basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

NOVEMBER 2015 (2)

MARKS: 150

TIME: 2½ hours

This question paper consists of 15 pages.

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. ALL drawings must be done in pencil and labelled 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 to D) next to the question number (1.1.1 to 1.1.8) in the ANSWER BOOK, for example 1.1.9 D.

1.1.1 In a monohybrid cross, the genotype of all the F_1-plants is Aa. If the F_1-plants are crossed, what percentage of the F_2-generation will have the dominant phenotype?

A 25
B 50
C 75
D 100

1.1.2 How many alleles control the human blood group?

A 4
B 3
C 2
D 1

1.1.3 Mendel hypothesised that reproductive cells have only one factor for each inherited characteristic. This hypothesis is supported by the observation that …

A haploid cells are produced by mitosis.
B diploid cells are produced by mitosis.
C haploid cells are produced by meiosis.
D diploid cells are produced by meiosis.

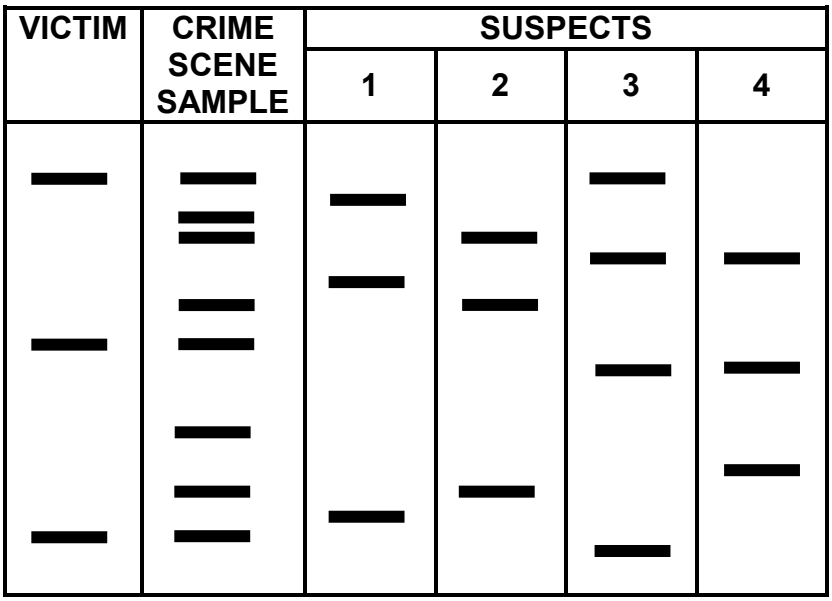
1.1.4 Artificial selection in farm animals over many generations has produced changes. These changes are mostly due to ...

` A random mating.
B gene mutations in each generation.
C improved traits for survival.
D breeding of selected animals.

1.1.5 Which ONE of the following is most likely the chromosome complement of a person with Down syndrome?

A 46 and XX
B 46 and XY
C 45 and XX
D 44 and XY

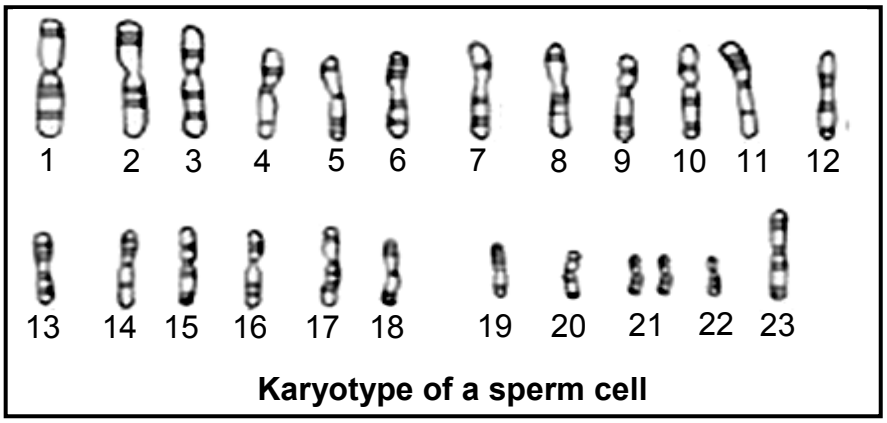
1.1.6 A person was seriously injured during a fight. Samples of blood were taken from the injured man (victim) and the crime scene. These samples were compared with blood samples collected from four people (**1** to **4**) suspected of injuring the man. The results are shown below.



