**OCR**

RECOGNISING ACHIEVEMENT

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

Advanced GCE

# BIOLOGY

**2805/05**

Mammalian Physiology and Behaviour

| Tuesday | **29 JANUARY 2002** | Morning | 1 hour 30 minutes |

Candidates answer on the question paper.
Additional materials:
    Electronic calculator

| 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 on the question paper.
- Read each question 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 stages in any calculations.

| FOR EXAMINER'S USE | | |
|---|---|---|
| Qu. | Max. | Mark |
| 1 | 15 | |
| 2 | 17 | |
| 3 | 14 | |
| 4 | 18 | |
| 5 | 14 | |
| 6 | 12 | |
| TOTAL | 90 | |

**This question paper consists of 16 printed pages.**

[Turn over

Answer **all** the questions.

**1** Fig. 1.1 represents the mammalian liver and its blood supply.

vena cava

aorta

vein from stomach,
pancreas and spleen

liver

**A**

**B**

anterior mesenteric
vein (from ileum)

posterior
mesenteric vein
(from colon
and rectum)

**C**

vena cava

aorta

**key**

⟶ direction of blood flow
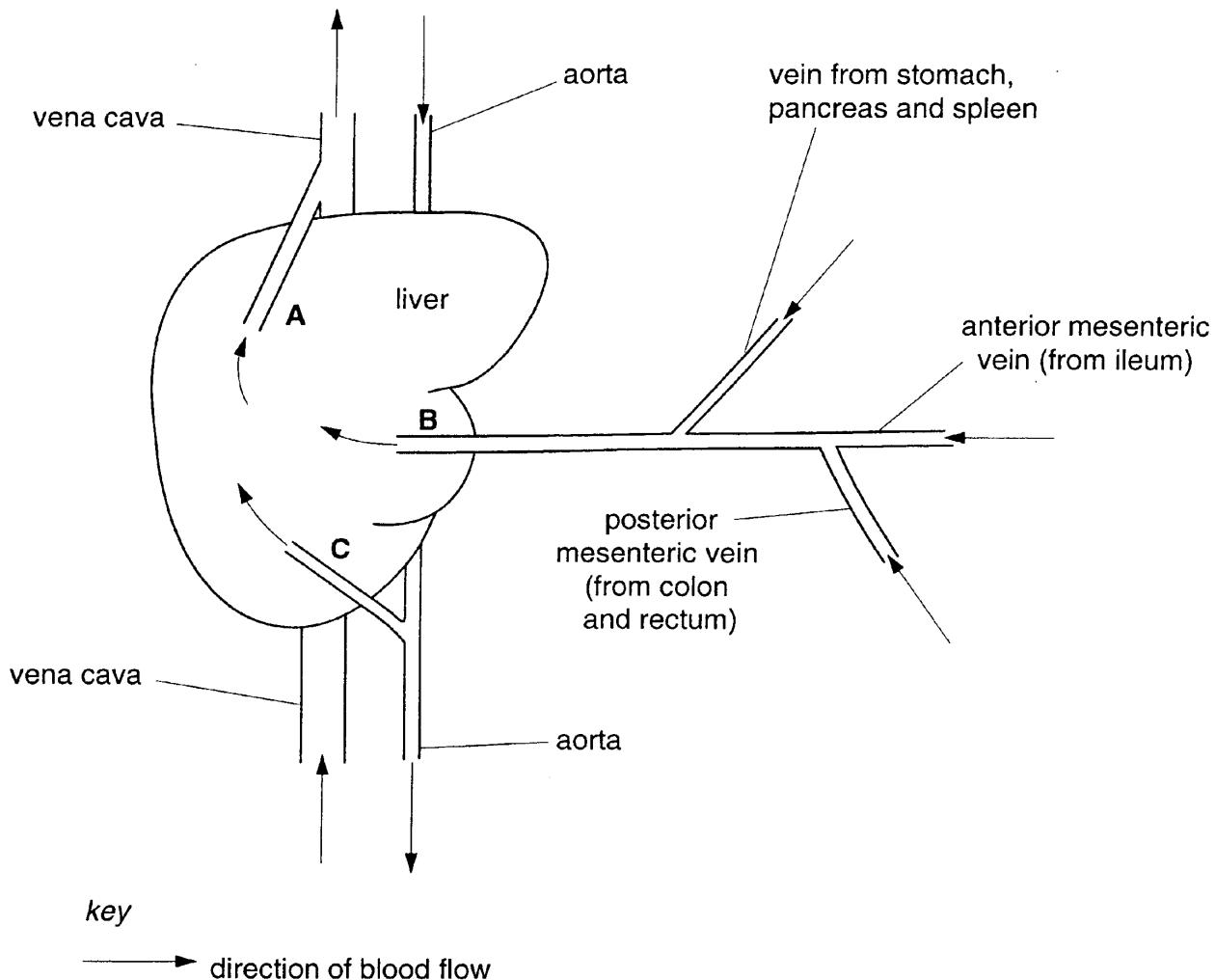
**Fig. 1.1**

**(a) (i)** Name vessels **A** and **B**.

**A** .................................................................................................................................

**B** ...........................................................................................................................