



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P1

NOVEMBER 2010

MARKS: 150

TIME: 2½ hours

This question paper consists of 15 pages.

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 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 or flow charts 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 may use a non-programmable calculator, protractor and a compass.
11. Write neatly and legibly.

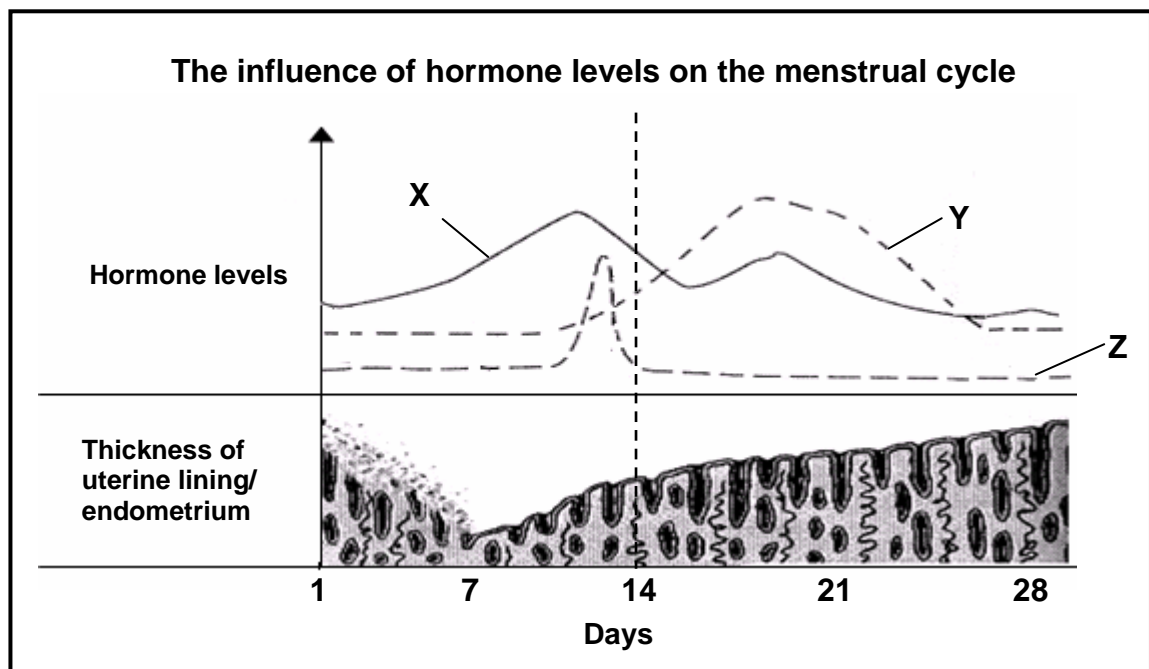
SECTION A**QUESTION 1**

1.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.5) in your ANSWER BOOK, for example 1.1.6 D.

1.1.1 Each somatic (body) cell in the human has ...

- A 23 different chromosomes.
- B 46 similar chromosomes.
- C 23 pairs of chromosomes.
- D 46 pairs of different chromosomes.

QUESTION 1.1.2 and QUESTION 1.1.3 refer to the graph below which shows the menstrual cycle and the influence that different hormones have on it.



