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PREPARATORY EXAMINATION

2023

10831

LIFE SCIENCES

(PAPER 1)

TIME: 2½ hours

MARKS: 150

LIFE SCIENCES: Paper 1



10831E

17 pages

X05



INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answers to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. Do ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, flow charts or tables only when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You must use a non-programmable calculator, protractor and a compass, where necessary.
11. Write neatly and legibly.

SECTION A**QUESTION 1**

- 1.1 Four options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A – D) next to the question numbers (1.1.1 to 1.1.10) in the ANSWER BOOK, e.g. 1.1.11 D.

1.1.1 Which structure in an amniotic egg collects nitrogenous waste and assists in the exchange of gases?

- A Albumen
- B Allantois
- C Yolk
- D Shell

1.1.2 Colour vision in human eyes is the function of photoreceptor cells called ...

- A cones.
- B rods.
- C fovea.
- D the blind spot.

1.1.3 The target organ for aldosterone is the ...

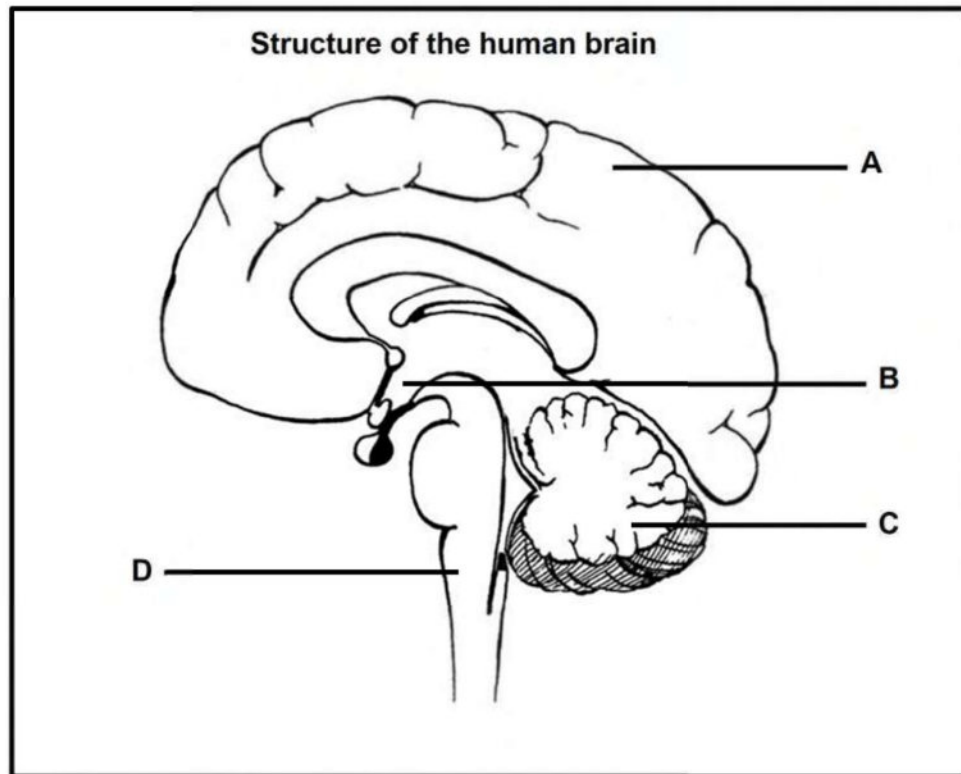
- A liver.
- B pituitary gland.
- C hypothalamus.
- D kidney.

QUESTIONS 1.1.4 AND 1.1.5 ARE **BASED ON THE PHOTOGRAPH BELOW, OF THE MAN TOUCHING THE WALL CLOCK.**



- 1.1.4 The man's condition is most likely caused by an over-secretion of ...
- A growth hormone.
 - B aldosterone.
 - C testosterone.
 - D glucagon.
- 1.1.5 Which gland secretes the hormone responsible for the man's condition?
- A Hypothalamus
 - B Pituitary gland
 - C Adrenal gland
 - D Thyroid gland

QUESTION 1.1.6 IS BASED ON THE DIAGRAM OF THE HUMAN BRAIN, BELOW.



