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TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2023

LIFE SCIENCES: PAPER I

EXAMINATION NUMBER

Time: 3 hours

200 marks

ANSWER BOOKLET

Please write your examination number in the blocks above.

QUESTION 1

1.1 Select the term in Column B that best matches a description in Column A. Write the letter of the term in the space between the brackets. Each letter may be used only once.

	COLUMN A		COLUMN B
[ ]	The selective killing of wild animals when their numbers exceed the carrying capacity of the habitat	A	Niche
[ ]	A measurement of the human demands on the world's ecosystems	B	Caste
[ ]	The specific role of each species in a community	C	Limiting factor
[ ]	An environmental pressure that prevents a population from having consistent and excessive growth	D	Poaching
[ ]	The birth rate of a population	E	Stable
[ ]	A population where the numbers fluctuate around the carrying capacity	F	Mortality
[ ]	A set of individuals in a colony that are specialised to perform a certain function	G	Culling
[ ]	The death rate of a population	H	Natality
[ ]	The interaction between two species where one organism hunts, kills and eats the other organism	I	Predation
		J	Ecological footprint

(9)

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1.2 Six multiple-choice questions follow. Choose the most correct option for each question and write the letter of your choice in the space provided in the table below.

Question	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6
Answer						

1.2.1 Which evolutionary process resulted in the development of many finch species on the Galápagos Islands from one original ancestral species?

A Asexual reproduction
B Selective breeding
C Ecological succession
D Natural selection (1)

1.2.2 Which statement best describes punctuated equilibrium?

A It is a mechanism that causes evolution and leads to the extinction of some species.
B It is the rapid appearance of new species between long periods of no change.
C It is when the rate of change in a population to form new species is slow and constant.
D It is the formation of new species due to geographic isolation caused by a land barrier.

(1)

1.2.3 Which hominid species has the smallest average brain size?

A *Australopithecus afarensis*
B *Australopithecus africanus*
C *Homo habilis*
D *Homo sapiens* (1)

1.2.4 Study the options listed below and determine which ONE of the following combinations of statements (A, B, C or D) represents the **founder effect**?

(i) Parental population consists of a small number of individuals.
(ii) Migration can frequently be a contributing factor.
(iii) Genetic variation increases.
(iv) Inbreeding can occur.
(v) Rare disorders can increase in frequency.

A (i), (ii), (iii) and (iv)
B (i), (ii), (iv) and (v)
C (i), (ii), (iii) and (v)
D (i), (iii), (iv) and (v)

(2)

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Question 1.2.5 and 1.2.6 refer to the information and image below (Figure 1.1).

Figure 1.1 shows a drawing of a trail of fossil footprints left by early bipedal organisms that was discovered by scientists in soft volcanic ash in East Africa.

Figure 1.1: Fossil footprints

[Source: <www.indiana.edu>]

1.2.5 Which statement below is an accurate observation that the scientists can make based on the appearance of the trail of footprints?

A The two individuals were running from predators.
B The two sets of footprints were made at different times.
C Two individuals with different-sized feet walked together.
D The footprints show a male and female walking together. (2)

1.2.6 Which statement is most accurate regarding the type of information that these footprints can provide to the scientists?

A It shows how these individuals co-operated to form hunting groups.
B It is a record of some structural similarities and differences they share with present-day species.
C It provides evidence about how these individuals changed during their lifetime.
D It offers data about the availability and type of food to which these individuals had access. (2)

