GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

2019

10832

LIFE SCIENCES

PAPER 2

TIME: 2½ hours

MARKS: 150

18 pages

LIFE SCIENCES: Paper 2

10832E

X10

P.T.O.

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(Paper 2)

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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 the answers to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. Do ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, tables or flow charts only when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You must use a non-programmable calculator, protractor and a compass, where necessary.
11. Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A – D) next to the question number (1.1.1 – 1.1.9) in your ANSWER BOOK, for example 1.1.10 D.

1.1.1 Below is a list of fossils discovered in South Africa.

(i) Mrs Ples
(ii) Taung child
(iii) Little foot
(iv) Karabo

Which ONE of the following combinations of fossils is classified in the genus *Australopithecus*?

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

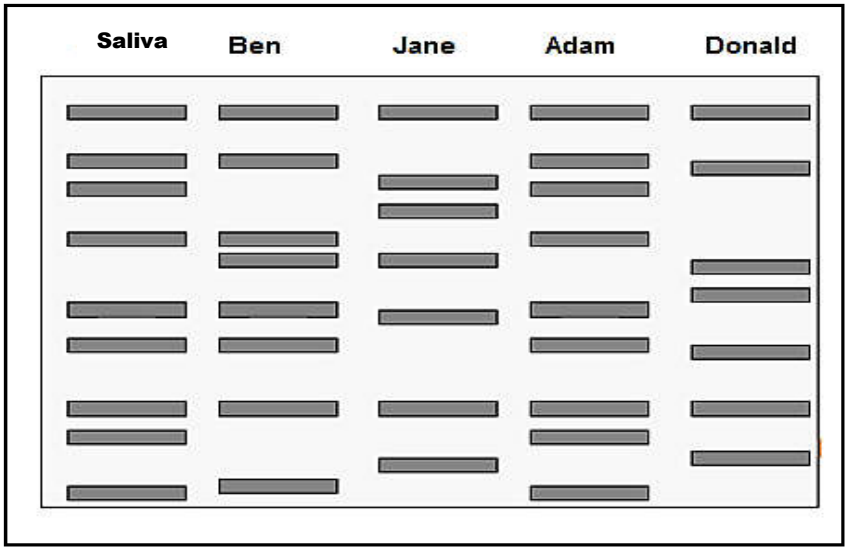
1.1.2 During cloning, a nucleus is taken from a somatic cell and introduced into …

A a sperm cell.
B an ovum.
C a zygote.
D another somatic cell.

1.1.3 A man who has haemophilia …

A has inherited a recessive allele from his father.
B has inherited a dominant allele from his mother.
C can pass a recessive allele to his daughter.
D can pass a dominant allele to his daughter.

1.1.4 A freshly smoked cigarette was found near the body of a murdered woman. Forensic specialists made a DNA profile from traces of saliva (not belonging to the murdered victim) found on the cigarette. Four suspects were required to give DNA samples to forensic officers and the following profiles were made:



Who is most likely the murderer?

A Ben
B Jane
C Adam
D Donald

1.1.5 Which ONE of the following indicates where the DNA molecule is likely to separate during DNA replication?

A Cytosine and guanine
B Phosphate ions and deoxyribose
C Ribose and adenine
D Ribose and thymine

1.1.6 An autosomal genetic disorder is caused by a dominant allele **R**.

Consider the following crosses.

(i) rr x Rr
(ii) rr x RR
(iii) Rr x Rr
(iv) Rr x RR

Which ONE of the following combinations of crosses can result in offspring without the disorder?

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

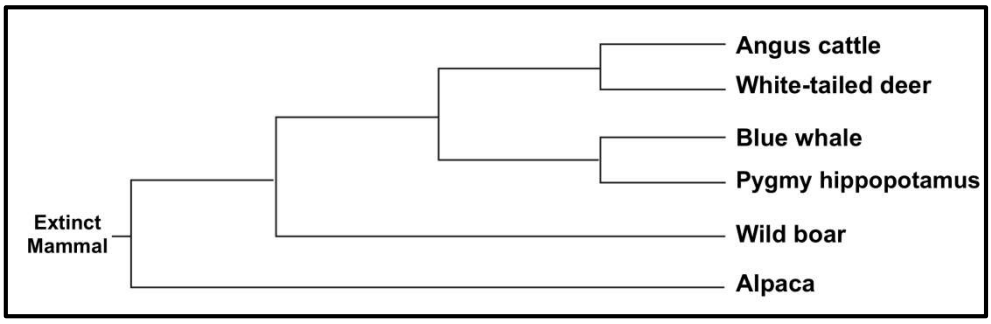
1.1.7 Studies of four excavation sites in the same general region of Africa yielded the following data on primate fossils.

