



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

**LIFE SCIENCES P1
FEBRUARY/MARCH 2009**

MARKS: 150

TIME: 2½ hours

This question paper consists of 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 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 nitrogenous base which replaces thymine in an RNA molecule is ...
- A guanine.
 - B uracil.
 - C adenine.
 - D cytosine.
- 1.1.2 Menstruation starts when the production of ...
- A oestrogen and progesterone decreases.
 - B progesterone is at its maximum.
 - C oestrogen is at its maximum.
 - D luteinising hormone is at its maximum.
- 1.1.3 Down's syndrome occurs when ...
- A a male sex cell undergoes mitosis.
 - B every cell of an organism has an extra pair of chromosomes.
 - C all somatic cells have an extra chromosome.
 - D a female sex cell undergoes mitosis.
- 1.1.4 In DNA, if the sequence of bases on one strand is AGG, the corresponding bases on the complementary strand are ...
- A ACC.
 - B TAA.
 - C CTT.
 - D TCC.
- 1.1.5 After the process of fertilisation in a flower, the ...
- A petals remain permanently attached to the flower.
 - B ovules and ovary wall enlarge greatly.
 - C whole flower dries and drops off.
 - D ovary becomes a seed.
- (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 remains of the Graafian follicle after ovulation
- 1.2.2 Genes in the same position on homologous chromosomes
- 1.2.3 The transfer of ripe pollen grains from an anther to a receptive stigma
- 1.2.4 The process by which amniotic fluid is withdrawn to test for abnormalities of the foetus
- 1.2.5 The organ in human males in which meiosis occurs
- 1.2.6 The meiotic process by which female gametes are formed in humans
- 1.2.7 Type of cell division during which the chromosome number does not change
- 1.2.8 A pair of identical chromosomes found in diploid cells (8)

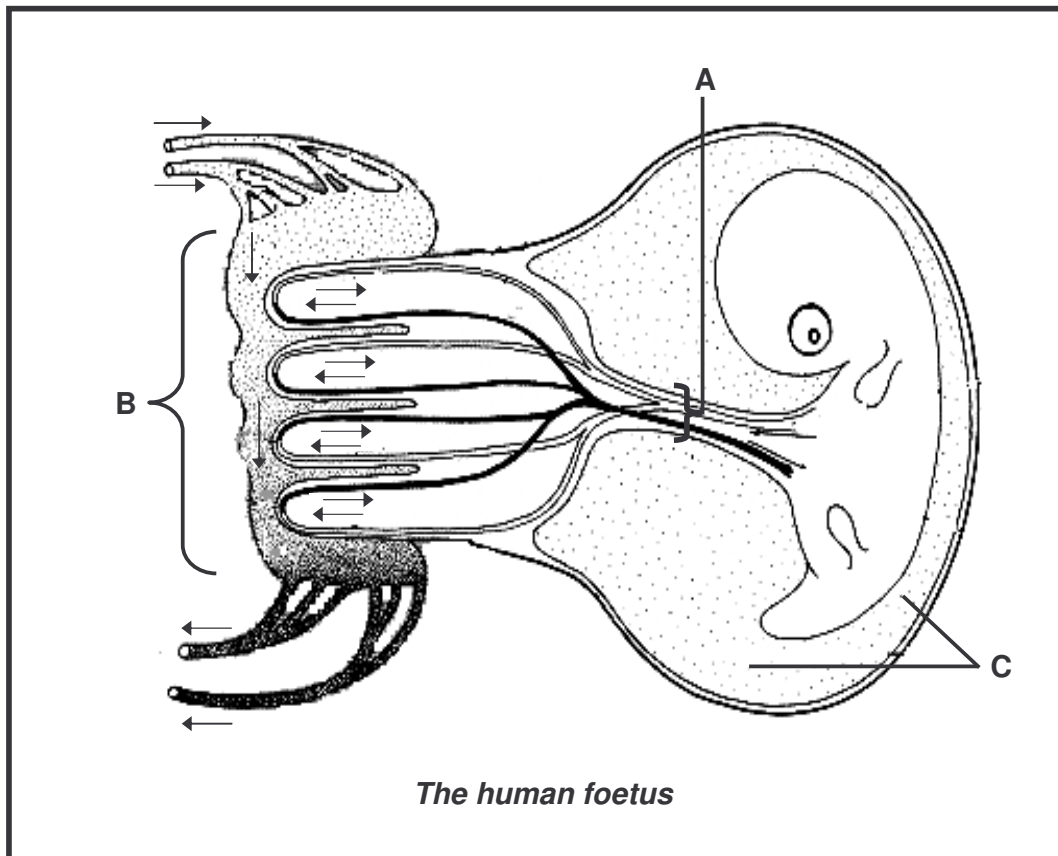
1.3 Choose an item from COLUMN II that matches a statement in COLUMN I. Write only the letter (A – H) next to the question number (1.3.1 – 1.3.5) in the ANSWER BOOK, for example 1.3.6 J.

