



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

NOVEMBER 2011

MARKS: 150

TIME: 2½ hours

This question paper consists of 13 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. 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 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 1.1.10) in your ANSWER BOOK, for example 1.1.11 D.

1.1.1 A scientific idea that still has to be tested is referred to as a ...

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

1.1.2 Which ONE of the following can be used as evidence to support common ancestry?

- A Different DNA sequencing in different species
- B Geographic distribution of different phyla
- C Homologous structures of a whale's flipper and a bird's wing
- D Analogous structures of a bird's wing and an insect's wing

1.1.3 The following statements relate to fossils:

1. Very few organisms end up as fossils.
2. Some organisms tend to decay before becoming a fossil.
3. Only soft parts of organisms preserve easily.
4. Geological processes may destroy fossils.

Which of the statements above are possible reasons why there are gaps in the fossil record?

- A 1, 2 and 3 only
- B 1, 2, 3 and 4
- C 2, 3 and 4 only
- D 1, 2 and 4 only

1.1.4 Which ONE of the statements below relates to biological evolution?

- A Artificial selection is essential for the evolution of species
- B Humans have now progressed from a technological age into an information age
- C Modern species evolved from ancestral species
- D Genetic mutations generally cause species to die

1.1.5 *Homo habilis* ...

- A was called Handyman because he was a toolmaker.
- B had a larger brain capacity than *Homo erectus*.
- C was the first *Homo* species without prominent brow ridges.
- D was the first *Homo* species to leave Africa.

1.1.6 The table below shows the percentage similarity of DNA of different primates compared to humans.

ORGANISM	DNA SIMILARITY (%)
Human	100
Capuchin monkey	84,2
Vervet monkey	90,5
Rhesus monkey	91,1
Gibbon	94,7
Chimpanzee	97,6

Which of the following pairs of primates are most closely related to humans?

- A Gibbon and chimpanzee
- B Gibbon and rhesus monkey
- C Rhesus monkey and vervet monkey
- D Capuchin monkey and vervet monkey

1.1.7 Blood group AB is a result of ...

- A complete dominance.
- B polygenic inheritance.
- C incomplete dominance.
- D co-dominance.

1.1.8 RNA differs from DNA in that it ...

- A has thymine and a phosphate group.
- B has a deoxyribose sugar and cytosine.
- C is a double stranded molecule.
- D has uracil and a ribose sugar.

1.1.9 The following refer to reproduction in different organisms:

1. Infertile offspring
2. Breed at the same time of the year
3. Species-specific courtship behaviour displayed in animals
4. Plants adapted to specific pollinators

Which of the above are reproductive isolating mechanisms?

- A 1, 2, 3 and 4
- B 1 and 2 only
- C 1, 3 and 4 only
- D 3 and 4 only

1.1.10 The probability that two heterozygous parents will have a homozygous dominant offspring, is ...

- A 75%.
- B 50%.
- C 25%.
- D 100%.

(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 your ANSWER BOOK.

- 1.2.1 A chemical substance that is designed to kill pathogenic bacteria
- 1.2.2 A group of similar organisms that can breed to produce fertile offspring
- 1.2.3 The complete disappearance of a species from Earth
- 1.2.4 An opening on primate skulls through which the spinal cord passes
- 1.2.5 Different forms of a gene which occur at the same locus
- 1.2.6 A cell condition in which the nucleus contains a single set of chromosomes
- 1.2.7 The biotechnological production of genetically identical offspring (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	Possible explanation of the development of resistant strains of tuberculosis-causing bacteria to treatment	A: Mutation B: Natural selection
1.3.2	The variable that is manipulated by the investigator during an investigation	A: Independent variable B: Dependent variable
1.3.3	Proposed the ideas of use and disuse, and the inheritance of modified characteristics to explain evolution	A: Alfred Wallace B: Erasmus Darwin
1.3.4	The type of gene mutation where only one nitrogenous base is replaced with another in the mRNA template	A: Frame-shift mutation B: Point mutation
1.3.5	The physical and functional expression of a gene	A: Genotype B: Phenotype
1.3.6	Evidence for evolution	A: Comparative embryology B: Comparative biochemistry
1.3.7	Fossils found in South Africa	A: <i>Australopithecus sediba</i> ('Karabo') B: Mrs Ples
1.3.8	Capable of bipedal locomotion	A: <i>Homo erectus</i> B: <i>Australopithecus africanus</i>

