GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

2021

10831

LIFE SCIENCES

PAPER 1

TIME: 2½ hours

MARKS: 150

17 pages

X05

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answers to EACH question on 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. Make 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 may use a non-programmable calculator, protractor and a compass where necessary.
11. Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various 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 number (1.1.1 to 1.1.8) in the ANSWER BOOK, for example 1.1.9 D.

1.1.1 Which part of a neuron transmits an impulse towards the cell body?

A Dendrite
B Cytoplasm
C Axon
D Nucleus

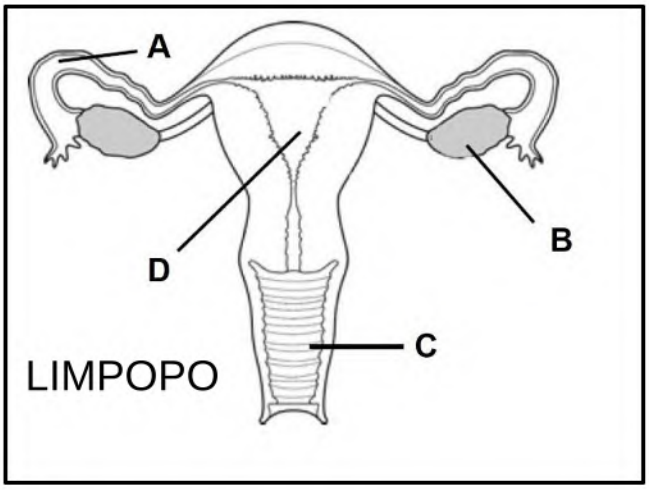
1.1.2 What is the gland that secretes insulin called?

A Thyroid
B Hypothalamus
C Pituitary/Hypophysis
D Pancreas

1.1.3 Which of the following structures in an amniotic egg protects the developing embryo from physical injury?

A Yolk sac
B Chorion
C Allantois
D Shell

1.1.4 Which labelled structures indicate the place where fertilization and implantation occur?



A **A** and **D**
B **A** and **B**
C **B** and **C**
D **B** and **D**

1.1.5 Study the following factors related to reproduction in females:

(i) When progesterone levels peak, FSH and LH levels are low.

(ii) Ovulation occurs at around day 14.

(iii) When fertilization occurs, FSH levels remain high.

(iv) Oestrogen and progesterone produced by the ovaries during the ovarian cycle influence the uterine cycle.

The correct statements are ...

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

1.1.6 Which of the following represents the correct sequence of development, after fertilization has taken place?

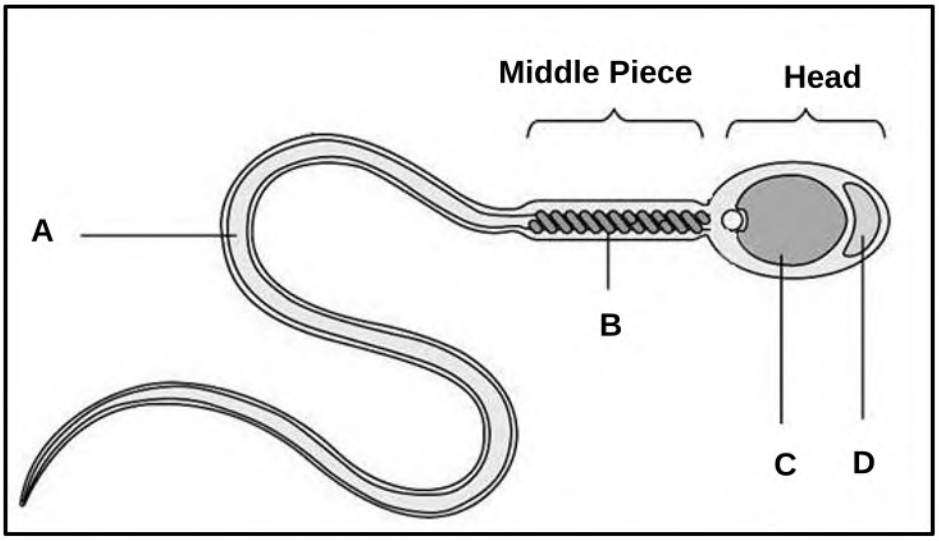
A Ovum → Zygote → Blastocyst → Morula → Foetus

B Zygote → Morula → Blastocyst → Foetus

C Ovum → Zygote → Morula → Blastocyst → Foetus

D Zygote → Blastocyst → Morula → Foetus

Use the diagram below to answer the QUESTION 1.1.7 and QUESTION 1.1.8.



1.1.7 The only part of the sperm cell that enters the ovum during fertilization is …

A part **D**.
B part **C**.
C part **B**.
D part **A**.

1.1.8 The parts of the sperm cell that assist the sperm with movement are …

A parts **A**, **B** and **C**.
B parts, **A** and **D**.
C parts **A** and **B**.
D parts **A**, **B** and **D**.