COLUMN I		COLUMN II	
1.3.1	The tube leading from the testes to the urethra	A	syphilis
1.3.2	Sexually transmitted disease	B	cells of Sertoli
1.3.3	Surgical method of contraception in males	C	vas deferens
1.3.4	Plays a role in the nutrition of human spermatozoa	D	diploid
1.3.5	The chromosome number in human somatic cells	E	malaria
		F	Fallopian tube
		G	mastectomy
		H	vasectomy

(5)



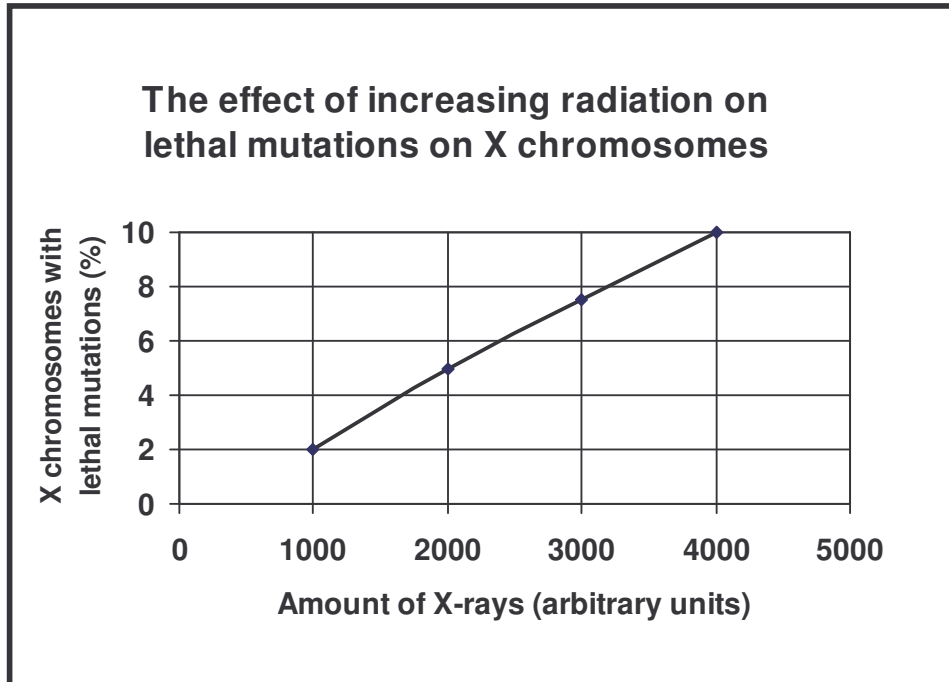
1.4 Study the diagram below and answer the questions that follow.



