OCR
RECOGNISING ACHIEVEMENT

ADVANCED GCE

BIOLOGY

Mammalian Physiology and Behaviour

2805/05

MONDAY 29 JANUARY 2007

Morning

Time: 1 hour 30 minutes

Additional materials: Electronic calculator
Ruler (cm/mm)

Candidate Name

Centre Number

Candidate Number

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	**17**	
2	**16**	
3	**16**	
4	**6**	
5	**19**	
6	**16**	
TOTAL	**90**	

This document consists of **22** printed pages, **2** blank pages and an insert.

[Turn over

Answer **all** the questions.

1 The cheetah, *Acinonyx jubatus*, is a member of the cat family. It is found mostly in Southern Africa where it hunts antelopes. The cheetah is anatomically and physiologically adapted to its specialised style of hunting. A cheetah can accelerate to 60 km h^{-1} in 3 seconds and may reach a maximum speed of 110 km h^{-1}. The chase is short and then the cheetah knocks over its prey, bites the underside of its throat and squeezes the windpipe causing suffocation.

Fig. 1.1 (on an insert) shows the skull of a cheetah.

(a) (i) Name the main type of teeth used by the cheetah to bite, hold and kill its prey.

..... [1]

(ii) Name the cheetah's specialised cheek teeth (molars and premolars) **and** describe their role in consuming prey.

name .....

role .....

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..... [3]

(b) After chasing prey, a cheetah breathes rapidly (pants) for half an hour before it can run again.

Explain why panting is necessary.

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(c) Fig. 1.2 shows the major bones of the front leg of a cheetah.

