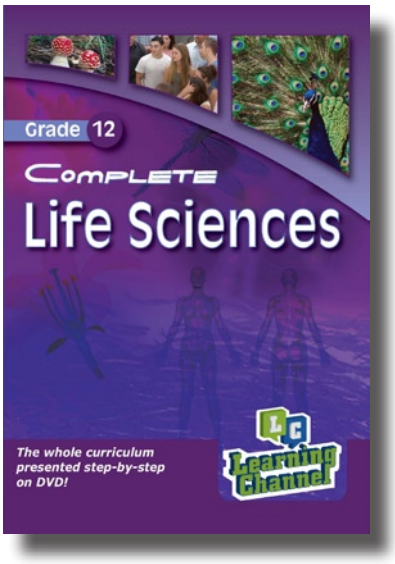
Learning Channel (Pty) Ltd
3rd Floor, The Mills
66 Carr Street
Newtown
Johannesburg
(011) 639-0179

Website: www.learn.co.za

National Senior Certificate
Grade 12
Life Sciences
Paper 2

Other products for Life Sciences available from Learning Channel:



MARKS: 150 **TIME 2 ½ hours**

This question paper consists of 12 pages.

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 EACH question on a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. If answers are NOT presented according to the instructions of each question, candidates will lose marks.
6. ALL drawings should be done in pencil and labelled in blue or black ink.
7. Draw diagrams and flow charts ONLY when requested to do so.
8. The diagrams in this question paper may NOT necessarily be drawn to scale.
9. The use of graph paper is NOT permitted.
10. Non-programmable calculators may be used.
11. Protractors, compasses and rulers must be used where necessary.
12. Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various possible options are provided as answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question number (1.1.1–1.1.5) in the ANSWER BOOK, for example 1.1.6 D.

1.1.1 If a fossil mammoth were discovered frozen in ice, its cells could be analysed to determine whether its proteins were similar to those of a modern elephant.

This type of investigation is known as comparative

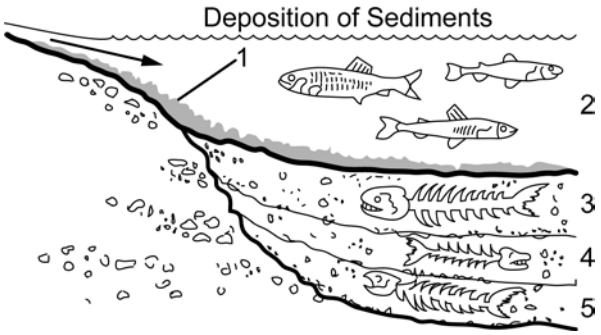
A anatomy

B embryology

C biochemistry

D ecology

Questions 1.1.2 and 1.1.3 refer to the following diagram:



1.1.2 Fossils are located in layer(s)

A 1 and 2

B 5 only

C 3, 4 and 5

D 2, 3, 4 and 5

1.1.3 The oldest fossil is located in layer

A 1

B 2

C 3

D 5

1.1.4 With reference to the two varieties of *Biston betularia* moths illustrated above, which of the following statements are true?

(i) The two moths are the same species.

(ii) Moth B is at a selective advantage when there is a lot of air pollution.

(iii) Moth A can be seen more easily than by predators than moth B in the conditions shown in the diagram.

A (i) only

B (i) and (ii)

C (i) and (iii)

D (i), (ii) and (iii)

1.1.5 Which of the following is a marine organism that is overexploited?

A Rhinoceros horn

B Perlemoen

C Devil's claw

D Hoodia (5 × 2) (10)

1.2 Give the correct biological term for each of the following descriptions. Write only the term next to the question number (1.2.1–1.2.6) in the ANSWER BOOK.

