



# basic education

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

## NATIONAL SENIOR CERTIFICATE

**GRADE 12**

**LIFE SCIENCES P1**

**VERSION 1 (NEW CONTENT) FOR FULL-TIME CANDIDATES**

**FEBRUARY/MARCH 2013**

**MARKS: 150**

**TIME: 2½ hours**

**This question paper consists of 16 pages.**



★ L F S C E 1 ★





**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. ALL drawings should be done in pencil and labelled 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 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 is the best definition of a species?
- A A population of similar animals which can interbreed
  - B A population of organisms which breed to produce fertile offspring
  - C A community of organisms which can interbreed
  - D A population of organisms with similar characteristics
- 1.1.2 What causes the genetic disorder where some males have the sex chromosomes XXY?
- A A sex-linked recessive allele
  - B Non-disjunction of chromosomes during meiosis
  - C Two sperm cells fertilise one ovum
  - D Crossing-over during meiosis
- 1.1.3 The chromosome complement of a human individual who inherits an X chromosome from the father, is ...
- A 44 and XX.
  - B 44 and XY.
  - C 46 and XX.
  - D 46 and XY.
- 1.1.4 Which ONE of the following is an example of artificial selection?
- A DDT resistance in mosquitoes
  - B The development of different species of tortoise from a common ancestor
  - C The decreasing effect of antibiotics on bacteria
  - D Breeding dairy cattle to increase milk production



- 1.1.5 Studies have shown that the number of dark moths in a woodland area next to an industrial area is related to the air pollution levels in the atmosphere. When the levels of pollution increase, trees become black from the smoke. Moths are eaten by birds in this area.

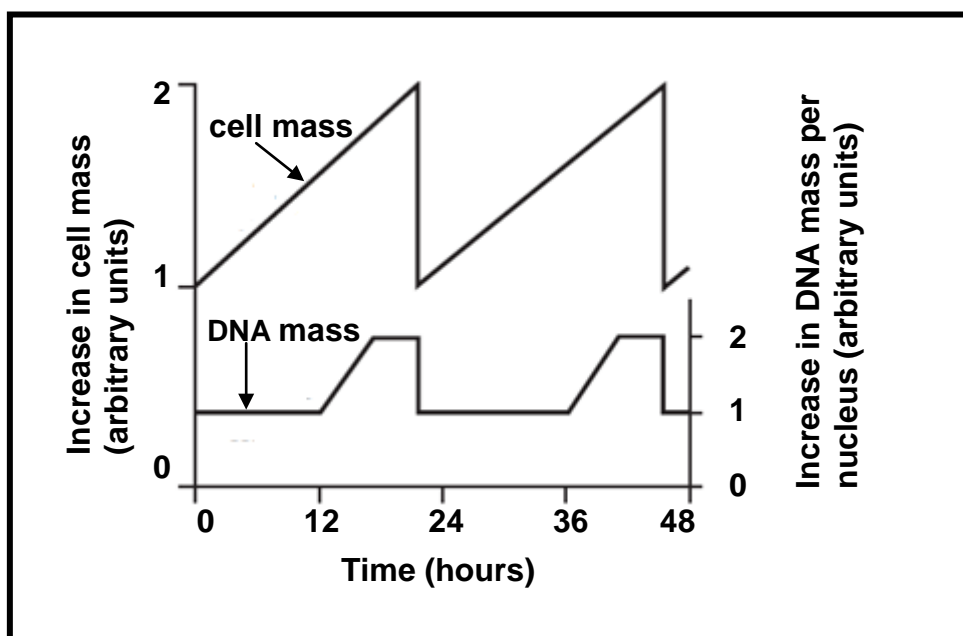
Which ONE of the following best describes what would happen to the number of dark moths when air pollution levels change?

	AIR POLLUTION LEVELS	NUMBER OF DARK MOTHS
A	Increase	Remain the same
B	Decrease	Increase
C	Increase	Decrease
D	Decrease	Decrease

- 1.1.6 What percentage of adenine bases is present in a DNA molecule with 2 000 bases, if 400 of the bases are cytosine?

- A 20%  
B 30%  
C 40%  
D 60%

- 1.1.7 The diagram below shows changes in cell mass and DNA mass during two cell cycles.



