

# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

## **SENIOR CERTIFICATE EXAMINATION - 2006**

**BIOLOGY P2**

**HIGHER GRADE**

**FEBRUARY/MARCH 2006**

**306-1/2 E**

**Marks: 200**

**2 Hours**

**This question paper consists of 18 pages.**

BIOLOGY HG: Paper 2



306 1 2E

HG

**X05**





**INSTRUCTIONS AND INFORMATION TO CANDIDATES**

Read the following carefully before answering the questions:

1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answer to each question at the top of a new page.
4. Number the answers exactly as the questions are numbered.
5. Write neatly and legibly.
6. If answers are not presented according to the instructions of each question, candidates will lose marks.
7. ALL drawings should be done in pencil and labelled in ink.
8. Only draw diagrams and flow charts when requested to do so.
9. The diagrams in the question paper may not necessarily be drawn to scale.
10. The use of graph paper is NOT permitted.
11. Non-programmable calculators, protractors and compasses may be used.

**SECTION A****QUESTION 1**

1.1 Various possible answers are provided for each question. Indicate the correct answer by writing only the **letter** of your choice next to the relevant question number.

1.1.1 Urine cannot be pushed back through the ureters into the kidney under normal conditions, because ...

- A the pressure in the bladder cannot increase to that extent.
- B the kidneys are situated too high above the bladder.
- C valves close the ureters when the bladder is filled.
- D of the high concentration of urine in the kidneys.

1.1.2 Which of the following consists of perforated capillaries and is in close contact with podocytes?

- A Renal calyx
- B Proximal convoluted tubule
- C Loop of Henlé
- D Glomerulus

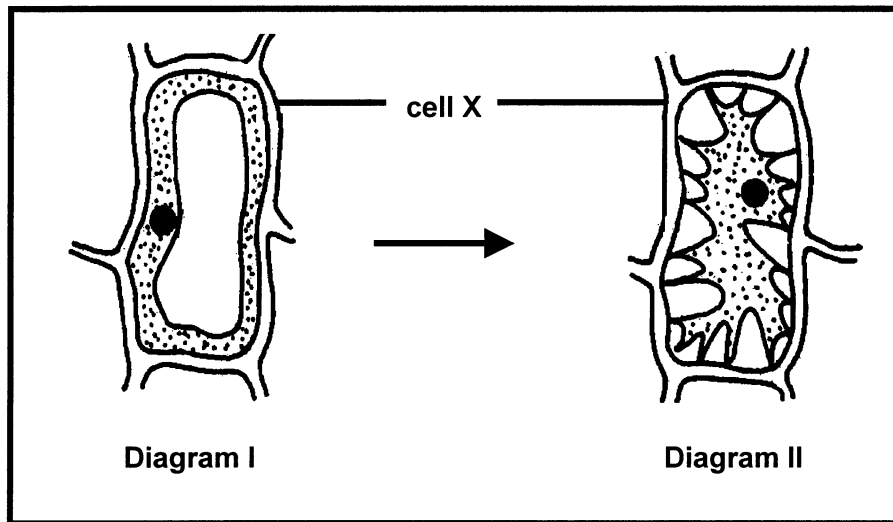
1.1.3 Which of the following functions as an endocrine gland only?

- A Sweat gland
- B Thyroid
- C Pancreas
- D Hypothalamus

1.1.4 A patient experiences slight visual and speech disturbances after a serious head injury. Which section of the brain was possibly damaged?

- A Cerebrum
- B Cerebellum
- C Hypothalamus
- D Medulla oblongata

1.1.5 Study the diagrams below.



Cell X has undergone physical changes from Diagram I to Diagram II. Which of the following statements are TRUE about cell X in Diagram II?

- (i) Cell X was boiled
- (ii) Cell X was exposed to very hot and dry conditions
- (iii) Cell X was placed in an isotonic solution
- (iv) Exosmosis has taken place in cell X

- A (i), (ii) and (iv)
- B (ii) and (iii)
- C (i) and (iv)
- D (ii) and (iv)

1.1.6 Two statements are provided below.

Statement I	Statement II
Stomata are mainly closed at night.	Water moves as a result of a higher water potential in the guard cells to adjacent cells.

Which ONE of the following is correct for Statements I and II?

- A Statement I is true, Statement II is false
- B Statement I is false, Statement II is true
- C Statements I and II are true, but Statement II does not explain Statement I correctly
- D Statement I and Statement II are true, and Statement II explains Statement I correctly

1.1.7 Which of the following pairs of body functions are normally involuntary actions but can be controlled voluntarily for short periods of time?