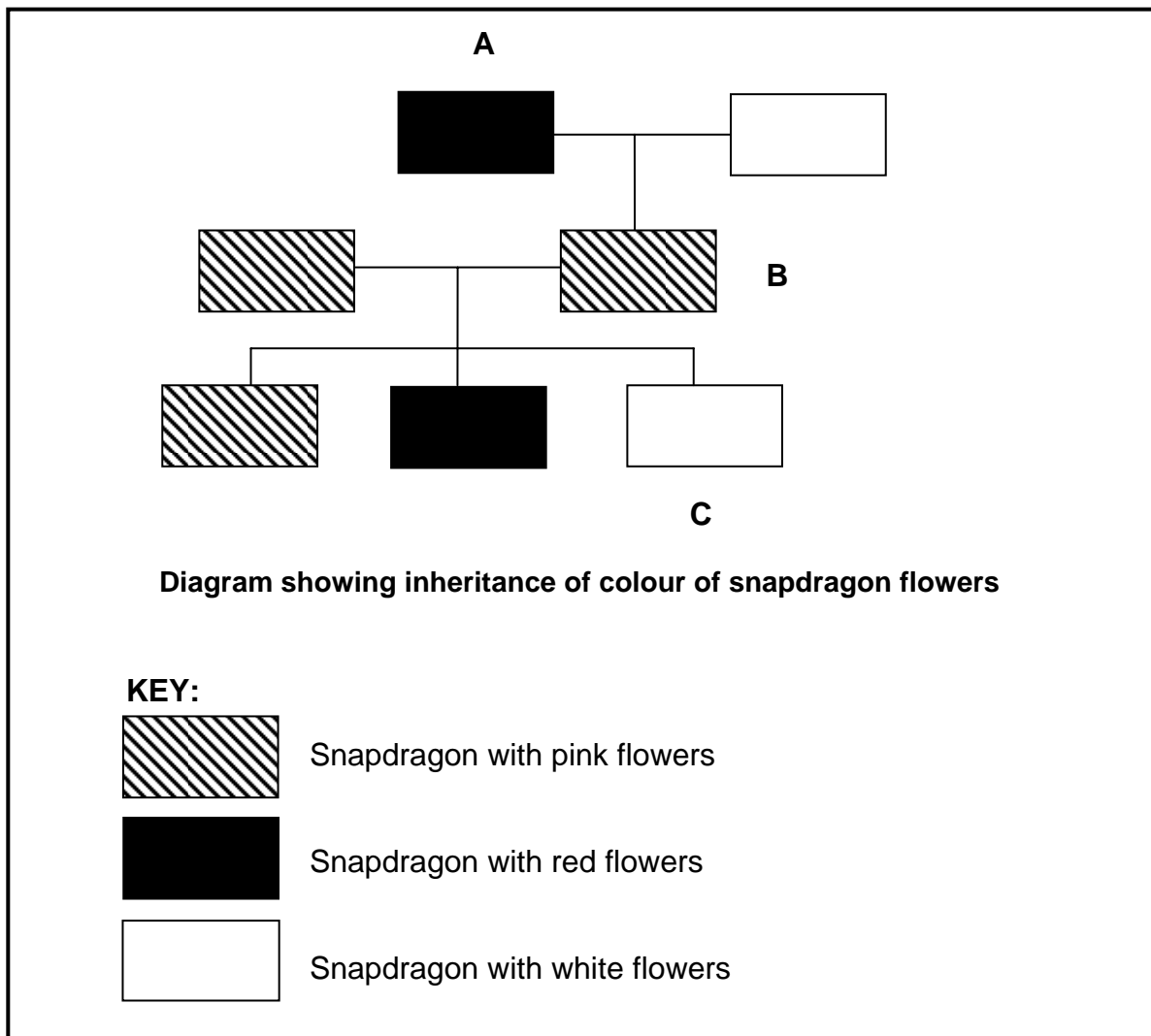
(8 x 2) (16)