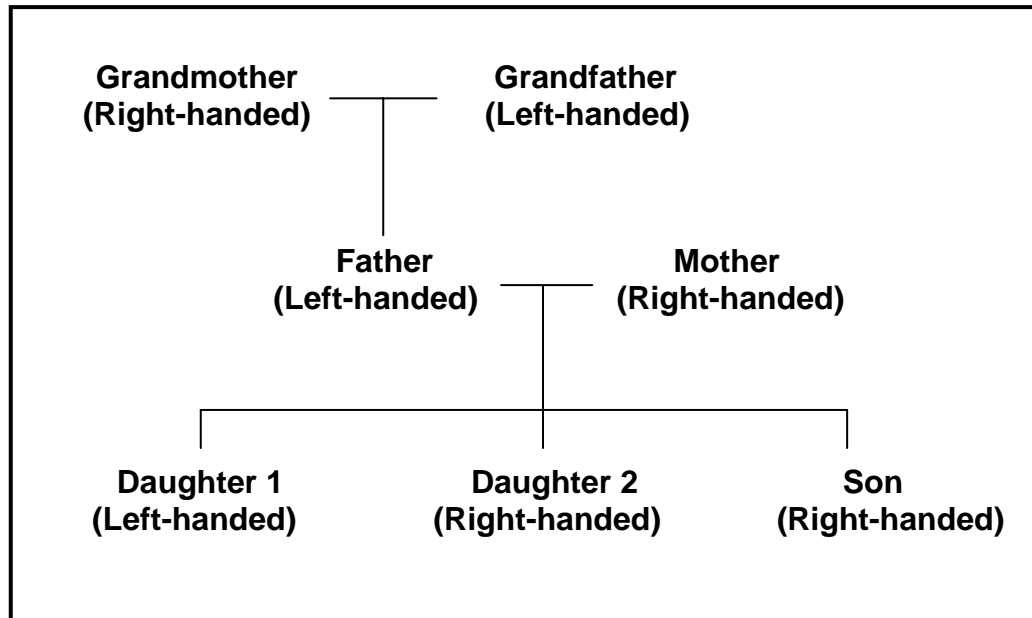
1.1.2 On which TWO days are the level of hormones X and Y the same?

- A 12 and 13
- B 14 and 21
- C 15 and 26
- D 7 and 27

1.1.3 Which of the following shows the pattern/trend of the level of hormones X and Z from days 13 to 14?

- A X decreases and Z increases
- B Both decrease
- C X and Z are at their optimum level
- D Both increase

- 1.1.4 In a human family, the gene for right-handedness (**R**) is dominant over the gene for left-handedness. The pedigree diagram of three generations is shown below.



Which is the correct expression of the genotypes of the following three individuals shown in the pedigree diagram?

	Grandmother	Mother	Daughter 1
A	Rr	Rr	RR
B	Rr	RR	rr
C	RR	Rr	rr
D	Rr	Rr	rr

- 1.1.5 A pregnant woman was told by a genetic counsellor that her baby had equal chances of having blood type A or blood type AB. This means that the genotypes of the woman and her husband must have been ...

- A $I^A I^A$ and $I^B i$
 B $I^A I^B$ and $I^B i$
 C $I^A i$ and $I^B I^B$
 D $I^A I^B$ and $I^A i$

(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 to 1.2.7) in your ANSWER BOOK.

- 1.2.1 The physically and physiologically expressed characteristics of an organism determined by its genotype and also by its environment
- 1.2.2 The disease caused by uncontrolled division of cells
- 1.2.3 The two parts of a chromosome held together by a centromere
- 1.2.4 The process by which sperms and eggs are produced
- 1.2.5 Paired chromosomes that are similar in structure and in the set of genes they carry
- 1.2.6 The process by which the DNA molecule duplicates itself
- 1.2.7 A sex-linked condition where blood fails to clot properly

(7)

