

**ADVANCED GCE
BIOLOGY**

Mammalian Physiology and Behaviour
FRIDAY 22 JUNE 2007

2805/05

Afternoon

Time: 1 hour 30 minutes

Additional materials: Electronic calculator
Ruler (cm/mm)



* OCR / T 22470 *

Candidate
Name

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name, 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.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- The number of marks for each question 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	13	
2	16	
3	17	
4	14	
5	15	
6	15	
TOTAL	90	

This document consists of **21** printed pages and **3** blank pages.

Answer all the questions.

- 1 (a) Fig. 1.1 shows a section through a human elbow joint.



Fig. 1.1

- (i) Name A and B.

A

B

[2]

- (ii) Describe the roles of A and B in the movement of the elbow joint.

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..... [3]

(b) Osteoporosis is a degenerative disease in which bone density gradually decreases, due to loss of calcium. This can result in bones becoming more likely to break (fracture).

Fig. 1.2 shows the number of fractures of the femur in five European countries per 10000 population per year.

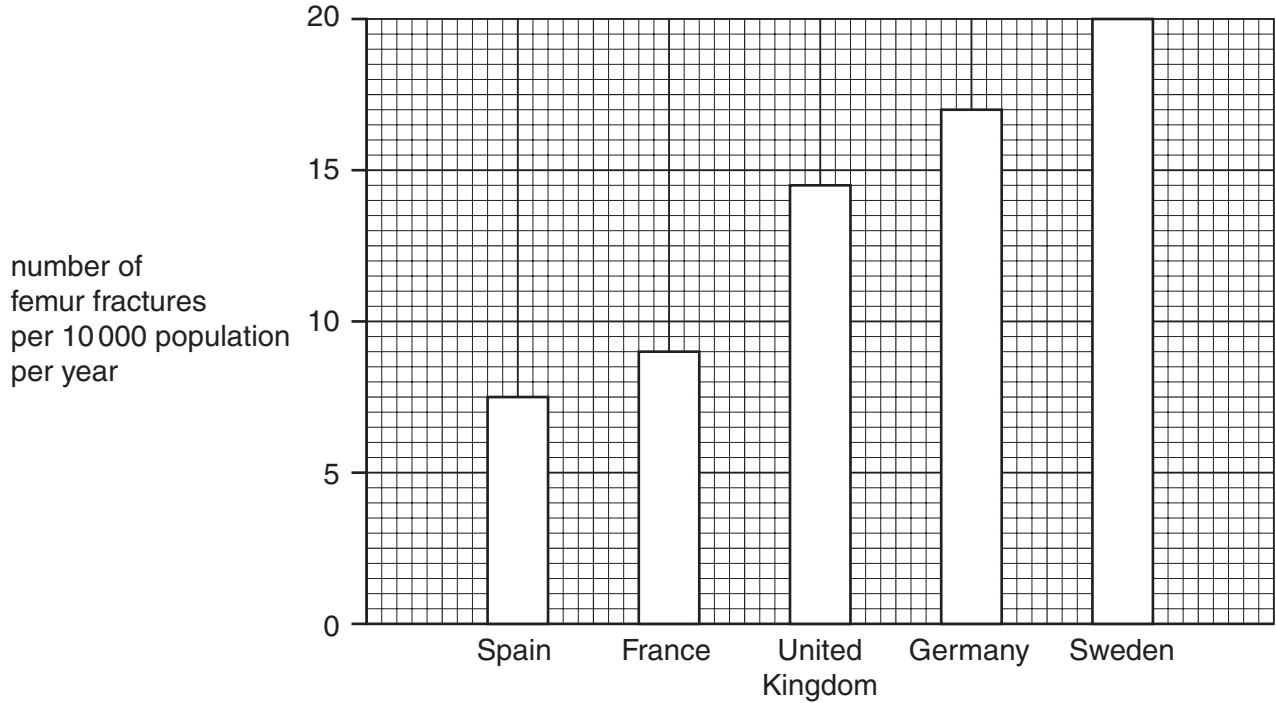


Fig. 1.2

Suggest why there are more fractures of the femur in some countries than in others.

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- (c) Medical researchers have developed a technique where new layers of bone tissue have been grown on a patient's healthy leg bone. The new tissue is then transplanted to mend bones in other parts of the patient's body.

The technique used is outlined in Fig. 1.3.

