



**education**

Department:  
Education  
PROVINCE OF KWAZULU-NATAL

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**LIFE SCIENCES P2  
PREPARATORY EXAMINATION  
SEPTEMBER 2019**

**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 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, tables 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 answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 Which ONE of the following refers to the position of a gene on a chromosome?

- A Allele
- B Locus
- C Genome
- D Karyotype

1.1.2 In humans, the sex of a child is determined by the ...

- A mother's gametes.
- B autosomes.
- C XX chromosomes of the mother.
- D father's gonosomes.

1.1.3 Lamarck's 'laws' regarding evolution were ...

- A rejected, because only characteristics that benefit offspring can be inherited.
- B not rejected, because evidence shows that acquired characteristics can be inherited.
- C rejected, because only characteristics that are coded for in the DNA can be inherited.
- D not rejected, because Darwin's theory supports Lamarck's ideas.

1.1.4 The table below shows the blood groups of two children in a certain family.

CHILD	PHENOTYPE
Happy	O
Sihle	A

Which ONE of the following represents the possible genotypes of their parents?

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

- 1.1.5 A short piece of DNA that is 15 nitrogenous bases long for each strand was analysed to determine the number of bases in each strand.

The results are shown in the table below.

Bases	A	C	G	T
Strand 1	-	6	-	3
Strand 2	-	-	-	4

How many guanines will be present in **strand 1**?

- A 2  
B 3  
C 4  
D 6
- 1.1.6 Which of the following crosses show the effects of co-dominant alleles?

	Phenotypes of Parents	Ratio of F <sub>1</sub> Phenotypes
A	Black x White	1 Black : 1 White
B	White x Red	All red and white stripes
C	Round x Long	All oval
D	Smooth x Smooth	3 Smooth : 1 Rough

- 1.1.7 A protein molecule contains the amino acid sequence:  
glycine – leucine – lysine – valine.

The table below shows DNA codes for these amino acids.

Glycine	Leucine	Lysine	Valine
CCC	GAA	TTT	CAA

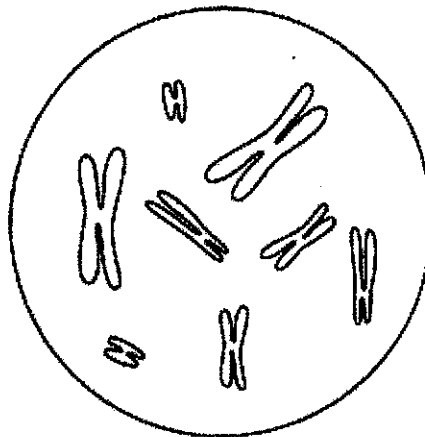
Which tRNA anticodons are needed for the synthesis of this protein?

- A CCC GAA TTT CAA  
B CCC GAA UUU CAA  
C GGG GUU AAA GUU  
D GGG CUU UUU GUU

1.1.8 Which ONE of the following statements is CORRECT for the 'Out of Africa' hypothesis?

- A All modern humans evolved from African apes and then migrated to other parts of the world.
- B The most developed artefacts (tools; cutlery; art) were found in Africa.
- C All modern humans originated in Africa and migrated to other parts of the world.
- D An analysis of mutations on the mitochondrial DNA shows that the oldest male ancestors were located in Africa.

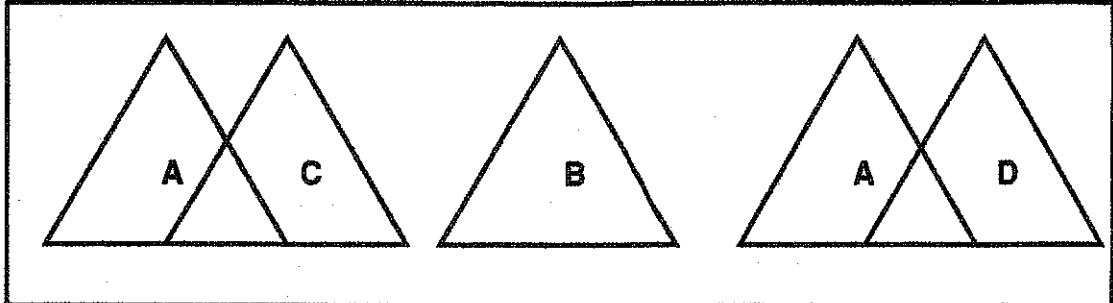
1.1.9 The diagram below shows a cell nucleus in prophase of mitosis.



Which statement describes the chromosomes found in each daughter nucleus immediately following division of this cell by mitosis?