1.2.1 A group of organisms of the same species occupying a specific area at a particular time with the ability to interbreed

1.2.2 Type of rock that might contain fossils

1.2.3 A book that lists rare species of plants and animals and those in danger of becoming extinct

1.2.4 A method of using resources in such a way that they are available to future generations

1.2.5 Competition between different species

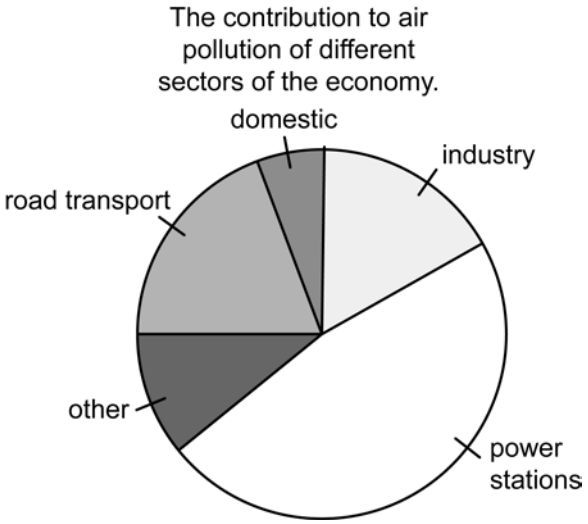
1.2.6 Pollutants that cannot be broken down in the natural environment (6)

1.3 Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–H) next to the question number (1.3.1–1.3.5) in the ANSWER book, for example 1.3.6 J.

	COLUMN A	COLUMN B
1.3.1	Microevolution	A Formation of new species B Inheritance of acquired characteristics C Study of the fossil record D The theory of continental drift E Small-scale changes within species F Mating of organism within one species that are not closely related G The theory of natural selection or descent with modification H Long term evolutionary changes resulting in new species, genera, families, etc.
1.3.2	Macroevolution	
1.3.3	Speciation	
1.3.4	Charles Darwin	
1.3.5	Jean-Baptiste Lamark	

(5 × 1) (5)

1.4 Different sectors of the economy are responsible for the release of gases that cause air pollution. The following pie graph shows the contribution of each sector of the economy to air pollution in country X.



1.4.1 Calculate the contribution of road transport to air pollution in country X. Show your working. (4)

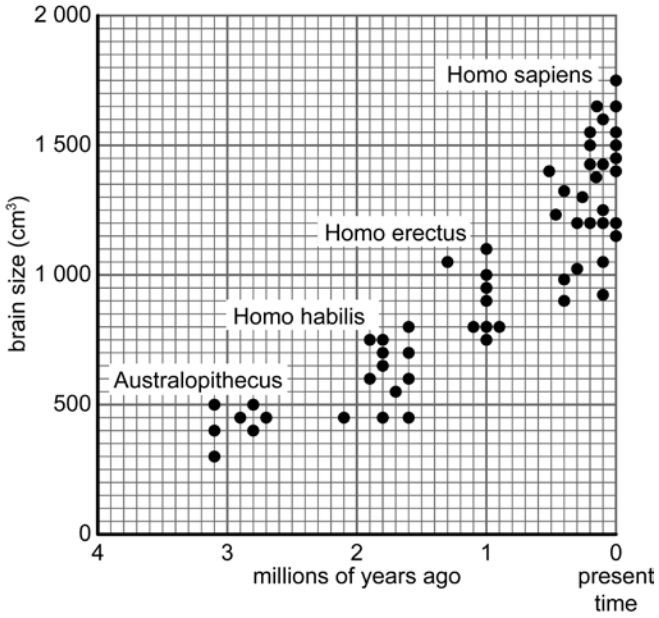
1.4.2 Name two gases that cause air pollution that are produced by vehicles/road transport. (2)

1.4.3 How are the gases mentioned in 1.4.2 produced? (1)

1.4.4 State THREE ways in which air pollutants can affect human health. (3)

[10]

