



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**LIFE SCIENCES P2  
FEBRUARY/MARCH 2016**

**MARKS: 150**

**TIME: 2½ hours**

**This question paper consists of 14 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. ALL drawings must be done in pencil and labelled 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 must use a non-programmable calculator, protractor and a compass, where necessary.
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 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 Which ONE of the following combinations results in genetic variation in organisms?

- A Mitosis; sexual reproduction; mutations
- B Meiosis; asexual reproduction; mutations
- C Mitosis; meiosis; sexual reproduction
- D Meiosis; sexual reproduction; mutations

1.1.2 The inheritance of one trait does not depend on the inheritance of another trait. This represents ...

- A Mendel's law of dominance.
- B the law of codominance.
- C the principle of variation.
- D Mendel's principle of independent assortment.

1.1.3 In bees, females are diploid and males are haploid. Females and males produce haploid gametes.

This means that ...

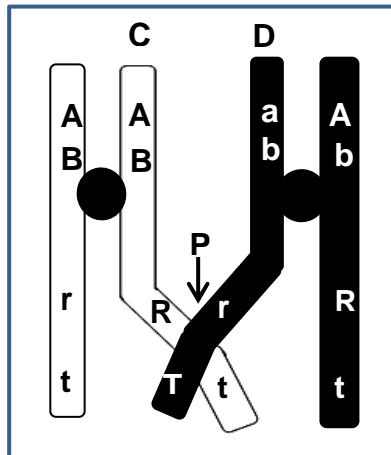
- A females produce gametes by mitosis.
- B males produce gametes by meiosis.
- C males produce gametes by mitosis.
- D females have half the number of chromosomes that males have.

1.1.4 In mice, the genotype **yy** produces grey fur and **Yy** produces yellow fur. The genotype **YY** results in death during the early embryonic stages.

A yellow female mouse is mated with a yellow male mouse. Which of the following shows the correct ratio of yellow to grey offspring that could be born alive?

- A 1 : 1
- B 1 : 3
- C 2 : 1
- D 3 : 1

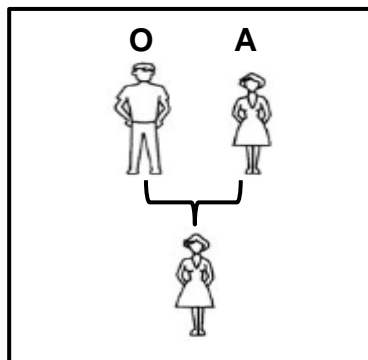
1.1.5 The diagram below shows crossing over.



Which ONE of the following combinations of alleles would be present in chromatid **C** after crossing over occurred at point **P**?

- A Aart
- B abrT
- C ABRt
- D ABRT

1.1.6 The diagram below shows the blood types of two parents.



The only possible blood type(s) of the offspring of the first generation ( $F_1$ ) is/are ...

- A AB and O.
- B A and O.
- C A only.
- D A and B.

1.1.7 The structure of DNA was determined by using X-ray pictures produced by ...

- A Watson and Crick.
- B Franklin and Wilkins.
- C Watson and Franklin.
- D Crick and Franklin.

1.1.8 Brown eye colour in humans is dominant over blue eye colour. A man with brown eyes marries a woman with blue eyes. They have a son with brown eyes and a daughter with blue eyes.

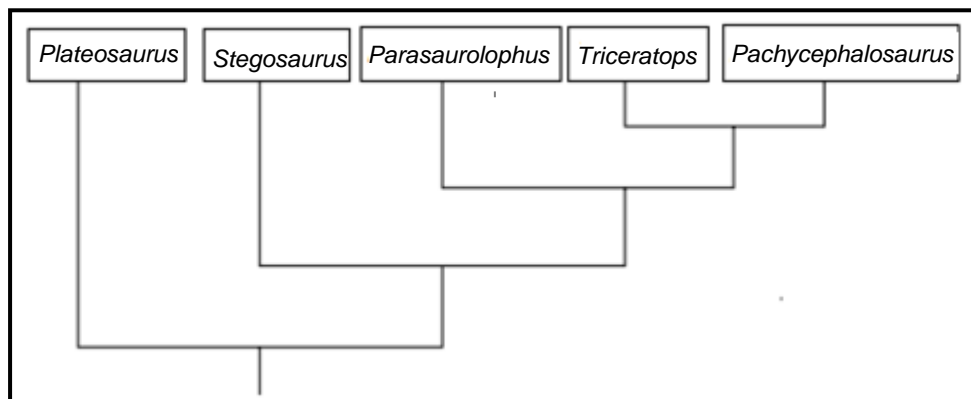
We can conclude that ...

