Northern Cape
Department of Education

GRADE 12

LIFE SCIENCES

JUNE 2024

TIME: 2 $\frac{1}{2}$ HOURS

MARKS: 150

This question paper consists of 15 pages.

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lsci

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in your ANSWER BOOK.
3. Start the answer 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 or flow charts only when asked to do so.
8. The diagrams in this question paper are NOT necessarily all drawn to scale.
9. Do NOT use graph paper.
10. You may use a non-programmable calculator, protractor and compass where necessary.
11. Write neatly and legibly.

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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 to D) next to the question numbers (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11.D

1.1.1 The table below shows the number of each type of nitrogenous base that occurs in some nucleic acid molecules. The letters W, X, Y and Z represent each of the four types of nitrogenous bases.

	W	X	Y	Z
Molecule 1	98	76	54	108
Molecule 2	715	523	523	715
Molecule 3	78	95	95	87
Molecule 4	103	89	89	103

Which ONE of the following combinations correctly refers to the type of nucleic acid represented by the molecules numbered 1 to 4?

	Molecule 1	Molecule 2	Molecule 3	Molecule 4
A	RNA	RNA	DNA	DNA
B	DNA	DNA	RNA	RNA
C	RNA	DNA	RNA	DNA
D	DNA	RNA	RNA	DNA

1.1.2 Four different blood groups are possible in the children if the parents blood groups are ...

A. AB and O.
B. A and B.
C. O and B.
D. B and AB.

1.1.3 Which of the following involves the development of the fetus inside the uterus of the mother, where it receives nutrients through the placenta?

A. Amniotic egg
B. Oivipary
C. Ovovivipary
D. Vivipary

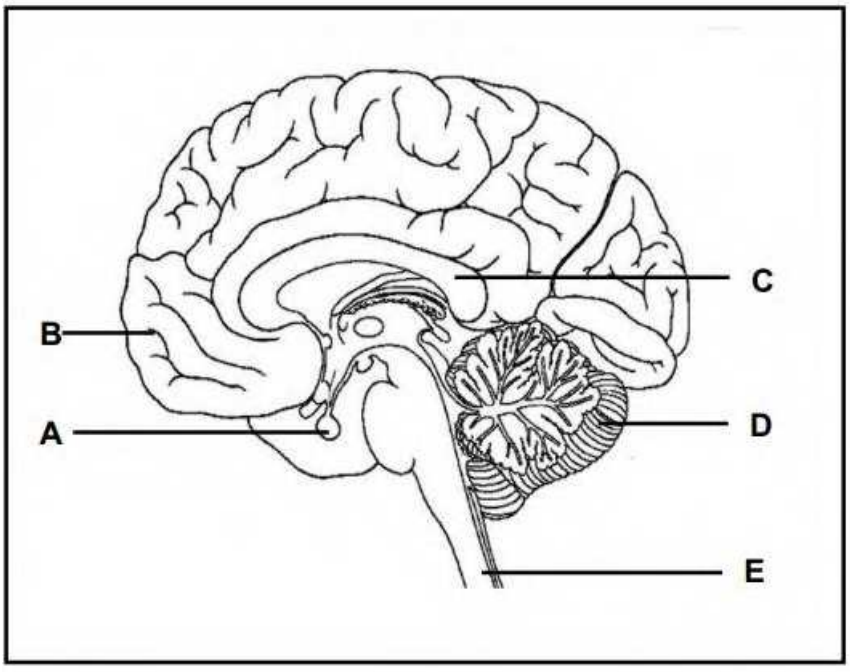
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1.1.4 Internal fertilisation is the fusion of …

A. a haploid male gamete with a haploid female gamete inside the body of a female.
B. diploid male gamete and a haploid female gamete inside the body of a female.
C. A haploid male gamete with a diploid female gamete inside the body of the female.
D. A haploid male gamete with a female somatic/body cell inside the body of the female.

QUESTIONS 1.1.5 TO 1.1.6 ARE BASED ON THE DIAGRAM BELOW:



1.1.5 Part of the brain that can memorise a cell phone number.

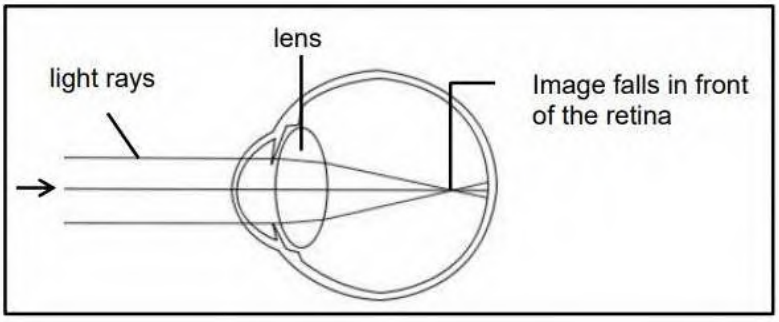
A. Part E
B. Part C
C. Part B
D. Part A

1.1.6 Name and Function of part **D** is:

A. Cerebrum - Secrete hormones.
B. Cerebellum - Coordinating all voluntary movements.
C. Spinal cord - Connecting the two hemispheres of part B
D. Corpus callosum - Part of the reflex reaction

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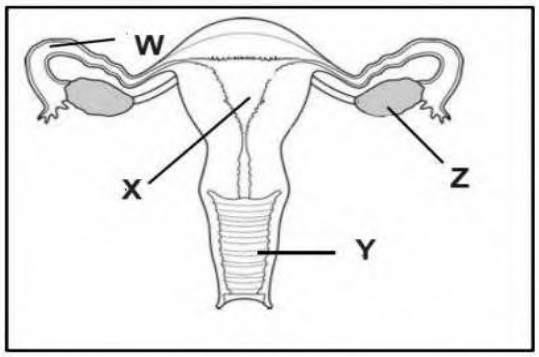
1.1.7 The diagram below shows a visual defect.



How can this visual defect be corrected?

A. Surgery to replace the lens with a synthetic lens.
B. Glasses with lenses shaped to correct the distortion.
C. Wearing glasses with converging (biconvex) lens.
D. Wearing glasses with converging (biconcave) lens.

1.1.8 In which structure does fertilisation take place?



A. W
B. Z
C. Y
D. X

1.1.9 What is the gland that secretes insulin called?

A. Thyroid gland
B. Hypothalamus
C. Pituitary gland/Hypophysis
D. Pancreas

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1.1.10 The level of aldosterone will most likely increase after …

A. consuming food with a high salt content.
B. sweating excessively.
C. consuming food with a high glucose content.
D. the constriction of blood vessels to the skin.

(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 1.2.7) in the ANSWER BOOK.

