

# Study & Master

## Support Pack | Grade 12



# Life Sciences

## Practice Examination: Paper 2

This support pack consists of a **Practice examination paper** for Paper 2 of the **Life Sciences Grade 12 CAPS curriculum** and provides valuable practice in writing the examinations.

An answer memo is provided separately for you to check learners' answers. Learners can work through these individually at home or these could form the basis of a catch-up class or online lesson. You have permission to print or photocopy this document or distribute it electronically via email or WhatsApp.

**Cambridge University Press Africa** is a proudly South African publisher – we are providing this material in response to the need to support teachers and learners during the school shutdown and for the remainder of the 2020 school year.

For more information on our *Study & Master* CAPS-approved textbooks and valuable resource materials, visit

**[www.cambridge.org](http://www.cambridge.org)**

**We are all in this together!**

# PAPER 2

**MARKS: 150**

**TIME: 2½ hours**

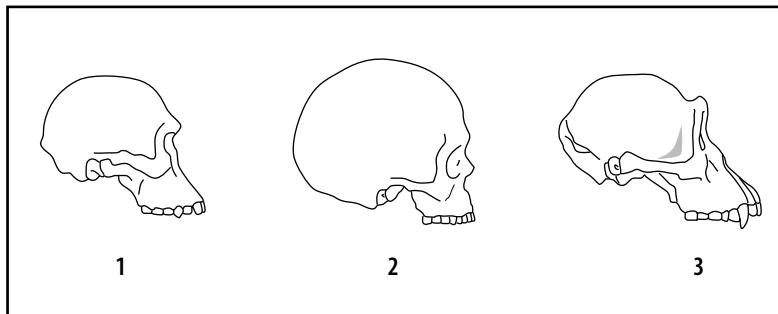
## **INSTRUCTIONS AND INFORMATION**

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 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 serves as evidence of cultural evolution in early *Homo* species?
- A** Drawings and carvings on rocks
  - B** Animal remains close to a *Homo* skeleton
  - C** Male and female skeletons in the same area
  - D** More than one *Homo* skeleton in an area
- 1.1.2 Changes to genetic material in organisms can ONLY be inherited by the next generation if they ...
- A** occur in somatic cells.
  - B** increase the survival chances of the species.
  - C** occur in reproductive cells.
  - D** increase the survival chances of an individual.
- 1.1.3 New alleles arise in a sexually reproducing population through ...
- A** mutations in DNA sequences prior to meiosis.
  - B** random fertilisation of gametes during reproduction.
  - C** random assortment of homologous chromosomes during meiosis.
  - D** exchange of chromatid segments between homologous chromosomes during meiosis.
- 1.1.4 Study the diagrams of hominid skulls below.



The correct sequence of evolution, from oldest to youngest, of the hominid species shown is ...

- A** 2, 3, 1
- B** 3, 1, 2
- C** 1, 3, 2
- D** 2, 1, 3

- 1.1.5** DNA sequences are now routinely used to determine how closely related different species are to each other. The table below shows DNA sequences from the amylase gene of four different organisms.

Amylase DNA sequence											
Organism 1	C	A	G	G	T	C	A	G	T	T	
Organism 2	C	C	G	G	T	C	A	G	G	T	
Organism 3	C	A	G	G	A	C	A	T	T	T	
Organism 4	C	C	G	G	T	C	A	C	G	T	

Based on this information alone, which TWO organisms are most closely related?

- A** Organism 1 and Organism 2
- B** Organism 2 and Organism 3
- C** Organism 2 and Organism 4
- D** Organism 3 and Organism 4

- 1.1.6** The following data represents a small section of a sequence of nucleic acid bases taken from an animal cell.

A G C U C G U U

From this data it is reasonable to conclude that ...

- A** this portion of nucleic acid will code for a chain of eight amino acids.
- B** the sequence given will be complementary to the sequence C T C G T G C T T.
- C** the nucleic acid shown contains the sugar ribose.
- D** the nucleic acid shown is DNA.