- A 8 chromosomes, each consisting of 4 chromatids
- B 8 chromosomes, each containing 1 molecule of DNA
- C 4 chromosomes, each consisting of 4 chromatids
- D 16 chromosomes, each containing 1 molecule of DNA

- 1.1.10 Letters **A**, **B**, **C** and **D** below refer to four populations of rabbits. These species are represented diagrammatically by triangles. Overlapping triangles show populations that are capable of interbreeding to produce fertile offspring.



It would be reasonable to conclude that ...

- A Populations **A**, **C** and **D** represent different species.
- B If population **A** was to die out, only three species would remain.
- C Populations **C** and **D** are different species, but populations **A** and **D** are of the same species.
- D Populations **A**, **C** and **D** are of the same species, but population **B** is a different species.

(10 x 2)

(20)

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 1.2.10) in the ANSWER BOOK.

- 1.2.1 The structure that forms the spindle during meiosis
- 1.2.2 The bond that joins two amino acids
- 1.2.3 A segment of a chromosome that codes for a particular characteristic
- 1.2.4 The study of the past and present distribution of similar organisms in different parts of the world
- 1.2.5 A type of vision shared by apes and humans that allows for depth perception
- 1.2.6 Undifferentiated cells that can form any type of tissue
- 1.2.7 A process where a gene is transferred from the cell of one organism to the cell of another organism to satisfy human needs
- 1.2.8 A type of variation characterised by a range of phenotypes
- 1.2.9 A sex-linked disorder that affects the ability to differentiate between red and green colour
- 1.2.10 The family to which the Homo species belong

(10 x 1) (10)

1.3 Indicate whether each of the descriptions 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 number (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	An evidence for evolution	A: Mutations B: Speciation
1.3.2	A South African scientist who discovered a fossil of an <i>Australopithecus africanus</i>	A: Lee Burger B: Ron Clarke
1.3.3	A nucleic acid that contains ribose	A: RNA B: DNA

(3 x 2) (6)

- 1.4 In mice, the mottled coat colour (**A**) is dominant over black coat colour. Ear shape is controlled by two alleles round (**R**) and long (**r**).

The punnet diagram below shows a cross between two individuals.

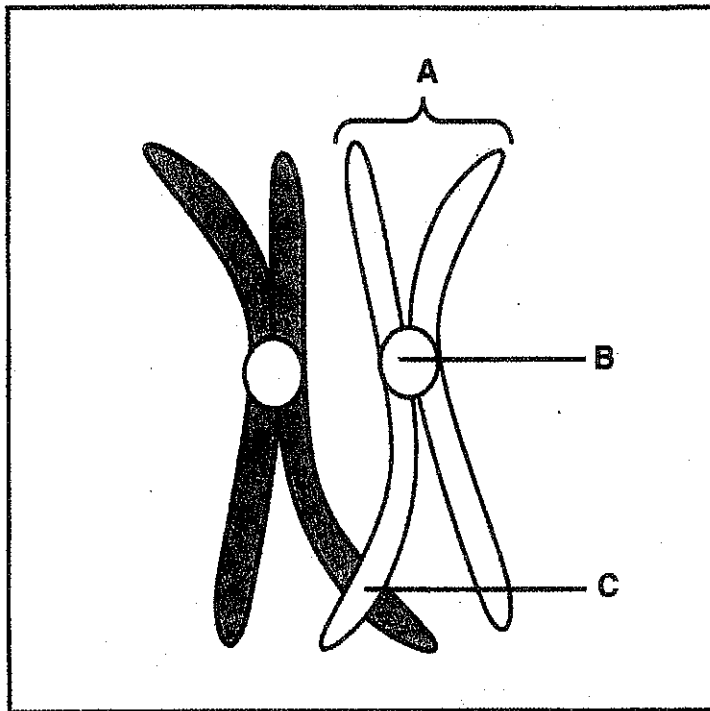
	<b>Gametes</b>	<b>AR</b>	<b>Ar</b>	<b>aR</b>	<b>ar</b>	<b>Parent 2</b>
<b>Parent 1</b>	<b>Ar</b>	<b>AARr</b>	<b>AArr</b>	<b>AaRr</b>	<b>Aarr</b>	
	<b>ar</b>	<b>(i)</b>	<b>Aarr</b>	<b>aaRr</b>	<b>aarr</b>	

- 1.4.1 Identify the type of crossing shown in the diagram above. (1)
- 1.4.2 What is the genotype of parent 1? (1)
- 1.4.3 Give the phenotype of the following:
- (a) **AaRr** (1)
- (b) **Aarr** (1)
- 1.4.4 Give the genotype of the offspring (i). (1)
- (5)