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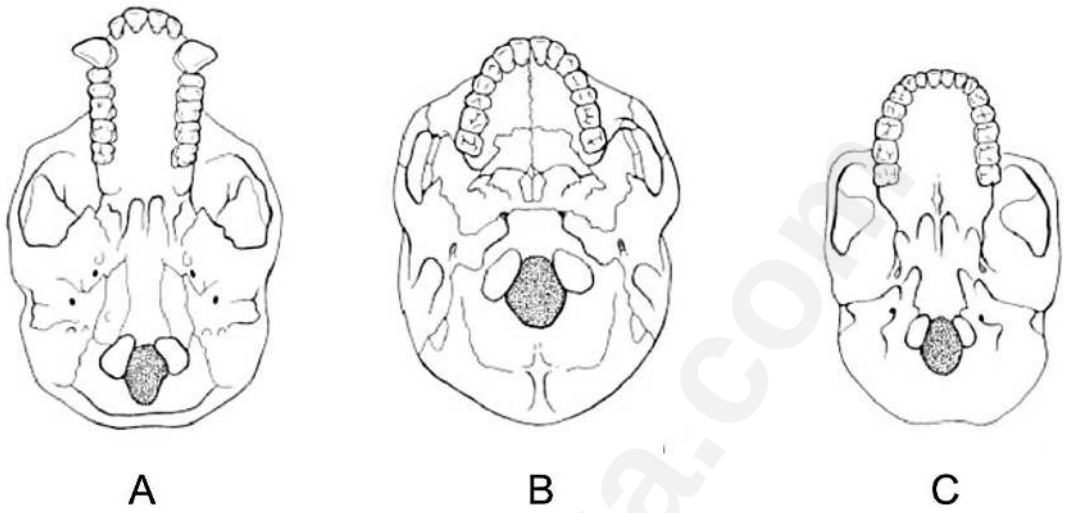
1.3 Study Figure 1.2 below that shows the skulls of three primates viewed from below.

Figure 1.2: Skulls of three primates



[Adapted: <http://www.talkorigins.org>]

1.3.1 Write the letter from Figure 1.2 that best matches the species listed in the table below.

Species	Letter
Homo sapiens	
Australopithecus africanus	
Gorilla gorilla	

(3)

1.3.2 On Figure 1.2, label the foramen magnum on any skull (A, B or C). (1)

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1.3.3 Explain how the position of the foramen magnum in the skull allows for bipedalism in a hominid.

