education

Department of Education
FREE STATE PROVINCE

GRADE 12

LIFE SCIENCES P1

SEPTEMBER 2009

MARKS: 150

TIME: 2½ hours

This question paper consists of 16 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 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. ALL drawings should be done in pencil and labelled in blue or black ink.
7. ONLY draw diagrams or flow charts when asked to do so.
8. The diagrams in this question paper are NOT all drawn to scale.
9. Do NOT use graph paper.
10. Non-programmable calculators, protractors and compasses may be used.
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 – 1.1.5) in the ANSWER BOOK, for example 1.1.6 D.

1.1.1 The purine base which joins cytosine in a DNA molecule is ...

A pyrimidine.
B thymine.
C adenine
D guanine.

1.1.2 The correct sequence of the developmental stages during spermatogenesis is ...

A germinal epithelial cells → spermatozoa → spermatogonia.
B germinal epithelial cells → spermatids → spermatozoa.
C spermatids → spermatogonia →spermatozoa.
D spermatogonia → spermatozoa → germinal epithelial cells.

1.1.3 The offspring of a homozygous white guinea-pig which had been crossed with homozygous black guinea-pig were all grey. What percentage of the F_2 generation will be grey if two grey guinea-pigs were mated?

A 75%
B 50%
C 43%
D 25%

1.1.4 The structure of a flower in angiosperms which bears all four whorls of floral leaves is ...

A sepals.
B carpels.
C receptacle.
D petals.

1.1.5 The particular position of a gene on a chromosome is called ...

A a locus.
B an allele.
C genetics.
D homologous.

(5 x 2) (10)

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 - 1.2.8) in the ANSWER BOOK.

1.2.1 The allele which is expressed in an organism when the condition is heterozygous

1.2.2 The inner lining of the uterus which nourishes the developing embryo

1.2.3 The process of making genetically identical organisms through non-sexual means

1.2.4 The collective term for stigma, style and ovary

1.2.5 The genetic crossing of two organisms in which two pairs of contrasting characteristics are studied

1.2.6 The display of all chromosomes of a somatic cell, arranged by size and shape

1.2.7 A genetic syndrome in which the person lacks the ability to produce the pigment melanin

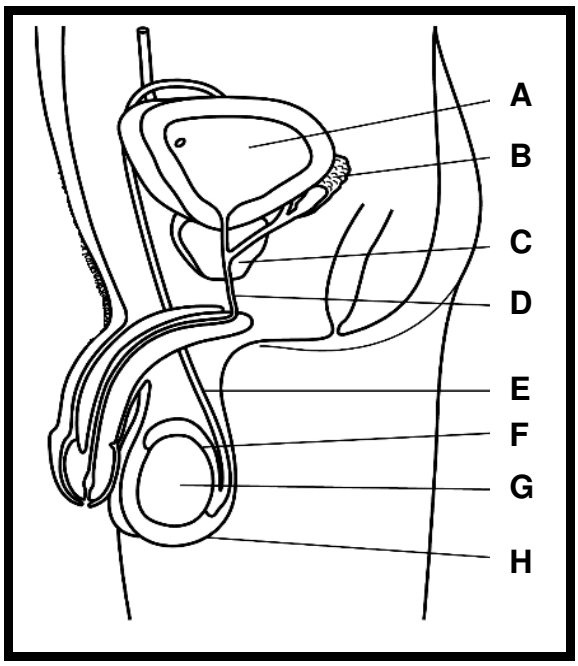
1.2.8 The new cells that result after a cell has divided (8)

1.3 Choose an item from COLUMN II that matches the statement in COLUMN I. Write only the letter (A – H) next to the question number (1.3.1 – 1.3.5) in the ANSWER BOOK, for example 1.3.6 J.