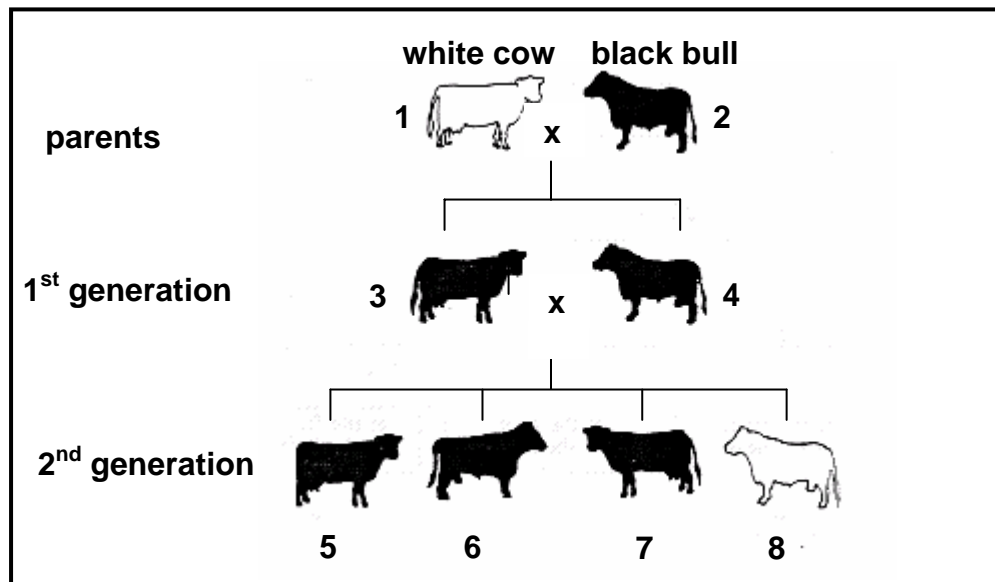
1.3 Choose an item from COLUMN II that matches a description in COLUMN I. Write only the letter (A to H) next to the question number (1.3.1 to 1.3.5) in your ANSWER BOOK, for example 1.3.6 J.

COLUMN I		COLUMN II	
1.3.1	Alleles of an organism for a particular trait	A	haploid
1.3.2	Two alleles that are equally expressed in an organism	B	genotype
1.3.3	A cell which has a single set of chromosomes	C	translation
1.3.4	The formation of mRNA (messenger RNA) from a DNA template	D	nucleolus
1.3.5	Sudden changes in the genetic make up of an organism	E	mutation
		F	transcription
		G	co-dominance
		H	phenotype

(5 x 1)

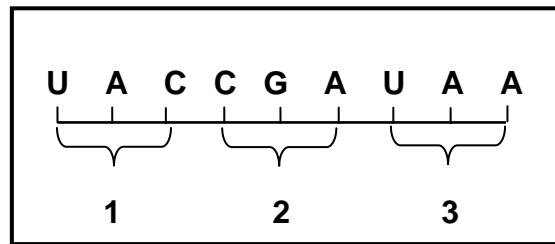
(5)

- 1.4 The diagram below shows the offspring of crosses between a pure-bred black coat bull and a pure-bred white coat cow. The coat colours of the offspring of the first and second generations are also shown. Coat colour is controlled by two alleles, one for black and one for white coat colour.