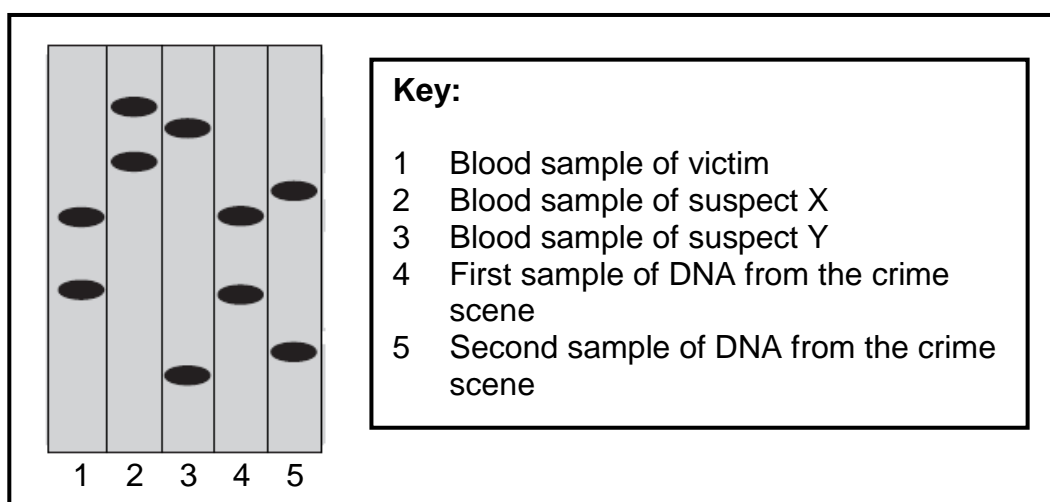
It can be concluded from the graph that during the cell cycle ...

- A the interphase is the longest phase.  
B the cell is dividing between 24 and 36 hours.  
C replication takes place between 0 and 12 hours.  
D cytokinesis takes place at 12 and 36 hours.

1.1.8 Two parents both have blood group A. Their child has blood group O. What is the best explanation for this pattern of inheritance?

- A The child has inherited the blood group directly from a grandparent.
- B The parents are homozygous for the blood group alleles.
- C The parents are heterozygous for the blood group alleles.
- D There has been a mutation in the blood group alleles.

1.1.9 The result of profiling various DNA samples in a criminal investigation is shown below.



Which conclusion about the crime could the DNA analyst draw?

- A Only suspect X was involved.
- B Only suspect Y was involved.
- C Suspects X and Y were both involved.
- D Neither suspect X nor Y was involved.

1.1.10 The table below shows some genotypes and phenotypes associated with a form of anaemia.

GENOTYPE	PHENOTYPE
Hb <sup>A</sup> Hb <sup>A</sup>	Unaffected
Hb <sup>A</sup> Hb <sup>S</sup>	Partial sickle-cell anaemia
Hb <sup>S</sup> Hb <sup>S</sup>	Severe sickle-cell anaemia

A person who has partial sickle-cell anaemia and an unaffected person have a child together. What are the chances of the child having severe sickle-cell anaemia?

- A 100%
- B 50%
- C 25%
- D 0%

(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 1.2.7) in the ANSWER BOOK.

- 1.2.1 The linking of the present-day distribution of organisms with the past movements of continental plates
- 1.2.2 The elimination of a species from the Earth
- 1.2.3 A point where the exchange of genetic material occurs during crossing-over
- 1.2.4 The stage in the process of the formation of a protein determined by the codons in the mRNA
- 1.2.5 The type of inheritance which has a range of intermediate phenotypes for a particular trait
- 1.2.6 An inherited disorder in which blood fails to clot properly
- 1.2.7 The position of a gene in a chromosome