- A the man is not the true father of the children.
- B the man is heterozygous for eye colour.
- C eye colour is sex-linked.
- D both parents are homozygous for eye colour.

1.1.9 A possible explanation for an observation that can be tested is known as a ...

- A fact.
- B law.
- C theory.
- D hypothesis.

1.1.10 Common structural characteristics between groups of dinosaurs were used to construct the phylogenetic tree below.



The two groups of dinosaurs with the most characteristics in common are ...

- A *Triceratops* and *Pachycephalosaurus*.
- B *Parasaurolophus* and *Triceratops*.
- C *Stegosaurus* and *Parasaurolophus*.
- D *Plateosaurus* and *Stegosaurus*.

(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 type of inheritance where the dominant allele masks the expression of the recessive allele in the heterozygous condition
- 1.2.2 The process by which genetically identical organisms are formed using biotechnology
- 1.2.3 A group of organisms of the same species in a specific habitat
- 1.2.4 The type of vision shared by apes and humans that allows for depth perception
- 1.2.5 The family to which humans belong
- 1.2.6 A human disorder caused by non-disjunction of chromosome pair 21
- 1.2.7 The stage of protein synthesis during which mRNA forms from DNA
- 1.2.8 Structures in different organisms that have a similar basic plan which suggests that they share a common ancestor
- 1.2.9 The position of a gene on a chromosome
- 1.2.10 The type of variation in a population with no intermediate phenotypes (10 x 1) **(10)**

1.3 Indicate whether each of the statements 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	Reproductive isolating mechanisms in plants	A:	Flowering at different times of the year
		B:	Adaptation to different pollinators
1.3.2	Evidence for evolution	A:	Biogeography
		B:	Fossil record
1.3.3	Found in African apes and humans	A:	Claws instead of nails
		B:	An opposable thumb

(3 x 2) **(6)**

1.4 The size and colour of unripe fruit in a plant species is genetically controlled. The allele for small fruit (**b**) is recessive to the allele for big fruit (**B**). The allele for yellow fruit colour (**g**) is recessive to the allele for green fruit (**G**).

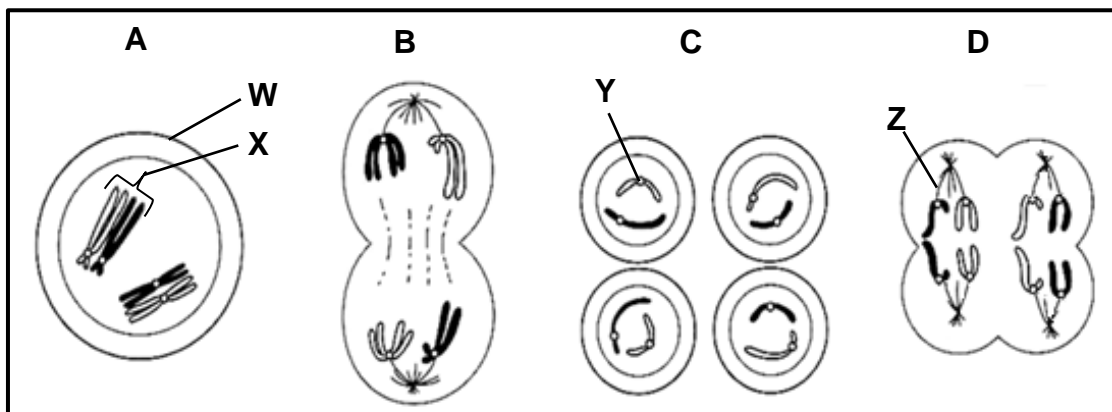
1.4.1 State:

(a) The phenotype of the plant with the genotype **BbGg** (2)