- 1.4.1 Provide labels for A and B. (2)
- 1.4.2 Explain ONE way in which the part labelled B is structurally adapted for its function. (2)
- 1.4.3 Name TWO functions of the fluid found at C. (2)
- 1.4.4 Name the condition that might occur in the foetus if the mother consumes too much alcohol during the pregnancy. (1)
- 1.4.5 State what effect the condition named in QUESTION 1.4.4 would have on the child that is born. (1)

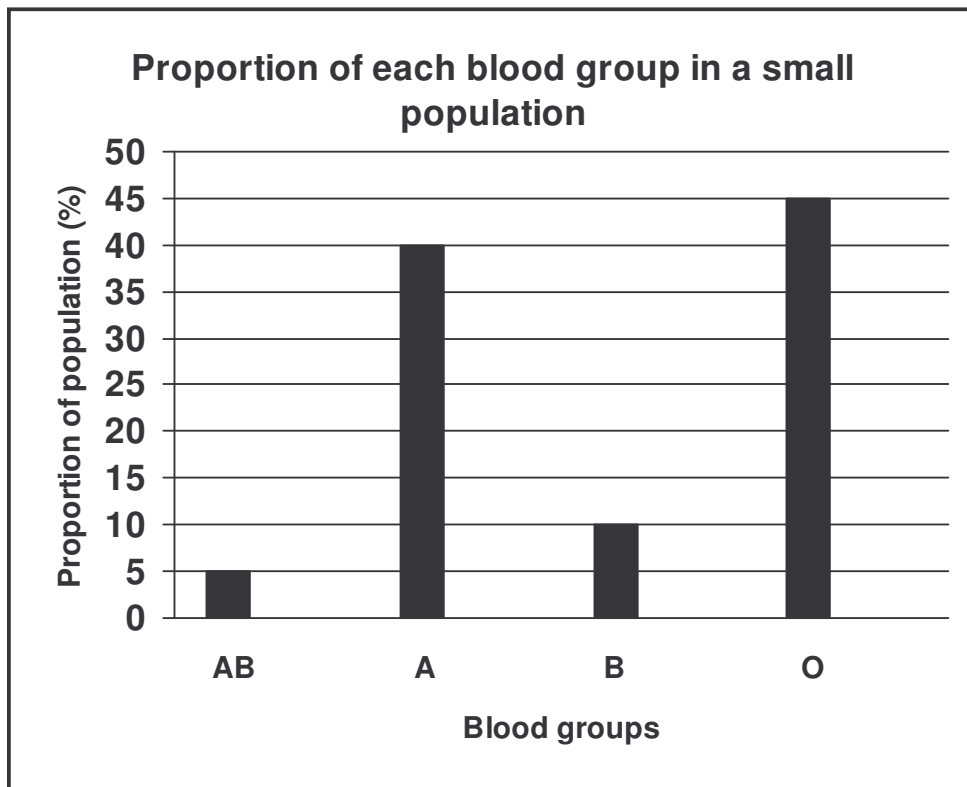
- 1.5 An investigation to determine the effect of increasing radiation on lethal (deadly) mutations on X chromosomes in fruit flies was undertaken by scientists.

The results are shown in the graph below.



- 1.5.1 Formulate a possible hypothesis for this investigation. (2)
- 1.5.2 Name ONE factor that was varied by the scientists in this investigation. (1)
- 1.5.3 How many different values of the factor named in QUESTION 1.5.2 above were used? (1)
- 1.5.4 Name TWO factors that would have to be kept constant during this investigation. (2)
- 1.5.5 What conclusion can be drawn from the results presented in the graph? (2)
- 1.5.6 If you were carrying out this investigation, describe ONE way in which you would ensure that the results obtained are reliable. (2)

- 1.6 The graph below shows the results of an investigation into the frequency of blood groups in a small human population.