1.2.1 Organelle outside the nucleus of animal cells that contain DNA.

1.2.2 A genetic cross involving only one characteristic.

1.2.3 The breeding of organisms by humans to achieve a desirable phenotype.

1.2.4 A hollow ball of cells formed from the zygote.

1.2.5 Enzyme filled cavity at the front of the head of the sperm.

1.2.6 Water regulation in the body.

1.2.7 The type of development in birds where the young are able to independently move and feed themselves after hatching.

(7 x 1) **(7)**

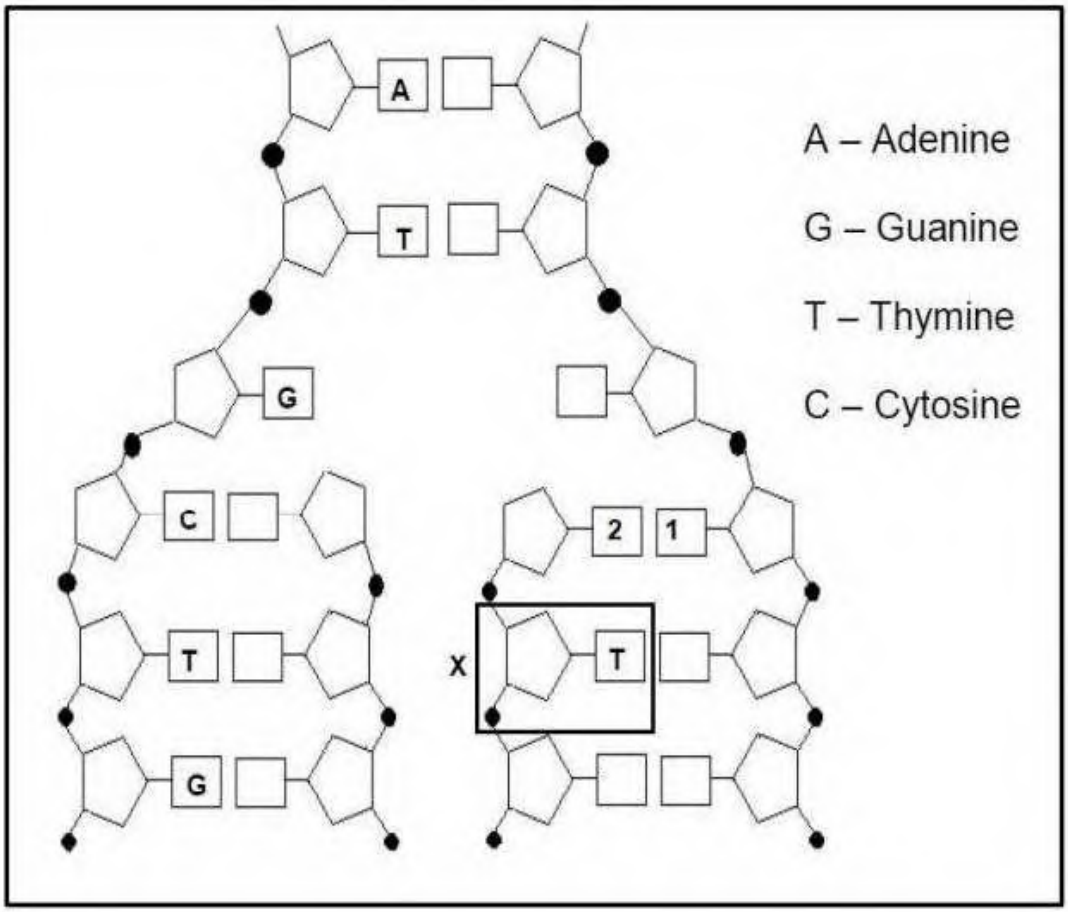
1.3 Indicate whether each of the statements in COLUMN I apply to **A ONLY**, **B ONLY, BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 - 1.3.5) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 Hormones secreted by the pituitary gland	A: Growth hormone B: FSH
1.3.2 The type of gland that has a duct to carry its secretion to where it is needed.	A: Endocrine gland B: Exocrine gland
1.3.3 The number, shape and arrangement of all the chromosomes in the nucleus of a somatic cell.	A: Karyotype B: Non-disjunction
1.3.4 Chromosomes involved in sex determination	A: Gonosomes B: Autosomes
1.3.5 Microscopic gap between the end of an axon of one neuron and the dendrites of another neuron.	A: Interneuron B: Synapse\

(5 X 2) **(10)**

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1.4 The diagram below represents a process involving DNA.



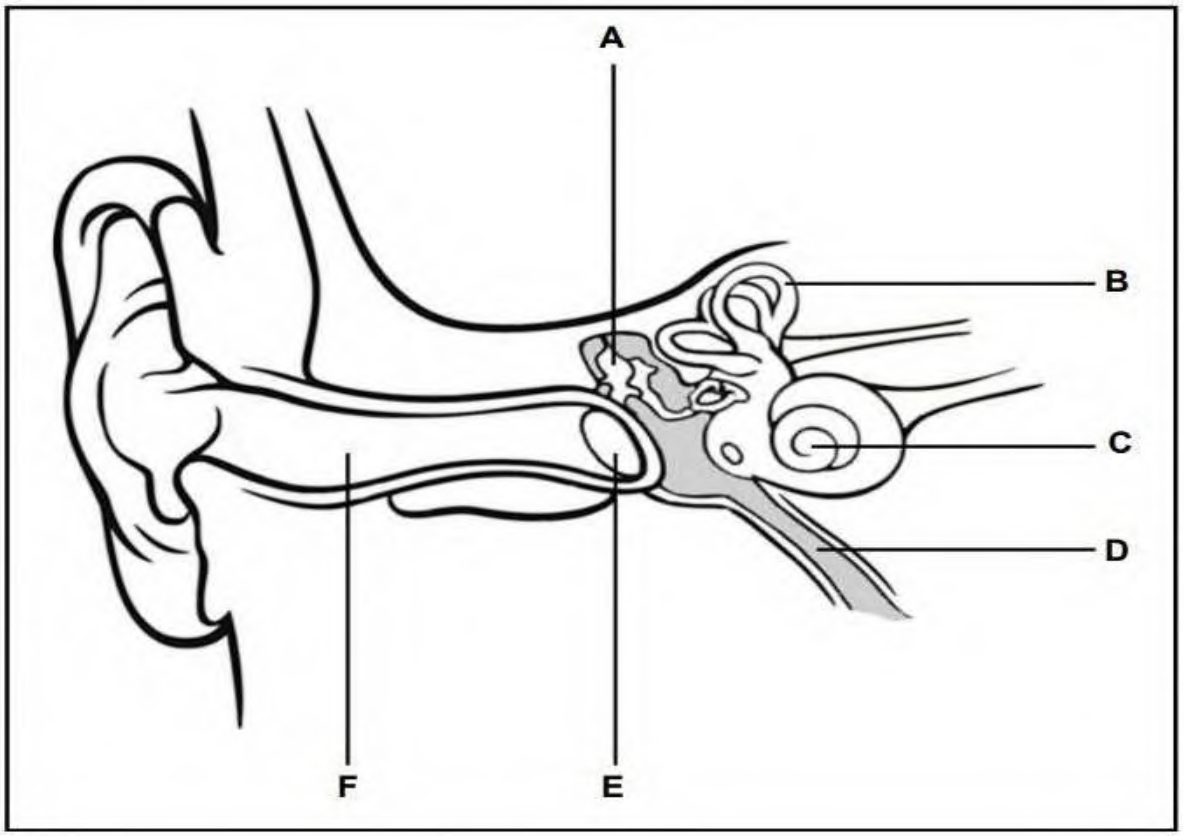
1.4.1 Identify the process illustrated in the diagram above. (1)

