



**Western Cape
Government**

Western Cape Education Department

Directorate: Curriculum FET

LIFE SCIENCES

REVISION BOOKLET 2026 TERM 3

Grade 12

This revision program is designed to assist you in revising the critical content and skills covered during the 3rd term. The purpose is to prepare you to understand the key concepts and to provide you with an opportunity to establish the required standard and the application of the knowledge necessary to succeed in the NCS examination.

The revision program covers the following topics:

- Evolution – 54 marks in Paper 2 of Final Examination

Table of Contents

Table of Contents	2
1. Evolution	3
1.1. Sources of variation	3
1.2. Theories of evolution	3
1.3. Speciation	4
1.4. Artificial selection	5
1.5. Reproductive isolating mechanisms	5
1.6. Evolution in present times	6
1.7. Human evolution	6
1.8. Out of Africa hypothesis	7

TERM 3 CONTENT**1. EVOLUTION****1.1. Name the sources of variation in a population:**

1. **Mutations** – involves a change in the structure of a genes.
2. Variation as a result of **meiosis** is due to:
 - **Crossing over:** during prophase I there is an exchange of genetic material between homologous chromosomes
 - **Random arrangement of chromosomes** – chromosomes arrange randomly at the equator during metaphase 1 and metaphase 2.
3. **Random fertilisation of gametes** – random fertilisation of the sperm cells and ova leading to different combinations of genetic material in the offspring
4. **Random mating** of individuals in a species leads to variation within the species.

1.2. Theories of evolution:

You should know the generic account of the evolutionary theories but you should also be able to apply the generic account on any given example.

Lamarck explained evolution using the following two 'laws':

- **The inheritance of acquired characteristics:** Characteristics developed during the life of an individual (acquired characteristics) can be passed on to their offspring.
- **The law of use and disuse:** As an organism uses a structure or organ more regularly, it becomes better developed or enlarged. If an organism does not use a structure or organ frequently, it becomes less developed or reduced in size and may disappear altogether.

Reasons why Lamarck's theory was rejected:

- There is no evidence that acquired characteristics are inherited/do not cause any change to the DNA of an organism's gametes (sperms or ova)
- Organisms did not evolve because they want to evolve/Lamarck's theory is deterministic

Darwin's theory of evolution by natural selection:

- There is a great deal of **variation** amongst the offspring.
- Some have favourable characteristics and some do not.
- When there is a change in the environmental conditions or if there is competition,
- then organisms with characteristics, which make them more suited, survive
- whilst organisms with unfavourable characteristics, which make them less suited, die.
- The organisms that survive, reproduce and thus pass on the **allele** for the favourable characteristic to their offspring.
- The next generation will therefore have a higher proportion of individuals with the favourable characteristic.

Punctuated equilibrium:

- Evolution involves long periods of time where species do not change or change gradually through natural selection (known as equilibrium).
- This alternates with (is punctuated by) short periods of time where rapid changes occur through natural selection
- during which new species may form in a short period of time.

1.3. Speciation:

You should know the generic account of speciation but you should also be able to apply the generic account on any given example.

- If a **POPULATION** of a single species
- becomes separated by a geographical barrier (sea, river, mountain, lake)
- then the population splits into two.
- There is now no gene flow between the two populations.
- Since each population may be exposed to different environmental conditions/the selection pressure may be different
- natural selection occurs independently in each of the two populations
- such that the individuals of the two populations become very different from each other
- genotypically and phenotypically.
- Even if the two populations were to mix again

- they will not be able to interbreed.
- The two populations are now different species.

NOTE: It is a *POPULATION* and not a *SPECIES* that becomes separated by a geographical barrier. Refer to the definitions of a population and a species.

Explain how speciation and extinction affect biodiversity:

- **Speciation increases biodiversity** since there is an increase in the number of species
- **Extinction** results in the loss of the number of species and therefore results in a **decrease in biodiversity**

1.4. Artificial selection:

Humans select organisms with a particular **desirable characteristic** and interbreed them with other organisms that also have the same desirable characteristic to improve this characteristic further in the offspring. They may also choose organisms with different desirable characteristics to get offspring with a combination of these desirable characteristics.