- A Heartbeat and blood pressure
- B Blinking of the eye and the mechanism of breathing
- C Contraction of skeletal muscles and pupil size
- D Control of body temperature and shivering

1.1.8 Which of the following are functions of adrenalin?

- A Influences the pupil size and controls the amount of water lost by the body through the kidneys
- B Increases the blood sugar level and blood pressure
- C Decreases metabolic rate and blood sugar levels
- D Affects growth and increases muscle tone

(8 x 2) (16)

- 1.2 Give the correct **biological term** for each of the following descriptions. Write only the **term** next to the relevant question number.
- 1.2.1 The pressure which develops in plant cells due to endosmosis
- 1.2.2 The group of plants where the stomata are sunken into the fleshy leaves
- 1.2.3 The tube connecting the urinary bladder with the exterior
- 1.2.4 The maintenance of a constant internal environment in living organisms
- 1.2.5 The part of the renal tubule found between the proximal and the distal convoluted tubules
- 1.2.6 The mass of tissue which joins the two hemispheres of the cerebrum
- 1.2.7 The part of the autonomic nervous system that generally controls the resting functions of the body
- 1.2.8 The part of the nervous system made up of the brain and the spinal cord
- 1.2.9 Animals in which body temperature changes with that of the environment
- 1.2.10 A state of dormancy during cold winter months (10)
- 1.3 Indicate whether each of the statements in COLUMN I, applies to **A only**, **B only**, **both A and B** or **none** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the relevant question number.

	COLUMN I	COLUMN II
1.3.1	The ability of a solution to undergo osmosis	A Water potential B Cell wall pressure
1.3.2	Transport of water	A Xylem B Cell walls
1.3.3	Transports blood from the kidney	A Renal artery B Renal vein
1.3.4	Increases the loss of heat in mammals	A Shivering B Sweating
1.3.5	Blood plasma with a greatly reduced protein content flowing in vessels	A Lymph B Tissue fluid

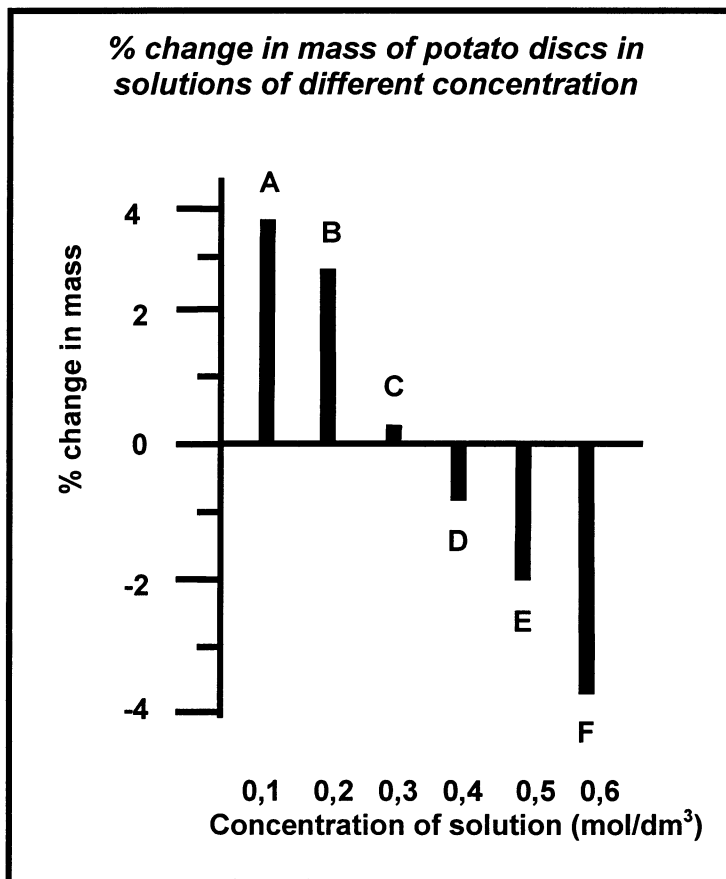
(5 x 2) (10)

1.4 A group of students carried out an investigation on osmosis.

They proceeded as follows:

- Thin discs of potato were cut and separated into batches of ten.
- Each batch (A, B, C, D, E and F) was weighed and placed into six different concentrations of salt solutions.
- Fifteen minutes later the discs of each batch were removed and the surface liquid wiped off. The discs were then weighed again.