Primate skeleton number	**Cranial size (cm^3)**	**Relative length of arms and legs**
I	290	arms longer than legs
II	1 300	arms shorter than legs
III	600	arms same length as legs
IV	1 000	arms shorter than legs

Which TWO individuals are probably bipedal?

A I and II.
B I and III.
C I and IV.
D II and IV.

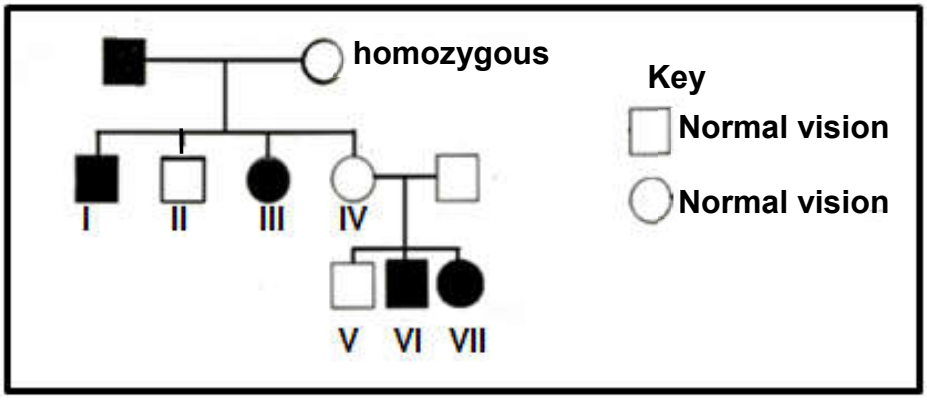
1.1.8 Study the phylogenetic tree below.



Which two species are LEAST related?

A Pygmy hippopotamus and blue whale
B White-tailed deer and wild boar
C Blue whale and white-tailed deer
D Alpaca and blue whale

1.1.9 Study the pedigree diagram below which shows the inheritance of colour-blindness caused by a recessive allele in humans.



Which offspring show the INCORRECT representation of the inherited trait?

A I, II and III
B I, IV and V
C I, III and VII
D I, II, III, VI and VII (9 x 2) **(18)**

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 – 1.2.8) in the ANSWER BOOK.

