GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
GRADE 12

2023

LIFE SCIENCES

TIME: **2½ hours**

MARKS: **150**

17 pages

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 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 numbers (1.1.1 to 1.1.7) in the ANSWER BOOK, for example 1.1.8 D.

1.1.1 The microscopic space between two adjacent neurons is a/an …

A axon.
B dendrite.
C synapse.
D myelin sheath.

1.1.2 The part of the brain that is stimulated when a learner is exposed to a change in the speed and direction of movement is the …

A cerebellum.
B cerebrum.
C corpus callosum.
D hypothalamus.

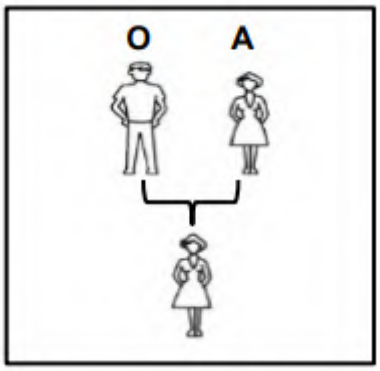
1.1.3 A human male underwent a vasectomy (each vas deferens was cut). Which of the following structures would no longer contribute to the production of semen?

A Seminal vesicles
B Prostate gland
C Seminiferous tubules
D Cowper's gland

1.1.4 Which of the following is TRUE about spermatogenesis?

A It occurs under the influence of oestrogen.
B It is controlled by the enzymes of the acrosome.
C Sperm cells undergo meiosis in this process.
D The amount of genetic material is reduced.

1.1.5 The diagram below shows the blood types of two parents.



The only possible blood type(s) of the offspring of the first generation (F1) is/are …

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

1.1.6 A light stimulus is converted into a nerve impulse in the ...

A retina.
B iris.
C optic nerve.
D choroid.

1.1.7 Which of the following represents the CORRECT combination of a visual defect, its nature and the corrective measure?

	Visual Defect	Nature of Defect	Corrective Measure
A	Cataracts	Curvature of lens is uneven	Biconcave lenses
B	Short-sightedness	Lens cannot become less convex	Biconcave lenses
C	Astigmatism	Lens cannot become more convex	Surgery
D	Long-sightedness	Lens becomes cloudy and opaque	Biconvex lenses

(7 x 2) **(14)**

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 The part of the peripheral nervous system that controls involuntary actions

1.2.2 Monomers of DNA and RNA

1.2.3 A hormone that triggers ovulation

1.2.4 The stage of protein synthesis during which mRNA is formed from DNA

1.2.5 A human disorder caused by non-disjunction of chromosome pair 21

1.2.6 The sex-linked disease resulting in the inability of the blood to clot due to the lack of a blood clotting factor

1.2.7 Type of DNA which can be used in tracing female ancestry

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

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	The receptor(s) that create(s) impulses to be sent to the cerebrum	A Organ of Corti B Maculae
1.3.2	Each gamete receives only one allele for each characteristic	A Mendel's principle of segregation B Mendel's principle of independent assortment
1.3.3	Chromosomes involved in sex determination	A Autonomic B Gametes

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

1.4 At a crime scene, a forensic scientist found a cigarette filter which had traces of lip cells on it (the specimen). DNA was extracted from these lip cells as well as from the victim and three suspects. Through a biotechnological process, the following sequences of bars were produced from the DNA samples collected.