Which ONE of the suspects was definitely at the crime scene?

A 1
B 2
C 3
D 4

1.1.7 The diagram below represents the chromosomes from a sperm cell.



Karyotype of a sperm cell

According to the karyotype, how many autosomes are present in the sperm cell?

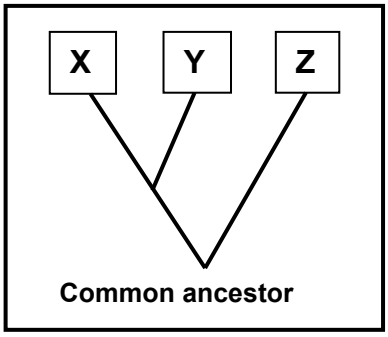
A 21
B 22
C 23
D 24

1.1.8 DNA analyses were done on three related species of fish (**X**, **Y** and **Z**). The number of differences is recorded in the table below. The more differences, the less related the species.

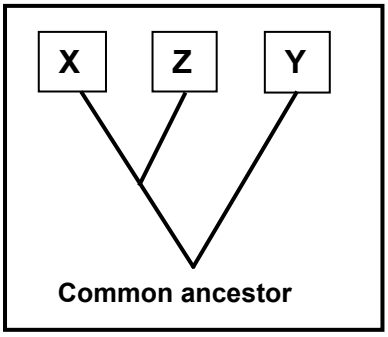
NUMBER OF DIFFERENCES IN DNA		
	Species Y	**Species Z**
Species X	11	3
Species Y	-	10

Based on this evidence, which phylogenetic tree best represents the evolutionary relationship amongst these three species?

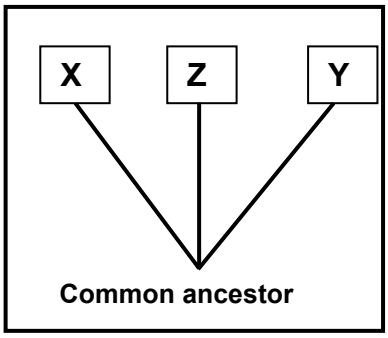
A



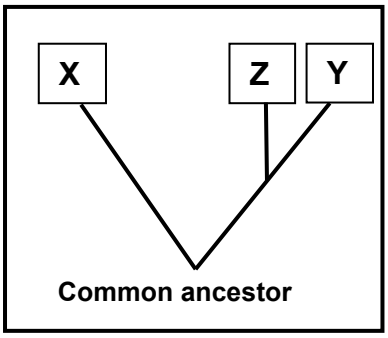
B



C



D



(8 x 2) **(16)**

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 to 1.2.8) in the ANSWER BOOK.