**SECTION B****QUESTION 2**

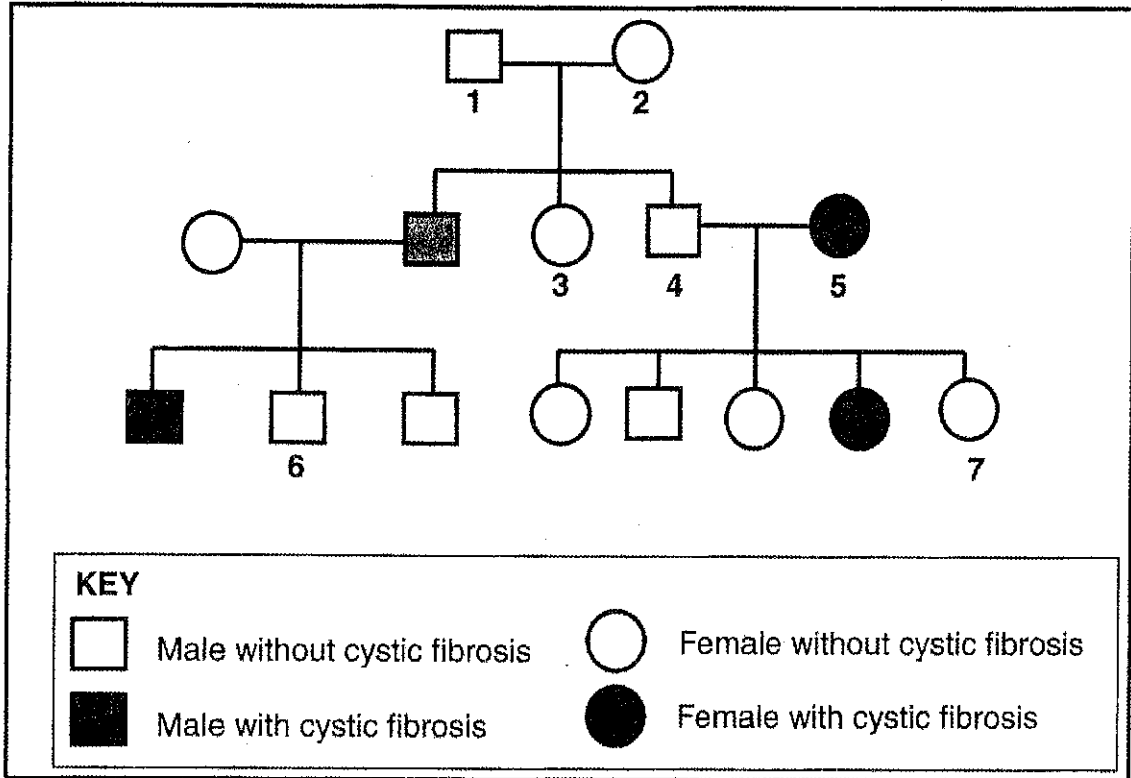
2.1 The diagram below represents the process in meiosis.



- 2.1.1 Identify part **A**. (1)
- 2.1.2 State ONE function of part **B**. (1)
- 2.1.3 Name the process during meiosis that is illustrated in the diagram. (1)
- 2.1.4 Explain what would happen if the process named in QUESTION 2.1.3 fail to take place during meiosis. (2)
- 2.1.5 Name the phase during which the process mentioned in QUESTION 2.1.3 occurs. (1)
- 2.1.6 Identify point **C**. (1)
- 2.1.7 Describe the process that has the same effect as the process mentioned in QUESTION 2.1.3 during meiosis. (4)
- (11)**

2.2 Cystic fibrosis is a genetic disease that causes lung infection and limits the ability to breathe over time. It is a disorder caused by recessive allele *r*.

The diagram below shows the inheritance of the disorder in a family.



- 2.2.1 How many males in this family are normal? (1)
- 2.2.2 Explain why individual 1 and 2 have a child who has a cystic fibrosis. (2)
- 2.2.3 Give the possible genotype/s of individual:
- (a) 3 (2)
- (b) 7 (1)
- 2.2.4 Give the phenotype of individual 6. (1)
- 2.2.5 Using evidence from the pedigree, explain why it can be concluded that the cystic fibrosis is not a sex-linked disorder. (3)
- (10)**

## 2.3 Read the extract below.

The first cloned mammal born in 1996 was a female sheep named Dolly. The nucleus of a certain sheep's egg cell was removed. It was replaced by a nucleus from its somatic cell. Then fertilisation was stimulated in the condition similar to the reproductive system of a sheep. When the embryo started developing it was then implanted in a female sheep to develop.