(8 x 2) **(16)**

1.2 Give the correct biological term for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.5) in the ANSWER BOOK.

1.2.1 A condition caused by the lens of the eye becoming cloudy

1.2.2 The part of the nervous system that responds when a person gets a fright

1.2.3 A phenomenon where the main central stem displays more growth than the side stems, at the tip of a tree

1.2.4 A type of development where young birds are born with their eyes closed and with no feathers

1.2.5 The structure that provides nutrients to the developing embryo in ovoviviparous animals

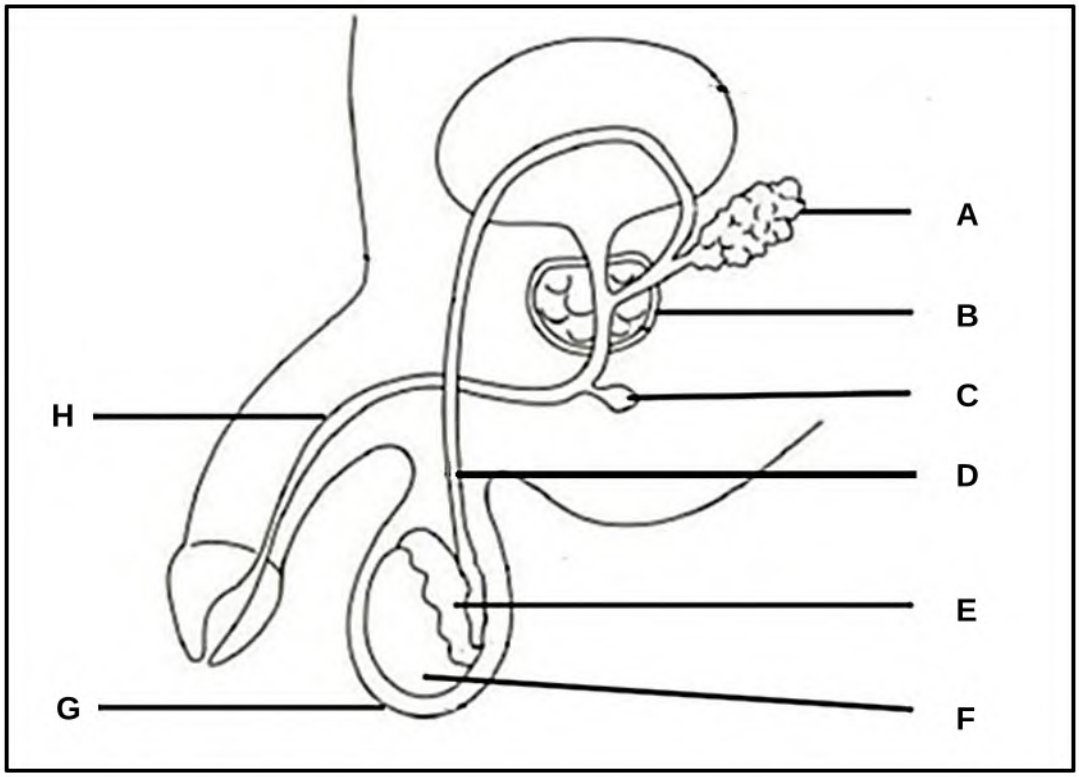
(5 x 1) **(5)**

1.3 Indicate whether each of the statements in COLUMN I apply 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 number (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	Hormone responsible for the falling off of ripe fruit	A B	Abscisic acid Gibberellins
1.3.2	Function/s of the allantois in an amniotic egg	A B	Involved in gaseous exchange Stores excretory waste from the developing embryo
1.3.3	A fish, laying eggs prior to fertilization	A B	External fertilization Ovipary

(3 x 2) **(6)**

1.4 The diagram below represents the human male reproductive system.



1.4.1 Give the LETTER of the part that is associated with each of the following statements:

(a) Temporarily stores sperm (1)

(b) If cut, semen will not contain sperm cells (1)

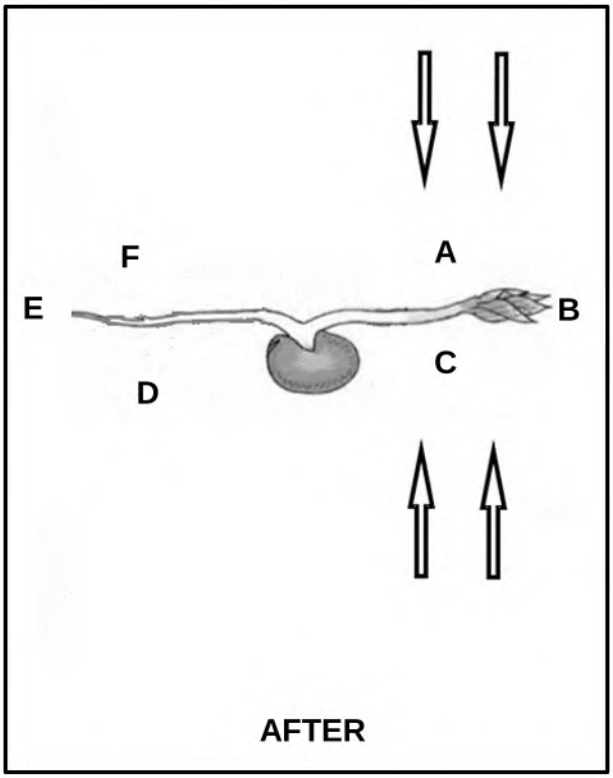
(c) Transports both urine and semen (1)

(d) Assists in optimum sperm production at a temperature lower than body temperature (1)

(e) Produces testosterone (1)

(f) Secretes alkaline fluid which neutralises the acidity of the vagina, which would kill sperm (1)
(6)

1.5 A young seedling was removed from the soil and placed on its side. Once placed on its side, the shoot excluding the tip, was exposed to light from all directions (indicated by the arrows), to prevent phototropism.



