

GRADE 12 LIFE SCIENCES 2023

Assignment Term 3: Evolution by natural selection

TOTAL: 50

TIME: 60 minutes

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This is a formal SBA task and needs to be done under supervised conditions in the classroom.
2. Each learner completes this task on his/her own (under test conditions).
3. Present your answers per the instructions of each question.
4. Draw all diagrams in pencil and labels in blue ink.
5. The diagrams in this task may NOT be drawn to scale.

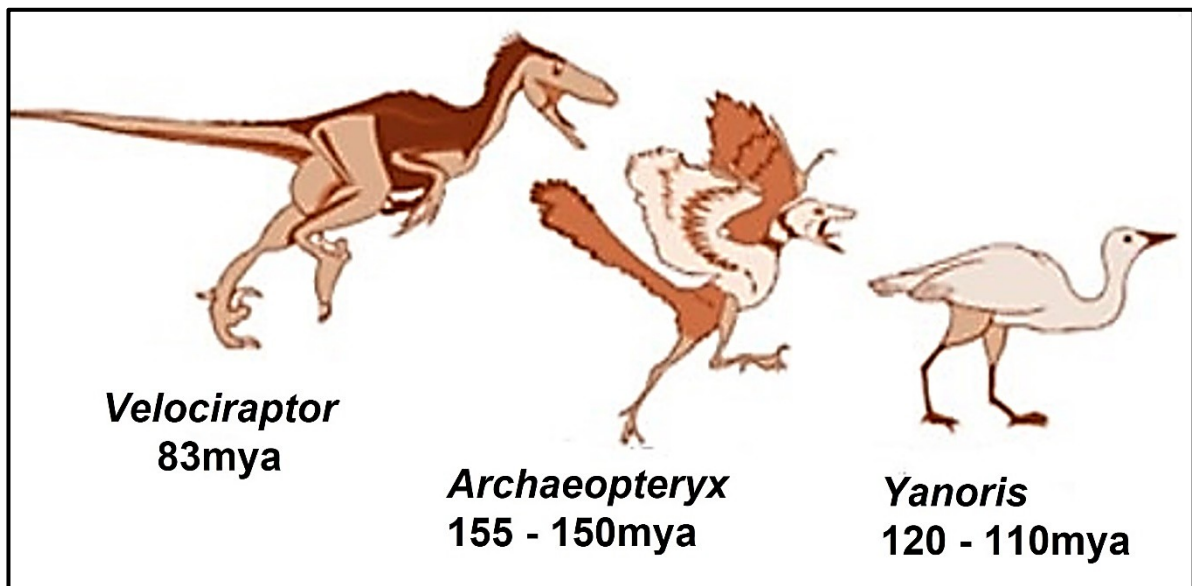
BACKGROUND INFORMATION

The theory of evolution has been developed over many years by many different scientists and is regarded as a scientific theory. The word evolution simply means change over time.

QUESTION 1

The diagram below shows three species. *Archaeopteryx* is a transitional fossil between a dinosaur and a bird.

Archaeopteryx had teeth and a long bony tail, just like other dinosaurs in the theropod family, including *Tyrannosaurus rex* and *Allosaurus*. But it had characteristics of modern birds, too, like feathers and a wishbone, or furcula, which aids modern birds' flight. It also had wings - but with claws on them.



1.1 Give ONE reason why *Archaeopteryx* is considered to be a transitional species. (2)

1.2 Give ONE characteristic *Archaeopteryx* shared with:

(a) Dinosaurs. (1)

(b) Birds. (1)

(4)

QUESTION 2

Read the extract and the information below.

There are high levels of oestrogen in both drinking water and in natural water supplies.

Sources of oestrogen polluting water supplies comes from certain types of plastics, crop fertilizers and livestock that are given synthetic and natural oestrogen to increase milk production.

