LIFE SCIENCES: PAPER II

Time: 2½ hours   150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1.   This paper consists of 15 pages. Please check that your question paper is complete.

2.   This paper consists of three sections.

3.   Section A consists of short questions. Answer these on the question paper in the spaces provided.

4.   Answer the questions to Sections B and C on the foolscap paper provided.

5.   It is in your interests to write legibly.

SECTION A

Answer the questions for section A on the question paper in the spaces provided.

QUESTION 1

1.1 Read the story of the Masaai below and answer the questions that follow.

> The Masaai tribe of Tanzania has traditionally been nomads. They do not settle in permanent villages but keep moving to new grazing areas. Their economy and culture are based on their cattle. Each household has about 20 cattle. The people's main source of food is milk, meat and blood from their cattle.
>
> In 1980, as a result of drought and political disturbances in the Northern part of Tanzania, some Masaai moved illegally into a wilderness conservation area known as Ruaha National Park. Over the years more and more people moved into the park where they have lived there ever since. By 2005 there were about 2 000 people living in the park. The people and their cattle compete with wildlife, such as zebra and buck, for resources.
>
> In 2005, the numbers of people in the conservation area had increased to the point where their impact on the park was so great that the Tanzanian government started forcing them to move to another part of the country. The people's cattle have to be herded across long distances of thousands of kilometers to a new place. This forced removal has led to many cattle dying whilst they were being herded across the country. Many people have died as well.
>
> There are still some people in the National Park who refuse to move.

1.1.1 Name two resources the Masaai and their cattle need that wildlife also needs.

_____

_____ (2)

1.1.2 Name the type of competition that occurs between the Masaai's cattle and wildlife.

_____ (1)

1.1.3 In the space below, draw a simple line graph to show the general pattern of how the numbers of Masaai within the National Park has changed between 1980 and 2005.

(7)

1.1.4 Name the population parameters which resulted in the increase in the number of people living in the National Park up to 2005.

_____

_____ (2)

1.1.5 The Masaai try to protect their cattle from predators.   List three things that would have led to the death of the cattle whilst they were being herded to their new home.

_____

_____

_____ (3)

1.1.6 Do you think the Tanzanian government is doing the correct thing by forcing these people to move? Give one good reason for your answer.

_____

_____

_____ (2)

[17]

1.2 A scientist used 30 live traps to gather information about the population of the striped field mice in a 1 hectare wheat field. (A live trap catches the mice in a box. The mice are later released unharmed).

During the first trapping night he caught 19 mice, which he marked by cutting a notch in their ears. He then released them into the field. Three days later he set his traps again and caught 22 mice, of which 3 had notches in their ears.

He used the formula: $P = \dfrac{M \times S}{T}$ to estimate the size of the population

M = total number of animals in first marked sample
S = total number of animals recaptured in second sample
T = total number of marked recaptured animals

1.2.1 What is the name given to this kind of sampling?

_____ (1)

1.2.2 What was the size of the mouse population in that one hectare?

_____ (2)

1.2.3 Why did he use live traps?

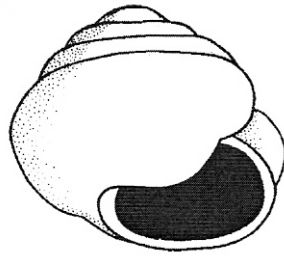_____

_____

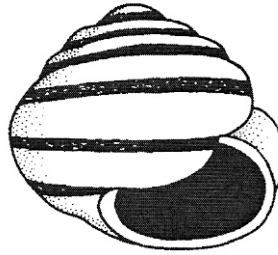_____ (3)

[6]

1.3   The drawings below show a banded and unbanded variety of a species
       of snail.

Unbanded   Banded

Scientists randomly collected snails from two different sites and the
numbers recorded are shown in the table below.

Site	Number of snails	
	Banded	Unbanded
Grassland	29	70
Under low shrubs	89	10

1.3.1 What sampling technique was used to get a random sample of the
       snails?

       _____

       _____   (1)

1.3.2 Suggest a reason for the different population numbers in the two
       different areas.

       _____

       _____   (2)
                                                                                  [3]

1.4

1.4.1 The following seven questions are all multiple choice. Choose the correct answer and write the correct letter corresponding to the correct answer in the table below.