	COLUMN I		COLUMN II
1.3.1	Plays a role in the protection of the developing foetus	A	chiasma
1.3.2	The process during which one nucleus fuses with polar nuclei and the other nucleus with the egg cell in angiosperms	B	alleles
1.3.3	The point at which chromatids of homologous chromosomes cross over during meiosis	C	testes
1.3.4	Alternative forms of a gene	D	amniotic fluid
1.3.5	The manipulation of genes in biotechnology	E	genetic engineering
		F	replication
		G	double fertilization
		H	chromosome

(5)

1.4 Study the diagram below which shows the male reproductive system and answer the questions that follow.



1.4.1 Provide a label for part E. (1)

1.4.2 State ONE function of part:

(a) A

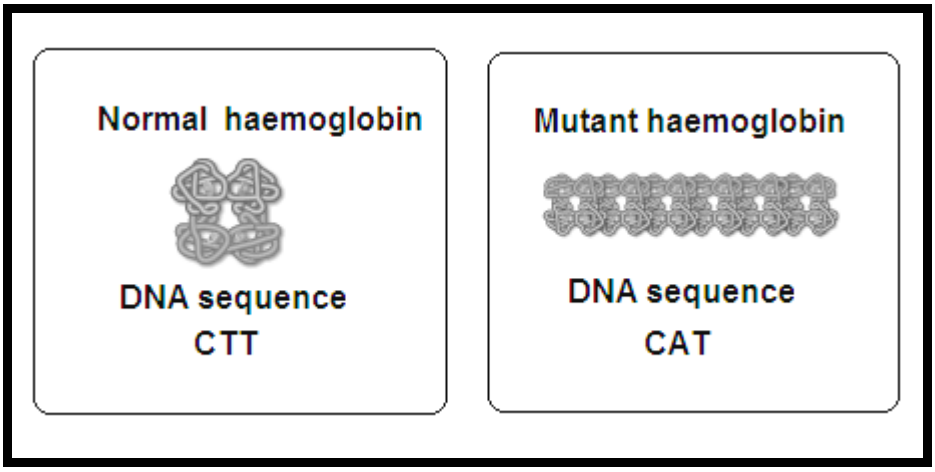
(b) D

(c) H (3)

1.4.3 Explain the function that parts B and C have in common. (2)

1.4.4 Write down the LETTER of the part in which meiosis occurs and name the type of cells that forms at the end of the process. (2)
(8)

1.5 Sickle-cell disease is caused by a gene mutation which causes a single change in the nucleotide sequence. Study the diagram below which shows normal and mutant haemoglobin and answer the questions that follow.



1.5.1 Use the DNA sequence and state the mRNA sequence for the ... haemoglobin.

(a) normal (1)

(b) mutant (1)

1.5.2 State THREE symptoms of sickle-cell disease. (3)

1.5.3 Which gas is the red blood cell unable to transport successfully when a person has sickle-cell disease? (1)

1.5.4 The gene for sickle-cell disease is recessive. When two people who are heterozygous for sickle-cell disease have a child, what is the possibility that the child will have sickle-cell disease? (2)
(8)

1.6 The table below shows the blood stock of the South African National Blood Service (SANBS) at a certain date for the different blood types. Study the table and answer the questions that follow.

BLOOD TYPES	DAY'S STOCK
A	3,5
AB	16,1
O	2,5
B	2,7

1.6.1 Which blood type has the lowest number of day's stock? (1)

1.6.2 State ONE possible reason why the stock of this blood type is lower than other blood types. (1)

1.6.3 SANBS needs an eight-day supply of blood at all times. Suggest ONE reason why there is a shortage of donated blood in South Africa. (2)

1.6.4 Sarah has a child who is blood group B. There are two men who are claiming paternity of the child. Paul is blood group O and James is blood group AB. Sarah's blood group is heterozygous A.

(a) Use a genetic cross to show why James is the father of the child. (6)

(b) What is the genotype of the child's blood type? (1)

(11)

TOTAL SECTION A: (50)

