

**ADVANCED GCE
BIOLOGY**

Mammalian Physiology and Behaviour

WEDNESDAY 18 JUNE 2008

2805/05

Afternoon

Time: 1 hour 30 minutes

Candidates answer on the question paper.

Additional materials: Electronic calculator
Ruler (cm/mm)



Candidate
Forename

Candidate
Surname

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Do **not** write in the bar codes.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is 90.
- 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	11	
2	18	
3	19	
4	14	
5	16	
6	12	
TOTAL	90	

This document consists of **20** printed pages and an insert.

Answer **all** the questions.

- 1 (a) Fig. 1.1 shows a fennec fox, *Vulpes zerda*, a carnivore that lives in desert regions. These mammals live in holes in the ground and generally only emerge at dusk to feed. Their diet consists mainly of rodents, lizards and insects.



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Fig. 1.1

- (i) With reference to Fig. 1.1, suggest how the fennec fox is adapted to locate its prey.

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- (ii) Suggest how the external ears of the fennec fox are an adaptation for temperature regulation.

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(b) Inherited deafness occurs in many breeds of dog.

- 8% of all Dalmatian dogs are deaf in both ears.
- This condition is **not** sex-linked.

Suggest how adult Dalmatian dogs, who can hear, may produce deaf offspring.

You may use a genetic diagram to help you with your answer.

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[4]

(c) Many airline passengers have problems with their hearing due to changes in air pressure inside the aeroplane. Symptoms may include temporary deafness and intense pain.

Suggest how a passenger may relieve these symptoms during a flight.

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..... [2]

[Total: 11]

- 2 The dental formula shows the teeth in the upper and lower jaws of one side of a mammal's skull.

The dental formula of an adult human is shown as

$$\text{I} \frac{2}{2} \text{C} \frac{1}{1} \text{PM} + \text{M} \frac{5}{5} = 16$$

Therefore, total number of teeth = 32.

- (a) Fig. 2.1, **on the insert**, shows the upper and lower jaw of a ruminant.

Complete the dental formula of this ruminant in the space below.

$$\text{I} \quad \text{C} \quad \text{PM} + \text{M} \quad =$$

Therefore, the total number of teeth =

[3]

(b) The llama, *Llama glama*, is a ruminant that lives in South America.

Fig. 2.2 shows the time a group of llamas spent ruminating and grazing.