Tabulate the differences between natural and artificial selection:

Natural selection	Artificial selection
The environment or nature is the selective force	Humans represent the selective force
Selection is in response to suitability to the environment	Selection is in response to satisfying human needs
Occurs within a species	May involve one or more species (as in cross-breeding)

1.5. Reproductive isolating mechanisms:

You should be able to name and describe the following **FIVE reproductive isolation mechanisms** that keep species separate.

- Breeding at different times of the year
- Species-specific courtship behaviour
- Plant adaptation to different pollinators
- Infertile offspring
- Prevention of fertilization

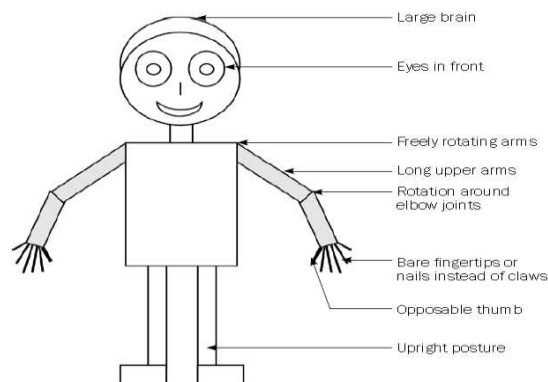
1.6. Evolution in present times:

You should be able to use ANY example and describe the role of mutations in evolution in present times.

- In a population of insects/bacteria/HI viruses/Galápagos finches
- mutations are a source of variation
- which may make some organisms more resistant
- to insecticides/antibiotics/antiretroviral medication.
- Those individuals that are not resistant will die, whereas
- those that are resistant, will survive
- to pass the resistant allele/resistance on to their offspring.
- This is known as natural selection
- As a result, individuals of the future generations will be resistant to the insecticides/ antibiotics/antiretroviral medication

1.7. Human evolution

Characteristics that humans share with African apes



Tabulate the differences between humans and African apes

Feature	Humans	African apes
Foramen magnum	Foramen magnum in a forward position	Foramen magnum in a backward position
Cranium	Larger cranium size	Smaller cranium size
Spine	More curved/S-shaped	Less curved/C-shaped
Teeth	Smaller teeth/canines	Larger teeth/canines
Jaws	Less protruding jaws/non-prognathous	More protruding jaws/prognathous (Note: NOT less prognathous)
Palate shape	Small and semi-circular	Long and rectangular
Cranial ridges	No cranial ridges	Cranial ridges across the top of the cranium
Brow ridges	Brow ridges less pronounced	Brow ridges pronounced

Study the following table:

Organism	When organism existed	Fossil site	Discovered by	Characteristics
<i>Ardipithecus ramidus</i>	5 – 4 mya	North-East Ethiopia	Tim White	Brain size: 300–350 ml Forward position of foramen magnum Very prognathous (more protruding jaws) Heavy brow ridges Pelvis structure: bipedal and tree climbing
<i>Australopithecus afarensis</i>	4 – 2,7 mya	Ethiopia, Kenya, Tanzania	Donald Johanson	Brain size: 375–550 ml Forward position of foramen magnum Very prognathous Heavy brow ridges Canines large and pointed Long arms No cranial ridge
<i>Australopithecus africanus</i>	3 – 2 mya	Taung; Sterkfontein	Raymond Dart	Brain size: 428–625 ml Forward position of foramen magnum Prognathous Brow ridges Teeth large, canines not long Long arms No cranial ridge
<i>Australopithecus sediba</i>	1,9 – 1,8 mya	Malapa Cave – in the cradle of humankind	Lee Burger	Brain size: 420 ml Less prognathous Brow ridges Large teeth, canines not long Long arms No cranial ridge
<i>Homo habilis</i>	2,2 – 1,6 mya	Tanzania	Louis and Mary Leakey	Brain size: 650 ml Less prognathous Less pronounced brow ridges Human-like teeth – smaller canines Long arms
<i>Homo erectus</i>	2 – 0,4 mya	Java in Indonesia and then Swartkrans	Eugene Dubois	Brain size: 900 ml Prognathous Cranial ridges Short canines Longer legs and shorter arms
<i>Homo sapiens</i>	200 000 years ago – present	Makapansgat in Limpopo; Border Cave in KZN; Blombos Cave in the Western Cape	Tim White	Brain size: 1200–1800 ml No brow ridges Small teeth Short arms

