GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION
2009

10832

LIFE SCIENCES

Second Paper

14 pages

LIFE SCIENCE: Paper 2
LFSC

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GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

LIFE SCIENCES
(Second Paper)

TIME: 2½ hours

MARKS: 150

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

- Answer ALL the questions.
- Write ALL the answers in the ANSWER BOOK.
- Start EACH question on a NEW page.
- Number the answers correctly according to the numbering system used in this question paper.
- If answers are NOT presented according to the instructions of each question, candidates will lose marks.
- ALL drawings should be done in pencil and labelled in blue or black ink.
- Draw diagrams or flow charts ONLY when requested to do so.
- The diagrams in this question paper may NOT necessarily be drawn to scale.
- The use of graph paper is NOT permitted.
- Non-programmable calculators, protractors and compasses may be used.
- Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various possible options are provided as answers to the following questions. Choose the 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 One solution to reduce air pollution may be ...

A the use of leaded petrol.
B the burning of wood and coal.
C the use of public transport.
D causing veld fires.

1.1.2 One of the following has a positive human influence on the environment.

A Deforestation
B Overpopulation
C Pollution
D Conservation

1.1.3 Biological control is useful because it ...

A usually attacks all plant species.
B can destroy an alien plant infestation or reduce its population numbers.
C usually originates in the country where the alien plant destroys indigenous vegetation.
D usually attacks all useful micro-organisms.

1.1.4 Pollutant gases have an adverse effect on the environment and on our health. The amounts of these gases have been steadily increasing over the years.

The table below shows the source and amount of some pollutant gases produced by human activities.

POLLUTANT GAS	SOURCE	AMOUNT PRODUCED PER YEAR (MILLIONS OF TONNES)
Carbon dioxide	Vehicle exhaust fumes	350
Sulphur dioxide	Burning coal and oil, industries	200
Nitrogen oxide	Vehicle exhaust fumes	55
Hydrocarbons	Vehicle exhaust fumes, industry	90

Which ONE of the following statements is correct?

A The total sulphur dioxide and nitrogen oxide produced per year is 145 million tonnes.
B Carbon monoxide is produced by industries.
C The combined total pollutant gases produced by nitrogen oxide and hydrocarbons, is less than the total produced by sulphur dioxide.
D Hydrocarbons is produced by vehicle exhaust gases only.

1.1.5 According to Darwin's theory, natural selection involves …

A new characteristics obtained by use and disuse.
B advantageous characteristics which enabled individuals to survive over weaker ones.
C all life forms developed from a single spermatozoon.
D all quadrupeds that got rid of inherited ancestral parts which were not used.

5x2= **(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 Using resources in such a way that they are still available for future generations.

1.2.2 The death rate of individuals in a population.

1.2.3 The ability of a substance to be broken down into simpler substances by natural processes.

1.2.4 The removal of vegetation in large quantities to create space for human use.

1.2.5 The process whereby species originate.

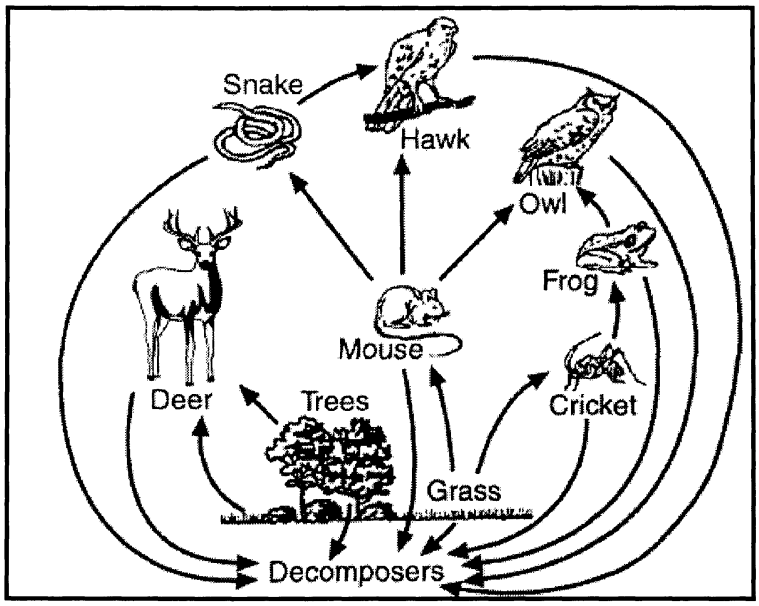
1.2.6 The preserved remains of living organisms found in rocks. **(6)**