1.5 The following diagram shows the brain size of several hominid species:



1.5.1 Give the time period when *Australopithecus* lived on Earth. (2)

1.5.2 Describe how the brain size changed during the evolution of modern humans. (1)

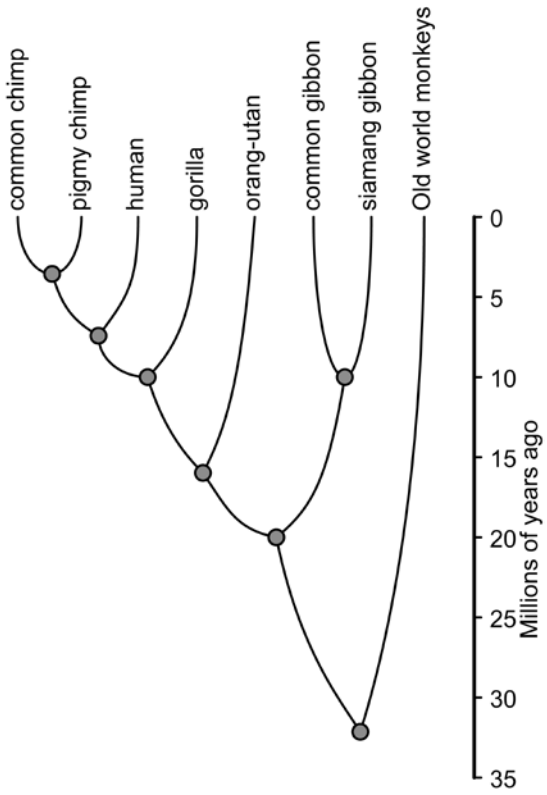
1.5.3 Calculate the average brain size of *Australopithecus* from the data given in the graph. Show all working. (4)

1.5.4 Explain how scientists work out the brain size of all these different species of hominids? (2) **[9]**

1.6 The diagram alongside shows the relationship between different species of primates.

1.6.1 Which pair of species, according to the information provided, is most closely related – the common chimp and the human or the gorilla and the orang-utan? Provide a reason for your answer. (2)

1.6.2 Which species was best adapted to changes that occurred in its environment over the longest period of time? Give a reason for your answer. (2)

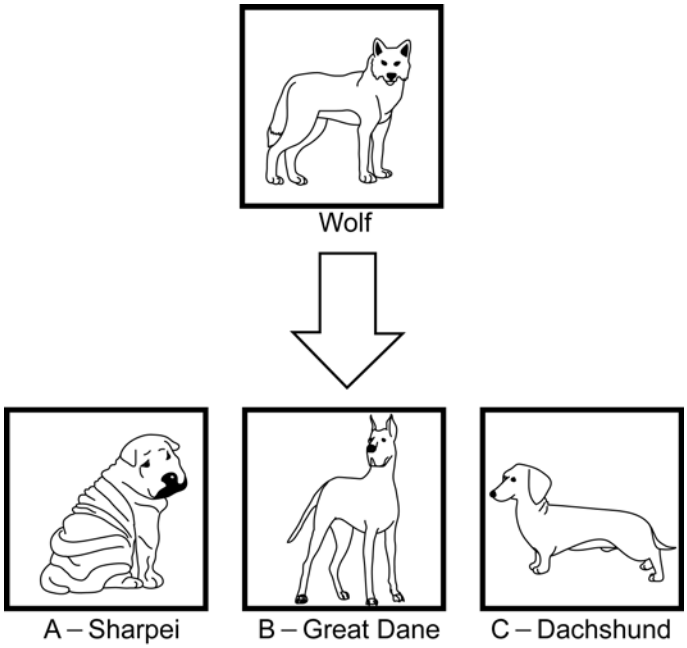


1.6.3 When would you expect the most recent common ancestor of the each of the following pairs to have lived on Earth in terms of the information provided?

(a) The human and the gorilla?