2.3.1 State what is meant by *cloning*? (1)

2.3.2 The number of chromosomes in sheep is 54.

(a) How many chromosomes would have been in the egg of the sheep? (1)

(b) What would have been the gender of the sheep in which the nucleus from the somatic cell was taken? (1)

(c) Explain the reason for your answer in QUESTION 2.3.2(b). (2)

(d) Explain why it was only the nucleus of the somatic cell that was used in producing Dolly. (2)

(7)

## 2.4 Read the extract below.

Rett syndrome(RTT) is a genetic disorder caused by a dominant gene(T) located on the **X- chromosome**. This disorder is caused by sudden mutation in the gene coding for neural development carried in the X-chromosome in a sperm cell. Usually the parents of an affected offspring do not have the disorder. The father is the carrier because his sperm cells carry the mutated gene which is not expressed in his phenotype. It can only be expressed when inherited by an offspring.

2.4.1 Explain why mutations that occur in the somatic cells cannot be passed on to offspring. (2)

2.4.2 Explain why a female offspring will always be affected if the father has an affected gene. (3)

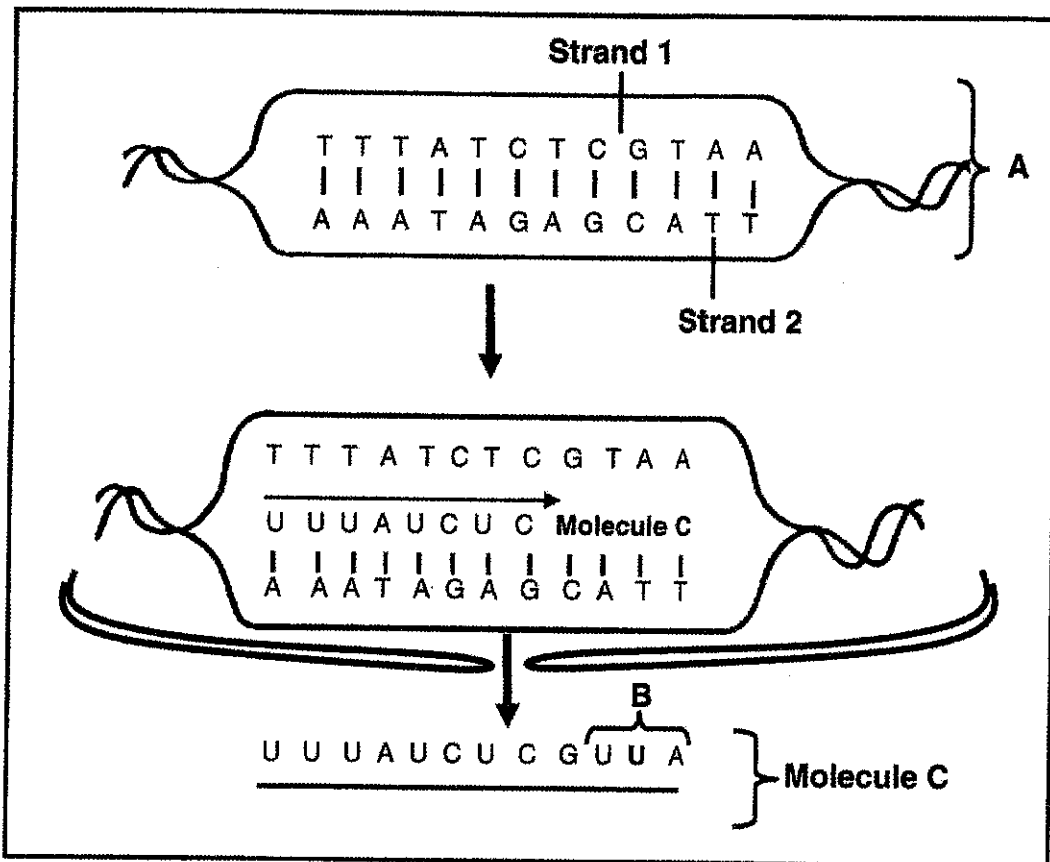
2.4.3 A father who has an affected gene but normal marries a woman who is normal.

Do a genetic cross to determine the percentage chance of having an affected male offspring.