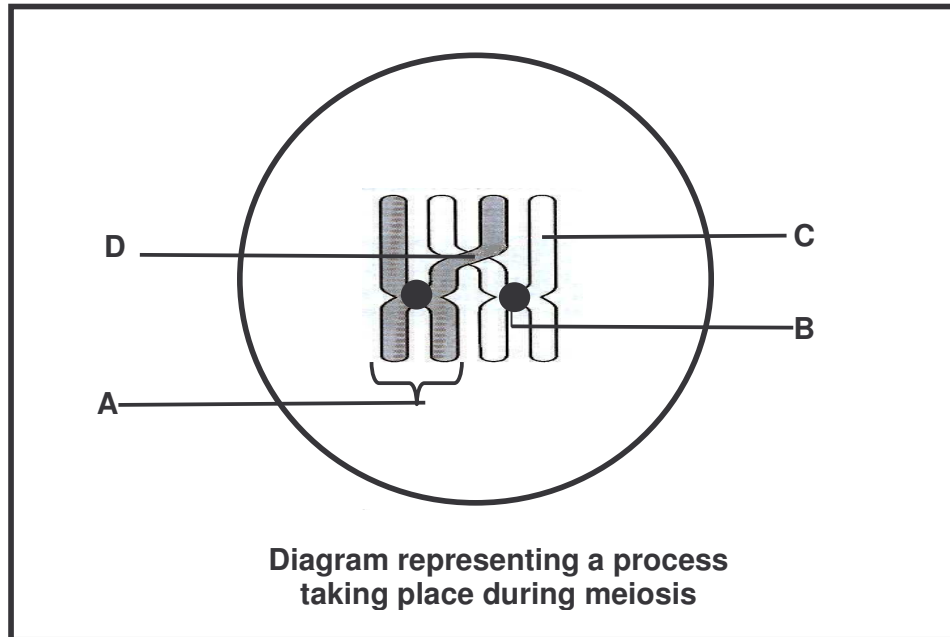
- 1.6.1 Which blood group has the lowest frequency in the population investigated? (1)
- 1.6.2 State ONE reason why it is suitable for the results of this investigation to be represented in the above type of graph. (2)
- 1.6.3 Using the information provided, construct a table to show the data that was used to draw the graph. (6)

TOTAL SECTION A: 50



SECTION B**QUESTION 2**

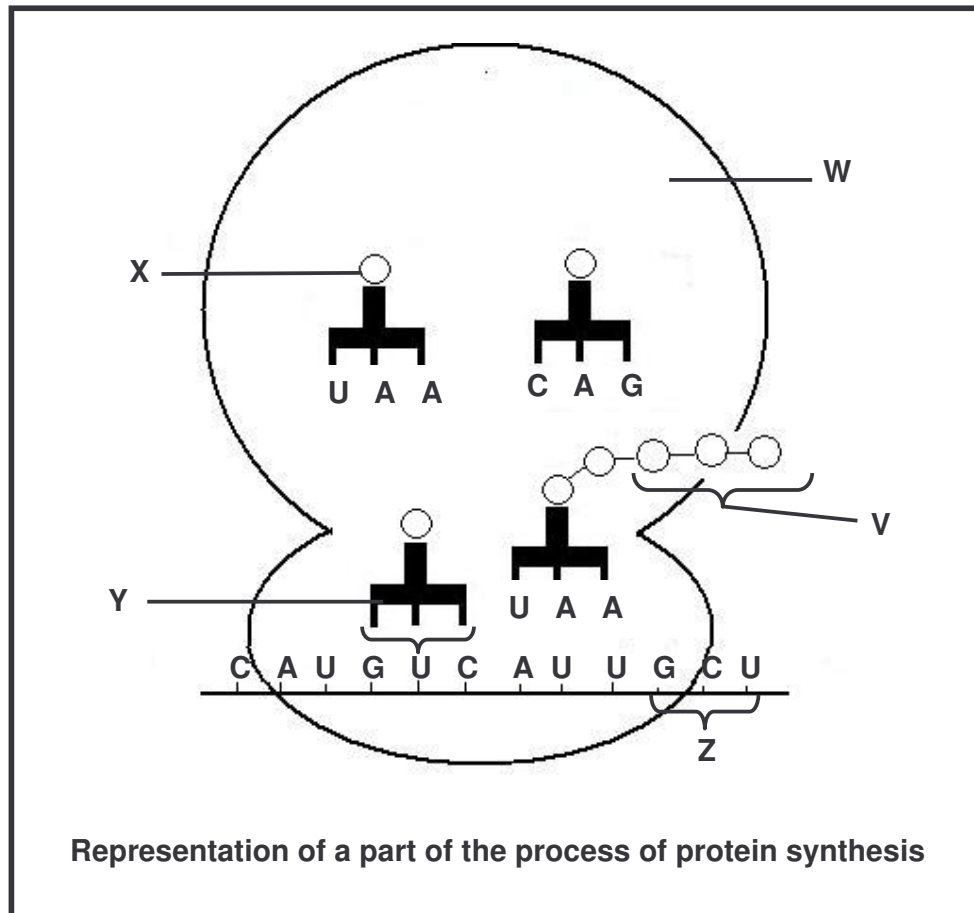
2.1 The diagram below represents a process taking place during meiosis.