(b) ALL possible genotypes of the gametes produced by the plant mentioned in QUESTION 1.4.1(a) (2)

1.4.2 In a cross between two plants with genotypes **BBGG** and **bbgg** what percentage of the offspring will be homozygous for both characteristics? (2)  
(6)

1.5 The diagrams below show different phases in meiosis.



1.5.1 Label structures **W** and **X**. (2)

1.5.2 How many chromosomes are present in each cell in:

(a) Phase **A** (1)

(b) Phase **C** (1)

1.5.3 Give only the LETTER of the diagram that represents anaphase II. (1)

1.5.4 State the function of structure **Y** and structure **Z**. (2)

1.5.5 Identify phase **C**. (1)  
(8)

**TOTAL SECTION A: 50**

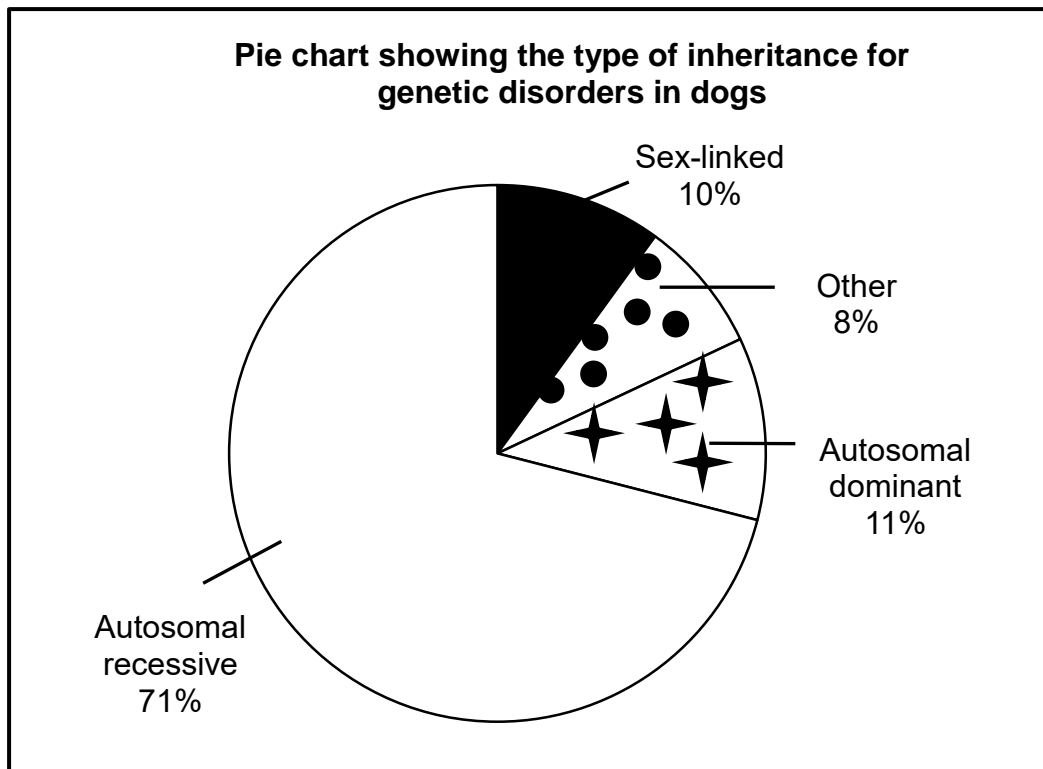
**SECTION B**

**QUESTION 2**

2.1 Scientists wanted to determine which type of inheritance accounted for most of the selected genetic disorders in dogs.

To do this they sequenced the genomes of a large number of dogs of the same breed that suffered from the genetic disorders.

The results of the investigation are shown below.