- 1.1.7** The list below provides information relating to the replication of DNA.

- i** Complementary nucleotides bind to each of the two strands
- ii** Sugar phosphate bonds form between the nucleotides
- iii** The newly formed DNA molecules are identical to each other
- iv** After unwinding, the DNA molecule forms two single strands

The correct order of these events as they occur in DNA replication is ...

- A** i, ii, iii and iv
- B** i, ii, iv and iii
- C** iv, ii, i and iii
- D** iv, i, ii and iii

- 1.1.8** Which one of the following accounts for gametes having a single allele only for a particular characteristic, instead of two?

- A** The chromosome number is halved during Meiosis II
- B** Mendel's principle of segregation
- C** Mendel's principle of independent assortment
- D** The 'law' of dominance

**1.1.9** Two parents have children with the following blood groups:

Child	Blood group
1	A
2	O
3	AB
4	B

If the father has blood group A, what blood group must the mother have?

- A** Blood group A
- B** Blood group B
- C** Blood group O
- D** Blood group AB

**1.1.10** In a monohybrid cross the two parental genotypes are AA and aa. The genotype of all the F<sub>1</sub> plants is Aa. If the F<sub>1</sub> plants are crossed, what percentage of the F<sub>2</sub> generation will have the dominant phenotype?

- A** 25
- B** 50
- C** 75
- D** 100

(10 × 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 **1.2.6**) in the ANSWER BOOK.

**1.2.1** The formation of new species in the absence of a physical barrier

**1.2.2** Similar structures that descend from a common ancestor

**1.2.3** Monomers/Building blocks of a nucleic acid

**1.2.4** The process of making new DNA from existing DNA

**1.2.5** The process of finding a desirable gene, isolating it and then moving it into the cells of another organism

**1.2.6** The two parts of a chromosome held together by a centromere

(6 × 1) [6]

- 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.

<b>Column I</b>		<b>Column II</b>	
<b>1.3.1</b>	Supports the 'Out of Africa' hypothesis	<b>A</b> <b>B</b>	Y chromosome mutations Migration of <i>Homo erectus</i>
<b>1.3.2</b>	Describes evolution as consisting of long phases of little change alternating with short phases of rapid change	<b>A</b> <b>B</b>	Punctuated equilibrium Darwinism
<b>1.3.3</b>	Variation within a population in which there is a range of intermediate phenotypes	<b>A</b> <b>B</b>	Discontinuous variation Continuous variation
<b>1.3.4</b>	Characteristics that may be used by scientists to build a phylogenetic tree	<b>A</b> <b>B</b>	Similarity of DNA sequencing Fossil evidence
<b>1.3.5</b>	Foramen magnum is towards the back of the skull	<b>A</b> <b>B</b>	Human Chimpanzee
<b>1.3.6</b>	Two alleles of a gene that are equally dominant	<b>A</b> <b>B</b>	Co-dominance Complete dominance
<b>1.3.7</b>	A sudden change in the sequence of nitrogen bases in DNA	<b>A</b> <b>B</b>	Translation Transcription
<b>1.3.8</b>	Bonds that hold amino acids together in a protein molecule	<b>A</b> <b>B</b>	Hydrogen bonds Peptide bonds

(8 × 2) [16]

- 1.4** In pea plants the allele for round seeds (R) is dominant over the allele for wrinkled seeds (r). The allele for yellow seeds (Y) is dominant over the allele for green seeds (y).

Plant A, heterozygous for both seed shape and seed colour, was crossed with plant B which had wrinkled, green seeds.

