basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P1

FEBRUARY/MARCH 2014

MARKS: 150

TIME: 2½ hours

LIFE SCIENCES: Paper 1 (NEW CONTENT)
1083E

10831E

This question paper consists of 16 pages.

X05

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GAUTENG

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 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, a protractor and a compass where necessary.
11. Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various options are given 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 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 A gradual change in the structure of organisms over time is known as ...

A evolution.
B a mutation.
C protein synthesis.
D natural selection.

1.1.2 The following are statements relating to evolution:

(i) Artificial selection and metamorphosis show how evolution in organisms may have occurred.
(ii) There are similarities among various organisms.
(iii) Use or disuse of an organ results in it being modified.
(iv) All life forms develop from simple forms.

Which combination of statements relates to ideas on evolution proposed by Erasmus Darwin?

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

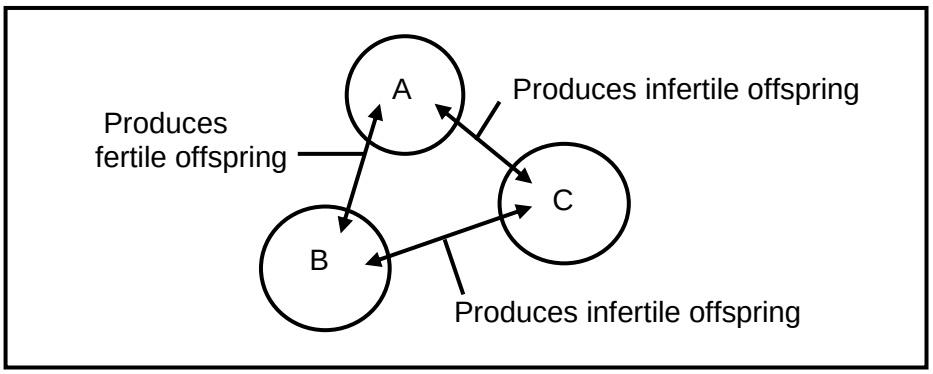
1.1.3 Which ONE of the following is the result of artificial selection?

A DDT resistance in mosquitoes
B Decreasing effect of antibiotics on bacteria
C Increased milk yield in dairy cattle
D Peppered moths not being detected by predators

1.1.4 Which of the following represents ONE advantage and ONE disadvantage of genetic engineering in developing desirable products?

	Advantage	Disadvantage
A	Increased rate of production	Cost of development is high
B	Cost of development is high	Possible release of the GMO into the environment
C	Increased range of products	Increased rate of production
D	Increased rate of production	Increased range of products

1.1.5 The diagram below shows the fertility of the offspring produced when three populations of mice, **A**, **B** and **C**, interbreed.



Which ONE of the following statements about populations **A**, **B** and **C** is the CORRECT interpretation of the information in the diagram above?

A All three populations are of the same species.
B Populations A and C are of the same species, but populations A and B are different species.
C Populations B and C are different species, but populations A and B are of the same species.
D Populations A and B are different species, but populations B and C are of the same species.

1.1.6 In humans the allele for blood group A is dominant to the allele for blood group O. Two parents both have blood group A. Their child has blood group O.

What is the best explanation of this pattern of inheritance?

A The child has inherited the blood group directly from a grandparent.
B The parents are homozygous for the blood group alleles.
C The parents are heterozygous for the blood group alleles.
D There has been a mutation in the blood group alleles.

1.1.7 In an investigation it was found that 10% of the bases in a molecule of DNA were thymine. What was the ratio of thymine to guanine in the same molecule?

A 1 : 2
B 1 : 3
C 1 : 1
D 1 : 4

1.1.8 After observing a certain phenomenon a scientist can formulate a/an ...

A theory.
B hypothesis.
C fact.
D law.

1.1.9 Genes in organisms can be manipulated by human beings in order to produce useful substances. One example of a useful substance produced in this way is the human protein insulin, which is used to treat diabetes.

