OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY 2805/05

Mammalian Physiology and Behaviour

Monday **31 JANUARY 2005** Afternoon 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator
Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Read the questions carefully before starting your answer.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	14	
2	14	
3	16	
4	20	
5	12	
6	14	
TOTAL	90	

This question paper consists of 21 printed pages and 3 blank pages.

Registered Charity Number: 1066969
[Turn over

Answer **all** the questions.

1 Fig. 1.1 shows the skeleton of a kangaroo. Fig. 1.2 shows the skull and teeth of a kangaroo.

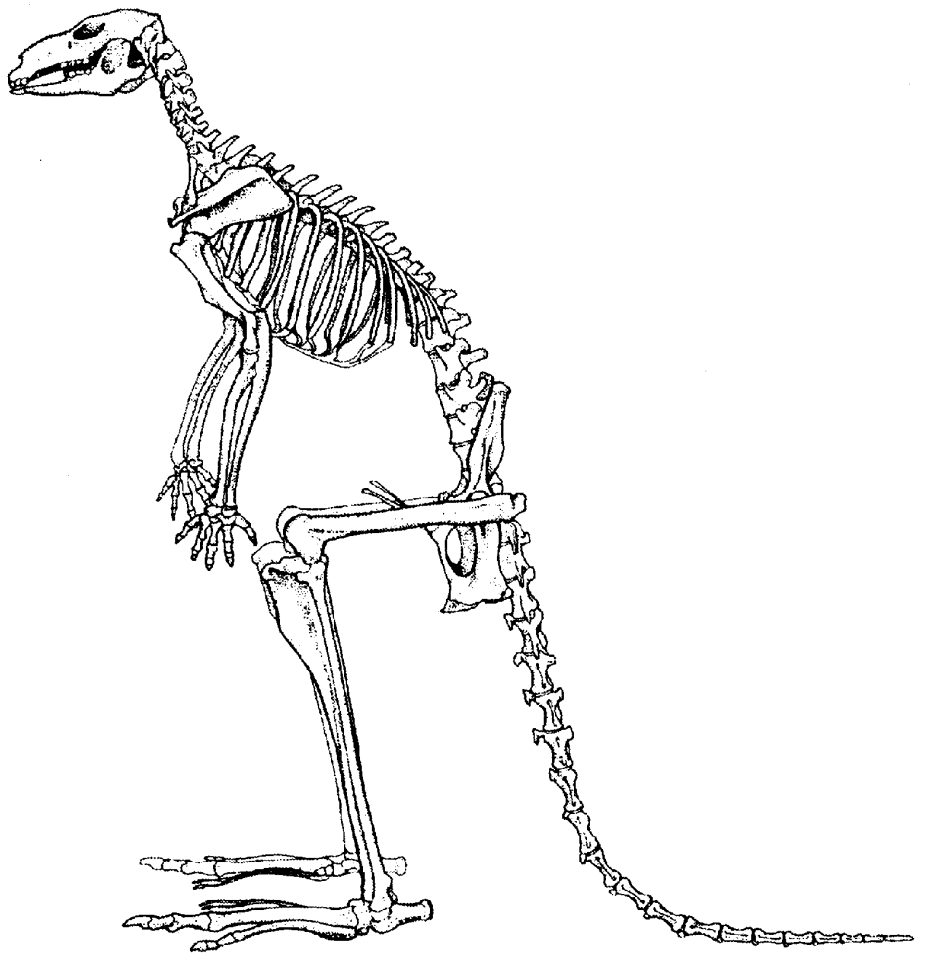

Fig. 1.1

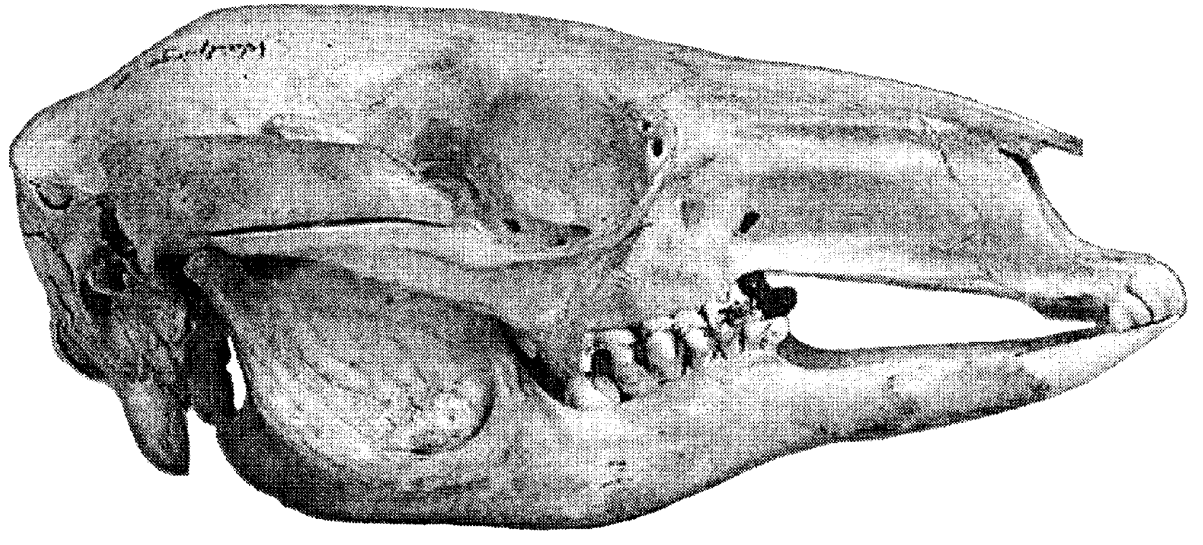

Fig. 1.2

(a) Use the letters **W**, **X**, **Y** and **Z** to label the structures on Fig. 1.1 as follows:

W a tarsal

X the scapula

Y a thoracic vertebra

Z a joint, which allows movement in **more** than one plane. [4]

(b) **(i)** Using **only** features visible in Fig. 1.1, explain why it is likely that kangaroos and humans evolved from a single common ancestor.

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(ii) Using **only** features visible in Fig. 1.2, explain why the kangaroo is a herbivore.

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In an investigation, a kangaroo walked at different speeds on a treadmill. The number of strides per minute and the rate of oxygen consumption were measured. Fig. 1.3 shows the results of this investigation.