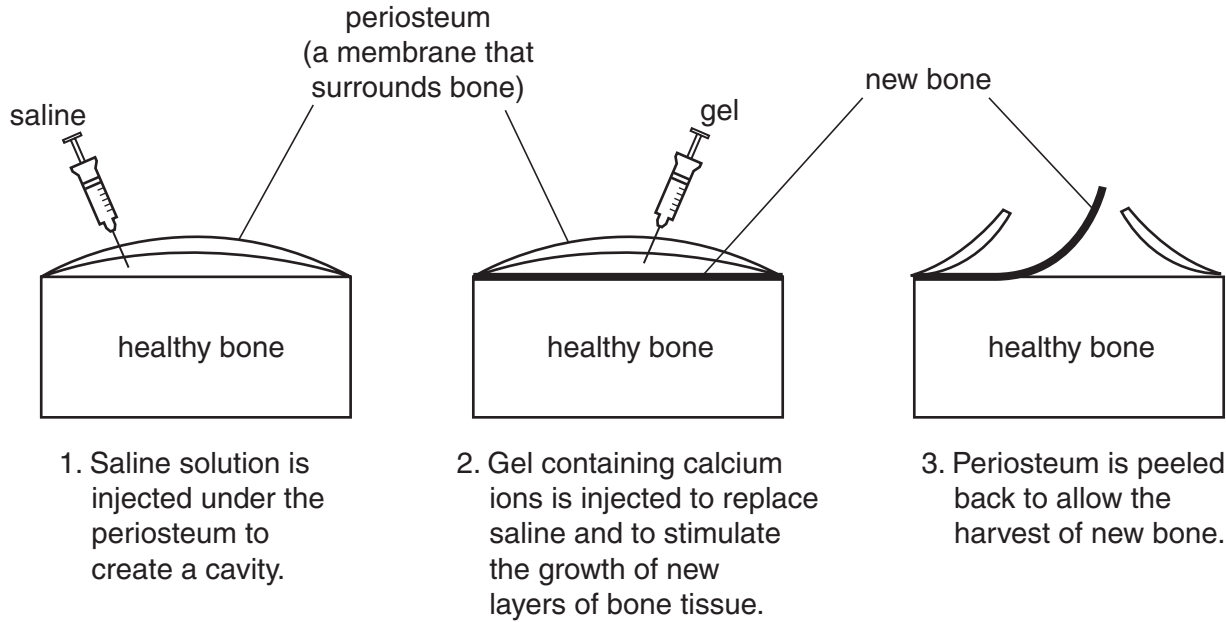


Fig. 1.3

- (i) Suggest advantages of using this technique for bone tissue transplantation.

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- (ii) Describe briefly the process of new **cell production** in tissues such as bone.

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[Total: 13]

2 The eyes of humans and dogs have the same basic structure, but there are differences.

The eyes of dogs function well in dim light whereas the eyes of humans do not.

Humans have high visual acuity but dogs do not.

(a) Complete the table below by suggesting reasons for these differences in sensitivity in dim light and in visual acuity between humans and dogs, in terms of the **structure** of their retinas.

feature	human	dog
sensitivity in dim light
visual acuity

[4]

(b) The eyes of dogs have very little ability to change their focus from near objects to distant objects.

Most domestic dogs have eyes that allow them to focus on near objects, whilst wild dogs have eyes that can focus on distant objects.

Suggest the advantages for a wild dog of being able to focus on distant objects.

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- (c) Outline how the human eye is able to focus on reading a book after having focused on a distant object.

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

Fig. 2.1 shows the left side of the cerebrum of a human.