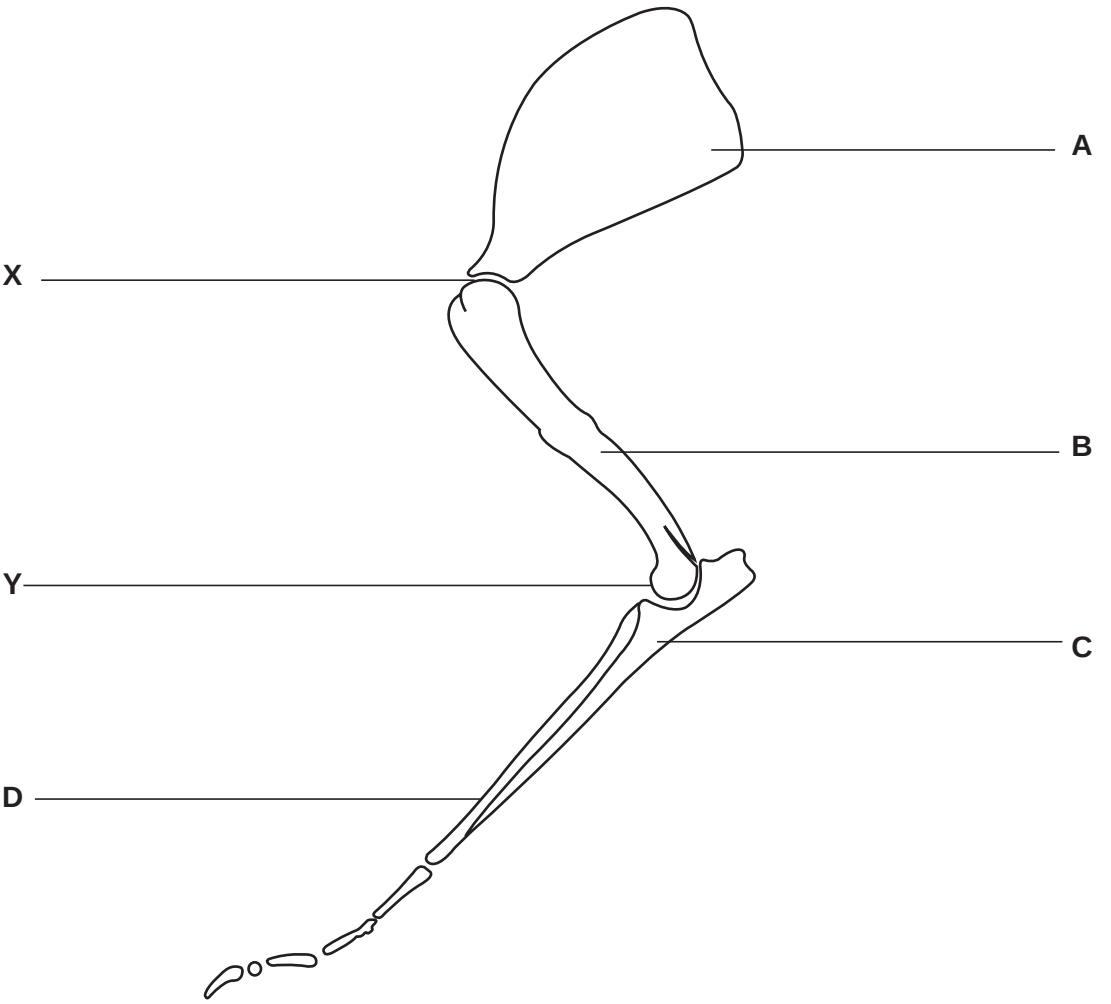

Fig. 1.2

(i) Name bones **A** to **D**.

A .....

B .....

C .....

D ..... [2]

(ii) Joints **X** and **Y** are synovial joints. Describe the roles played by ligaments and cartilage in this type of joint.

ligaments .....

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.....

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cartilage .....

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..... [4]

(iii) The muscles that move the lower part of the front leg at joint **Y** are antagonistic.

Describe how antagonistic muscles are used to move the lower arm of a human.

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..... [3]

[Total: 17]

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2 Cancer and cirrhosis are diseases that can occur in the liver.

(a) Describe how cancers may form.

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(b) Outline **three** ways in which the structure of the liver changes in a person with cirrhosis.

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Fig. 2.1 shows how the death rates from liver cancer and cirrhosis varied from 1985 to 2001, for men in Catalonia, a region of Spain.