- 2.1.1 Provide labels for parts A, B, C and D. (4)
- 2.1.2 Name the process in meiosis that is illustrated in the diagram above. (1)
- 2.1.3 State ONE importance of the process named in QUESTION 2.1.2 (2)
- 2.1.4 During which phase of meiosis does the process named in QUESTION 2.1.2 occur? (1)
- 2.1.5 Draw a diagram of the structure labelled **A** to show its appearance immediately after the process named in QUESTION 2.1.2. (2)



2.2 The diagram below represents a part of the process of protein synthesis.



2.2.1 Name the part/stage of protein synthesis that is illustrated in the diagram above. (1)

2.2.2 Name the organelle labelled **W**. (1)

- 2.2.3 The table below shows the base triplets of mRNA that correspond to the different amino acids.

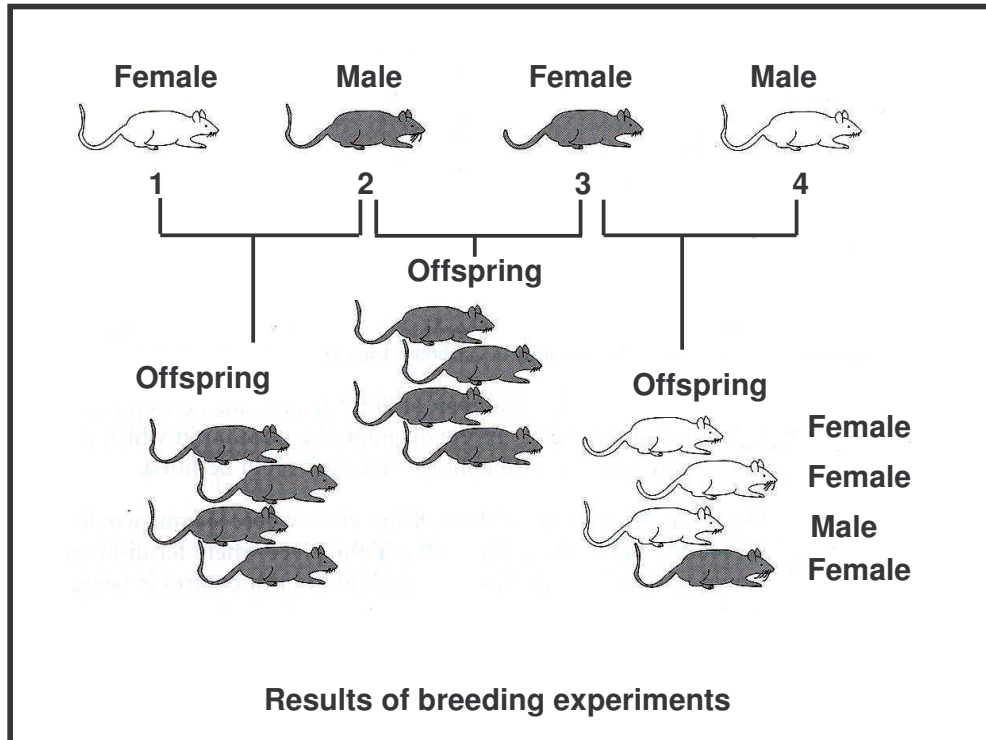
mRNA	AMINO ACID
CAU	histidine
AUU	isoleucine
GUC	valine
CUU	leucine
GCU	alanine
CCU	proline
CGA	arginine