The results are shown in the graph below.



1.4.1 Explain each of the following precautionary procedures:

- (i) Drying the surface of the discs before re-weighing (2)
- (ii) The use of batches of 10 discs instead of a single disc (2)
- (iii) Waiting for 15 minutes before weighing the discs again (2)

1.4.2 Explain what has happened to the mass of the discs shown on the graph in batches:

- (i) A, B and C (1)
- (ii) D, E and F (1)



1.4.3 Explain the change mentioned in QUESTION 1.4.2(ii). (3)

1.4.4 Determine from the graph the concentration of salt solution at which there will be no change in the mass of the potato discs. (2)

1.4.5 Explain why the percentage change in mass, and not the actual change in mass is recorded in the graph. (2)  
(15)

1.5 In Diagram I below, the growing point of a shoot is separated from the rest of the plant by a piece of plastic. It is then exposed to light from one side only.

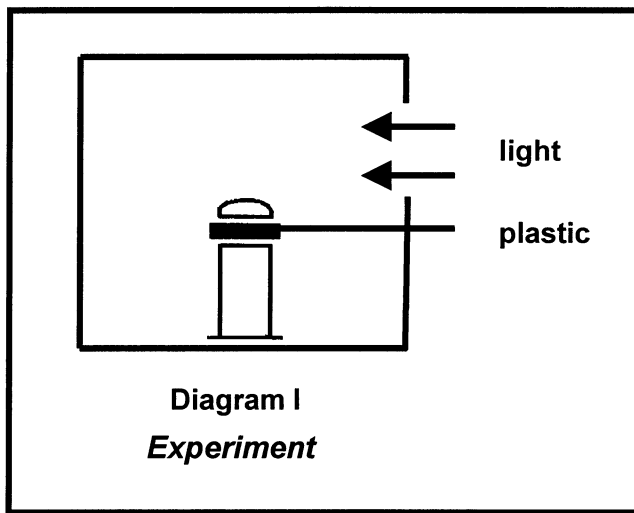
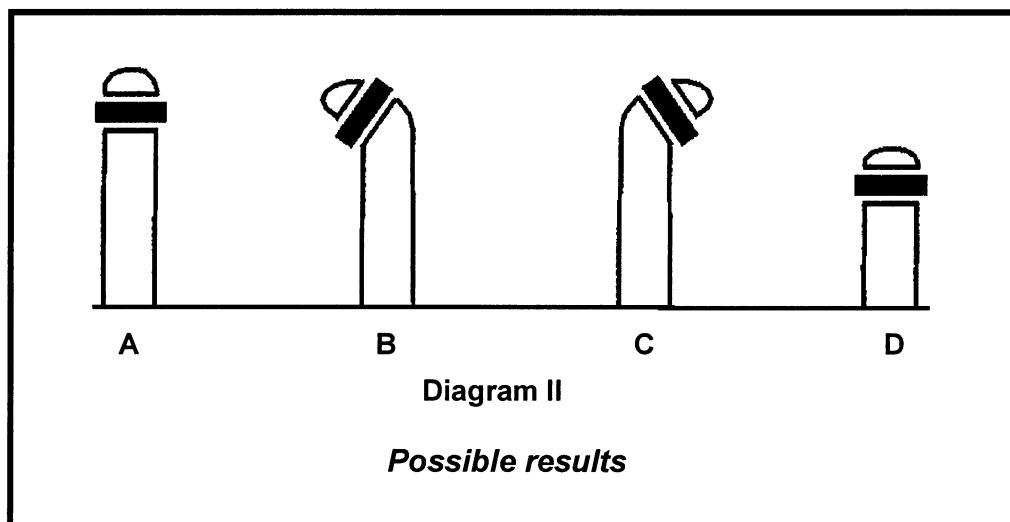


Diagram II below shows possible results.