1.2.1 More than two alleles for the same gene

1.2.2 A section of DNA that carries the code for a particular trait

1.2.3 A genetic cross in which both alleles are expressed equally in the phenotype

1.2.4 Cells that can differentiate into many other cell types

1.2.5 A process by which genetically identical organisms are formed using biotechnology

1.2.6 Organelle outside the nucleus of animal cells that contain DNA

1.2.7 A genotype having two non-identical alleles for a trait

1.2.8 A mapping of the exact position of all the genes in all the chromosomes within a cell

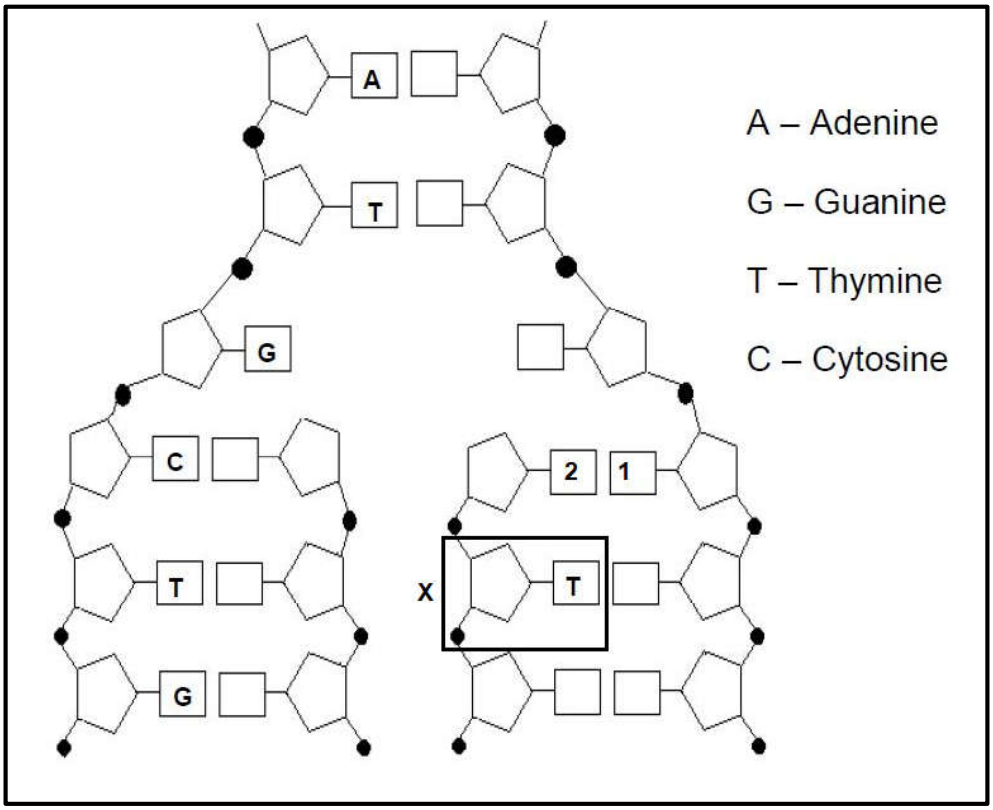
(8 x 1) **(8)**

1.3 Indicate whether each of the descriptions in COLUMN I apply to **A ONLY, B ONLY, BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only, B only, both A and B** or **none** next to the question number (1.3.1 – 1.3.3) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 Contains uracil	A: DNA B: RNA
1.3.2 Cause of Down syndrome	A: Gene mutation B: Extra copy of chromosome number 23
1.3.3 An allele for one gene could appear in the same gamete with any of the alleles of another gene	A: Dihybrid cross B: Mendel's law of independent assortment

(3 x 2) **(6)**

1.4 The diagram below represents a process involving DNA.



1.4.1 Identify the process illustrated in the diagram above. (1)

1.4.2 Identify the monomer **X.** (1)

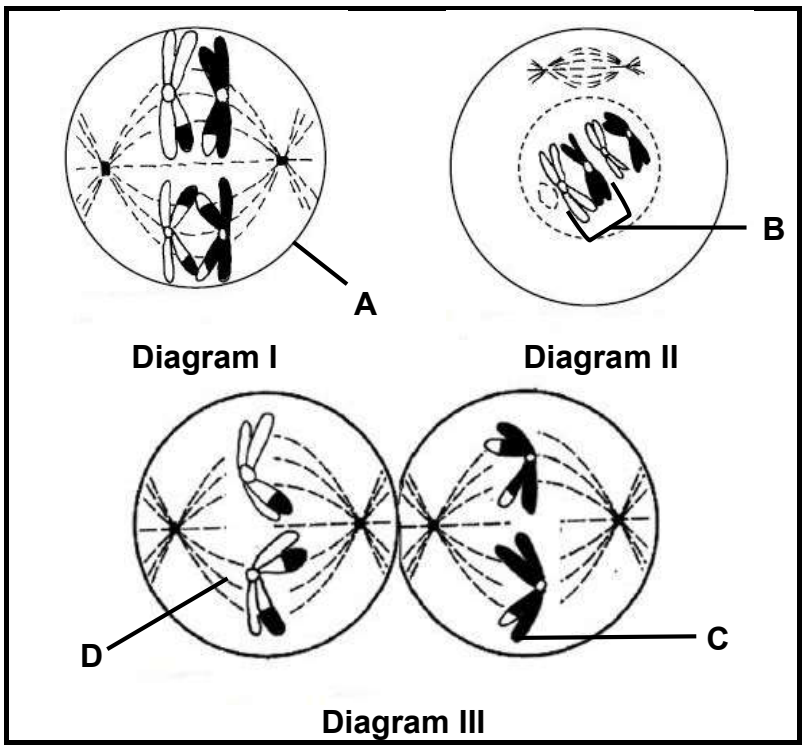
1.4.3 Using the key provided, give the names for **1** and **2** respectively. (2)

1.4.4 What is the natural shape of the molecule represented? (1)

1.4.5 Name the type of bond that is formed between **1** and **2**. (1)
(6)

.