[<www.berkeley.edu>]

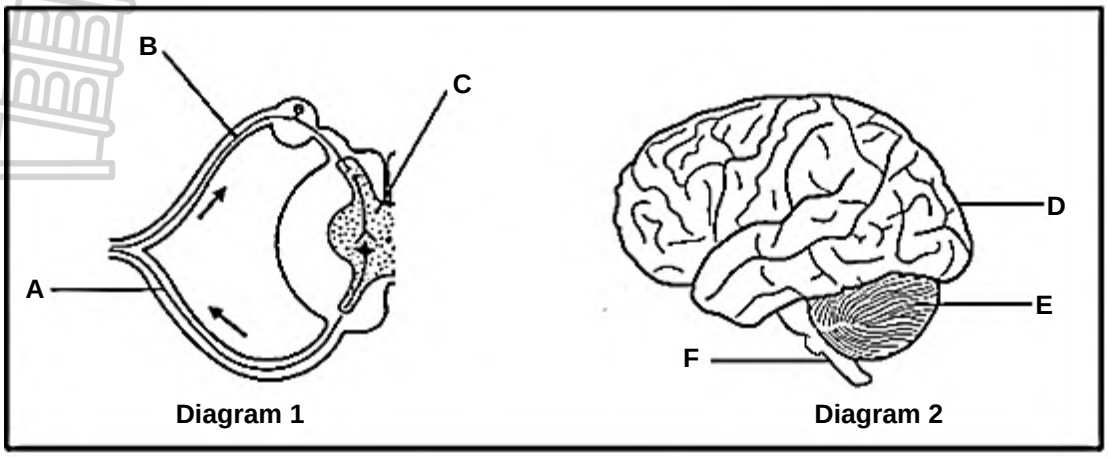
1.4.1 Name the sequence of bars produced by the biotechnological process mentioned above. (1)

1.4.2 Did the lip cells found on the cigarette filter belong to the victim? (1)

1.4.3 Identify the suspect (**1**, **2** or **3**) that most likely smoked that cigarette. (1)

1.4.4 Name TWO other uses of a DNA profile. (2)
(5)

1.5 The diagrams below show parts of the central nervous system.



1.5.1 Give the LETTER and NAME of the part in Diagram **2**:

(a) Which controls the muscle tone (2)
(b) Which controls vitally important processes (2)
(c) Which controls voluntary actions (2)

1.5.2 Name the process that is occurring in Diagram **1** so that the impact of injury to the body is minimised. (1)

1.5.3 Name the root of the spinal nerve through which neuron:

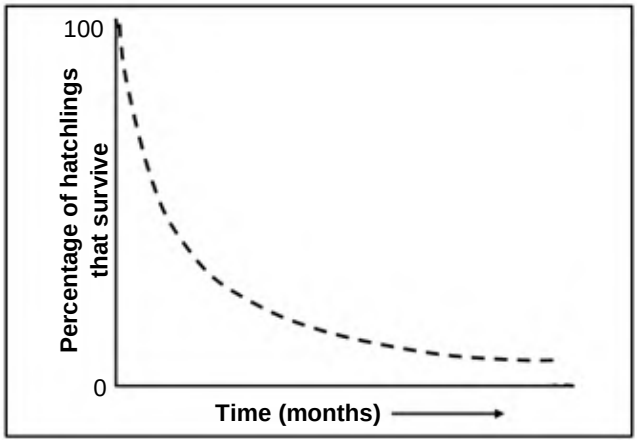
(a) **A** will travel (1)
(b) **B** will travel (1)

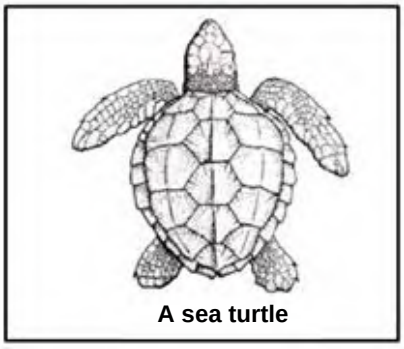
1.5.4 Provide the LETTERS of the neurons, in the correct order, through which the impulse will travel, during the process mentioned in QUESTION 1.5.2. (3)
(12)

1.6 Read the extract below on the life cycle of turtles.

In a species of sea turtles (shown below), the females leave the water to lay their eggs in a nest on the beach. The female makes the nest by digging a hole with her hind legs. A female is known to lay about 100 or more eggs. After the eggs have been laid, the female covers the nest with sand to hide it from predators and leaves the eggs to incubate on their own.