[Source: <http://www.instituteofcaninebiology.org>]

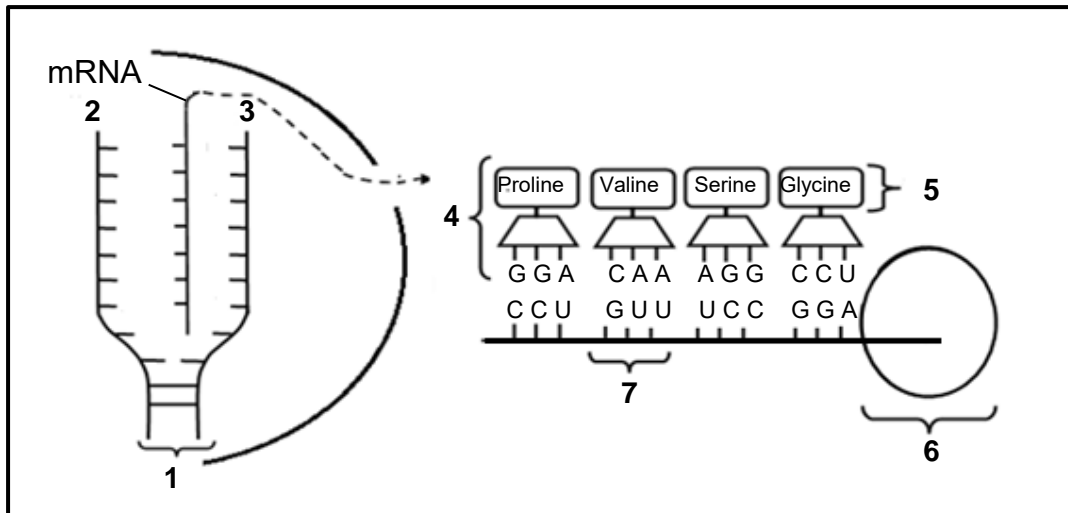
- 2.1.1 If 2 000 dogs were studied in this investigation, how many dogs had disorders that were caused by autosomal dominant inheritance? Show ALL calculations. (3)
- 2.1.2 State TWO ways in which the scientists could improve the reliability of their results. (2)
- 2.1.3 State ONE factor that was kept constant in this investigation. (1)
- 2.1.4 Explain why there is no need to keep the age of the dogs constant in this type of investigation. (2)
- 2.1.5 Provide a conclusion for this investigation. (2)
- (10)**



2.2 In dogs rough hair (**H**) is dominant to smooth hair (**h**). A heterozygous rough-haired dog is mated with a smooth-haired dog.

Represent a genetic cross to show the phenotypic ratio of the puppies. **(6)**

2.3 The diagram below represents two stages of protein synthesis.



2.3.1 Provide labels for:

(a) Molecule **1** **(1)**

(b) Organelle **6** **(1)**

2.3.2 Give only the NUMBER of the part which represents a:

(a) DNA template strand **(1)**

(b) Monomer of proteins **(1)**

(c) Codon **(1)**

2.3.3 Describe *translation* as it occurs at organelle **6**. **(4)**

2.3.4 Provide the:

(a) DNA sequence that codes for glycine **(2)**

(b) Codon for proline **(2)**

2.3.5 State TWO differences between a *DNA nucleotide* and an *RNA nucleotide*. **(4)**  
**(17)**

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

### USE OF STEM CELLS

Dr Orly Lachan-Kaplan of Monash Immunology and Stem Cell Laboratories has used stem cell manipulation to create an ovary-like structure containing ova. Although it is not yet clear if the cells of this ovary-like structure are functional, she hopes that this method can be used to develop functional human ova.

[Source: <http://monash.edu/news/releases/308>]

- 2.4.1 Name ONE source of stem cells. (1)
- 2.4.2 Explain why the characteristics of stem cells make them useful in treating some disorders. (3)
- 2.4.3 Explain ONE possible advantage of creating an ovary-like structure. (3)
- (7)  
[40]

### QUESTION 3

3.1 Errors that occur during DNA replication may sometimes lead to mutations.

3.1.1 Describe *DNA replication*. (5)

3.1.2 Describe how an error in DNA replication may lead to a gene mutation. (2)  
(7)

3.2 The passage below refers to human evolution.

Research, using DNA evidence, suggests that all modern humans arose from a single group of *Homo sapiens* that migrated from Africa 2 000 generations ago and spread throughout Europe and Asia over thousands of years.