_____

_____

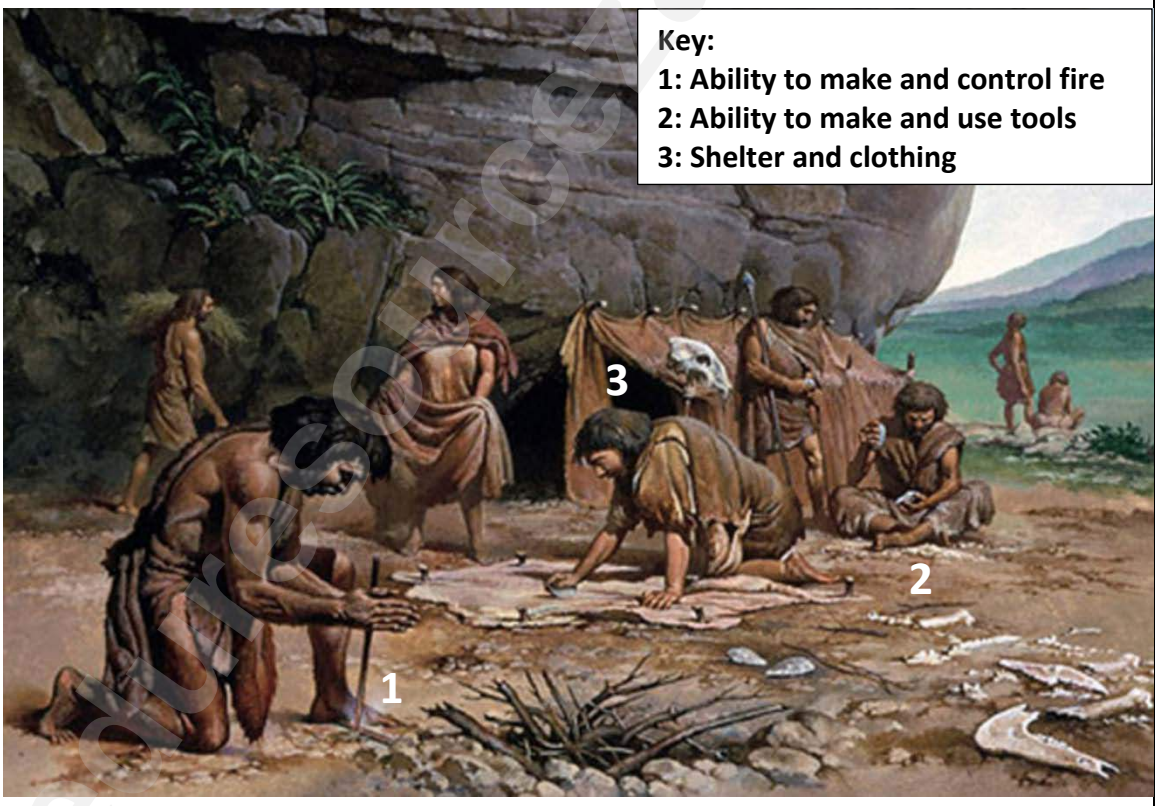
_____

_____

(3)

1.4 The image below shows aspects of early human cultural developments.

Figure 1.3: Cultural developments in early human culture



[Adapted: <https://greennews.ie>]

1.4.1 Explain what you understand by the term 'cultural evolution' related to the hominids you have studied.

_____

_____

_____

(2)

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1.4.2 Consider how each of the cultural developments listed below contributed to the ability of early humans to survive in their environment:

(a) The use of fire (explain two facts).

(4)

(b) Tool making (explain one fact).

(2)

1.4.3 Name ONE type of material that early humans would have used to make tools.

(1)

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1.5 Study the following table that consists of two items (numbered 1 and 2) in the first column and a term in the second column. **Decide which item(s) relate to the term in the same row.**

Write down your choice in the space provided in the **ANSWER** column, making use of the following codes:

A Only item 1 relates to the term.
B Only item 2 relates to the term.
C Both items 1 and 2 relate to the term.
D Neither item 1 nor item 2 relates to the term.

Item	Term	Answer
1. Decrease in genetic variation 2. Share a common ancestor	Divergent evolution	
1. Hybrid produced from a cross between a domestic cat and a wild cat 2. Mating of closely related individuals	Outbreeding	
1. Populations separated by a geographical barrier 2. Gene flow exists between populations	Sympatric speciation	
1. Location of *Australopithecus africanus* fossils 2. World heritage site in South Africa	Cradle of Humankind	

(4)