Question	1.4.1	1.4.2	1.4.3	1.4.4	1.4.5	1.4.6	1.4.7
Answer							

An aphid is a small insect that sucks sugars from plant stems.

The graphs below show the effectiveness of four different biological control organisms (A, B, C and D), used to control a species of aphid.

The control organisms were released during the first summer of a number of years. Study the graphs and then select the biological control organism (A, B, C or D) that would be most suitable to control the aphid.
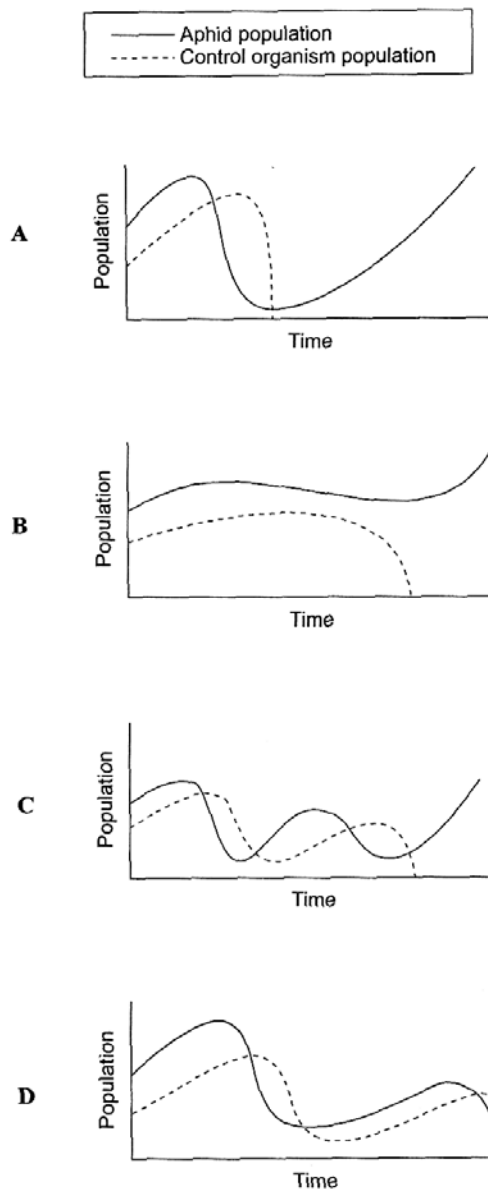
(2)

1.4.2 Four species of small mammals were studied in their natural environment and were found to have the following food preferences, habitats and shelter requirements:

Mammal species	Food preference	Habitat	Shelter requirements
I	ants	open grassland	burrows
II	shoots and leaves	open grassland	hollow logs
III	ants	dense forest	hollow logs
IV	berries and roots	dense forest	hollow logs

Which two species would be most likely to compete with each other much of the time?

A   I and III
B   I and II
C   III and IV
D   II and IV   (2)

1.4.3 The Black Death is a disease caused by a bacterium that is spread by the fleas on rats. In just 3 years (1348–1350), at least one-quarter of the population of Europe died from the disease.

What is this an example of?

A   Interspecific competition
B   A density – independent factor causing mortality
C   A density – dependent factor causing mortality
D   Predation   (2)

1.4.4 Which of the following is a **density – independent** factor in population regulation?

A   severe frost
B   predation
C   territoriality
D   disease   (2)

1.4.5 Which country has **not** agreed to the Kyoto protocol (code of behaviour) for controlling emission of green house gases?

A   United Kingdom
B   South Africa
C   Canada
D   United States of America   (2)

1.4.6 Which of the following is **not** a strategy for survival in lions?

A   mothers look after their young
B   litters are large (up to 20 cubs)
C   lion prides hunt in territories
D   family groups stay together and hunt together   (2)

1.4.7 Male weaver birds build the nests. The females choose their mate according to how good the male's nest and courtship display is. What is this an example of?

