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ST ALBAN'S COLLEGE

LIFE SCIENCES PAPER 1

ANSWER BOOKLET- QUESTION 1

Answer ALL questions for this section on the spaces provided on this answer booklet.

NAME: _____

QUESTION 1

- 1.1. Match the columns- write the LETTER from COLUMN C that corresponds to the description in COLUMN B. The letter can be written in COLUMN A.

COLUMN A	COLUMN B	COLUMN C
	1.1.1. Enzyme used to facilitate bonding of free DNA nucleotides	A. Immigration
	1.1.2. A factor which reduces population size	B. Bivalent
	1.1.3. The point of crossing over between homologous chromosomes	C. Polymerase
	1.1.4. A single trait which is controlled by many different genes at different loci	D. Watson & Crick
	1.1.5. Recorded first images of DNA using X-Ray Crystallography	E. Emigration
		F. Multiple Alleles
		G. Polygenic
		H. Chiasma
		I. Franklin
		J. Helicase

[5]

1.2. Multiple Choice- write the correct LETTER in the space provided in the table below:

1.2.1.	1.2.2.	1.2.3.	1.2.4.	1.2.5.

[5]

1.2.1. The human population pyramid below shows which type of population?

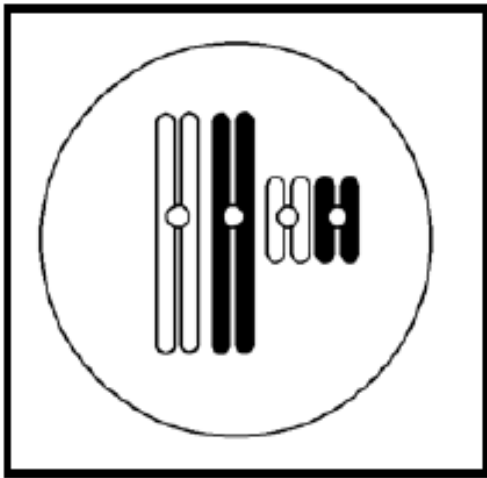


- A. Growing
- B. Stable
- C. Declining
- D. Slow Growing

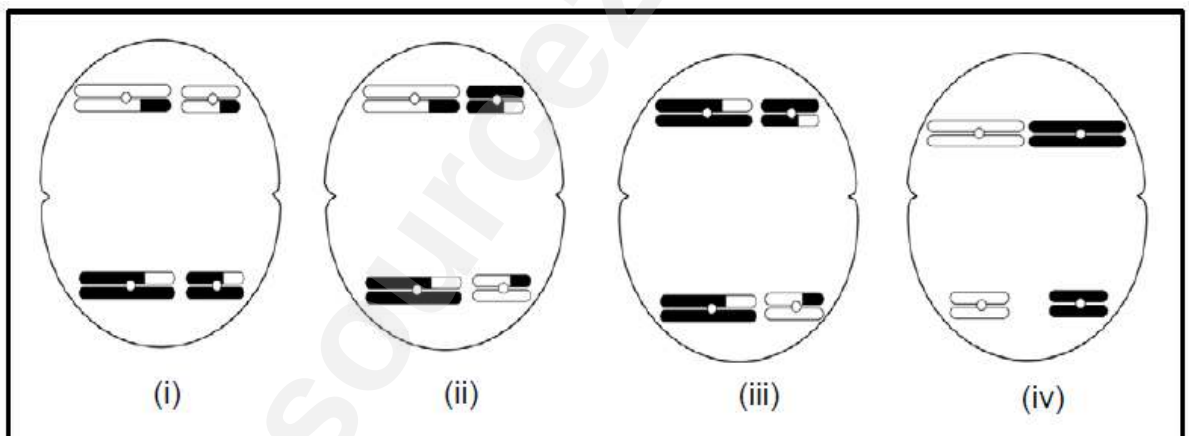
1.2.2. Which of the following is the starting point of evolution?