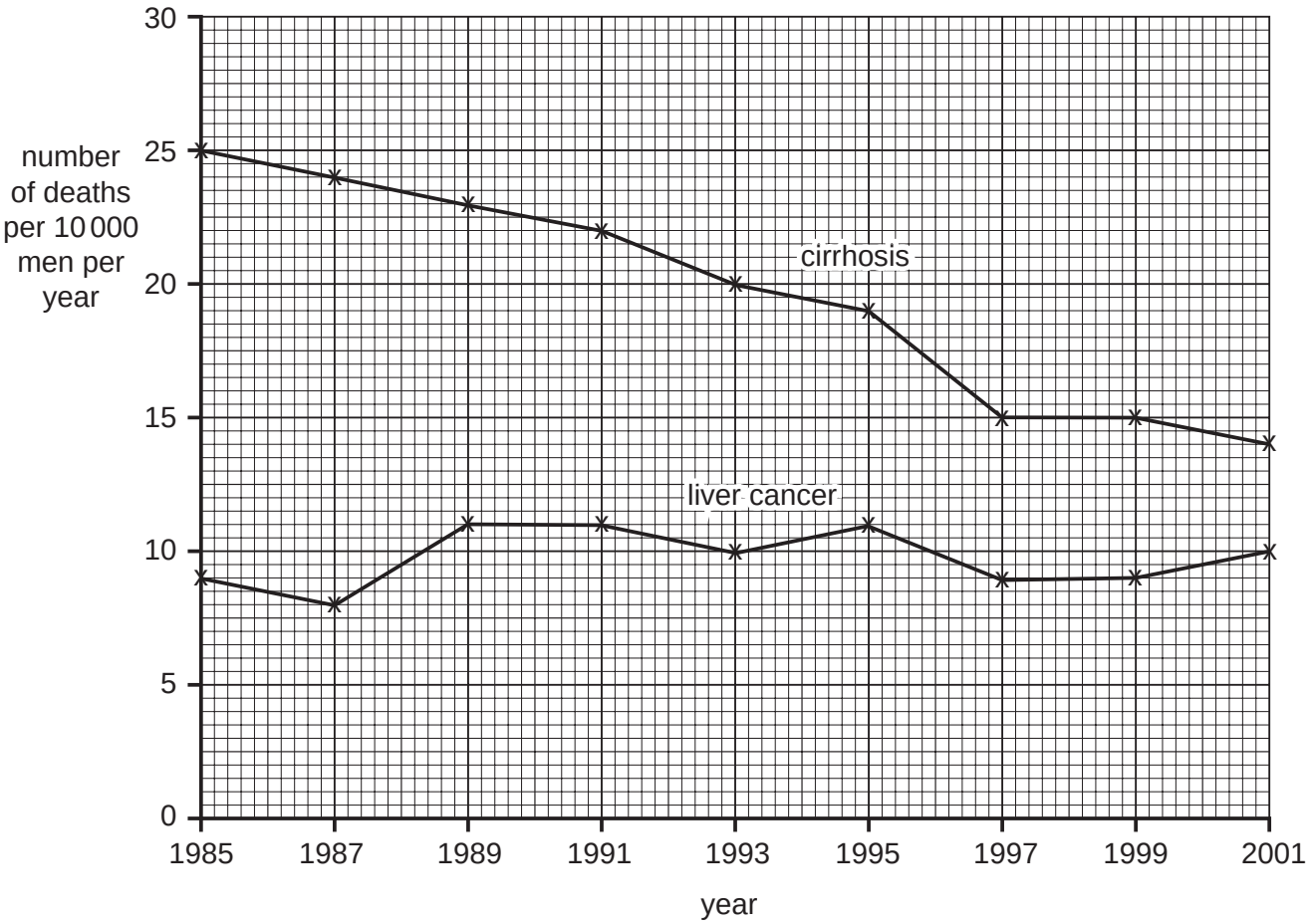

Fig. 2.1

(c) (i) With reference to **both** diseases, describe the data shown in Fig. 2.1.

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..... [2]

(ii) Suggest a reason for the trend shown for the number of deaths from cirrhosis.

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..... [1]

The liver is responsible for the production of many plasma proteins, two of which are important in the clotting of blood.

Fig. 2.2 outlines the roles of plasma proteins **A** and **C** in the process of blood clotting.

