



SUBJECT and GRADE	Life Sciences Grade 12	
TERM 2	Term 2 (Week 3)	
TOPIC	Evolution (speciation and Artificial selection, reproductive isolation mechanisms, evolution in present times)	
AIMS OF LESSON	At the end of this lesson you should be able to: <ul style="list-style-type: none"><li>• Define terminology such as speciation, biological species, population, artificial selection etc.</li><li>• Identify the differences and similarities between artificial selection and natural selection</li><li>• Know the reproductive isolation mechanisms</li><li>• Apply your knowledge of natural selection to examples in present times</li></ul>	
RESOURCES	<b>Paper based resources</b>	<b>Digital resources</b>
	Refer to: <ul style="list-style-type: none"><li>• Your textbook sections on speciation, artificial selection, natural selection, reproductive isolation mechanisms and evolution in present times</li><li>• Pages 70 to 71 in your Mind the Gap Study Guide</li></ul>	Click on links below to download online resources on this topic/s:  Refer to pages 17-19 in the Grade 12 Telematics learner workbook 2016: <a href="https://drive.google.com/file/d/17qzbJGZXTm7VNDzAfe59wpkj-WGN2wAc/view?usp=sharing">https://drive.google.com/file/d/17qzbJGZXTm7VNDzAfe59wpkj-WGN2wAc/view?usp=sharing</a>  Refer to PowerPoint slides on natural selection and speciation: <a href="https://drive.google.com/file/d/1BK3eBxE_jhijWWyp0j10izT3aAe_WkcS/view?usp=sharing">https://drive.google.com/file/d/1BK3eBxE_jhijWWyp0j10izT3aAe_WkcS/view?usp=sharing</a>  Watch Telematics videos on natural selection, punctuated equilibrium and speciation at: <a href="https://bit.ly/2lq6Lzl">https://bit.ly/2lq6Lzl</a>
INTRODUCTION	<ul style="list-style-type: none"><li>• You have studied Darwin's theory of evolution by natural selection in lesson 1. You also had to differentiate between a species and a population in lesson 1</li></ul>	



CONCEPTS AND SKILLS

Study the following definitions. (Note that at least 2 marks are awarded if you can define a term correctly in the examination)

**Population** - a group of organisms of the same species found in the same habitat at the same time

**Species** - a group of organisms with similar characteristics that are able to interbreed to produce fertile offspring

**Speciation** – The evolutionary process during which new species form

**Natural selection** – the mechanism of evolution where nature selects the individuals with favourable characteristics for survival

**Artificial selection** – the deliberate breeding of plants and animals by humans for desired characteristics that would not necessarily benefit the survival of the offspring.

**Extinction** - The permanent disappearance of a species from earth

**Speciation:**

Study the generic account of speciation through geographic isolation:

- If a **POPULATION** of a single species
- becomes separated by a geographical barrier (sea, river, mountain, lake)
- then the population splits into two.

Know the meaning of instructional verbs in test and examination questions e.g.

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

Answer the following questions:

**Question 1:**

The anole lizard of the Caribbean Islands represents a group of about 150 closely related species, which evolved within the past 50 million years from a single species. Use this example to *describe* how natural selection led to the process of speciation that gave rise to the 150 different species of lizards.

**Question 2:**

Three populations of butterflies, **A**, **B** and **C** live separately on three oceanic islands. The butterflies on Island 2 and Island 3 originated from Island 1. The islands experience strong prevailing winds from the north-west throughout the year. Populations **A** and **B** can interbreed and produce fertile offspring. Population **B** can mate with Population **C**, but the



- 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.

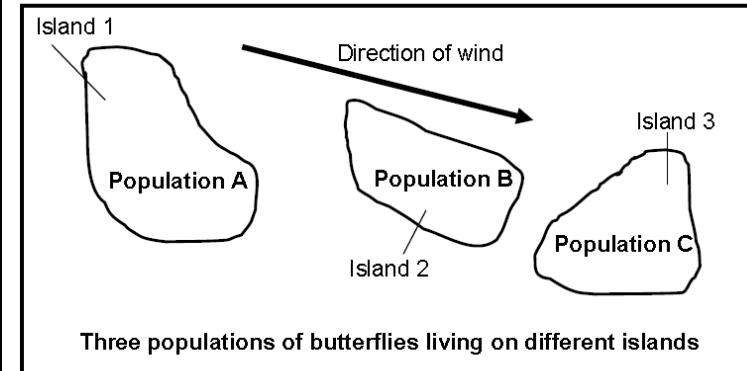
**NOTE: It is a POPULATION and not a SPECIES that becomes separated by a geographical barrier. Refer to the definition of a population and a species.**

**You should now be able to APPLY the generic account of speciation on any given examples in a test or examination.**

**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**

offspring are infertile. Mating does not occur between Populations **A** and **C** at all.