(b) The orang-utan and the common gibbon? (2)[**6**]

1.7 Artificial selection has been carried out on domestic animals and crops for thousands of years. The following diagram shows the results of artificial selection in the breeding of dogs:



1.7.1 What is artificial selection? (1)

1.7.2 The diagram shows that all domestic dogs are descended from wolves. Name the main physical characteristics that have been selected for in each of the three breeds of dog labelled A, B and C. (3)[**4**]

[50]

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Read the following passage:

The mopane worm is a well-known insect in South Africa. The moth (the adult form of the mopane worm) lives for a few days and lays many eggs. Small larvae (the actual mopane worm) hatch from the eggs and grow considerably before forming a pupa, which eventually produces a new adult moth.

The mopane worm is an important source of income for many people who collect them from the wild. Unfortunately overexploitation of this resource has led to the extinction of many local populations of mopane worms. Recolonisation of these areas is a very slow process. This is because the mopane worm adults do not live for very long and are unable to travel very far in the few days that they have to reproduce. The larvae are slow moving and are unlikely to move far from the mopane tree where they will have hatched. A possible solution to this problem is to hatch eggs and rear larvae in captivity and then reintroduce them into the wild. This would require financing as well as the education of the local communities. Another possible solution is to rear mopane worms in a similar way to the rearing of silkworms, feeding them on mopane leaves collected from the wild, and then harvesting some of them when they are the right age/size.

2.1.1 What is the mopane worm used for? (1)

2.1.2 Why have some local populations of mopane worms become extinct? (1)

2.1.3 Why is recolonisation of areas previously occupied by mopane worms slow? (2)

2.1.4 Why do local communities that rely on mopane worms as a source of income need to be educated? (2)

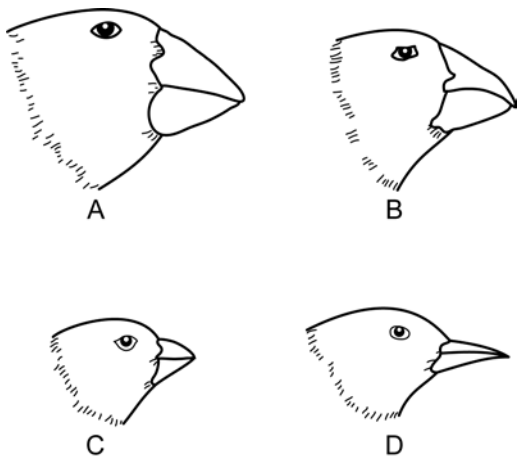
2.1.5 What would be a sustainable method of harvesting mopane worms? (2)

2.1.6 If mopane worms are reared in a similar way to silk worms, what could happen to the local mopane trees? (1)

2.1.7 Suggest a way of dealing with the problem mentioned in question 2.1.6. (1)

[10]

2.2 The accompanying diagram shows the heads of four species of finches found on one of the Galapagos Islands. These islands are situated about 1 000 kilometres away from the coast of Ecuador in South America.



2.2.1 What is the major difference between the four different species of finch? (1)

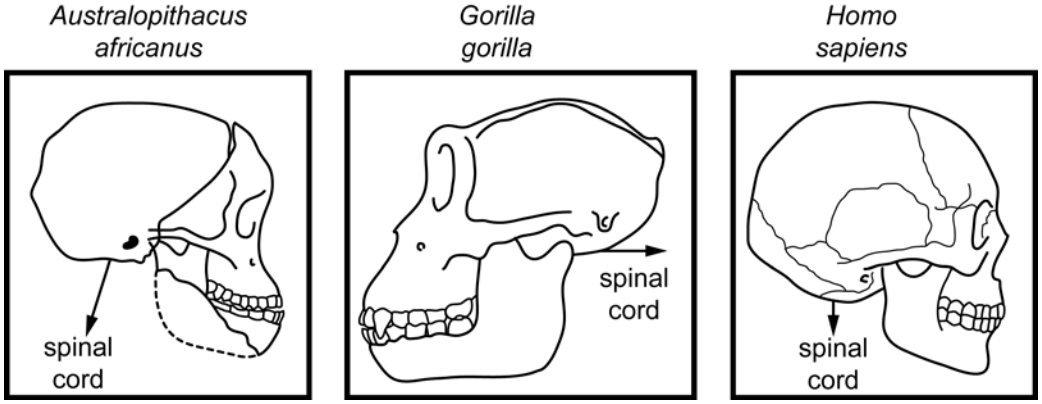
2.2.2 What is the reason for the difference that you gave in 2.2.1? (1)