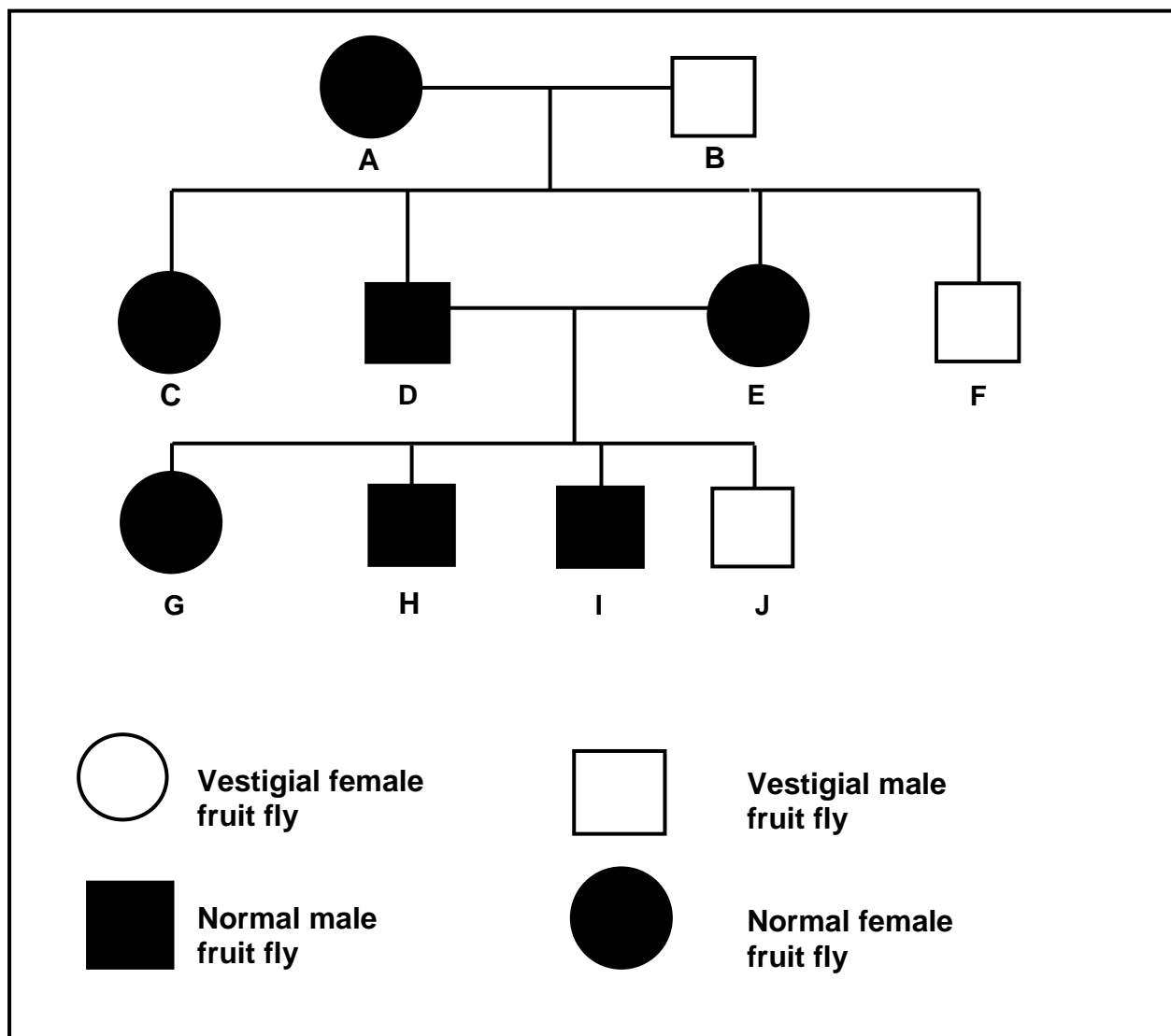
**(7)**

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 1.3.8) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 Discovered the double helical structure of DNA	A: Francis Crick B: James Watson
1.3.2 A process which can detect mutant genes in an individual	A: Genetic counselling B: Genetic testing
1.3.3 The breeding of organisms over many generations in order to achieve a desirable phenotype	A: Cloning B: Artificial selection
1.3.4 Introduces variation within a species	A: Random mating B: Mutation
1.3.5 An advantage of polyploidy in agriculture	A: Increase in the size of fruit B: Increase in the size of flowers
1.3.6 The type of cell division that takes place in angiosperm plants	A: Mitosis B: Meiosis
1.3.7 Influences the inheritance of blood groups	A: Codominance B: Multiple alleles
1.3.8 Bonds that holds amino acids together in a protein molecule	A: Hydrogen bonds B: Peptide bonds

**(8 x 2)****(16)**

- 1.4 The pedigree diagram below traces the inheritance of vestigial (reduced in size) and normal wing characteristics in fruit flies. Study the diagram and answer the questions that follow.