With reference to the diagram in QUESTION 2.2 and the table above:

- (a) Name the amino acid labelled **X**. (1)
- (b) State the base sequence of the molecule labelled **Y**. (1)
- (c) What collective name is given to the triplet of mRNA bases that correspond to each amino acid? (1)
- (d) How would the composition of the protein molecule change if the base sequence at **Z** was CGA instead of GCU? (2)
- 2.2.4 Use the information in the table to write the DNA base sequence that would correspond with the amino acid histidine. (2)



- 2.3 Study the diagrams below that show some breeding experiments on mice. A single pair of alleles showing complete dominance controls coat colour (white or grey) in these mice.



- 2.3.1 State which sex chromosomes would be present in the gametes of parent mouse **2** and mouse **3**, respectively. (2)
- 2.3.2 If mice **3** and **4** had a second set of offspring, what is the percentage chance that the first mouse born would be female? (1)
- 2.3.3 Which of the parent mice (**1**, **2**, **3** or **4**) is likely to be homozygous dominant for coat colour? (1)
- 2.3.4 State why mouse **3** can only be heterozygous for coat colour. (2)

- 2.4 A group of Grade 12 learners did a survey about the frequency of genetic disorders in a small human population. The results are shown in the table below. The number of people in the population is 1 200.

RESULTS OF THE SURVEY ON THE FREQUENCY OF GENETIC DISORDERS IN A POPULATION

GENETIC DISORDERS	FREQUENCY IN POPULATION (%)
Albinism	7
Down's syndrome	x
Sickle cell anaemia	10
Without any disorder	78

- 2.4.1 According to the table, which disorder is most common in this community? (1)
- 2.4.2 Calculate the number of people with Down's syndrome. Show ALL working. (3)
- 2.4.3 Give ONE reason why genetic counselling would be important for parents who are expecting children that may be sufferers of a disorder such as Down's syndrome. (1)

[30]



QUESTION 3

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

GENETICALLY MODIFIED PIG BRED WITH 'GOOD FAT'

Scientists in the United States of America have produced genetically modified pigs with fat containing omega-3 fatty acids. These fatty acids, which are usually found in salmon, mackerel and fresh tuna, are thought to be responsible for a number of benefits, from combating heart disease to improving intelligence.

Researchers from the University of Pittsburgh – School of Medicine created piglets capable of converting less useful omega-6 fatty acids into omega-3 fatty acids. They implanted 1 800 embryos into 14 female pigs. Ten live offspring, which were able to make high levels of omega-3 fatty acids, were born.

[Adapted from: *Cape Argus*, 27 March 2006]