[2]

**(ii)** State which **one** of the vessels, **A**, **B** or **C**, would be most likely to have the **highest** concentration of

carbon dioxide    ...........................................

oxygen    ...........................................

insulin    ...........................................

glucose soon after eating    ...........................................

glucose 12 hours after eating    ...........................................

[5]

One of the functions of the liver is to synthesise bile.

**(b)  (i)** List **four** main constituents of bile, other than water.

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[4]

**(ii)** Outline the roles of bile in the alimentary canal.

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[Total : 15]

**[Turn over**

**2** Fig. 2.1 shows a vertical section of the human brain.

G _ _ _ _ _ _ _ _ _ _ _ _     D _ _ _ _ _ _ _ _ _ _ _

pineal gland

pituitary gland

E _ _ _ _ _ _ _ _ _ _

F _ _ _ _ _ _ _ _ _ _
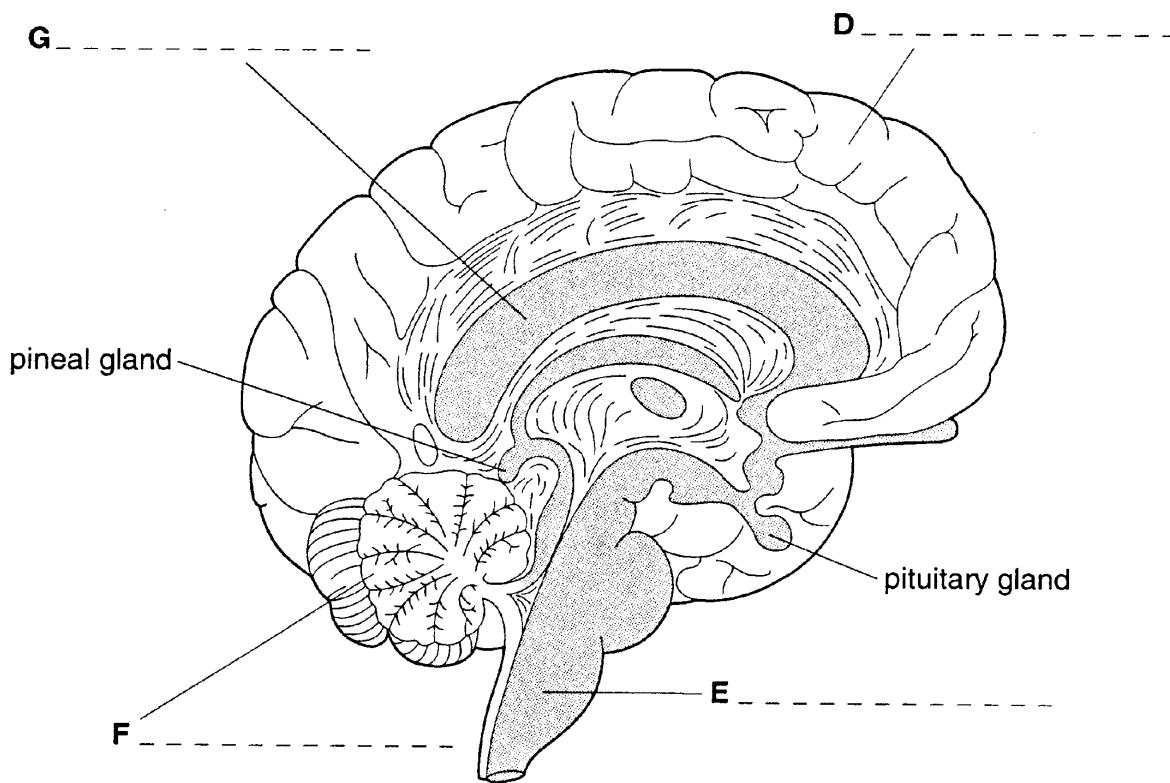
**Fig. 2.1**

**(a) (i)** Name, on Fig. 2.1, the regions of the brain labelled **D** to **G**.                [4]

**(ii)** State **one** function of each of the regions **D** to **G**.

**D** ..............................................................................................................................