1.2.1 A nucleic acid that carries amino acids to the ribosome for protein synthesis

1.2.2 The natural shape of a DNA molecule

1.2.3 A section of a DNA molecule that codes for a specific protein

1.2.4 Evolution with long periods of no change followed by short periods of rapid change

1.2.5 The sex chromosomes in an organism

1.2.6 The production of genetically identical organisms from an adult organism by using biotechnology

1.2.7 The physical or functional expression of a gene

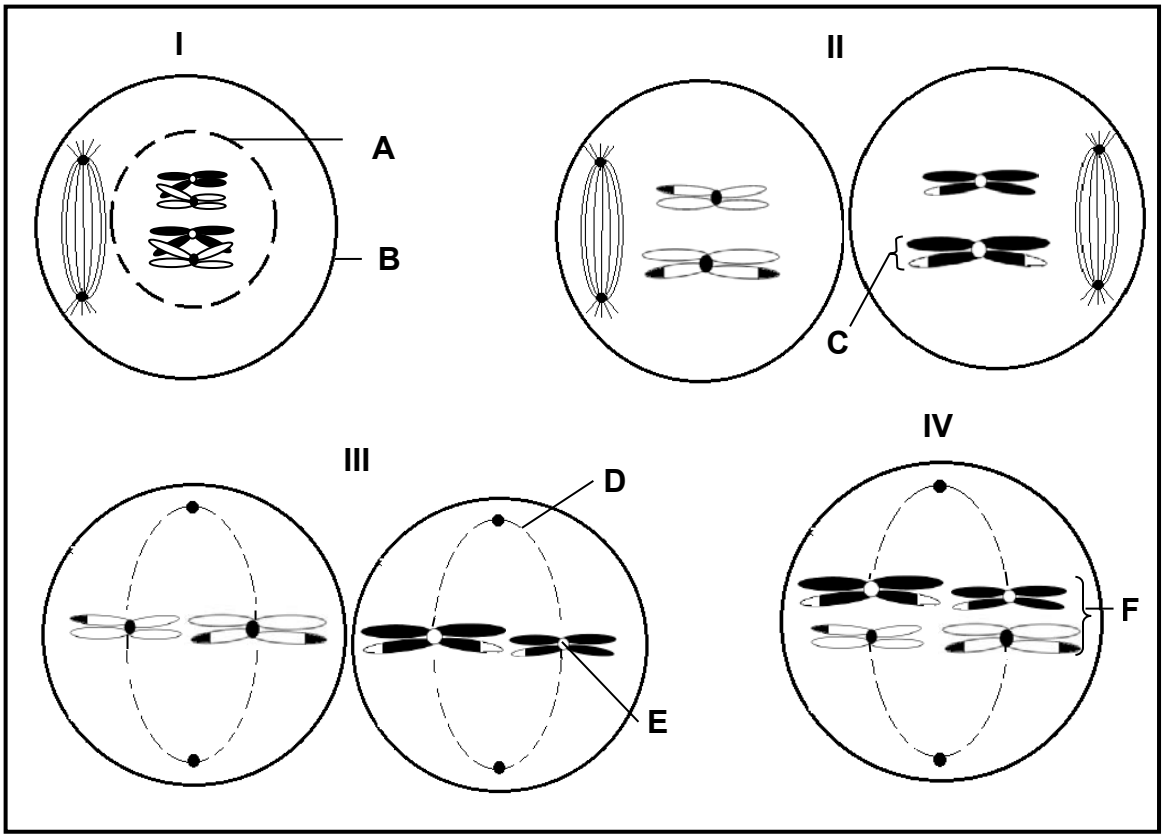
1.2.8 Descent with modification over time (8 x 1) **(8)**

1.3 Indicate whether each of the statements in COLUMN I applies 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 to 1.3.4) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 The location of DNA in the cell	A: Nucleus B: Ribosome
1.3.2 A sex-linked genetic disorder	A: Haemophilia B: Colour-blindness
1.3.3 Source of variation	A: Fertilisation B: Cloning
1.3.4 Used as evidence for the 'Out of Africa' hypothesis	A: Fossils B: Mitochondrial DNA

(4 x 2) **(8)**

1.4 The diagrams below show an animal cell in the various stages of meiosis in the incorrect order.



1.4.1 Provide labels for structures **A**, **B**, **C** and **F**. (4)

1.4.2 Give the NUMBER of the diagram (**I** to **IV**) which represents cells:

(a) Where crossing over occurs (1)