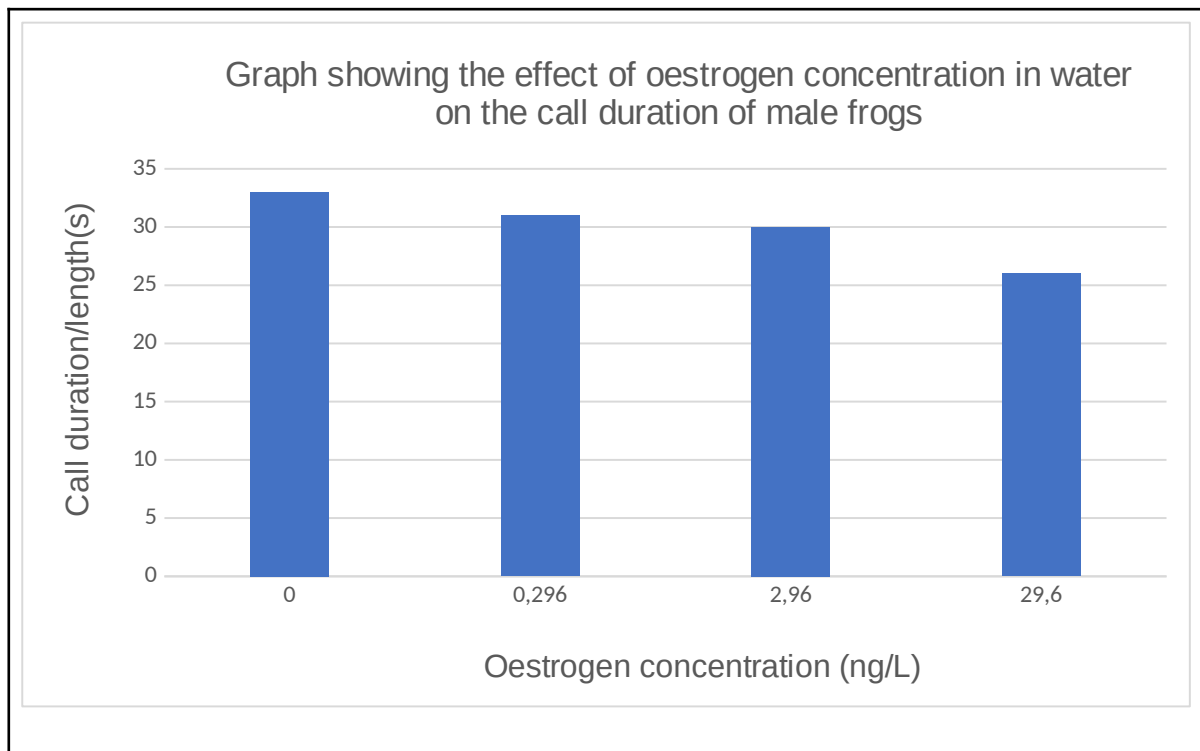
Scientists are concerned that the high level of oestrogen can disrupt the reproductive behaviour of aquatic organisms.

A study was done to investigate the effect of oestrogen on the mating behaviour of adult male frogs belonging to the species, *Xenopus laevis*. The males of this species attract

females by producing clicking sounds.

- Five-year-old male frogs were kept in groups of 25 males inside 60 litre tanks.
- Frogs were exposed for 96 hours to different concentrations of oestrogen.
- The nocturnal calling (clicking sounds) of the frogs was then recorded over 4 nights.

The results are shown in the graph below:



- 2.1 From the text state TWO sources of oestrogen found in water. (2)
- 2.2 When were the clicking sounds of the male frogs recorded? (1)
- 2.3 What is the purpose of the clicking sounds produced by the male frogs? (1)
- 2.4 State the relationship between the concentration of oestrogen in the water and the duration of length of the call of male frogs. (2)
- 2.5 Suggest how the link between length of call and oestrogen concentration could affect frog reproductive behaviour. (2)

(8)