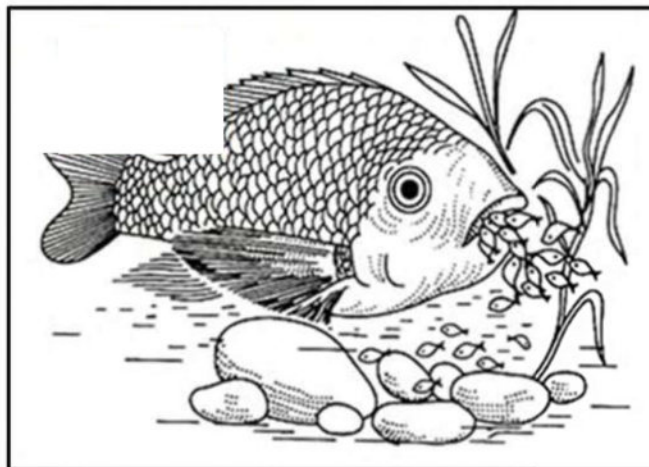
1.1.6 The part labelled **C** is called the ...

- A cerebellum.
- B spinal cord.
- C cerebrum.
- D pituitary gland.

1.1.7 The structure that controls the breathing rate is the ...

- A cerebellum.
- B cerebrum.
- C hypothalamus.
- D medulla oblongata.

- 1.1.8 Certain species of fish are mouth brooders. Mouth brooding is a strategy where parents keep the newly hatched fish in their mouths.



Mouth brooding is an example of ...

- A internal fertilisation.
 - B ovovivipary.
 - C parental care.
 - D vivipary.
- 1.1.9 The structure in the male reproductive system where sperm cells are stored and matured is called the ...
- A testis.
 - B epididymis.
 - C vas deferens.
 - D seminal vesicle.
- 1.1.10 Which of the following is the only type of embryonic development that is possible for organisms that have external fertilisation?
- A Ovipary
 - B Ovovivipary
 - C Vivipary
 - D Parental care

(10 x 2) (20)

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers (1.2.1 to 1.2.9) in the ANSWER BOOK.