1.8. State the Out of Africa hypothesis:

All modern humans/*Homo sapiens* originated in Africa and migrated to other parts of the world.

Describe the evidence for the 'Out of Africa' hypothesis:

Fossil evidence:

- Fossils of *Ardipithecus* were found ONLY in Africa/Rift Valley/Ethiopia/South Africa
- Fossils of *Australopithecus* were found ONLY in Africa/Rift Valley/Ethiopia/South Africa

- The fossils of *Homo habilis* were ONLY found in Africa
- The OLDEST fossils of *Homo erectus* were found in Africa
- The OLDEST fossils of *Homo sapiens* were found in Africa

Genetic evidence:

- Mitochondrial DNA is inherited only from the maternal line.
- Analysis of mutations on this mitochondrial DNA shows that the oldest female ancestor was located in Africa and that all humans descended from her.

REVISION QUESTIONS (EVOLUTION)

- Answer the questions below.
- The **instructional verbs (in italics)** e.g. name, give, describe, explain etc. and the **mark allocation per question** give an indication of what and how much information you should provide in your answer.

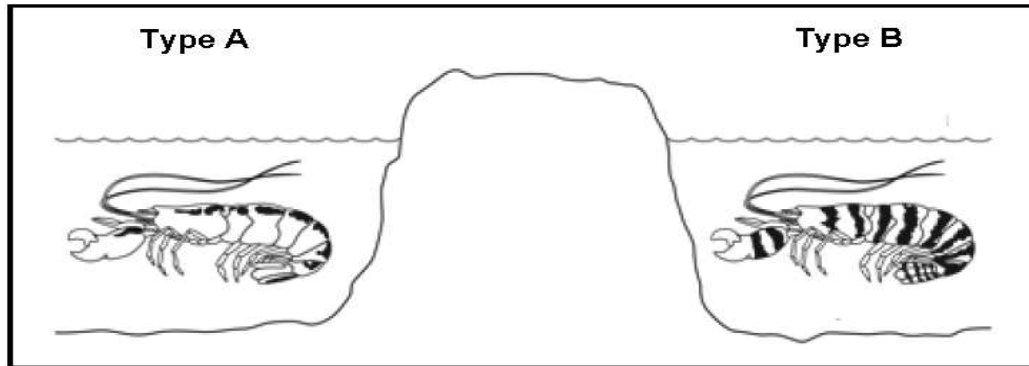
Examples of some of the instructional verbs used in test and examination questions:

Instructional verb	Meaning
<i>Name</i>	Give the name of something
<i>Differentiate</i>	Use differences to qualify between two or more categories
<i>Tabulate</i>	Draw a table and indicate the answers as direct pairs.
<i>Describe</i>	State in sentences the main points of a process
<i>Explain</i>	Give your answer in a cause-effect or statement and reason sequence
<i>Compare</i>	Give similarities and differences between concepts

- Please note that **HIGHER ORDER questions** are in **BOLD** and marked with a (*)

Topic: Evolution:

1. The diagram below represents two types of shrimp. Each type lives in shallow seas on opposite sides of a strip of land. In an investigation to determine whether the two types of shrimp were from one species, scientists placed type **A** shrimps and type **B** shrimps together in a tank of seawater. Although the shrimps mated with their own types, the two types of shrimp did not mate with each other. The scientists repeated the investigation several times and obtained the same result each time.