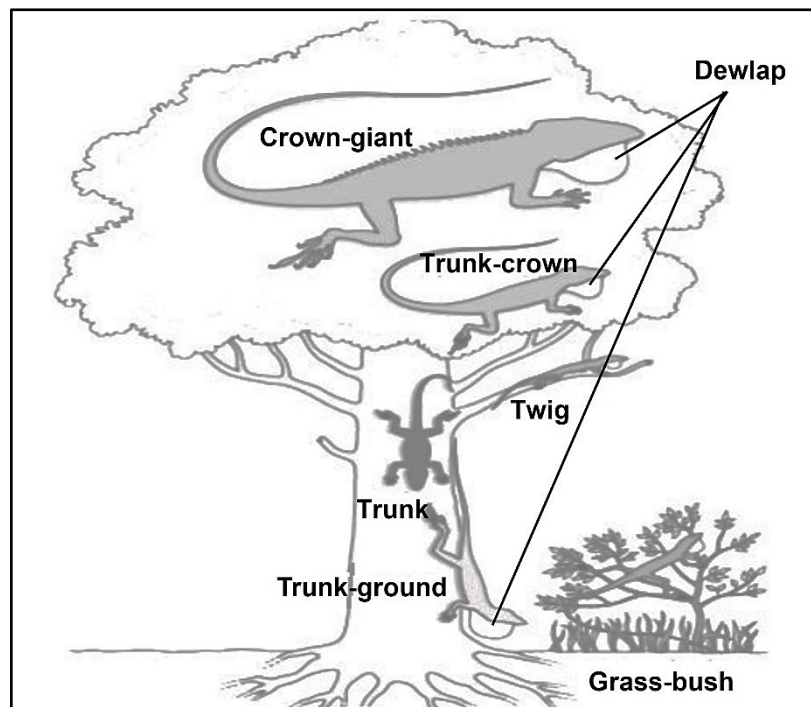
QUESTION 3

Read the following information on natural selection in lizards.

Researchers have studied closely related groups of lizards called anoles (genus *Anolis*) that live and have evolved to occupy different niches in the Caribbean islands. The species of the anoles can be categorized into six groups according to their body characteristics (morphology) and the ecological niches they occupy. The groups are referred to as ecomorphs.

Anoles have a notable feature lacking in most lizards, the dewlaps. The dewlap is a piece of loose extendable skin on the throat that they use to communicate with each other. The male anoles display their dewlaps to attract females to reproduce.

The figure below shows the six ecomorphs of anole lizards found in the Caribbean islands in their habitats.