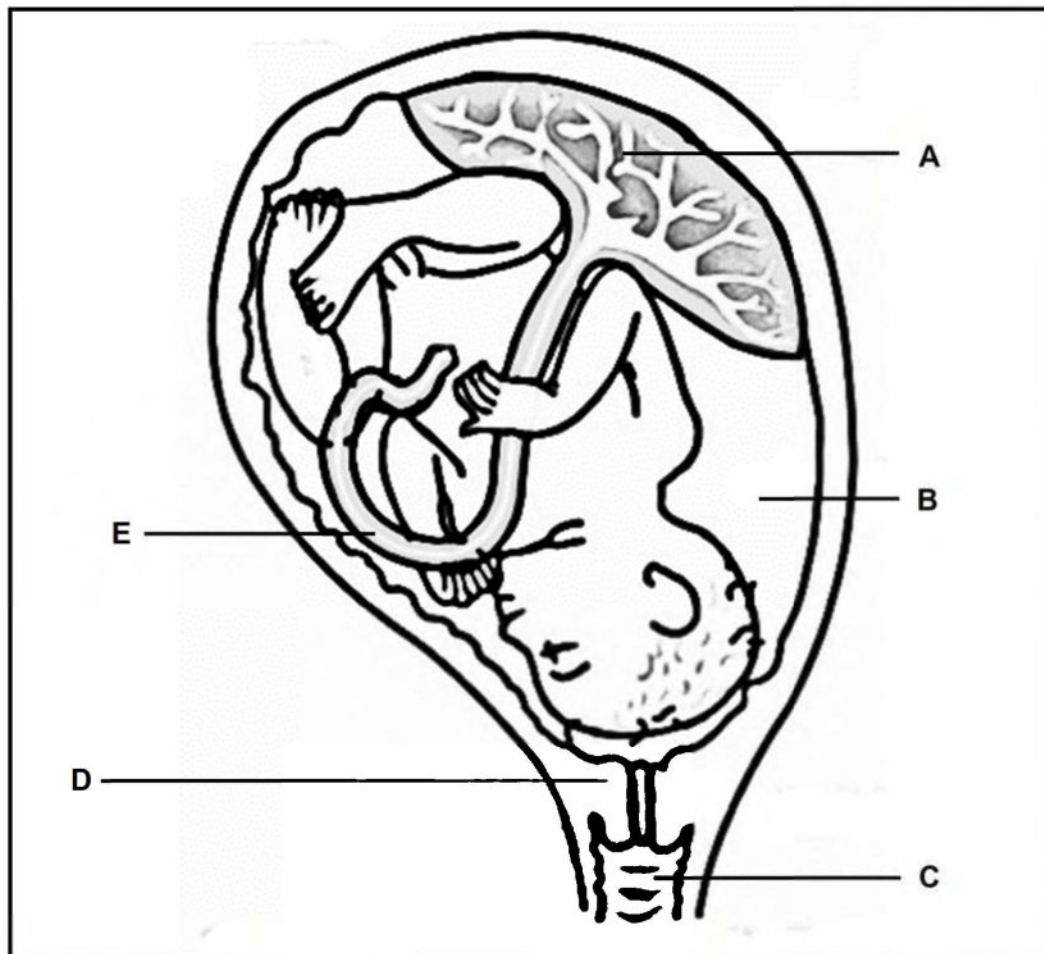
- 1.2.1 External opening of the vagina
- 1.2.2 A gland which secretes aldosterone
- 1.2.3 Maintaining a constant internal balance, irrespective of changes in the external or internal environment
- 1.2.4 A visual defect that occurs when the transparent lens becomes cloudy
- 1.2.5 The introduction of the penis into the vagina, followed by a discharge of semen
- 1.2.6 Site of fertilisation in humans
- 1.2.7 A gas that stimulates change in the breathing rate and heart rate
- 1.2.8 An enlarged thyroid gland due to under secretion of thyroxin
- 1.2.9 Developmental stage of the embryo consisting of a solid ball of cells
- (9 x 1) (9)

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 question numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 Increased abscisic acid	A Seeds germinate B Flowers develop
1.3.2 The outermost structure of a developing embryo	A Chorion B Amnion
1.3.3 Haploid cells are produced by meiosis.	A Oogenesis B Spermatogenesis

(3 x 2) (6)

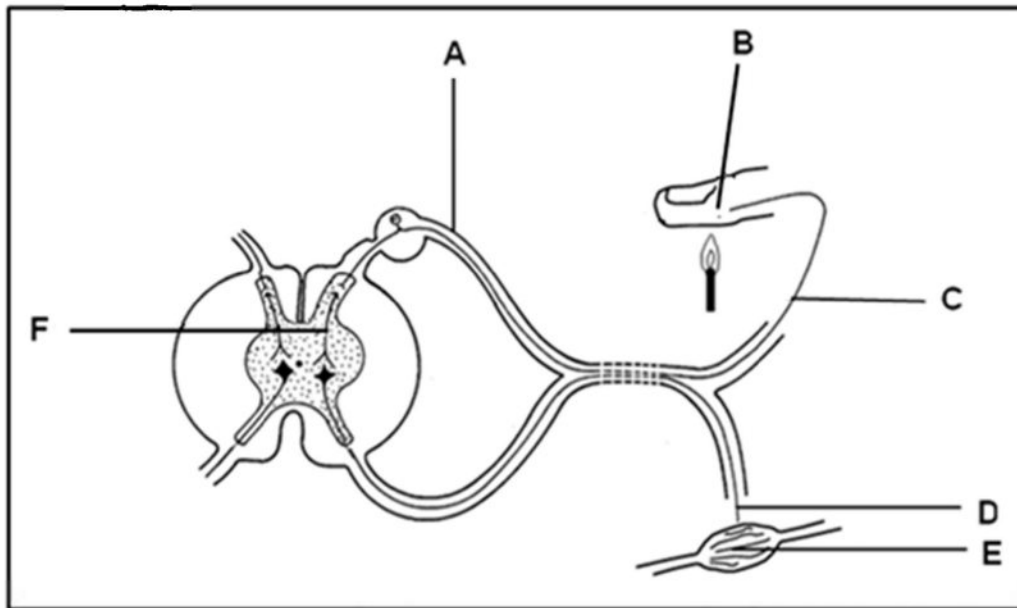
1.4 Study the diagram below that shows a human foetus at 34 weeks of gestation.