- A. Many different species in a community
- B. Competition for resources
- C. The strongest survive
- D. Variation within a population

1.2.3. The diagram below represents a cell during Prophase 1



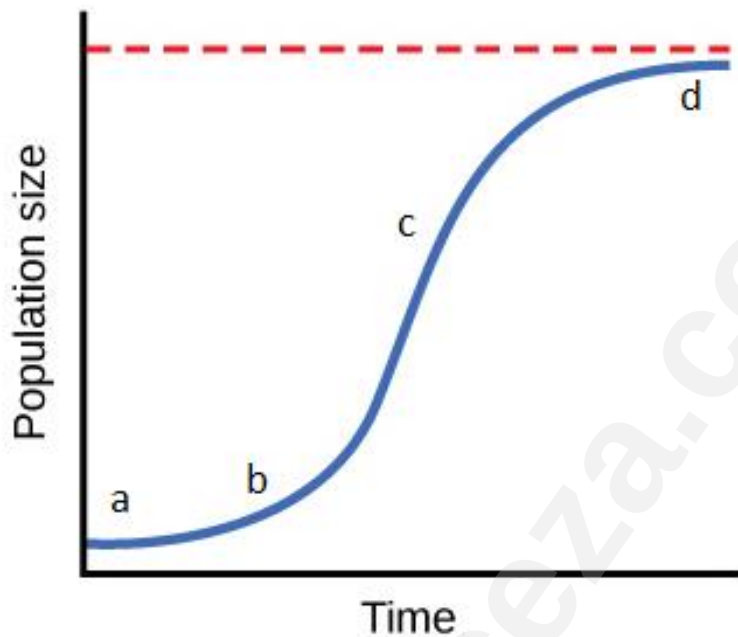
Various combinations of chromosome arrangements are given below:



Which diagrams are possible representations of chromosomes at the poles of the cells during Telophase 1 of meiosis?

- A. (iii) and (iv) only
- B. (i) and (ii) only
- C. (i) and (iii) only
- D. (i), (iii) and (iv) only

The following graph (showing the population growth of a certain species in a certain area) pertains to questions 1.2.4 and 1.2.5

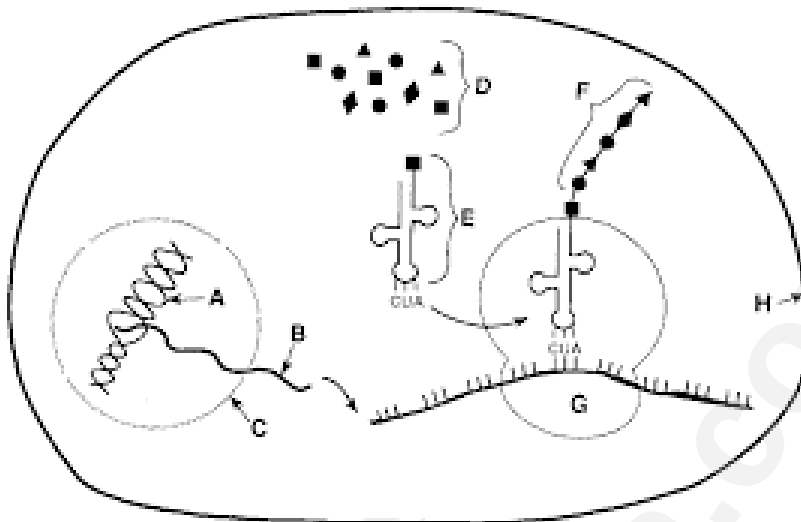


1.2.4. Part D on the graph is where...

- A. Natality equals mortality
- B. Mortality rate exceeds natality
- C. Emigration exceeds immigration
- D. Natality exceeds Emigration