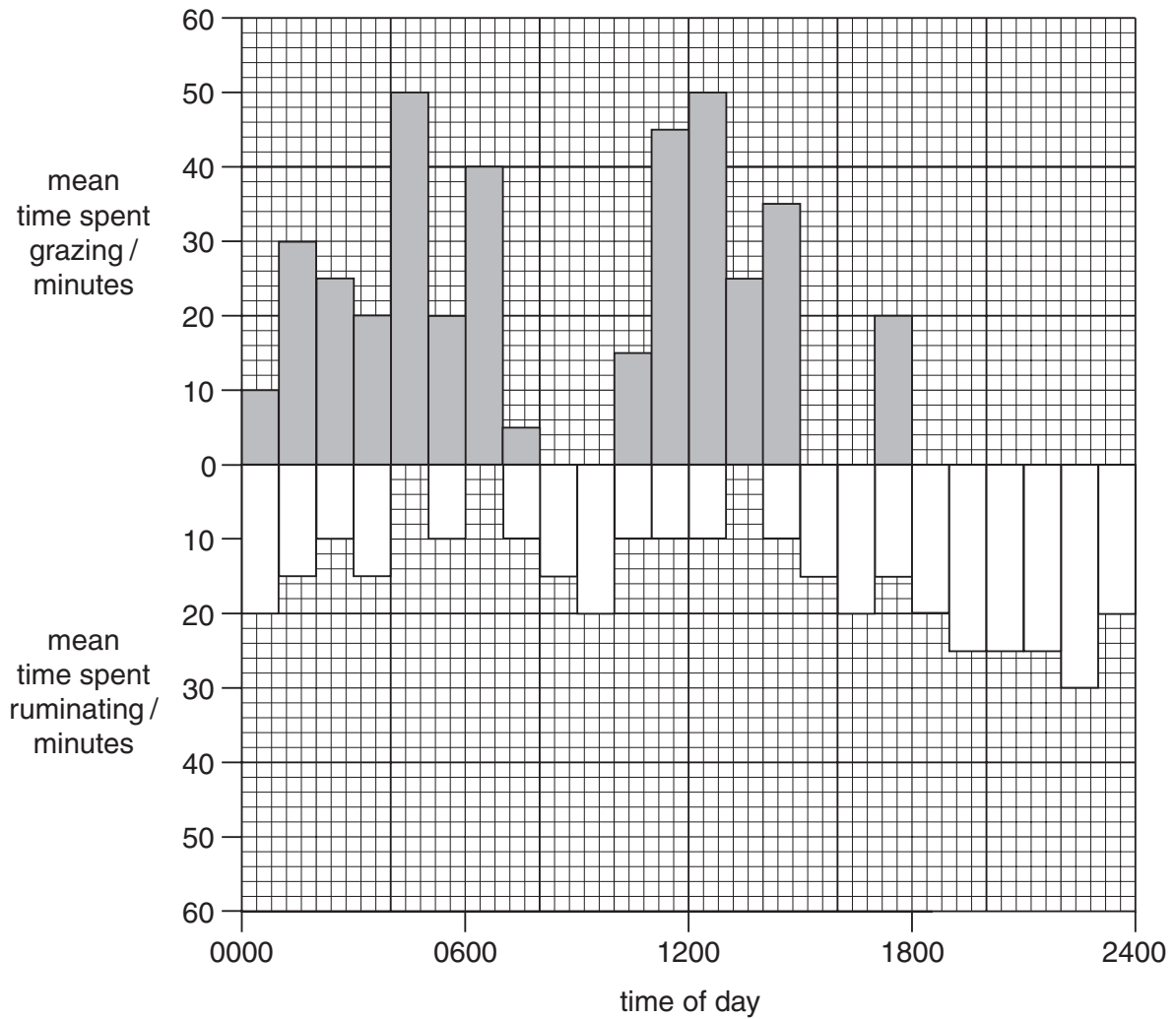


Fig. 2.2

(i) Calculate the percentage of time spent ruminating between 1800 and 2400 hours.

Show your working and give your answer **to the nearest whole number**.

Answer = % [2]

(ii) Explain why the roots of the chewing teeth of a llama remain open, as compared to the chewing teeth of a carnivore where the roots are closed.

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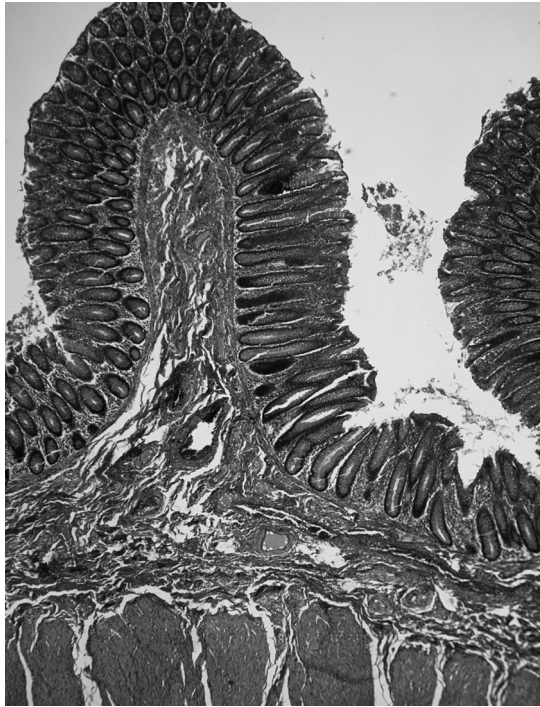
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(c) Fig. 2.3 shows a section through part of the wall of the colon of a mammal.