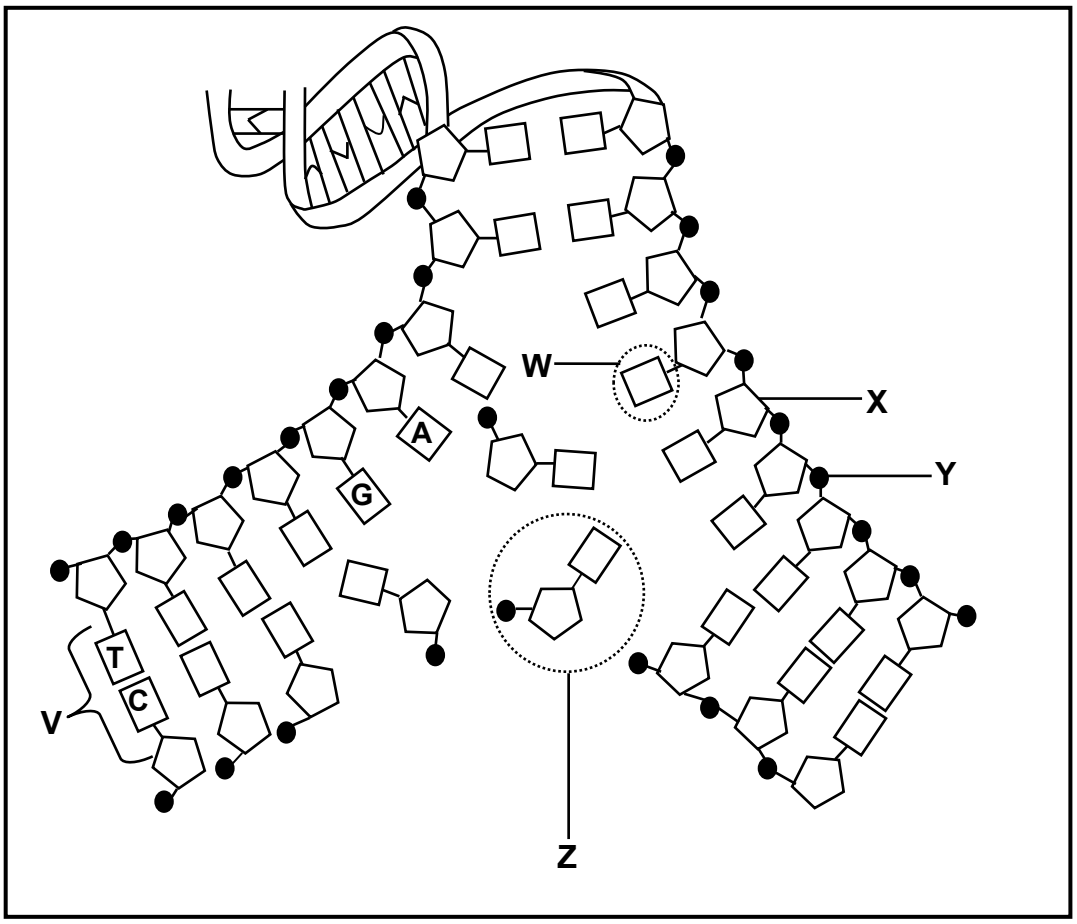
(b) That are haploid (1)

1.4.3 Give the LETTER and NAME of the structure that:

(a) Is produced from the centrioles (2)

(b) Holds two chromatids together (2)
(10)

1.5 The diagram below represents DNA replication.



1.5.1 Identify:

(a) **X** (1)

(b) **Z** (1)

1.5.2 Give TWO reasons why DNA replication is important in cells. (2)

1.5.3 During what phase of the cell cycle does DNA replication take place? (1)

1.5.4 Identify the nitrogenous base, labelled **W**, in the diagram. (1)

1.5.5 Describe the type of error at **V** on the diagram. (2)
(8)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The explanation for evolution by Lamarck is not accepted today.

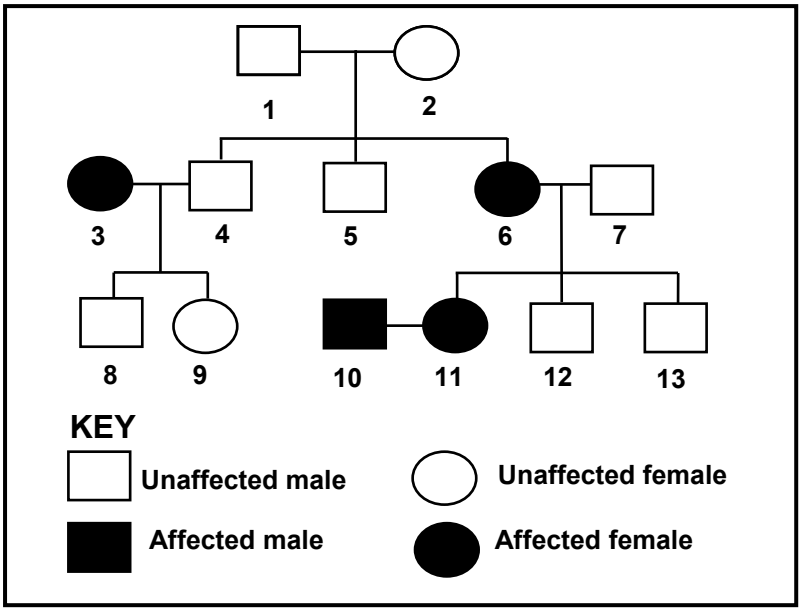
2.1.1 Describe how Lamarck explained evolution. (4)

2.1.2 Give TWO reasons for the rejection of Lamarck's theory. (2)

2.1.3 Differentiate between a *hypothesis* and a *theory*. (2)
(8)

2.2 A genetic disorder, phenylketonuria (PKU), is caused by a recessive allele (**n**).

An individual with the disorder is described as affected and an individual without it is described as unaffected. The pedigree diagram below illustrates inheritance of this disorder in a family.



