LIFE SCIENCES

PAPER 1

SEPTEMBER 2009

TIME : 2½ hours
MARKS: 150

education

Western Cape Education Department

NATIONAL STRATEGY FOR LEARNER ATTAINMENT

NATIONAL SENIOR CERTIFICATE

SEPTEMBER EXAMINATION – 2009

This question paper consists of 15 pages.

INSTRUCTIONS AND INFORMATION

Carefully read the following instructions before answering the questions

1. Answer ALL the questions.
2. Write ALL the answers in the answering book.
3. Start each question on a new page.
4. Number the questions according to the numeration system used in this question paper.
5. You will be penalized if you fail to adhere to the instructions on each question.
6. ALL drawings should be done in pencil and labels in blue or black ink.
7. draw diagrams and flow charts ONLY when requested to do so.
8. The diagrams in this question paper may NOT necessarily be drawn to scale.
9. Graph paper may NOT be used.
10. Non-programmable calculators, protractors and compasses may be used.
11. Write neatly and legibly.

SECTION A

QUESTION 1

1. Various possible options are provided as 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 Between which types of compounds in a double-stranded DNA molecule must the bonds break before replication takes place?

A Phosphate-bases
B Sugar-phosphate
C Nitrogenous bases
D Sugar-bases

1.1.2 If the code for an amino acid is ATG on the DNA molecule, the anti-codon on the t-RNA molecule may be written as …

A ATG.
B CTG.
C AUG.
D CTA.

1.1.3 Alleles for the same trait are separated from each other during the process of …

A mitosis.
B meiosis II.
C cross-pollination.
D segregation.

1.1.4 The phenotypic ratio in the offspring resulting from the cross Tt x Tt is …

A 1:2:1.
B 3:1.
C 1:1.
D 9:3:3:1.

1.1.5 An intra-uterine device (IUD) is used …

A to determine the sex of an unborn baby.
B as a contraceptive by preventing implantation.
C to prevent transmission of STI's.
D to increase the amount of breast milk released.

(5X2) **(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 – 1.2.6) in the ANSWER BOOK.

1.2.1 The type of reproductive process in plants whereby a piece of a stem is bound to a suitable root-stock.
1.2.2 A change in the chemical structure of a gene.
1.2.3 The structure in the female body of humans where meiosis takes place.
1.2.4 An individual with alleles for a dominant characteristic on both chromosomes of a homologous pair.
1.2.5 The 44 somatic chromosomes found in human cells.
1.2.6 The part of the sperm cell that releases enzymes.