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

COLUMN A		COLUMN B	
1.3.1	Living in water	A	Indicates species threatened with extinction
1.3.2	Organisms that do not naturally live in a particular habitat	B	Mutualism
1.3.3	Outbreeding	C	Different alleles of genes in a population
1.3.4	Lichens	D	Alien species
1.3.5	Red data list	E	Aquatic
		F	Commensalism
		G	Union of gametes from genetically dissimilar individuals

5x1=**(5)**

1.4 The diagram below illustrates the relationships between organisms in an ecosystem. Study the diagram and answer the questions.



1.4.1 Name all the producers in the diagram. (2)

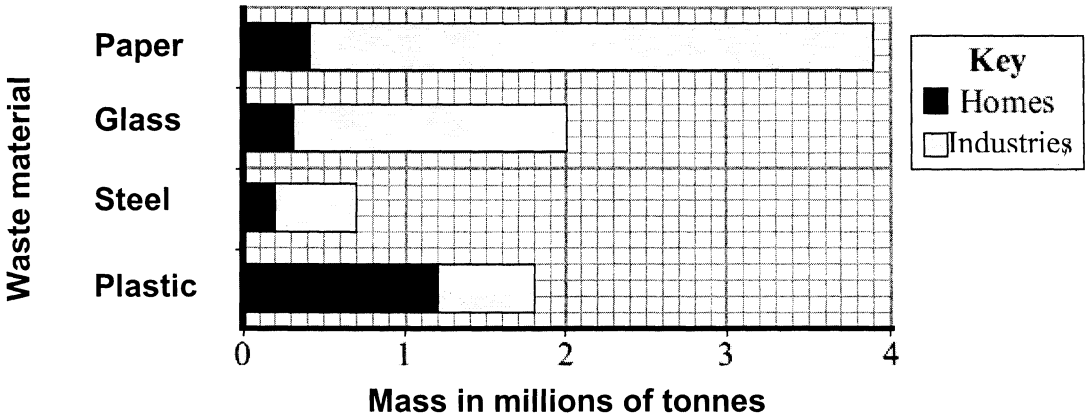
1.4.2 What ecological phenomenon does the diagram above represent? (2)

1.4.3 Predict what the direct effect would be if all the crickets were killed by an insecticide. (3)

1.4.4 What is the role of the decomposers in the diagram? (2)

1.4.5 State ONE example of a predator-prey relationship found in the diagram. Indicate which organism is the predator and which is the prey. (4)
(13)

1.5 The human population is increasing rapidly. This increases the amount of waste produced.
The bar graph below shows the mass of waste produced by homes and industries in South Africa in 2007.



1.5.1 Provide the name of ONE item from the graph which would lead to fewer trees being cut down if this item is recycled. (1)

1.5.2 Which material formed the smallest mass of waste from homes? (1)

1.5.3 Calculate the percentage of plastic waste that was produced by industries. Show all your calculations. (4)

1.5.4 Industries produced 1,7 million tonnes of one of these materials. Name this material. (1)

1.5.5 Draw a table to show the data provided for paper and steel in the graph. Waste from homes and industries must be shown in different columns. (9)
(16)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Each year, a New York State power agency provides its customers with information about some of the fuel sources used in generating electricity. The table below applies to the period of 2002 – 2003.

Fuel sources used

Fuel source	Percentage electricity generated
Hydro- (water)	75
Coal	12
Nuclear	6
Oil	3
Solar	0
Other	4

2.1.1 Use the information given in the table to construct a pie chart. (11)

2.1.2 Identify TWO fuel sources in the table that are considered fossil fuels. (2)

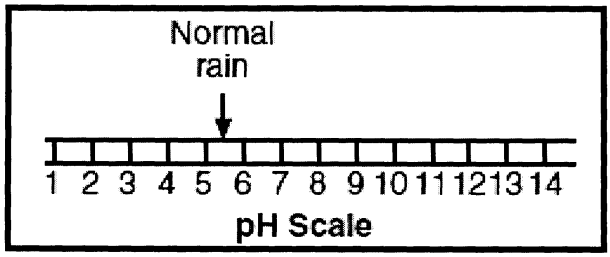
2.1.3 Identify TWO fuel sources in the table that are classified as renewable resources. (2)