It takes about two months for the hatchlings to emerge from the nest. The hatchlings must try to make it to the sea safely. Only about 10% of the hatchlings usually make it to the sea safely and survive to reproduce.




A sea turtle

The graph above shows the percentage of survivors in a sea turtle population over a period of time.

1.6.1 Identify the type of embryonic development shown in the extract above. (1)

1.6.2 Give a reason for your answer to QUESTION 1.6.1. (2)

1.6.3 Calculate the estimated number of turtles that will make it safely to the sea from 5 females that lay 100 eggs each. Show your calculations. (3)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The following diagram shows various structures that occur in the female reproductive system.

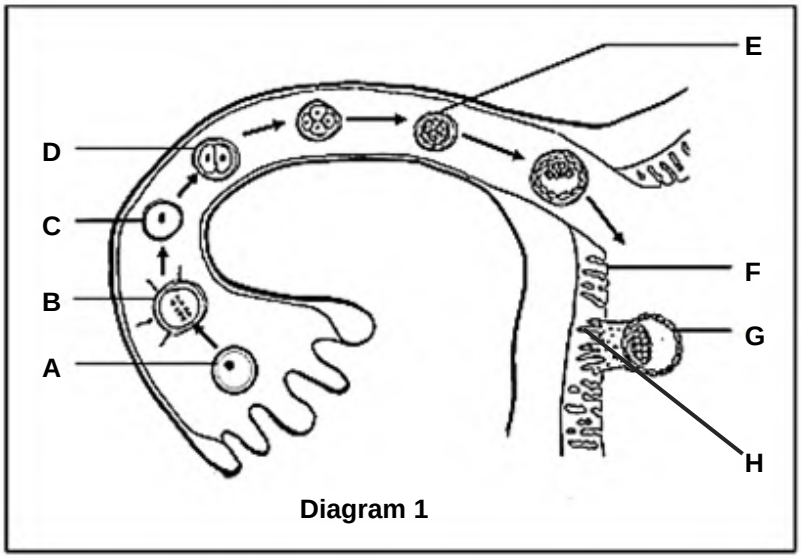


Diagram 1

2.1.1 Identify the structure labelled:

(a) **A** (1)
(b) **E** (1)

2.1.2 Identify the structure that develops from a combination of **F** and **H**. (1)

2.1.3 Name and describe the process that is occurring at **B**. (2)

Read the extract below and compare Diagram 1 on page 9 with Diagram 2 below.

Ectopic Pregnancies – An ectopic pregnancy is a situation which occurs when the embryo attaches outside the uterus. In most cases the embryo implants on the fallopian tube but implantation can also occur on the ovaries, in the cervix or in the abdominal cavity. An ectopic pregnancy cannot proceed normally and the embryo usually cannot survive. Ectopic pregnancies are caused by one of the following:

- An infection of the fallopian tubes
- The development of scar tissue from a previous infection
- A surgical procedure in the fallopian tubes
- Previous surgery in the pelvic area

The fallopian tube where the ectopic pregnancy occurs has to be removed surgically to save the woman's life.