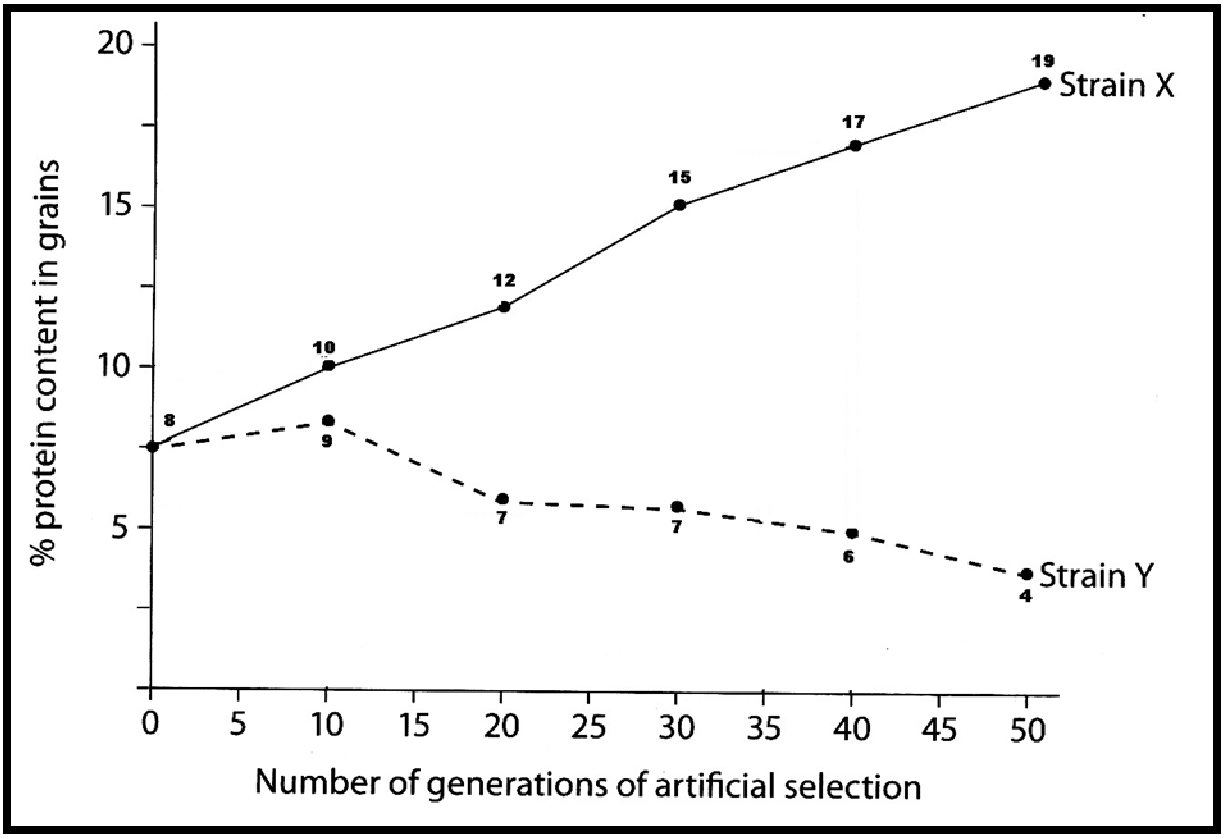
(6X1) **(6)**

1.3 Choose an item from **COLUMN II** that matches a description in COLUMN I. Write only the letter (A – H) next to the question number (1.3.1 – 1.3.6) in the ANSWER BOOK, for example 1.3.7 J.

	COLUMN I	**COLUMN II**
1.3.1	All the genes contained in a single set of chromosomes.	A zygote
1.3.2	The process of copying of DNA.	B translation
1.3.3	A cell that can grow into a new individual, formed by the fusion of gametes.	C blastocyst
1.3.4	A photograph of chromosomes organised as matched pairs in a table arranged by size.	D replication
1.3.5	The site for spermatogenesis.	E morula
1.3.6	Hollow ball of cells that implants into the uterus lining.	F seminiferous tubules
		G genome
		H karyotype

(6X1) **(6)**

1.4 The following line graph gives the results from a study to investigate the effect of genetic manipulation on the protein content of a species of cereal grains.



1.4.1 Supply a suitable caption (heading) for the graph. (2)

1.4.2 State a hypothesis for this investigation. (2)

1.4.3 Use the data in the graph to draw a table that shows the results that were obtained. (7)

1.4.4 What is the increase in the percentage protein content in strain X between generations 10 and 40? Show your calculations. (2)

1.4.5 What is the difference in the percentage protein content between strain X and Y after 35 generations of genetic manipulation? Show your calculations. (2)

(15)

1.5 The body of a young woman was found on an open plot. She was allegedly murdered and raped. DNA specimens are taken at the scene.

1.5.1 What is the purpose of taking DNA specimens at the scene? (2)

1.5.2 What other purpose, (not those mentioned in 1.5.1) can DNA fingerprinting also be used for? (1)
(3)

1.6 Dr Ronald Crystal is known for his research to help cure people with cystic fibrosis. One of the problems of this disease is that sufferers cannot produce certain proteins. His studies to insert genes into the lung cells of sufferers from the disease have progressed well.

1.6.1 Explain in SIX steps how Dr Ronald Crystal could transfer the healthy genes into the lung cells of his patients. (6)