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Fig. 2.3

- (i) On Fig. 2.3, use a label line and the appropriate letter to identify each of these structures.

S – smooth muscle

M – mucosa

[2]

- (ii) Explain how the folding, shown in Fig. 2.3, helps the colon to carry out its functions.

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- (d) Ulcerative colitis is a disease of the colon. The lining of the colon becomes inflamed, leading to the development of ulcers.

This disease is thought to be caused by an immune response to naturally-occurring bacteria in the colon.

Inflamed epithelial cells secrete large amounts of ions into the lumen of the colon. As a result, a lot of water moves from these cells into the lumen causing diarrhoea, as most of this water is not reabsorbed.

- (i) Suggest how these bacteria may **stimulate** an immune response.

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- (ii) Explain why the secretion of ions into the lumen results in the movement of water into the lumen.

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- (e) Loperamide hydrochloride is a short-term treatment for diarrhoea. It acts by relaxing smooth muscle in the intestinal wall.

Suggest how the action of loperamide hydrochloride may reduce diarrhoea.

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..... [2]

[Total: 18]

- 3 Antlers of red deer stags, *Cervus elaphus*, start to re-grow in early summer as bony projections from the skull. They grow at extremely fast rates using calcium from other parts of the body, primarily the ribcage. Much of the calcium is reabsorbed into the body before the antlers are shed in the winter.

- (a) (i) Explain how bone cells in the ribcage **and** in the bony projections of the skull are used to enable the rapid growth of antlers.

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- (ii) Describe briefly the roles of calcium in bone.

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Osteoarthritis is a degenerative disease of the joints causing pain and a reduction in flexibility. This is partly due to a decrease in the distance between cartilages in a joint. The pain can be relieved by non-steroidal anti-inflammatory drugs (NSAIDs) such as aspirin. A dietary supplement, glucosamine, has been found to provide relief in some people with arthritis.

The structure of glucosamine is shown in Fig. 3.1.

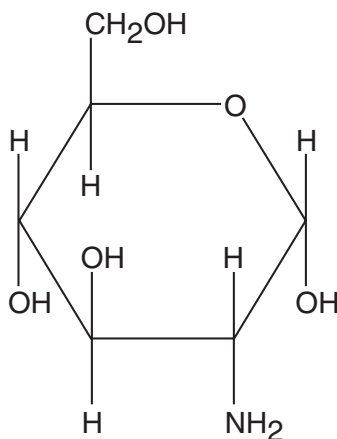


Fig. 3.1

(b) Describe how the structure of glucosamine differs from the structure of alpha glucose.

.....
 [1]

- (c) A clinical trial was carried out on the effectiveness of glucosamine compared to NSAIDs in three groups of people with osteoarthritis.

The three groups received treatments as follows:

- group **A** was given glucosamine
- group **B** was given an NSAID
- group **C** was given a placebo.

A placebo is an inactive substance given instead of a trial drug.

The people were not aware which treatment they were receiving.

- The trial lasted for three years.
- The people were asked to describe any changes in the pain they felt during the trial.
- The distances between the cartilages in the knee joints of each person were measured at the start and end of the trial.

The results are shown in Table 3.1.

Table 3.1

group	treatment	pain perception	mean decrease in distance between knee joint cartilages / mm
A	glucosamine	moderate decrease	0.06
B	NSAID	moderate decrease	0.28
C	placebo	slight decrease	0.31

Describe **and** explain the results shown in Table 3.1.

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..... [4]

[7]

[Turn over

- 4 A reflex action can be used to determine whether a driver has a blood alcohol concentration above the legal limit. This is called the pupil response test. A bright light is shone into one eye and the speed with which the pupil reduces in diameter can be measured.