1.4 Study the diagram below which shows three generations of snapdragon plants and answer the questions which follow.

Use the following symbols for the contrasting alleles:

W – for white flowers

R – for red flowers



1.4.1 State the kind of dominance shown in the diagram above. (1)

1.4.2 Use the symbols **R** and **W** and write down the genotypes of each of the following snapdragon plants:

- (a) A (2)
 - (b) B (2)
 - (c) C (2)
- (7)**

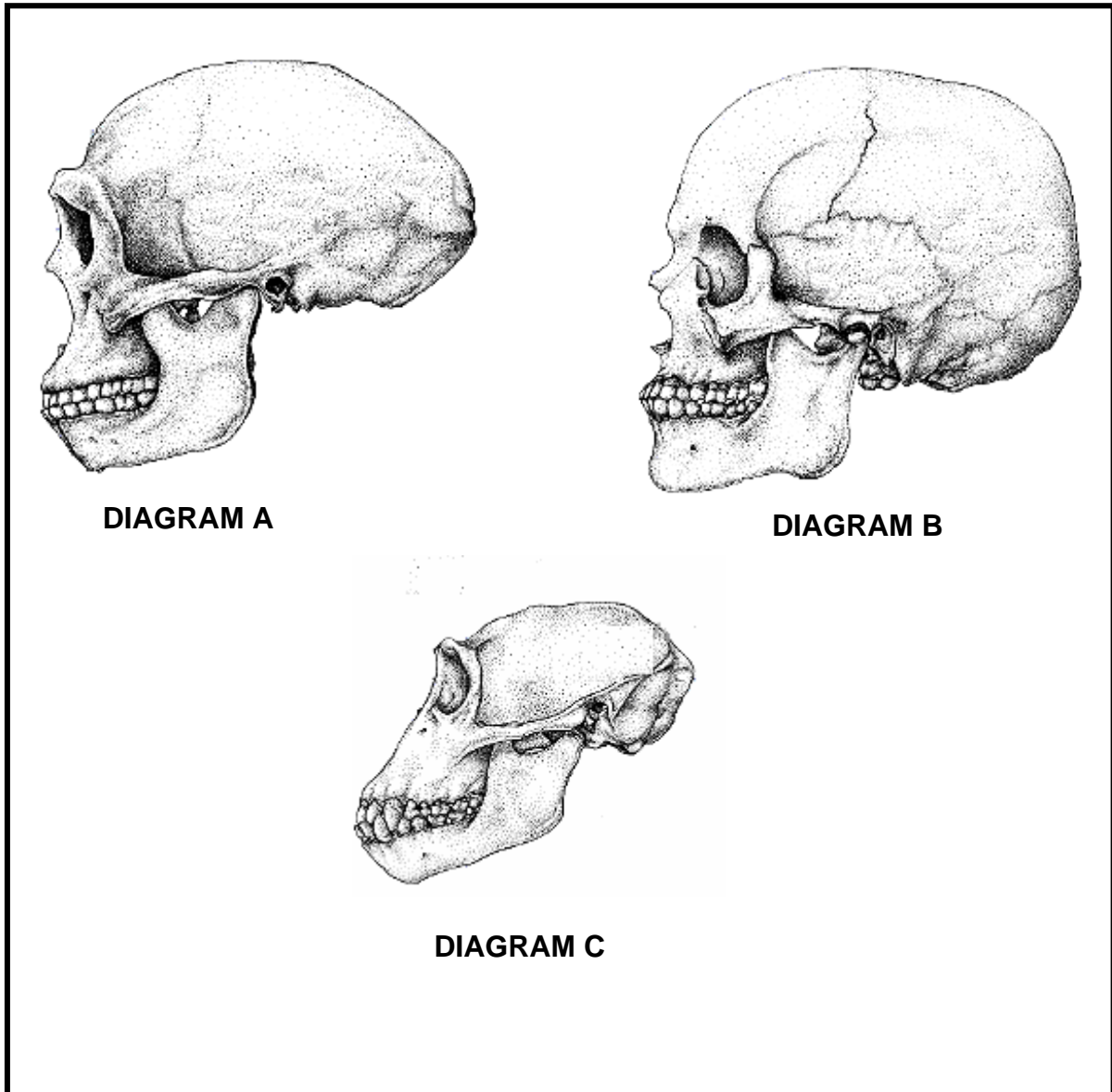
TOTAL SECTION A: 50

SECTION B**QUESTION 2**

- 2.1 Haemophilia is a sex-linked disease caused by the presence of a recessive allele (X^h). A normal father and heterozygous mother have children.
- 2.1.1 Represent a genetic cross to determine the possible genotypes and phenotypes of the children of the parents mentioned in QUESTION 2.1. (6)
- 2.1.2 What are the chances of the parents having a child that will be a haemophiliac male? (2)
- 2.1.3 Explain why the father is not a carrier for haemophilia. (2)
- (10)**
- 2.2 The risks and benefits of using biotechnology have been the subject of considerable debate in recent times. State the following:
- 2.2.1 THREE disadvantages of genetic engineering (3)
- 2.2.2 THREE advantages of genetic engineering (3)
- (6)**
- 2.3 Height of humans is a trait that is controlled by more than one gene. The Grade 12 learners at a girl's school did an investigation to determine the height of the Grade 12 learners.
- The results of the investigation are shown in the table below.
- | Height (cm) | 150–151 | 152–153 | 154–155 | 156–157 | 158–159 | 160+ |
|-----------------|---------|---------|---------|---------|---------|------|