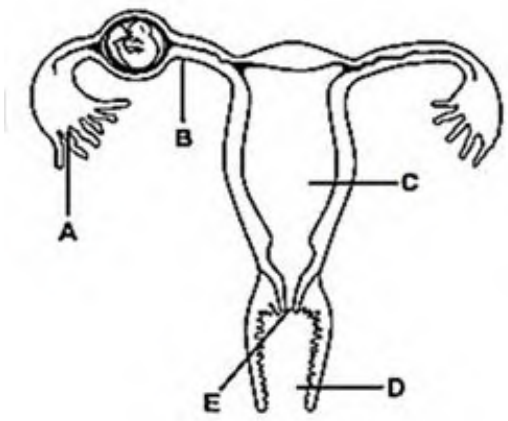


Diagram 2

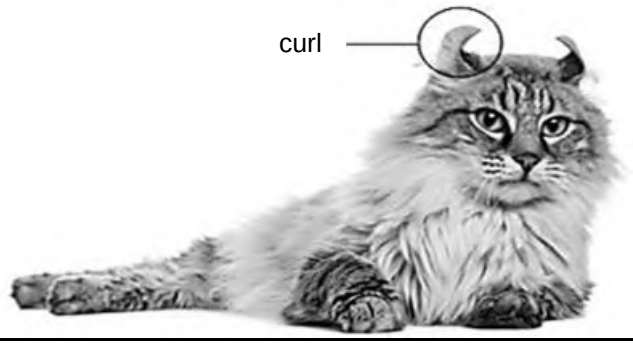
2.1.4 Name ONE cause of an ectopic pregnancy from the extract. (1)

2.1.5 Compare the site of implantation in **Diagram 1** and **Diagram 2** and state the outcome that occurs in each. (4)

2.1.6 Explain ONE reason why the pregnancy in **Diagram 2** is dangerous. (2)
(12)

2.2 Read the information below on the inheritance of cat ear shapes and answer the questions that follow.

The American Curl Cat is a relatively new breed originating in the 1980s by selective breeding. The trait is a result of a natural mutation that causes distinctively curled ears. A single gene with two alleles codes for the ear-shape trait. The dominant allele **(R)** codes for curled ears, and the recessive allele **(r)** codes for straight ears.

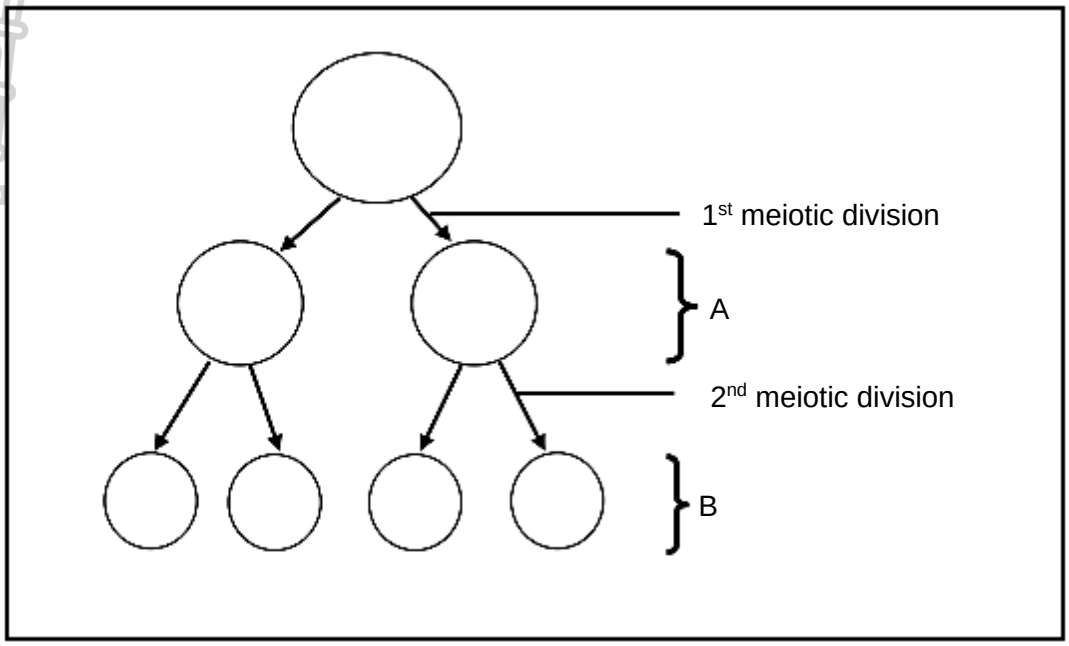


2.2.1 Differentiate between *a gene* and *an allele*. (2)

2.2.2 A heterozygous male curled-ear cat is crossed with a homozygous female curled-ear cat.

Using a genetic cross, determine the expected percentages of the different genotypes and phenotypes of the offspring. (6)
(8)