Which ONE of the following accurately describes how human insulin can be produced and used to treat diabetes?

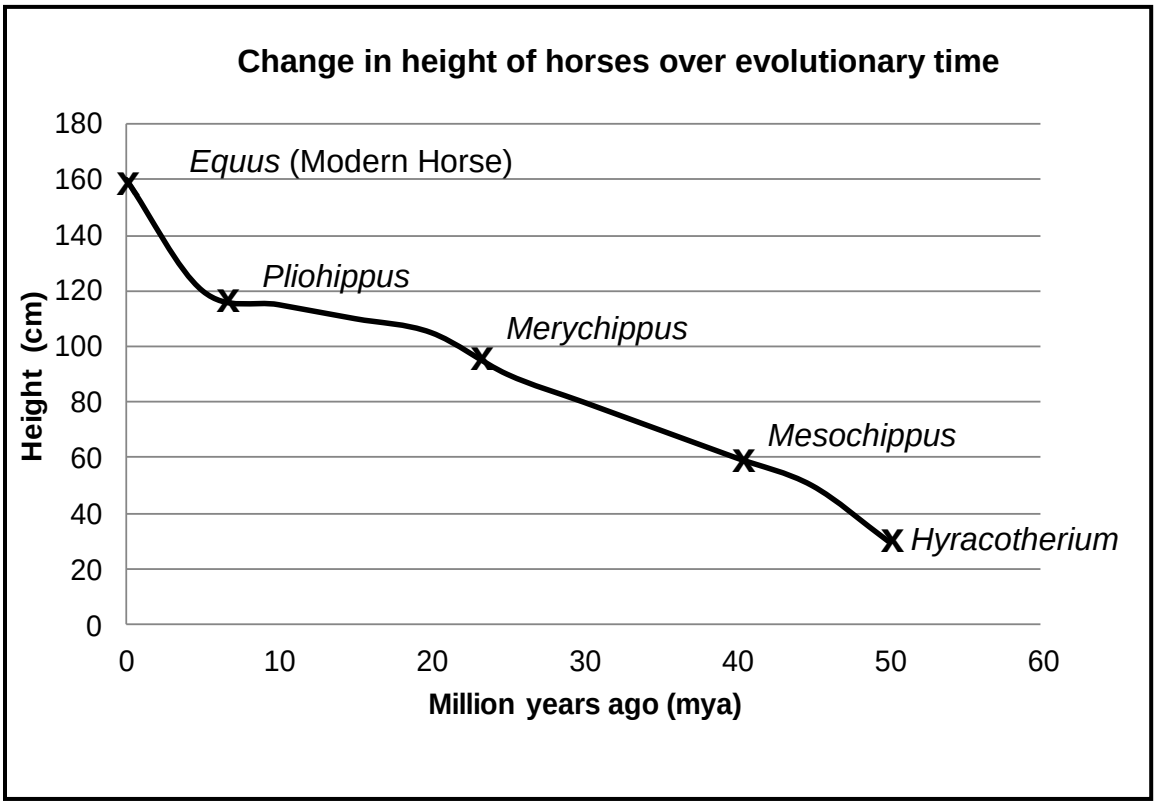
A Take insulin from bacteria and place it in a human being, thus enabling the human being to produce insulin.

B Take insulin genes from bacteria and place them in a human being, thus enabling the human being to produce insulin.

C Take insulin genes from a human being and place them in bacteria. Use the insulin produced by the bacteria to treat diabetes.

D Take insulin from a human being and grow it in bacteria. Use the insulin produced by the bacteria to treat diabetes.

1.1.10 The graph below shows the changes in the height of horses over evolutionary time.



[Adapted from *Biology*, Jones and Jones, 1993]

What can be reasonably concluded from the graph above?