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**E** ..............................................................................................................................

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**F** ..............................................................................................................................

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**G** ..............................................................................................................................

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**(b)** Describe **changes** that may occur in the brain in Alzheimer's disease and outline the **symptoms** which can result.
*(In this question, 1 mark is available for the quality of written communication.)*

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[Total : 17]

**[Turn over**

**3** Fig. 3.1 shows a section of pancreas, as seen using a light microscope.



acinar cells

intralobular
duct of flattened
epithelium

interlobular
connective
tissue

islet of
Langerhans

interlobular duct

main duct

columnar epithelium

smooth muscle

connective tissue

blood vessel

X150
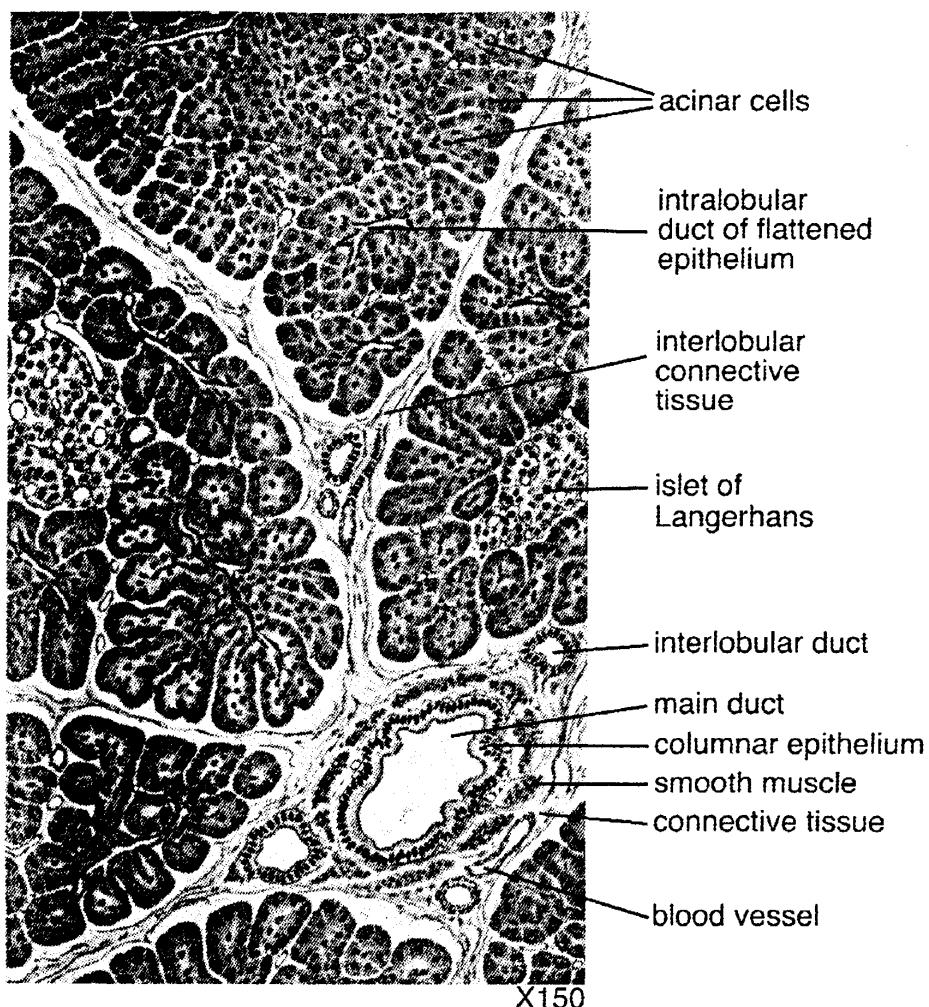
**Fig. 3.1**

Most of the cells shown, acinar cells, form *exocrine* glandular tissue.

**(a)** State what is meant by *exocrine*.

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**(b)** State the function of the *intralobular duct*.