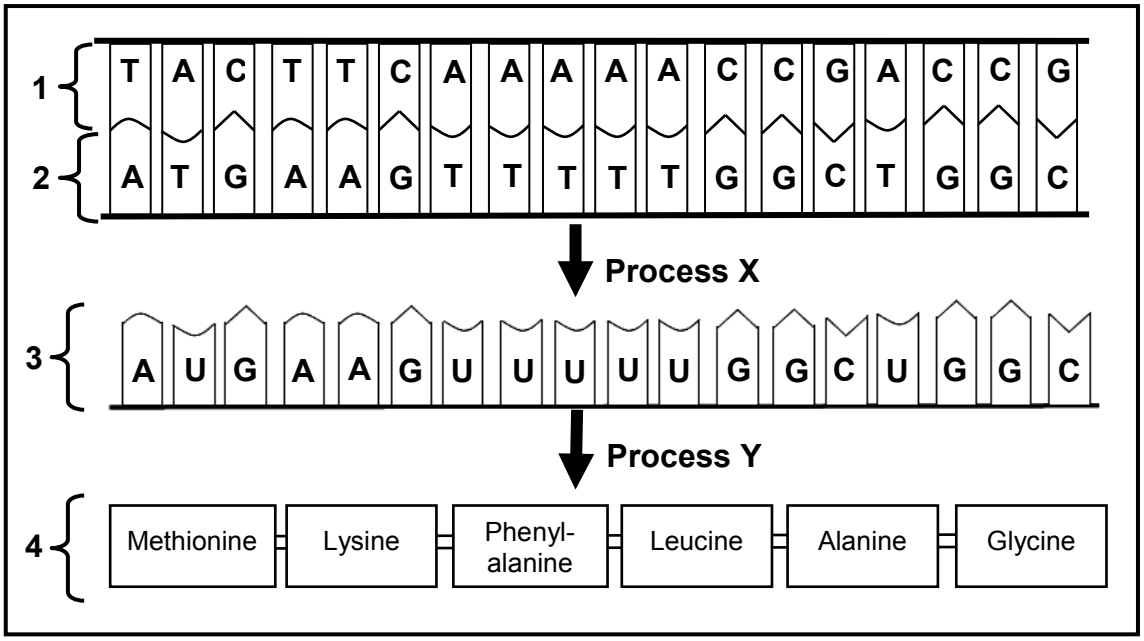
2.2.1 Give the possible genotype(s) of individual **4**. (2)

2.2.2 How many individuals in the second generation (individuals **3** to **7**) are homozygous recessive? (1)

2.2.3 Give the NUMBER only of any TWO individuals in the third generation (individuals **8** to **13**) that are heterozygous. (2)

2.2.4 Using information from the pedigree diagram above, explain why the allele for PKU cannot be sex-linked. (3)
(8)

2.3 The diagram below represents protein synthesis.



2.3.1 Which strand (**1** or **2**) is the coding strand for process **X**? (1)

2.3.2 Identify:

(a) Molecule **3** (1)

(b) Molecule **4** (1)

2.3.3 Give the:

(a) Codon for alanine (1)

(b) Anticodon for lysine (1)

(c) DNA base triplet for leucine (1)

2.3.4 Name the cell organelle where process **Y** takes place. (1)

2.3.5 Give the name of process **Y**. (1)

2.3.6 Describe the process represented by **X**. (5)
(13)

2.4 In guinea pigs the allele for a black coat colour (**B**) is dominant over the allele for a white coat colour (**b**). The allele for a rough coat texture (**R**) is dominant over the allele for a smooth coat texture (**r**).

A male guinea pig which is homozygous dominant for coat colour and heterozygous for coat texture was mated with a white female guinea pig that is heterozygous for coat texture.

2.4.1 How many characteristics of the guinea pigs are being investigated? (1)

2.4.2 Give the possible gametes of the female guinea pig. (2)

2.4.3 Two of the offspring of the F_1-generation were crossed. The genotypes of their offspring are represented in the Punnett square below, except at **(i)** and **(ii)**.