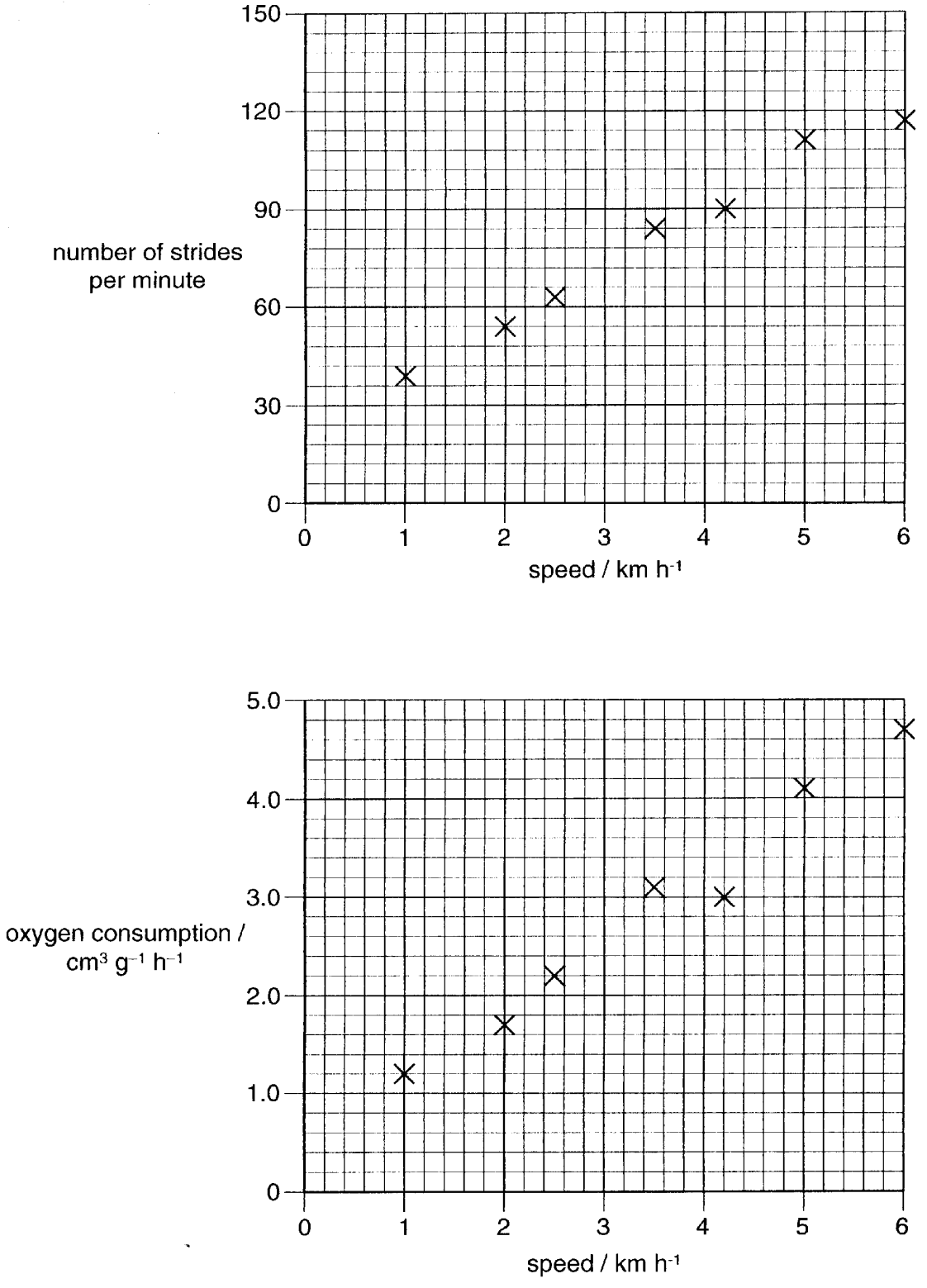

Fig. 1.3

(c) State **and** explain the relationship between the speed of the kangaroo on the treadmill and its oxygen consumption.

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[Total: 14]

2 Reflexes are automatic, stereotyped responses to stimuli that can also be conditioned.

(a) Explain the meaning of the terms

(i) *automatic*;

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.....[1]

(ii) *stereotyped*;

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.....[1]

(iii) *conditioned*.

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.....[1]

(b) Describe **one** example of a reflex response to a **named** stimulus.

stimulus

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response

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.....[1]

Fig. 2.1 shows a piece of apparatus called a puzzle box, used by Edward Thorndike to investigate operant conditioning in animals.

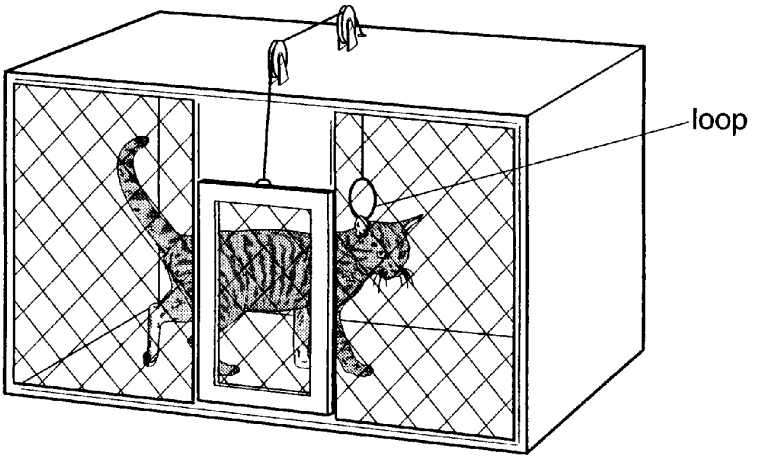

Fig. 2.1

During an experimental trial, a cat was placed inside the puzzle box. If the cat pulled the loop with its mouth or a paw, the door opened and it could escape. The time taken for the cat to escape was recorded. The experiment was then repeated several times with the same cat.

Fig. 2.2 shows a graph of the time taken for the cat to escape from the puzzle box during repeated trials.