1.5.1 Which growth hormone is being investigated? (1)

- 1.5.2 (i) Which letter (A, B, C or D) from Diagram II, shows the correct result expected after three or four days? (1)
- (ii) Explain your answer in QUESTION 1.5.2(i). (3)
- 1.5.3 (i) Filter paper is permeable to the hormone being investigated. If the same experiment was repeated with a thin piece of filter paper instead of a piece of plastic, which letter (A, B, C or D) from Diagram II would then show the correct result? (1)
- (ii) Explain your answer in QUESTION 1.5.3(i). (3)
- (9)

**TOTAL QUESTION 1: 60**

**TOTAL SECTION A: 60**

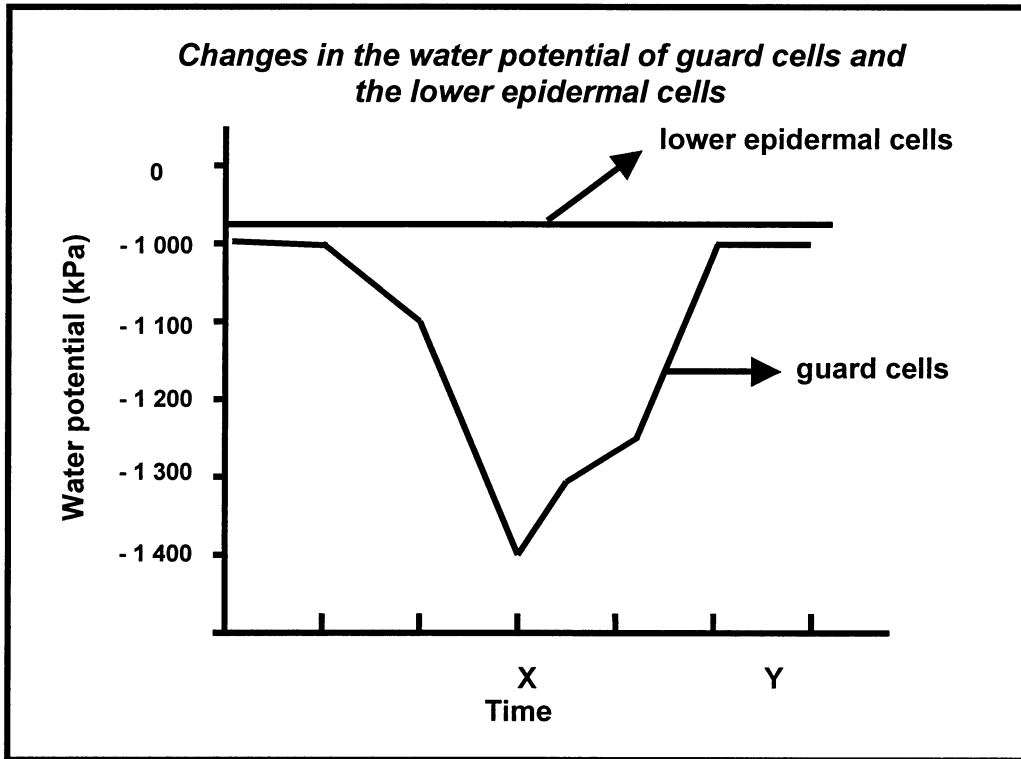
**SECTION B****QUESTION 2**

- 2.1 The rate of water loss from the leaves of a potted plant can be measured by determining the mass of the plant at one-hour intervals. An investigation was done to determine the effect of light intensity on the rate of water loss. At each light intensity the apparatus was left for 15 minutes before determining the mass. The loss of water was then determined and recorded in the following table:

Light intensities (kilolux)	Loss of water (g/hour)
0	1
10	15
20	20
30	22
40	22

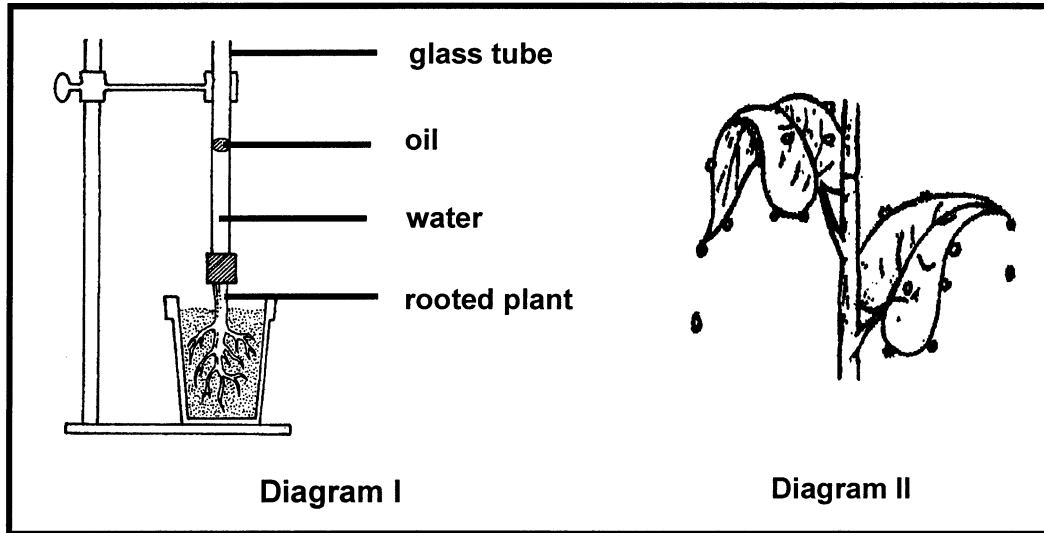
- 2.1.1 Describe ONE way in which the reliability of the results could be improved at each light intensity. (2)
- 2.1.2 Draw a line graph showing water loss at different light intensities. (11)
- 2.1.3 Explain why the water loss at 30 kilolux and 40 kilolux is the same. (3)
- (16)**