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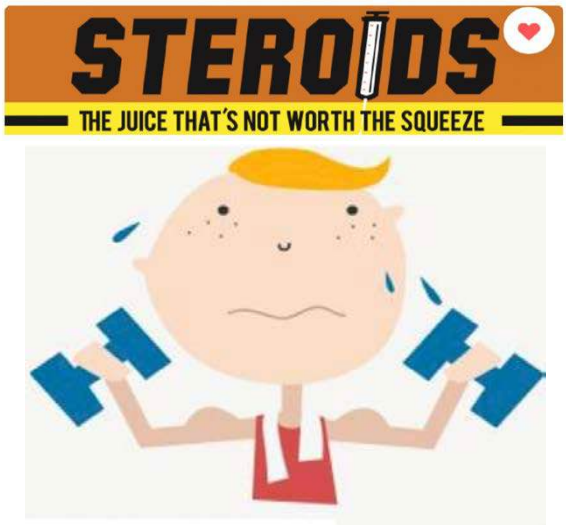
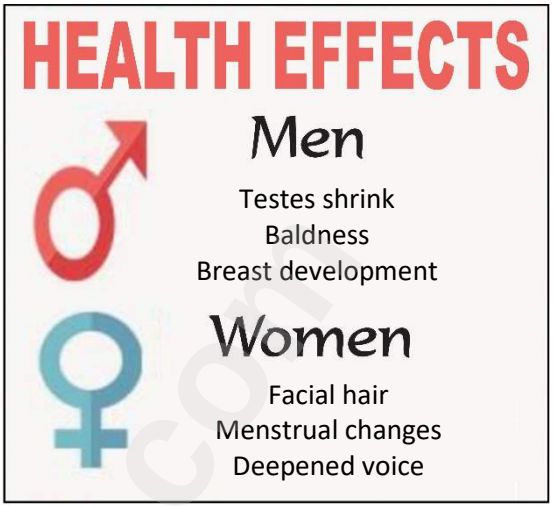
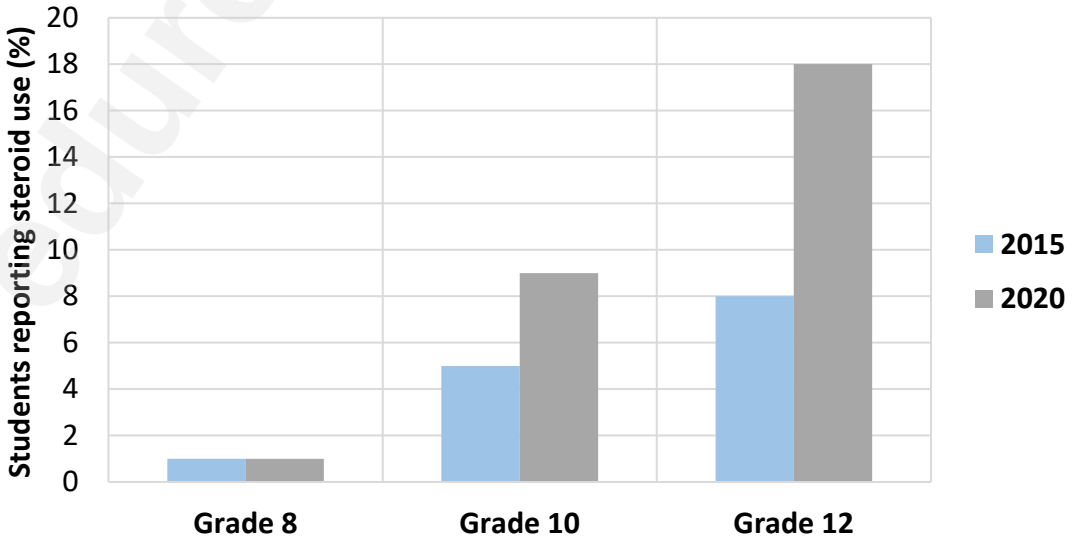
1.6 Study the infographic below and use it to answer the questions that follow.





- Most anabolic steroids are synthetic substances – they are made in a laboratory and mimic hormones.
- They are taken orally or are injected.
- Some people, especially athletes, abuse anabolic steroids to build muscle and enhance their performance.
- Anabolic steroids have been shown to increase muscle mass and strength gains.
- Studies have also shown that just believing that you are on steroids already increases strength gains (i.e. the placebo effect).

Graph showing the number of high school students reporting use of steroids in 2015 and 2020



[Adapted from: <www.nutritiontactics.com>; <https://archives.drugabuse.gov> and <www.asapofanderson.org>]

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1.6.1 The six statements in the table below relate to the information on steroid use on page viii.

For each statement decide whether:

A the statement is supported by the information,
B the statement is contradicted by the information, or
C the statement is neither supported nor contradicted by the information.

	Statement	**A, B or C**
(a)	The use of steroids affects secondary sexual characteristics in men and women.	
(b)	Females are more likely to take steroids than males.	
(c)	There is a decrease in the number of Grade 8 students reporting steroid use since 2015.	
(d)	Steroids are only available as an injectable substance.	
(e)	Steroids are more affordable in 2020 than in 2015.	
(f)	There was a 10% increase in steroid use in Grade 12 students between 2015 and 2020.	