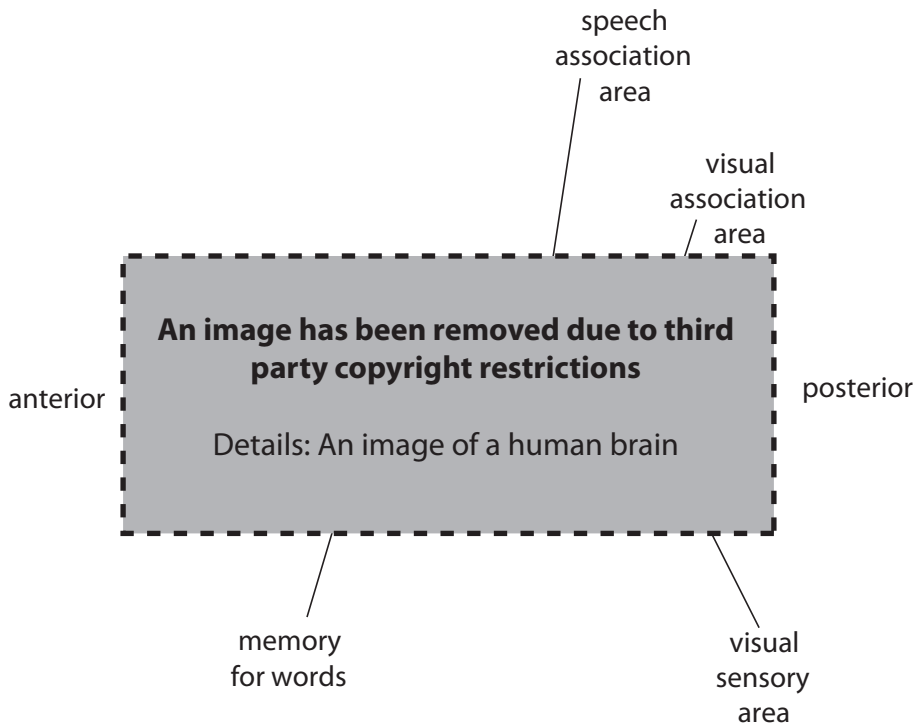


Fig. 2.1

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3 Fig. 3.1 is a scanning electronmicrograph of part of the lining of the stomach.

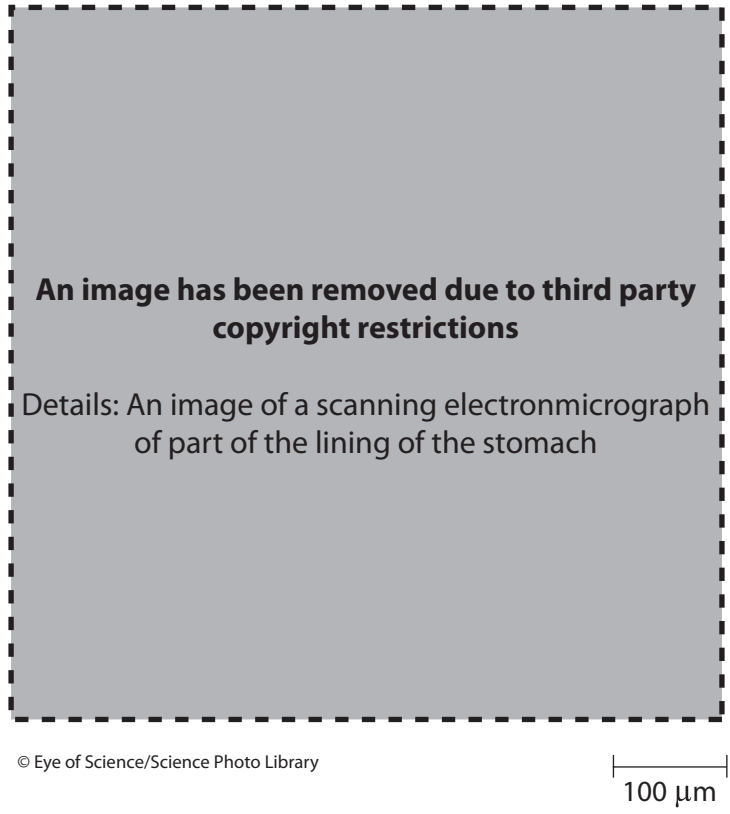


Fig. 3.1

(a) Using the letters E and G, label on Fig. 3.1

- an epithelial cell (E)
- a gastric pit (G).

[2]

(b) Gastric juice contains several substances, including hydrochloric acid and lipase.

State one function, in the stomach , of each substance.

hydrochloric acid

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lipase

..... [2]

- (c) Explain how the stomach protects itself from the effects of acid and enzymes produced by the gastric pits.

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- (d) In the early part of the nineteenth century, William Beaumont, a Canadian army doctor, was able to investigate the functioning of the stomach. He treated Alexis St. Martin, a trapper who had been shot in the abdomen. Dr. Beaumont could not successfully close the wound and Alexis St. Martin survived with a hole in the wall of his stomach, with a passage called a gastric fistula leading to the outside of his body. Dr. Beaumont could investigate digestion of food in the stomach of Alexis St. Martin by pushing food through the fistula into the stomach. He also experimented with the gastric juice extracted from the stomach.