1.5.1 Name the hormone which stimulates seed germination. (1)

1.5.2 Name the tropic movement that will be observed in the seedling above, after it was placed on its side. (1)

1.5.3 Give the LETTER/S of the area/s where:

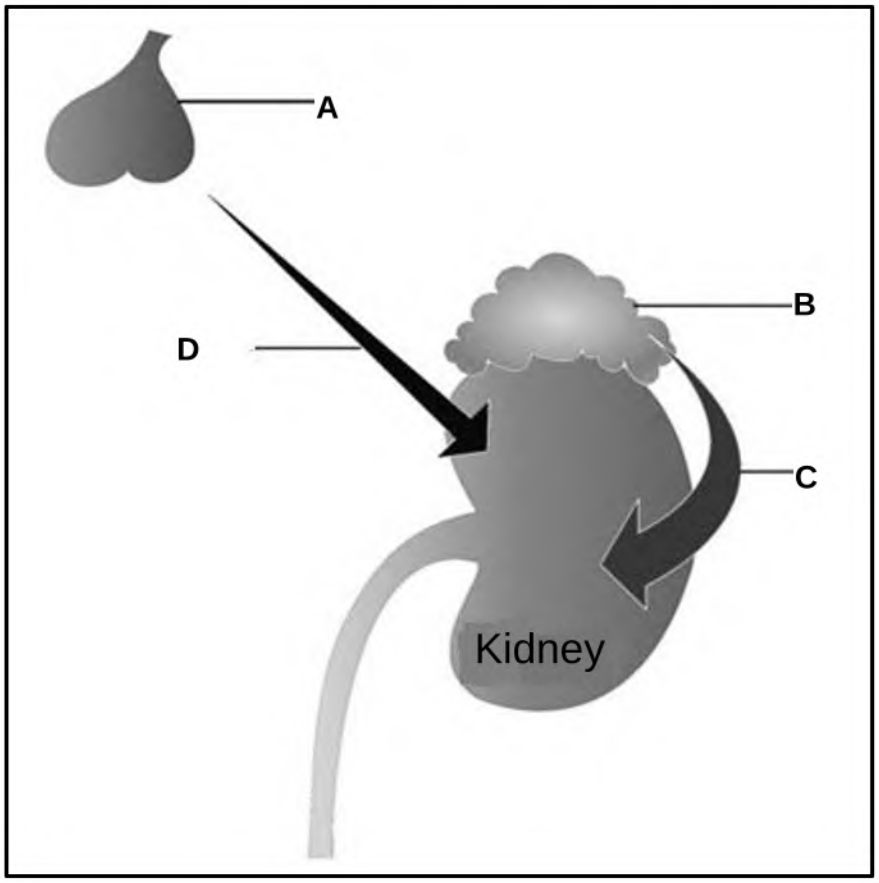
(a) The seedling had the highest concentration of auxins BEFORE being placed on its side (2)

(b) The seedling would have the highest concentration of auxins AFTER being placed on its side (2)

(c) Cell elongation would be inhibited in the shoot (2)

1.5.4 Name TWO defence mechanisms used by plants to stop herbivores from eating them. (2)
(10)

1.6 The diagram below shows different glands, the hormones they release and their target organs.



1.6.1 Identify each of the following:

(a) The glands labelled **A** and **B** (2)

(b) The hormones labelled **C** and **D** (2)

1.6.2 Which substance in the body is regulated by hormone **C**? (1)

1.6.3 Name ONE other hormone released by gland **B**. (1)

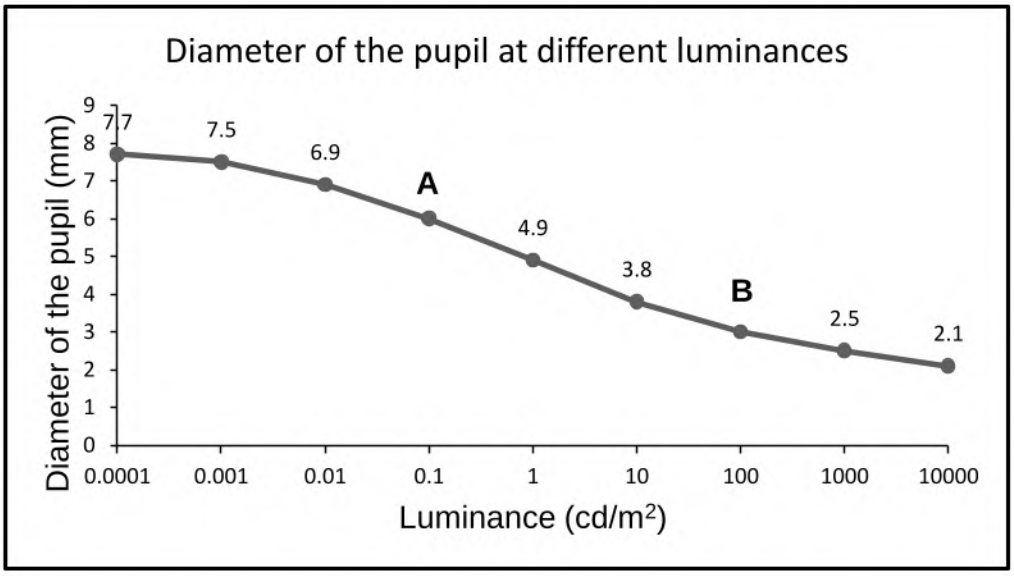
1.6.4 Give the term used to describe the regulation of a constant internal balance, even if the internal or external environment changes. (1)
(7)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The graph below shows changes in the diameter of the pupil under different luminances. Luminances refer to how bright the light is. The diameter of the pupil ranges from approximately 2 mm to 8 mm.