(a) Describe how the reduction in diameter of the pupil in bright light is brought about.

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..... [3]

(b) The legal limit for blood alcohol concentration in the UK is 0.08%.

An investigation was carried out to find out how accurate the pupil response test was.

- 20 volunteers consumed sufficient quantities of alcohol to produce blood alcohol concentrations over 0.10%.
- The pupil response test was carried out on each volunteer at hourly intervals.
- Blood tests were also taken to check the accuracy of the pupil response test.

Fig. 4.1 shows the percentage of volunteers correctly identified as being over the legal limit using the pupil response test.

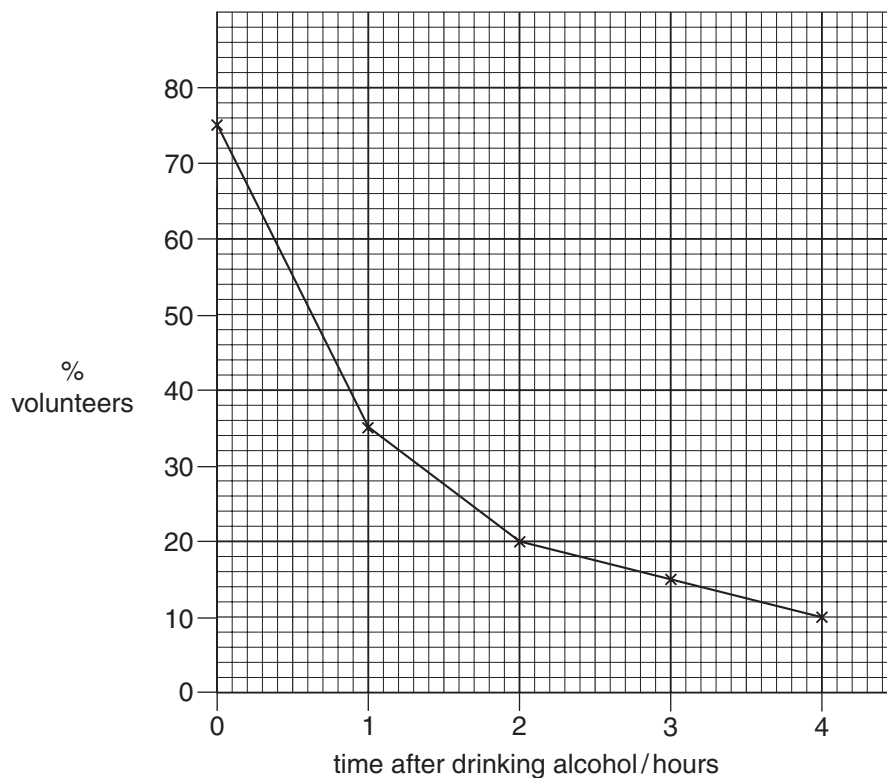


Fig. 4.1

- (i) With reference to Fig. 4.1, describe the relationship between the percentage of correct identifications of people over the legal limit, **determined by the pupil response test**, and the time after drinking alcohol.

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- (ii) Suggest the advantages of using the pupil response test instead of the blood alcohol test.

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(c) Describe the process of detoxification of alcohol by hepatocytes.

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(d) Explain why the excessive consumption of alcohol can lead to the condition known as fatty liver.

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[Total: 14]

- 5 Fig. 5.1 is a computer assisted tomography (CAT) scan of part of a human vertebral column.