A The increase in height was caused by climatic change.
B The height of the horse varied over time.
C *Mesochippus* was taller than *Merychippus.*
D In 100 years' time, the horse will be significantly taller than horses today. (10 x 2) **(20)**

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 An inherited disease that affects haemoglobin and changes the shape of red blood corpuscles

1.2.2 The genetic make-up of an organism in respect of the alleles it possesses

1.2.3 The complete disappearance of a species from Earth

1.2.4 The full complement of genes present in an organism

1.2.5 The ability of an organism to walk on two feet

1.2.6 The chromosome complement/condition of a body cell which contains two sets of chromosomes

1.2.7 The point at which chromatids of homologous chromosomes cross over during meiosis

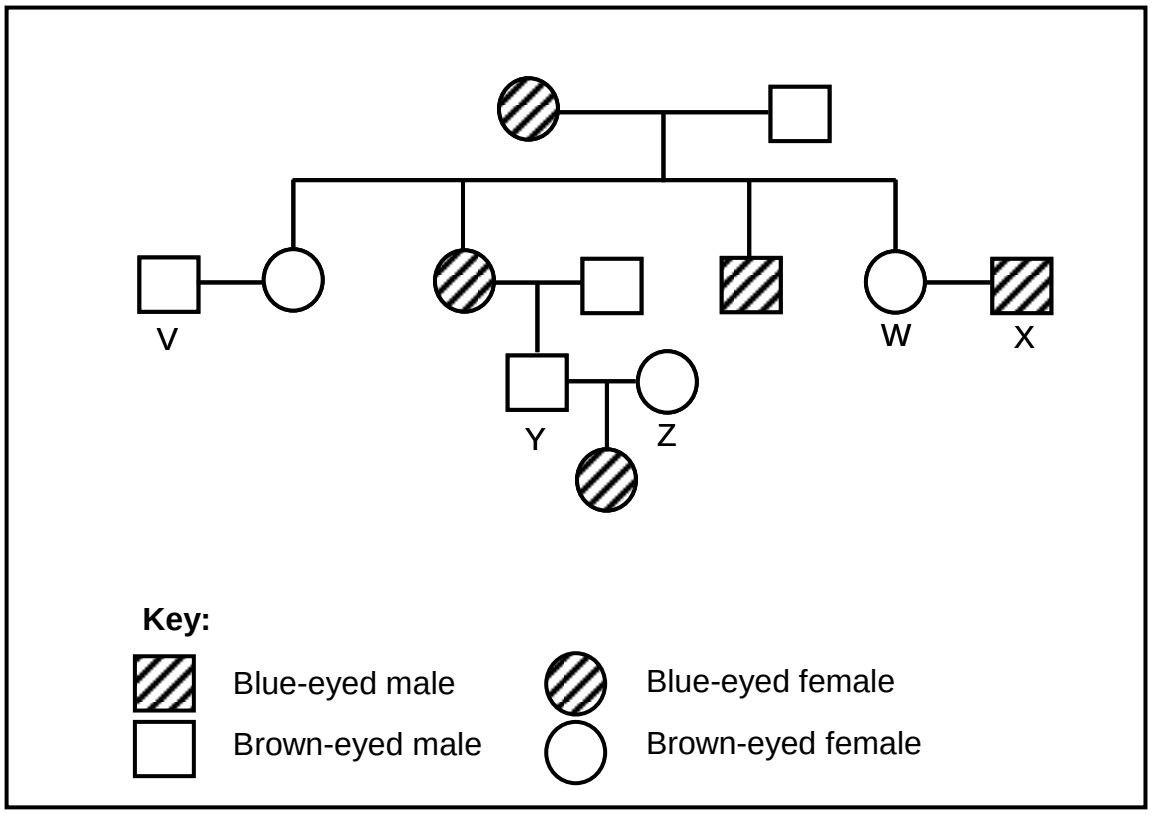
1.2.8 A visual representation of an organism's chromosomes **(8)**