2.3 The diagram below shows the formation of male gametes at the end of meiosis.



2.3.1 Name the specific process by which male gametes in humans are formed through meiosis. (1)

2.3.2 Name the organ in males where the process mentioned in QUESTION 2.3.1 takes place. (1)

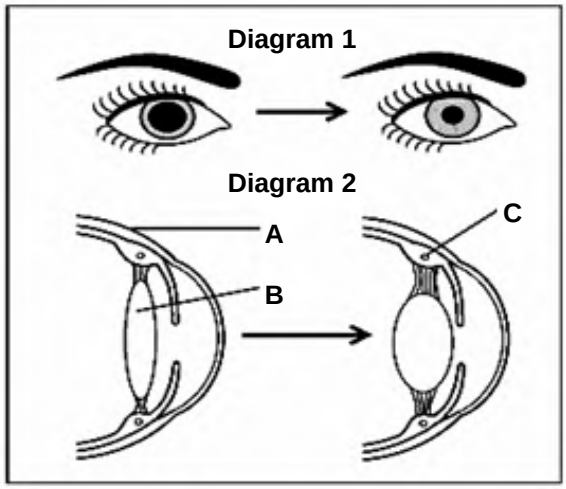
2.3.3 How many chromosomes will be found in each human cell at:

(a) **A** (1)
(b) **B** (1)

2.3.4 Name TWO processes occurring during the first meiotic division that contribute to the genetic variation of cells. (2)

2.3.5 Make a scientific drawing of ONE of the mature cells that is the result at **B**. (5)
(11)

2.4 Two mechanisms of the eye are illustrated in Diagram **1** and Diagram **2** below. The arrows show the changes to specific parts of the eye.



2.4.1 The arrow in Diagram **1** shows changes in the structures of the eye. With reference to these structures, name and describe the process that is occurring in Diagram **1**. (5)

2.4.2 Explain the changes that are occurring in Diagram **2**. (2)

2.4.3 Name the TWO structures that cause structure **B** to change its shape. (2)

2.4.4 Name the condition that would occur if structure **B** cannot change in the direction of the arrow as shown in Diagram **2**. (1)

(10)

2.5 In humans, freckles **(F)** are dominant over non-freckles **(f)**. Brown eyes **(B)** are dominant over blue eyes **(b)**. Parents who are heterozygous for both traits are crossed.

The Punnet diagram below shows the possible genotypes of the offspring.

	FB	**Fb**	**fB**	**Fb**
FB	FFBB	FFBb	FfBB	FfBb
Fb	FFBb	FFbb	FfBb	Ffbb
fB	FfBB	FfBb	**Y**	ffBb
fb	FfBb	**X**	ffBb	ffbb

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

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

2.5.3 Give the genotype(s) of the two parents who were crossed. (2)

2.5.4 Identify the:

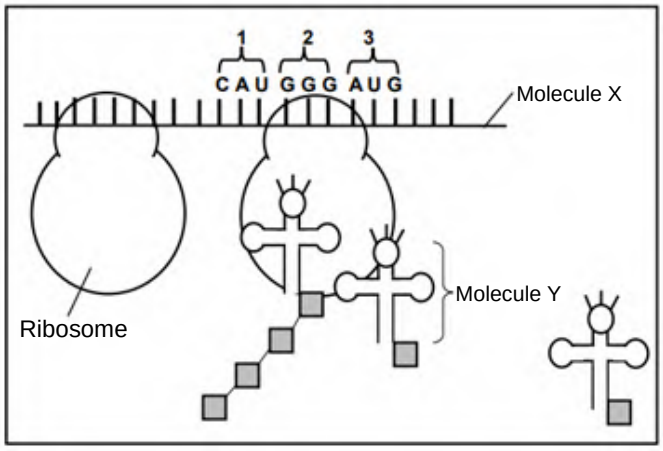
(a) Phenotype of offspring **X** (2)
(b) Genotype of offspring **Y** (2)

