



NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2012

LIFE SCIENCES: PAPER I

EXAMINATION NUMBER

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ANSWER BOOKLET

There are (vi) pages in this Answer Booklet.

QUESTION 1

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

Column A

- [] The person who recorded the first experimental evidence on the inheritance of traits
- [] A mechanism that prevents gene flow and interbreeding between populations
- [] An extinct organism which gave rise to two or more new species
- [] Selective reproduction among close relatives leading to an increased number of homozygous individuals
- [] When an individual competes successfully for resources and survives longer to produce offspring
- [] Location of a gene on a chromosome
- [] Having only one of each type of chromosome that is characteristic for a species

Column B

- A** Common ancestor
- B** Haploid
- C** Gregor Mendel
- D** Natural selection
- E** Hybrid
- F** Inbreeding
- G** Reproductive isolation
- H** Alfred Wallace
- I** Locus

(7)

- 1.2 Four multiple choice questions are given below. Choose the most correct alternative in each question and write only the letter of the correct answer in the space provided in the table.

1.2.1	1.2.2	1.2.3	1.2.4

- 1.2.1 Variations in hair colour are due to differences in alleles inherited from parents. The term 'alleles' can best be described as:

- A alternate/contrasting forms of a gene used in determining hair colour
- B the presence of the same form of gene for hair colour on the homologous chromosomes
- C the position where the hair colour genes are located on the chromosomes
- D the hair colour genes occurring in pairs on the homologous chromosomes

(1)

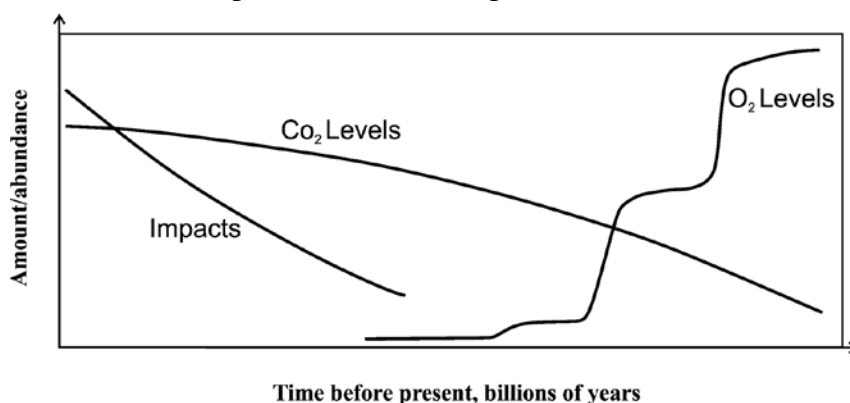
- 1.2.2 In DNA, which of the following determines the traits/characteristics of an organism?

- A The number of DNA molecules in a chromosome
- B The number of nucleotides in a DNA molecule
- C The sequence of nitrogen bases in a DNA molecule
- D The length of the chromosome on which the DNA is found

(1)

- 1.2.3 The graph below shows the relationship between asteroid impacts and some of the changes that have taken place in the Earth's atmosphere which resulted in the evolution of a great diversity of living organisms. The information in the graph is best explained by which of the following statements?

[An asteroid is a piece of rock from space]



- A Asteroid impacts and CO₂ levels increased at the same time
- B There is no relationship between asteroid impacts and the change in atmospheric CO₂ and O₂
- C A decline in asteroid impacts resulted in a decline in CO₂ and an increase in O₂ levels
- D The number of organisms on earth increased as O₂ levels increased

(2)

1.2.4 Which of the following is an example of convergent evolution?

- A The embryos of all vertebrates are similar in appearance and pass through a number of similar developmental stages
- B The same antifreeze proteins are found in different fish species from both the Arctic and the Antarctic Oceans
- C Ostriches and penguins arose from the same ancestral species and adapted to different habitats
- D Male dragonflies use special appendages to clasp females during copulation and therefore cannot mate with a female of a different species

(2)

1.3

Cystic fibrosis (CF) is one of the most common human genetic disorders caused by a recessive gene on chromosome number 7. In patients with CF, lubricating mucus in the lungs becomes thick and sticky and provides a breeding ground for microorganisms. This can cause frequent respiratory infections which damage the lungs. Cystic fibrosis is a chronic disease and adults with CF may only live into their thirties.