1.6.2 What is this type of treatment called? (2)

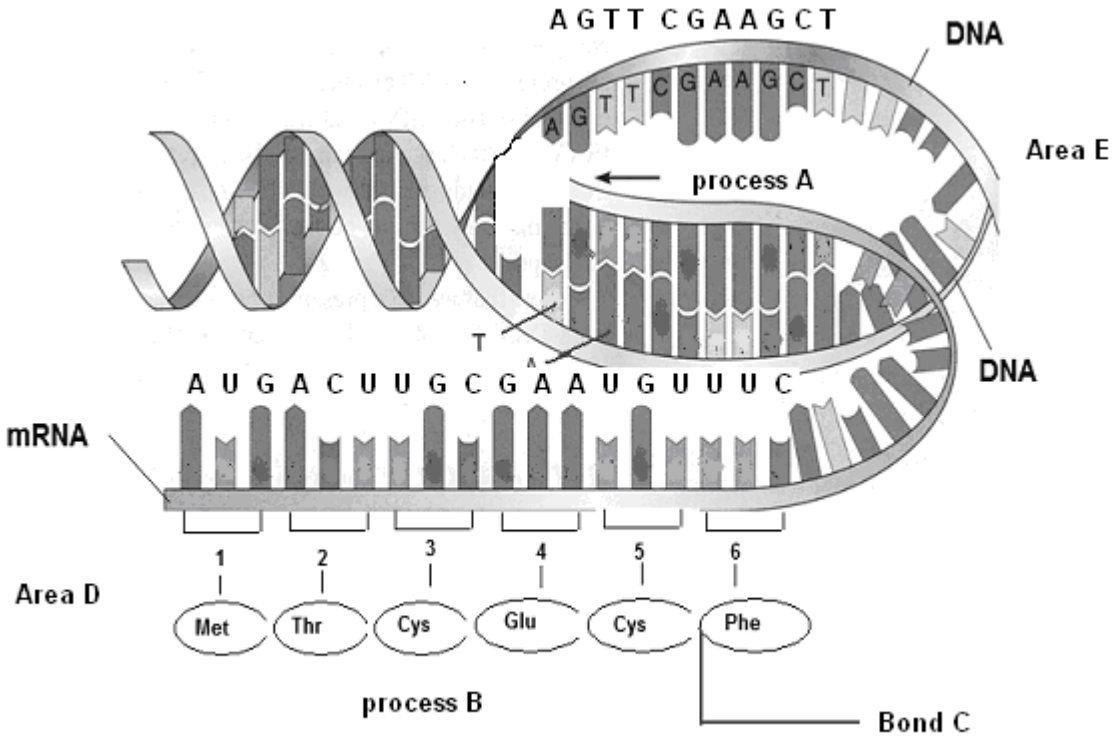
1.6.3 This procedure has only been tested on sterile men. State ONE possible reason. (2)
(10)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The following diagram illustrates the different steps during the synthesis of a specific protein.



2.1.1 Name the processes taking place at A and B respectively. (2)

2.1.2 Which organelles are found at “area D” and “area E” respectively? (2)

2.1.3 What are the base triplets called found on the mRNA? (2)

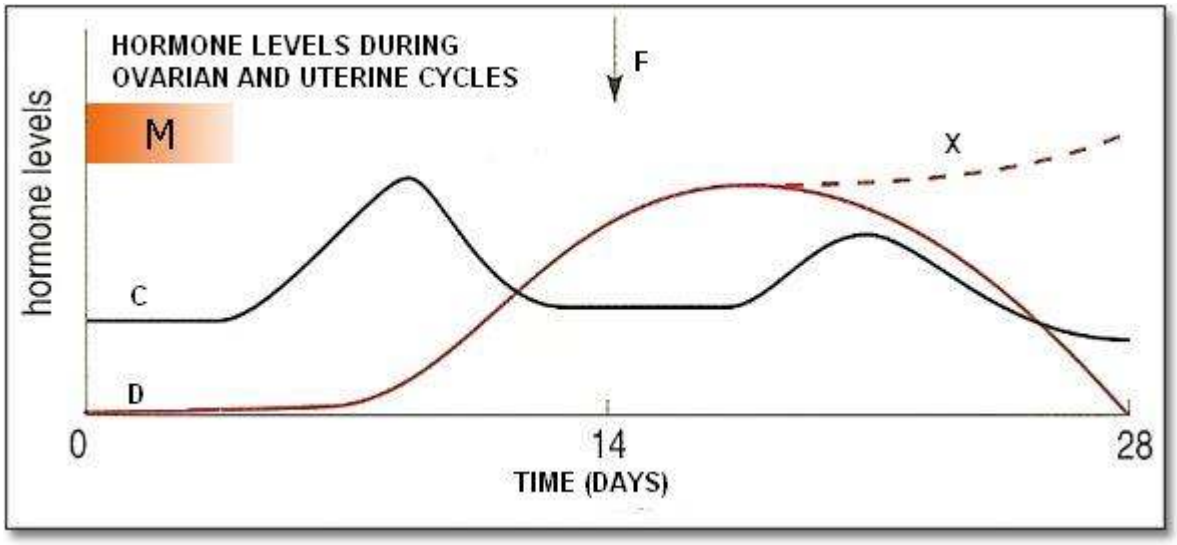
2.1.4 Which type of bond is found at C? (1)