2.5.5 Give the proportion of offspring that could have freckles, as a simplified fraction. (1)

(9)
[50]

QUESTION 3

3.1 The diagram below shows the process of protein synthesis.



3.1.1 Name and describe the process that is occurring in the diagram above. (5)

3.1.2 State where in the cell this process takes place. (1)

3.1.3 Identify:

(a) Molecule **X** (1)
(b) Molecule **Y** (1)

The table below shows the base triplets of DNA that code for the different amino acids found in human proteins.

AMINO ACID	BASE TRIPLET IN DNA
Leucine	GAA
Proline	GGG
Lycine	TTT
Histidine	GTA
Serine	TCA
Methionine	TAC
Glycine	CCC
Glutamine	GTC

3.1.4 Using the information in the table and the diagram on page 14, write down the sequence of the amino acids that correspond with structures **1**, **2** and **3** respectively. (3)

3.1.5 During replication, the second nitrogenous base of the DNA triplet which codes for histidine was replaced with an adenine. Using the table on page 14, describe how this mutation will cause a different protein to be formed. (2)
(13)

3.2 Blood groups are an inherited characteristic. The table below shows the percentage of people in a community with each of the different blood groups.

Blood groups	**O**	**A**	**B**	**AB**
Percentage (%) of the community	**46**	**35**	**14**	**5**

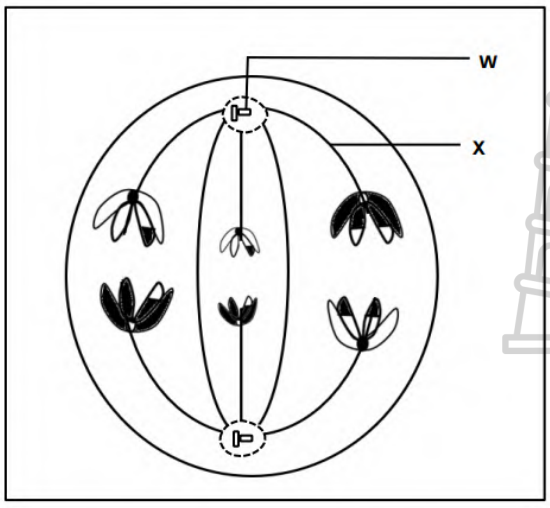
3.2.1 State the number of alleles that control blood groups. (1)

3.2.2 State the possible genotype(s) of blood group B. (2)

3.2.3 Explain the type of dominance found in a person who is heterozygous for blood group A. (2)

3.2.4 Draw a pie chart to show the percentage distribution of the different types of blood groups within this community. (6)
(11)