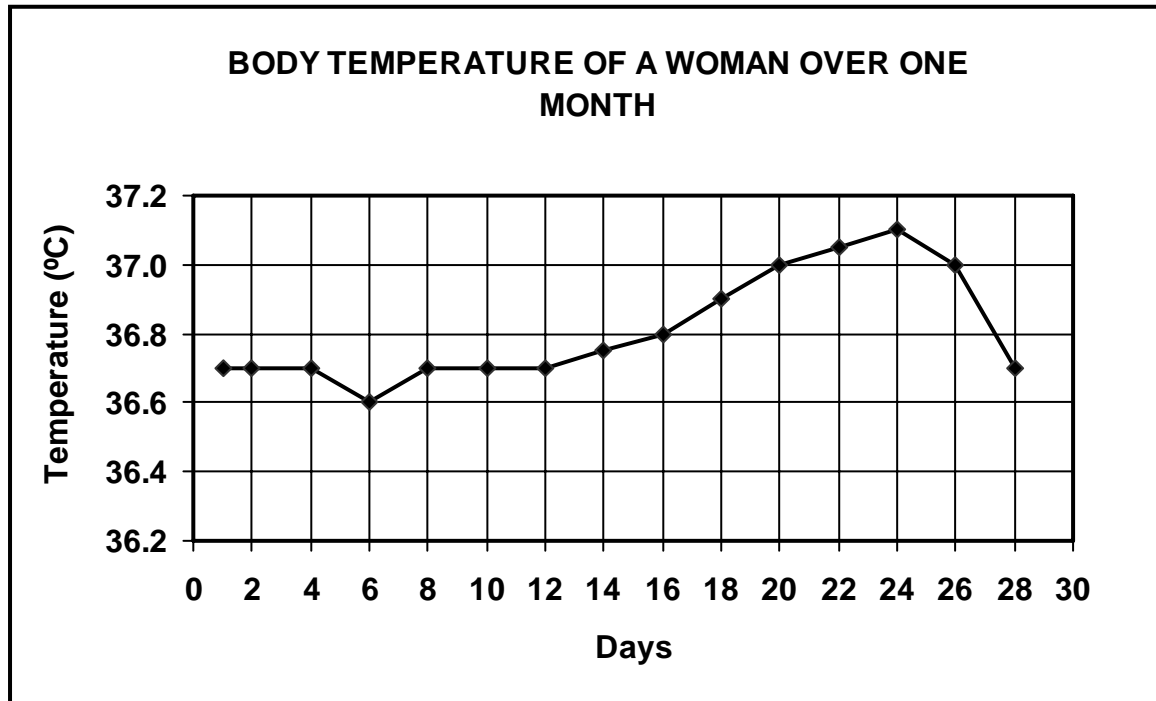
- 1.4.1 Use the letters **B** and **b** and state which gene is responsible for the following:
- (a) Black coat colour (1)
- (b) White coat colour (1)
- 1.4.2 Which animal(s) (1 to 8) in the diagram **must be** homozygous for coat colour? (3)
(5)

1.5 The diagram below shows part of a mRNA (messenger RNA) molecule.



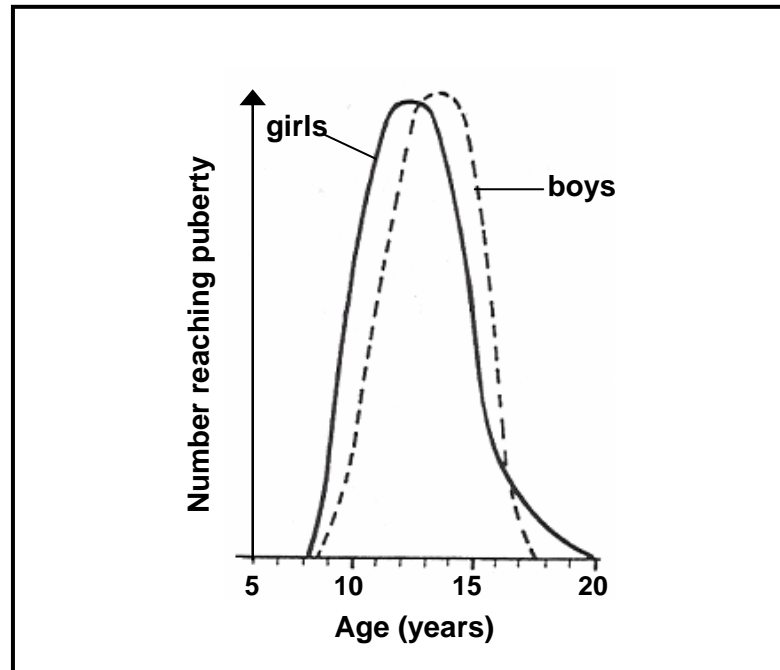
- 1.5.1 How many codons are shown in the diagram of this section of mRNA? (1)
- 1.5.2 Write down the complementary base sequence of the DNA strand that formed codon 1 of the mRNA strand in the above diagram. (1)
- 1.5.3 Explain the purpose of a specific sequence of codons in a mRNA molecule. (2)
- 1.5.4 A tRNA (transfer RNA) molecule carries complementary bases for a particular codon.
- (a) Write down the complementary base sequence of a tRNA for codon 1 in the mRNA sequence shown in the above diagram. (1)
- (b) Briefly describe the role of tRNA molecules in the translation process of protein synthesis. (3)
- (8)**

- 1.6 The graph below shows a woman's body temperature taken every second day as soon as she wakes up. From the results/evidence it is assumed that ovulation occurred on day 14.