A   Intra specific competition
B   Inter specific competition
C   Altruism
D   Territoriality   (2)

[7 x 2 = 14]

1.5   **Match the terms in Column B with the descriptions in Column A. Write only the correct letter from Column B in the box on the left.**

Correct letter	Column A	Column B
	1. This gas is a major contributor to the greenhouse effect	A: Montreal protocol
	2. The burning of these materials is the major cause of the increase in carbon dioxide in the atmosphere	B: Kyoto protocol
	3. These compounds are the major cause of the hole in the ozone layer	C: fossil fuels
	4. This agricultural product is an organic pollutant of fresh water	D: methane
	5. This compound causes acid rain	E: chloroflurocarbons
	6. The international protocol (code of behaviour) to reduce the impact of CFCs on the ozone layer	F: carbon monoxide
		G: nitrous oxide
		H: biofuels
		I: organophosphates

(6)

1.6   Provide a word or a term for each of the following descriptions. Write the answer in the first column.

1.	The type of growth in a population which doubles in numbers every year.
2.	The method used by governments to count how many people are in their country.
3.	The name given to the parameter concerned with the number of babies born in a population.
4.	This happens when every individual in a population dies and the species is wiped out.

(4)

[10]

Total for Section A: 50 marks

SECTION B

Answer all questions in this section on the paper provided.

QUESTION 2

Table to show the total population of Africa and the percentage population in rural areas in Africa for 1950-2010

Year	Total Population (millions)	Percentage in rural areas
1950	224 202	85.1
1955	250 633	83.4
1960	282 241	81.4
1965	319 574	79.1
1970	364 132	76.8
1975	416 446	74.7
1980	479 786	72.5
1985	554 294	70.4
1990	637 421	68.1
1995	726 334	65.4
2000	820 959	62.9
2005	922 011	60.3
2010	1 032 013	57.6

2.1 What percentage of the total population will be living in urban environments in 2010? (1)

2.2 What is the % increase in population projected for Africa between 2005 and 2010? Show your working. (2)

2.3 Explain three of the implications of this migration of people into cities for the countries of Africa. (3 x 3 = 9)

[12]

QUESTION 3

Africa continues to lead all continents in the world in population growth, while Europe is experiencing a *negative* RNI, (rate of natural increase). *(Comment and data adapted from: http://esa.un.org/unpp/p2k0data.asp Africa).*

3.1   What causes a negative RNI?   (3)

3.2   Give one way in which a negative RNI could affect the continent of Europe.   (2)

3.3   Look at the table below.

Table showing rate of natural increase (RNI) in several countries and regions

Country/Region	Country/Region	RNI (%)
World	**World**	**1.14**
	Less Developed Countries	1.38
	More Developed Countries	0.08
Continents	**Africa**	**2.03**
	Europe	**-0.14**
Countries	Afghanistan	2.62
	Yemen	3.44
	Saudi Arabia	2.71
	Congo	3.01
	Botswana	-0.89
	South Africa	**-0.22**
	Germany	-0.20
	Australia	0.50
	Canada	0.32
	USA	0.58
	UK	0.07

Suggest one reason why South Africa's RNI is much lower than the rest of Africa as a whole.   (3)
                                                                              [8]

QUESTION 4

People have become the most important biotic factor in the world. Our interference in the environment can often bring disaster. One example of this is that of the deer population on the Kaibab plateau in the USA.

Before 1906, the plateau supported a herd of about 4 000 deer as well as some domestic grazing animals. The population of deer was kept to that number by predators such as the pumas (mountain lion), wolves and coyotes (similar to jackals) which preyed on the deer.

When the area was declared a wildlife park in 1906, the domestic livestock were removed and the "gentle, defenseless deer" were protected by the systematic killing of 3 000 coyote, 600 puma and 11 wolves. The result was that the deer population increased to 100 000 in 1924, well above the 30 000 that the vegetation of the plateau could support (its carrying capacity).