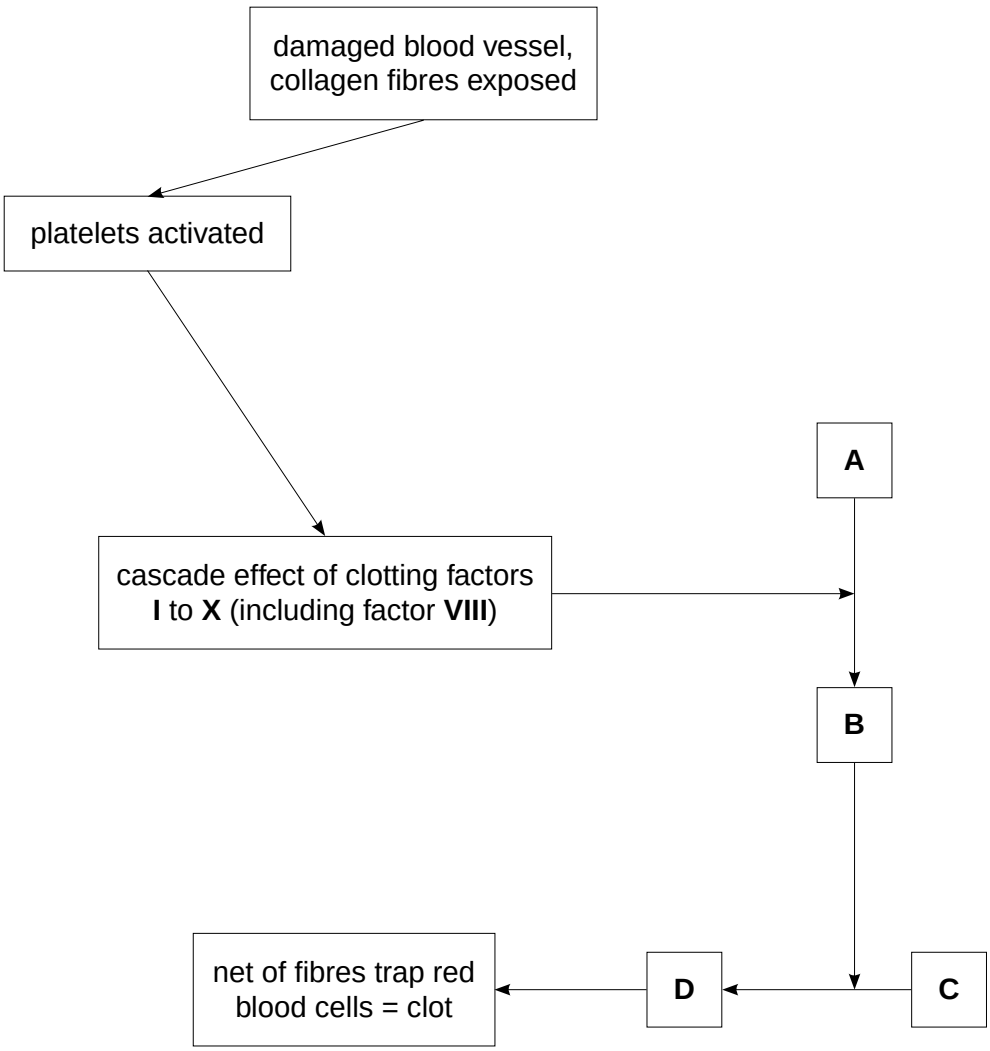

Fig. 2.2

(d) (i) Name substances **A** to **D**.

A .....

B .....

C .....

D ..... [4]

(ii) Describe the role of substance **B** in the conversion of **C** to **D**.

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..... [1]

(iii) In some people factor **VIII** is not produced so that substances **B** and **D** cannot be made.

Suggest how the absence of factor **VIII** may affect health.

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[Total: 16]

3 The bottlenose dolphin, *Tursiops truncatus*, shown in Fig. 3.1, communicates by means of sounds of varying frequency and loudness (amplitude).

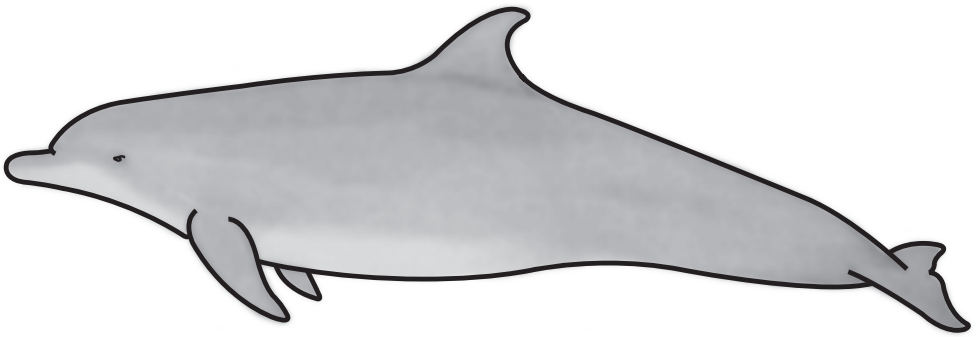

Fig. 3.1

The hearing threshold is the minimum amplitude of a sound of a particular frequency required to stimulate the cochlea.

Fig. 3.2 shows the hearing thresholds, in decibels (dB), of the bottlenose dolphin over a range of frequencies from 1 to 150 kHz.