1.3.1 Complete the following genetic cross to show the possible genotypes of the children of two parents who are heterozygous (Bb) for cystic fibrosis. Write the correct genotypes into the blocks on the Punnett Square on the left OR complete the cross in the space provided on the right.

Normal gene = **B**

Cystic fibrosis gene = **b**

P₁: **Bb** **x** **Bb** **or:** P₁: **Bb** **x** **Bb**

Punnet diagram:

♀		
♂		

(6)

Probability of having a child with CF: _____

(1)

1.3.2 Explain why CF is not a sex-linked disease.

(1)

1.3.3 What percentage of the children could have the following phenotypes?

(a) unaffected individuals: _____

(b) carriers of the disease: _____

(2)

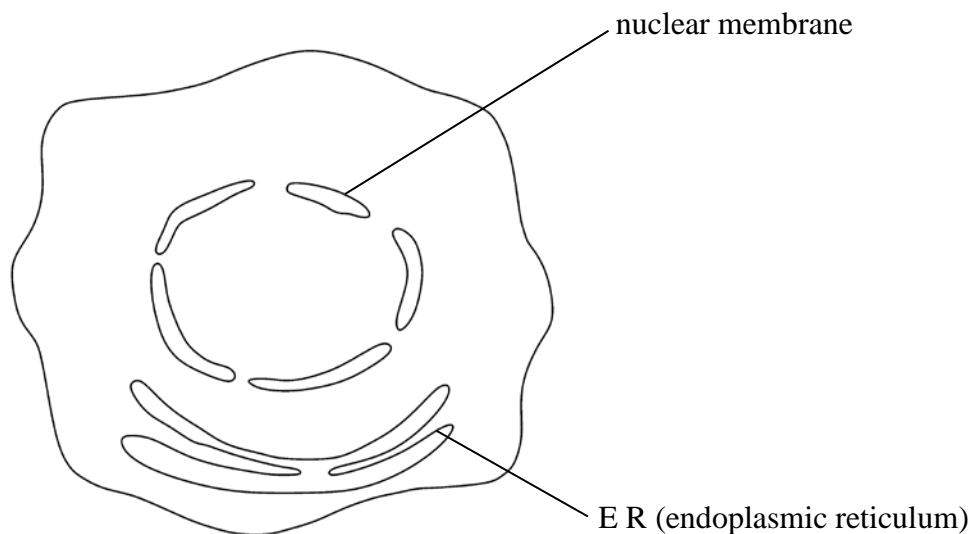
1.3.4 Read the following extract and use it to assist you in answering the following questions.

In the normal unaffected condition, a gene on chromosome 7 codes for a protein that allows salt to be transported across cell membranes. However, the mutated gene causes the protein to function abnormally on the surface of the cell membrane and salt cannot be transported correctly. This leads to dehydration and increased stickiness of mucus secretions in an affected person. Sufferers also excrete sweat that is more salty than normal.

The diagram below shows the outline of one of the cells which secrete mucus in a human with cystic fibrosis. Draw the following structures in the correct places on the diagram and label the structures:

- Labels:
1. Cystic fibrosis chromosome
 2. A gene on the chromosome
 3. An organelle where the protein is assembled
 4. A vacuole at the surface membrane of the cell

Annotate TWO of these labels with the function of the part.



(6)

1.3.5 List TWO symptoms of cystic fibrosis.

(2)

1.3.6 Briefly explain how the CF protein code would be transferred from the chromosome to the cytoplasm.

(3)

- 1.4 Jean-Baptiste Lamarck and Charles Darwin were both interested in the large variety of organisms that they observed in nature. They proposed different theories about the diversity of species.

Statements in the table below illustrate some of their ideas on the 'origin of species'.

If the statement applies to **Darwin only**, write **D** in the block next to it.