2.2 Study the graph below and answer the questions that follow.



- 2.2.1 State the main difference between the graphs for the lower epidermal cells and for the guard cells. (2)
  - 2.2.2 What is the water potential of the guard cells at time X? (2)
  - 2.2.3 Will the stomata of the plant be open or closed at time Y? Explain your answer. (3)
- (7)**

2.3 Study the diagrams below and answer the questions that follow.



2.3.1 Name the process illustrated in:

- (i) Diagram I (1)
- (ii) Diagram II (1)

2.3.2 What is the purpose of oil in Diagram I? (2)

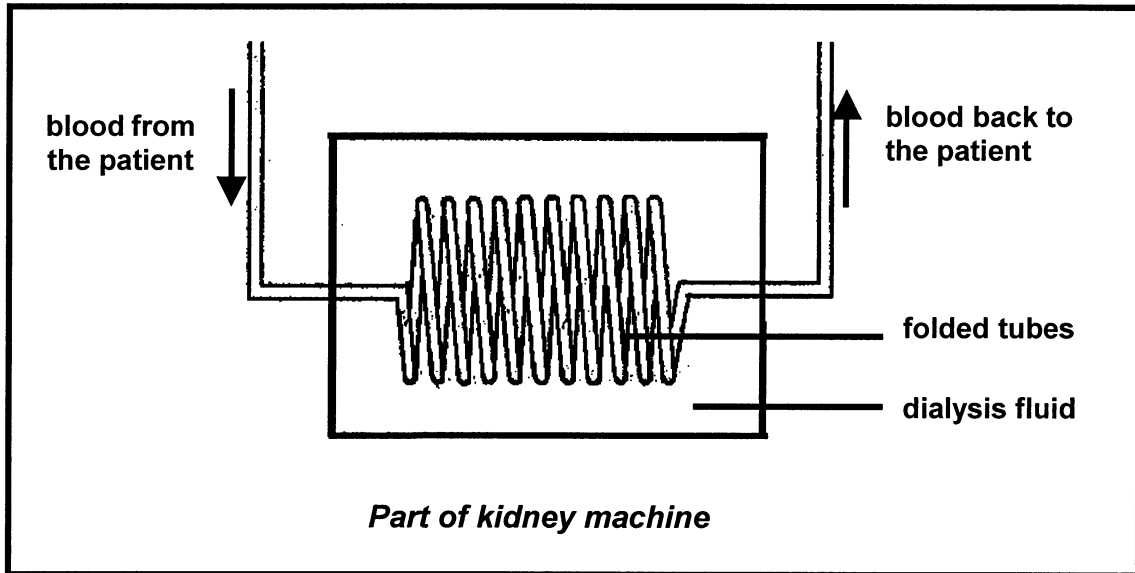
2.3.3 List FOUR environmental factors which will favour the process mentioned in QUESTION 2.3.1(ii). (4)

2.3.4 Explain the significance of the process in Diagram I for the process in Diagram II. (4)  
(12)

**TOTAL QUESTION 2: 35**

**QUESTION 3**

- 3.1 The diagram below shows a part of a kidney machine which is used in cases of kidney failure. Study the diagram and answer the questions that follow.



- 3.1.1 Explain why the tubes are folded rather than straight. (2)
- 3.1.2 Explain ONE requirement that the material which makes up the folded tubes, should meet to ensure effective functioning. (2)
- 3.1.3 Describe the composition of the dialysis fluid for the effective functioning of the kidney machine. (4)
- 3.1.4 Give TWO reasons why a successful kidney transplant would be better for a patient than treatment on a kidney machine. (2)
- (10)**
- 3.2 Study the passage and table below and answer the questions that follow.