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**(c)** Name the organ into which the main duct empties.

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**(d)** **(i)** Name **four** soluble **proteins** which you would expect to find in the main duct.

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**(ii)** Explain why the fluid in the main duct is alkaline.

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In the inherited condition known as cystic fibrosis (CF), the pancreas may fail to function normally and the ducts leading from it may become blocked.

**(e)** Outline the problems that may occur in the alimentary canal of a person living with CF and suggest how such problems could be treated.

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[Total : 14]

**[Turn over**

4    Fig. 4.1 represents a section through the complete wall of the back of a mammalian eye.
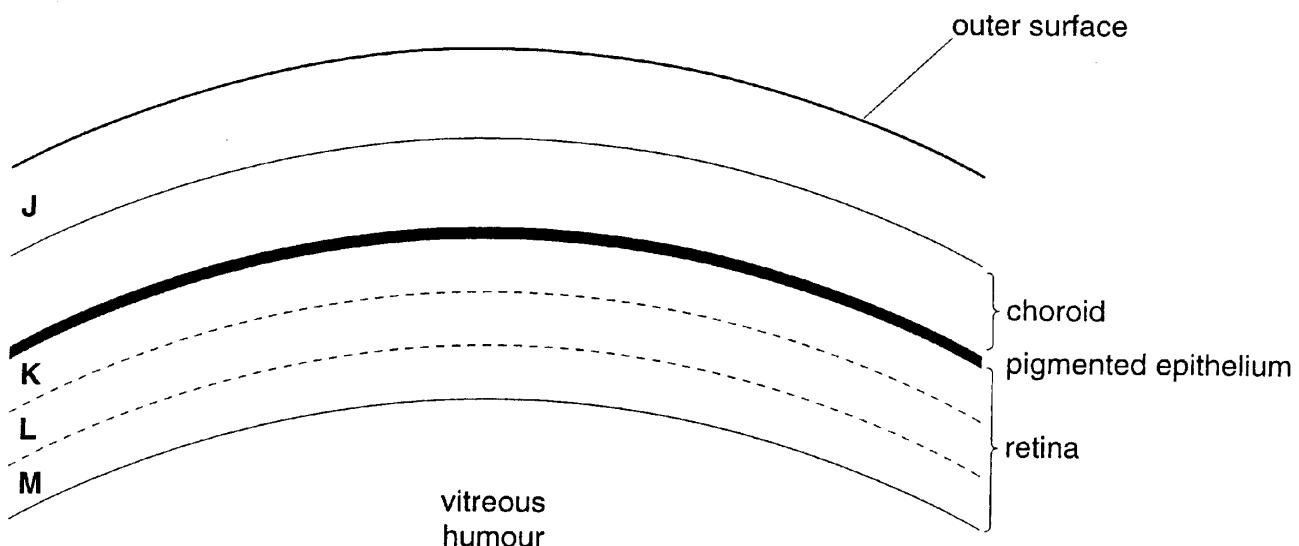


**Fig. 4.1**

**(a)** Using letters from Fig. 4.1, indicate which layer contains,

**(i)** ganglion cells;            ...........................

**(ii)** photoreceptors;          ...........................

**(iii)** many collagen fibres;   ...........................

**(iv)** bipolar neurones.        ...........................

[4]