(6)

1.6.2 Suggest two ways in which schools can help reduce steroid use in teenagers.

_____

_____

_____

_____

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_____

(2)

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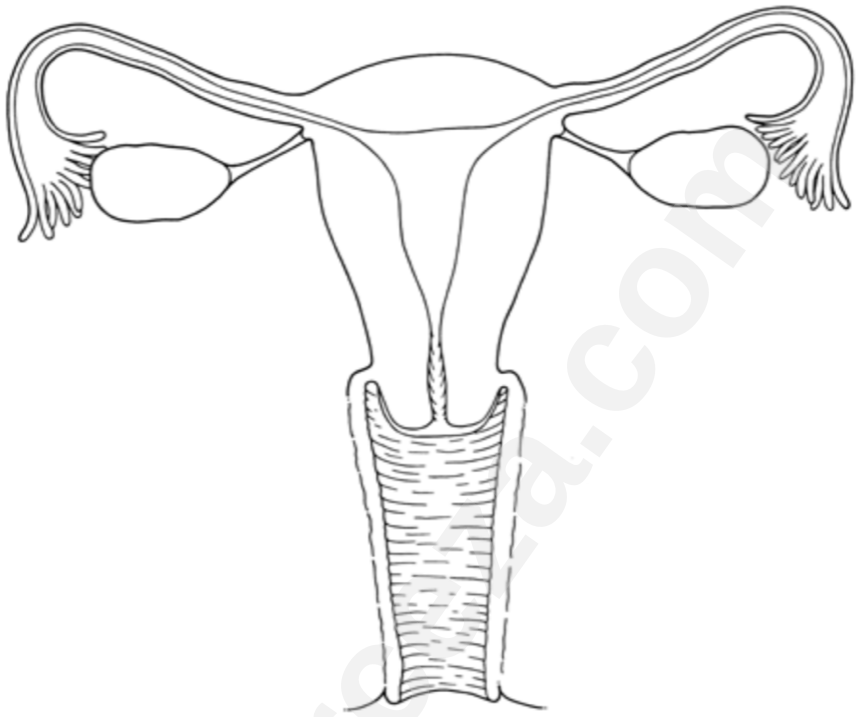
1.7 The diagram below shows the female reproductive system.

Figure 1.4: Female reproductive system



[Source: <s2.thingpic.com>]

1.7.1 On the diagram above, label the following: vagina, cervix and ovary. (3)

1.7.2 An ectopic pregnancy occurs when a fertilised ovum implants in the fallopian tube instead of in the endometrium in the uterus.

(a) Place a letter '**X**' on the diagram above to indicate where an ectopic pregnancy could occur. (1)

(b) Suggest why an ectopic pregnancy will not be successful (last full term)?

_____

_____

_____

_____

_____

(2)

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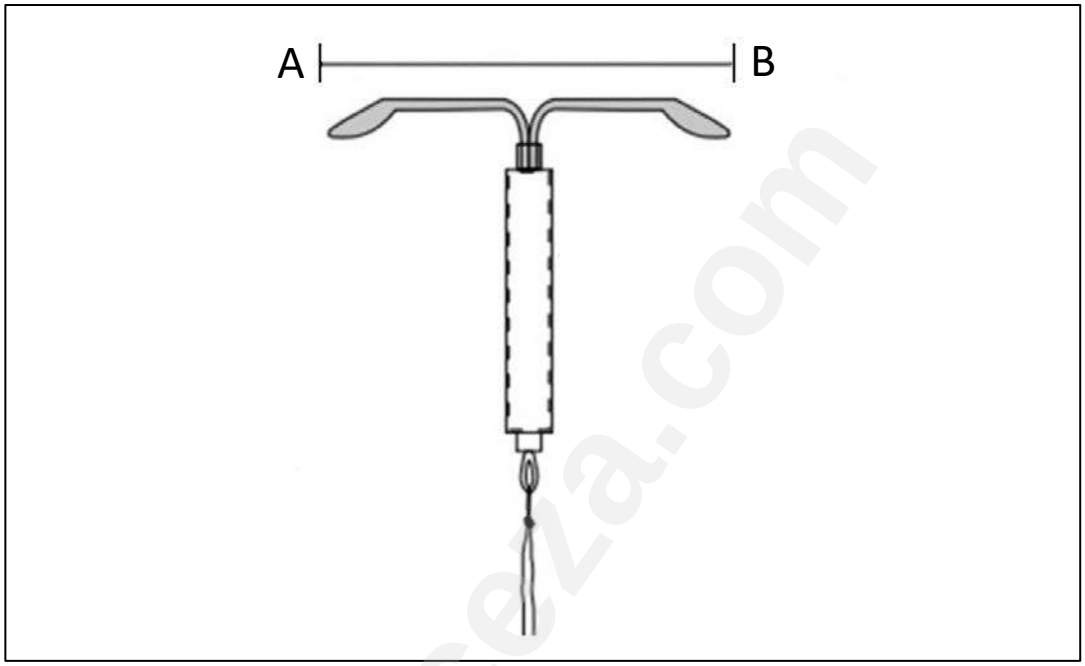
1.7.3 The image below shows a type of contraception known as an intra-uterine device (IUD).