2.1.1 Give the diameter of the pupil at point **A**. (1)

2.1.2 Calculate the average diameter of the pupil using only the points indicated between **A** and **B** on the graph. (Show all working.) (3)

2.1.3 Describe the relationship between luminance and the diameter of the pupil from point **A** to point **B**. (2)

2.1.4 Explain the role that pupillary reflex plays in changing the diameter of the pupil from point **A** to point **B**. (3)

2.1.5 Define each of the following:

(a) *Luminance* (1)

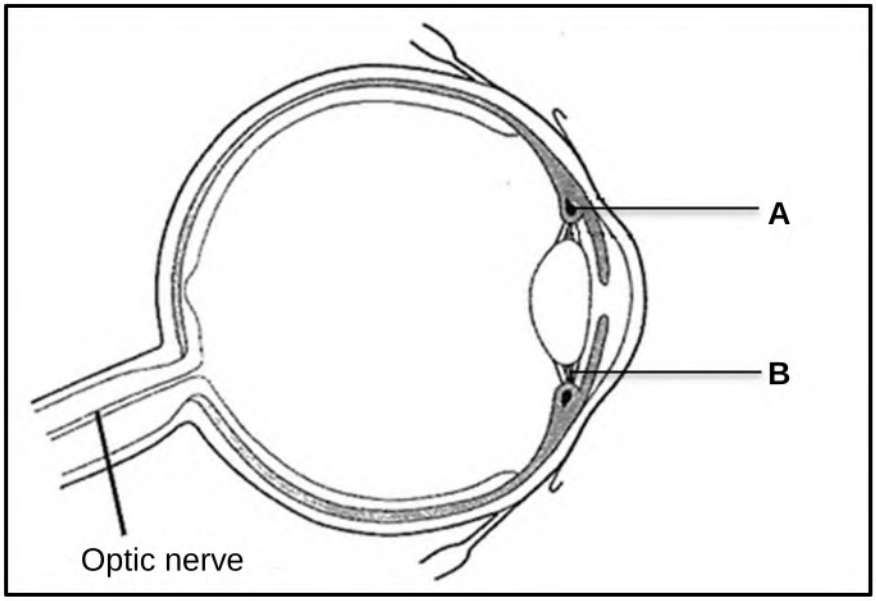
(b) *A reflex action* (2)

2.1.6 The beam of light from a laser pointer has a high enough luminance to burn any receptor cell in the retina in about 10 seconds.

Explain how shining a laser pointer directly onto the retina for more than 10 seconds, will affect your eyesight. (3)

(15)

2.2 The diagram below shows the internal structure of the eye.



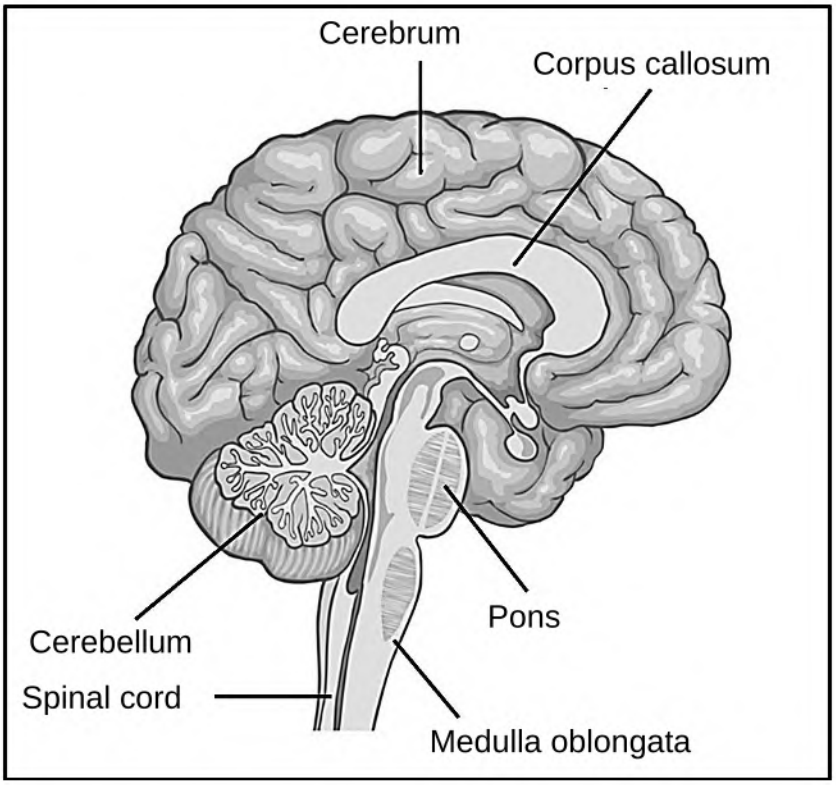
2.2.1 Identify the structures labelled **A** and **B**. (2)