- 1.6.1 What is the body temperature of the woman on day **2**? (2)
- 1.6.2 By how much did the temperature (°C) rise between day **16** and day **24**? (1)
- 1.6.3 Explain how the information in the graph above can be used to predict the days when the woman is fertile. (3)
(6)

- 1.7 The graph below represents the age when puberty is reached by boys and girls in a population.

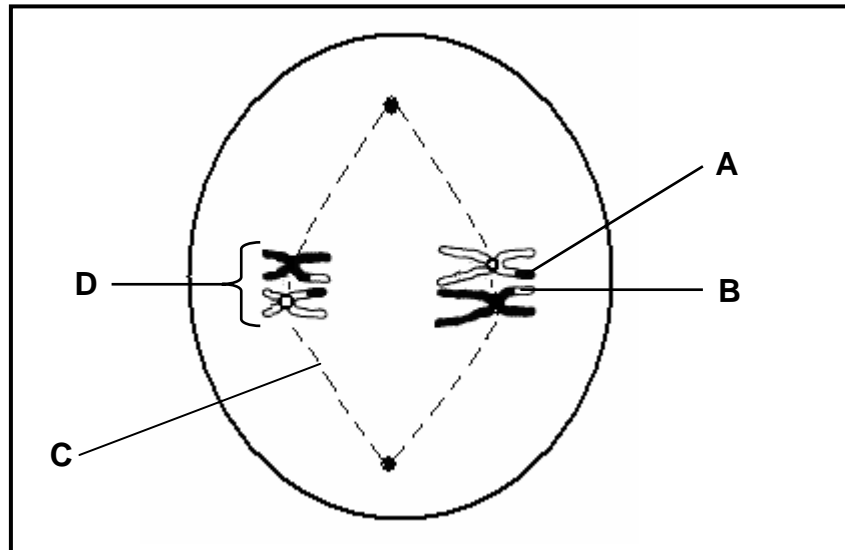


- 1.7.1 At what age does the largest number of boys reach puberty? (1)
- 1.7.2 Use the graph to compare the average age at which puberty occurs in most boys and most girls. (2)
- 1.7.3 Mary is sixteen years old but she has not reached puberty yet. Explain why she and her parents should not be worried. (2)
- 1.7.4 Although boys and girls who have reached puberty can have children, give TWO reasons explaining why you would advise teenagers not to have children at a young age. (4)

(9)**TOTAL SECTION A: 50**

SECTION B**QUESTION 2**

2.1 The diagram below represents an animal cell in a phase of meiosis.



- 2.1.1 Label **C** and **D**. (2)
- 2.1.2 (a) Identify the phase represented in the diagram above. (1)
- (b) Give a reason for your answer to QUESTION 2.1.2 (a). (2)
- 2.1.3 Name the process which resulted in parts **A** and **B** being different from each other. (1)
- 2.1.4 Describe how the process referred to in QUESTION 2.1.3 occurs. (3)
- 2.1.5 State the importance of the process named in QUESTION 2.1.3. (1)
- 2.1.6 (a) How many cells will be formed at the end of the first division of the cell drawn in the diagram above? (1)
- (b) How many chromosomes will each daughter cell have when the cell, drawn in the diagram above, has completed meiosis? (1)
- (12)**

2.2 In humans, the gene for curly hair is dominant over that for straight hair. Use the letter **H** to represent the gene for curly hair and the letter **h** to represent the gene for straight hair.