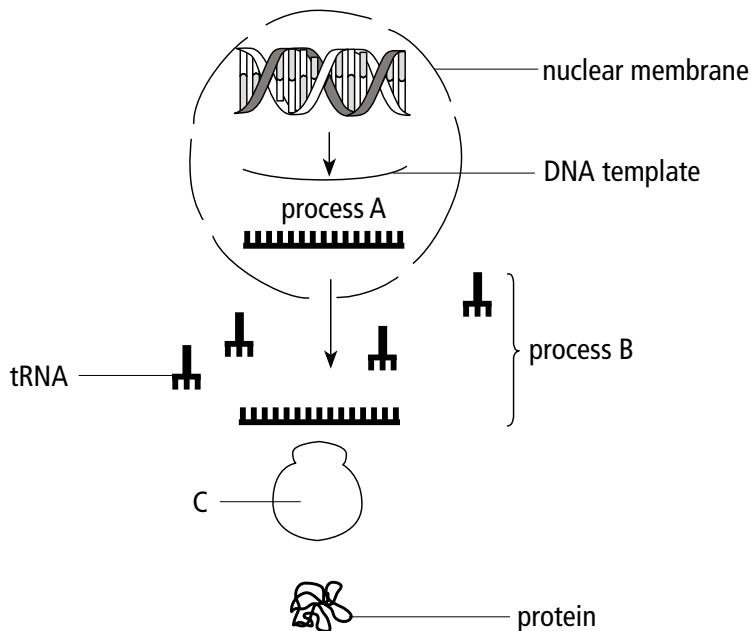
- 1.4.1** Write down the genotype of: (2)  
 a) Plant A  
 b) Plant B
- 1.4.2** Write down the genotypes of the gametes of plant A (2)
- 1.4.3** State the phenotype of an offspring having the genotype: (2)  
 a) rrYy  
 b) RrYy
- 1.4.4** When plant B was crossed with plant C, all the offspring produced had round, yellow seeds. Use this information to state the genotype of plant C. (2)

[8]

**TOTAL SECTION A: [50]**

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

2.1 The diagram below shows the process of protein synthesis.



2.1.1 Name the following processes:

- a) A (1)
- b) B (1)

2.1.2 Name the organelle labelled C. (1)

2.1.3 Explain how the mRNA is made from the DNA template during process A. (5)

2.1.4 Describe the process B of protein synthesis. (5)

2.1.5 Processes A and B above can be summarised by the table below. Write the numbers 1–3 and next to each number the nitrogenous bases that will complete the table. (3)

Base sequence on DNA	Codon on mRNA	Anticodon on tRNA	Amino acid
CAA	1	2	Valine
3	GCA	CGU	Alanine

[16]

- 2.2** Study the information about the discovery of a new species of australopithecine in South Africa.

#### DISCOVERY OF A NEW SPECIES IN SOUTH AFRICA

Professor Lee Berger a paleoanthropologist at the University of the Witwatersrand, with the help of his 9-year-old son, found two fossils in South Africa on 15 August 2008.

Berger and about 60 of his colleagues from all over the world, studied the fossilised bone fragments before they announced their findings to the public on 8 April 2010. Their findings were published in a scientific journal.

They presented it as a new species called *Australopithecus sediba*, dated to approximately 1,78 to 1,95 million years ago. It consists of many primitive features characteristic of other australopithecine species and more advanced features typical of later *Homo* species.

The almost 2-million-year-old partial skeletons are thought to possibly be that of the transitional species between *Australopithecus africanus* (such as the famous Mrs Ples) and either *Homo habilis* or *Homo erectus*, the early ancestors of humans.

Berger said that the brain, hand and foot have characteristics of both modern and early pre-human forms. It represents a model that could have led to the human genus *Homo*.