(7)  
(12)  
[40]

**QUESTION 3**

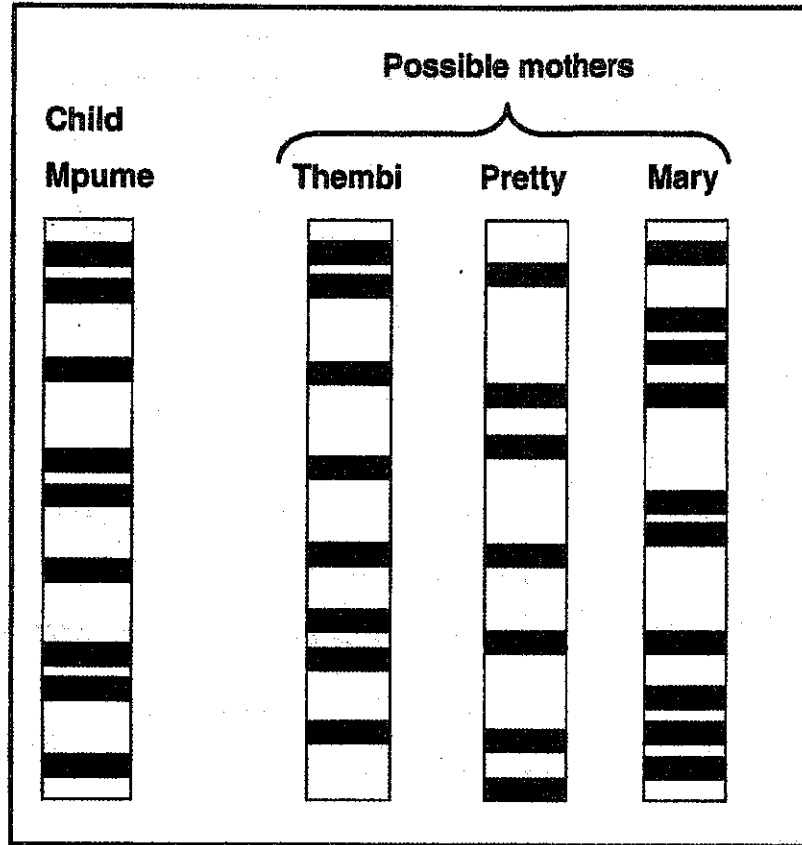
3.1 The diagram below shows a process in a cell.



- 3.1.1 Explain why the process in the diagram above represent transcription and not replication. (2)
  - 3.1.2 Name the organelle of the cell in which transcription take place. (1)
  - 3.1.3 Identify molecule **C**. (1)
  - 3.1.4 Explain the purpose of a specific sequence of codons in molecule **C**. (3)
  - 3.1.5 Write down the anticodon for the base sequence at **B**. (1)
  - 3.1.6 Describe the role of molecule **A** in protein synthesis. (4)
- (12)**

- 3.2 A DNA profiling was carried out to find out who is the mother of Mpume between Thembi, Pretty and Mary.

The results are shown below.



- 3.2.1 According to the results, who is likely the mother of Mpume? (1)
- 3.2.2 Give a reason for your answer in QUESTION 3.2.1. (2)
- 3.2.3 Explain TWO reasons why DNA profiles found in a crime scene cannot be considered as the only evidence in convicting a criminal. (4)  
(7)
- 3.3 A saguaro cactus is a plant that has the ability to grow in desert conditions because it can store water. Within a population of saguaro cacti, the stems can be smooth or pleated. The pleated stems have the ability to store water for longer periods of time.
- Explain why in a desert there would be a greater proportion of saguaro cacti that have pleated stems than those with smooth stems in a population. (6)
- 3.4 Describe speciation by geographic isolation. (6)

- 3.5 The antibiotic vancomycin is used to treat bacterial infections. A study regarding bacterial resistance to vancomycin antibiotics in intensive care units was done in 100 hospitals in the United States.

The results are shown in the table below

Year	Percentage of infections resistant to vancomycin (%)
1983	0
1985	0
1987	0
1989	2
1991	6
1993	14
1995	20
1997	24
1999	25
2001	28

- 3.5.1 State THREE ways in which the validity of this investigation would have been increased. (3)
- 3.5.2 If 4000 patients were treated in the hospitals with vancomycin, calculate the number of patients who were successfully treated in 1999. Show ALL working. (3)
- 3.5.3 State ONE way in which the reliability of the results was ensured for this investigation. (1)
- 3.5.4 Write a conclusion for the results obtained in the investigation. (2)

(9)  
[40]  
80

**TOTAL SECTION B:**

**SECTION C****QUESTION 4**

Explain structural features that enabled bipedalism and the advantages of being bipedal in hominids. Also explain challenges of using fossils as the only evidence in tracing human ancestry.

Content: (17)  
Synthesis: (3)  
**(20)**

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

**TOTAL SECTION C: 20**  
**GRAND TOTAL: 150**