1.4.1 Provide the LETTER and NAME of the part:

- | | | |
|-----|--|------------|
| (a) | Where nutrients diffuse from the mother's blood to the foetal blood | (2) |
| (b) | That stretches or dilates to allow the foetus to be expelled during childbirth | (2) |
| (c) | That protects the foetus against temperature changes | (2) |
| | | (6) |

- 1.5 The diagram below represents a part of the human nervous system that involves impulses travelling via the spinal cord.



- 1.5.1 Name the pathway of the impulse represented by the diagram above. (1)
- 1.5.2 Give only the LETTER of the part that:
- (a) Contains the sensory neuron (1)
 - (b) Produces a reaction (1)
 - (c) Is responsible for converting a stimulus into an impulse (1)
- 1.5.3 Give the LETTERS of ALL the structures that represent neurons. (1)
- 1.5.4 Name the part of the neuron which transmits an impulse towards the cell body. (1)
- 1.5.5 Name TWO structures which protect the spinal cord. (2)
- 1.5.6 Which part of a neuron is affected by multiple sclerosis? (1)

(9)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

- 2.1 Scientists found that high sweat rates over prolonged work periods (8 to 12 hour-shifts) in the heat leads to water levels in the blood decreasing below normal. This eventually leads to dehydration, which causes reduced mental and physical performance and may pose a serious risk to health.

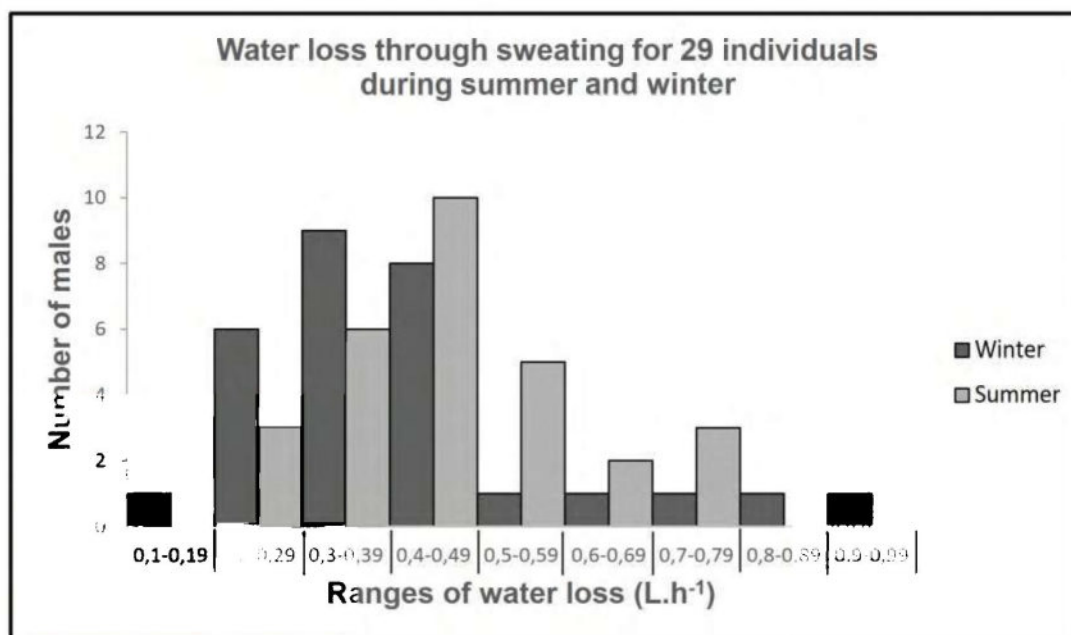
Scientists therefore carried out an investigation to determine the amount of sweat loss that an individual experiences during manual labour/exercise in summer and winter.