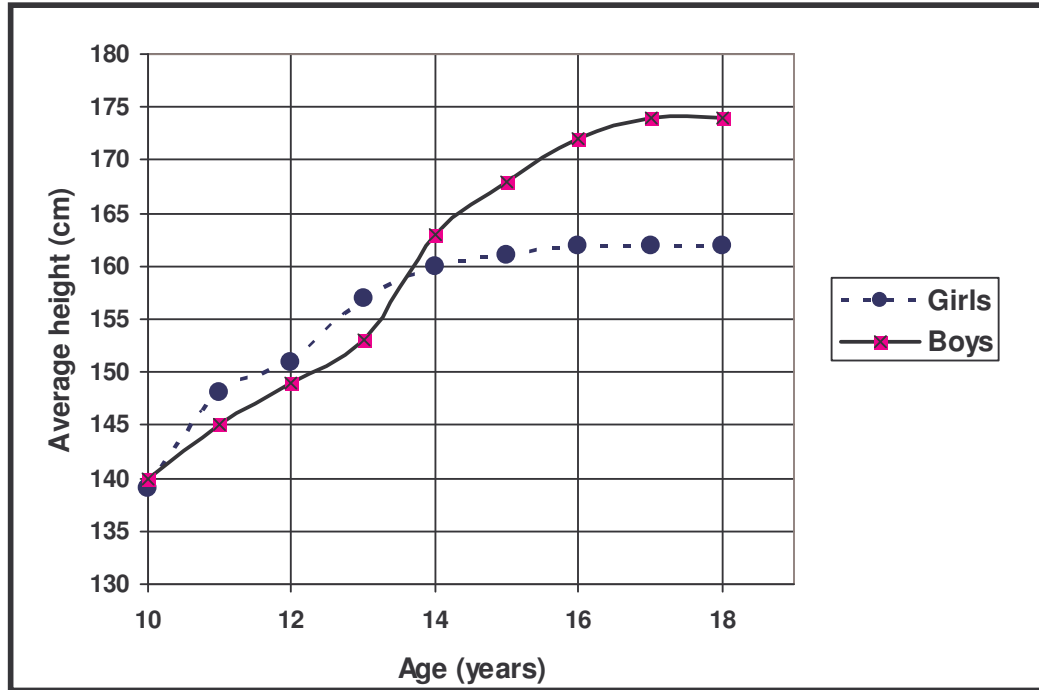
- 3.1.1 Name TWO health benefits of omega-3 fatty acids. (2)
- 3.1.2 What percentage success did the scientists have with the implanted embryos in forming a clone of pigs capable of producing omega-3 fatty acids? Show ALL working. (3)
- 3.1.3 To produce genetically modified pigs, the gene that produces omega-3 fatty acids is inserted into the pig embryos. Describe the steps in forming and introducing many copies of the desirable gene (using bacteria) into the pig embryos. (4)
- 3.1.4 Give TWO reasons why:
- (a) Some people may support the use of genetically modified pigs to produce omega-3 fatty acids (2)
 - (b) Some people may be against the use of genetically modified pigs to produce omega-3 fatty acids (2)



- 3.2 A group of Grade 12 learners were asked to test the following hypothesis with regard to phenotypes:

At each age group boys are taller than girls.

- 3.2.1 Name any THREE steps in the planning process that must be considered in this investigation. (3)
- 3.2.2 The results of the learners' investigation are shown in the graph below.



- (a) At what age is the average height of the boys and the girls the same? (1)
- (b) Provide a caption for the graph. (2)
- (c) Should the Grade 12 learners accept the hypothesis as a possible explanation of the results? (1)
- (d) Give a reason for your answer to QUESTION 3.2.2(c) above. (2)
- 3.3 In humans, the allele for blue (b) eyes is recessive to the allele for brown (B) eyes. A man, heterozygous for brown eyes, marries a woman with blue eyes. Show how the possible genotypes, phenotypes and ratio of individuals with brown and blue eyes in the F₁-generation, may be obtained. (8)

[30]