*Osmoregulation in a mammal ensures that the total volume of its blood plasma and the concentration of dissolved substances in the plasma and tissue fluids all remain constant. This is achieved in two basic ways; namely by controlling the amount of water and the amount of salt gained and lost by the body. An analysis of a person's daily input and output of water and salts reveals that the production of urine plays a large part in water and salt losses and it is no surprise to discover that humans and other mammals osmoregulate mainly by controlling the volume and concentration of their urine.*

**Adapted from: A-level Biology, WD Phillips and TJ Chilton**

**Typical daily input and output of water and salts for an adult person**

INPUT			OUTPUT	
Water (cm <sup>3</sup> per day)	diet	2 500	expired air	400
	respiration	500	sweat	900
			faeces	200
			urine	1 500
TOTAL	3 000	TOTAL	3 000	
Salts (g per day)	food	10,5	sweat	0,25
			faeces	0,25
			urine	10,00
	TOTAL	10,5	TOTAL	10,5

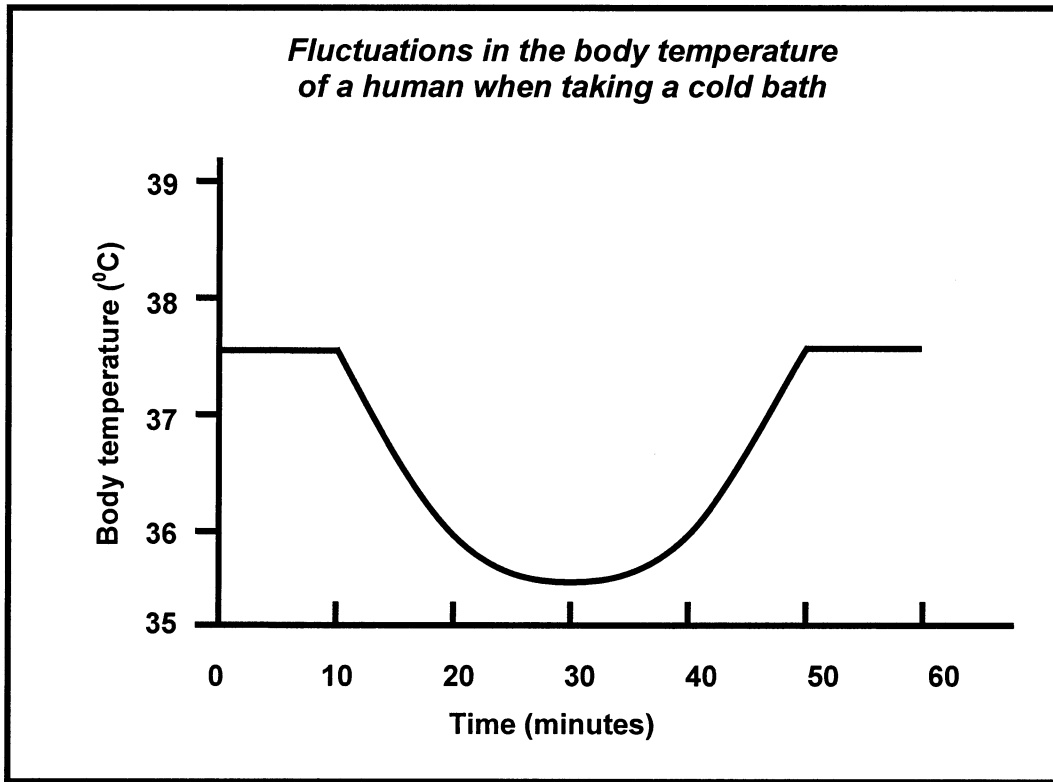
Adapted from: *A-level Biology*, WD Phillips and TJ Chilton

- 3.2.1 Which TWO substances work together to ensure homeostasis regarding osmoregulation in humans? (2)
- 3.2.2 Explain why the kidney, rather than the skin, plays a major role in osmoregulation. (6)
- 3.2.3 Calculate the water output in urine if the water output in sweat is 1 100 cm<sup>3</sup> per day while all the other inputs and outputs of water remain the same. (4)
- 3.2.4 (i) Give TWO conditions which may lead to a higher water output in sweat. (2)
- (ii) Explain the role of ADH under the conditions applicable in QUESTION 3.2.4(i). (6)
- 3.2.5 Explain why heart failure often results in renal failure. (3)
- 3.2.6 Explain why desert animals have a long loop of Henlé. (2)
- (25)**