1.2.5. Which letter on the graph indicates the point at which the natality rate is the highest?

1.3. Study the diagram below and answer the questions that follow.



1.3.1. Which process is being depicted in the diagram?

_____ (1)

1.3.2. Explain why the process above is of such importance to living organisms.

_____ (2)

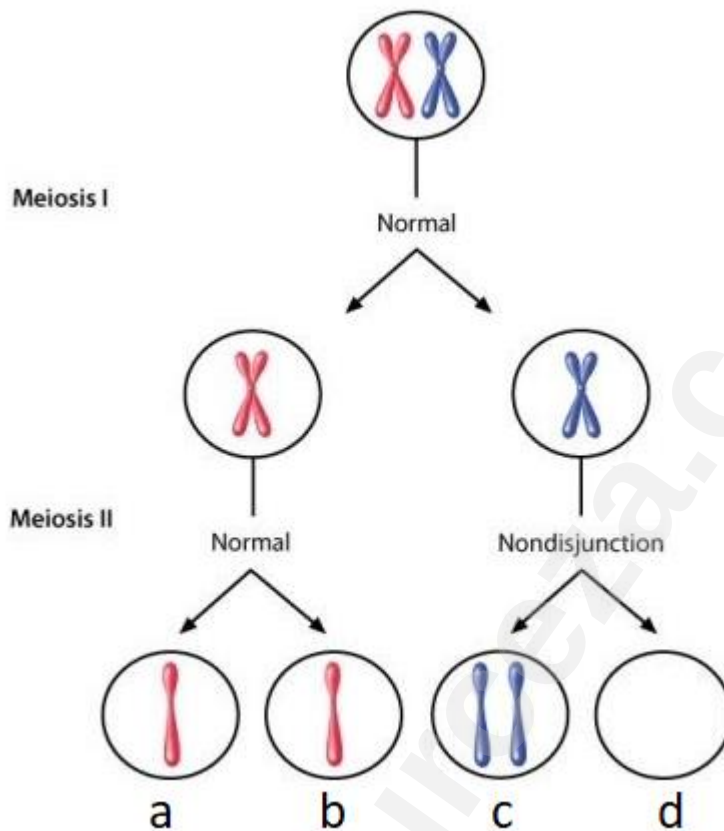
1.3.3. Complete the table below by naming labels A-H from the diagram on the previous page.

Letter	Label
A	
B	
C	
D	
E	
F	
G	
H	

(8)

[11]

- 1.4. The image below demonstrates what happens when there is an abnormality in the process of meiosis.



Adapted from www.bioexplorer.net

- 1.4.1. Define the term “meiosis”. In your definition you are required to describe what the products of meiosis are. (3)

- 1.4.2. Briefly describe what has gone wrong in the diagram of meiosis above. (2)

- 1.4.3. Looking at the image, what percentage of the gametes formed are abnormal? (1)

- 1.4.4. Assuming the image above refers to **human meiosis**, write down the **number** of chromosomes that the gametes a,c and d will contain. (3)

Gamete a: _____

Gamete c: _____

Gamete d: _____

- 1.4.5. A large contributor to the abnormal meiosis shown in the image is the **maternal age effect**. Briefly explain what this term means. (2)

- 1.4.6. Assuming that the meiosis diagram above takes place in a female and the chromosome pair represents the gonosome pair, what would the result be if...

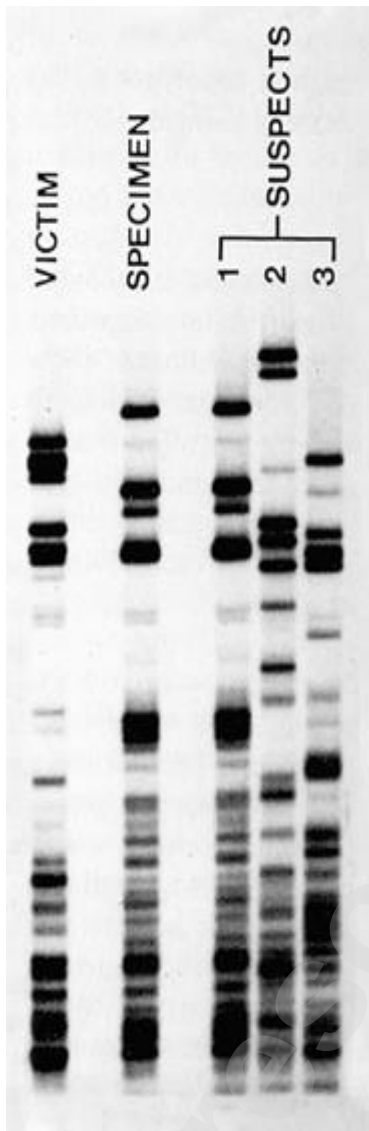
a. Gamete B was fertilised by a sperm containing a Y chromosome? (2)

b. Gamete C was fertilised by a sperm containing a Y chromosome? (2)

c. Gamete D was fertilised by a sperm containing an X chromosome? (2)

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- 1.5. An ongoing murder case had a breakthrough when trace amounts of DNA were found on the scene. DNA from the three suspects and victim were analysed and compared. The comparison is seen below:



1.5.1. What is the name of process used to obtain the pattern comparison alongside? (1)

1.5.2. Which process would be used to amplify the trace amounts of DNA in order to be able to test it? (1)

1.5.3. Why was the Victim's DNA also analysed? (2)

1.5.4. Which one of the suspects is most likely the perpetrator? (1)

1.5.5. Is the evidence seen alongside enough to convict the suspect identified in 1.5.4.? Substantiate your answer. (2)

www.berkley.edu

[7]

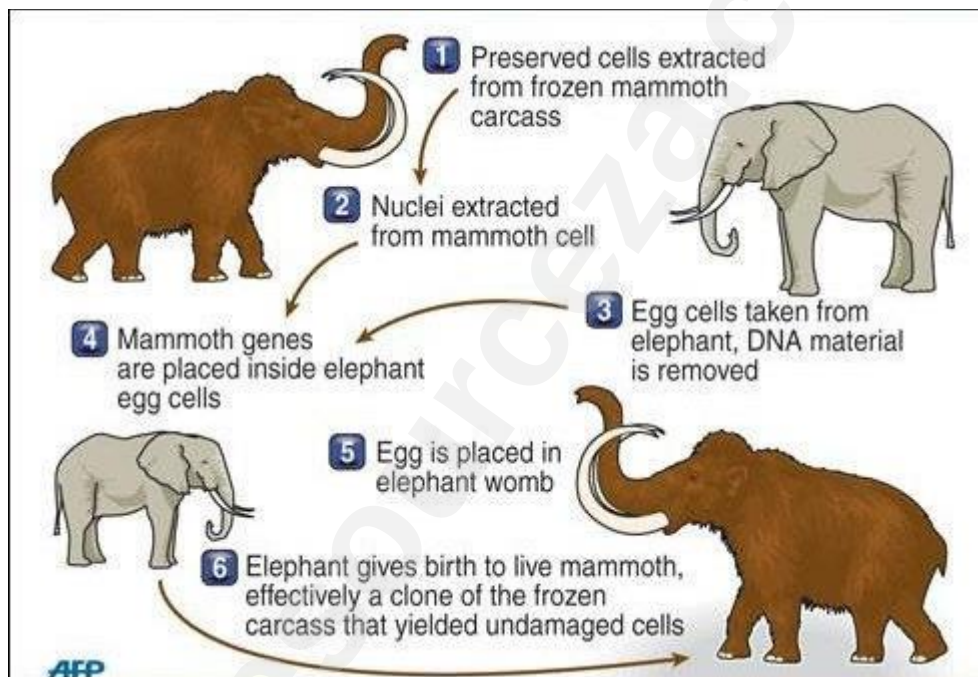
- 1.6. In the year 2013, a Woolly Mammoth was found in a remote part of Siberia. The Mammoth was perfectly frozen and preserved. Since then, scientists have been asking many questions. These questions include the following:

Has the DNA of the mammoth been preserved well enough to analyse the complete genome?

Would it be possible to clone the Woolly Mammoth?

Would it be ethical to clone to Woolly Mammoth?

The image below shows the proposed process of cloning the woolly mammoth:



www.factsanddetails.com

- 1.6.1. Using the context above, define the term “clone”. (2)

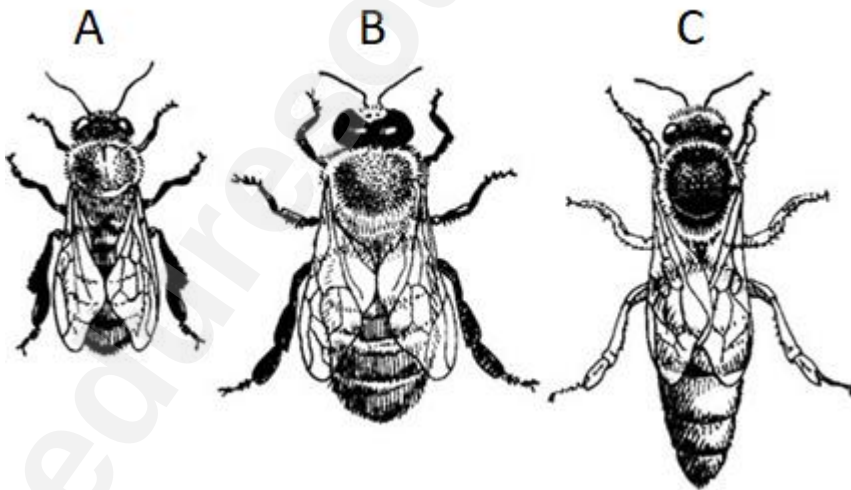
- 1.6.2. How much of the “parent” elephant’s DNA will be passed on to the Woolly Mammoth clone? Explain your answer. (2)