2.2.1 Explain why the statement below is TRUE:

A person with curly hair may be heterozygous or homozygous for this characteristic.

(2)

2.2.2 Show diagrammatically, by means of a genetic cross, how a man with curly hair, who marries a woman with curly hair, may have a child with straight hair.

(6)

(8)

2.3 Tabulate THREE structural differences between DNA and RNA.

(7)

2.4 Analysis of DNA samples from a patient with an illness showed that there were two different types of DNA present. One was double-stranded human DNA and the other was single-stranded virus DNA. The two types of DNA were isolated and put into separate test tubes. The analyses of the nitrogenous base composition of each test tube is shown in the table below.

	Nitrogenous base composition (%)			
	Adenine	Cytosine	Guanine	Thymine
Test tube 1	22.1	27.9	27.9	22.1
Test tube 2	31.1	31.3	18.7	18.9

2.4.1 Which test tube (**1** or **2**) contains virus DNA?

(1)

2.4.2 Explain your answer to QUESTION 2.4.1.

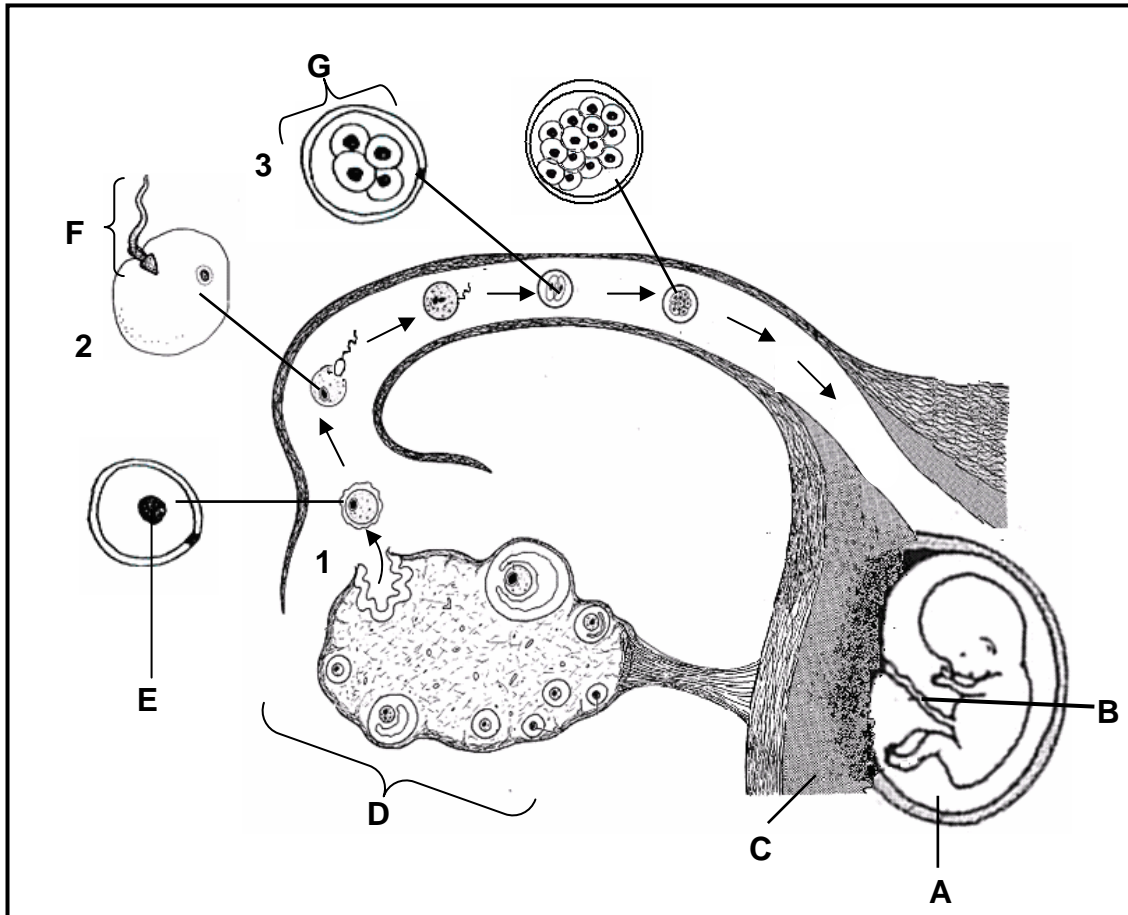
(2)