**TOTAL QUESTION 3: 35**

**QUESTION 4**

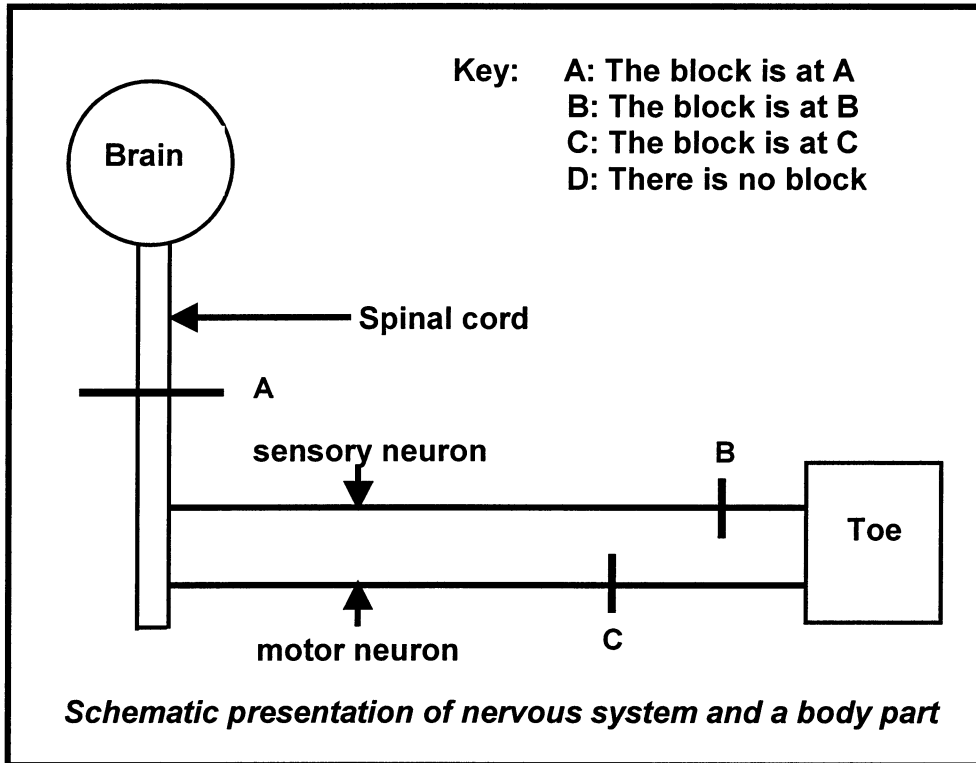
4.1 Study the graph below and answer the questions that follow.



- 4.1.1 What is the normal body temperature of this person? (2)
  - 4.1.2 How long did it take for the body temperature to return to normal? (2)
  - 4.1.3 Why did the body temperature of this person decrease? (2)
  - 4.1.4 Explain how shivering helps to maintain body temperature. (3)
  - 4.1.5 (i) Will you lose more heat through your thumbs or through your ears? (1)
  - (ii) Explain your answer in QUESTION 4.1.5(i). (2)
- (12)**
- 4.2 List THREE layers of the human eye. (3)
  - 4.3 Draw a labelled diagram of part of the human ear to show the air-filled cavities and the structures they contain. (9)



4.4 In the diagram below letters A, B, and C represent regions of the human nervous system that can be blocked by chemicals for medical reasons. Study the diagram and answer the questions that follow.



4.4.1 Write the **letter** (A, B, C or D) for each of the following statements, using the key given above:

- (i) When the skin of the toe is stimulated, the toe moves and the patient knows it is moving. (2)
- (ii) The patient can feel the toe being touched or pinched, but cannot move the toe. (2)
- (iii) When the skin of the toe is stimulated, the toe and foot move involuntarily, but the patient cannot move the toe voluntarily or feel it moving. (2)
- (iv) The patient can move the toe, but cannot feel the stimulus. (2)