The subjects were 29 healthy, male, outdoor, manual workers (various trades) aged between 18 and 50 years. All agreed to participate in the study. Male subjects exercised in a temperature-controlled room on two consecutive days under both winter and summer conditions. Sweat collecting devices were attached to the upper arms and legs.

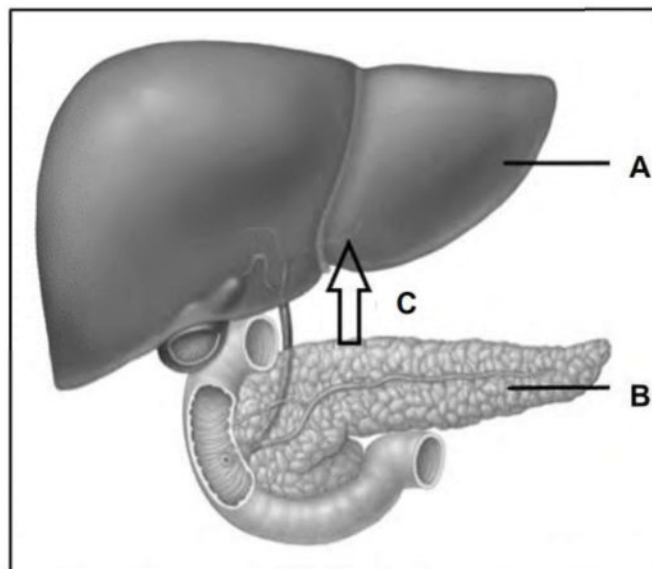
They found that the average water loss through sweating for the group was 0,47 litres per hour ($\text{L}\cdot\text{h}^{-1}$) in the summer compared with 0,41 litres per hour ($\text{L}\cdot\text{h}^{-1}$) in winter.

The graph below shows the number of males that fall into the different ranges of water loss, under summer and winter conditions.

[Adapted from: *Journal of Occupational Medicine and Toxicology*]



- 2.1.1 Use the text provided and state ONE effect of dehydration on the body. (1)
- 2.1.2 Give the water loss range that the largest number of males fell into under summer conditions. (1)
- 2.1.3 Describe how the body of a healthy person will try to prevent dehydration when the water levels in the blood decrease to below normal. (5)
- 2.1.4 Explain how the change in the average water loss through sweating, from winter to summer, affects body temperature. (4)
- 2.1.5 Suggest TWO ways in which a company can decrease the risk of dehydration for their workers. (2)
- (13)**
- 2.2 The diagram below shows an endocrine gland involved in regulating blood glucose levels. It shows the hormone it releases when blood glucose levels are high and one of the target organs of the hormone.