Colour vision in humans is based on the trichromatic (3-colour) principle. The responses of the three types of photoreceptor cell, $c_1$, $c_2$ and $c_3$, to different wavelengths of light are shown in Fig. 4.2. The colours corresponding to the wavelengths of the visible spectrum are shown in Table 4.1.
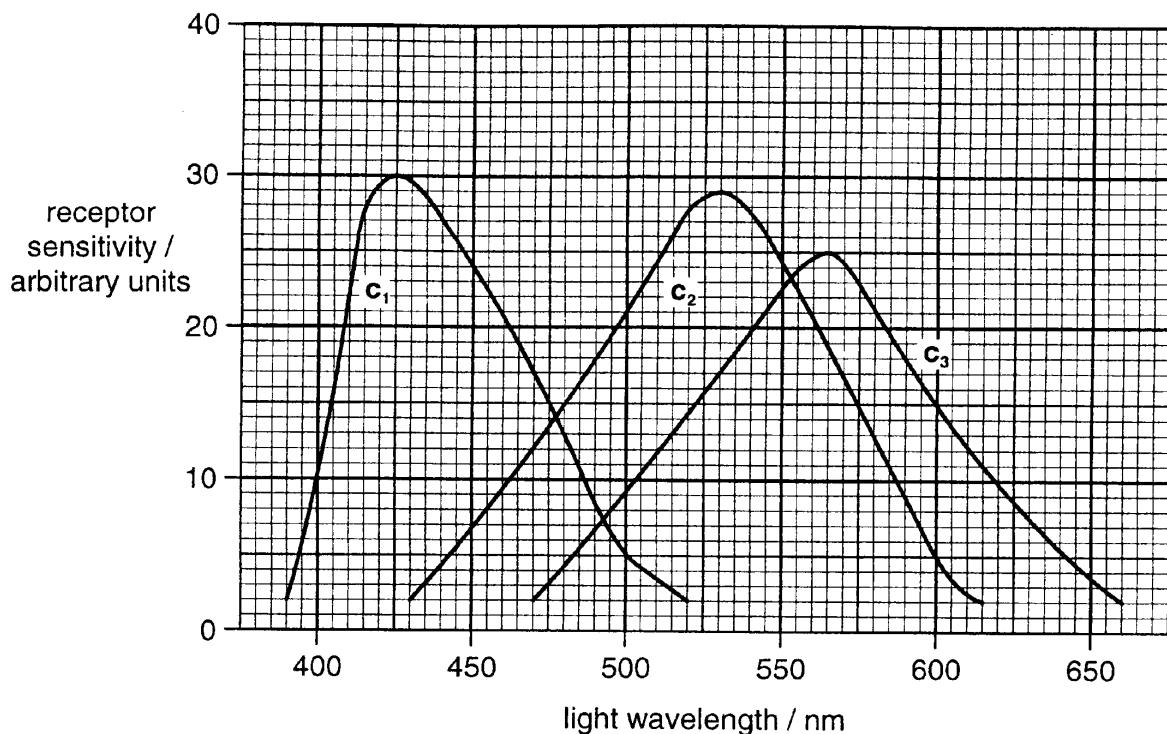


**Fig. 4.2**

**Table 4.1**

| light wavelength /nm | below 440 | 440–499 | 500–569 | 570–589 | 590–620 | above 620 |
|---|---|---|---|---|---|---|
| colour | violet | blue | green | yellow | orange | red |

**(b)** With reference to Fig. 4.2, determine the wavelengths of light to which cells $c_1$ and $c_2$ are most sensitive.

$c_1$ ................................................................

$c_2$ ................................................................

[2]

**[Turn over**

Cells of type $c_3$ have a maximum sensitivity to light of 565 nm and are often referred to as 'red cones'.

**(c)** Suggest what is anomalous about this common name.

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**(d)** State what the brain would perceive if all the photoreceptors were stimulated equally.

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**(e)** There are no specific photoreceptor cells for detecting violet light. From the information given, suggest a mechanism whereby the brain could distinguish between 'blue' light and 'violet' light.

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The size of the pupil in the eye is controlled by the autonomic nervous system.

**(f)** Describe the role of the autonomic nervous system in controlling the size of the pupil in the eye.
*(In this question, 1 mark is available for the quality of written communication.)*

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[Total : 18]