1.5 The diagram below shows different phases of meiosis in an organism.



1.5.1 Provide labels for **A**, **B** and **D**, respectively. (3)

1.5.2 Give TWO observable reasons why chromosomes **B** above are regarded as *homologous*. (2)

1.5.3 Identify the phases shown in Diagrams **I**, **II** and **III,** respectively. (3)

1.5.4 Give a reason for identifying the phase in Diagram **III**. (2)

1.5.5 Identify TWO events in meiosis that contribute to genetic variation. (2)
(12)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Study the DNA base triplets **1**, **2** and **3** below.

Base triplet 1	Base triplet 2	Base triplet 3
GTC	**AAG**	**CCT**

The table below shows the RNA codons that code for different amino acids.

CODON	AMINO ACID
UUC	Phenylalanine
AUC	Isoleucine
AAU	Asparagine
GAA	Glutamic acid
GUA	Valine
CAG	Glutamine
CAU	Histidine
GGA	Glycine

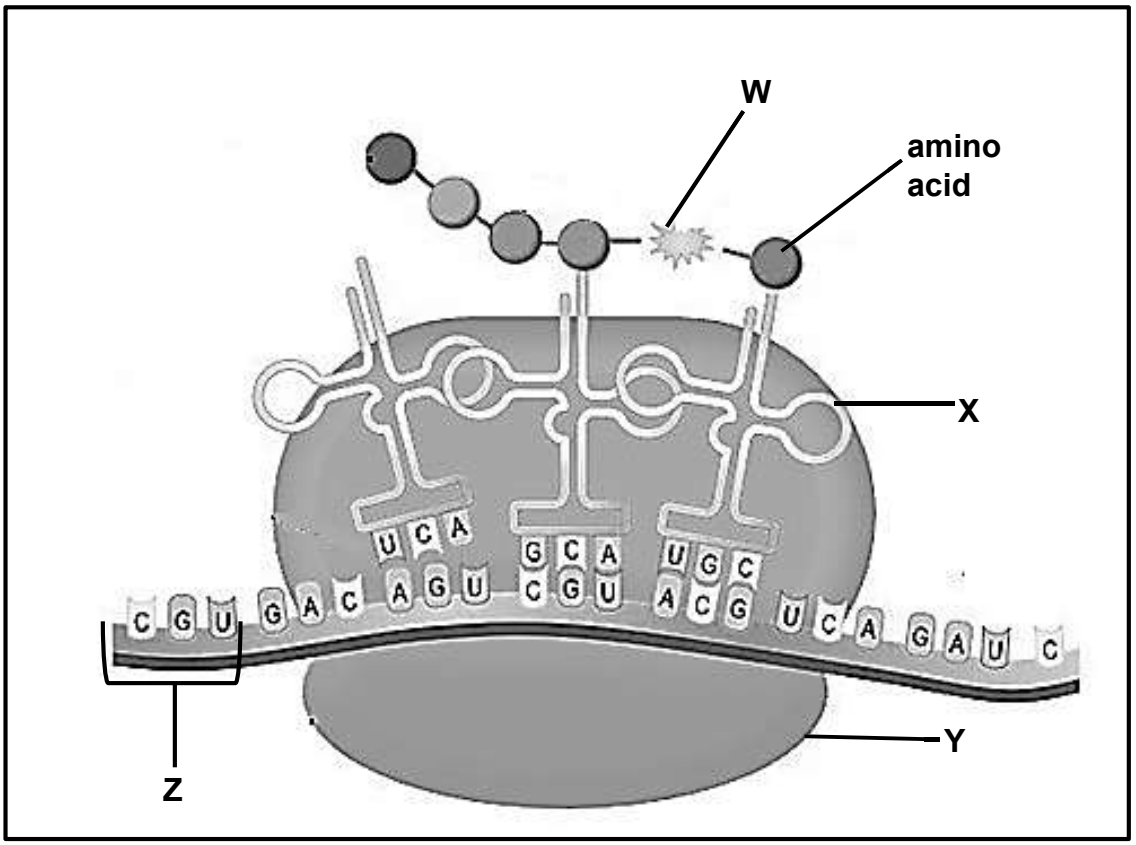
2.1.1 Write down the three bases of the DNA base triplet that codes for glycine. (1)