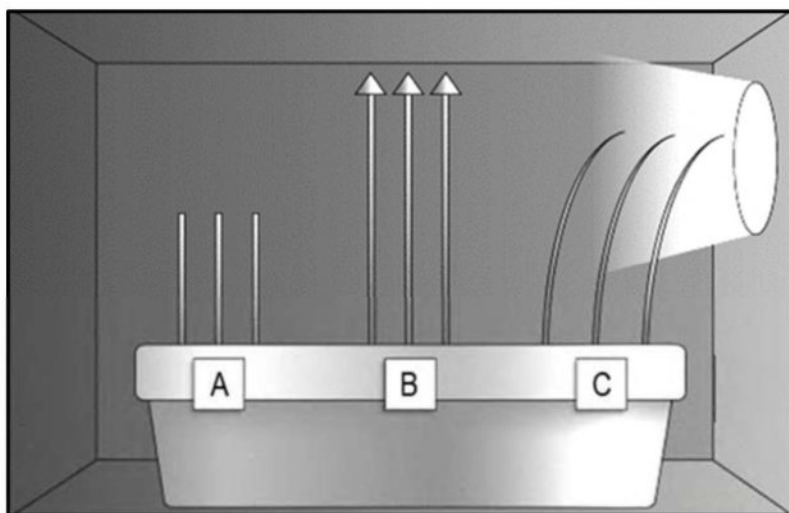
- 2.2.1 Identify each of the following:
- (a) Organs **A** and **B** (2)
- (b) Hormone **C** (1)
- 2.2.2 What is a *hormone*? (2)
- 2.2.3 Explain how a lack of hormone **C** affects blood glucose levels. (3)
- 2.2.4 List THREE other hormones that can directly or indirectly affect blood glucose levels. (3)

(11)

- 2.3 An investigation was conducted to determine the effect of a plant hormone and light on a plant's growth response.

The investigator placed nine plants (in groups of three) in a dark box with light entering on one side (unilateral light). The plants were all at the same height at the start of the investigation. In group **A** he removed the apical meristems, in group **B** he covered the apical meristems with foil and in group **C** the apical meristems remain untouched.

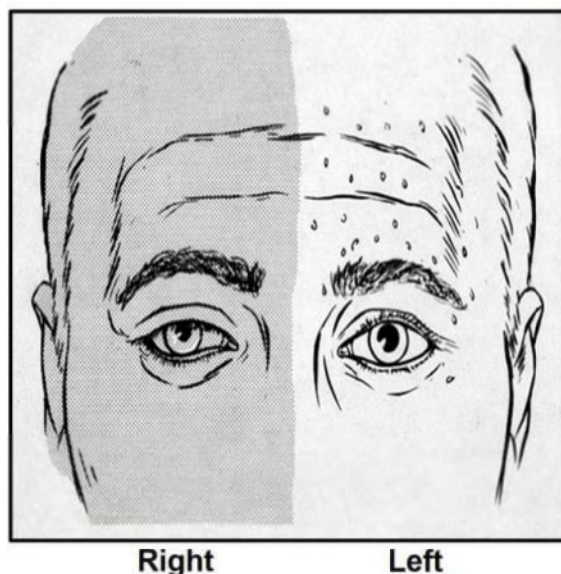
The diagram below represents what was observed after a week.



- 2.3.1 Give the term used to describe the plant growth response being investigated. (1)
- 2.3.2 Name the plant hormone involved in the growth response mentioned in QUESTION 2.3.1 (1)
- 2.3.3 Give the letters (**A**, **B** or **C**) of the groups which are NOT affected by unilateral light. (2)
- 2.3.4 Explain why the plants in group **C** bent towards the light. (4)
- 2.3.5 Explain ONE way in which the removal of the apical meristem of a plant is financially beneficial to a citrus farmer. (3)
- (11)**

- 2.4 Horner syndrome (*Oculosympathetic palsy*) is a condition that negatively affects parts of the sympathetic nervous response in the face and eye on one side of the body, and is caused by a disruptive nerve in the brain.

This condition may lead to decreased pupil size, a drooping eyelid and decreased sweating on the affected side of the face. Horner syndrome however, does not affect a person's ability to focus on an object (near or far).