2.1.5 List the names of the amino acids (numbered 1 to 6 as abbreviated in the diagram) and write down the corresponding base triplets of the tRNA molecule. (6)

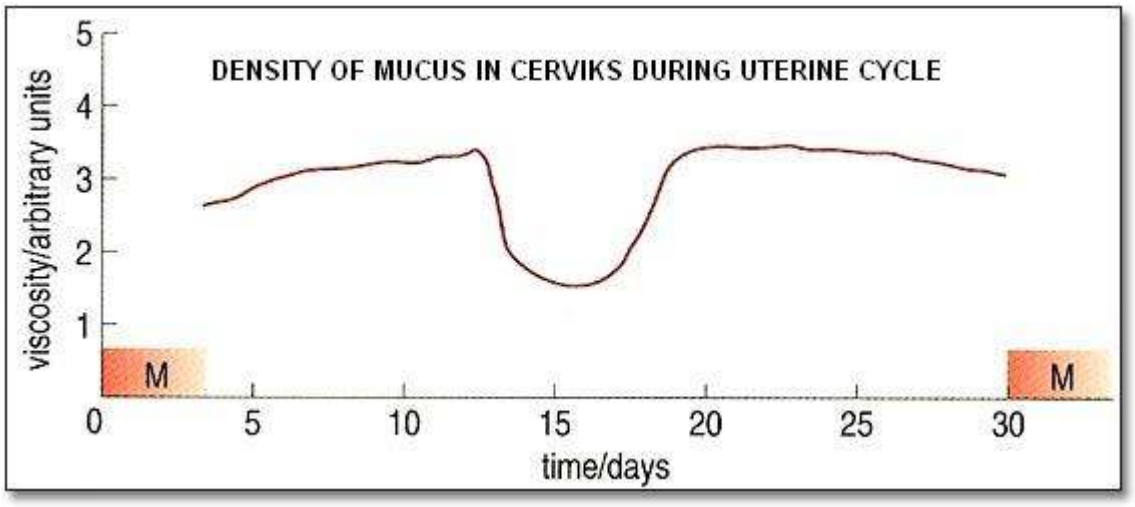
(13)

2.2 The following two graphs, A and B, show the levels of hormones during the cycles of the ovaries and the uterus, as well as the density (viscosity) of the mucus in the cervix during the same cycles.

GRAPH A



GRAPH B



2.2.1 Which process occurs at "M"? Briefly explain what this process entails. (3)

2.2.2 Explain the relationship between the density of the cervical mucus (graph B) and the occurrence at F (day 14) in graph A. (3)

2.2.3 Identify the hormones marked C and D respectively. Also mention the structure that secretes each of the hormones. (4)

2.2.4 Which event can cause the hormone levels of D to stay high as indicated by the dotted line? (1)

(11)

2.3 Answer the following questions on cloning.

2.3.1 Mention one difference between the embryos that are formed by cloning and those formed by *in vitro* fertilization. (2)