[Source: <http://images.sciencedaily.com>]

3.2.1 Name the hypothesis on human evolution that is described in the passage. (1)

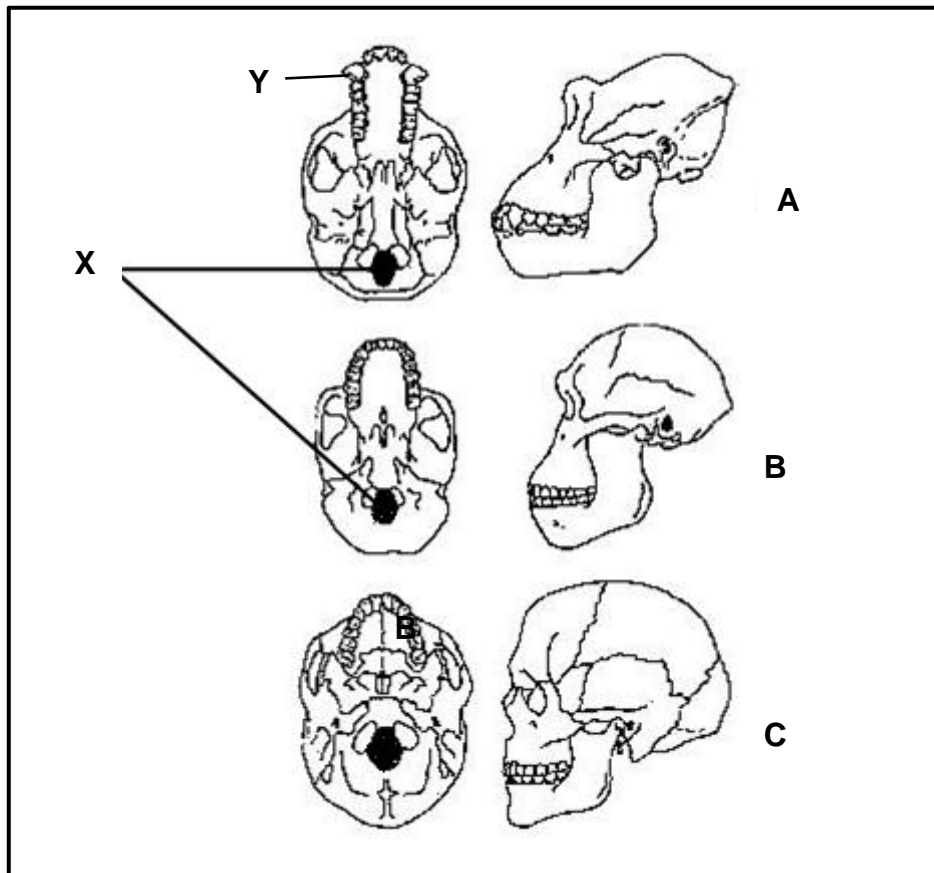
3.2.2 Name the type of DNA outside the nucleus that is analysed in support of the hypothesis named in QUESTION 3.2.1. (1)

3.2.3 Explain how the type of DNA named in QUESTION 3.2.2 is used to provide evidence for the hypothesis named in QUESTION 3.2.1. (3)

3.2.4 Apart from DNA evidence, state ONE other line of evidence that may be used to support the hypothesis mentioned in QUESTION 3.2.1. (1)  
(6)

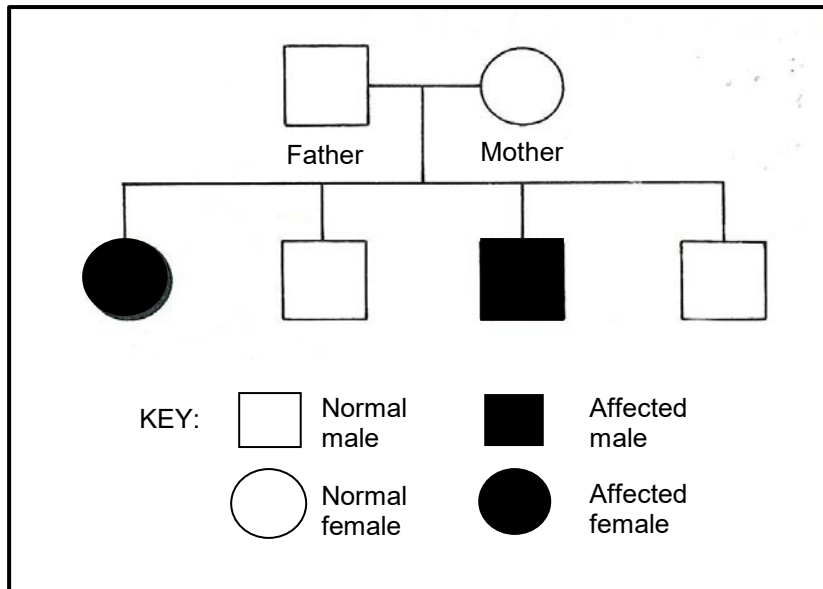
3.3 Describe how a new species is formed through geographic isolation. (6)