2.1.2 In base triplet 2 the **first** adenine was replaced by **T** as a result of a mutation.

Describe how this mutation will affect the protein that will be formed. (3)

2.1.3 State TWO ways in which the events of transcription in protein synthesis are different from that of DNA replication. (2 x 2) (4)
(8)

2.2 The diagram below illustrates the process of translation in protein synthesis.



Identify:

2.2.1 The bond formed at **W** (1)

2.2.2 Structure **X** (1)

2.2.3 The anticodon that matches with **Z** (1)

2.2.4 Organelle **Y** (1)
(4)

2.3 A set of triplets, two of which were known to be genetically identical, were separated at birth and brought up under very different circumstances. At the age of 23 the following data was recorded.

Trait	Tom	Dick	Harry
Height (cm)	188	180	188
Weight (kg)	72	87	87
Blood Type	O	AB	O
IQ (measure of intelligence)	138	142	125

2.3.1 Which two boys are genetically identical? (1)

2.3.2 Give a reason for your answer to Question 2.3.1. (1)

2.3.3 If the three boys were reunited and were attempting to locate their parents, what would be the only possible blood types of each of their parents? (2)
(4)

2.4 In an experiment, rats with white coats (**W**) were crossed with rats with black coats (**B**). The F_1 were **all** grey.

2.4.1 What type of dominance is shown in the genetic cross above? (1)

2.4.2 If the grey offspring were interbred, use a genetic cross to determine the genotypes and phenotypic ratio of their offspring. (6)
(7)

2.5 For flower colour in sweet-pea plants, the allele **(A)** for purple flowers is dominant over the allele **(a)** for white flowers.

For the shape of the pollen grains, the allele **(B)** for long pollen grains is dominant over the allele **(b)** for round pollen grains.

Plant **X** with the genotype **AABb** was crossed with plant **Y** that had white flowers and round pollen grains.

2.5.1 Identify the phenotype of plant **X**. (1)

2.5.2 Write down all the possible gametes of plant **Y**. (2)

2.5.3 Write down all the expected phenotypes of the offspring in a cross between plant **X** and **Y**. (2)
(5)

2.6 The table below shows the mass gain of two babies during an investigation on the type of milk used for feeding the babies until they were one year old. One was fed on milk from a genetically modified cow and the other on milk from a normal cow. Both babies were two months old and had the same mass at the beginning of the study.

Time (months)	Mass of babies (kilograms)	
	Milk source from genetically modified cows	Milk source from normal cows
2	4,0	4,0
4	6,7	5,8
6	9,0	8,0
8	12,0	10,5
10	14,0	11,0
12	15,8	11,5

[Adapted from *Woman's Weekly* 2009]

2.6.1 Identify:

(a) ONE independent variable (1)

(b) The dependent variable (1)

2.6.2 Identify ONE factor that was kept constant in this investigation. (1)

2.6.3 Calculate the percentage increase in mass over the period of the investigation, for the baby fed on genetically modified milk. Show all calculations. (3)

2.6.4 Draw a bar graph to show the trend in mass gain of both babies, from ages 2 – 8 months. (6)
(12)
[40]

QUESTION 3

3.1 There are different explanations for evolution.

3.1.1 Describe the TWO laws used by Lamarck to explain evolution. (4)

3.1.2 Describe punctuated equilibrium. (4)

3.1.3 Darwin explained evolution through natural selection.

Tabulate TWO differences between artificial selection and natural selection. (5)
(13)

3.2 Read the following extract following a survey done by naturalist Colin Donihue on the effects of hurricane Irma on the populations of an endemic species of lizard on two islands in the West Indies.