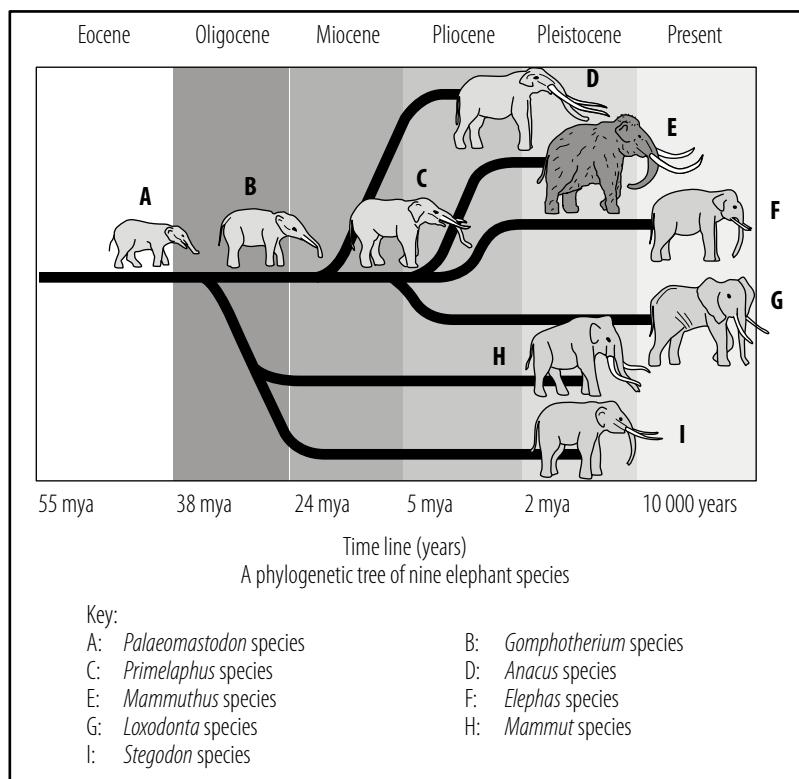
It was noted that the brain of *A. sediba* is small, like that of a chimpanzee, but with a re-organisation more human-like, particularly with an expansion behind and above the eyes.

*Adapted from <http://www.sciencemag.org>*

- 2.2.1** Explain why scientists took a long time to present their findings to the public. (3)  
**2.2.2** Explain why it was important to publish their findings in a scientific journal. (3)  
**2.2.3** Define the term ‘transitional form’. (3)  
**2.2.4** Use ONE characteristic from the passage to explain your answer to Question 2.2.3. (2)

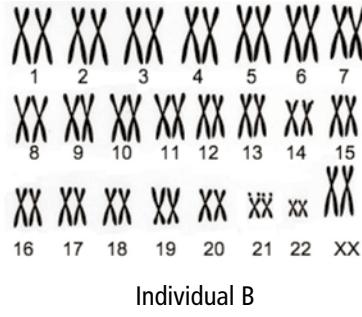
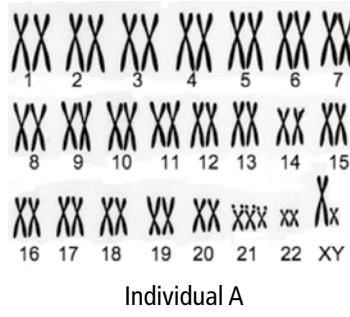
[11]

- 2.3** Study the phylogenetic tree of nine elephant species over six geologic time periods from 55 million years ago (mya) to the present and answer the questions below.



- 2.3.1** According to the phylogenetic tree above, which is the ancestral species of ALL the named species? (1)
- 2.3.2** Name the TWO species of elephants that exist today. (2)
- 2.3.3** Name the immediate ancestor of the two species mentioned in Question 2.3.2. (1)
- 2.3.4** In which period did:
- The *Anancus* species first appear (1)
  - The *Stegodon* species become extinct (1)
- [6]

- 2.4** The diagrams below show the sets of chromosomes (karyotypes) in two human individuals, A and B. Study the diagrams and answer the questions that follow.



- 2.4.1** Which individual (A or B) is female? (1)
- 2.4.2** Give a reason for your answer in Question 2.4.1 above. (1)
- 2.4.3** Identify which individual (A or B) has an abnormal number of chromosomes. (1)

- 2.2.4** Name the genetic disorder that the individual in Question **2.4.3** has. (1)
- 2.2.5** Account for the abnormal chromosome number of the disorder named in Question **2.4.4**. (3)  
[7]

**TOTAL QUESTION 2:** [40]

## QUESTION 3

- 3.1** In an investigation to establish the resistance of mosquitoes to DDT, scientists captured a sample of mosquitoes from the environment. They then applied a standard dose of DDT (4% DDT for 1 hour) in the laboratory and counted how many mosquitoes were killed. The scientists repeated this procedure every two months over a period of 16 months. The results are indicated in the table below.