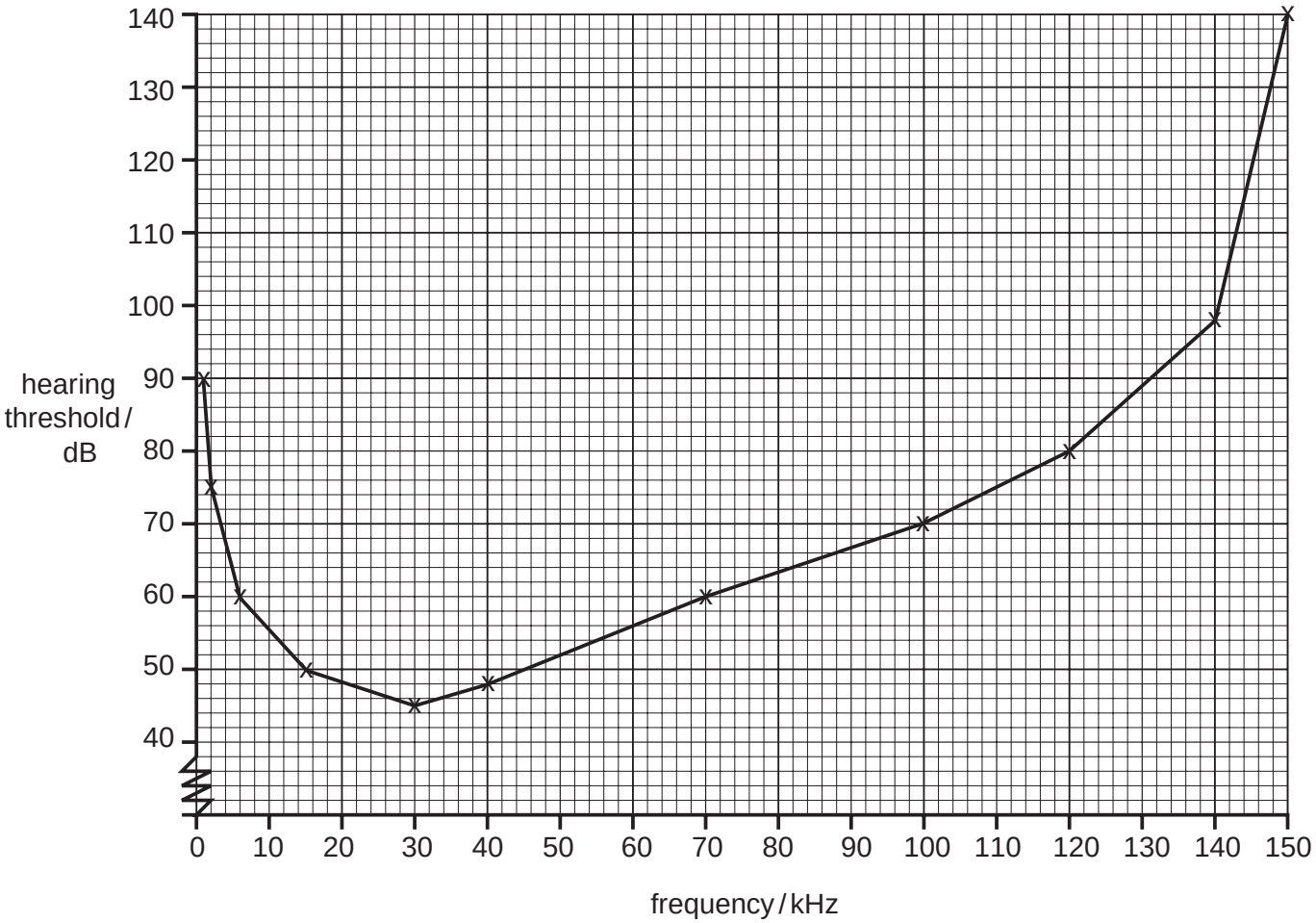

Fig. 3.2

(a) Using the information in Fig. 3.2,

(i) state the frequency used in the investigation at which the ear of the dolphin was most sensitive,

..... [1]

(ii) calculate the percentage increase in the hearing threshold when the frequency rises from 40 kHz to 150 kHz. Show your working.

Answer = ... % [2]

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

Explain how the cochlea of mammals, such as the bottlenose dolphin, converts sound energy into nerve impulses.

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Quality of Written Communication [1]

(c) Sensorineural hearing loss is caused by changes in the inner ear, specifically the cochlea. One form of this type of hearing loss is due to inherited factors. The gene GJB2 codes for a protein, connexin26, which is involved in converting sound waves to electrical impulses in the inner ear. People affected by hearing loss make an abnormal form of connexin26.

(i) Explain how **abnormal** connexin26 would be made.

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..... [3]

(ii) Suggest how two parents with normal hearing could have a child with this form of hearing loss.