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 1.3.8) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	Characteristics are inherited from the parents by the offspring	A: B:	Lamarck's observation Darwin's observation
1.3.2	Causes of variation during meiosis	A: B:	Random fertilisation Random mating
1.3.3	Provides evidence for common ancestry	A: B:	Homologous structures Analogous structures
1.3.4	Book published by Darwin	A: B:	*HMS Beagle* *On the Origin of Species*
1.3.5	Reproductive isolation mechanism	A: B:	Courtship behaviour Breeding at the same time
1.3.6	Fossils found in South Africa	A: B:	Mrs Ples Lucy
1.3.7	Genetic evidence for the 'Out of Africa' hypothesis	A: B:	DNA from the X-chromosome DNA from ribosomes
1.3.8	Increases variation in a species	A: B:	Cloning Mutation

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

1.4 In humans, the allele for brown eye colour (B) is dominant over the allele for blue eye colour (b). A scientist collected information about the inheritance of eye colour in a certain family. The information obtained is represented in the pedigree diagram below.



QUESTIONS 1.4.1 and 1.4.2 refer to the following possible answers (i, ii, iii, iv). Write only the number (i, ii, iii or iv) next to the question number (1.4.1–1.4.2).

(i) They have the same phenotype and the same genotype.
(ii) They differ in phenotype, but have the same genotype.
(iii) They have the same phenotype, but differ in genotype.
(iv) They differ in both phenotype and genotype.

1.4.1 If person **V** is homozygous for the dominant eye colour allele, then which of the above statements is TRUE about person **V** and person **W**? (2)

1.4.2 Which of the statements above is TRUE about person **Y** and person **Z**? (2)

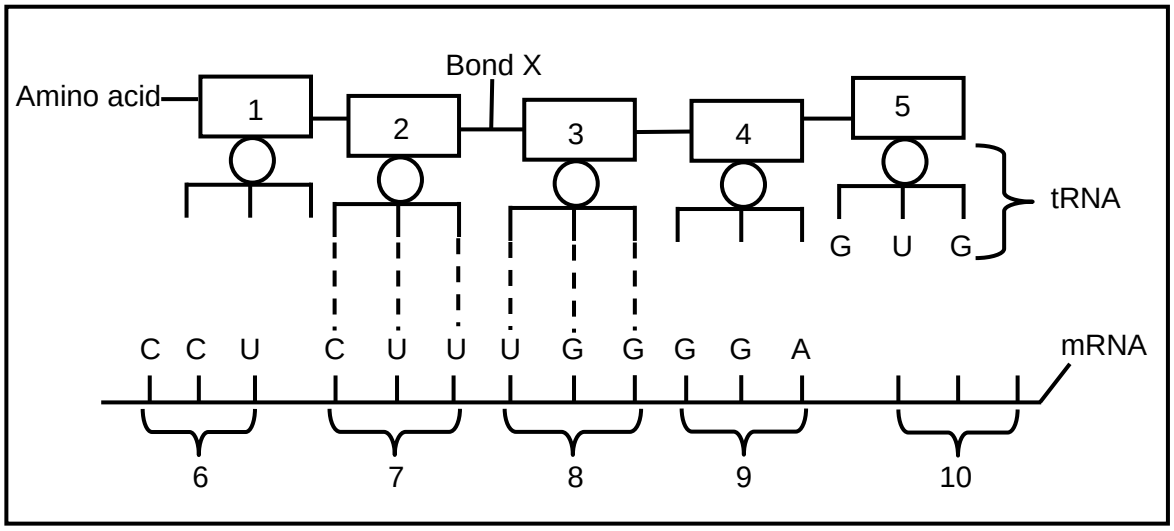
1.4.3 What is the percentage chance of person **W** and person **X** having a blue-eyed child? (2)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Study the diagram below, which shows a stage in protein synthesis.