2.3.2 Study the picture and explain why you regard the cloning of humans as ETHICAL or UNETHICAL. (2)

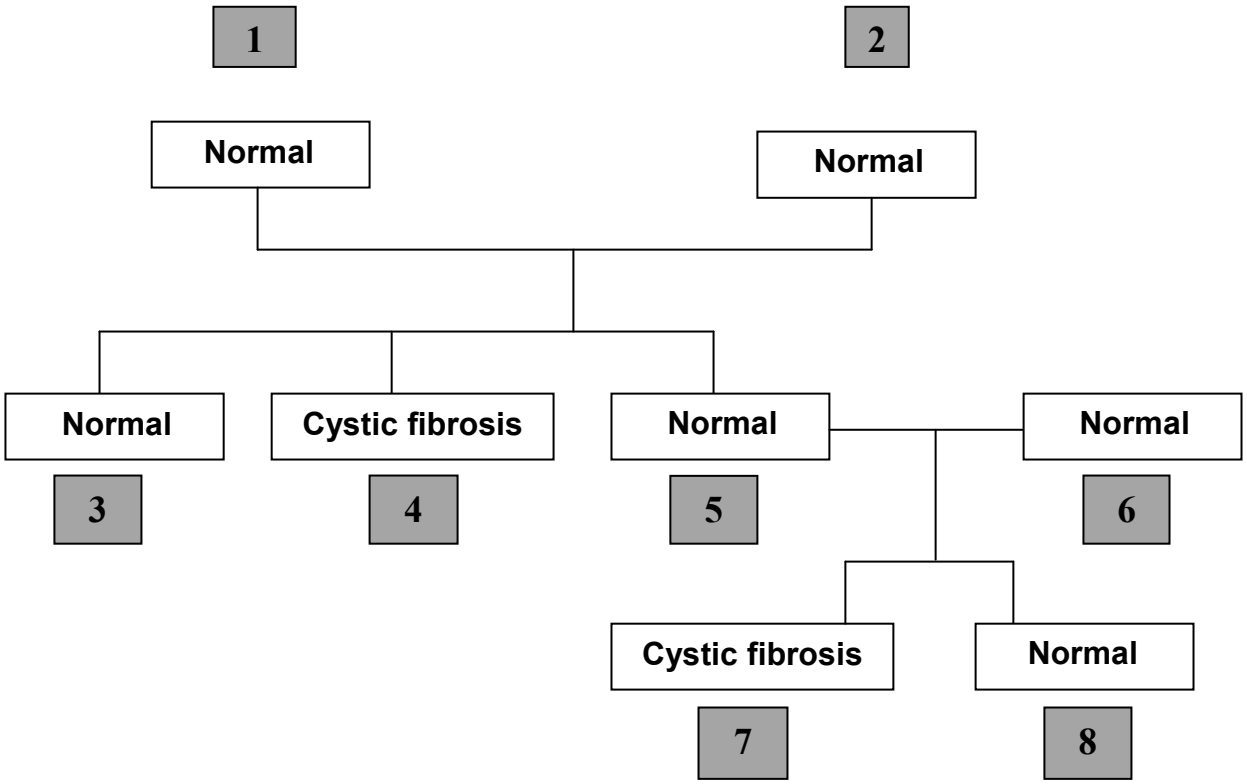
2.3.3 Cloning is widely used in agriculture. Explain TWO advantages of tissue culture for agriculture. (2)

(6)

TOTAL QUESTION 2: 30

QUESTION 3

3.1 The diagram below shows a family tree for cystic fibrosis. This condition is produced by a recessive allele, ***f***, while the normal condition is controlled by the dominant allele, ***F***.



3.1.1 What are the possible genotypes of individuals 1, 4, and 5 respectively? (3)

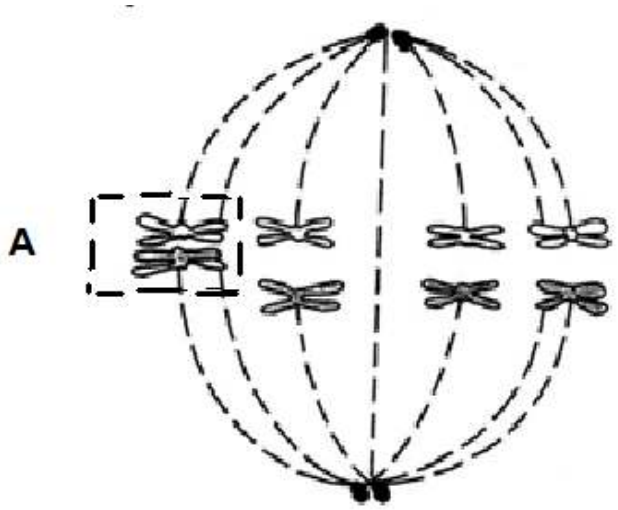
3.1.2 Briefly explain TWO symptoms of cystic fibrosis. (2)

3.1.3 If individual 8 is heterozygous, what are the chances of individuals 7 and 8 of having a NORMAL child? Show this by means of a Punnett diagram. (5)