1.4.2 Identify the monomer **X**. (1)

1.4.3 What does the monomer **X** identified in Question 1.4.2 consist of? (3)

1.4.4 Using the key provided, give the names for **1** and **2** respectively. (2)
(7)

1.5 The diagram below shows the internal structure of the ear



1.5.1 Identify structures:

(a) **E** (1)

(b) **C** (1)

1.5.2 Give the LETTER of the part of the ear that:

(a) Is the first of three ossicles (1)

(b) Contains receptors for balance. (1)

1.5.3 Name the:

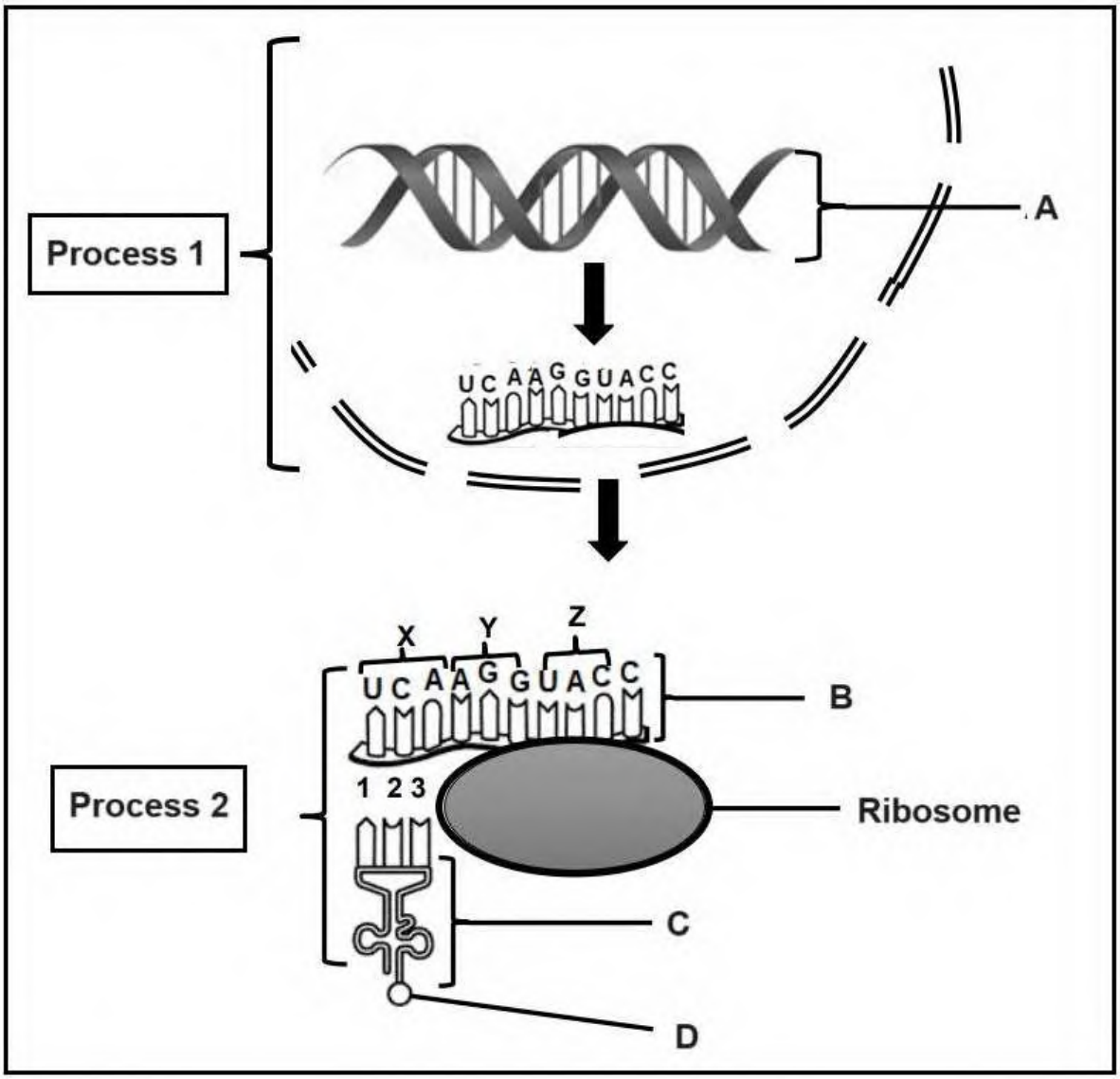
(a) Receptor found at C. (1)

(b) Nerve that carries the impulses from parts B and C to the brain. (1)
(6)

TOTAL SECTION A: 50

SECTION B
QUESTION 2

2.1 The diagram below shows part of the process of protein synthesis.



2.1.1 Identify:

(a) Molecule **B** (1)

(b) Process **2** (1)

(c) Monomer **D** (1)