- 1.4.1 State the dominant wing characteristic of the flies used in these crosses. (1)
- 1.4.2 Use the letters **G** and **g** and write down the genotype of the following:
- (a) **A** (1)
- (b) **J** (1)
- 1.4.3 If fruit fly **C** was crossed with a male having vestigial wings, what would be the possible genotype(s) of the offspring? (4)  
(7)

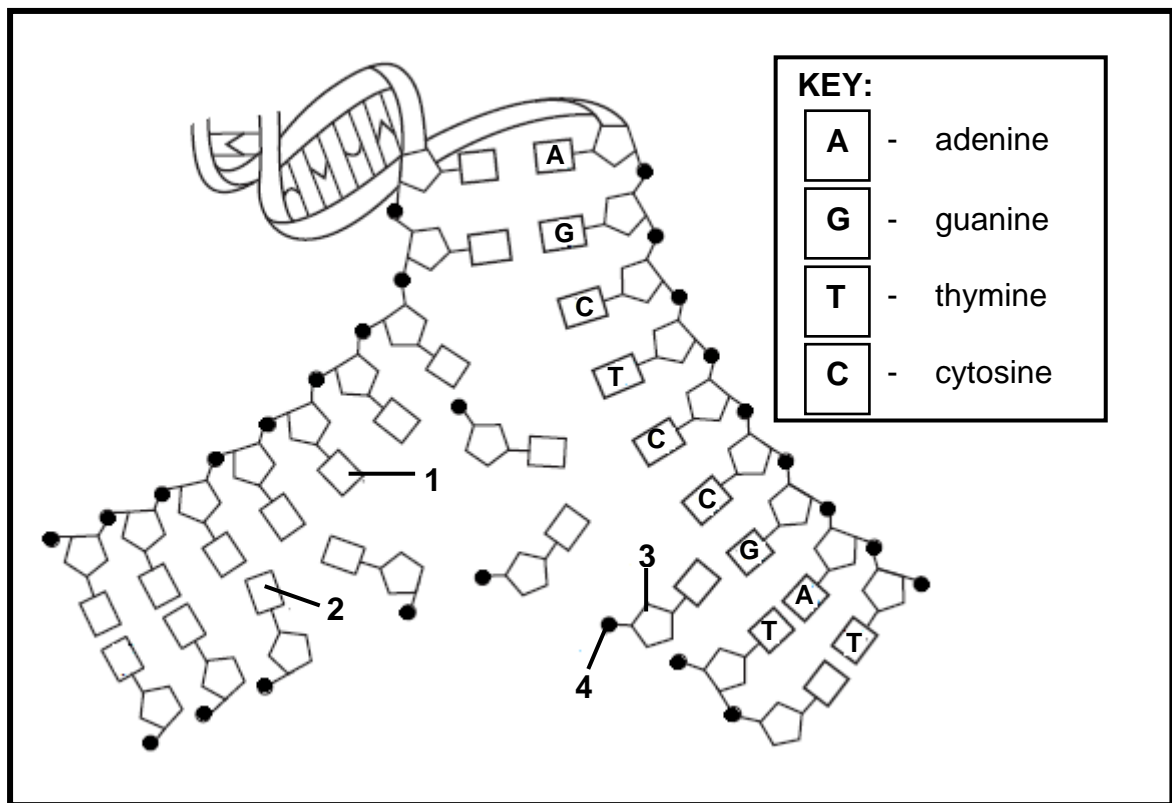
**TOTAL SECTION A: 50**





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

- 2.1 The diagram below shows part of a DNA molecule in a nucleus just before cell division.



- 2.1.1 Identify the parts labelled:

- (a) 3 (1)
- (b) 4 (1)

- 2.1.2 Identify the nitrogenous bases labelled:

- (a) 1 (1)
- (b) 2 (1)

- 2.1.3 Explain why the diagram above represents replication and not transcription. (2)