2.1.4 State ONE specific environmental problem that can result from burning coal to generate electricity. (1)

2.1.5 Calculate the ratio between the percentage of electricity generated by water and that generated by nuclear power. Show all your calculations. (3)

2.1.6 Provide another possible source of energy represented as 'other' in the table, which could account for the remaining 4% of electricity generated. (1)
(20)

2.2 Acid rain can have a pH between 1,5 and 5,0. The scale below shows the pH of normal rain.



Sameera and Yaseera wanted to test the effect that acid rain has on the early growth of bean plants in the laboratory. Provide the information requested below that should be included in a research plan/scientific report.

2.2.1 Write down a possible hypothesis for this investigation. (2)

2.2.2 Identify the independent variable. (1)

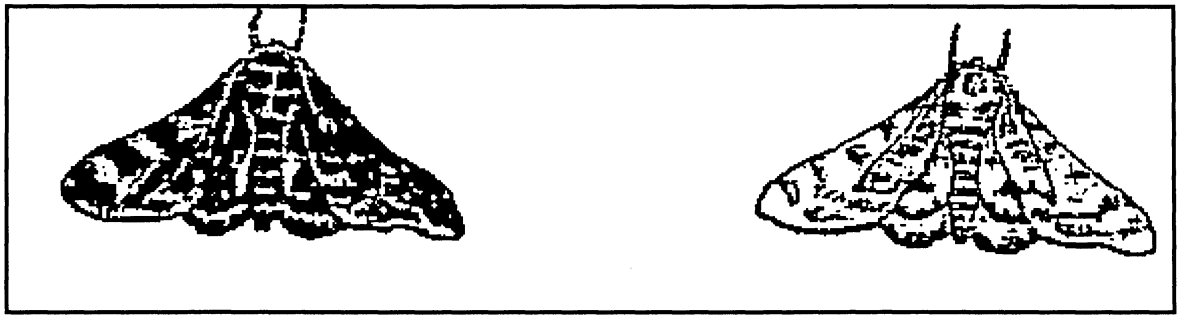
2.2.3 State FOUR factors that should be kept constant. (4)

2.2.4 What is the purpose of having a control in an investigation? (2)

2.2.5 Name ONE other effect acid rain has on the environment besides the effect being investigated. (1)
(10)

QUESTION 3

3.1 Read the case study below and answer the questions that follow.



There were two forms of peppered moths (*Biston betularia*) in Britain, a pale-greyish white and a melanic (dark) form. They existed in almost equal numbers. After the 1850 industrial revolution, the cities of Sheffield and Birmingham were polluted with sooty (black) smoke. The pale-greyish white moth decreased in numbers due to it being easily spotted by predatory birds against the dark polluted woodlands. Scientists discovered that the melanic moth population, which only breeds annually, increased in number in the polluted woodlands compared to the unpolluted forest. They first believed that the caterpillar (larva stage of moth) fed on the soot-covered leaves of the forest and when the caterpillar changed into a moth these black chemicals resulted in the moths having dark melanic-coloured wings. It was further suggested that the increase in number was due to the offspring inheriting this industrial melanism (black pigmentism). It was also discovered that the *allele frequency for wing colour in the peppered moths* changed after fifty generations.