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..... [2]

[Total: 16]

4 Fig. 4.1 shows the relationship between the hypothalamus and the pituitary gland.

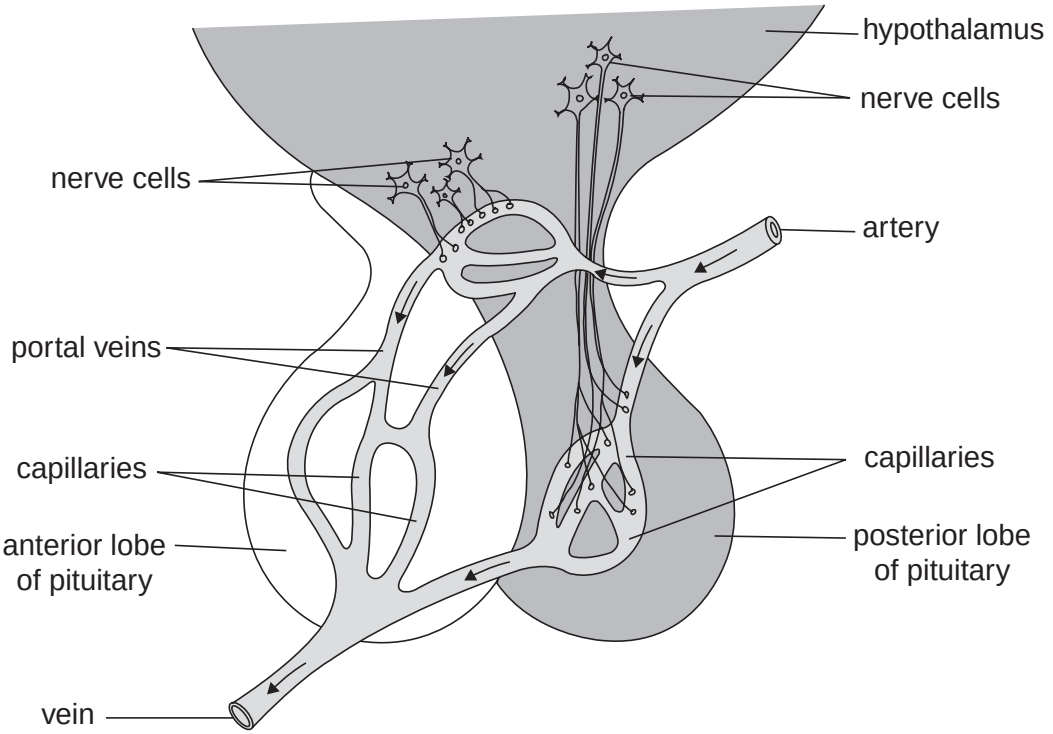

Fig. 4.1

(a) The hypothalamus produces releasing hormones, which stimulate the production of hormones by the anterior lobe of the pituitary gland.

(i) State the process by which hormones from the hypothalamus are released.

..... [1]

(ii) Name a releasing hormone produced by the hypothalamus **and** the corresponding hormone subsequently produced by the anterior lobe of the pituitary gland.

releasing hormone .....

pituitary hormone ..... [2]

(b) The hypothalamus produces anti-diuretic hormone (ADH) that is released by the posterior pituitary gland into the blood.

Brain damage can occur due to trauma to the head. Traumatic brain injury (TBI) can cause many and varied malfunctions of parts of the brain. One condition that can arise from TBI is a lack of ADH in the blood.

Suggest the symptoms you would expect in a person with a lack of ADH.

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..... [3]

[Total: 6]

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

(a) Carbohydrates, such as starch, are an important part of the diet of some mammals.

Describe **and** explain how starch molecules (amylose and amylopectin) are digested in the small intestine **and** how their products are absorbed.

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Quality of Written Communication [1]

(b) The contents of the ileum pass eventually into the large intestine, which consists of the appendix, caecum, colon and rectum.

(i) State **two** functions of the colon.

1 .....

2 ..... [2]

(ii) Describe the composition of the faeces of a human.

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..... [2]

(c) The caecum in a human is small but in a rabbit it is relatively large. A rabbit's caecum contains microorganisms similar to those found in a cow's stomach. The microorganisms produce enzymes to digest the plant cell walls of the rabbit's food. This is an example of mutualism.

Suggest what is meant by *mutualism* in this case.

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..... [2]

(d) Rabbits practise coprophagia: they ingest their faecal pellets. The pellets are rich in nutrients, including calcium.

Explain why rabbits need to ingest their faeces whereas cows do not need to do this.