The actual length of an IUD is 32 mm.



[Adapted: <https://www.researchgate.net>]

(a) On Figure 1.4 of the female reproductive system (on the opposite page), draw an IUD to show where a doctor would place it in the female reproductive system. (1)

(b) Calculate the magnification of the IUD shown above. Use the scale line A – B in the image.

Show all working. Round off the answer to one decimal place.

Answer: _____ (3)

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1.8 Read the information below on an investigation into blood glucose levels.

A healthy female was given a meal and her blood glucose levels were measured for three hours. Table 1.1 shows the blood glucose results for the female over the three-hour period after eating the meal.

Table 1.1: Blood glucose levels over time

Time after meal ingested (hours)	Blood glucose level (mg/dℓ)
0 (meal eaten)	75
1	130
2	100
3	75

[Source: Examiners' own]

1.8.1 Name the organ that secretes the hormones required to control blood glucose levels.

_____

(1)

1.8.2 Complete the flow diagram to show how the endocrine system returns blood sugar levels to normal after eating a meal. Quote data from the table in your answer.

Blood glucose level increases after eating a meal

↓

(5)

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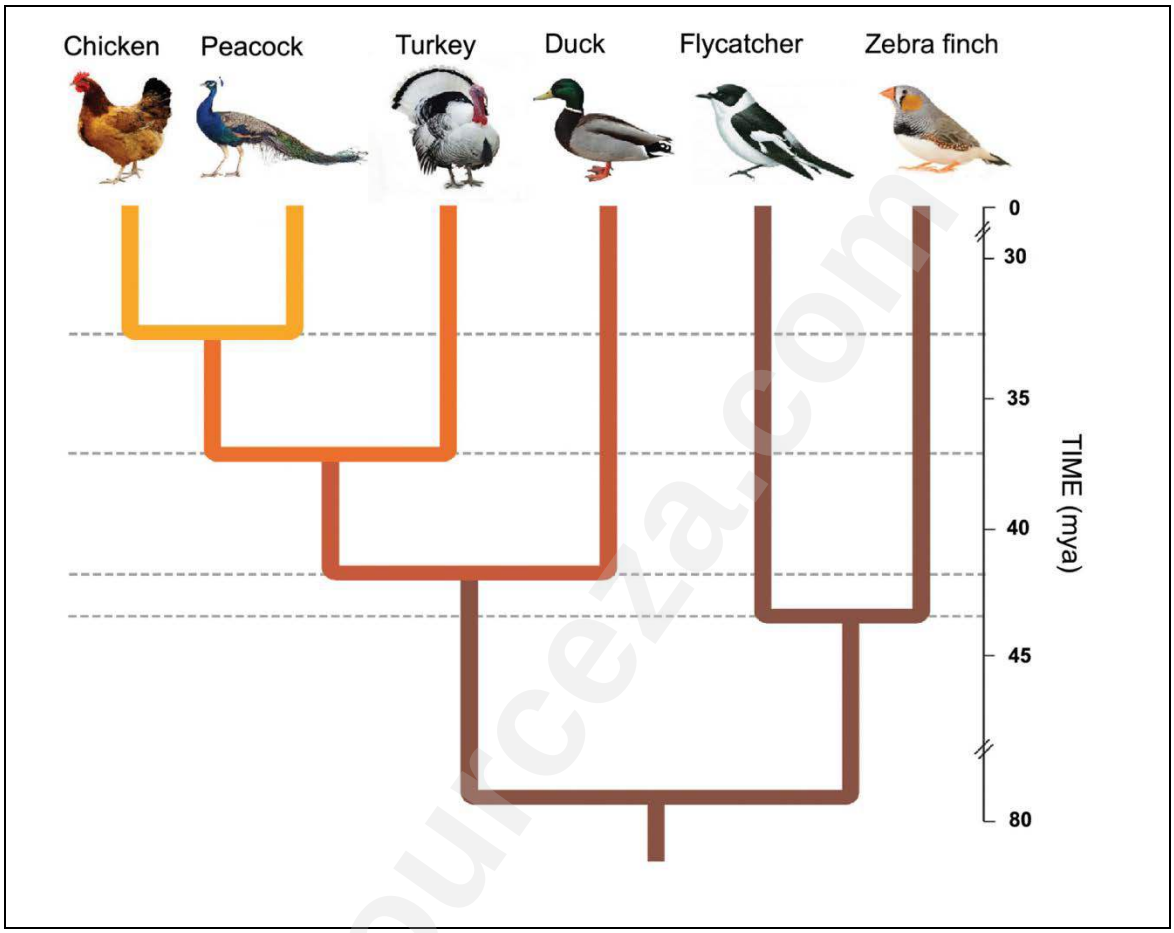
1.9 The phylogenetic tree below has been constructed by a team of biologists to show the relatedness between some common birds. Refer to it to answer the following questions.