2.2.2 The optic nerve is a sensory neuron.
Tabulate TWO differences between a *sensory neuron* and a *motor neuron*. (5)

2.2.3 Name the part of the nervous system which is composed of cranial and spinal nerves. (1)

2.2.4 Describe how structures **A** and **B** enable the ability to focus on objects further than 6 m away. (4)
(12)

2.3 The diagram below shows a section through the human brain.



2.3.1 Give ONE function for each of the following:

(a) The corpus callosum

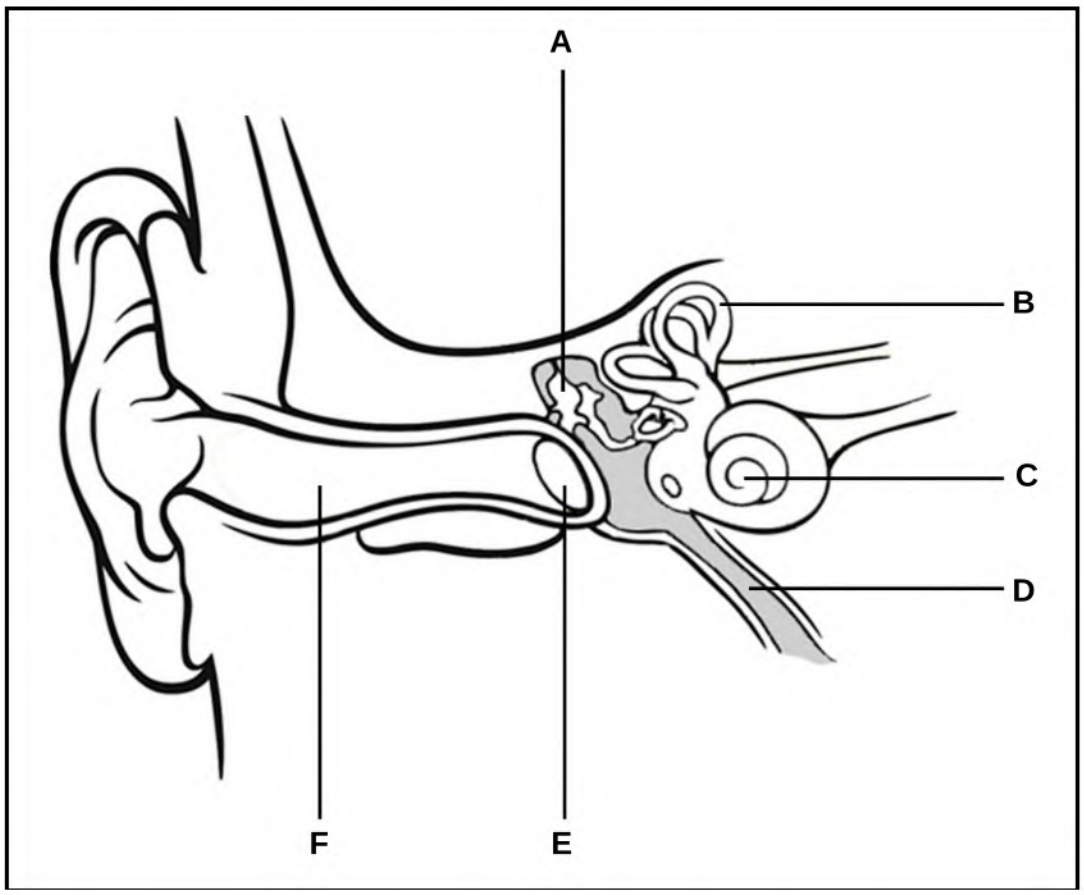
(b) The cerebrum

(c) The spinal cord (3)

2.3.2 Draw a labelled diagram of a simple reflex arc and indicate the direction in which the impulse travels. (5)

(8)

2.4 The diagram below shows the internal structure of the ear.



2.4.1 Give the LETTER and NAME of the part of the ear that:

(a) Allows air to move between the middle ear and the throat (2)

(b) Contains receptors for hearing (2)

(c) Is a membrane separating the outer ear from the middle ear (2)

(d) Is the first of three ossicles (2)

(e) Conducts sound waves from the pinna to the structure labelled **E** (2)

2.4.2 In a soccer match the goalkeeper dived to save a goal from being scored by the opposing team.

Describe the role of the semi-circular canals in maintaining balance as the goalkeeper dived. (5)

(15)

[50]

QUESTION 3

3.1 Read the extract below and answer the questions that follow.

> The Comrades Marathon is an ultra-marathon of approximately 89 kilometres which is run annually in the KwaZulu-Natal province between the cities of Durban and Pietermaritzburg. It is the world's largest and oldest ultra-marathon race. Athletes run up to 12 hours continually to complete the race. Runners train for many months and they carbo-load (consume a diet high in carbohydrates such as pastas and grains) in preparation for this race.

3.1.1 While running, an athlete's body temperature increases.

Describe the negative feedback mechanism that will restore the athlete's body temperature to normal. (6)

3.1.2 Explain the effect of running for long periods of time on each of the following:

(a) Water levels in the blood (2)
(b) Carbon dioxide levels in the blood (2)

3.1.3 Explain how carbo-loading before the race assists athletes to have enough energy during the race. (6)

(16)

3.2 Read the extract below and answer the questions that follow.

Tshepang read a WhatsApp message which stated: "Wearing a facemask increases the carbon dioxide levels in the blood and could lead to sickness." He decided to conduct an investigation to determine whether wearing a facemask increases the carbon dioxide levels in the blood.

- He could not afford a device that measures the carbon dioxide levels in the blood, so he decided to measure the pulse rate (indicates heart rate) and the breathing rate.
- He chose 10 classmates for the investigation.
- The breathing rate and pulse rate of each classmate was measured, after 4 hours of not wearing a facemask and again after 4 hours of wearing a facemask.

3.2.1 Identify the dependent variable in this investigation. (1)

3.2.2 State TWO variables which relate to the classmates and should be kept constant in order to ensure the validity of this investigation. (2)

3.2.3 Give TWO planning steps that Tshepang needed to consider before conducting his investigation. (2)

3.2.4 Explain how the breathing rate can be used to show an increase in the carbon dioxide levels in the blood. (4)
(9)

3.3 Read the extract below and answer the questions that follow.

How to optimise the chances of conception

It is estimated that one in five couples in South Africa are suffering from infertility and are experiencing difficulty in conceiving. Research has shown that conception (fertilization) is more likely to happen when intercourse takes place in the 3 or 4 days leading up to ovulation. Recent evidence has also shown that many women have a poor understanding of their menstrual cycle and the process of ovulation. Incorrect timing of intercourse is therefore thought to be a common, but easily correctable cause of difficulty in conceiving.

The introduction of home-based hormonal digital ovulation tests (DOTs) has at least provided a simple solution for women wishing to optimise the timing of intercourse when trying to conceive.