SECTION B

QUESTION 2

2.1 Study the accompanying diagram and answer the questions that follow.

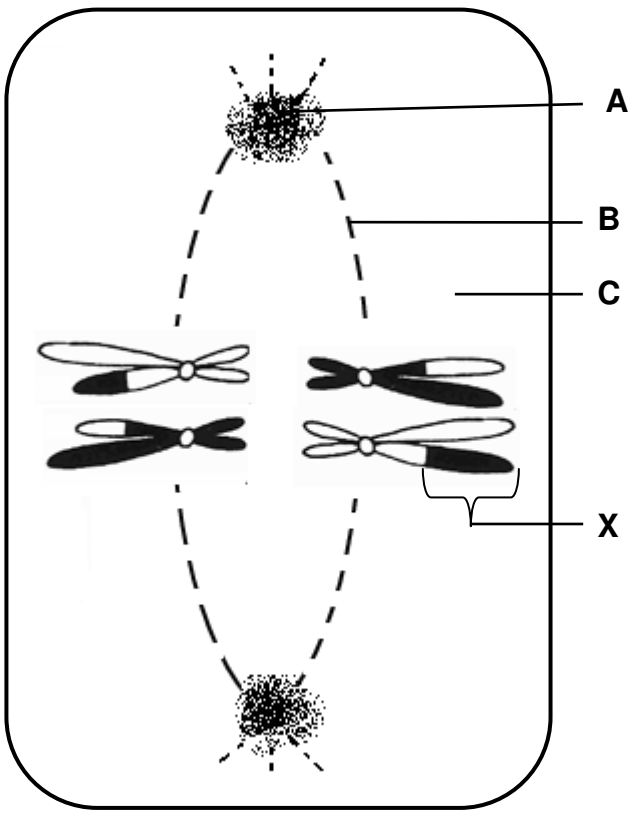


Diagram representing a phase of meiosis

2.1.1 Name the phase represented in this diagram. (1)

2.1.2 Provide labels for parts A, B and C. (3)

2.1.3 How many chromosomes are visible in the diagram above? (1)

2.1.4 Is this cell haploid or diploid? (1)

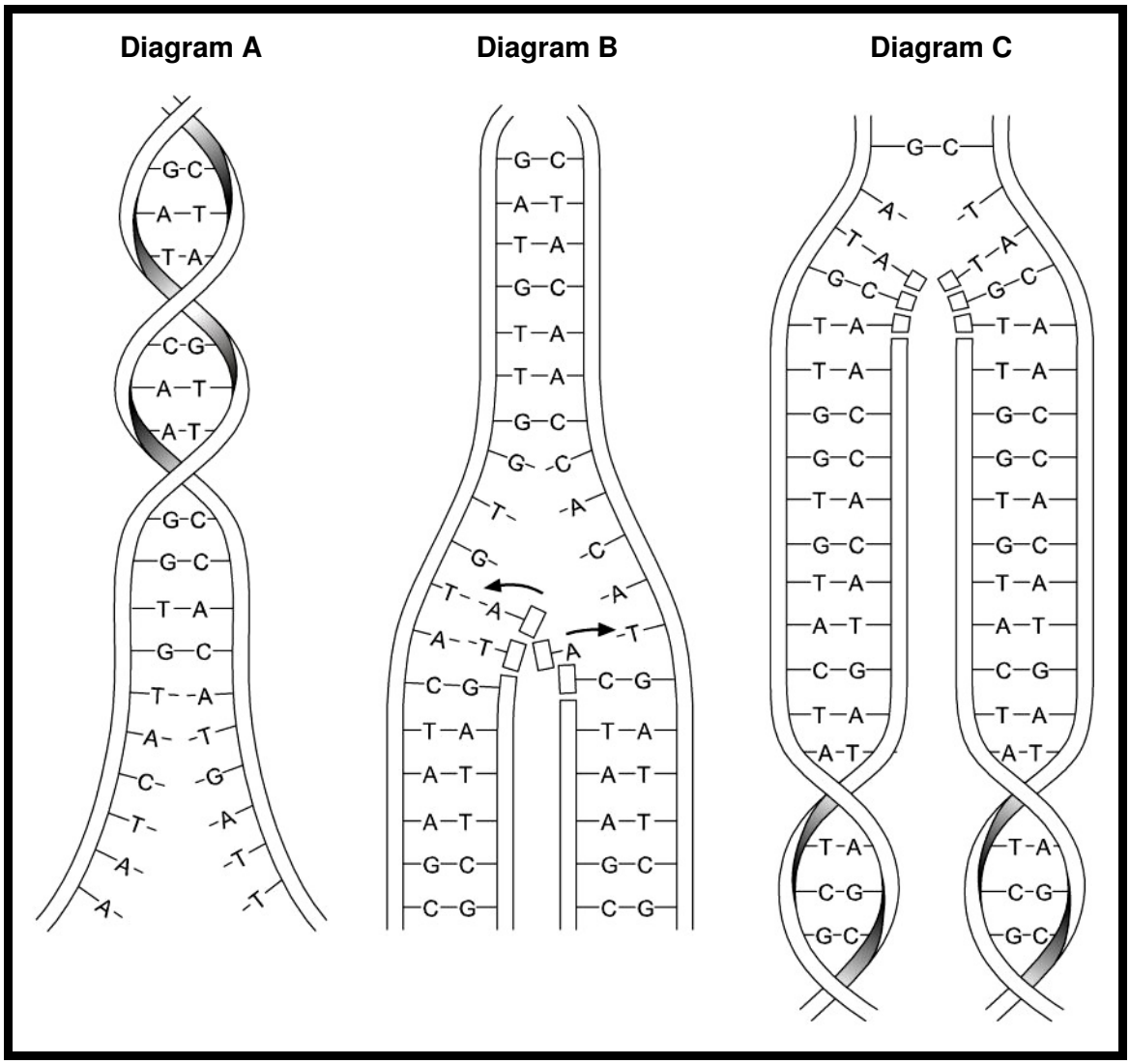
2.1.5 Give a reason for your answer in QUESTION 2.1.4. (1)