3.3 The diagram below represents a phase in meiosis.



3.3.1 Name the phase that is shown in the diagram. (1)

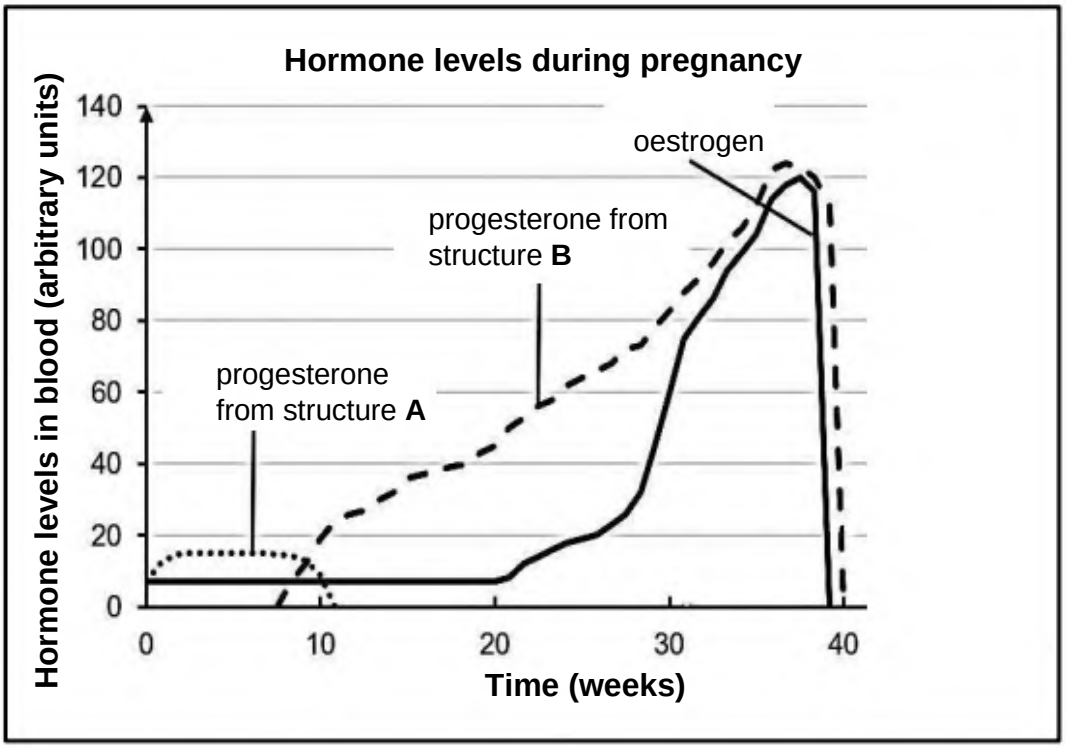
3.3.2 Give a reason for your answer to QUESTION 3.3.1. (2)

3.3.3 Label parts:

(a) **W** (1)
(b) **X** (1)

3.3.4 The final phase of this meiotic division is telophase 2.
Describe the cells and their contents during this phase. (4)
(9)

3.4 The diagram below shows hormone levels during pregnancy.



3.4.1 Identify structure:

(a) **A** (1)
(b) **B** (1)

3.4.2 Name the reproductive hormone with which progesterone has a negative feedback relationship. (1)

3.4.3 Explain the levels of progesterone during pregnancy and the effect of the mechanism mentioned in QUESTION 3.4.2 on reproduction. (4)

3.4.4 Describe how structure **A** is formed. (2)
(9)

3.5 Thando conducted an experiment among his classmates to determine which gender has the faster reaction time. Out of the 15 learners in his class, he randomly selected a sample of 5 girls and 5 boys.

The following steps were followed for each member of the sample during the experiment:

- Thando held a metre ruler, vertically, between his thumb and index finger just above the 100 cm mark.
- Each learner then placed the thumb and index finger on either side of the metre ruler at the 0 cm mark.
- As Thando dropped the metre ruler the learner caught it by closing the thumb and forefinger.
- During each trial Thando recorded the distance at which the metre ruler was caught.
- The procedure was repeated five times for each learner.

The table below shows the average distance at which the meter ruler was caught by 5 boys and 5 girls over 5 trials.

AVERAGE DISTANCE AT WHICH THE METRE RULER WAS CAUGHT OVER 5 TRIALS (CM)			
BOYS		**GIRLS**	
Boy 1	5,8	Girl 1	4,8
Boy 2	5,0	Girl 2	4,7
Boy 3	4,9	Girl 3	4,2
Boy 4	4,8	Girl 4	4,0
Boy 5	4,6	Girl 5	3,9
Average (cm)	**5,02**	**Average (cm)**	**3,32**

3.5.1 State the:

(a) Independent variable (1)
(b) Dependent variable (1)

3.5.2 Give ONE reason why this experiment is regarded as reliable. (1)

3.5.3 Identify TWO variables that should be kept constant. (2)

3.5.4 State the conclusion of the experiment. (1)

3.5.5 Describe the impact of having more controlled variables in the investigation. (2)

(8)
[50]

TOTAL SECTION B: 100

TOTAL: 150