2.2.3 There are more species of finches on the island than any other kind of bird. Suggest an explanation for this. (2)

2.2.4 There are fewer species of finch found on the nearest mainland than on the island. Suggest an explanation for this. (2)

[6]

2.3 The following diagram shows three skulls from living and fossil primates:



The arrows in the diagram indicate the orientation of the vertebral columns of the above organisms.

2.3.1 Copy and complete the following table comparing the three species, using information from the diagram: (12)

	Australopithecus africanus	*Gorilla gorilla*	*Homo sapiens*
Shape of canines – large or small?			
Forehead – straight up or sloping?			
Position of ridges above the eye socket – high or low?			
Vertebral column – horizontal or vertical?			

2.3.2 Do you think that *Australopithecus africanus* walked upright or on all fours? Give an observable reason for your answer. (2)

[14]

[**30**]

QUESTION 3

3.1 Read the following information about biodiversity in South Africa:

South Africa has been called 'a world in one country'. This is because different parts of the country have different climates and patterns of vegetation (biomes) due to the wide range of topographical features such as mountains, deserts, wetlands, etc.

This has contributed to the very high biodiversity found in South Africa. We have a large number of species of plants and animals. There are more than 20 300 species of flowering plants, and many species of vertebrates (243 species of mammals, over 800 species of birds, 370 species of amphibians and reptiles and over 2 220 species of fish). In addition, we have at least 80 000 species of insects.

Source: http://www.bcb.uwc.ac.za/envfacts/facts/biosa.htm

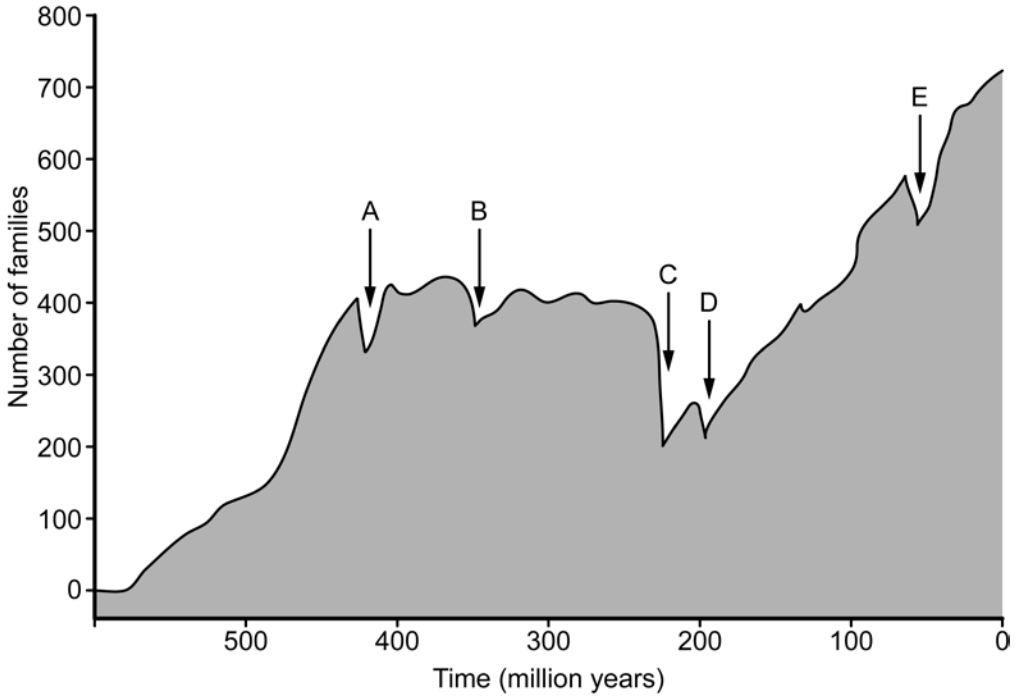
3.1.1 What is biodiversity? (1)