3.3.1 Give TWO reasons according to the passage, why women may have difficulty conceiving. (2)

3.3.2 The digital ovulation test monitors an increase in a specific hormone. Name this hormone. (1)

3.3.3 Name the gland that produces the hormone mentioned in QUESTION 3.3.2. (1)

3.3.4 Name the gland that releases a hormone which triggers ovulation. (1)

3.3.5 Give ONE reason why intercourse should take place 3 to 4 days before ovulation. (1)

3.3.6 Explain why the secretion of too little progesterone can pose an additional problem to a female trying to fall pregnant. (2)
(8)

3.4 An ultrasound (sonogram) is an imaging technique that uses sound waves to produce images of the foetus in the uterus. Dr Mkhize monitored the development of the foetus in one of her patients during pregnancy by measuring the foetal head circumference. She also monitored the blood flow along the umbilical cord.

The results are shown in the table below.

Time (weeks)	Head circumference (cm)
14	12
18	16
22	20
26	24
30	28
34	31
38	33
40	36

3.4.1 Give the correct biological term for pregnancy. (1)

3.4.2 Use the information in the table above to plot a line graph. (6)

3.4.3 Give THREE functions of the amniotic fluid that surrounds the foetus during pregnancy. (3)

3.4.4 List TWO structures through which the foetus will pass during natural birth. (2)

3.4.5 While doing the ultrasound, the doctor noticed that the umbilical arteries were blocked but there was normal blood flow through the umbilical vein.

Explain the effect that this will have on the developing foetus. (5)

(17)

[50]

TOTAL SECTION B: 100

TOTAL: 150

END

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2021

MARKING GUIDELINES

LIFE SCIENCES (PAPER 1) (10831)

12 pages

PRINCIPLES RELATING TO THE MARKING OF LIFE SCIENCES

1. **If more information than marks allocated is given**
   Stop marking when maximum marks are reached and place a wavy line and 'max' in the right-hand margin.

2. **If for example, three reasons are required and five are given**
   Mark the first three irrespective of whether all or some are correct/incorrect.

3. **If the whole process is given when only part of it is required**
   Read all and credit relevant parts.

4. **If comparisons are asked for, but descriptions are given**
   Accept if differences/similarities are clear.

5. **If tabulation is required but paragraphs are given**
   Candidates will lose marks for not tabulating.

6. **If diagrams are given with annotations when descriptions are required**
   Candidates will lose marks.

7. **If flow charts are given instead of descriptions**
   Candidates will lose marks.

8. **If sequence is muddled and links do not make sense**
   Where sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If sequence and links become correct again, resume credit.

9. **Non-recognised abbreviations**
   Accept if first defined in the answer. If not defined, do not credit the unrecognised abbreviation but credit the rest of the answer if correct.

10. **Wrong numbering**
    If answer fits into the correct sequence of questions but the wrong number is given, it is acceptable.

11. **If language used changes the intended meaning**
    Do not accept.

12. **Spelling errors**
    If recognisable, accept the answer, provided it does not mean something else in Life Sciences or if it is out of context.

13. **If common names are given in terminology**
Accept provided it was accepted at the memo discussion meeting.

14. **If only letter is asked for, but only name is given (and vice versa)**
Do not credit.

15. **If units are not given in measurements**
Candidates will lose marks. Memorandum will allocate marks for units separately.

16. **Be sensitive to the sense of an answer which may be stated in a different ways.**

17. **Caption.**
All illustrations (diagrams, drawings, graphs, tables, etc.) must have a caption.

18. **Code-switching of official languages (terms and concepts)**
A single word or two that appear(s) in any official language other than the learners' assessment language used to the greatest extent in the learners' answers should be credited if it is correct. A marker that is proficient in the relevant official language should be consulted. This is applicable to all official languages.

19. **Changes to the marking guidelines**
No changes may be made to the marking guidelines without consulting the provincial internal moderator.

SECTION A

QUESTION 1

1.1 1.1.1 A✓✓

1.1.2 D✓✓

1.1.3 D✓✓

1.1.4 A✓✓

1.1.5 D✓✓

1.1.6 B✓✓

1.1.7 B✓✓

1.1.8 C✓✓

(8 x 2) **(16)**

1.2 1.2.1 Cataract✓

1.2.2 Autonomic✓ (nervous system)/Sympathetic

1.2.3 Apical dominance✓

1.2.4 Altricial✓

1.2.5 Yolk✓/Albumen

(5 x 1) **(5)**

1.3 1.3.1 A Only✓✓

1.3.2 B Only✓✓

1.3.3 Both A and B✓✓

(3 x 2) **(6)**

1.4	1.4.1	(a)	E✓	(1)
		(b)	D✓	(1)
		(c)	H✓	(1)
		(d)	G✓	(1)
		(e)	F✓	(1)
		(f)	A✓	(1)
				(6)
1.5	1.5.1		Gibberellins✓	(1)
	1.5.2		Geotropism✓	(1)
	1.5.3	(a)	B✓ and E✓/E and B	(2)
		(b)	B✓ and D✓/D and B	(2)
		(c)	A ✓ and C ✓/C and A	(2)
	1.5.4		Chemical✓ Mechanical✓/thorns	(2)
				(10)
1.6	1.6.1	(a)	A – Pituitary✓/Hypophysis B – Adrenal✓gland	(2)
		(b)	C – Aldosterone✓ D – ADH✓/Anti-diuretic hormone	(2)
	1.6.2		Salt✓/Sodium	(1)
	1.6.3		Adrenalin✓	(1)
	1.6.4		Homeostasis✓	(1)
				(7)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 2.1.1 6 mm✓ (1)

2.1.2 $\frac{4,9 \text{ mm} + 3,8\checkmark \text{ mm}}{2\checkmark}$ **OR** $\frac{8,7\checkmark}{2\checkmark}$

= 4,35✓ mm (3)

2.1.3 As the luminance increases, the diameter of the pupil decreases. ✓✓ (2)

2.1.4
- In the iris,✓
- the circular muscles contract,✓
- the radial muscles relax,✓
- diameter of the pupil decreases✓/pupil constricts,
- less light enters the eye. ✓ (Any 3) (3)