2.1.1 Name the stage in protein synthesis represented by the diagram above. (1)

2.1.2 Write down the DNA base triplets that correspond to the codons numbered **6** and **10**. (2)

2.1.3 Name:

(a) The bond represented by **X** (1)

(b) The organelle in which the process represented in the diagram above takes place (1)

2.1.4 The table below shows the amino acids coded for by various tRNA anticodons.

Anticodons on tRNA	Amino acid coded for
CCU	Proline
GAA	Glutamate
GGA	Glycine
CUU	Leucine
GUG	Histidine
ACC	Threonine
CAC	Valine
UGG	Tryptophan

Use the information in the table above and:

(a) Write down the names of the amino acids coded for by the codons numbered **7** and **9** (2)

(b) Identify amino acid **5** (1)

(8)

2.2 Cystic fibrosis is a genetic disorder characterised by an abnormal production of mucus in the lungs of humans. It is caused by a mutation in a gene on chromosome 7 that codes for the protein CFTR. The protein CFTR is made up of 1 480 amino acids. The normal sequence and the mutated part of the gene are shown below.

Sequence	**Base triplets of the nitrogenous bases**						
Normal	**ATT**	**ATC**	**ATC**	**TTT**	**GGT**	**GTT**	**TCC**
Mutated	**ATT**	**ATC**	**TTT**	**GGT**	**GTT**	**TCC**	

2.2.1 How do we know that the base triplets represented are those of DNA? (1)

2.2.2 Name the type of gene mutation represented by the information in the table above. (1)

2.2.3 Explain the effect of the gene mutation named in QUESTION 2.2.2. (2)
(4)

2.3 The inheritance of fur colour in cats is sex-linked. The tortoise-shell colour of cats is a combination of black and orange fur. The allele for black fur is represented by X^B and the allele for orange fur is represented by X^O.

A female cat with a tortoise-shell colour mates with an orange male cat.

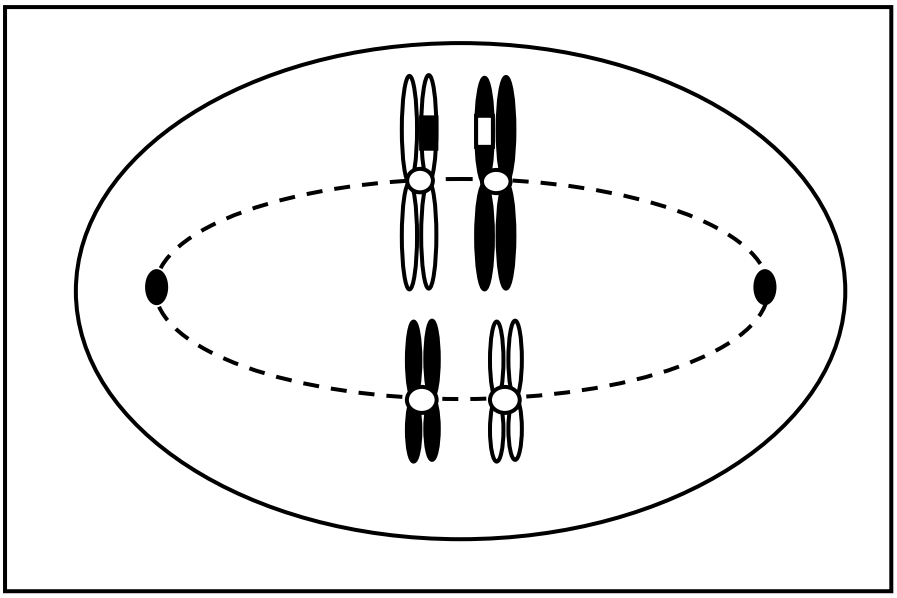
HINT: The sex chromosomes/gonosomes in cats are the same as in humans.