3.1.1 Which theory or process is being referred to in lines 7 to 9? (1)

3.1.2 Explain your answer in Question 3.1.1. (2)

3.1.3 State the hypothesis that was derived by the scientists as indicated in lines 4 to 5. (2)

3.1.4 Provide the term used to describe the phenomenon in lines 11 and 12. (1)
(6)

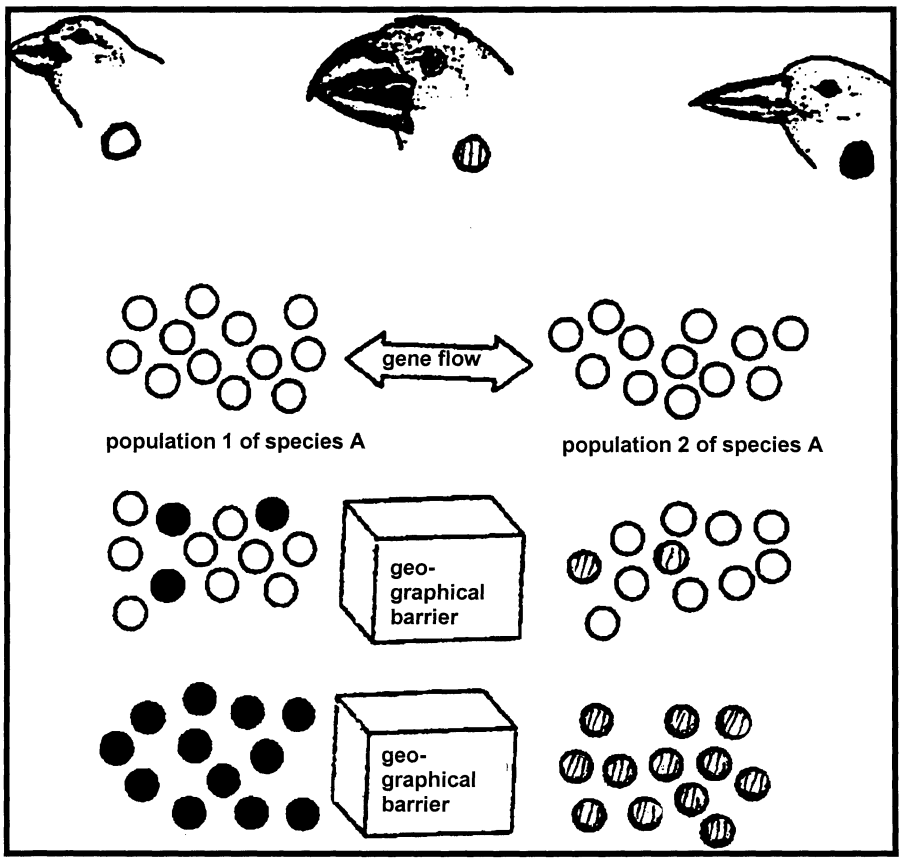
3.2 The sketch below illustrates how new species of finches were brought about on the Galapagos Islands discovered by Darwin.

The clear circles (○) represent the ancestral blue-black grassquit finch (*species A*).

The black circles (●) represent the medium-ground finch (*species B*).

The circles with the lines (◍) represent the sharp-beaked finch (*species C*).

The ancestral finch population separated due to a geographical barrier on the Galapagos Islands and a smaller group of this population settled on an island nearby. The environmental conditions and food on both these islands varied resulting in the finches having different structural adaptations.



3.2.1 Which process of natural selection is being demonstrated in the above sketch? (1)

3.2.2 Briefly explain what is meant by the 'gene flow' between population 1 and 2. (1)

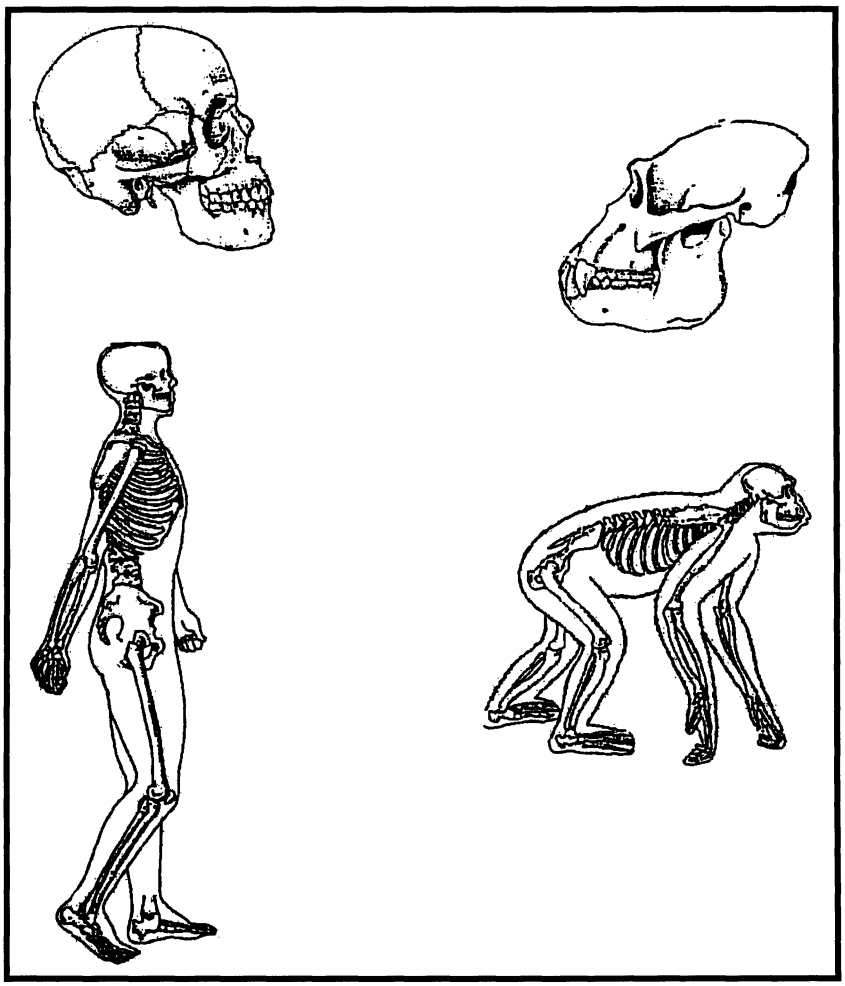
3.2.3 What would the geographical barrier in the above illustration be? (1)