**[Turn over**

5    Fig. 5.1 shows two bones meeting and forming a synovial joint at the human elbow.
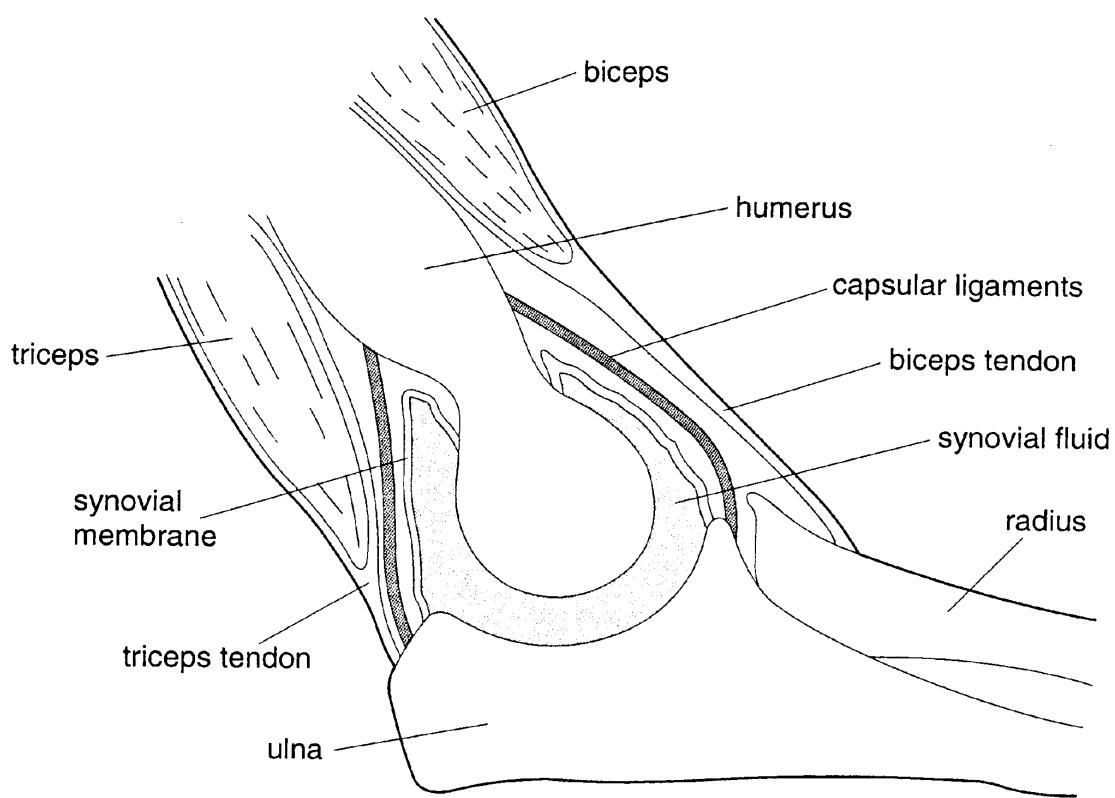


**Fig. 5.1**

**(a)**  With respect to Fig. 5.1, state the type of synovial joint shown.                    [1]

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Fig. 5.1 does not show hyaline cartilage.

**(b)**  Draw and label, on Fig. 5.1, where hyaline cartilage is found in the elbow joint.      [2]

**(c)**  Describe the effects of osteoarthritis on load-bearing joints.

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**(d)** Outline the roles of the structures shown in Fig. 5.1, including hyaline cartilage, in the movement of the joint.

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[8]

[Total : 14]

**[Turn over**

**6** Read the passage below then answer the questions which follow.

*Burrhus Skinner had no particular desire to watch animals. He was simply curious to discover as much as possible about how behaviour changes. To him, animals were a means to an end. He perfected a device, rather like an automated puzzle-box, in which a confined animal could record its own activity. By learning to press a lever when a light bulb shone, a rat or pigeon obtained a small pellet of food. Once the apparatus was set up, no one needed to watch the creature because its lever-pressing activity was displayed on ticker tape. The Skinner Box had many advantages. Several such boxes could provide huge amounts of information which could be collected by an untrained assistant.*

*Skinner made some surprising discoveries using his boxes. For example, he found one day that he was short of food pellets and needed to ration the rewards. He programmed one of his boxes to dispense a pellet after much lever pressing, rather than after each press. Skinner incorrectly thought that the pigeon would lose interest because the food would appear too infrequently. The bird worked even harder for its infrequent rewards, attacking the lever with enthusiasm. He realised that the scheduling of food rewards had a profound effect upon the speed of learning. Lever pressing was most heavily reinforced by infrequent rewards.*

**(a)** Explain why Skinner's methods allowed easy collection of numerical data.

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**(b)** Describe the relationship between frequency of rewards and speed of learning in Skinner's experiment.

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**(c)** In this example, the behaviour of the rat or pigeon changed because the animal linked or associated a stimulus and a response. Identify the stimulus and the response involved in this experiment.

stimulus ...........................................................................................................................

response .....................................................................................................................[2]

**(d)** Name the term that is used for the type of behaviour (of the rat or pigeon) referred to in the passage.

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**(e)** Suggest **two** criticisms, implied in this passage, which could be made of Skinner's work.

1 ...........................................................................................................................................

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2 ...........................................................................................................................................

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Wolfgang Kohler, a German zoologist, is famous for his studies of insight learning in mammals, such as chimpanzees.

**(f)** Describe how Kohler's methods of investigation differed in principle from those of Skinner.

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[Total : 12]