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..... [2]

(e) Calcium ions are necessary for the contraction of the rabbit's striated muscle.

Describe the role played by calcium ions in the contraction of striated muscle.

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[Total: 19]

6 A positron emission tomography (PET) scan can be used to investigate the activity of the brain. PET scans can help to diagnose conditions such as Alzheimer's disease. A radioactive isotope is attached to molecules similar to glucose and injected into the blood supplying the brain. The molecules with the radioactive isotope are taken up by healthy cells, but are not metabolised. Instead they emit positrons, which can be detected by the PET scanner.

Fig. 6.1 (on an insert) shows PET scans of a normal brain and the brain of a person with Alzheimer's disease.

- Red and yellow indicate high emissions of positrons.
- Blue and black indicate low emissions of positrons.

(a) With reference to Fig. 6.1 and the information above, explain the differences between the two PET scans.

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(b) One form of treatment for people with Alzheimer's disease is to use drugs that act on acetylcholinesterase.

A study using one of these drugs, phenserine, was carried out on elderly rats.

- Ten rats were given injections of saline and another ten were given injections of phenserine.
- Each rat was placed in a maze and the entrance was shut.
- Each rat was allowed to find its way to the exit.
- The number of errors made was recorded.
- The experiment was repeated a further three times with each rat.

The results of the experiment are shown in Fig. 6.2.