3.1.4 Is cystic fibrosis a sex-linked disease? Briefly explain your answer. (2)

(12)

3.2 The following diagram shows an abnormality during a certain phase of meiosis with the number 21 chromosome pair.



3.2.1 Which phase of meiosis does this diagram refer to? (2)

3.2.2 What is the specific purpose of this phase of the cell division? (2)

3.2.3 What specific genetic condition does this abnormality (shown by A) cause? (1)

3.2.4 Give TWO symptoms of this genetic abnormality. (2)

3.2.5 People with this condition are often sterile. Explain why you think this is so. (2)

(9)

3.3 The following procedure can be used to determine this condition (in Question 3.2) prior to birth.

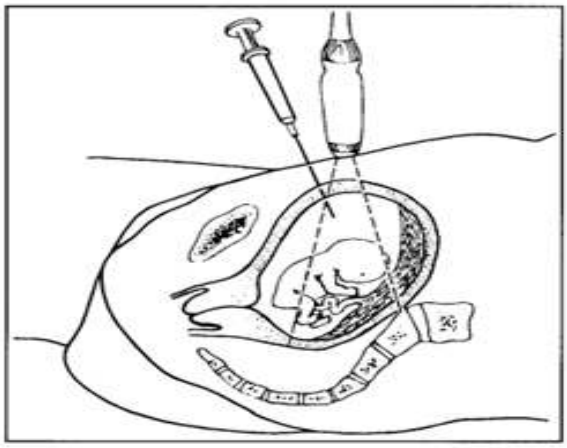


Diagram that shows the process where amniotic fluid is extracted

3.3.1 What is this test or process called? (1)

3.3.2 Give ONE other aspect, except checking for genetic diseases that can be determined by having this test done. (1)

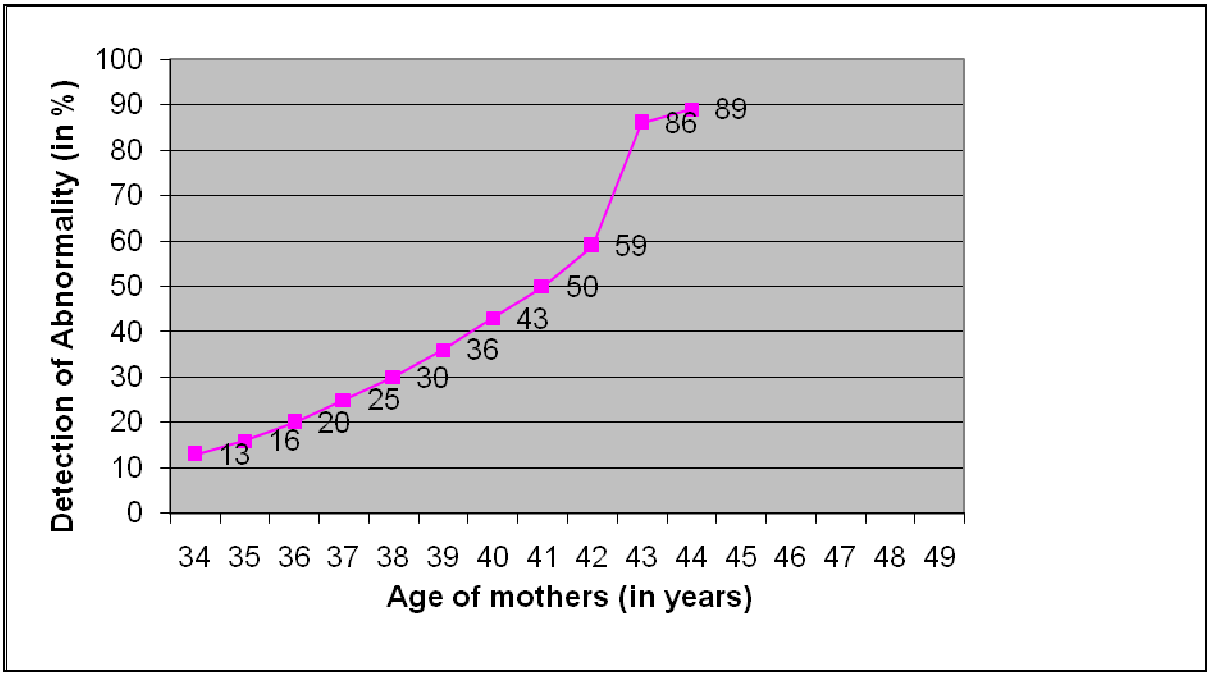
3.3.3 Give TWO reasons why it is important for prospective parents of children with a genetic deflection to go for genetic counselling? (2)