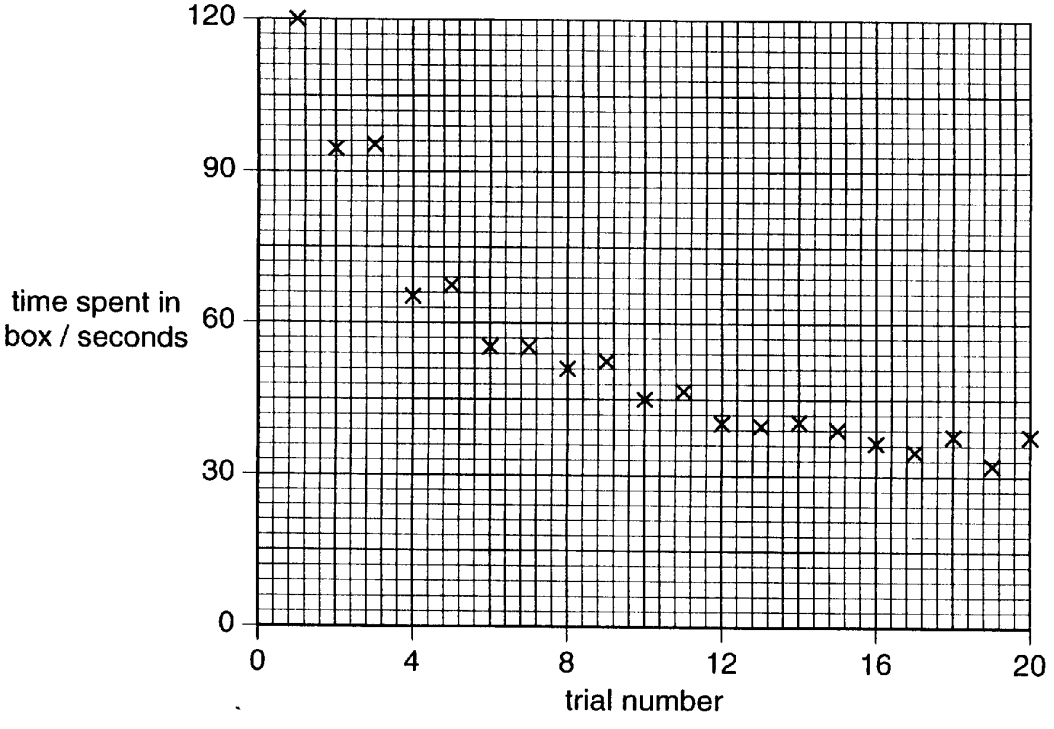

Fig. 2.2

(c) In this question, one mark is available for the quality of spelling, punctuation and grammar.

Describe **and** explain the data shown in Fig. 2.2.

Include in your answer a reason why the type of learning shown by the cat is operant conditioning.

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Quality of Written Communication [1]

(d) State **two** differences between operant conditioning and classical conditioning.

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2 .....

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[Total: 14]

3 **(a)** Complete the following passage.

Mechanical digestion of food involves chewing by teeth in the mouth and churning in the stomach. Both these actions increase the .... of food. Chemical digestion is performed by enzymes. Each enzyme is specific to a particular substrate, for example starch is broken down by ..... and maltose is broken down by maltase.

However, in all these reactions as well as the enzyme, a molecule of water is needed to break each chemical bond, so all digestion reactions are examples of ..... reactions.

Some enzymes are released in their active form, others are released in their inactive form. The inactive form of trypsin is ..... and is secreted from ..... cells in the pancreas.

Other enzymes remain embedded in the cell surface membrane of cells, which produce them. Examples include ..... and ....., which are found in the membranes of epithelial cells in the ileum. [7]

[Turn over

(b) Outline the role of the hormones, secretin and cholecystokinin (CCK), in the control of digestive secretions.

secretin .....

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cholecystokinin (CCK) .....

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.....[4]

(c) Coeliac disease affects an increasing number of people. A major feature of coeliac disease is destruction of villi in the small intestine.

Outline the likely consequences of the loss of villi, for:

- the small intestine;
- the general health of people with coeliac disease.

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[Total: 16]

4 The whole of the lens of the eye is made up of cells. These cells contain soluble proteins called crystallins. These proteins help maintain the shape of the lens.

As a person ages, crystallins become insoluble and may clump together to form a cataract. A cataract reduces the amount of light passing through the lens. If the cataract is large enough, a person becomes blind in that eye.

Cataracts are simple to remove by surgery. Drops of a drug, which affects the autonomic nervous system, are administered to produce dilation (widening) of the pupil. A tiny probe can then be inserted into the eye through a small cut in the cornea. The probe emits ultrasound waves, which break up the lens so that it can be removed by suction through the probe. Alternatively, after dilation of the pupil, a larger cut is made in the cornea and the lens is removed intact.

(a) The eye drops affect the activity of the autonomic nervous system to produce dilation of the pupil.

Explain how this may occur.

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(b) Suggest why removing the lens by ultrasound is less likely to cause complications for the patient than surgical removal of the intact lens.

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(c) Although most cataracts appear to be caused by ageing, a small number are due to the inheritance of a mutated gene, which codes for the production of an abnormal form of a crystallin protein.

Explain how a mutated gene can produce abnormal crystallin protein.

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(d) In this question, one mark is available for the quality of use and organisation of scientific terms.

Macula degeneration and retinitis pigmentosa are two degenerative diseases that affect the retina. Table 4.1 shows some details of these diseases.

Table 4.1

	macula degeneration	retinitis pigmentosa
part of the retina affected	approximately the centre of the retina, surrounding and including the fovea	the outer (peripheral) regions of the retina
symptoms	• difficulty in reading • loss of central vision	• difficulty seeing in dim light • loss of peripheral vision
signs	• cell death and breakdown • formation of yellow deposits within the retina	• cell death and breakdown • formation of dark deposits within the retina

Explain the symptoms and signs of:

macula degeneration

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retinitis pigmentosa

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Quality of Written Communication [1]

(e) A major factor in the onset of macula degeneration is atherosclerosis of the arteries supplying blood to the retina.