Table showing percentage mortality of mosquitoes after applying DDT

Time (in months)	Mortality of mosquitoes (%)
0	95
2	87
4	80
6	69
8	60
10	54
12	35
14	27
16	22

- 3.1.1** Identify the:  
a) Independent variable (1)  
b) Dependent variable (1)
- 3.1.2** State TWO ways in which the scientists could improve the reliability of their results. (2)
- 3.1.3** Explain, in terms of natural selection, how mosquitoes may develop resistance to DDT. (8)  
[12]

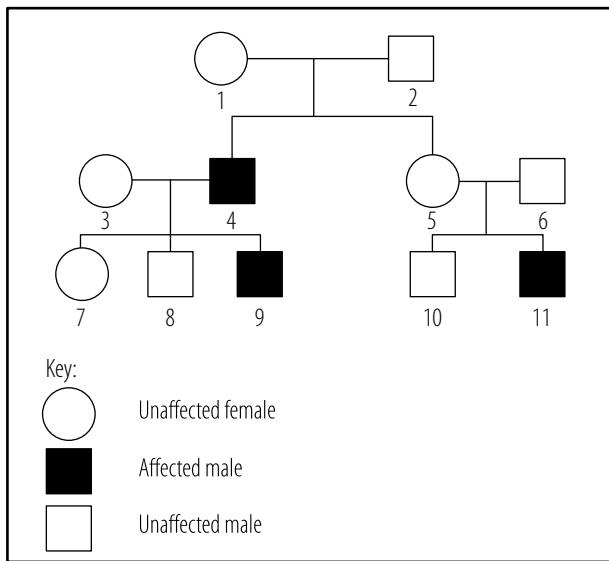
- 3.2** During their work to establish the structure of DNA, Watson and Crick were interested in the proportion of nucleotides in the DNA of skin cells from a particular organism. They considered the results from three different samples done in the same laboratory, as shown in the table below.

Percentage of each nucleotide			
Nucleotides in DNA	Sample 1	Sample 2	Sample 3
A	29	31	30
T	31	29	30
C	21	20	19
G	19	21	20

- 3.2.1** Why did Watson and Crick consider results from three samples? (1)  
**3.2.2** What is the ratio of adenine to thymine in the overall experiment? (1)  
**3.2.3** Give a reason for your answer to Question 3.2.2. (1)  
**3.2.4** Draw a pie chart illustrating the percentages of the different nucleotides in sample 1. Show ALL working. (8)

[11]

- 3.3** The pedigree diagram below traces the inheritance of haemophilia in a family.



- 3.3.1** How many family members not affected by haemophilia are carriers? (1)  
**3.3.2** Explain why this disorder affects mostly males in this family. (3)  
**3.3.3** Use the possible alleles XH, Xh and Y to determine the genotype of the following:
  - Individual 1 (2)
  - Individual 4 (2)

[8]

- 3.4** Study the table below, which indicates some of the hominid fossils found in different parts of the world.

Species	Region it was found	Period of existence
<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]

- 3.4.1** Explain why the information in the table supports the 'Out of Africa' hypothesis. (2)  
**3.4.2** Briefly describe what you understand by the 'Out of Africa' hypothesis. (4)  
**3.4.3** Explain how the analysis of mitochondrial DNA is used to support the 'Out of Africa' hypothesis. (3)

[9]

**TOTAL QUESTION 3:** [40]

**TOTAL SECTION B:** [80]

#### QUESTION 4

One of the observations Darwin made during his study of pigeons was about artificial selection. In 1859 Darwin and Wallace jointly proposed that new species could develop by a process of natural selection.

Using examples, describe natural and artificial selection and also highlight the differences between these two processes.

Content: (17)  
 Synthesis: (3)

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

**TOTAL SECTION C:** [20]

**GRAND TOTAL:** [150]