| Number of girls | 5 | 18 | 30 | 24 | 14 | 2 |
- 2.3.1 Plot a histogram using the information in the table above. (9)
- 2.3.2 Name this type of inheritance that is controlled by more than one gene. (1)
- 2.3.3 How is the type of inheritance, named in QUESTION 2.3.2, different from that of inheritance due to one gene? (2)
- 2.3.4 State TWO other possible variables/factors that might have an influence on the height of a person. (2)
- (14)**
[30]

QUESTION 3

- 3.1 DIAGRAMS **A**, **B** and **C** below illustrate the skulls of *Homo sapiens*, *Homo erectus* and *Pan troglodytes* (chimpanzee). The diagrams are drawn to scale.



- 3.1.1 From the DIAGRAMS (**A**, **B** and **C**), name the species that appeared on Earth as follows:

(a) First

(b) Second

(c) Last

(3)

- 3.1.2 Tabulate THREE visible structural differences between DIAGRAM A and DIAGRAM B that illustrate evolutionary trends in human development.

(7)

(10)

3.2 Describe TWO lines of evidence which support the idea that the human population had its origins on the African continent. (4)

3.3 The peppered-moth, *Biston betularia*, has two phenotypes for body colour, dark (blackish) and pale (whitish). The trunks of the trees on which the moths rest are black in polluted environments compared to the white trunks of trees in unpolluted environments. In both unpolluted and polluted environments, birds are the predators of the moths.

An investigation was carried out to determine the number of dark and pale peppered-moths present in polluted and unpolluted environments using a sampling technique.

The results of the investigation are shown in the table below.