2.1.5 (a) How bright the light is✓ (1)

(b) A fast✓, involuntary/automatic response✓ to a stimulus. (2)

2.1.6
- Cone cells/rod cells/photoreceptors will be damaged, ✓
- no stimulus will be picked up, ✓
- no impulse will be created. ✓
- No impulse is sent along the optic nerve,✓
- and no interpretation takes place in the cerebrum. ✓
- Vision will be impaired ✓*

(Any 2 + 1* Compulsory) (3)

(15)

2.2 2.2.1 A – Ciliary muscles✓
B – Suspensory ligaments✓ (2)

2.2.2

Sensory Neuron	Motor Neuron
Carries an impulse towards the central nervous system ✓/ afferent neuron.	Carries an impulse away from the central nervous system ✓/efferent neuron.
Has only one dendrite/ unipolar.✓	Has many dendrites/multipolar.✓
Both the dendrite and axon are myelinated. ✓	Only the axon is myelinated. ✓
Makes up only part of white matter. ✓	Makes up part of white and grey matter. ✓
Found in dorsal root.✓	Found in ventral root.✓
Shorter axon✓	Longer axon✓

(Mark first TWO only) (2 x 2 + 1 Table) (5)

2.2.3 Peripheral✓ (1)

2.2.4
- Structure A/ciliary muscle is relaxed, ✓
- Structure B/suspensory ligaments are tight/taut.✓
- The tension on the lens is increased. ✓
- The lens is less convex/flatter. ✓
- The refractive power of the lens will be decreased✓/light rays are refracted less. (Any 4) (4)

(12)

2.3 2.3.1 (a)
- Joins the two hemispheres✓ of the cerebrum
- Allows for communication between the two hemispheres✓ of the cerebrum.

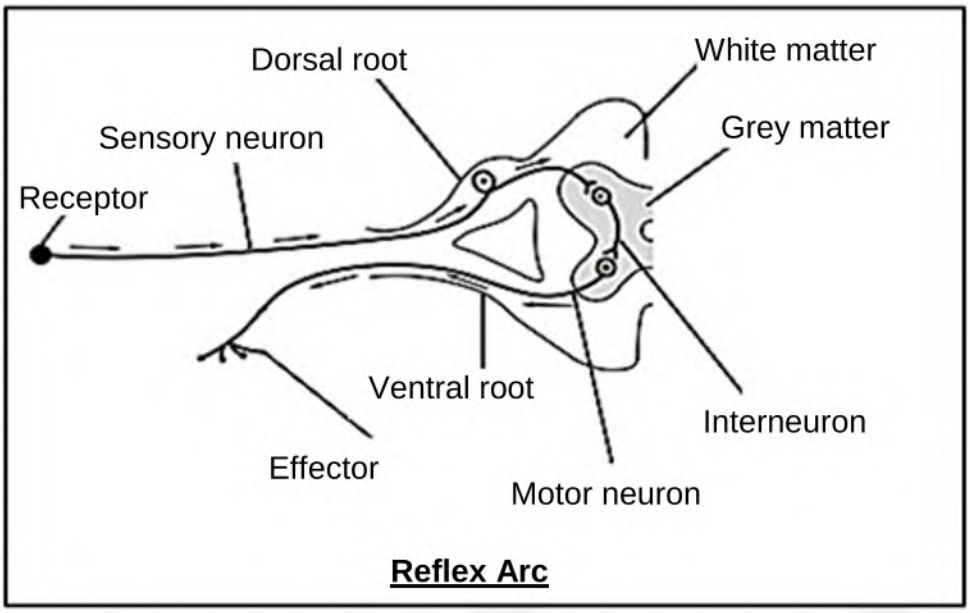
(Mark first ONE only) (Any 1) (1)

(b)
- Controls voluntary actions.✓
- Receives and interprets sensations from sense organs✓
- Higher thought processes✓

(Mark first ONE only) (Any 1) (1)

(c) Transmits impulses between the peripheral nerves and brain.✓/ Allows for reflex actions to take place. (1)

2.3.2



Reflex Arc

Criteria for assessing diagram:

Neurons positioned correctly in diagram	**(P)**	1
Correct direction of the impulses indicated	**(D)**	1
Any TWO correct labels	**(L)**	2
Caption	**(C)**	1

NOTE: Diagram may be drawn on the right or left side of the spinal cord. (5)

(8)

2.4 2.4.1 (a) D✓ – Eustachian tube✓ (2)

(b) C✓ – Cochlea✓  (2)

(c) E✓ – Tympanic membrane✓/Eardrum (2)

(d) A✓ – Malleus✓/Hammer (2)

(e) F✓ – Auditory canal✓/Ear canal (2)

2.4.2
- The cristae,✓ in the semi-circular canal
- are stimulated by changes in speed and direction, ✓
- as the head moves when the goalkeeper dives. ✓
- This causes the endolymph in the semi-circular canals to move. ✓
- The cristae convert the stimuli to nerve impulses. ✓
- The nerve impulses are transported along the auditory nerve, ✓
- to the cerebellum ✓to be interpreted. (Any 5) (5)

(15)

[50]

QUESTION 3

3.1 3.1.1
- The hypothalamus is stimulated,✓
- and sends impulses to the blood vessels of the skin.✓
- Blood vessels dilate ✓/blood vessels become wider/vasodilation occurs.
- More blood flows to the surface of the skin.✓
- More heat is lost,✓
- through radiation ✓from the skin.
- More blood is sent to the sweat glands. ✓
- Sweat glands become more active. ✓/More sweat is released.
- Evaporation of the sweat cools (the skin). ✓ (Any 6) (6)