- 1.6.3. List **two** reasons why cloning the Woolly Mammoth poses ethical issues. (2)

- 1.6.4. Provide **one** reason why cloning the Woolly Mammoth would be beneficial. (1)

[7]

- 1.7. The image below shows three different types of bees that can be found in a beehive. Each type of bee plays a vital role in the survival of the hive. The worker bee is the smallest bee- it is a female who maintains the hive and helps to look after the young bee larvae. Worker bees also collect pollen and have stings. The Queen is the largest bee in the hive. Her job is to lay eggs. Drones are males, and are all haploid. They are “fatherless” bees as their single set of chromosomes come from their mother. Drones mate with the queen bee, and die shortly after a mating cycle. Drones have no stings nor do they collect pollen. If a drone does not mate with the queen, it will be evicted from the hive and left to freeze or starve.



www.brittanica.com

- 1.7.1. Identify the bees A, B and C.

A: _____ B: _____

C: _____ (3)

- 1.7.2. What is the term given to a group of organisms such as bees and termites that have different groups of individuals with different jobs to fulfil?

_____ (1)

- 1.7.3. Drones are “fatherless bees”. Explain **in your own words** how this is possible. (2)

- 1.7.4. Drones are haploid. Define the term haploid. (1)

- 1.7.5. Calculate the actual length of the queen bee if the image has been magnified 2,5 times. Draw a line to indicate your measurement. Show all your calculations. (4)

[11]

- 1.8. Hummingbirds are very unique and interesting birds. They are well known for their small size and ability to hover in one place whilst feeding. They have a variety of adaptations to assist them in fulfilling their own unique ecological niche:



- Their long & thin beaks make it easy to probe into the neck of the flower for food
- Hummingbirds have fewer tail feathers than other birds- to reduce their body weight
- Their wings are narrow and tapered, allowing them to beat fast and furiously for hours on end
- They have very high energy needs- they often eat food with a mass of 1,5 to 3 times their body weight per day!

Adapted from www.sciencenordic.com

- 1.8.1. What is the reason for the hummingbird's high energy needs? (1)

- 1.8.2. **Darwin** and **Lamarck** would each have their own unique way of explaining how the hummingbird has its own unique traits. Choose **one** of the traits bulleted above (underneath the image of the bird) and describe how each of the evolutionists would explain how it came about. (3 x 2= 6)

DARWIN: _____

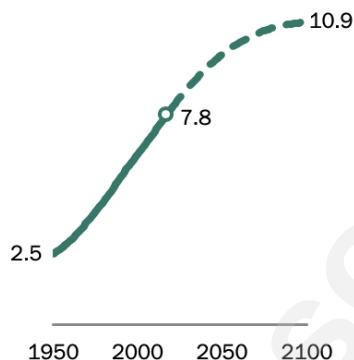
LAMARCK: _____

[7]

- 1.9. The data below shows the growth of the human population over the last few decades, as well as the predicted growth pattern for future decades.

World population growth is projected to flatten in coming decades

World population, in billions



Note: Data labels shown for 1950, 2020 and 2100.

Source: United Nations Department of Economic and Social Affairs, Population Division, "World Population Prospects 2019."

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- 1.9.1. Is the data provided in the image credible? Substantiate your answer. (2)

- 1.9.2. List **three** factors that led to the rapid population growth between 1950 and 2000. (3)

- 1.9.3. The human census is a means of collecting information about the numbers, ages and demographics of people in a country. The data is used for a variety of things. Describe **two** ways in which the census information might assist the South African Government. (2)

- 1.9.4. The South African Census may not yield accurate results. Describe **two** limitations that the census may have. (2)

- 1.9.5. Give **one** reason why the world population is predicted to flatten in the coming decades. (1)

[10]

QUESTION 1 TOTAL [80]