**(6)**

- 2.2 A rare form of rickets in humans is caused by a sex-linked dominant allele (**R**) which is carried on the X-chromosome. An affected female, whose father was unaffected, married an unaffected male.
- 2.2.1 Determine the possible genotypes and phenotypes of their offspring by representing a genetic cross. (6)
- 2.2.2 What is the percentage chance that they will have a child who is an unaffected male? (2)
- 2.2.3 Explain why this disorder, although it is sex-linked, does NOT affect males only. (2)
- 2.2.4 This genetic disorder is caused by a gene mutation in which the DNA triplet CAG is altered to TAG.
- (a) Name this type of mutation. (1)
- (b) Describe how the type of mutation mentioned in QUESTION 2.2.4(a) will affect the structure of the protein it codes for. (2)
- 2.2.5 Give TWO reasons why this couple should undergo genetic counselling before having children. (2)
- (15)**
- 2.3 Ribonuclease is an enzyme made up of 127 amino acids.
- 2.3.1 What is the minimum number of DNA bases needed to code for amino acids of this enzyme? (1)
- 2.3.2 The sequence of DNA bases coding for seven amino acids in the enzyme ribonuclease is:

**GTT TAC TAC TCT TCT TCT TTA**

The number of each type of amino acid coded for by this sequence of DNA bases is shown in the table below.

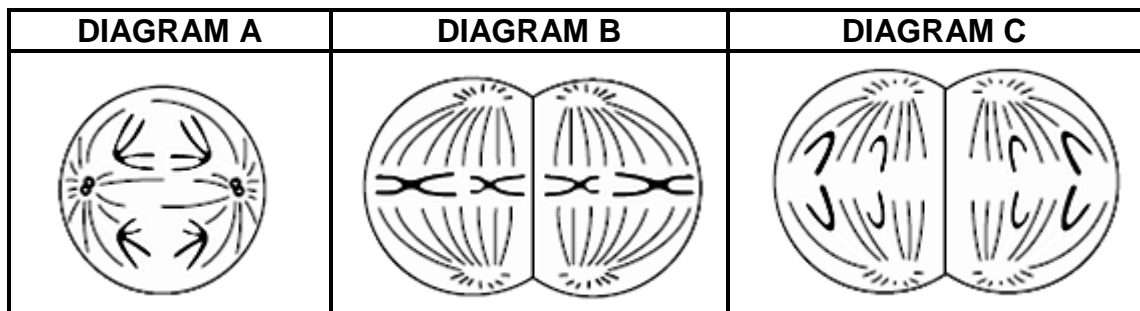
AMINO ACID	NUMBER OF AMINO ACIDS PRESENT
Arg	3
Met	2
Gly	1
Asn	1

The first amino acid in this enzyme is **Gly** which is coded for by GTT in DNA. Use the DNA base sequence and the table above to work out the sequence of the remaining amino acids in this part of the enzyme.

(3)  
(4)



- 2.4 Study the diagrams below representing various phases of meiosis in an organism.



- 2.4.1 Which diagram (**A**, **B** or **C**) represents meiosis I? (1)
- 2.4.2 Suggest why the chromosomes in diagram **B** will be genetically different from that of the parent cell at the beginning of meiosis. (1)
- 2.4.3 How many chromosomes will each daughter cell have at the end of this cell division? (1)
- 2.4.4 Give TWO reasons why this type of cell division is important. (2)
- (5)**  
**[30]**



**QUESTION 3**

- 3.1 Professor Lee Berger and his colleagues studied the fossils they found in a cave at the Cradle of Humankind. The skeletons from the cave are ranked amongst the most complete finds to date. The adult female, *Australopithecus sediba*, was remarkably well preserved and some of the following characteristics were identified:

Some characteristics of *Australopithecus sediba*:

- A small brain size
- Bipedal
- Smaller canines
- Projecting nose
- Small body size

[Adapted from 'Part Ape Part Human', Josh Fischmann, *National Geographic*, August 2011]

- 3.1.1 Write down THREE characteristics from the list above that also apply to the *Homo* species. (3)
- 3.1.2 State TWO advantages of *A. sediba* being bipedal. (2)
- 3.1.3 Professor Berger called *Australopithecus sediba* a transitional fossil. Using the information in the list above, explain why he called *A. sediba* a species in transition. (2)
- (7)**



- 3.2 Study the table below, which indicates some of the hominid fossils found in the world and answer the questions that follow.