2.1.2 Give the anticodon nitrogen base sequence of codon **X.** (1)

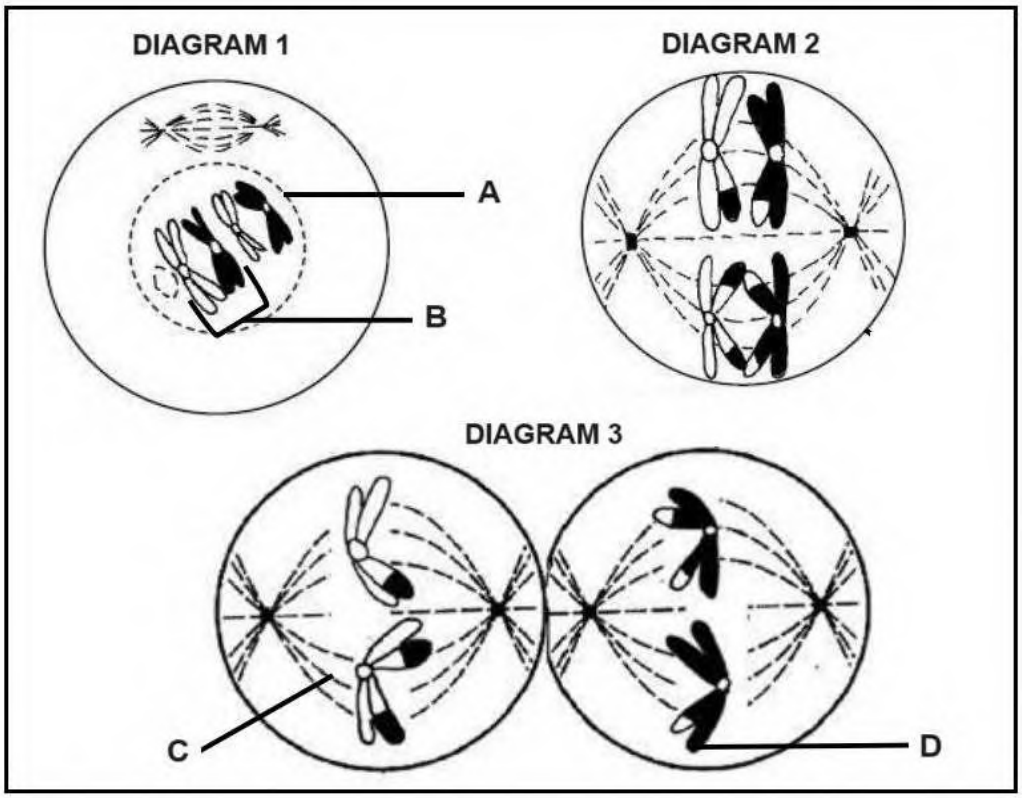
2.1.3 Name and describe Process 1. (5)

2.1.4 The table below shows the amino acids that correspond with different DNA codes.

DNA CODE	AMINO ACIDS
ACA	Cysteine
TCC	Methionine
ATG	Arginine
AAA	Lysine
AGT	Glycine

Write down the correct sequence of amino acids coded for by codons **X**, **Y** and **Z** respectively. (3)
(12)

2.2 The diagram below shows different phases of meiosis in an organism.



2.2.1 Identify structures:

(a) A (1)

(b) C (1)

2.2.2 Describe the role of part D in the movement of chromosomes during meiosis. (2)

2.2.3 Give TWO observable reasons why chromosomes B above are (2)



regarded as homologous.

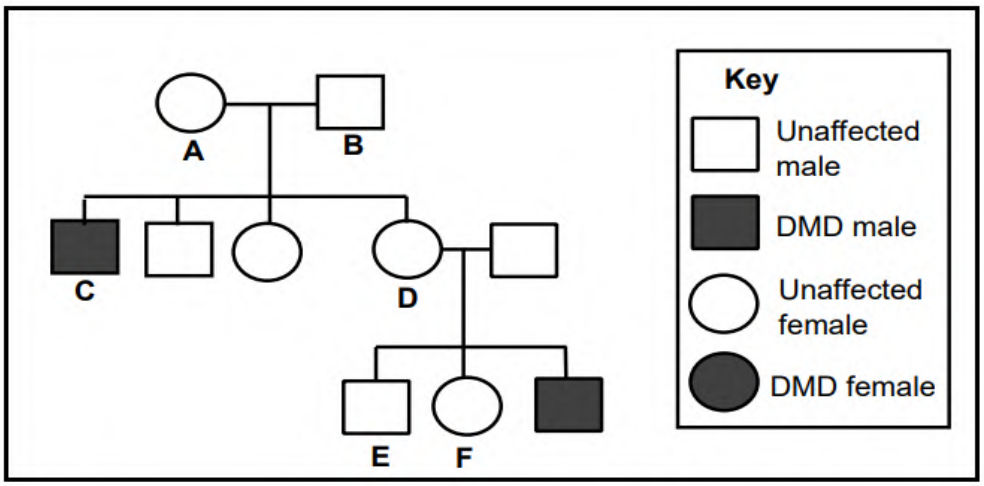
2.2.4 Identify the phase in diagram 1. (1)

2.2.5 During the phase identified in Question 2.2.4 a process takes place that leads to genetic variation. Name and describe this process. (5)

(12)

2.3 Duchenne muscular dystrophy (DMD) is a neuromuscular disorder and is caused by a recessive allele $\mathbf{X^d}$ on the X-chromosome. The allele for normal neuromuscular functioning is $\mathbf{X^D}$.

The inheritance of DMD in a family is shown in the diagram below.



2.3.1 How many generations are shown in this family? (1)

2.3.2 State the phenotype of individual **C**. (1)

2.3.3 Give all the possible genotypes of individual **F**. (2)

2.3.4 Explain why individual **A** can only be heterozygous for this condition. (3)

2.3.5 Individual E marries a woman who is normal for neuromuscular functioning but carries the recessive allele.
Use a genetic cross to show the percentage of offspring that will have DMD. (6)

(13)

2.4 Stem cells are special cells that can develop into many different cell types. This can range from muscle cells to brain cells. In some cases, they can also fix damaged tissues.

Scientists cultured stem cells under ideal laboratory conditions to replace damaged cells associated with several disorders in the human body.
The table below represents the number of stem cells used in the treatment of some of the disorders.

DISORDERS	NUMBER OF STEM CELLS IN MILLIONS
Cancer	450
Alzheimer's disease	200
Heart disease	150
Diabetes	90

2.4.1 Name ONE other use of stem cells, other than the treating of disorders. (1)

2.4.2 Draw a bar graph to illustrate the information provided in the table. (6)
(7)

2.5 In tomato plants the allele for tall plants (**T**) is dominant over the allele for short plants (t) and the allele for red fruit (**R**) is dominant over the allele for yellow fruit (**r**) and

A red fruit tomato plant that is tall is crossed with a yellow fruit, short plant.

The Punnett diagram below shows the possible gametes produced by each parent.

PLANT 1 → **PLANT 2 ↓**	**TR**	**Tr**	**tR**	**tr**
tr		X		
tr				
tr			Y	
tr				

2.5.1 (a) State the type of cross represented above. (1)

(b) Give a reason for your answer to QUESTION 2.5.1 (a). (1)

2.5.2 Give the:

(a) Phenotype of offspring **X**. (2)

(b) Genotype of offspring **Y**. (1)

2.5.3 What percentage of offspring is expected to be recessive for both characteristics? (1)
(6)
[50]

QUESTION 3

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



Jade read an article 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 decided to measure the pulse rate (indicates heart rate) and the breathing rate of 8 of his 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.