2.3.1 Use the symbols $\mathbf{X^B}$, $\mathbf{X^O}$ and **Y** to represent a genetic cross of the mating stated above. Also indicate the proportion of the F_1 phenotypes. (7)

2.3.2 Explain why the male kittens can never have the tortoise-shell colour. (2)

2.3.3 Explain why the female kittens can have the tortoise-shell colour. (2)
(11)

2.4 The diagram represents a cell at metaphase of meiosis I.

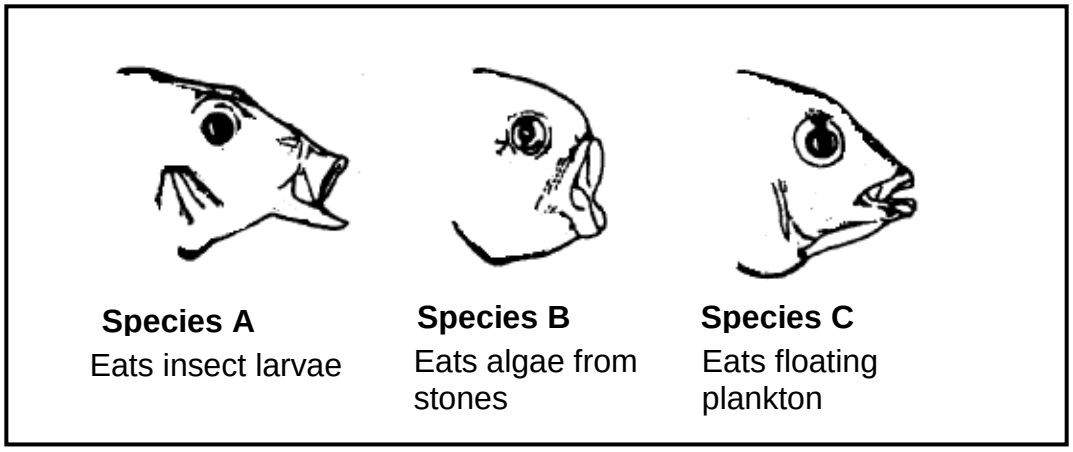


Draw a fully labelled diagram to represent ONE of the resulting cells at the same phase of meiosis II. **(7)**

[30]

QUESTION 3

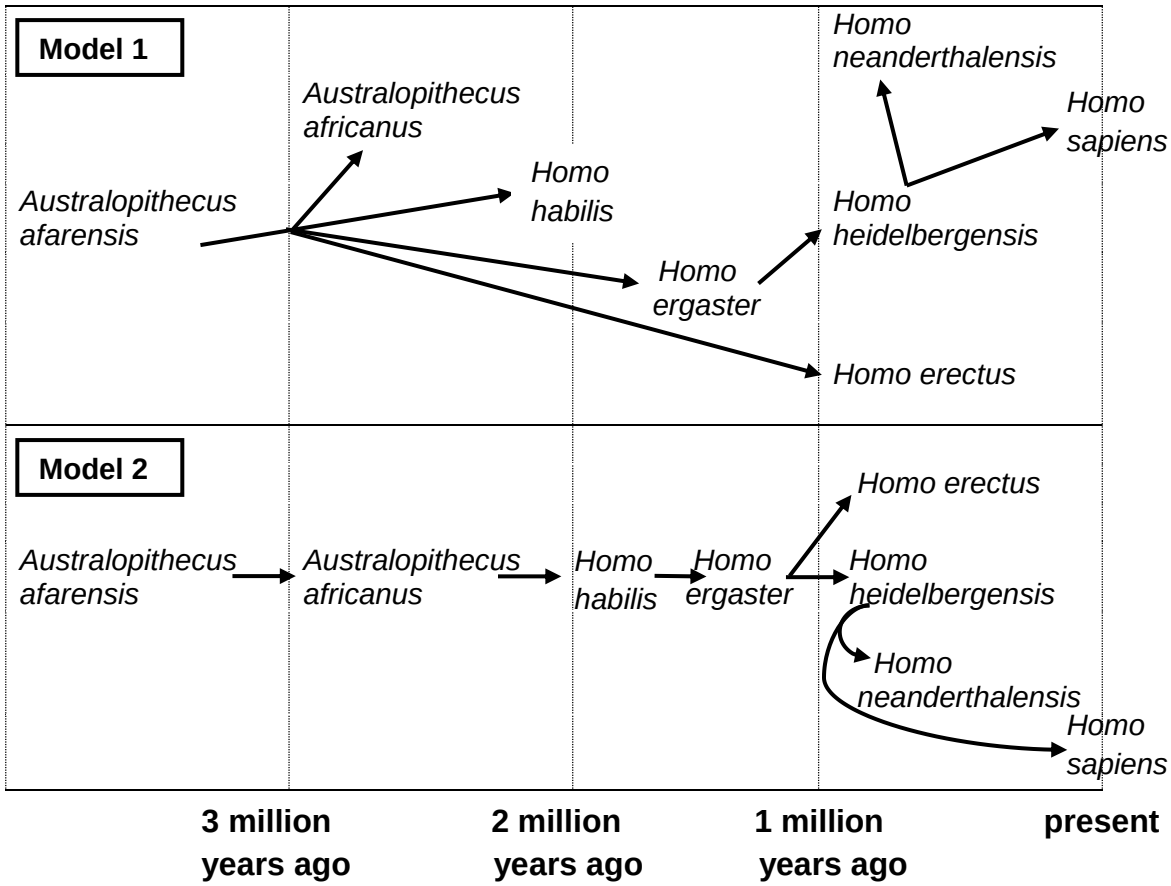
3.1 Many species of cichlid fish are found in Lake Malawi in Africa. All these species have evolved from a single ancestral species. The diagrams below show the mouths of three different cichlid fish species formed through sympatric speciation in the same lake in Malawi. It also gives information about their feeding methods.