The results of experiments carried out over several months are summarised in Table 3.1.

Table 3.1

experiment	site	liquid	food	temperature /°C	time to complete digestion /hours
1	stomach	gastric juice	cabbage	37	no digestion
2	stomach	gastric juice	beef	37	2
3	test-tube	gastric juice	beef	20	16
4	test-tube	gastric juice	beef	37	10
5	test-tube	gastric juice	cabbage	37	no digestion

Describe **and** explain the results of these experiments.

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..... [5]

(e) Unlike the ileum, the stomach is not well-adapted for the absorption of nutrients.

Describe the features of the ileum which make it a much more efficient absorptive surface than the stomach.

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..... [4]

[Total: 17]

- 4 An investigation was carried out into the effect of consuming meals rich in carbohydrate on two hormones in the blood.

Fig. 4.1 shows the relationship between glucose concentration in the blood and the concentrations in the blood of the two hormones, **Q** and **R**.

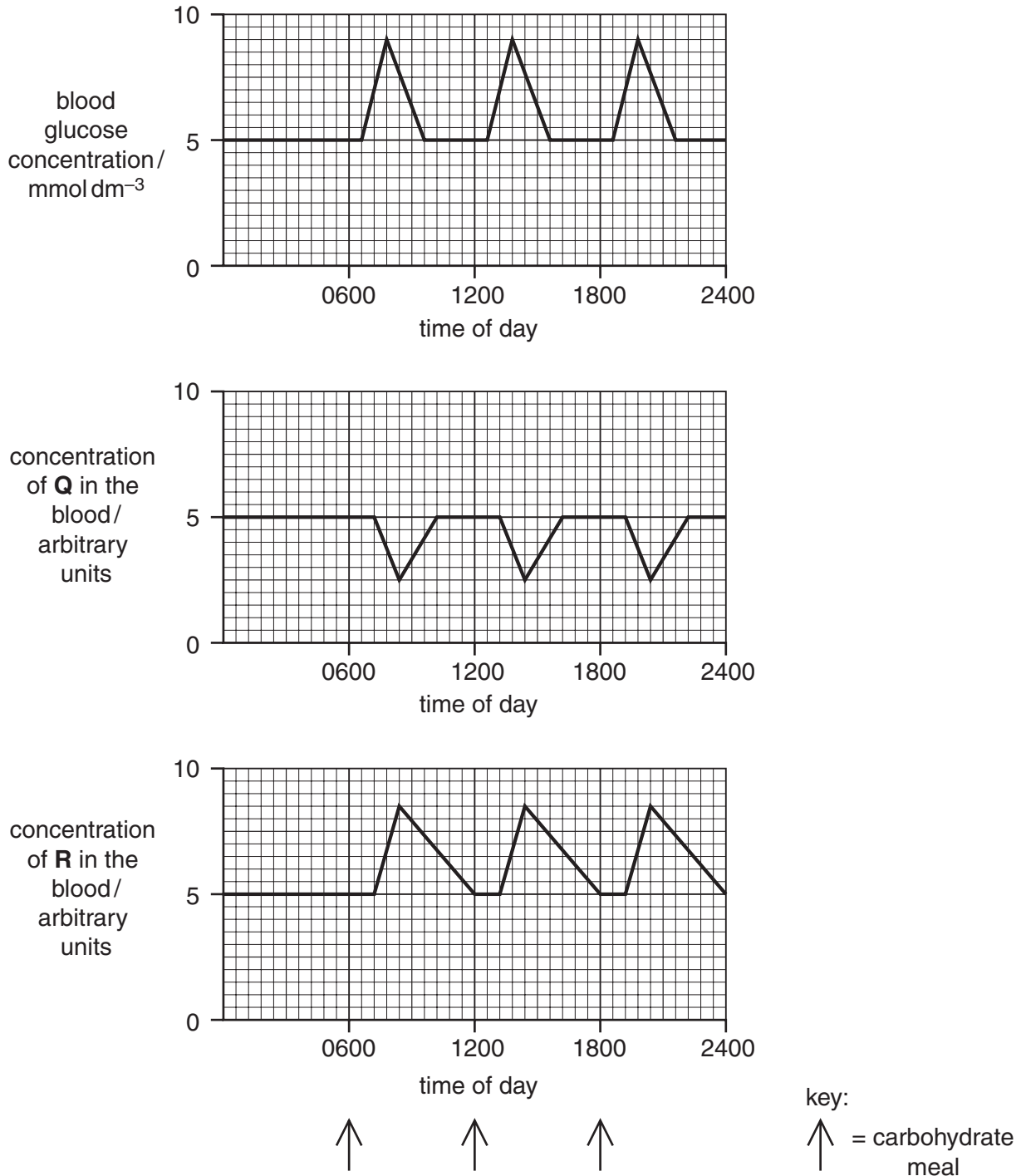


Fig. 4.1

(a) Name hormones **Q** and **R**.

Q

R

[2]

(b) Using the information in Fig. 4.1, outline the role of liver cells (hepatocytes) in carbohydrate metabolism.

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The liver is responsible for many aspects of protein metabolism, such as transamination and deamination.

(c) What is transamination **and** why is it necessary?

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..... [2]

(d) Excess amino acids are deaminated by hepatocytes to produce ammonia and pyruvate.

Describe what happens to the ammonia and pyruvate produced by deamination.

ammonia

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pyruvate

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..... [5]

[Total: 14]

15
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5 The cerebellum and medulla oblongata are regions of the brain. The cerebellum is concerned with the control and coordination of movement and posture.

(a) Suggest why the cerebellum of a chimpanzee is **relatively** larger than the cerebellum of a cow.

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..... [2]

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

The medulla oblongata controls breathing, heart rate and blood pressure.

Describe how the medulla oblongata responds to an increase in carbon dioxide concentration in the blood during exercise. Explain how this response leads to a decrease in the concentration of carbon dioxide in the blood.

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- (c) A drugs company introduced a new drug, which it claimed had beneficial effects in patients with moderate to severe symptoms of Alzheimer’s disease. An independent research group carried out a study to test the effects of this drug. The study was based on the observations of nurses experienced in caring for people with Alzheimer’s disease. Each nurse was asked to make careful observations and then complete a questionnaire.