TYPE OF ENVIRONMENT	DARK MOTHS	PALE MOTHS
Polluted	150	40
Unpolluted	30	170

3.3.1 Formulate a hypothesis for the above investigation. (3)

3.3.2 Suggest THREE factors that might have decreased the validity of this investigation. (3)

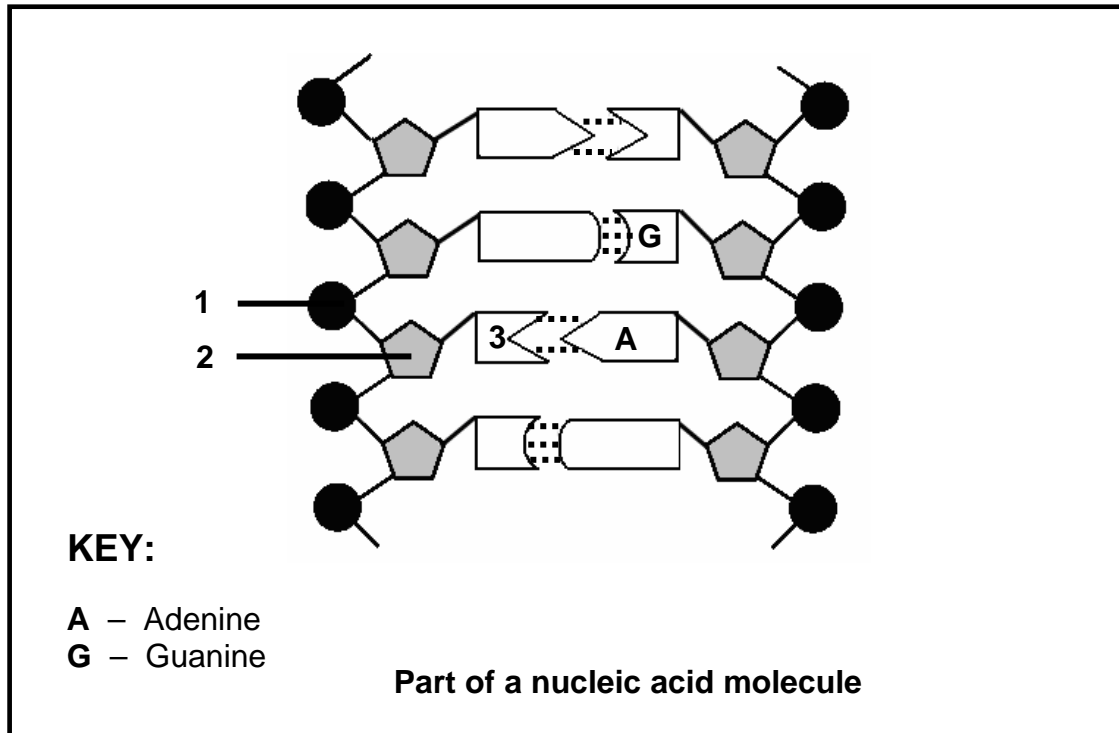
3.3.3 Using the table and your understanding of natural selection, explain the results for the polluted environment. (4)
(10)

3.4 Describe how sympatric speciation occurs. (6)
[30]

TOTAL SECTION B: 60

SECTION C**QUESTION 4**

- 4.1 Study the diagram below which represents a part of a nucleic acid molecule and answer the questions that follow.



- 4.1.1 Identify the nucleic acid shown in the diagram above. (1)
- 4.1.2 Label the following:
- (a) Part 1
- (b) Part 2
- (c) The nitrogenous base 3 (3)
- 4.1.3 What is the collective name for the parts numbered 1, 2 and 3? (1)
- (5)

4.2 The questions below are based on DNA profiling/fingerprinting.

4.2.1 What is *DNA profiling*? (1)

4.2.2 DNA evidence of a murder suspect was found at the scene of a crime.

Give TWO possible reasons why the suspect might be found not guilty in court, by referring to the DNA evidence. (4)
(5)

4.3 The questions below are based on protein synthesis.

4.3.1 Describe the role of DNA during transcription in protein synthesis. (4)

4.3.2 The diagram below shows the sequence of nitrogenous bases of a small part of a strand of DNA which codes for part of a protein molecule.

CGG — TAT — CCT

Write down the mRNA codon sequence that reads from left to right from the DNA sequence above. (3)

4.3.3 The table below shows the tRNA anticodons and their corresponding amino acids.

ANTICODONS OF tRNA	AMINO ACIDS
CAA	Valine
CCC	Glycine
CGU	Alanine
AAA	Phenylalanine
UUA	Asparagine
UAC	Methionine
GGU	Proline
ACC	Tryptophan
UCA	Serine

Select and write down from the table above, the amino acids (in the correct sequence) that would be required for the base sequence of mRNA shown below.

GGG — CCA — AGU

(3)
(10)

- 4.4 Describe the mechanisms by which meiosis contributes to genetic variation and describe how abnormal meiosis leads to Down's syndrome and polyploidy. Also describe the advantages of polyploidy in agriculture. (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