TOTAL SECTION B: 60



SECTION C**QUESTION 4**

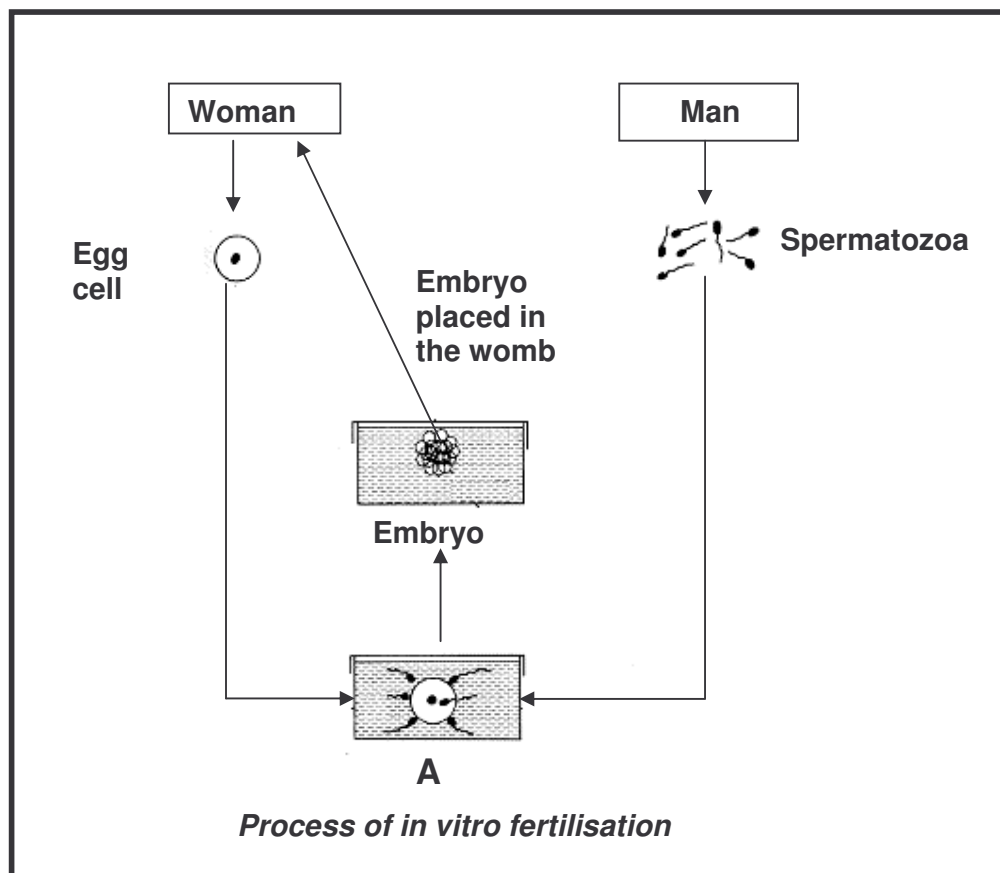
- 4.1 Records of human fertility for the period 1941 – 1990 have shown changes in the sperm counts of normal men. The table below summarises the changing percentages of men with high or low sperm counts over a period of 50 years.

TIME PERIOD	MEN WITH HIGH SPERM COUNTS (%)	MEN WITH LOW SPERM COUNTS (%)
1941 – 1950	50	4
1951 – 1960	45	5
1961 – 1970	28	11
1971 – 1980	21	14
1981 – 1990	15	18

- 4.1.1 By how much did the percentage of men with high sperm counts decrease in the period 1951 to 1970? (1)
- 4.1.2 On the same system of axes, draw TWO sets of bar graphs to compare the percentages of men with a high sperm count and a low sperm count from 1941 to 1990. (11)
- 4.1.3 Describe the trend for men with low sperm counts and compare it with those with high sperm counts over the 50-year period. (2)
- 4.1.4 Explain ONE reason why it is necessary for a large number of sperm to be produced when only one sperm is required to bring about fertilisation. (2)



4.2 The diagram below illustrates what happens during in vitro fertilisation (IVF).



- 4.2.1 What process takes place at **A**? (1)
- 4.2.2 Give TWO reasons why a couple may not be able to have children normally. (2)
- 4.2.3 In IVF more embryos are produced than can be implanted in the woman's uterus. Explain whether each of the following uses of the spare embryos is ethical or not:
- (a) It could be sold to couples that cannot have children (2)
- (b) It could be used to enhance research in embryology (2)
- 4.2.4 State ONE way in which IVF differs from cloning. (2)

- 4.3 Write a mini-essay explaining how any THREE contraceptive methods affect human reproduction. You should also explain ONE way in which contraception can influence the quality of human life.

Content (12)

Synthesis (3)

NOTE: NO marks will be awarded for answers in the form of flow charts or diagrams. (15)

TOTAL SECTION C: 40

GRAND TOTAL: 150