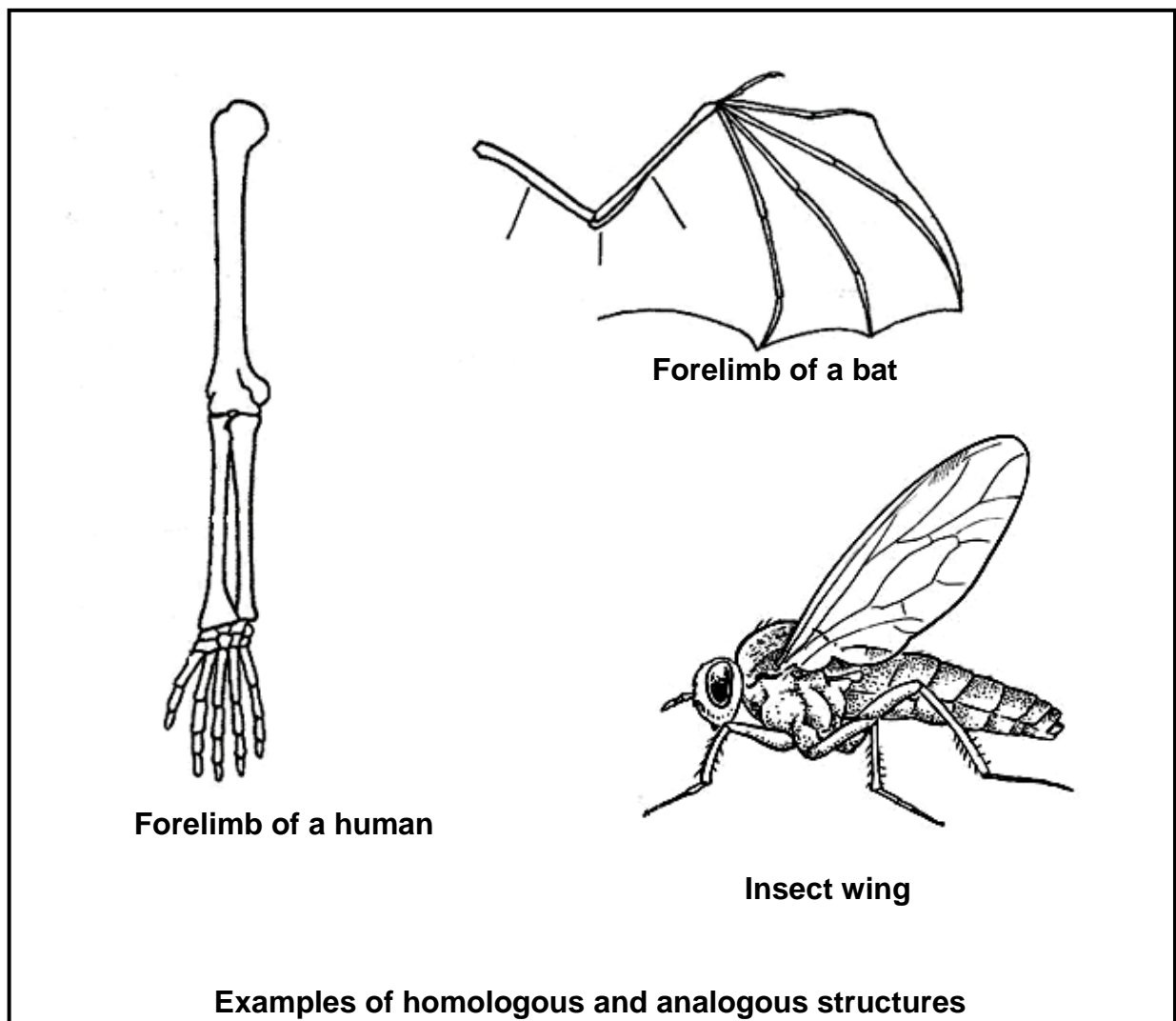
SPECIES	REGION WHERE IT WAS FOUND	PERIOD OF EXISTENCE (WHEN IT LIVED)
<i>Australopithecus afarensis</i>	Eastern Africa	3,4–2,8 mya
<i>Australopithecus africanus</i>	Southern Africa	2,1–2,8 mya
<i>Australopithecus sediba</i>	Southern Africa	2,0–1,9 mya
<i>Homo habilis</i>	Sub-Saharan (Africa)	2,3–1,4 mya
<i>Homo erectus</i>	Africa, Europe, Asia	1,5–0,2 mya
<i>Homo heidelbergensis</i>	Europe, China	0,6–0,35 mya
<i>Homo neanderthalensis</i>	Europe, Western Asia	0,35–0,03 mya
<i>Homo sapiens</i>	Worldwide	0,2 mya–present