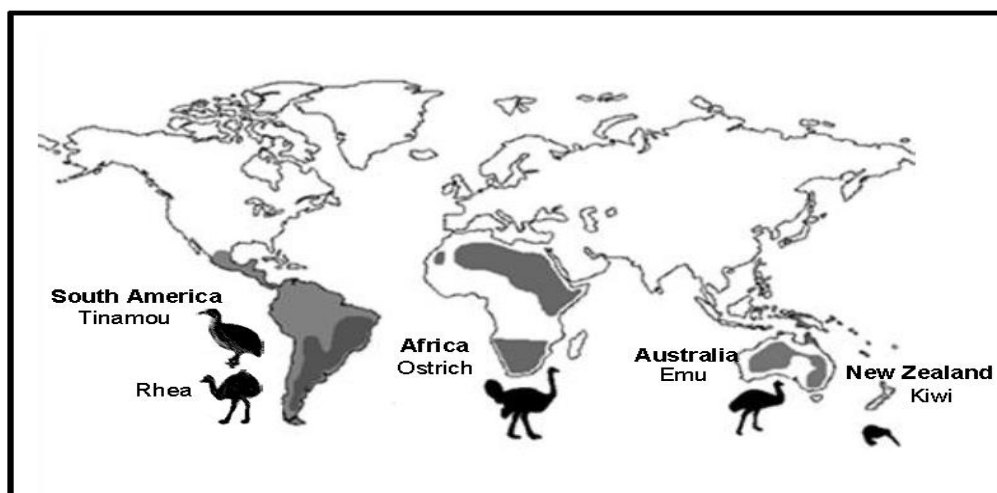


[Adapted from www.pbs.org/wgbh/evolution/library]

- (*)1.1 Give ONE conclusion the scientists came to after the investigation. (2)
 (*)1.2 Explain your answer to QUESTION 1.1. (2)
 (*)1.3 Why did the scientists repeat the investigation? (1)

2. Tabulate FOUR differences between Lamarckism and Darwinism. (9)

3. Flightless bird species that are currently distributed across different continents are shown in the picture below. Scientists hypothesise that these species of flightless birds arose from a single common ancestor that was able to fly.



(*)3.1 Describe how Lamarck would have explained the evolution of flightless birds. (4)

3.2 Name FIVE reproductive isolation mechanisms that keep species separate. (5)

4. Read the extract below.

The red-bellied black snake (*Pseudechis porphyriacus*) and the green tree snake (*Denderelaphis punctulatus*) are predators that sometimes feed on cane toads (*Bufo marinus*) that contain a toxin that may kill them.

The snakes consume the toads by swallowing them whole. A decrease in the average jaw size of the snakes has been observed over a period of 70 years. Some scientists believe that this may be an example of punctuated equilibrium. With this change it was also noted that the snakes could no longer swallow the large cane toads. This has resulted in an increase in the survival of the snakes.

4.1 Define punctuated equilibrium. (3)

4.2 What characteristic of the toad species protects it from predation? (1)

4.3 Explain how the change in jaw size helped the snakes to survive. (3)

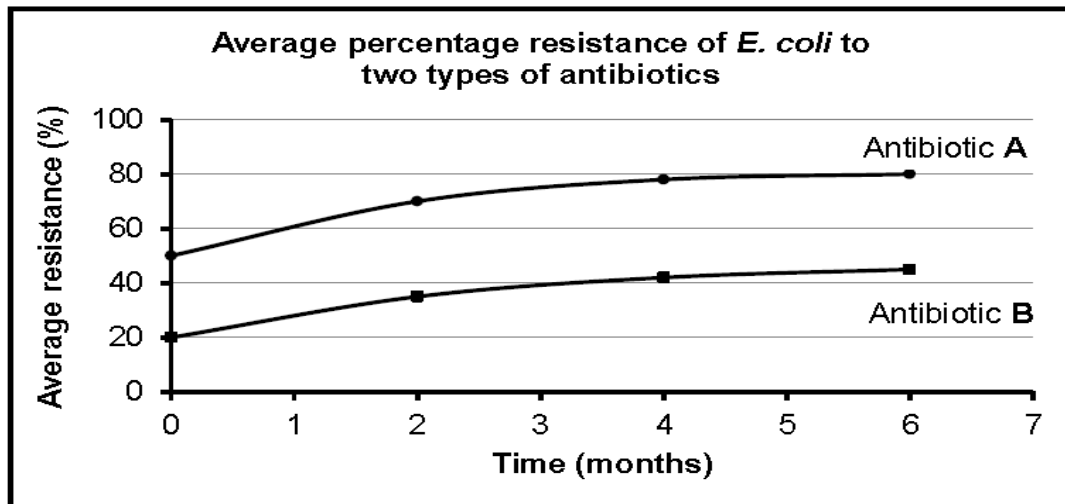
(*)4.4 How would Lamarck have explained the development of a small jaw size in the snakes? (4)