[Adapted from *Advanced Biology*, M Kent, 2000]

2.1 How many species are represented by the three populations?

2.2 *Explain* your answer to QUESTION 2.1.

2.3 Use the information provided to *explain* how speciation might have taken place in the above example.

### Question 3:

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.



**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.

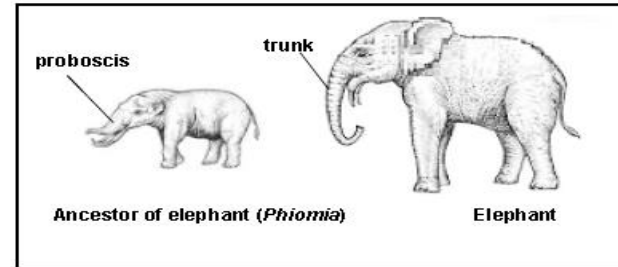
**Differences between artificial selection and natural selection:**

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)

**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



Explain the way in which an increase in the length of the trunk of the elephant could be achieved through **artificial selection**.

**Question 4:**

Read the extract below.

Long before the development of agricultural crops, South African villagers would pick the sweetest and largest fruits of the marula tree and scatter them around their camps. The seeds of these fruit would germinate and grow into fruit-bearing trees. The best fruit would then be chosen from these trees and the process would be repeated.

In recent times, farmers use a process called marcotting. This involves peeling away the bark in one area around a branch. This area is stimulated to form roots. The branch is then removed from the tree and planted in the soil to produce more marula trees.

- 4.1 Name the characteristics that the villagers were selecting.
- 4.2 Explain how this practice is an example of artificial selection.
- 4.3 Give ONE environmental factor that could affect the characteristics named in QUESTION 4.1.
- 4.4 Explain ONE disadvantage of a plantation of marula trees grown through marcotting compared to a population of marula trees that have reproduced naturally.



- Adaptation to different pollinators
- Infertile offspring
- Prevention of fertilisation

**Evolution in present times:**

Use ONE 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

**Question 5:**

Study the table below that shows the change in antibiotic resistance in three strains of bacteria (MRSA, VRE and FQRP) over a period of 20 years.

YEAR	ANTIBIOTIC RESISTANCE (%)		
	MRSA	VRE	FQRP
1981	2	0	0
1985	10	0	0
1989	15	2	0
1993	40	5	5
1997	40	20	10
2001	60	20	25

[Source: <http://wallace.genetics.uga.edu/groups/evol>]

- 5.1 Which bacterial strain was the:
- (a) Most resistant to antibiotics over the years
  - (b) Last to develop antibiotic resistance
- 5.2 Calculate the percentage increase in antibiotic resistance in VRE from 1993 to 1997.
- 5.3 Draw a line graph to show the development of antibiotic resistance in the bacterial strain MRSA.



	<p><b>Common errors made by learners in examinations:</b></p> <ul style="list-style-type: none"><li>• Learners incorrectly indicate that a species instead of a population separates by a geographical barrier when they give a generic account of speciation.</li><li>• Learners cannot differentiate between a species and a population.</li><li>• Learners do not know the differences between artificial selection and natural selection.</li><li>• Learners cannot apply their knowledge of speciation and artificial selection on different examples and in different contexts.</li></ul>	
ACTIVITIES/ASSESSMENT	Complete the activities/questions on the sections of speciation and artificial selection in your textbook. Alternatively work through the questions and activities on page 71 of your Mind the Gap Study Guide	
CONSOLIDATION	<ul style="list-style-type: none"><li>• Define all the terminology relevant to the topic/s covered in this lesson</li><li>• Write a general explanation of speciation</li><li>• Apply your general knowledge of speciation on any other examples/scenarios</li></ul> <p><b>Note:</b> The knowledge and skills gained in this section will help you to have a better understanding of the following sections of evolution that you still need to deal with i.e.</p> <ul style="list-style-type: none"><li>• Human evolution</li></ul> <p><b>Expanded activity:</b> Conduct research on the following real life-scenarios linked to the topic of natural selection:</p> <ul style="list-style-type: none"><li>• HIV resistance to antiretroviral medication</li><li>• Resistance of TB bacteria to antibiotics</li><li>• Resistance of insects to insecticides</li></ul>	
VALUES	I hope that you have noticed that scientific knowledge and understanding has been developed over time by people who were curious and who persevered with their quest for knowledge. Scientific knowledge is dynamic and can change over time.	