Graph to show the changes in deer population on Kaibab plateau.
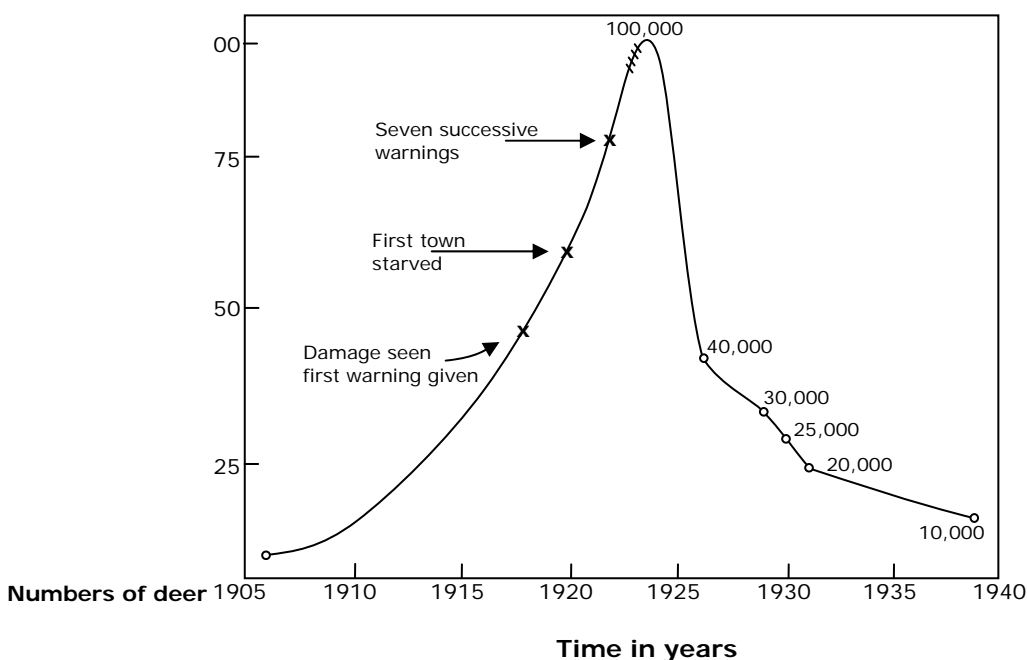
4.1   Name the natural predators of the deer of the Kaibab plateau.   (3)

4.2   Why are predators an important part of a stable population?   (2)

4.3   What does the term carrying capacity mean?   (2)

4.4   Study the graph and describe what happened to the deer and the environment of the Kaibab plateau from 1920, (when the last predator was removed), up to1940.   (7)

4.5   Explain carefully what would have happened to the deer and the environment if the predators had not been killed.   (4)

[18]

QUESTION 5   GLOBAL WARMING" What's the fuss?

The picture below is the front cover of the issue of TIME magazine early in 2007 that had a special article on global warming.
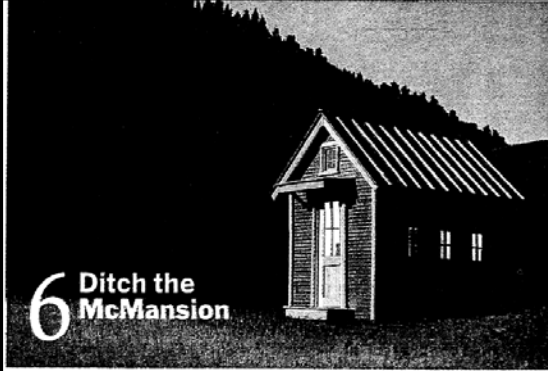
5.1   What is global warming?   (1)

5.2   What are the major causes of global warming?   (3)

5.3   Explain why the increased demand for electricity is contributing to global warming.   (5)

5.4   Why do you think that the TIME magazine has a picture of a penguin on an iceberg to illustrate their issue on global warming?   (4)

5.5

5.5.1 This issue of TIME magazine suggested 51 things people can do to make a difference to control global warming.

Look at the two examples that follow and write your own short paragraph for inclusion in a magazine on **one other** way that you and your family could make a difference.

Example One

Example Two

Rate your suggestion in the same way as TIME magazine has done (as a mark out of 10) according to the three criteria:

1   impact on the environment
2   time line
3   feel good factor   (12)
   **[25]**

QUESTION 6

Effluent (animal wastes) can pollute fresh water. One way of measuring the levels of pollution is by looking at the biochemical or biological oxygen demand (BOD).

Micro-organisms that live in water decompose the organic wastes in the effluent and use up the oxygen in the water.

BOD is measured as the mass (mg) of oxygen used by one litre of a sample of the effluent stored in darkness at 20° C for 5 days.