3.1.1 State a hypothesis for this investigation. (2)

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

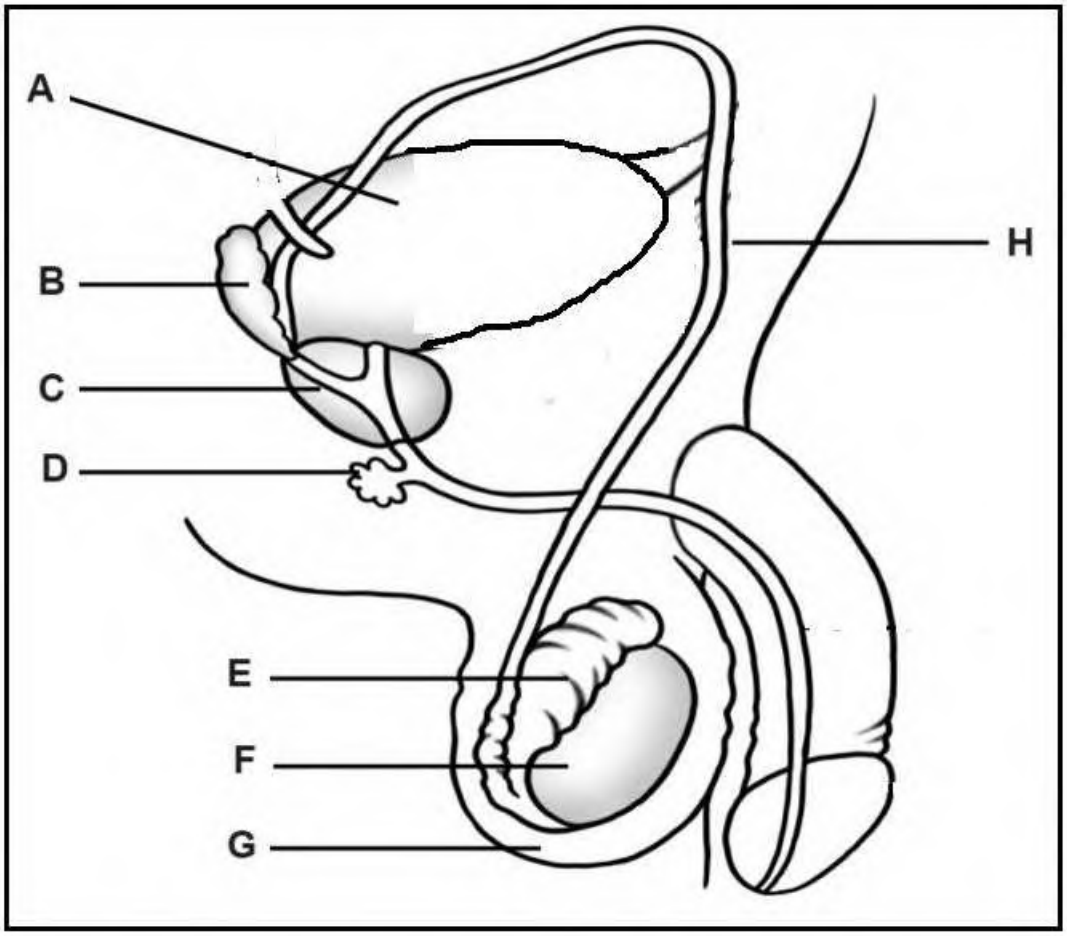
3.1.3 State TWO variables which relate to the classmates and should be kept constant in order to ensure the validity of this investigation. (2)

3.1.4 Give ONE planning step that Jade needed to consider before conducting his investigation. (1)

3.1.5 State ONE way in which he could improve the reliability of his investigation. (1)

3.1.6 Explain how the breathing rate can be used to show an increase in the carbon dioxide levels in the blood. (4)
(11)

3.2 The diagram below represents the male reproductive system.



3.2.1 Give the LETTER and NAME of the following:

(a) Tube that temporarily stores sperm. (2)

(b) A gland that produces a nutrient rich fluid that that provides energy for the sperm cells. (2)

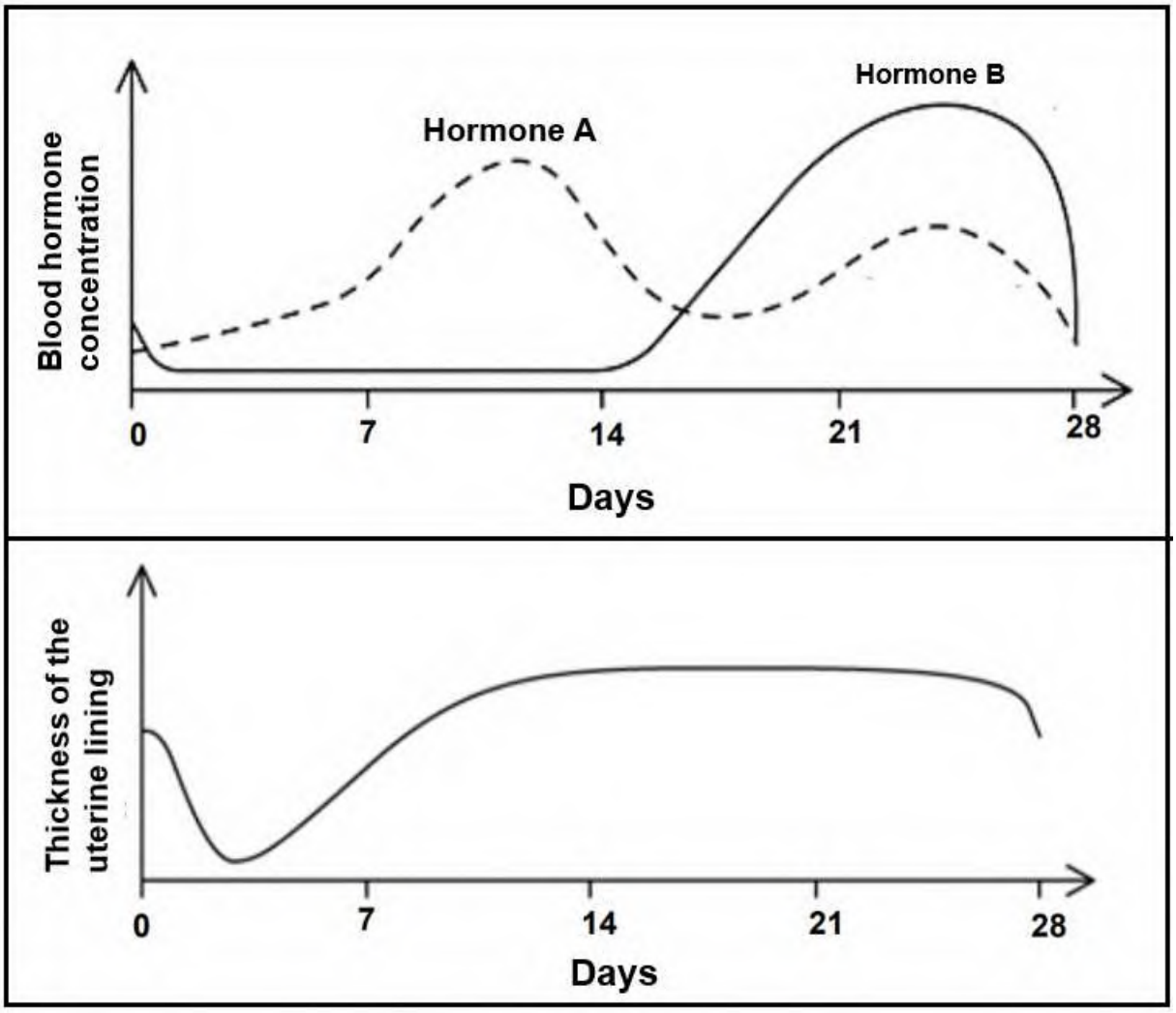
3.2.2 Explain why it is necessary for part **F** to be on the "outside" of the male body. (2)