3.1.2 (a)
- (Blood water content) will decrease✓
- due to increased sweating.✓ (2)

(b)
- (Blood CO_2 levels) will increase✓
- due to increased respiration✓ in the muscle cells. (2)

3.1.3
- When carbo-loading before the race,
- excess carbohydrates/glucose is stored,✓
- as glycogen✓/fats.
- While running there is increased cellular respiration,✓
- this decreases the blood glucose level✓/uses up glucose.
- The stored glycogen in the liver✓/muscles,
- is converted to glucose,✓
- when glucagon is secreted,✓
- by the islets of Langerhans✓/pancreas. (Any 6) (6)

(16)

3.2 3.2.1 CO_2 levels✓ (1)

3.2.2 The same:
- Age✓
- Sex ✓
- Level of fitness✓/health
- Weight✓
- Levels of activity✓
- Diet✓

(Mark first TWO only) (2)

3.2.3
- Get permission from school/parents/volunteers.✓

Decide:
- which variables need to be controlled✓
- what method will be used✓
- what equipment will be needed✓
- how the result will be recorded✓
- what safety measures will be needed✓
- a date/time when the investigation would be carried out✓

(Mark first TWO only) (2)

3.2.4 When CO_2 levels in the blood increase above normal:
- It decreases the pH of the blood✓
- which stimulates receptors✓
- to send an impulse to the Medulla Oblongata.✓
- The Medulla oblongata stimulates the breathing muscles (intercostal muscles and diaphragm) ✓
- to contract faster✓
- and the breathing rate increases ✓
- so that excess carbon dioxide is exhaled faster. ✓ (Any 4) (4)

(9)

3.3 3.3.1
- Many women have a poor understanding of the menstrual cycle✓
- or the process of ovulation.✓
- Incorrect timing of intercourse✓

(Mark first TWO only) (2)

3.3.2 Oestrogen✓ (1)

3.3.3 Ovary✓/Ovarian follicle/Graafian follicle (1)

3.3.4 Pituitary✓**/**Hypophysis (1)

3.3.5 Fertilization will be more likely. ✓

OR

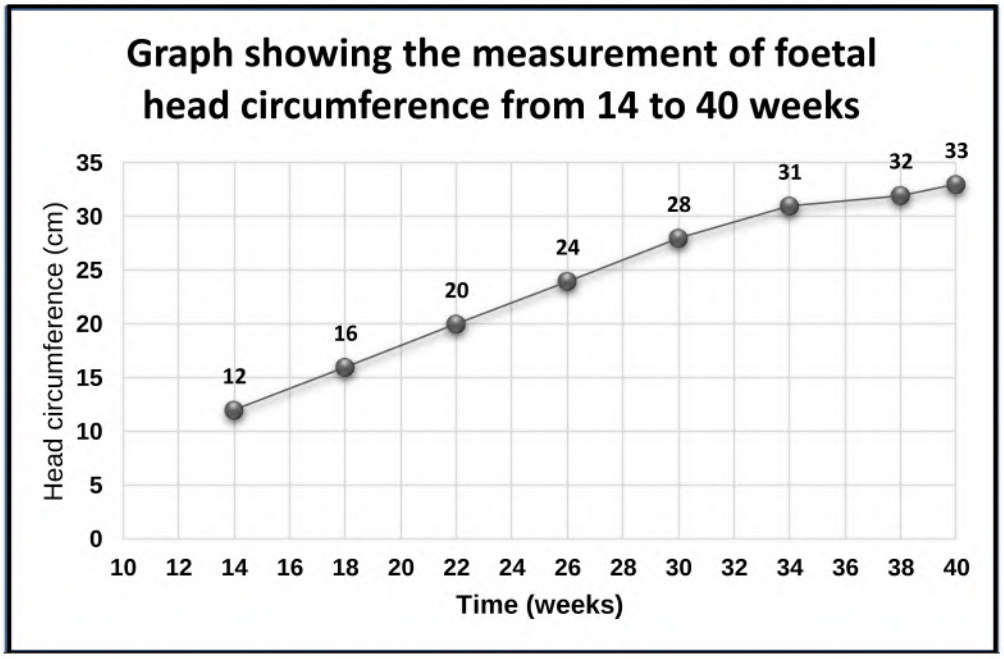
Sperm will already be present in fallopian tubes when the ovum is released.✓ (1)

3.3.6
- The endometrium will not be thick enough✓/maintained
- therefore, no implantation will take place✓. (2)

(8)

3.4 3.4.1 Gestation✓ (1)

3.4.2



Criteria for assessment of the graph

Correct type of graph	**(T)**	1
Caption for graph (includes both variables)	**(C)**	1
Correct label for X-axis (including unit) and Y-axis (including unit)	**(L)**	1
Correct scale for X-axis and Y-axis	**(S)**	1
Plotting of points: 1 to 7 points correct All 8 points correct	**(P)**	 1 2

(6)

3.4.3
- Protects the foetus against shock/mechanical injuries✓
- Keeps the foetus moist✓/Protects the foetus from drying out
- Protects the foetus from temperature changes✓
- Allows the foetus to move freely✓/Supports the body of the foetus during development

(Mark first THREE only) (Any 3) (3)

3.4.4
- Cervix✓
- Vagina✓
- Vulva

(Mark first TWO only) (Any 2) (2)

3.4.5
- Nutrients✓/Oxygen
- will flow to the foetus✓
- via the umbilical vein. ✓
- Metabolic waste✓/urea/ toxic substances
- will not flow away from the foetus✓
- via the umbilical arteries ✓
- therefore, the foetus will be negatively affected✓ die**/**miscarry.

(Any 5) (5)
(17)

[50]

TOTAL SECTION B: 100

TOTAL: 150