[Adapted: <www.frontiersin.org>]

1.9.1 Name the bird that is most closely related to the flycatcher. Explain your answer.

_____

_____

(2)

1.9.2 How long ago did the turkey lineage diverge from the chicken and peacock lineages?

_____

(2)

1.9.3 The dodo is an extinct bird that lived on the island of Mauritius. The dodo shared ancestry with turkeys and peacocks.

Draw in a line and a label to show the possible position of the dodo lineage on the phylogenetic tree above.
(A diagram of the bird is not required).

(2)

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1.10 Read the information below on the southern ground hornbill and use the information and your knowledge to answer the questions that follow.

Southern ground hornbill facts:

- Large birds: one metre tall.
- Long life span: 70 years.
- Live in groups (3 – 12 individuals).
- Co-operative breeding: alpha breeding pair and male helpers in the group.
- Territorial and require large amount of space.
- Low productivity – 1 offspring is raised per group per year.

Figure 1.5: Southern ground hornbills (adult shown on right)

Breeding

- Breeding females lay eggs in a nest located in a hole in a tree about four metres above the ground.
- Habitat loss and degradation of land through farming, urbanisation and forestry have resulted in limited (very few) breeding sites.
- To address the problem of limited breeding sites, artificial nests have been introduced in various areas.
- In 2002, 31 artificial nests were introduced into areas with very few nests available. Table 1.2 shows the results of the study after 12 breeding seasons (2002 to 2014).

Table 1.2: Number of chicks that hatched after introduction of artificial nests over a 12-year period

Year	Number of chicks hatched
2002	2
2004	10
2006	22
2008	36
2010	48
2012	58
2014	70

[Adapted: <www.birdlife.org.za> and <www.researchgate.net>]