Describe the advice that doctors might give to people showing early signs of macula degeneration.

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.....[3]

[Total: 20]

5 The liver plays an important role in carbohydrate metabolism. The balance between the processes of glycogenesis and glycogenolysis helps to regulate the concentration of glucose in blood plasma. Fig. 5.1 shows some of the stages of these processes.

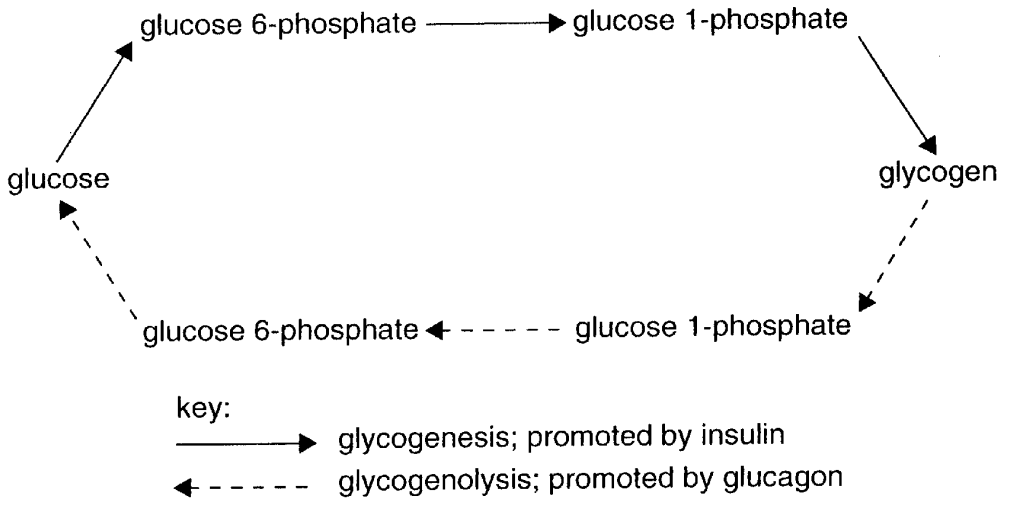

Fig. 5.1

(a) (i) Name **one** other hormone that promotes **glycogenolysis**.

.....[1]

(ii) Explain why glycogen is suitable for energy storage in cells.

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The last step in **glycogenesis** is catalysed by the enzyme glycogen synthetase. The first step in **glycogenolysis** is catalysed by the enzyme glycogen phosphorylase.

Glucose molecules have direct effects on glycogen synthetase and on glycogen phosphorylase. These effects do **not** require the presence of insulin and glucagon.

Table 5.1 shows the rate of activity of glycogen synthetase and glycogen phosphorylase inside liver cells, during exposure of the cells to a concentrated solution of glucose.

Table 5.1

time after addition of glucose solution / s	rate of activity of glycogen synthetase / arbitrary units	rate of activity of glycogen phosphorylase / arbitrary units
0	28	410
30	28	280
60	32	140
90	49	65
120	94	42
150	136	40
180	189	40
210	272	40

(b) Explain how a high concentration of glucose causes the storage of glycogen in liver cells. You will gain credit if you use the data in Table 5.1 in your answer.

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(c) After a prolonged period of fasting, glycogen levels in the liver are depleted. However, the liver can still produce glucose by the process of **gluconeogenesis**.

Describe **one** way in which this is done.

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[Total: 12]

6 **(a)** The cerebellum and medulla oblongata are both parts of the hindbrain. Outline the functions of these two parts of the brain.

cerebellum

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medulla oblongata

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.....[2]

(b) Alzheimer's disease is characterised by several changes in the cerebrum, including 'tangles' inside neurones and 'plaques' between neurones.

State what causes

(i) tangles; .....

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(ii) plaques. .....

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.....[2]

Another change in the cerebrum of a person with Alzheimer's disease is a decrease in acetylcholine released by neurones that form memory circuits.

During a clinical trial, people with Alzheimer's disease were treated with a drug that inhibited the enzyme acetylcholinesterase. This improved their short-term memory.

(c) Suggest how the drug may inhibit acetylcholinesterase.

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(d) Suggest how the drug improves short-term memory.

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(e) State **three** precautions that should be taken when designing such clinical trials, to ensure that any effects are due to the drugs being tested.

1 .....

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2 .....

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3 .....

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[Total: 14]

END OF QUESTION PAPER