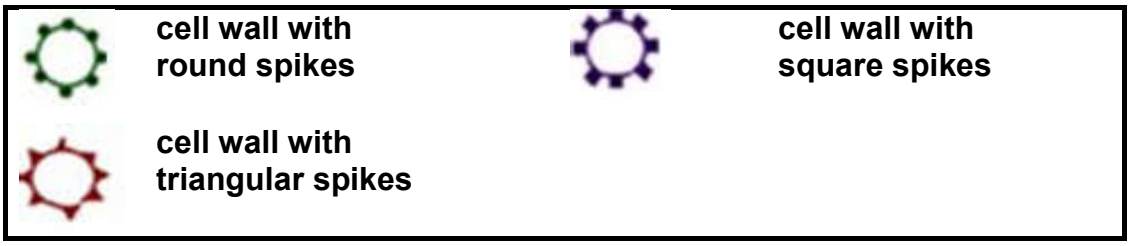
> Colin and his team visited the islands after hurricane Irma had struck. They captured as many as possible of the endemic lizards, *Anolis scriptus*.
>
> The captured lizards all had the following features: Bigger toepads, longer arms and shorter hind legs. The first two observations made sense as these were known to increase clinging ability in *Anolis* but the third did not. Wouldn't longer hind legs cling to vegetation better? – So why did more lizards with shorter hind legs survive? Colin realized that the longer hind legs of the lizards, once they lost their grip on a branch, acted as 'sails', catching the wind, and thus carrying the lizard away into the sea.

3.2.1 What is the scientific name of the lizard that was studied? (1)

3.2.2 Give TWO characteristics that were favourable for the survival of the lizard. (2)

3.2.3 Explain ONE characteristic that was unfavourable for the survival of the lizard. (2)
(5)

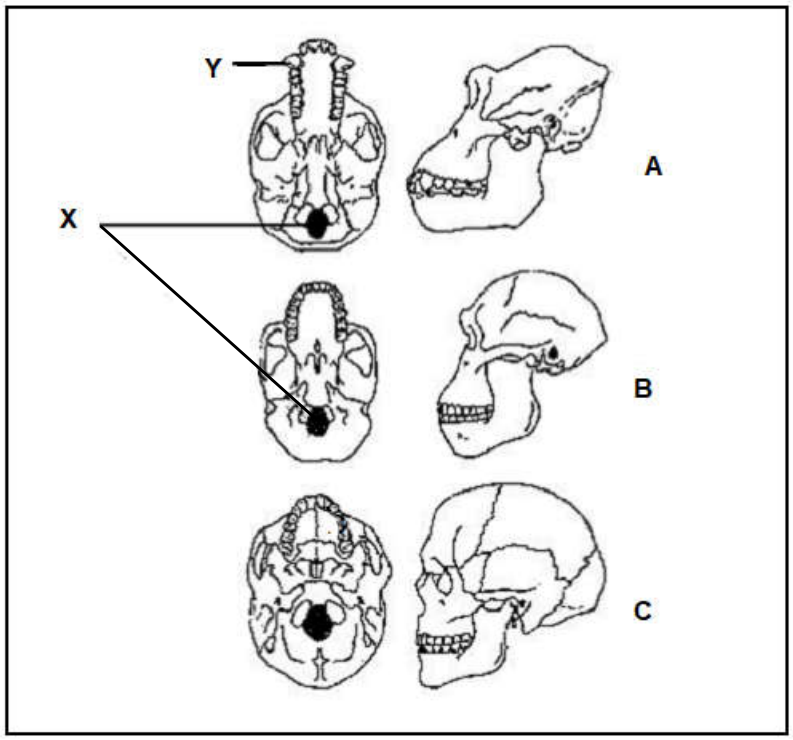
3.3 As a result of a mutation, bacteria with three varieties of cell wall exist as shown below.



An antibiotic destroys the bacteria by binding with it. The antibiotic has two binding sites, one triangular and the other square.

Use Darwin's theory of evolution through natural selection to explain why the bacteria with round spikes on their cell walls will increase in proportion in future generations. **(6)**

3.4 The diagram below shows the skulls of three organisms.



3.4.1 Label part **X** and the type of teeth at **Y.** (2)

3.4.2 Explain the significance of the location of structure **X** in organism **C**. (3)

3.4.3 Which of the skulls (**A**, **B** or **C**) belongs to:

(a) An australopithecine (1)

(b) A quadripedal primate (1)

3.4.4 Explain how the change in the skull from **B** to **C** could indicate a change in intelligence. (3)

3.4.5 Describe the significance of the shape of each of the following as a trend in human evolution:

(a) Spine (2)

(b) Shape of the pelvis (2)

3.4.6 Describe the significance of *Homo erectus* to the 'Out of Africa' hypothesis. (2)
(16)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

The formation of new species contributes to an increase in biodiversity.

Describe how speciation occurs through geographic isolation and describe FOUR reproductive isolating mechanisms that keep species separate.

Content: (17)
Synthesis: (3)
[20]

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

TOTAL SECTION C: 20

TOTAL: 150

END