	BR	**Br**	**bR**	**br**
Br	BBRr	BBrr	BbRr	**(i)**
br	BbRr	Bbrr	**(ii)**	bbrr

Give the:

(a) Genotype of the offspring at **(i)** (1)

(b) Phenotype of the offspring at **(ii)** (1)

(c) Phenotypic ratio of all the offspring (2)

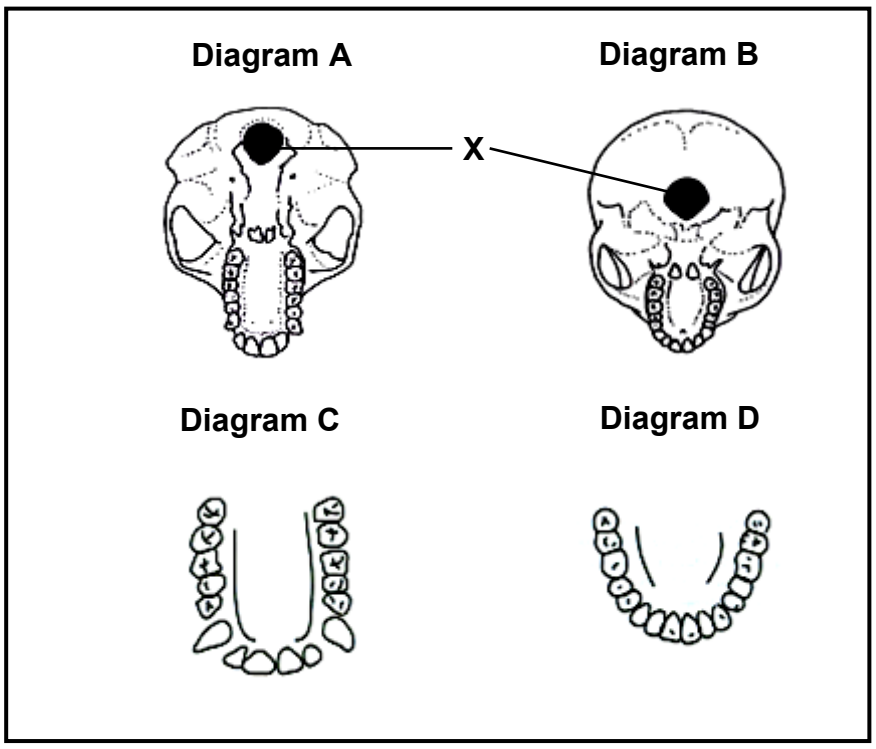
2.4.4 The parents in QUESTION 2.4.3 produced 64 offspring during their lifetime. How many of them would have had black, rough coats? Show ALL working. (2)

2.4.5 The owner of a pet shop would like to breed white guinea pigs with a smooth coat texture. In order to do this, he wants to breed a female that has a white, smooth coat with a male that has a black, rough coat.

State what the genotype of the male should be for him to breed white guinea pigs with smooth coats. (2)
(11)
[40]

QUESTION 3

3.1 Study the diagrams below showing the different anatomical structures of a chimpanzee and a human. The diagrams are not drawn to scale.



3.1.1 Provide a label for **X**. (1)

3.1.2 Tabulate TWO anatomical differences between the jaws in diagrams **C** and **D** which represent trends in human evolution. (5)