[Adapted from 'The Evolutionary Road', Jamie Shreeve, *National Geographic*, July 2010]

- 3.2.1 Explain why the information in the table supports the 'Out of Africa' hypothesis. (3)
- 3.2.2 If a fossil of *Australopithecus afarensis*, dated 3,2 mya, is found in Asia, explain the implications for the 'Out of Africa' hypothesis. (2)
- 3.2.3 Describe TWO genetic lines of evidence that support the 'Out of Africa' hypothesis. (4)
- (9)**

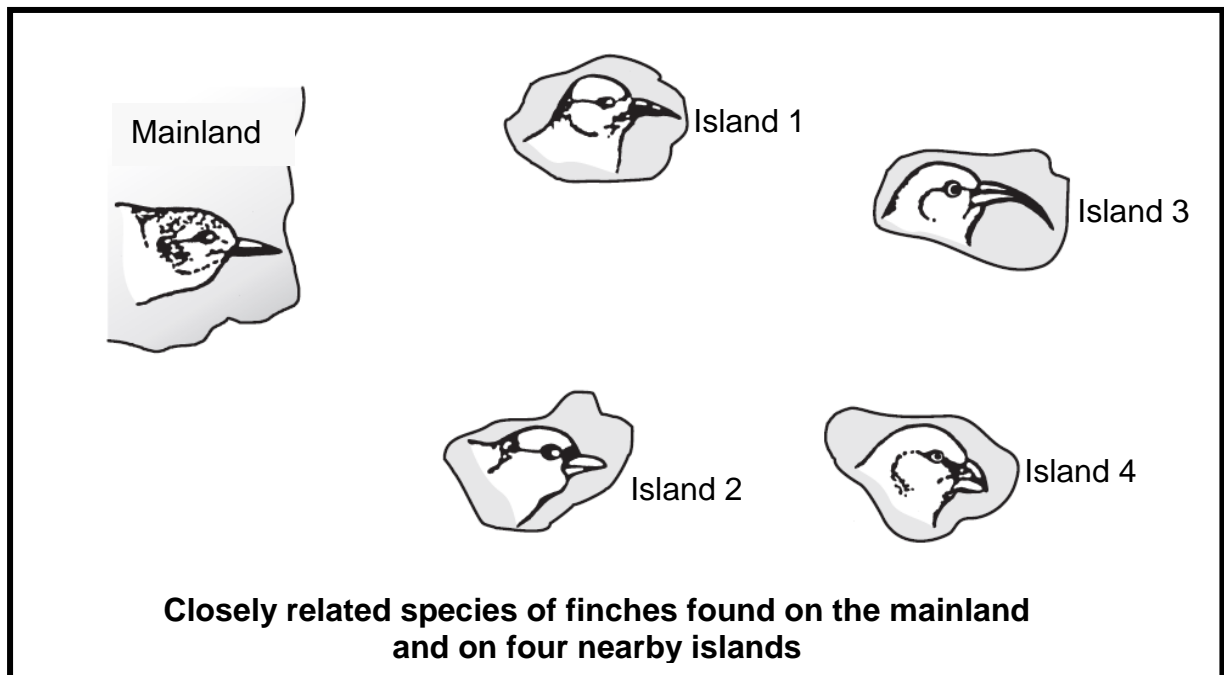


- 3.3 Study the analogous and homologous structures below, which can be used as evidence for evolution and answer the questions that follow.



- 3.3.1 Identify TWO structures in the diagram that are:
- (a) Analogous (2)
  - (b) Homologous (2)
- 3.3.2 Describe how the homologous structures named in QUESTION 3.3.1(b) give evidence for evolution. (2)  
(6)

- 3.4 The diagram below shows five closely related species of finches found on the mainland and on four nearby islands.



Describe how the different species on the four islands evolved over many generations from the original ancestor on the mainland.

(8)  
[30]

**TOTAL SECTION B: 60**

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

- 4.1 A group of learners investigated the frequency of dominant and recessive traits in their school. Their hypothesis was:

*There will be more learners with dominant traits than learners with recessive traits.*

The traits below were investigated in 200 learners:

<b>DOMINANT TRAIT</b>	<b>RECESSIVE TRAIT</b>
Unattached earlobe	Attached earlobe
Rolled tongue	Unrolled tongue
Bent little finger	Straight little finger

The results below were obtained during the investigation.