- 3.4 The diagram below represents the fossilised skulls of three different species of primates. They were either bipedal or quadrupedal (organisms that habitually walk on all four limbs).



- 3.4.1 Label part **X** and the type of teeth at **Y**. (2)
- 3.4.2 Explain the significance of the location of structure **X** in organism **C**. (3)
- 3.4.3 Which of the skulls (**A**, **B** or **C**) belongs to:
- (a) An *Australopithecine* (1)
- (b) A quadrupedal primate (1)
- 3.4.4 Explain how the change in the skull from **B** to **C** could indicate a change in intelligence. (3)
- 3.4.5 Tabulate TWO observable differences, other than those mentioned in QUESTIONS 3.4.2 and 3.4.4, between skulls **B** and **C** that represent trends in human evolution. (5)
- (15)**

- 3.5 The pedigree diagram below shows the pattern of inheritance of a certain genetic disorder controlled by a recessive allele. The dominant allele is represented by **N** and the recessive allele by **n**.



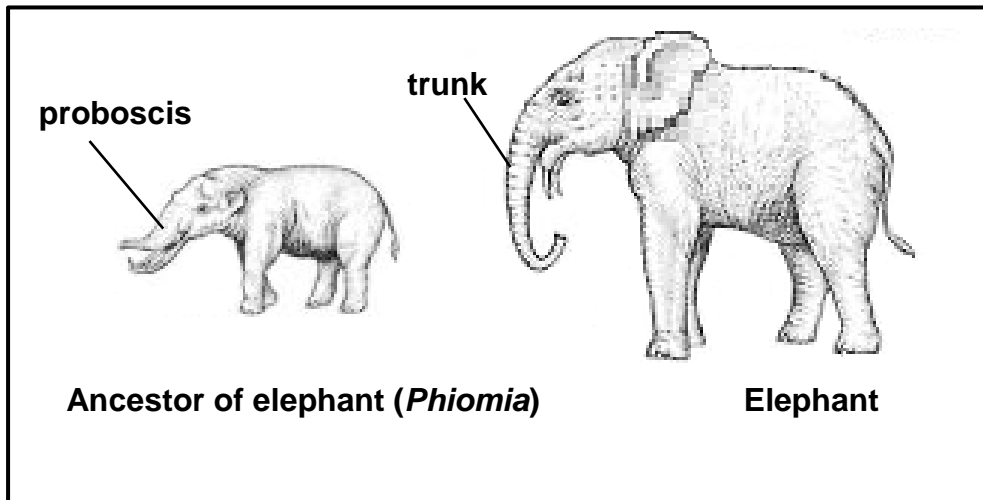
- 3.5.1 Explain why both parents must be heterozygous for this characteristic. (2)
- 3.5.2 Give the possible genotype(s) of the normal children. (2)
- 3.5.3 Provide evidence from the pedigree diagram to show that this characteristic is not sex-linked. (2)
- (6)**  
**[40]**

**TOTAL SECTION B: 80**

**SECTION C**

**QUESTION 4**

An ancestor of the elephant, *Phiomia*, had a long nose-like structure called a proboscis which evolved into the trunk of the elephant. The proboscis was used to gather leaves as food. The proboscis of *Phiomia* and the trunk of the elephant are shown below. The diagrams have been drawn to scale.



Explain the evolution of the elephant's trunk in terms of Lamarckism and Darwinism as well as the way in which an increase in the length of the trunk of the elephant could be achieved through artificial selection.

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

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

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