3.2.4 State the main structural difference in the physical features of these finches. (1)

3.2.5 Give a reason why the structural change referred to in Question 3.2.4 was necessary. (2)

(6)

3.3 Study the pictures below on parts of the skeletal structure of primates and answer the questions that follow.



3.3.1 State ONE reason why apes and humans are referred to as "hominoids". (2)

3.3.2 Name the term used to describe the locomotion of

(a) humans. (1)
(b) chimpanzees. (1)

3.3.3 Suggest TWO ways in which locomotion of modern humans will be disadvantaged if they had the skeletal structure of apes and chimpanzees. (2)

3.3.4 Distinguish between the skeletal structure of man and the chimpanzee, other than those mentioned in Question 3.3.3. 5x2=(10)

3.3.5 Predict the shortcoming (problem) the ape would experience if it had the phalanges of *Homo sapiens*. (2)
[18]

TOTAL SECTION B: [60]

SECTION C

QUESTION 4

4.1 4.1.1 Define a *gene mutation*. (2)

4.1.2 Name TWO factors that can cause gene mutations. (2)

4.1.3 Differentiate between *fixed*, *neutral* and *lethal mutations*. (6)

4.1.4 Name TWO types of fossils found in rocks. (2)

4.1.5 List THREE places, other than rocks, in which fossils have been found. (3)
(15)

4.2 Cytochrome C and certain enzymes were isolated from the mitochondria of many types of cells. The number of differences in the amino acid sequences of Cytochrome C from different species are compared to human Cytochrome C in the data table below.

Differences in Amino Acid Sequences

Organism	Number of Differences in Cytochrome C compared to Humans
Tuna	21
Mould	48
Moth	31
Dog	11
Horse	12
Chicken	13
Monkey	1

4.2.1 Which one of the organisms listed in the above table, has a DNA code for Cytochrome C that is MOST similar to that of a human? (1)

4.2.2 What inference/deduction do evolutionists make because of the similarity mentioned in Question 4.2.1? (2)

4.2.3 List FOUR other evidences that evolutionists use to support the theory of evolution. (4)

4.2.4 Which one of the organisms listed in the above table, has a DNA code for Cytochrome C that is LEAST similar to that of a human? (1)

4.2.5 Provide a reason for your answer to Question 4.2.4. (2)
(10)

4.3 In the past, a specific antibiotic was effective in killing a certain species of bacteria. Now, most members of this bacterial species are resistant to this antibiotic.

4.3.1 Explain, in terms of Darwin's theory, how this species of bacteria has become resistant. (9)

4.3.2 Provide THREE arguments against the theory of evolution. (3)

NOTE: NO marks will be awarded for answers in the form of flow charts or diagrams.
(3 marks will be awarded for the quality of your answer.) (3)
[15]

TOTAL SECTION C: [40]

GRAND TOTAL: 150

END