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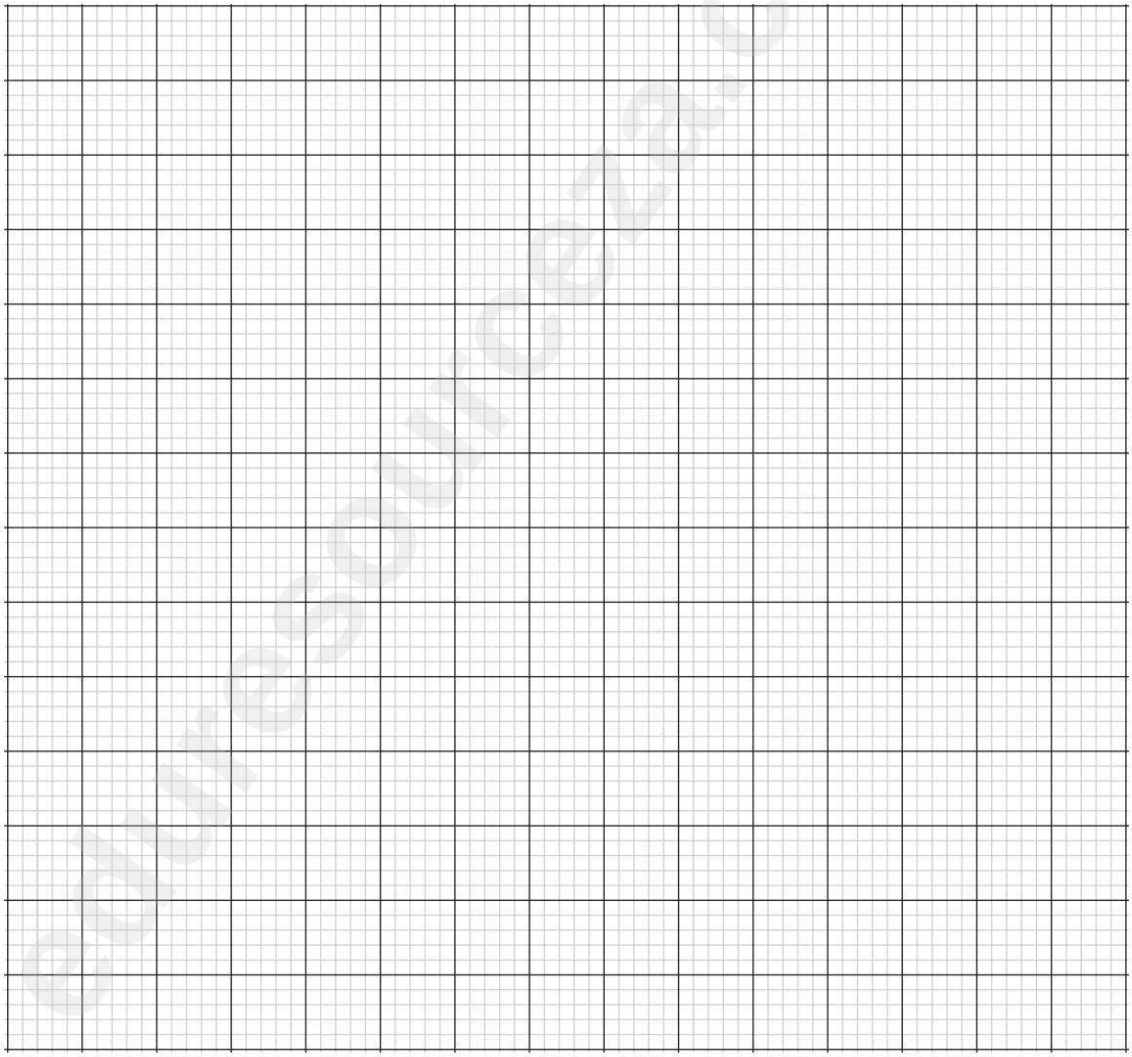
1.10.1 Give a reason why the southern ground hornbills choose nesting sites that are four metres above the ground?

_____

_____

(1)

1.10.2 Plot an appropriate graph of the data in Table 1.2 on the graph paper provided below.



(7)

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1.10.3 How does the social organisation of the southern ground hornbill help improve the survival of the species?

_____

_____

_____

_____

_____

_____

(2)

1.10.4 Why is it important that biologists introduce artificial nesting sites for the southern ground hornbill species?

_____

_____

_____

_____

_____

(2)
[80]

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