3.2.3 Explain how pregnancy would be prevented if part labelled **H** is cut and sealed on both sides. (3)
(9)

3.3 The graphs below show the blood hormone concentration of two ovarian hormones and changes that occur in the uterus lining during a 28-day cycle of



a woman.



3.3.1 Determine the duration of the menstrual cycle according to the diagram. (1)

3.3.2 Identify Hormone A. (1)

3.3.3 Name the structure that is responsible for the production of Hormone B. (1)

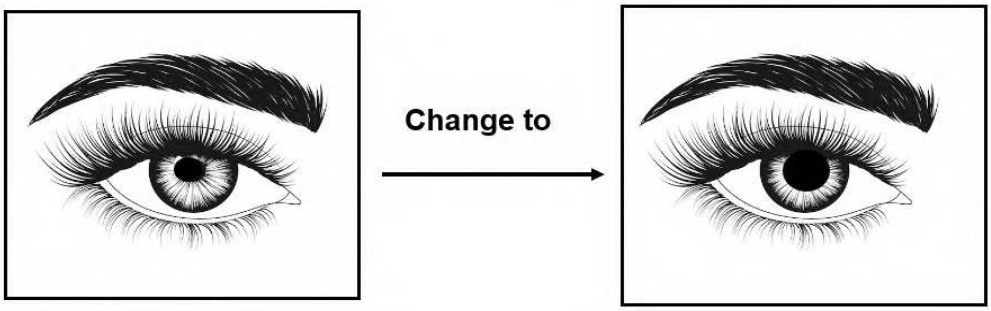
3.3.4 State the biological term used for the uterus lining. (1)

3.3.5 Describe the negative feedback mechanism involving FSH and Hormone B when no fertilisation took place. (4)

(8)

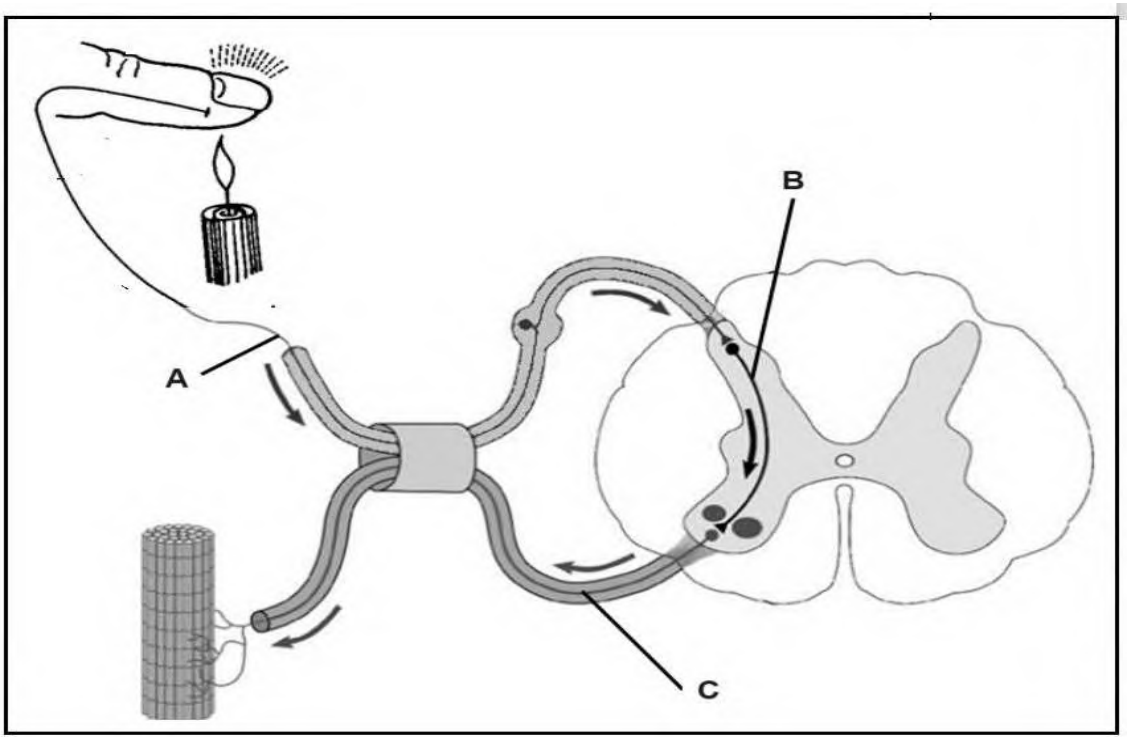
3.4 Describe the process of spermatogenesis. **(5)**

3.5 The diagram below shows two external views of the eye. **(5)**



Name and explain how the change shown in the diagram above occurs. (5)
(5)

3.6 The diagram below represents a portion of the central nervous system.



3.6.1 Name the type of reaction that is shown in the diagram. (1)

3.6.2 State the significance of the reaction mentioned in QUESTION 3.6.1. (1)

3.6.3 Give the LETTER and NAME of the neuron that transports impulses towards the spinal cord. (2)

3.6.4 State ONE function of the myelin sheath in neurons. (1)

3.6.5 Use a flow diagram to give the correct sequence of neurons from the receptor to the effector. (2)

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3.6.6 Explain why the brain is not involved in the reflex action that will follow the reflex arc above. (3)

3.6.7 Explain what the effect will be on the reflex arc and reflexes, of a person suffering from multiple sclerosis. (2)

(12)

[50]

TOTAL SECTION B: 100

GRAND TOTAL: 150

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Northern Cape
Department of Education

GRADE 12

LIFE SCIENCES

MEMORANDUM

JUNE 2024

TIME: $2\frac{1}{2}$ HOURS

MARKS: 150

This question paper consists of 11 pages

PRINCIPLES RELATED TO MARKING LIFE SCIENCES

1. **If more information than marks allocated is given**
   Stop marking when maximum marks is reached and put 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 whole process is given when only part of it is required**
   Read all and credit relevant part.