(3)

[30]

QUESTION 3

3.1 The diagram below shows part of the female reproductive system. Structures **B** to **G** and processes **1**, **2** and **3**, occurring in the Fallopian tube and uterus, are magnified.



- 3.1.1 Label **C** and **D**. (2)
- 3.1.2 State which processes are taking place at **1**, **2** and **3** respectively. (3)
- 3.1.3 State how many chromosomes are present in the following structures:
 - (a) **E** (1)
 - (b) Each cell of structure **G** (1)
- 3.1.4 Draw an enlarged labelled diagram of structure **F** to show its details. (5)
- 3.1.5 State TWO functions of fluid **A**. (2)
- 3.1.6 Structure **B** transports substances to and from the foetus.
 - (a) Name ONE useful substance transported to the foetus. (1)
 - (b) Name ONE waste product transported from the foetus. (1)

(16)

3.2 Name TWO types of twins formed in humans and explain how each type is formed during fertilisation. (6)

3.3 The flowers of the African savanna tree are pollinated by different animals.

The tree produces about 200 flower buds at the end of each branch. However, not all the flower buds open at the same time. On any one night in the flowering season, about 40 flowers open per branch. Each flower lives for a short while and then it withers and dies.

In an investigation into the pollination of the flowers, the following observations were made:

Time	State of flowers	Animals visiting the flowers
17:00	Closed	None
17:30	Flowers begin to open and nectar production begins	Honey bees feed on the nectar
19:30	Flowers fully open	First bats visit the flowers
21:30	Very large amounts of nectar produced	Many bats visit the flowers
00:30	Anthers widely spaced and little nectar produced	Fewer bats visit the flowers
05:30	Very little nectar produced	Bats stop visiting flowers and honeybees collect pollen
06:30	No more pollen	Birds feed on remaining nectar
11:30	Flowers wither and die	None