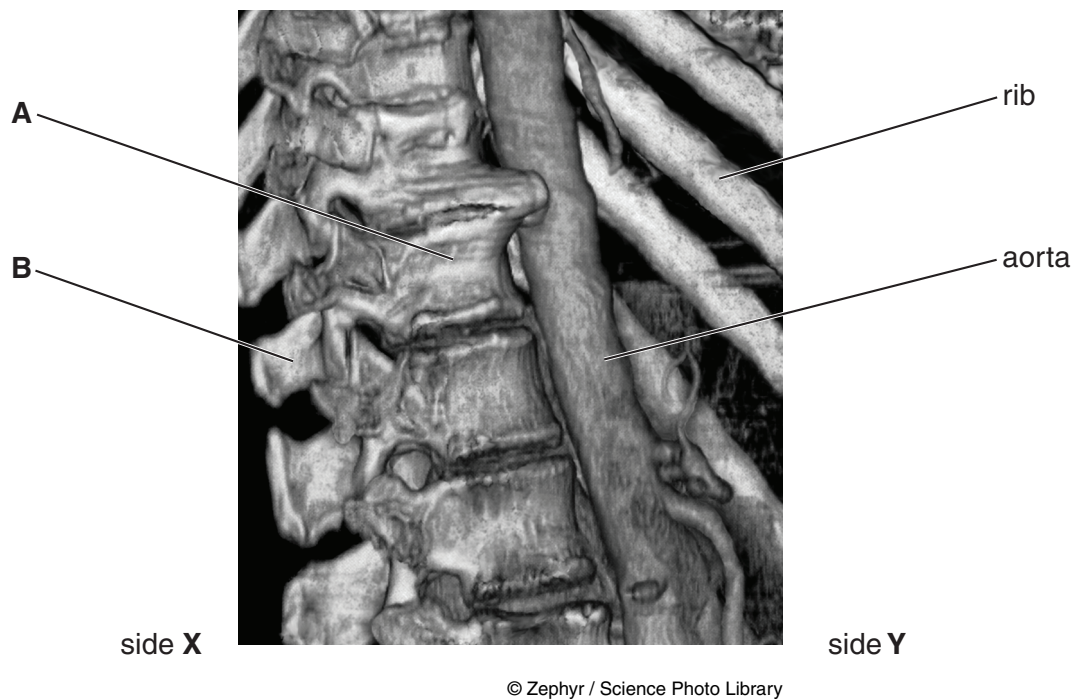


Fig. 5.1

- (a) (i) Name the parts of the vertebra labelled **A** and **B**.

A

B

[2]

- (ii) State, giving a reason, which side, **X** or **Y**, is the dorsal side of the image.

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..... [1]

- (b) Describe **two** roles played by the intervertebral discs in the vertebral column.

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..... [8]

Quality of Written Communication [1]

[Total: 16]

Fig. 6.1 shows the times when the rat pressed the lever.