2.1.6 Name the process that took place to form the part labelled X. (1)

2.1.7 Explain the importance of the process named in QUESTION 2.1.6 (2)

(10)

2.2 The following three diagrams (A, B and C) show an important process that occurs before cell division.

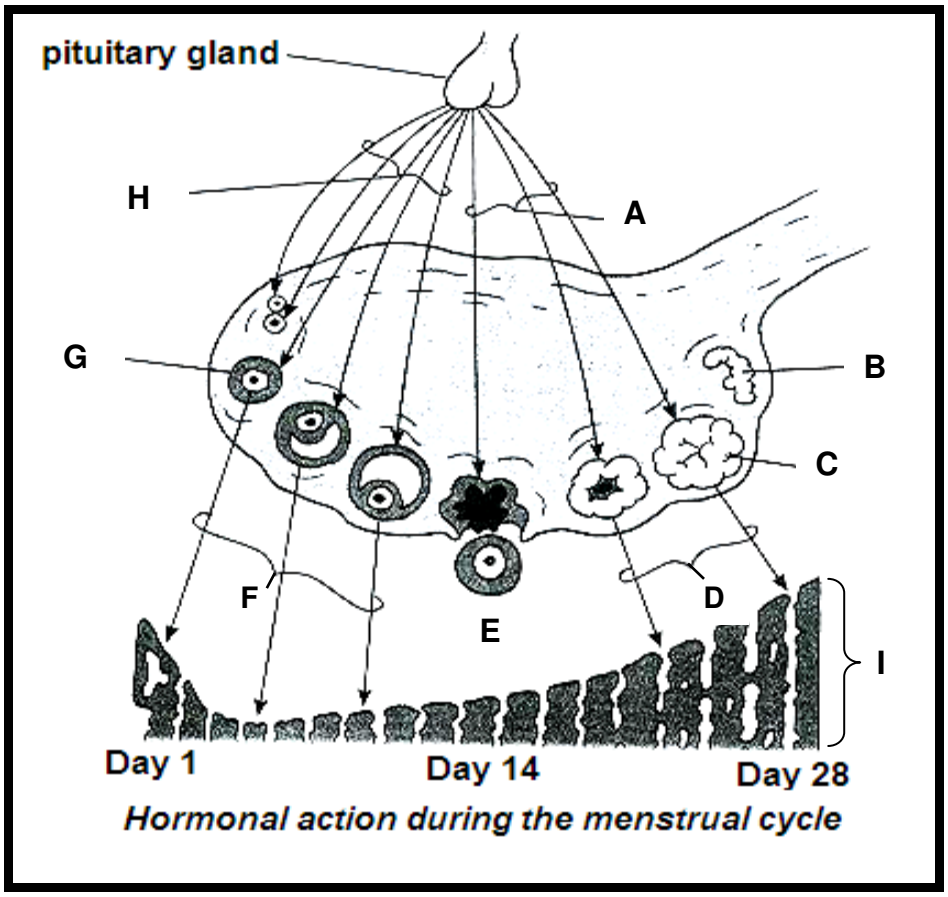


2.2.1 Name the process that is being shown in the diagram. (1)

2.2.2 Provide a brief explanation for what is being shown in each of the diagrams A, B and C. (3)

(4)

2.3 The diagram below shows the hormonal action during the menstrual cycle. Study this diagram and then answer the questions that follow:



Hormonal action during the menstrual cycle

2.3.1 State the TWO hormones shown at A and H. (2)

2.3.2 Which process is taking place at E? (1)

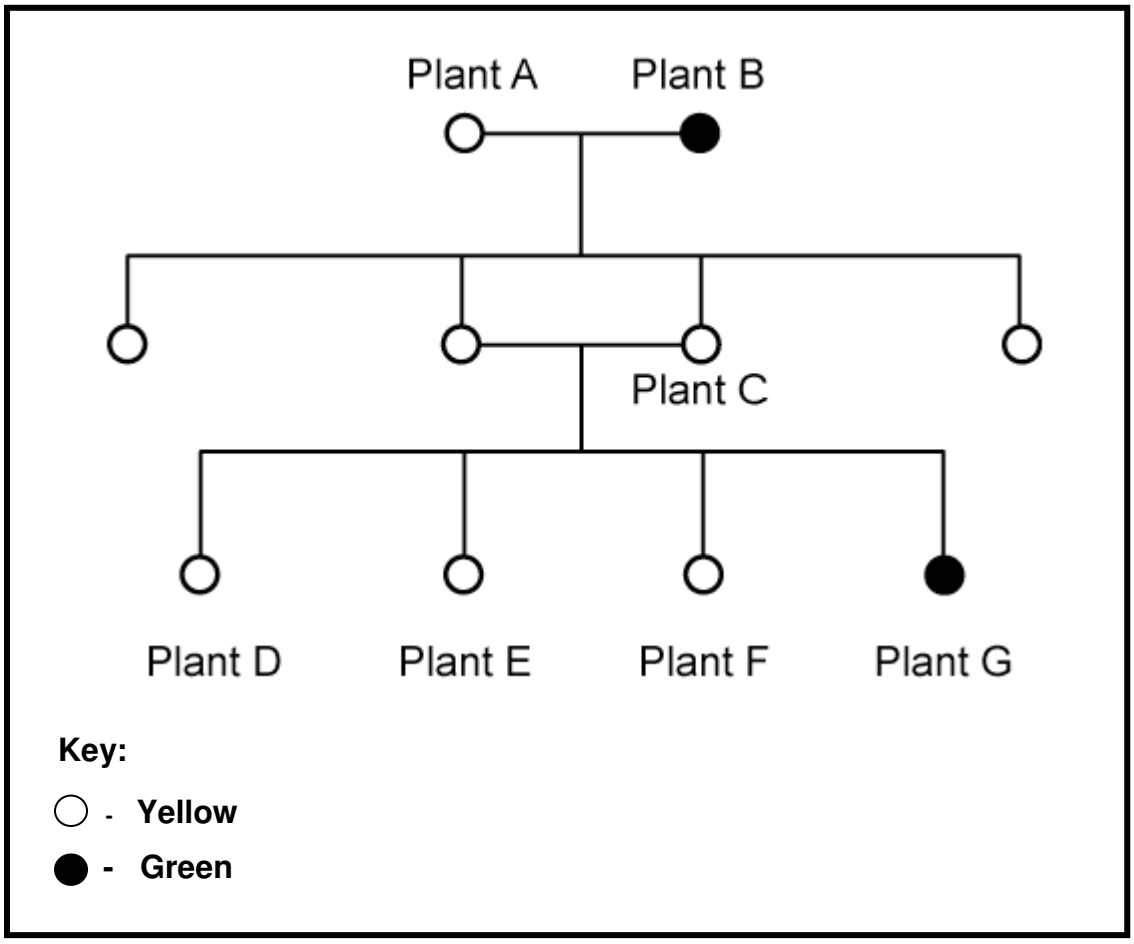
2.3.3 Identify structures C and E. (2)

2.3.4 Explain why the lining of the uterus (I) needs to be repaired and maintained. (2)

2.3.5 Name the main hormone produced at C after day 14 and give its function. (2)

2.3.6 Under what circumstances will hormone H not be produced and secreted in a healthy young woman? (1)
(10)

2.4 Sello crosses two pure breeding garden pea plants in the laboratory. Plant A produces yellow peas and plant B green peas. He knows that the gene for yellow peas (Y) is dominant over the gene for green peas (y). The diagram below shows the results he obtained for two generations of pea plants. Study the diagram and answer the questions that follow.