4. **If comparisons are asked for and 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 is incorrect, do not credit. If sequence and links becomes correct again, resume credit.

9. **Non-recognised abbreviations**
   Accept if first defined in answer. If not defined, do not credit the unrecognized abbreviation but credit the rest of 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 recognizable accept provided it does not mean something else in Life Sciences or if it is out of context**.**

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

14. **If only letter is asked for and only name is given (and vice versa)**
    No 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 way**.

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

18. **Code-switching of official languages (terms and concepts)**
A single word or two that appears in any official language other than the learners' assessment language used to the greatest extent in his/her 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. No changes must be made to the marking memoranda without consulting the Provincial Internal Moderator.

SECTION A
QUESTION 1

1.1	1.1.1	C✓✓		
	1.1.2	B✓✓		
	1.1.3	D✓✓		
	1.1.4	A✓✓		
	1.1.5	C✓✓		
	1.1.6	B✓✓		
	1.1.7	D✓✓		
	1.1.8	A✓✓		
	1.1.9	D✓✓		
	1.1.10	B✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Mitochondria ✓		
	1.2.2	Monohybrid cross✓		
	1.2.3	**DO NOT MARK THIS QUESTION**		
	1.2.4	Blastocyst/blastula✓		
	1.2.5	Acrosome✓		
	1.2.6	**DO NOT MARK THIS QUESTION**		
	1.2.7	Precocial✓development	(5 x 1)	**(5)**
1.3	1.3.1	Both A and B✓✓		
	1.3.2	B only✓✓		
	1.3.3	A only✓✓		
	1.3.4	A only✓✓		
	1.3.5	B only ✓✓	(5 x 2)	**(10)**
1.4	1.4.1	DNA Replication ✓		(1)
	1.4.2	Nucleotide ✓		(1)
	1.4.3	Phosphate ✓ Deoxyribose sugar ✓ Nitrogen base/Thymine ✓		(3)
	1.4.4	1 – guanine ✓ 2 – cytosine ✓		(2) **(7)**
	1.5.1	(a) Tympanic membrane✓/Eardrum (b) Cochlea ✓		(1) (1)
	1.5.2	(a) A ✓ (b) B ✓		(1) (1)
	1.5.3	(a) Organ of Corti ✓ (b) Auditory nerve ✓		(1) (1) **(6)**
			TOTAL SECTION A:	**48**

SECTION B

QUESTION 2

2.1 2.1.1 (a) mRNA ✓/ messenger RNA (1)
(b) Translation ✓ (1)
(c) Amino acid ✓ (1)

2.1.2 AGU ✓ (1)

2.1.3 **Transcription*** ✓

- The double helix DNA unwinds✓.
- The double-stranded DNA unzips✓/weak hydrogen bonds break to form
- **two separate** strands. ✓
- One strand is used as a template ✓
- to form mRNA ✓
- using free RNA nucleotides ✓ from the nucleoplasm.
- The mRNA is complementary ✓to the DNA.
- mRNA now has the coded message for protein synthesis. ✓

(1* compulsory mark + Any 4) (5)

2.1.4 Glycine✓ - Methionine✓ - Arginine ✓ **(In this order)** (3)
(12)

2.2 2.2.1 (a) A – Nuclear membrane ✓ (1)

(b) C – Spindle fibers ✓ (1)

2.2.2 **DO NOT MARK THIS QUESTION**

2.2.3 Same size/length✓
Same shape✓
Same centromere position✓
(Mark first TWO only) **Any two** (2)

2.2.4 Prophase 1✓ (1)

2.2.5 **Crossing over *✓**

- occurs during prophase I ✓
- Homologous chromosomes ✓
- non-sister – chromatids overlap ✓
- at points called chiasma✓ /chiasmata
- Genetic material✓ is exchanged
- resulting in new combinations of genetic material ✓

(1* compulsory mark + Any 4) (5)
(10)

2.3 2.3.1 Three/3 ✓ (1)

2.3.2 **DO NOT MARK THIS QUESTION**

2.3.3 **DO NOT MARK THIS QUESTION**

2.3.4
- Individual A is unaffected✓
- caused by dominant allele on X chromosome✓/X^D
- Offspring C inherits Y chromosome from individual B✓ /father
- and X^d from individual A /mother ✓

OR

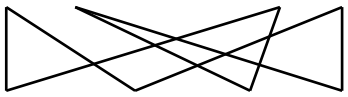
- Individual A has an offspring C who is affected ✓
- Therefore, receiving a recessive allele✓/Xd from individual A
- individual A must have a dominant allele as well✓
- hence she is unaffected ✓ **Any** (3)

2.3.5 **P_1** Phenotype Normal male x Normal female ✓

Genotype X^DY x X^DX^d ✓

Meiosis

Gametes X^D , Y x X^D, X^d ✓

Fertilisation 

F_1 Genotype X^DX^D : X^DX^d : X^DY : X^dY ✓

Phenotype **3** normal/unaffected : **1** with Duchene muscular dystrophy✓/DMD/affected

There is a **25% chance✓*** of offspring having Duchene muscular dystrophy /DMD.

P_1 and F_1 ✓
Meiosis and fertilization ✓

(1* compulsory mark + Any 5)

OR

P_1 Phenotype Normal male x Normal female ✓

Genotype X^DY x X^DX^d ✓

Meiosis

Fertilization

Gametes	X^D	Y
X^D	$X^D X^D$	X^DY
X^d	X^DX^d	X^dY

1 mark for correct gametes✓
1 mark for correct genotypes✓

F_1 Genotype X^DX^D : X^DX^d : X^DY : X^dY ✓

Phenotype **3** normal/unaffected : **1** with Duchene muscular dystrophy✓/DMD/affected

There is a **25% chance✓*** of offspring having Duchene muscular dystrophy /DMD.