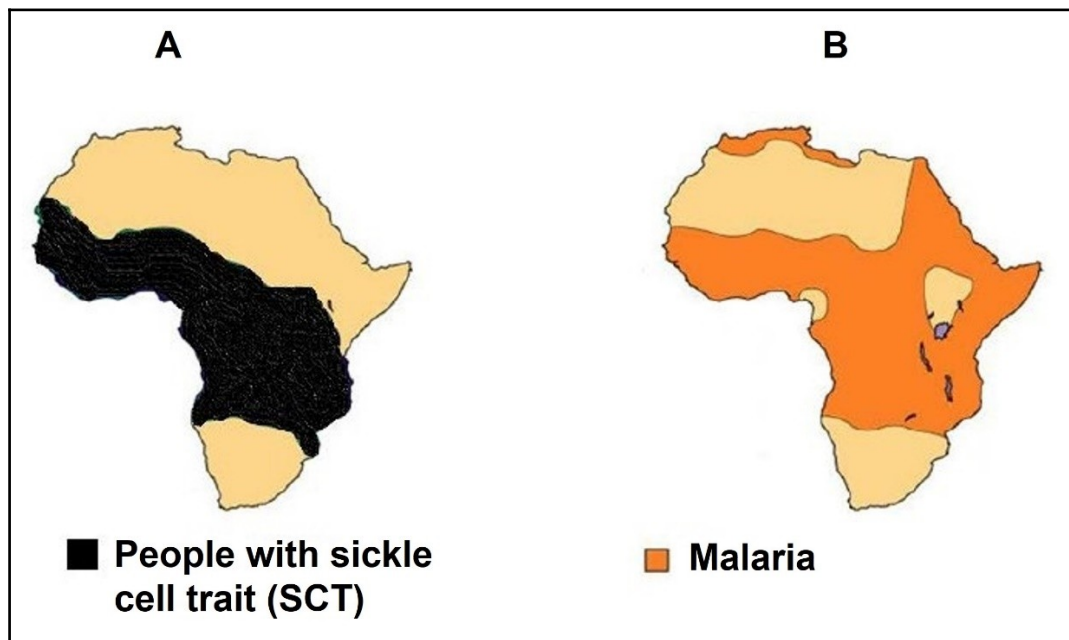


- 3.1 Define the term *species*. (1)
 - 3.2 Describe how new species may have formed on the different islands from the ancestral anoles. (6)
 - 3.3 Use Lamarck's laws to explain why the male anoles have a large dewlap. (4)
 - 3.4 Mention TWO reproductive isolating mechanisms that would prevent interbreeding between the species of anoles. (2)
- (13)**

QUESTION 4

Sickle cell trait (SCT) is caused by a mutation of the gene for haemoglobin. A person with SCT means that the person inherited the sickle cell allele from one of his or her parents. They also inherited one allele for normal haemoglobin and as a result usually do not have any symptoms of sickle cell disease and live a normal life. People with SCT are resistant to malaria infection. Malaria is a life-threatening disease that is caused by a parasite that infects red blood cells.

The maps below show areas in Africa that have people with sickle cell trait (**A**) and a high incidence of malaria (**B**).



Using the theory of natural selection explain how people with sickle cell trait became more prevalent in the areas in Africa where there is a high incidence of malaria.

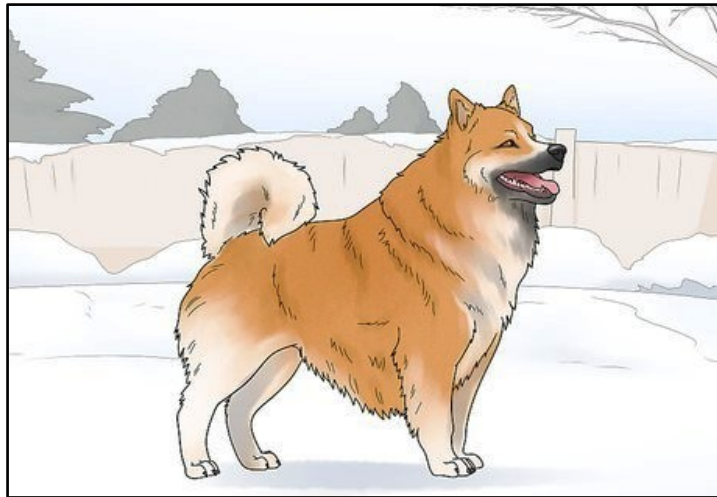
(5)

QUESTION 5

Different dog breeds have been bred by humans by artificial selection, e.g. the Icelandic Sheepdog which is a very rare dog breed. They are used to herd and guard sheep, horses and cattle. They are hard-working, highly alert, intelligent, hardy and agile (able to move quickly and easily) dogs. They are small-to-mid-sized and make loyal, loving family pets. In 1955, the Icelandic Sheepdog breed was founded with a very small number of dogs, 36 in total.

After 1990, the population grew rapidly and numbered 2 500 by 2010.

A small, closed population like this suffers from inbreeding.



5.1 Define the term *artificial selection*. (1)

5.2 Give:

(a) ONE characteristic that makes these dogs suitable for their purpose as work dogs. (1)

(b) ONE characteristic that makes them suitable to have as family pets. (1)

5.3 Why can inbreeding be seen as a threat to the Icelandic Sheepdog breed? (2)

5.4 State TWO similarities between the selective breeding process and the genetic engineering process. (2)

(7)

QUESTION 6

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

6.1 Identify the:

(a) Independent variable (1)

(b) Dependent variable (1)

6.2 Describe how the researchers ensured the reliability of the investigation. (1)

6.3 Which bacterial strain was the:

(a) Least resistant to antibiotics over the years. (1)

(b) Last to develop antibiotic resistance. (1)

6.4 What percentage did the MRSA contribute to the total antibiotic resistance in 2001?
Show ALL your calculations. (2)

6.5 Draw a line graph to show the development of antibiotic resistance in the MRSA bacterial strain. (6)
(13)

[50]