5. The *E. coli* bacterium lives in the intestines of pigs where they reproduce rapidly. Certain strains of *E. coli* cause diarrhoea in young pigs (piglets). Scientists carried out an investigation using 100 piglets to determine the resistance of *E. coli* to two antibiotics, **A** and **B**.

The scientists:

- Injected the piglets with antibiotic **A** and antibiotic **B**.
- Took a sample of *E. coli* from the intestines of each piglet a week later and placed them in separate petri dishes.
- Allowed the bacteria to grow for 24 hours.
- Added antibiotic **A** to one petri dish and antibiotic **B** to the other petri dish.
- Measured the growth of the bacteria in each petri dish after 24 hours.
- Used the growth measurement as an indication of the resistance of the bacteria to each antibiotic.
- Repeated the process over a period of six months.
- Calculated the average percentage resistance to both antibiotics.

The results are shown in the graph below.



(*)5.1 Identify the independent variable in this investigation. (1)

(*)5.2 Identify TWO factors that should be kept constant during the investigation. (2)

(*)5.3 State TWO ways in which the scientists ensured the reliability of the investigation (2)

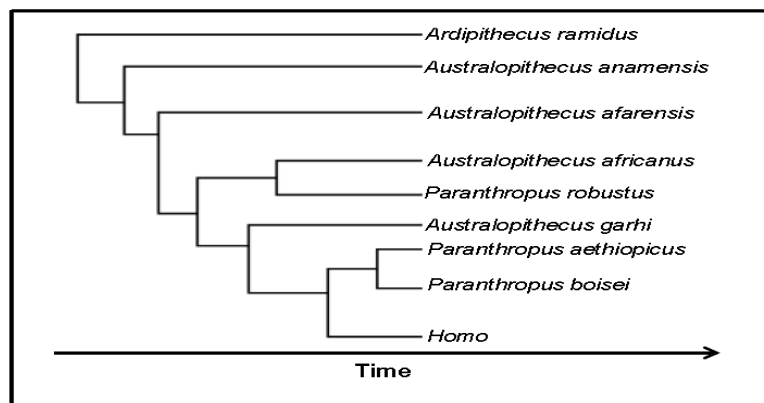
5.4 Which antibiotic will you recommend for controlling *E. coli* in piglets? (1)

5.5 Support your answer to QUESTION 5.4 using evidence in the graph. (2)

(*)5.6 Explain the results that are shown in the graph for antibiotic A in terms of natural selection. (5)

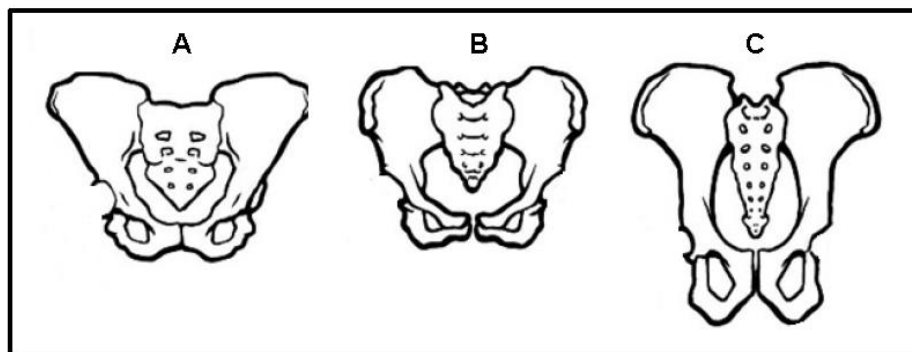
6. Describe how speciation occurs through geographic isolation (6)