(4)

3.4 Read the following extract:

> "The risk of the condition mentioned in Question 3.2 is directly related to the age of the mother. The number of births with this condition is relatively low for 18-year-old mothers about 1 in 2 100 births. In the later childbearing years the risk increases significantly from 1 in 1,000 births for 30-year-old women to 1 in 100 births for 40-year-old women."

The following graph shows this relationship:



3.4.1 Provide a caption for the graph. (2)

3.4.2 Describe the trend of the relationship between the age of a mother and the incidence of abnormalities as shown in the graph. (2)

3.4.3 Suggest a possible reason for the trend as seen in the graph. (1)

(5)

TOTAL QUESTION 3: 30

TOTAL SECTION B: 60

SECTION C

QUESTION 4

4.1 The following information on the incidence of HIV-infections was published on 9 June 2009. (*Die Burger*, 10 June 2009).

Provinces	Percentage of HIV positive people in the nine provinces of South Africa from 2002 to 2008		
	2002	**2005**	**2008**
Western Cape	10,7	1,9	3,8
Eastern Cape	6,6	8,9	9,0
Northern Cape	8,4	5,4	5,9
Freestate	14,5	12,6	12,6
Kwazulu-Natal	11,7	16,5	15,8
North West	10,3	10,9	11,3
Gauteng	14,7	10,8	10,3
Mpumalanga	14,1	15,2	15,4
Limpopo	9,8	8,0	8,8
National	11,4	10,8	10,9

4.1.1 Which two provinces currently (as in 2008) have the highest percentages of HIV positive people? (2)

4.1.2 Give THREE possible reasons why the HIV infection rate is so high in these two provinces. (3)

4.1.3 Which province currently has the lowest % of HIV positive people in the country? (1)

4.1.4 The report also states that the statistics show a decrease amongst children and teenagers, but that women between the ages of 25 and 29 are “still the most vulnerable group”. Can you suggest TWO reasons for this persistent tendency amongst young women? (2)

4.1.5 Why, do you think, do the statistics for the Western Cape differ so much from 2002 to 2005 and 2008? Give TWO possible reasons. (2)

4.1.6 Mention one other sexually transmitted infection (STI), apart from HIV/AIDS, caused by
(a) a virus and
(b) a bacterium. (2)

4.1.7 Briefly explain a method of contraception which also offers protection against STI’s. (3)

4.1.8 Draw a bar graph to compare the percentage (%) of HIV positive cases for the nine provinces as determined in 2008. (10)
(25)

4.2 The extract below refers to a number of issues regarding human reproduction.

> One of the functions of the placenta is to prevent all pathogens from being transferred from the mother to the baby. Still, babies of HIV positive mothers could also be born HIV positive. However, it was found that babies from HIV positive mothers are not always HIV positive themselves; it does happen that HIV positive mothers give birth to healthy babies.
>
> Research has found that the risk for the baby of being HIV positive at birth is decreased if the mother takes certain medication (anti-retroviral medication) during the pregnancy. These substances, however, can sometimes have negative side effects on the baby and may even cause miscarriages.
>
> The decision to to give certain medication to the mother or not, should also be seen in the light of the traumatic experience it is for a family to have an HIV positive baby, as well as the life expectancy of the mother and the baby.

Write a mini-essay in which you discuss the baby's chances of being HIV positive or not; also refer to the role of the placenta. Also refer to the consequences for the mother and baby as well as the rest of the family when the baby is born HIV positive. Also pay attention to the ETHICAL as well as UNETHICAL aspects of the treatment of a pregnant woman with anti-retroviral, or waiting to see whether a baby is HIV positive or not before treatment is started.

Facts: 12
Synthesis: 3
Max. [15]

(No marks will be given for answers in the form of drawings or flow charts.)

TOTAL SECTION C: 40

GRAND TOTAL: 150