3.1.2 Draw a table showing the number of species found in each group of organisms mentioned in the article. (6)

3.1.3 Describe THREE important threats to biodiversity in South Africa. (3)

[10]

3.2 The following graph shows the numbers of different families of marine organisms found on Earth over the last 500 million years:



3.2.1 What evidence do we have for the number of families that lived in the different periods shown on the graph? (1)

3.2.2 What term do we use to describe the events that occurred during the periods shown by the arrows A–E on the graph? (1)

3.2.3 What happens to biodiversity during these events? (1)

3.2.4 Name THREE **Earthly theories** that provide an explanation for these events. (3)

3.2.5 Explain why rapid evolution of many new species/families usually follows these events. (3)

[9]

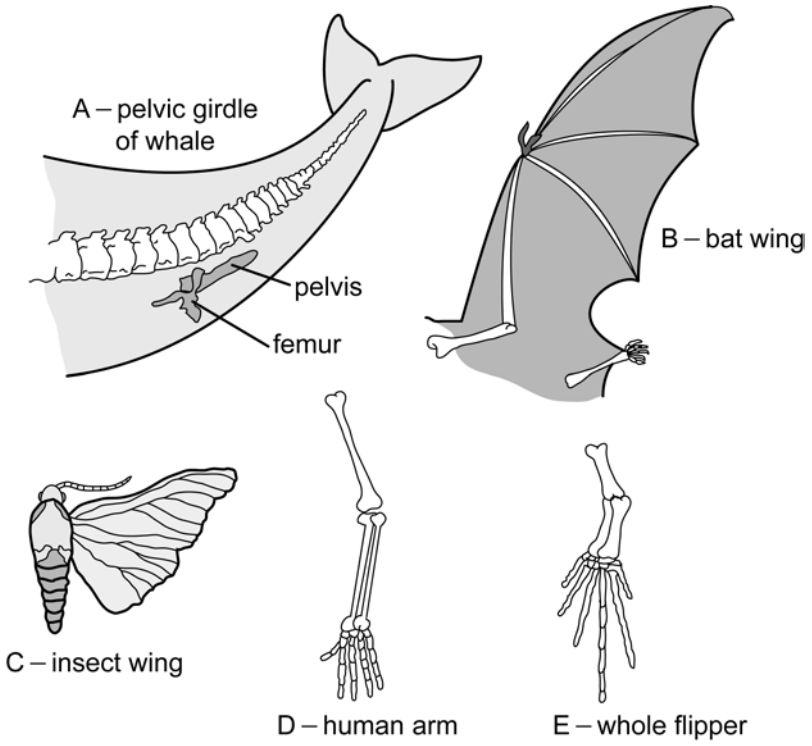
3.3 Comparative anatomy provides us with evidence for evolution.
Referring to the examples in the following pictures, discuss:

3.3.1 homologous structures (4)

3.3.2 analogous structures (4)

3.3.3 vestigial structures. (3)

[11]



[30]

