Control and co-ordination in mammals

Question Paper 3

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Control and co-ordination
Sub Topic	Control and co-ordination in mammals
Booklet	Theory
Paper Type	Question Paper 3

Time Allowed : **82 minutes**

Score : **/ 68**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a)** Outline the ways in which the endocrine **and** nervous systems carry out their roles in control and coordination in animals. [8]

(b) Describe the part played by auxins in apical dominance in a plant shoot. [7]

[Total: 15]

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2 **(a)** Fig. 3.1 shows a drawing of a section through an ovarian follicle.

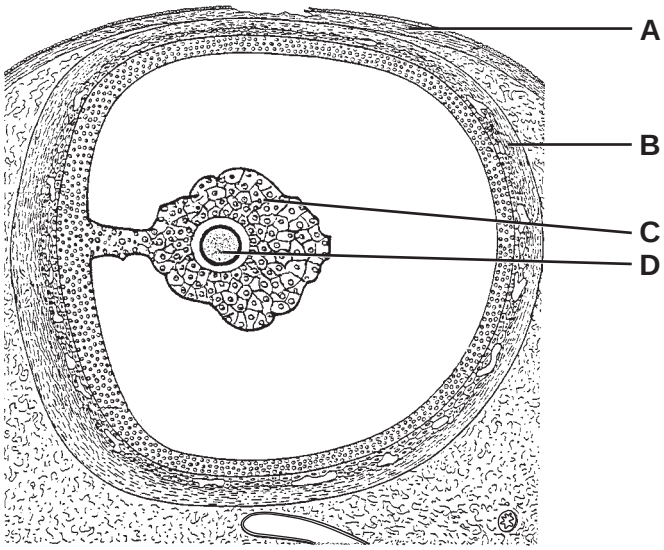

Fig. 3.1

State the names of the parts labelled **A**-**D** in Fig. 3.1.

A .....

B .....

C .....

D ..... [4]

(b) Outline the biological basis of the effect of the oestrogen/progesterone contraceptive pill.

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(c) The zona pellucida of an oocyte is made up of ZP proteins. ZP3, which does not occur anywhere else in the body, has a complex tertiary structure and acts as a receptor for sperm during fertilisation.

A new method of contraception, which does not involve the use of hormones, is in the early stages of development. It involves blocking the expression of the gene coding for ZP3.

(i) Explain how blocking the expression of the gene coding for ZP3 acts as a contraceptive.

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(ii) Explain why it is desirable to devise a method of contraception that does not involve oestrogen and progesterone.

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(iii) Explain why it is important, when blocking the expression of the gene coding for ZP3, that ZP3 is only found in the zona pellucida.

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[Total: 15]