Changes in memory of their patients were scaled as follows:

1 = much improved

2 = no change

3 = much worse.

Functional capacity was measured as the ability of the patients to look after themselves. It was scored on a scale of 1 to 54, in which 54 represents no observed effects of Alzheimer’s disease.

In addition, the nurses recorded how many hours of care were needed per month per patient.

Mean scores for all patients in the study were calculated and the results are shown in Table 5.1.

Table 5.1

observation	mean scores at start of study	mean score (after 28 weeks) for patients treated with drug	mean score (after 28 weeks) for patients not treated with drug
change in memory	–	2.4	2.7
functional capacity	33.0	30.5	28.1
nursing time/hours of care needed per month per patient	350	358	409

- (i) Calculate the percentage change in functional capacity after 28 weeks for the patients **treated with the drug**.

Show your working and give your answer to **one decimal place**.

Answer = % [2]

(ii) Using the information in Table 5.1, describe the results of this study.

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[Total: 15]

- 6 (a) Classical conditioning concerns learning by association and was discovered by the Russian scientist Ivan Pavlov, using dogs.

A study was carried out on a group of people to test classical conditioning.

- Each person was given a slight electric shock on the hand, which caused the arm to be jerked back.
- The procedure was carried out again but this time a red light was shone just before the electric shock was applied.
- This was repeated many times.
- Eventually, when presented with a red light, most people withdrew their arms even though a shock was not applied.

For **this** study state precisely:

- (i) the conditioned stimulus
(ii) the conditioned response [2]

- (b) Operant conditioning was initially investigated by the scientist B.F. Skinner, using rats.

Explain briefly how a rat can learn to press a lever in its cage.

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(c) Fig. 6.1 shows a simplified diagram of a mammalian reflex arc.



Fig. 6.1

(i) Name S and T.

S

T [2]

(ii) Explain why the withdrawal of a hand, which has been subjected to pressure, is an example of a reflex action.

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- (iii) In this reflex, when pressure is applied to the receptor, impulses are generated in the sensory neurone.

Outline what happens in the membrane of the sensory receptor in response to pressure.

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- (iv) Explain why, in the reflex arc shown in Fig. 6.1, impulses can only travel in the direction shown.

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[Total: 15]

END OF QUESTION PAPER

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