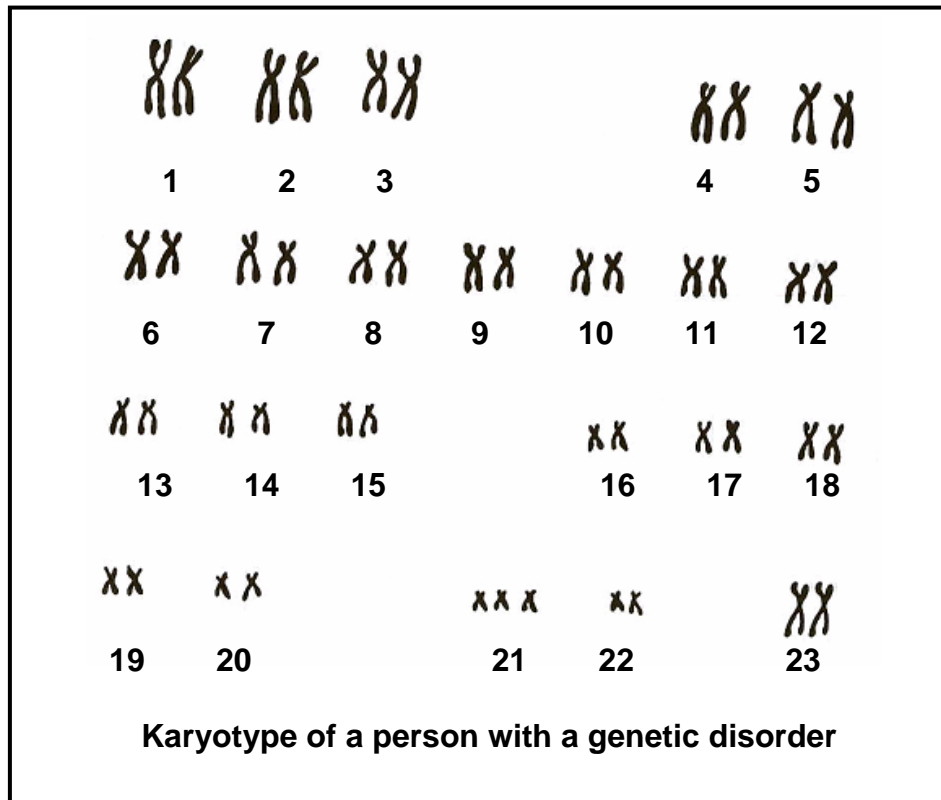
- 3.3.1 For how many hours do the flowers live after they open? (1)
- 3.3.2 Which are the first animals to visit the flowers? (1)
- 3.3.3 State why the bats stop visiting the flowers. (1)
- 3.3.4 State how the plant benefits from producing nectar. (1)
- 3.3.5 Explain the advantage to the plant of having only a small number of flowers open each evening. (2)
- 3.3.6 After pollination, fertilisation usually occurs. Name what the following parts of the flower will develop into after fertilisation:
- (a) Ovule (1)
- (b) Ovary (1)
- (8)**
[30]

TOTAL SECTION B: 60

SECTION C

QUESTION 4

4.1 Study the karyotype of a human below and answer the questions based on it.



- 4.1.1 Is this karyotype that of a male or a female? (1)
 - 4.1.2 Give a reason for your answer to QUESTION 4.1.1. (1)
 - 4.1.3 Name the genetic disorder that the individual with this karyotype has. (1)
 - 4.1.4 Give a reason for your answer to QUESTION 4.1.3. (2)
- (5)**

- 4.2 The table below shows the results obtained by first crossing a pure-bred black furred mouse with a brown furred mouse. The gene for black fur is dominant over the gene for brown fur. The F₁ generation was used as parents (consisting of 4 breeding pairs) of the F₂ generation.

	Number of black mice	Number of brown mice
Parents	1	1
F₁ generation	8	0
F₂ generation		
Offspring of 1 st breeding pair	8	0
Offspring of 2 nd breeding pair	7	1
Offspring of 3 rd breeding pair	5	3
Offspring of 4 th breeding pair	4	4

- 4.2.1 From the data, calculate the phenotypic ratio of the mice with black fur and the mice with brown fur in the F₂ generation. Show ALL your workings. (2)
- 4.2.2 Suggest why it is better to use the four sets of offspring to calculate the ratio rather than using only one set. (2)
- 4.2.3 Draw bar graphs on the same system of axes to represent the phenotypic results of the F₂ generation offspring of each breeding pair shown in the table above. (9)
(13)
- 4.3 The blood bank wants to carry out an investigation to determine the distribution of blood groups of 1 200 learners in a high school. They decide to use a sample to do their investigation in order to save costs and time. They also want to get a reliable result.
- 4.3.1 State any FOUR planning steps that the blood bank should put in place to do this investigation, before they draw blood from the learners, using a syringe. (4)
- 4.3.2 State THREE precautions that the blood bank should take when drawing blood from the learners. (3)
(7)
- 4.4 Describe what stem cells are, and give TWO sources from which human stem cells may be harvested. Also explain TWO arguments, with reasons, for the use of stem cells and TWO arguments, with reasons, against the use of stem cells in humans. (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