3.1.1 State ONE advantage of the three cichlid species being specialised feeders, eating different types of food. (2)

3.1.2 Describe the process that led to the formation of the three species shown above. (6)
(8)

3.2 Two palaeontologists suggested different models for the human evolutionary tree. The models they proposed are shown below.



3.2.1 State TWO similarities between the two models with regard to relationships among the different species. (2)

3.2.2 Describe TWO ways in which the models are different with regard to relationships among the different species. (4)

3.2.3 Fossilised skeletons of *Australopithecus sediba* were discovered in the Malapa Caves. When scientists analysed the fossils, they discovered that they shared some characteristics with the genus *Homo*.

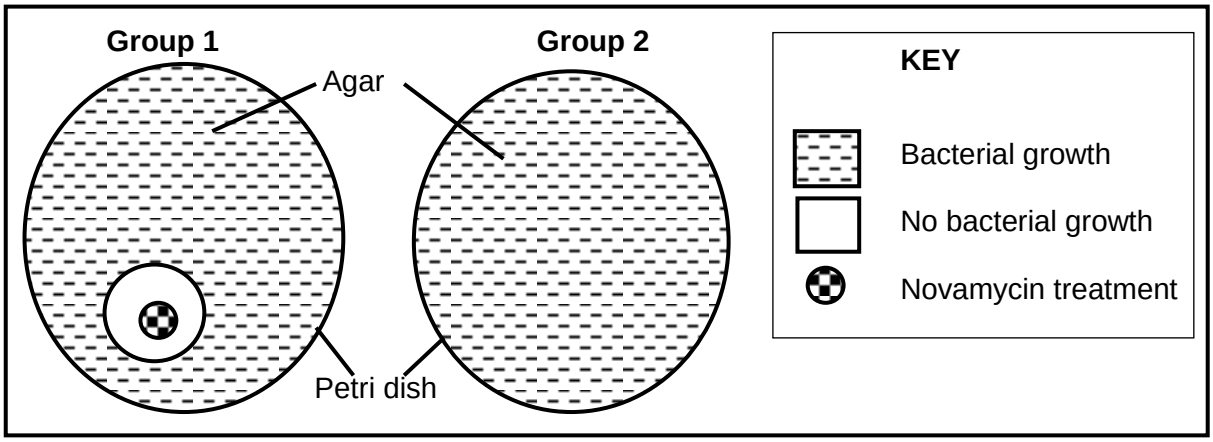
Between which TWO species would *Australopithecus sediba* be placed in Model 2? (1)