<b>TRAIT</b>	<b>NUMBER OF LEARNERS</b>	
	<b>DOMINANT</b>	<b>RECESSIVE</b>
Earlobe	70	130
Tongue	24	176
Little finger	15	185

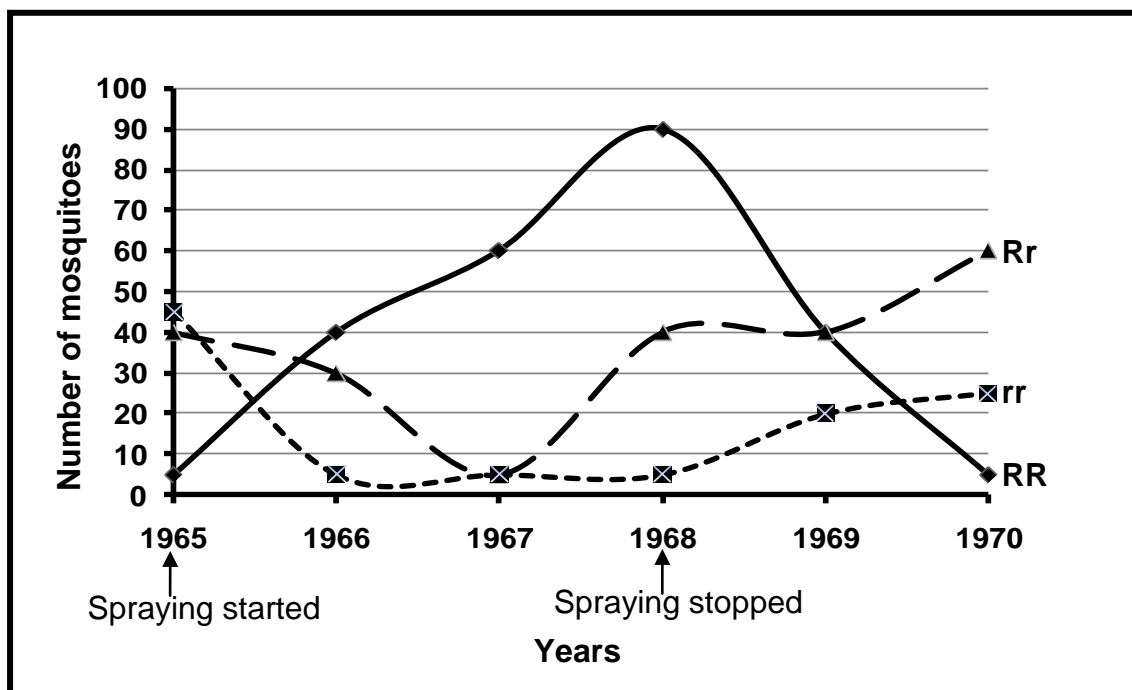
- 4.1.1 Show the results for each trait above as bar graphs on the same system of axes. (8)
- 4.1.2 Explain why age need NOT be controlled in this investigation. (2)
- 4.1.3 State ONE way in which the learners ensured reliable results. (1)
- 4.1.4 State any TWO planning steps that the learners had to consider before conducting the investigation. (2)
- 4.1.5 Will the learners accept or reject their hypothesis? (1)
- 4.1.6 Explain your answer to QUESTION 4.1.5. (2)
- (16)**





- 4.2 In mosquitoes there is a gene locus which has alleles involved in resistance to DDT, a well-known insecticide.

The graph below shows the number of mosquitoes and their genotypes collected from 1965 when DDT was first used, until 1970, two years after the spraying of DDT stopped.



- 4.2.1 How many alleles are involved in the trait for resistance in mosquitoes? (1)
- 4.2.2 State the genotype for resistance to DDT. (1)
- 4.2.3 Which genotype appeared most frequently in the population in 1970? (1)
- 4.2.4 Which genotype's chances of survival were reduced after the spraying of DDT was stopped in 1968? (1)
- (4)**

- 4.3 Charles Darwin and Jean Baptiste de Lamarck had different ideas to explain evolution. Describe how each of them would have explained the evolution of the long necks of giraffes. Justify whose idea is more acceptable in the science community today.

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

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

**TOTAL SECTION C: 40**  
**GRAND TOTAL: 150**