6.1   Describe how effluent from human activity can cause a very high BOD in a lake. (4)

6.2   What is the likely effect of a reduced BOD on the fish in the lake? (1)

6.3   Explain why the sample which is going to be tested is kept in the dark for 5 days before measuring the oxygen demand. (4)

6.4   Read the information in the graph below. It shows the numbers of diatoms and phosphate levels taken from a stream flowing through an industrial area during the month of September.
(Diatoms are a type of unicellular microscopic algae that grow in fresh water).
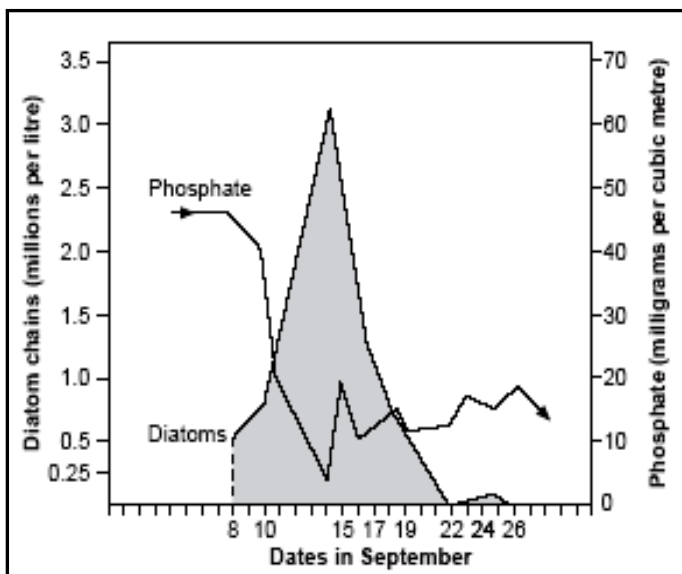
6.4.1 Use the graph to explain what is happening in the stream in terms of what you know about eutrophication and algal blooms. (4)

6.4.2 What will the effect of this be on the BOD in the stream on the 15th September? (2)

6.4.3 Look at the graph and suggest a solution to the problem. (2)

[17]

Total for Section B: 80 marks

SECTION C

QUESTION 7

The following article is adapted from Jean Lindsey's article in the KwaZulu Natal's Conservancies Association booklet, The Guinea Fowl, December 2006.

Throughout South Africa there has been an enormous increase in the number of "eco-estates" and golfing estates.

Eco-estates tend to have many houses clustered in a large fenced complex with open areas that often have indigenous habitats. There may be as many as 600 houses on one estate. Many eco-estates are developed on land that was farmland, such as sugar cane fields. These estates often have patches of indigenous forest, grassland or fynbos between the houses. Golf course estates are very large fenced areas and may have anything from 20 to 300 large houses in the estate. Many of the smarter, more expensive ones in the Southern Cape have been developed in untouched natural areas, like coastal fynbos, where there has been no previous development.

"In a water-scarce country like ours, the increase in water-expensive 'playgrounds of the rich' seems completely inappropriate and environmentally unaffordable. Just one golf course uses enough water in a day to give three quarters of South Africa's population free water daily. Many, if not all, have destroyed sensitive ecosystems. The estates use large quantities of pesticides and fertilisers, which result in pollution risks to our valuable groundwater resources."

"Many golf courses now use recycled effluent (recycled from their sewage systems) to water the greens and fairways. Increased nutrients from the recycled water often encourage alien plants to invade and discourage indigenous plants that cannot tolerate the high nutrient load." The water run-off from the open areas in estates will eventually end up in streams and rivers.

"… many people have an attitude towards development that we once had towards smoking: sure it's bad but it won't be a problem for me."

Jean Lindsey believes that there are too many of these eco-estates and golfing estates and that there has not been an adequate study or assessment of the impact they have on the environment. Do you agree with Jean Lindsey's opinion?

Write a well-structured argument of approximately one page in which you use your knowledge of the following to support your opinion:
• the impact of man on his environment
• the sustainable use of land and resources that is needed to minimise environmental destruction, whilst still allowing necessary economic development
• the need to manage competing populations in an environment.   **[20]**

Total for Section C: 20 marks

Total: 150 marks