3.2.4 Tabulate TWO structural features of the skull that would distinguish the australopithecines from *Homo sapiens.* (5)
(12)

3.3 A scientist wanted to test whether a new antibiotic, called Novamycin, could restrict the reproduction of a population of bacteria which was resistant to other antibiotics.

The investigation was set up as follows:

- The bacteria were cultured in the same type of agar medium in 20 petri dishes of the same size and then divided into 2 groups:
  - Group 1: 10 petri dishes were treated with Novamycin of the same concentration
  - Group 2: 10 petri dishes were given no treatment
- The petri dishes were then incubated under the same conditions and examined for bacterial growth.
- The diameter of the area where no bacteria grew, was measured for each petri dish.



3.3.1 For the investigation above identify:

(a) The dependent variable (1)

(b) THREE factors that should have been kept constant during the investigation, other than those mentioned above (3)

3.3.2 Why did the scientist use more than one petri dish in each group? (1)

3.3.3 What was the purpose of Group 2 in the investigation? (1)

3.3.4 A similar experiment was done in which the cultured bacteria were divided into 5 groups. These groups were then treated with different concentrations of Novamycin.

(a) Formulate a hypothesis for the above investigation. (3)

(b) State ONE factor related to Novamycin that must be kept constant. (1)

(10)
[30]

TOTAL SECTION B: 60

SECTION C

QUESTION 4

4.1 The table below shows the birth weight and the number of babies that survive at the different weights.

Birth weight (kg)	Number of babies surviving
1,0–1,5	100
1,6–2,0	200
2,1–2,5	300
2,6–3,0	1 300
3,1–3,5	2 300
3,6–4,0	1 200
4,1–4,5	250
4,6–5,0	150

[Source: *Basic Genetics, A Human Approach*, 1991]

4.1.1 Draw a histogram using the information in the table above. (7)

4.1.2 Name the type of inheritance that is controlled by many genes, such as in birth weight. (1)

4.1.3 How is the type of inheritance mentioned in QUESTION 4.1.2 different from that of inheritance due to one gene? (2)
(10)

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

DNA TESTING OF MEAT

Research by Stellenbosch University scientists found traces of donkey, water buffalo and goat meat in beef mince samples taken from across the country.

Of the 139 samples tested, 95 (68%) contained species which were not indicated on the product labelling.

Scientists at the University of the Western Cape did DNA tests on 146 kudu biltong samples. The results showed that 77% of the samples were mislabelled. In some cases the samples contained beef, giraffe, kangaroo, zebra or pork.

DNA testing is expensive, at around R3 500 per sample.

[Adapted from *iol news*, March 2013]

4.2.1 Explain how it was possible for scientists to identify the different species in the meat samples tested. (2)

4.2.2 Give TWO reasons why the biltong manufacturers would substitute kudu with beef or pork. (2)

4.2.3 Explain why the proper labelling of the meat products is important to some people. (2)

4.2.4 Give ONE reason mentioned in the text why testing for the composition of meat products is not done regularly. (1)

4.2.5 Give ONE reason that can be used to dispute the DNA results. (1)

4.2.6 State TWO uses of DNA profiling other than the one mentioned in the extract. (2)
(10)

4.3 Start with a cell containing FOUR chromosomes and describe ALL the chromosomal changes that occur during meiosis, resulting in the formation of abnormal gametes due to non-disjunction in meiosis 1.

Content (17)
Synthesis (3)
(20)

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

TOTAL SECTION C: 40
GRAND TOTAL: 150

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