) The sympathetic nervous system and the parasympathetic nervous system, in relation to the control of the cardiac cycle

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(3)

(b) Arthritis and osteoporosis

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(3)

(Total 6 marks)

Q6

The table shows the heart rate and stroke volume for a 19 year old male athlete at rest.

Heart rate /beats per minute	Stroke volume /cm^3
72	75

(a) Calculate the cardiac output in dm^3 per minute for the athlete. Show your working.

Answer .... dm^3 min^{-1}

(2)

(b) State what you would expect to happen to the resting heart rate and stroke volume of the athlete after a 6-month period of aerobic training.

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(2)

(c) Explain why the changes you have given in part (b) would be beneficial to the performance of the athlete.

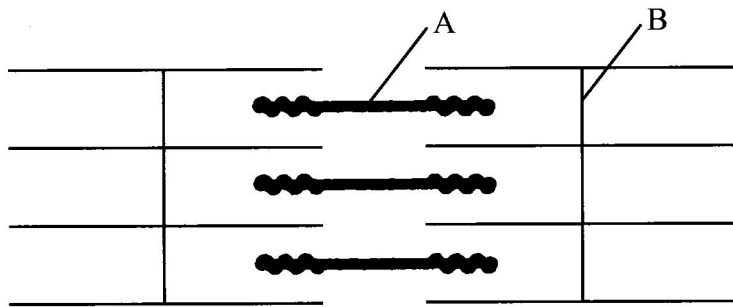..

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(3)

Q7

(Total 7 marks)

8. The diagram below shows part of a myofibril in a relaxed muscle.

(a) Name the parts labelled A and B.

A ....

B ....

(2)

(b) In the space below, make a drawing to show this part of the myofibril when it is fully contracted.

(3)

(c) Describe the role of calcium ions in muscle contraction.

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(2)

(Total 7 marks)

Q8

9. One of the parameters used to assess an athlete's fitness is VO_2 max.

A person's VO_2 max is the maximum volume of oxygen that can be consumed per kilogram of body mass per minute.

Training programmes can be designed to increase the VO_2 max of an athlete.

The rate of oxygen consumption of a 25 year old athlete was measured as she carried out different activities. These rates were then calculated as a percentage of her VO_2 max. Her pulse rate was also measured, as shown in the table below.

Activity	% of VO_2 max	Actual pulse rate (beats per minute)
Jogging	35	105
Long slow running	50	115
Steady running	60	139
Slow marathon pace	70	153
Fast marathon pace	80	168
Running in 800 m race	100	191

(a) Suggest why an increase in VO_2 max should enable better performance by an athlete.

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(2)

(b) In order to estimate VO_2 max, measurements of the tidal volume are taken. Explain what is meant by **tidal volume**.

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(2)

(c) With reference to the table, suggest an activity that may be harmful if used for prolonged training sessions. Explain your answer.

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(3)

(d) Describe how a programme of aerobic training can improve transport of oxygen to the muscles.

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(3)

Q9

(Total 10 marks)

TOTAL FOR PAPER: 70 MARKS

END