2.4.1 Give the genotype for plant A and plant B. (2)

2.4.2 Provide the phenotypic ratios for the F_2 generation. (2)

2.4.3 If Sello allows plant G to self-pollinate, give the phenotype and genotype of the offspring. (2)
(6)

[30]

QUESTION 3

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

PROTEIN PRODUCTION IN BACTERIA

Researchers at the University of California have determined which factors are responsible for protein production in bacteria – a finding that provides new targets for the development of antibiotics.

In the study, researchers reported how the mRNA instructions on how to make a protein are unfolded in a bacterial cell. Since unfolding the instructions is an essential step in protein synthesis, the researchers say that drugs designed to interfere with this step would make ideal antibiotics.

*(*Adapted from*: University of California Report Journal)*

3.1.1 According to the article, what important discovery have researchers made at the University of California? (1)

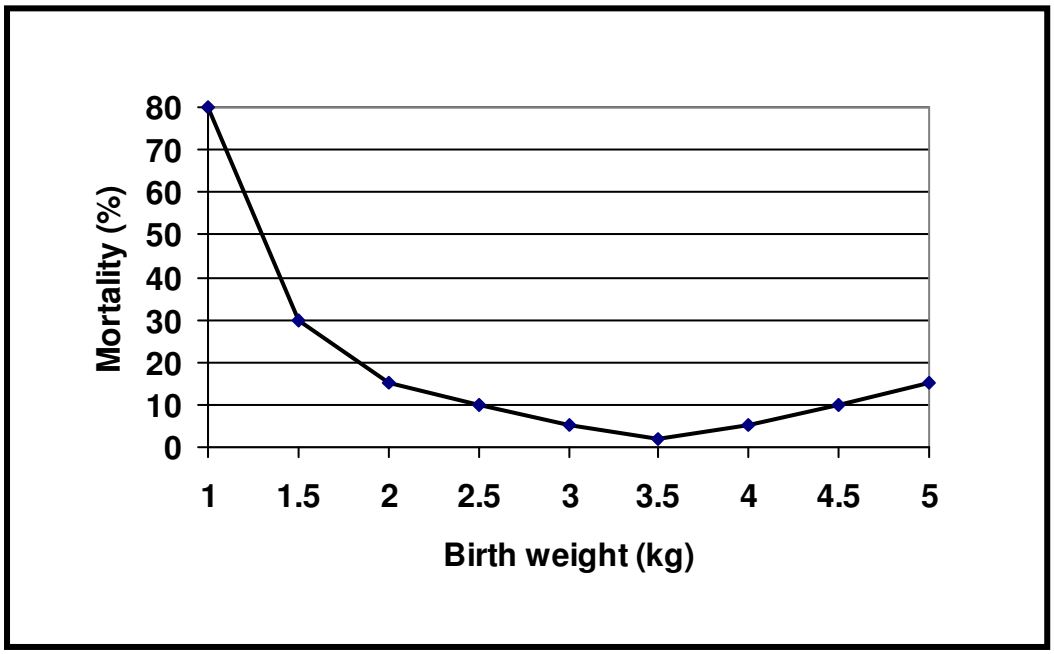
3.1.2 Why do bacteria become resistant to antibiotics? (1)

3.1.3 According to the article, discuss how the new antibiotics could work to control disease-causing bacteria? (2)

3.1.4 Explain the functions of mRNA during protein synthesis in human cells. (4)

3.1.5 State the building blocks of proteins. (1)
(9)

3.2 A group of Grade 12 learners visited a hospital in a city to investigate the relationship between birth weight and mortality rate in new born babies. Their results are shown in the graph below. Study the graph and answer the questions that follow.



3.2.1 What is the optimum birth weight in terms of the lowest newborn mortality rate? (2)

3.2.2 State a hypothesis for this investigation. (2)

3.2.3 Use the data in the graph to draw a table that shows the results they have obtained. (6)

3.2.4 State ONE way how the learners could improve the validity of their results? (1)

3.2.5 Explain the possible relationship between the birth weight and the newborn mortality rate. (4)
(15)

3.3 A married couple has four girls but no boys.

3.3.1 Explain why this does not mean that the husband only produces X sperms. (2)

3.4 The relative amounts of DNA were measured in the cells of the house plant (spiderwort) *Tradescantia sp.* during meiosis and mitosis. The results are given in the table below.