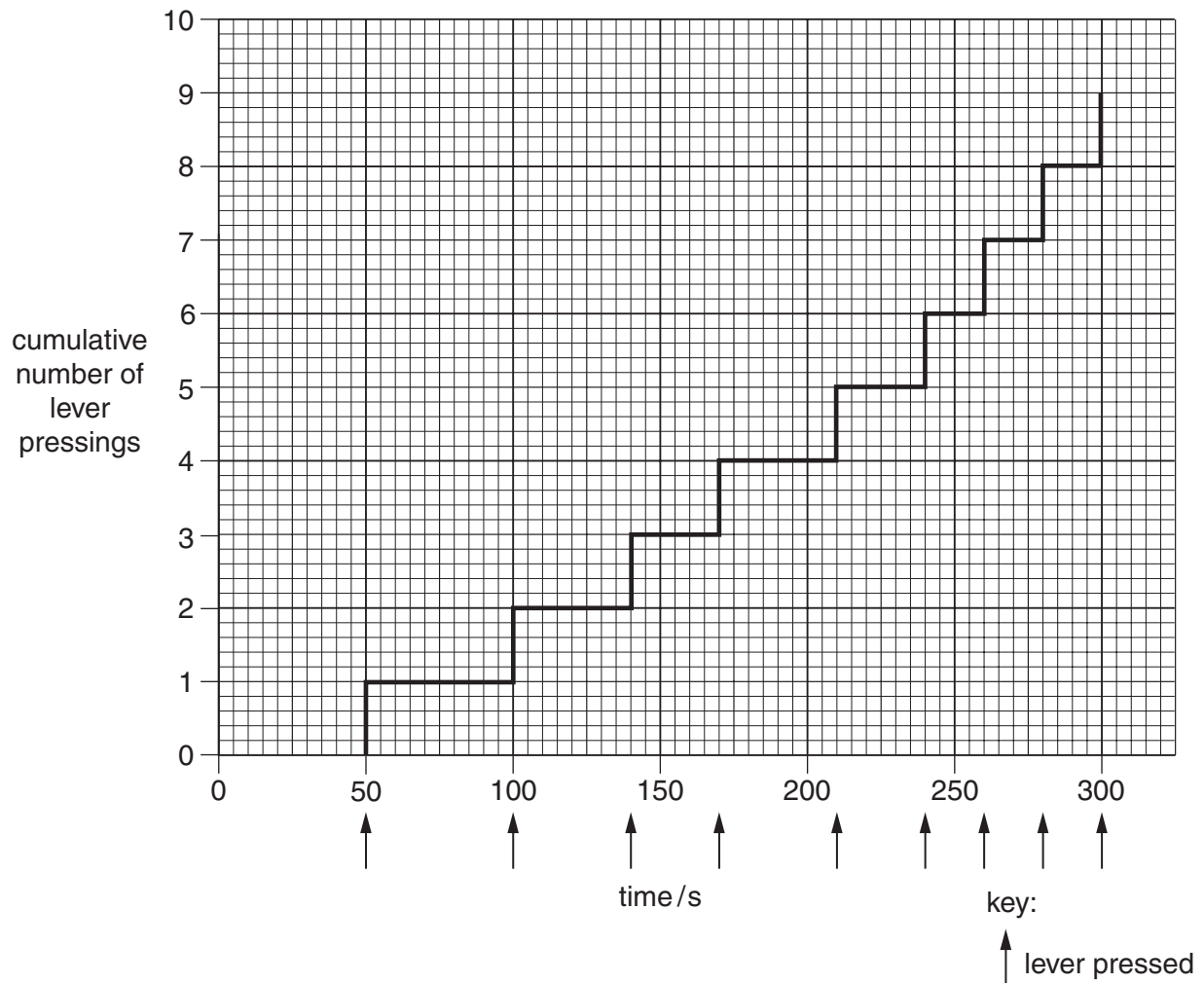


Fig. 6.1

- (a) (i)** Describe **and** explain the results of the investigation.

..... [5]

- (ii) Describe how you would carry out a control experiment for this investigation.

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- (iii) Suggest the results you would expect from such a control experiment.

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- (b) Learnt behaviour is stored in the areas of the cerebrum concerned with memory.

Calcineurin is an enzyme that limits the development of synapses between neurones in the cerebrum. Scientists have produced an inhibitor to calcineurin that leads to the formation of more synapses and better memory.

Suggest how the enzyme calcineurin may be inhibited.

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..... [4]

[Total: 12]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE

Copyright Acknowledgements:

Fig. 1.1	© Anthony Mercieca / Science Photo Library
Fig. 2.2 data	Source: G. P. Lofgreen, <i>et al. Behaviour patterns of sheep and cattle being fed pasture or silage</i> . Journal of Animal Science, vol. 16, 1957, pp. 773-780.
Fig. 2.3	© Manfred Kage / Science Photo Library
Q.3c and Table 3.1	Source: J.Y. Reginster, <i>et al. Long-term effects of glucosamine sulphate on osteoarthritis progression: a randomised, placebo-controlled clinical trial</i> . Lancet, vol. 357 (9252), 2001. pp. 251-256.
Fig. 5.1	© Zephyr / Science Photo Library

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