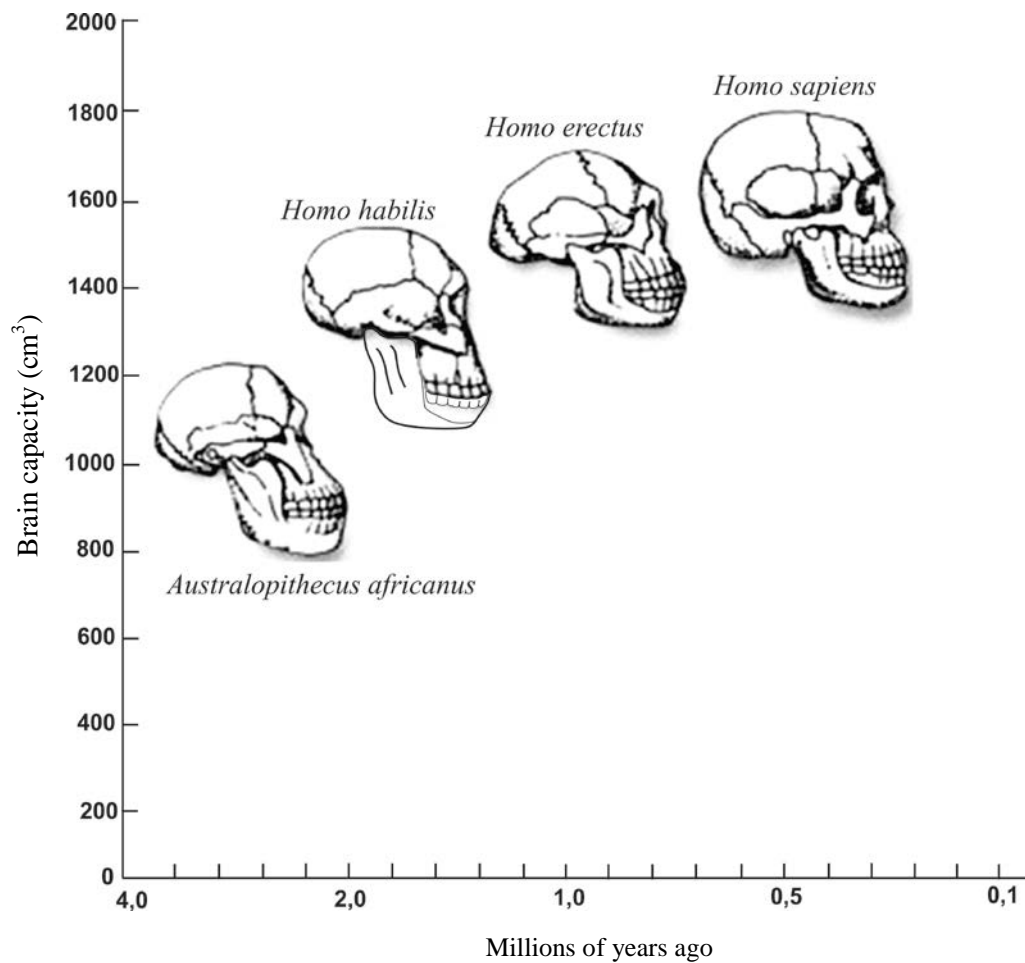
If the statement applies to **Lamarck only**, write **L** in the block next to it.

If the statement applies to both **Darwin and Lamarck**, write **D and L** in the block next to it.

Statement		L, D, or D and L
1.	All the members of a species display varying characteristics and over time their appearances change.	
2.	Only the fittest individuals with the most advantageous characteristics survive in a changing environment.	
3.	Species acquire better and more efficient body structures by their increased use, and pass on their acquired characteristics to their offspring.	
4.	An example of a species becoming more diverse is when bacteria become resistant to antibiotics, are able to survive and then pass on their resistance to their offspring.	

(4)

- 1.5 Study the graph below and then answer the question which follows. The skulls are drawn to scale.



List TWO facts about hominids that are illustrated by the graph and the skull diagrams.

1. _____
2. _____

(2)
[40]