Phase of nuclear cycle		**DNA content per cell**
Mitosis	Early interphase	2
	Prophase	4
Meiosis I	Late telophase	2
	Early prophase	4
Meiosis II	Late prophase	2
	Telophase	2

3.4.1 Account for the differences in DNA content between:

(a) Mitosis early interphase and mitosis prophase. (2)

(b) Meiosis I prophase and meiosis II telophase. (2)
(4)

TOTAL SECTION B: 60

SECTION C

QUESTION 4

4.1 The Human Research Council conducted a study of HIV/AIDS prevalence and tested 8 428 people of different ages for HIV/AIDS in 2002. The results are shown in the table below.

AGE	NUMBER	HIV POSITIVE (%)	
		Male	Female
Children (2 – 14)	2 348	5.9	5.2
Youth (15 – 24)	2 099	6.1	12.0
Adults (25+)	3 981	14.1	16.2
TOTAL	8 428	9.5	12.8

4.1.1 Which age group has the highest incidence of HIV+? (1)

4.1.2 State a reason for your answer in QUESTION 4.1.1. (1)

4.1.3 On the same system of axes, draw TWO sets of bar graphs to compare the percentages of HIV+ males with HIV+ females for the THREE different age groups. (11)

4.1.4 When the survey was conducted, 13 512 people were asked if they would allow themselves to be tested for HIV but only 8 428 people agreed to be tested.

State a possible reason why many people refused to be tested. (1)

4.1.5 The following proposal was made to control the spread of HIV:

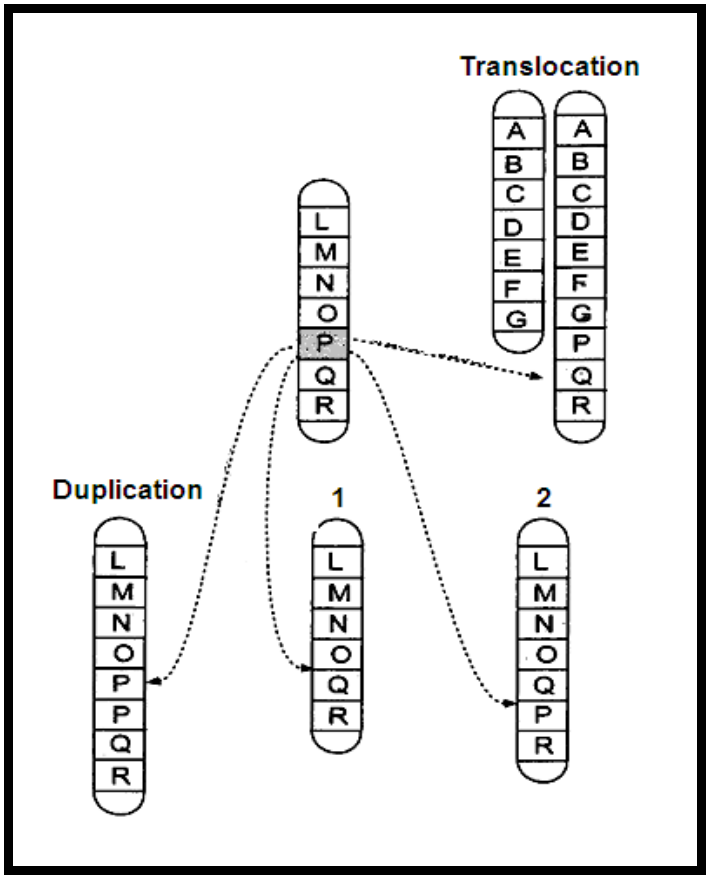
All sexually active people should be compelled by law to get a HIV test and to make the results available to any body that needs this information.

(a) State TWO advantages of this proposal. (2)

(b) State TWO disadvantages of this proposal. (2)

(18)

4.2 Study the diagrams below that show four ways in which the structure of a chromosome can change and answer the questions that follow.



4.2.1 Identify and describe the type of mutation represented by 1 and 2 in the diagrams above. (4)

4.2.2 List THREE causes of mutations. (3)

(7)

4.3 Gonorrhoea and syphilis are common sexually transmitted diseases (STD's) which infect a relatively high percentage of young sexually active people on the African continent and world-wide.

Write a mini-essay in which you discuss the causes, symptoms and possible treatment for each of these STDs.

Content: (12)
Synthesis: (3)
(15)

NOTE: NO marks will be awarded for answers in the form of flow charts or diagrams.

TOTAL SECTION C: 40
GRAND TOTAL: 150