7. The diagram below shows possible evolutionary relationships between hominids.



[Source: <http://tolweb.org/tree>]

- 7.1 What is this type of diagram called? (1)
- 7.2 How many genera are shown in the diagram above? (1)
- 7.3 According to this diagram, which: (1)
- (a) Genus is most recently evolved (1)
 - (b) Genus is the oldest (1)
 - (c) Hominid share a common ancestor with *Australopithecus africanus* (1)
- 7.4 Give ONE example of an *Australopithecus africanus* fossil found in South Africa. (1)
- 7.5 Name TWO *Homo* species, besides *Homo sapiens*, that were found in Africa. (2)
8. In a study to establish the mode of locomotion of some species, scientists compared the pelvic structure of their fossils. They established that two of these species had the ability to walk upright permanently. The diagrams (A, B and C) below show the pelvic structure of three species, drawn to scale.



- 8.1 What term is used to describe organisms that are able to walk upright permanently? (1)
- (*)8.2 Which TWO diagrams above represent the pelvis of the organisms in QUESTION 8.1? (2)
- (*)8.3 Explain your answer to QUESTION 8.2. (2)
- 8.4 State ONE feature of the spine of the organism represented by C. (1)
9. Tabulate THREE differences between the skulls of humans and African apes. (7)

10. The diagram shows the upper jaw, skull and pelvic girdle of a modern human and an African ape. The diagrams are NOT drawn to scale.

ORGANISM	UPPER JAW	SKULL (BOTTOM VIEW)	PELVIC GIRDLE
A			
B			

- 10.1 Which organism has a pelvic girdle for bipedalism? (1)

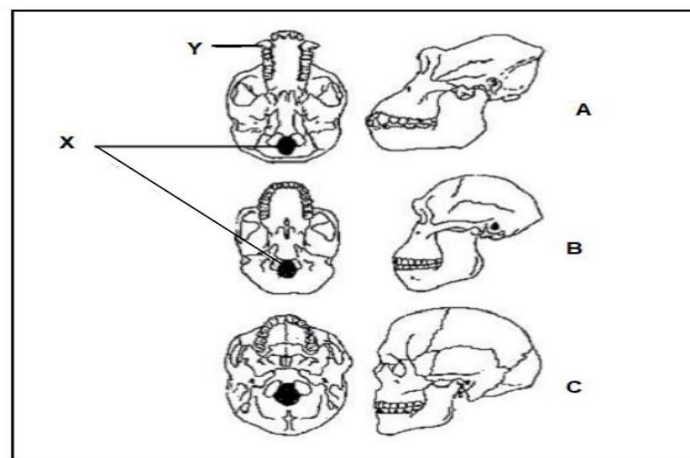
- 10.2 Explain your answer in QUESTION 10.1. (2)

- 10.3 Tabulate THREE visible differences between the upper jaws of organisms **A** and **B**. (7)

- (*)10.4 Explain the significance of bipedalism for hominids. (4)**

11. Give FOUR characteristics of the upper limbs that humans share with African apes. (4)

12. The diagram below shows the skulls of three organisms.



12.1 Identify part **X** and the type of teeth at **Y**. (2)

(*)12.2 Explain the significance of the location of structure X in organism C. (2)

12.3 Which of the skulls (**A**, **B** or **C**) belongs to:

(a) An australopithecine (1)

(b) A quadripedal primate (1)

12.4 Explain how the change in the skull from **B** to **C** could indicate a change in intelligence. (3)

(*)12.5 Describe the significance of the shape of each of the following as a trend in human evolution:

(a) Spine (2)

(b) Shape of the pelvis (2)

(*)12.6 Describe the significance of *Homo erectus* to the 'Out of Africa' hypothesis. (2)

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