- 2.4.1 Which side of the face shown above is affected by Horner syndrome? (1)
- 2.4.2 Give ONE reason for your answer in QUESTION 2.4.1 by referring to the text and the diagram. (1)
- 2.4.3 Name the part of the brain which interprets what you see. (1)
- 2.4.4 Name the part of the nervous system which controls the pupillary reflex. (1)
- 2.4.5 Describe the risk that the decreased pupil size in Horner syndrome may pose to a driver at night. (2)
- 2.4.6 Tabulate TWO differences between the functions of adrenalin and the parasympathetic nervous system. (5)
- 2.4.7 Name and describe the process which allows a person with Horner syndrome to focus clearly on an object which was far away and is now less than 6 m from them. (4)

(15)
[50]

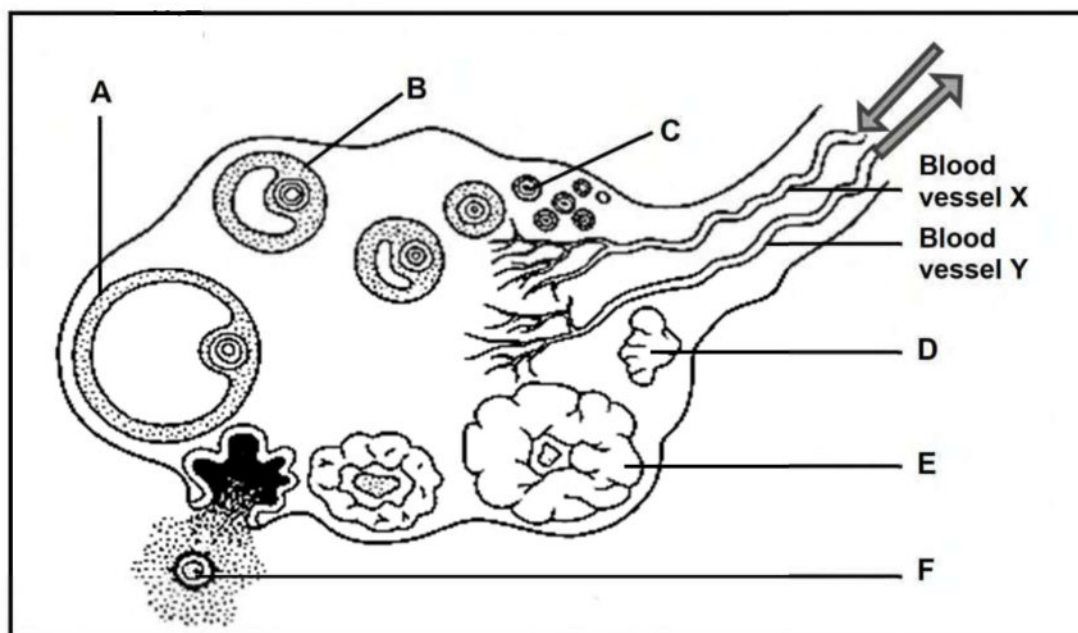
QUESTION 3

- 3.1 Testosterone is responsible for a number of secondary sexual characteristics in males, including the growth of beards. A group of learners hypothesised that a greater density of beard growth will be found in men with an increased concentration of testosterone. They got male volunteers with different facial hair density, and they measured the amount of testosterone for each. The results of the study are shown below:

Density of hair growth (Hair follicles per cm ²)	Measured testosterone level (µg)
30	0,52
40	0,53
50	0,52
60	0,51
70	0,53

- 3.1.1 List TWO other secondary sexual characteristics that are unique to males. (2)
- 3.1.2 State a suitable aim for this investigation. (2)
- 3.1.3 Suggest THREE variables regarding the males that learners should have kept the same to increase the validity of the investigation. (3)
- 3.1.4 Calculate the average testosterone level. Show all calculation steps. (3)
- 3.1.5 Was the learners' hypothesis accepted or rejected? Explain your answer. (2)
- (12)**

- 3.2 The diagram below shows a part of the menstrual cycle in humans. The arrows represent the direction of blood flow.