3.1.3 Give the LETTER ONLY of the diagram that represents:

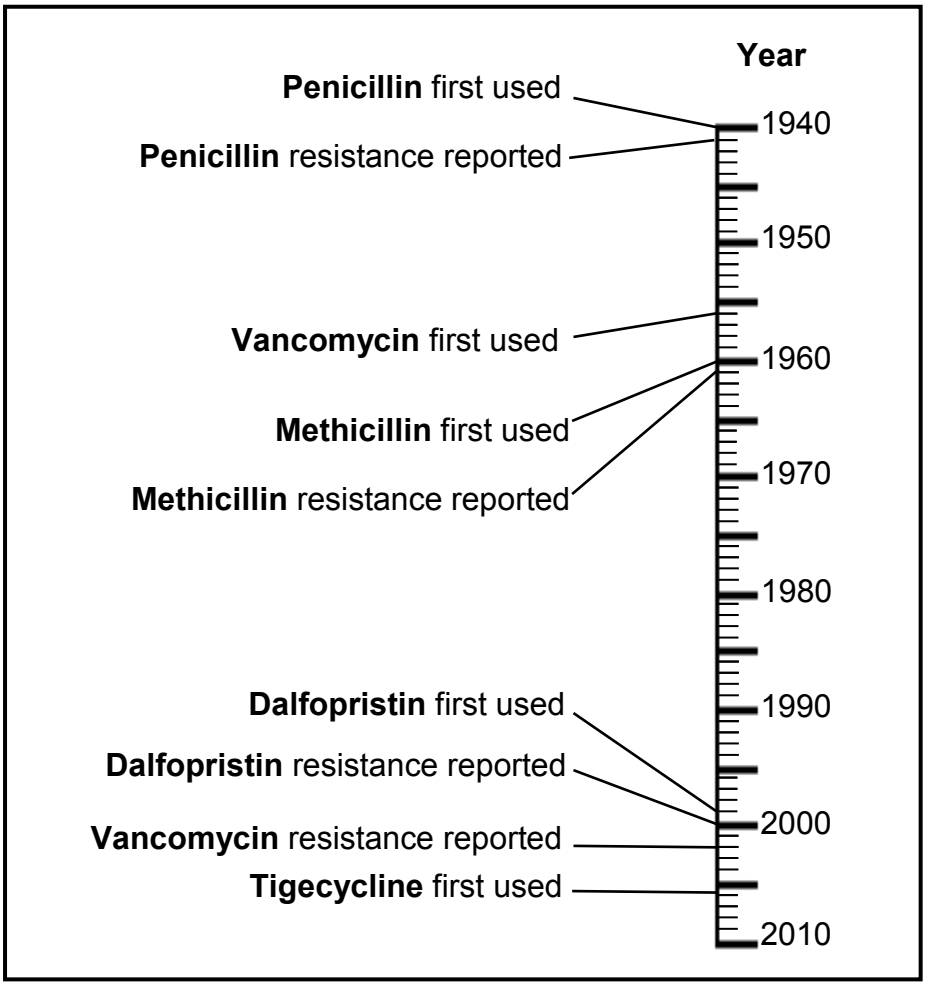
(a) The skull with a larger brain capacity (1)

(b) A more prognathous skull (1)

3.1.4 Account for the position of **X** in the skull in diagram **B**. (2)

3.1.5 Explain the significance of the shape of the spine that is associated with the skull in diagram **B**. (2)
(12)

3.2 The diagram below represents a timeline for the introduction and use of antibiotics and the development of resistance to these antibiotics by bacteria. The names of the antibiotics are shown in bold print.



[Adapted from http://.pbs.org]

3.2.1 How long did it take on average for resistance to penicillin, methicillin and dalfopristin to develop? (1)

3.2.2 Which antibiotic remained effective against bacteria for the longest period of time? (1)

3.2.3 Suggest ONE possible reason why the antibiotic named in QUESTION 3.2.2 remained effective for much longer than the other antibiotics. (1)

3.2.4 Explain how some bacteria have developed resistance to antibiotics. (6)
(9)

3.3 Learners conducted an investigation to determine to which blood group most learners in their school belong.

They recorded the blood groups of 120 learners from each grade. The results are shown in the table below.

GRADE	NUMBER OF LEARNERS IN EACH BLOOD GROUP			
	A	**B**	**AB**	**O**
8	20	30	16	54
9	36	24	28	32
10	35	5	15	65
11	50	20	15	35
12	24	26	28	42

3.3.1 Formulate a hypothesis for this investigation. (2)

3.3.2 State TWO planning steps that should be considered before undertaking this investigation. (2)

3.3.3 Draw a bar graph, illustrating the blood group distribution of Grade 11 learners. (6)

3.3.4 Using the information from the table, write a suitable conclusion for this investigation. (2)

3.3.5 Explain why blood group **O** occurs normally more frequently in a population. (3)
(15)

3.4 Read the extract below and answer the questions that follow.

> In spring, frogs usually migrate to their breeding sites at night. Some frogs have a light-coloured skin and others have a dark-coloured skin. Frogs are preyed on by birds, snakes and other predators. The birds and snakes follow the frogs, catching and eating some.
>
> [Adapted from http://www.ehow.com]

3.4.1 Identify ONE sentence in this passage which describes variation among the frogs. (1)

3.4.2 Which of the frogs have the most 'suitable' characteristic for survival? (1)

3.4.3 Give a reason for the characteristic named in QUESTION 3.4.2. (2)
(4)
[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 tables, flow charts or diagrams.

TOTAL SECTION C: 20
GRAND TOTAL: 150