P_1 and F_1 ✓
Meiosis and fertilization ✓ (6)

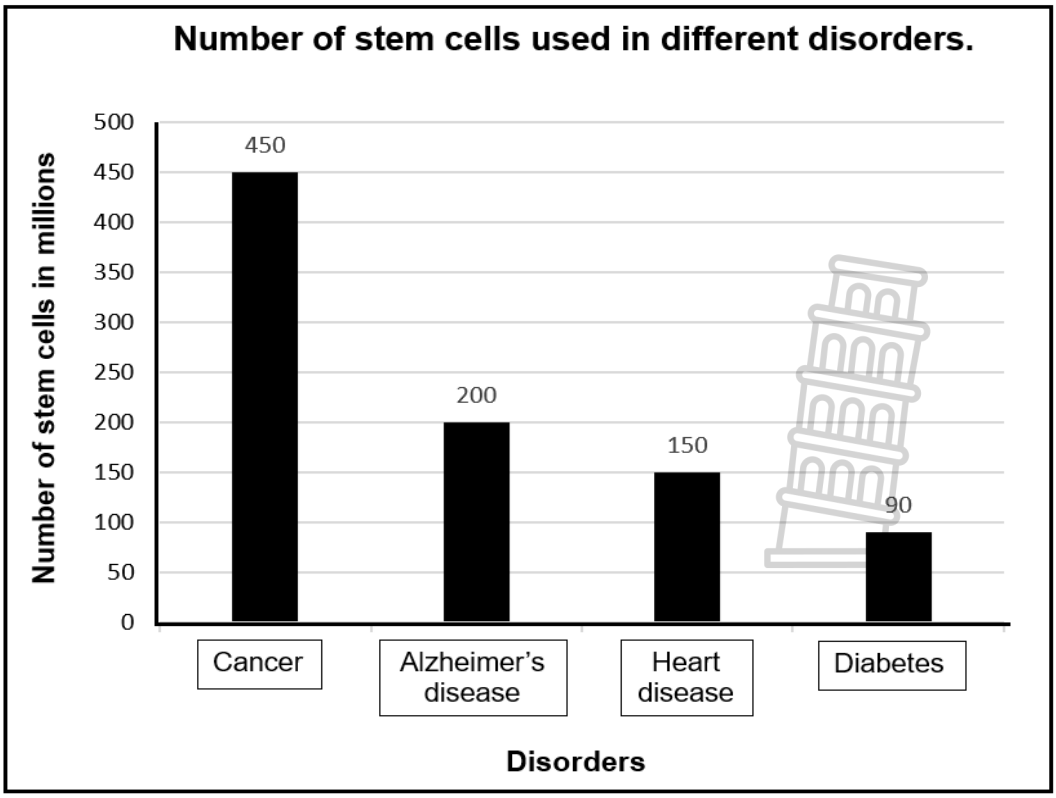
(1* compulsory mark + Any 5) **(10)**

2.4 2.4.1

- It can develop in any type of tissue ✓
- Used for therapeutic purposes✓
- Treat spinal injuries✓
- Cultivated tissue cultures to form meat✓

Any (1)

2.4.2



Criteria	Mark allocation
Type: Bar graph is drawn. (**T**)	1
Caption of the graph includes both variables (**C**)	1
Correct labels on X-axis and Y-axis (**L**)	1
Correct scale for Y-axis Equal width of bars and spaces (**S**)	1
Plotting: (**P**) 1- 3 bars are plotted correctly All 4 bars are plotted correctly	 1 2

(6)
(7)

2.5 2.5.1 (a) Dihybrid cross✓ (1)

(b) Involves the inheritance of two characteristics✓ (1)

2.5.2 (a) Tall plant✓ with yellow fruit✓ (2)

(b) ttRr ✓ (1)

2.5.3 25✓% (1)

(6)
[45]

QUESTION 3

3.1 3.1.1 Wearing a facemask increases the carbon dioxide levels in the blood. ✓✓

OR

Wearing a facemask does not increase the carbon dioxide levels in the blood.✓✓

OR

Wearing a facemask does not have any effect on the carbon dioxide levels in the blood. ✓✓ (2)

3.1.2 CO_2 levels (in the blood)✓/Carbon dioxide levels (in the blood) (1)

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

(Mark first TWO only) (2)

3.1.4
- 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 ONE only) (1)

3.1.5
- Use more than 8 classmates/ increase sample size. ✓
- Repeat the investigation.

(Mark first ONE only) (1)

3.1.6 **DO NOT MARK THIS QUESTION**

(7)

3.2 3.2.1 (a) E✓ – Epididymis ✓ (2)

(b) B✓ - Seminal vesicle ✓

OR

C✓- Prostate gland ✓

OF

D✓- Cowper's gland✓ (2)

3.2.2 **DO NOT MARK THIS QUESTION**

3.2.3
- The sperm would not be transported to the urethra✓/ semen would not have any sperm present,
- Without the sperm, fertilisation cannot take place✓
- and therefore, pregnancy cannot occur ✓ (3)

(7)

3.3 3.3.1 28 days ✓ (1)

3.3.2 Oestrogen ✓ (1)

3.3.3 Corpus luteum ✓ (1)

3.3.4 Endometrium ✓ (1)

3.3.5
- If the ovum is not fertilised, the corpus luteum disintegrates✓/shrink
- secretion of progesterone decreased/drop✓
- Low levels of progesterone stimulates✓ the production of FSH
- to develop a new follicle✓
- and for menstruation to start. ✓ **Any** (4)

(8)

3.4
- Spermatogenesis takes place under the influence of testosterone✓
- in the seminiferous tubules/testes✓
- diploid cells ✓
- undergo meiosis✓
- to form haploid sperm cells✓ **(5)**

3.5 **Pupillary mechanism / pupil reflex** ✓
- Radial muscles ✓of the iris contract✓
- Circular muscles✓ of the iris relax✓
- Pupil dilates / widens / gets bigger ✓
- and more light enters the eye✓ **Any** (5)

(5)

3.6 3.6.1 Reflex ✓action (1)

3.6.2 It protects the body ✓from further injury/ prevents harm to body (1)

3.6.3 A✓ – Sensory neuron✓/afferent neuron (2)

3.6.4
- The transmission of impulses is accelerated✓
- It insulates the nerve fibres✓ /one-way transmission of impulses.

Any (1)

3.6.5 Sensory neuron ➢interneuron➢motor neuron ✓✓
(TWO marks ONLY if the sequence is correct) (2)

3.6.6
- The spinal cord shortens reaction time by sending the impulse directly to the effector✓
- The brain delays the reaction causing ✓
- injury /death✓ (3)

3.6.7
- The myelin sheaths are damaged ✓/worn out
- This will cause a slow transmission of impulses ✓
- and slow reaction time ✓ **Any** (2)

(12)
[44]

TOTAL SECTION B: 89
GRAND TOTAL: 137