3 Fig. 4.1 is a photomicrograph of a transverse section through the leaf of a C4 plant.

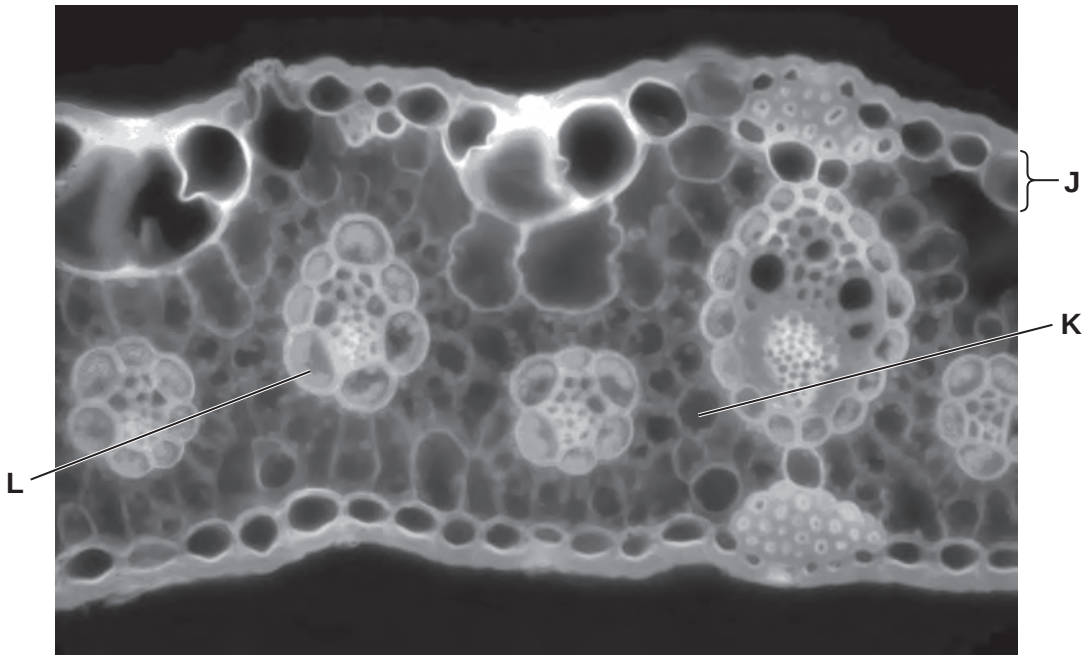

Fig. 4.1

(a) **(i)** Identify structures **J** to **L**.

J .....

K .....

L ..... [3]

(ii) Outline how this leaf anatomy adapts the plant for high rates of carbon fixation at high temperatures.

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(b) Sorghum is a C4 plant and *Sorghum bicolor* is a major food crop in dry tropical regions. The leaves of *S. bicolor* are covered with a layer of wax made up of a mixture of esters and free fatty acids, with a melting point of 77–85 °C. Waxes from the leaves of non-tropical plants tend to have melting points lower than this. For example, wax from the bayberry, *Myrica* sp., has a melting point of 45 °C.

Suggest how the wax on sorghum leaves helps the plant to survive in dry, tropical regions.

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(c) An investigation was carried out into the response of sorghum to being kept at a low temperature for a short period of time. Soybean plants, which are better adapted than sorghum for growth in subtropical and temperate climates, were used for comparison.

Plants of sorghum and soybean were kept at 25 °C for several weeks and then at 10 °C for three days. The temperature was then increased to 25 °C again for seven days. Day length, light intensity and carbon dioxide concentration were kept constant throughout.

The uptake of carbon dioxide, as mg CO_2 absorbed per gram of leaf dry mass, was measured

- at 25 °C before cooling
- on each of the three days at 10 °C
- for seven days at 25 °C.

The results are shown in Table 4.1.

Table 4.1

plant	carbon dioxide uptake / mg CO_2 g^{-1}				
	at 25 °C, before cooling	at 10 °C			at 25 °C (mean over days 4 to 10)
		day 1	day 2	day 3	
sorghum	48.2	5.5	2.9	1.2	1.5
soybean	23.2	5.2	3.1	1.6	6.4

(i) Compare the **changes** in carbon dioxide uptake in sorghum and soybean during the three days at 10 °C.

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(ii) During the cooling period, the ultrastructure of the sorghum chloroplasts changed. The membranes of the thylakoids moved closer together, eliminating the spaces between them. The size and number of grana became reduced.

Explain how these changes could be responsible for the low rate of carbon dioxide uptake by sorghum even when returned to a temperature of 25 °C.

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[Total: 15]

4 Follicle stimulating hormone (FSH) and luteinising hormone (LH) both consist of two polypeptide chains, the α and β chains.

- The α chains of FSH and LH are identical.
- The β chain of FSH has 111 amino acids and that of LH 121 amino acids.
- FSH and LH bind to different receptors in the cell surface membranes of their target cells.
- This binding leads to steroid synthesis by the target cells.

(a) Explain why FSH does not bind to a LH receptor.

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(b) Name the cells of a human female that carry

(i) FSH receptors .....

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(ii) LH receptors. .....

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(c) Describe what happens when FSH binds to its receptors on its target cells.

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[Total: 8]

5 **(a)** Describe the structure of a myelinated sensory neurone. [7]

(b) Explain how an action potential is transmitted along a sensory neurone. [8]

[Total: 15]

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