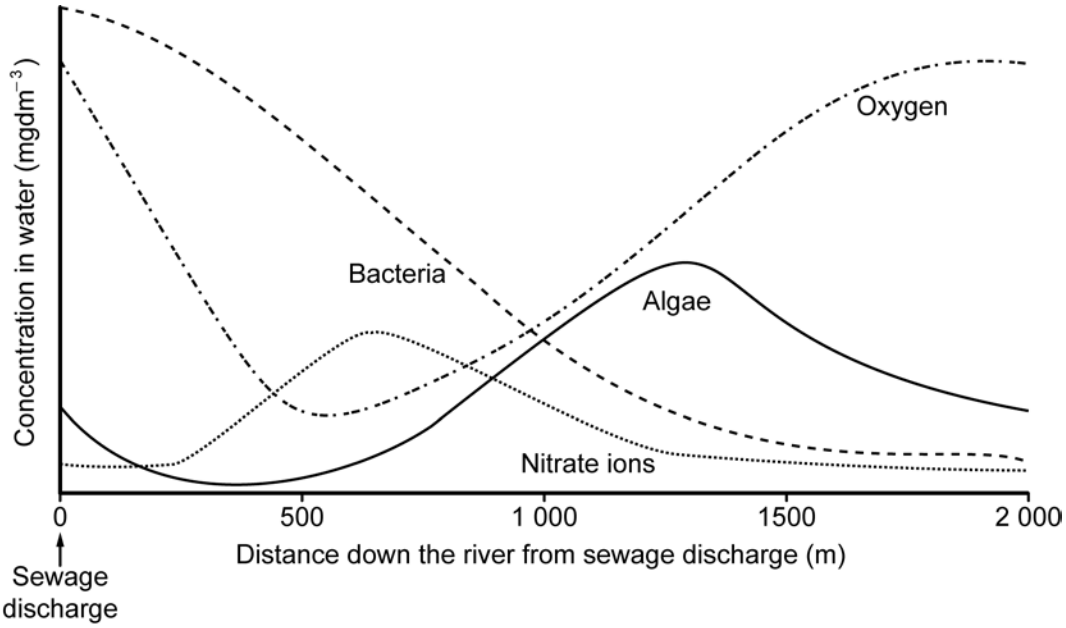
TOTAL SECTION B: 60

SECTION C

QUESTION 4

4.1 Human sewage is treated in treatment plants. If the treatment plant is near a river, dam or the sea, sewage spills may occur and raw sewage (untreated sewage) may pass directly into the adjacent water body. Human sewage contains bacteria. These bacteria feed on the organic material in sewage, breaking it down into inorganic nutrients. Inorganic nutrients can be used by algae for growth.

The following graph shows the concentration of bacteria, oxygen, nitrates and algae in the water of a river at and downstream from the point of a sewage spill into the river.



4.1.1 What would have happened to the number of bacteria when the sewage was added? Explain your answer. (2)

4.1.2 What effect did the change in the number of bacteria have on the oxygen concentration of the water? Provide an explanation for your answer. (3)

4.1.3 What effect did the change in the number of bacteria have on the nitrate concentration of the water? Provide an explanation for your answer. (4)

4.1.4 Why does the oxygen concentration gradually increase and return to its original level further downstream? (4)

4.1.5 Dead fish were found in the water at 500 m downstream from the point of the sewage spill. Provide an explanation for this. (2)

4.1.6 This sewage spill occurred in the summer. Would the effect of a sewage spill in winter be the same or different? Provide an explanation for your answer. (2)

4.1.7 People living downstream from the sewage spill got sick. Name THREE ways that people living downstream could come into contact with contaminated water. (3)

4.1.8 Name TWO human diseases that can be transmitted to humans from water that is contaminated by sewage. (2)

4.1.9 Explain what the people living downstream should do to reduce the chances of getting sick from contaminated water. (2)

(1)

[25]

4.1 Whose responsibility is it to manage/control the treatment of human sewage?

4.2 The following headlines are all from recent articles on sewage spills into water bodies in different parts of South Africa:

> **'Crumbling sewage infrastructure threatens the water quality of Cape Flats residents'**
>
> *'High levels of E.coli found in Durban rivers'*
>
> **'Raw sewage pouring into the Hartebeestpoort dam'**

Write an essay in which you discuss at least one strategy that each of the following groups of people could employ/use to reduce the chances of this happening or to prevent this from happening in the future.

- The residents of a community that are supplied with or that rely on water that could be contaminated
- Reporters from a local newspaper
- Legal experts/lawyers working in the community
- Local councillors
- Members of parliament
- Members of environmental organisations (12)

Synthesis (3)

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

TOTAL SECTION C: 40

GRAND TOTAL: 150