4.4.2 List **THREE** ways in which the brain is protected. (3)  
 (11)

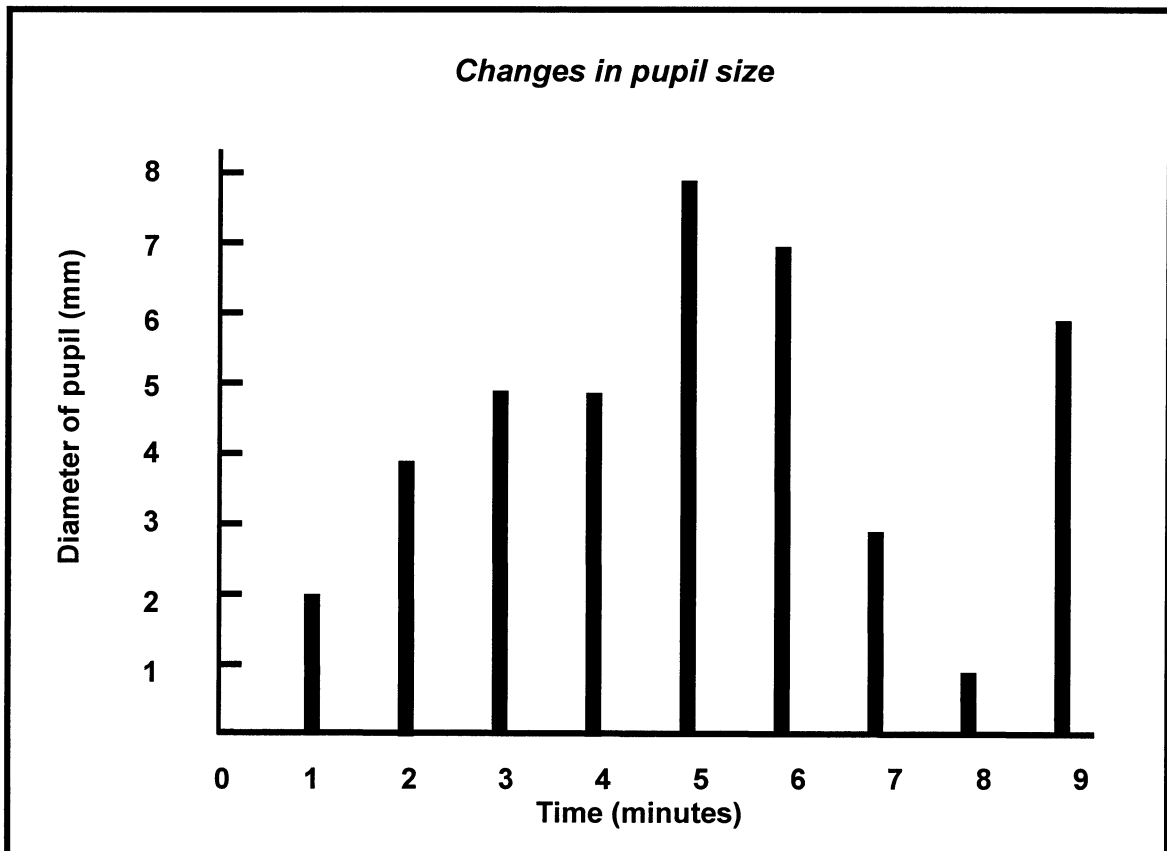
**TOTAL QUESTION 4: 35**

**TOTAL SECTION B: 105**

## SECTION C

## QUESTION 5

- 5.1 A person sitting in a darkened room covers one eye. A dim electric bulb, positioned at varying distances from the person is switched on at one-minute intervals for a period of 10 seconds. During this period the diameter of the pupil of the eye is measured. The results obtained are shown in the graph below. Study the graph and answer the questions that follow.



- 5.1.1 Which structure in the eye controls the size of the pupil? (1)
- 5.1.2 Between which TWO consecutive time intervals did the following changes in the diameter of the pupil occur?
- (i) Smallest increase (2)
  - (ii) Biggest decrease (2)
- 5.1.3 Why did the diameter of the pupil remain the same during the third and fourth time interval? (1)

- 5.1.4 At which time interval was the electric bulb the greatest distance away from the person? Explain your answer. (4)
- 5.1.5 Explain the pupillary mechanism for the period between the 8<sup>th</sup> and 9<sup>th</sup> minutes. (4)
- 5.1.6 Describe the general relationship that exists between the diameter of the pupil and the distance of the electric bulb from the eye. (2)
- 5.1.7 In which way does the pupil carry out a protective function in the eye? (1)  
(17)
- 5.2 A person walking barefoot stepped on a thorn with his left foot. He immediately withdrew his left foot, balancing himself on his right foot. Explain how the person managed to maintain balance and body position.

Contents: 15  
Synthesis: 3  
(18)

**TOTAL QUESTION 5: 35**

**TOTAL SECTION C: 35**

**GRAND TOTAL: 200**