- 3.2.1 Identify structure **C**. (1)
- 3.2.2 Name the cycle, shown in the diagram above, which forms part of the menstrual cycle. (1)
- 3.2.3 Arrange the letters **A – E** in the correct sequence of their appearance in the cycle named in QUESTION 3.2.2. (2)
- 3.2.4 Draw a labelled diagram of gamete **F** and identify it in the caption. (4)
- 3.2.5 A high concentration of which TWO reproductive hormones will be ...
- (a) supplied by blood vessel **X**? (2)
 - (b) transported to other structures by blood vessel **Y**? (2)
- 3.2.6 Explain how the formation of structure **D** will lead to the start of the next menstrual cycle. (3)
- (15)**

- 3.3 Hearing loss is a partial or total inability to hear in one or both ears. It can occur when there is a problem with the auditory system which may be caused by exposure to loud noise, aging, infection, or it may be hereditary. Hearing loss is diagnosed when hearing tests find that a person is unable to hear sounds under 25 decibels in at least one ear.

Sound intensity is measured in decibels (dB). The lower the decibels the softer the sound and the higher the decibels, the louder the sound. The information below shows the minimum audible sound intensity ranges used to classify different hearing abilities.

- Normal hearing (0 – 25 dB)
- Mild hearing loss (26 – 40 dB)
- Moderate hearing loss (41 – 70 dB)
- Severe hearing loss (71 – 90 dB)
- Profound hearing loss (greater than 90 dB)

Researchers have reported the effect of hearing aids on audible sound intensity over a twelve-month period for persons diagnosed with severe hearing loss. The amplification of the hearing aid was adjusted (increased) every 3 months and the audible sound intensity tested. The results are shown in the table below.

Time (Months)	Minimum audible sound intensity (dB)
3	78
6	41
9	30
12	15

- 3.3.1 Name the part of the ear that:

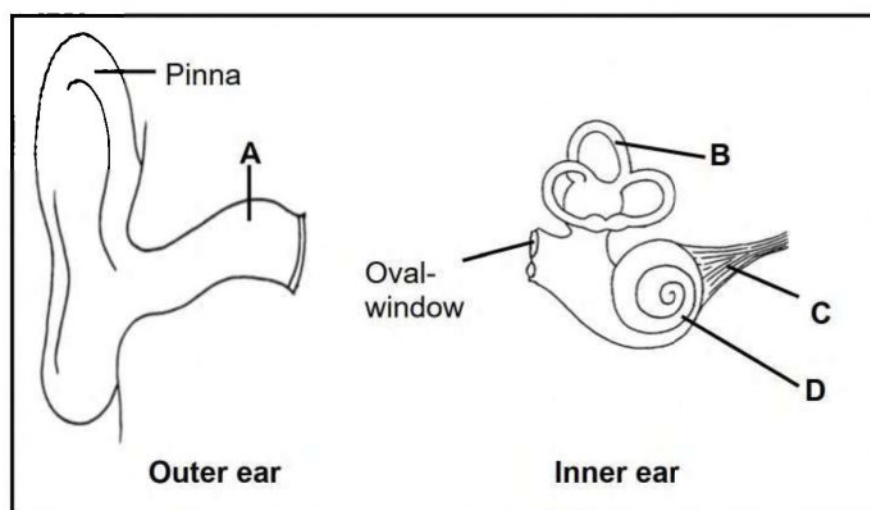
- (a) Amplifies sound vibrations by means of bone tissue (1)
- (b) Contains the receptor for hearing (1)

- 3.3.2 Explain how hearing loss is caused by a damaged eardrum. (4)

- 3.3.3 Give evidence which shows that increasing the amplification of the hearing aid improved the person's hearing after 12 months. (1)

- 3.3.4 Use the information in the table to plot a bar graph. (6)
- (13)

3.4 The diagram below shows the outer and inner ear of humans.



3.4.1 Give the LETTER of the part that:

- (a) Transmits impulses to the brain (1)
- (b) Produces wax (1)
- (c) Has structures that are arranged at right angles to each other (1)

3.4.2 Describe the role of the middle ear in equalising air pressure. (2)

3.4.3 Explain how part **B** of the inner ear is involved in restoring balance when a person trips over a brick. (5)

(10)

[50]

TOTAL SECTION B: 100

TOTAL: 150