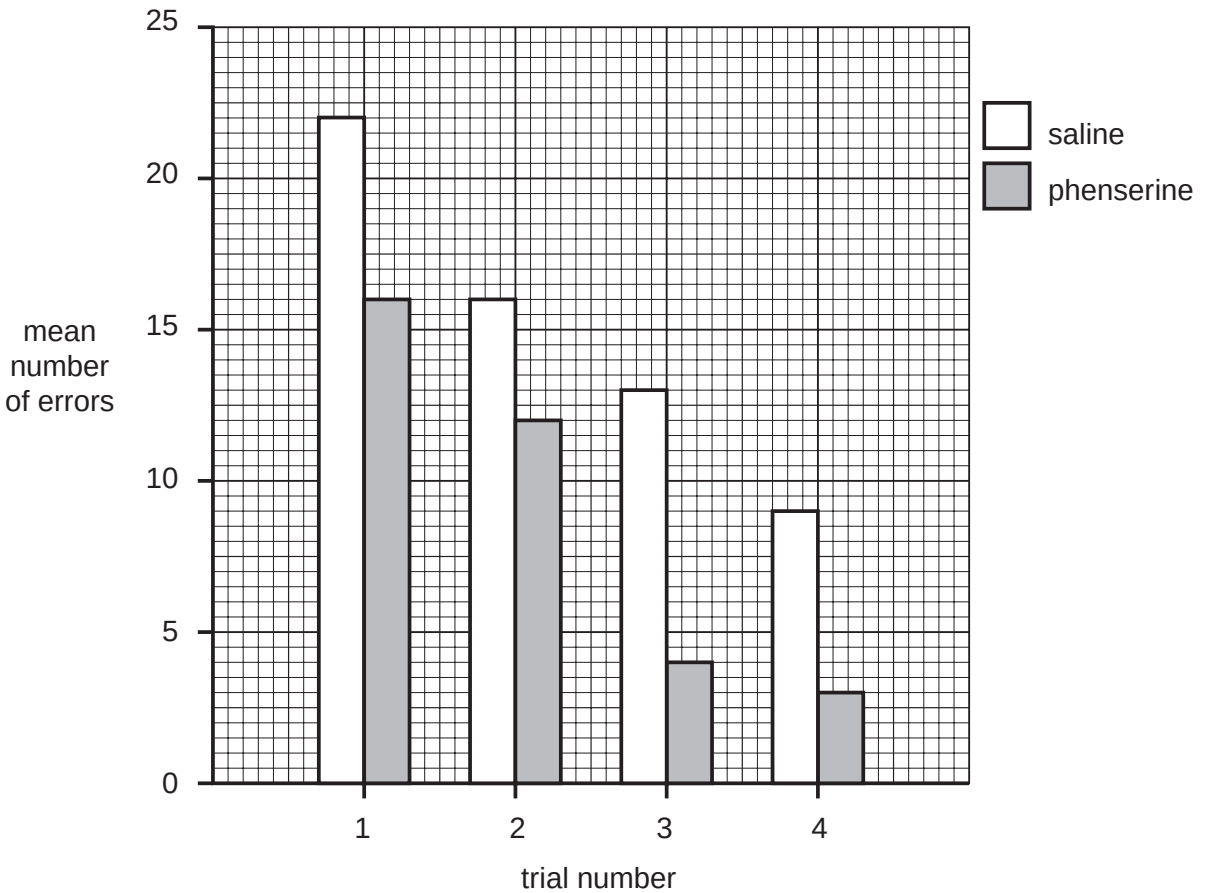

Fig. 6.2

(i) Explain why some rats were given an injection of saline.

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..... [1]

(ii) Describe the results shown in Fig. 6.2.

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(iii) Explain briefly the type of learning taking place.

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(iv) Suggest how phenserine may work in the brain.

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(c) If the cheek of a newborn baby is brushed with a finger, as shown in Fig. 6.3, the baby will turn its head towards the finger.

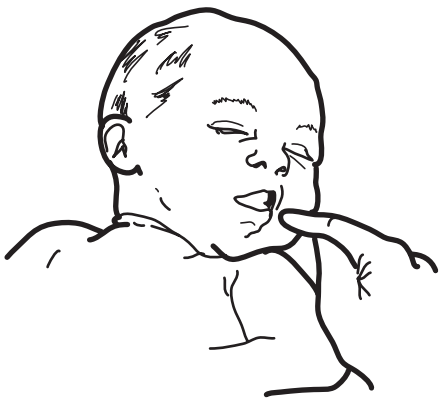

Fig. 6.3

Describe the type of behaviour shown by the baby in Fig. 6.3 and suggest an advantage of this response.

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[Total: 16]

END OF QUESTION PAPER

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2805/05

BIOLOGY

Mammalian Physiology and Behaviour

INSERT

MONDAY 29 JANUARY 2007

Morning

Time: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

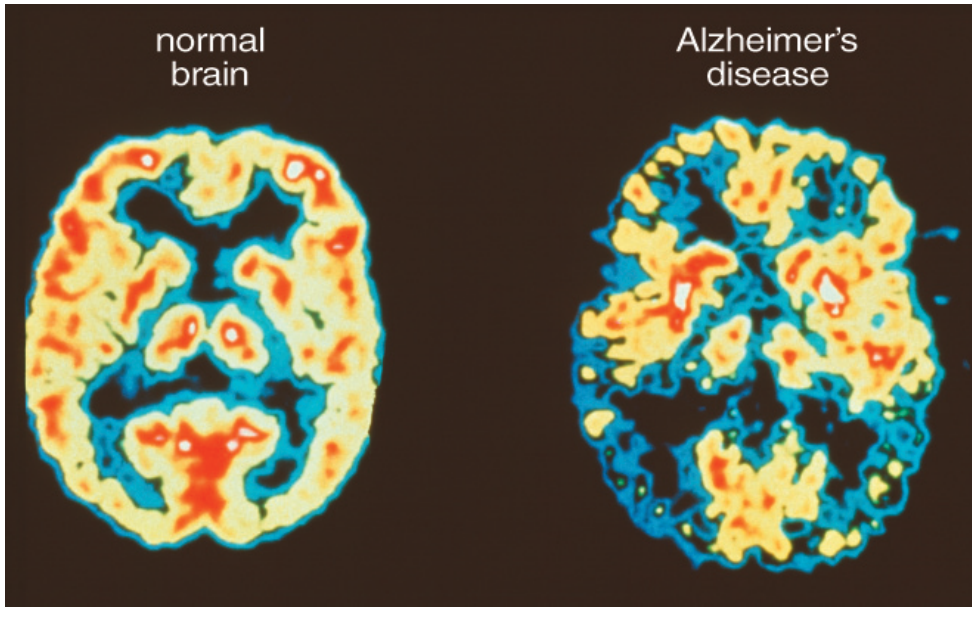
- This insert contains Fig. 1.1 and Fig. 6.1.

This insert consists of **2** printed pages.

© Bone Clones

Fig. 1.1

FRONT



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BACK

Fig. 6.1

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