education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

FEBRUARY/MARCH 2010

MARKS: 150

TIME: 2½ hours

This question paper consists of 16 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 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 should be done in pencil and labelled 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 all drawn to scale.
9. Do NOT use graph paper.
10. Non-programmable calculators, protractors and compasses may be used.
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 1.1.5) in the ANSWER BOOK, for example 1.1.6 D.

1.1.1 According to Charles Darwin, organisms that will be most successful biologically, are those that …

A are best adapted to their environment.
B are the largest in the population.
C reproduce the slowest.
D do not change.

1.1.2 A consequence of an increasing human population is that …

A natural gas reserves will increase.
B raw materials will be conserved.
C more waste will be produced.
D more resources will be saved.

1.1.3 Which of the following are used to explain mass extinction?

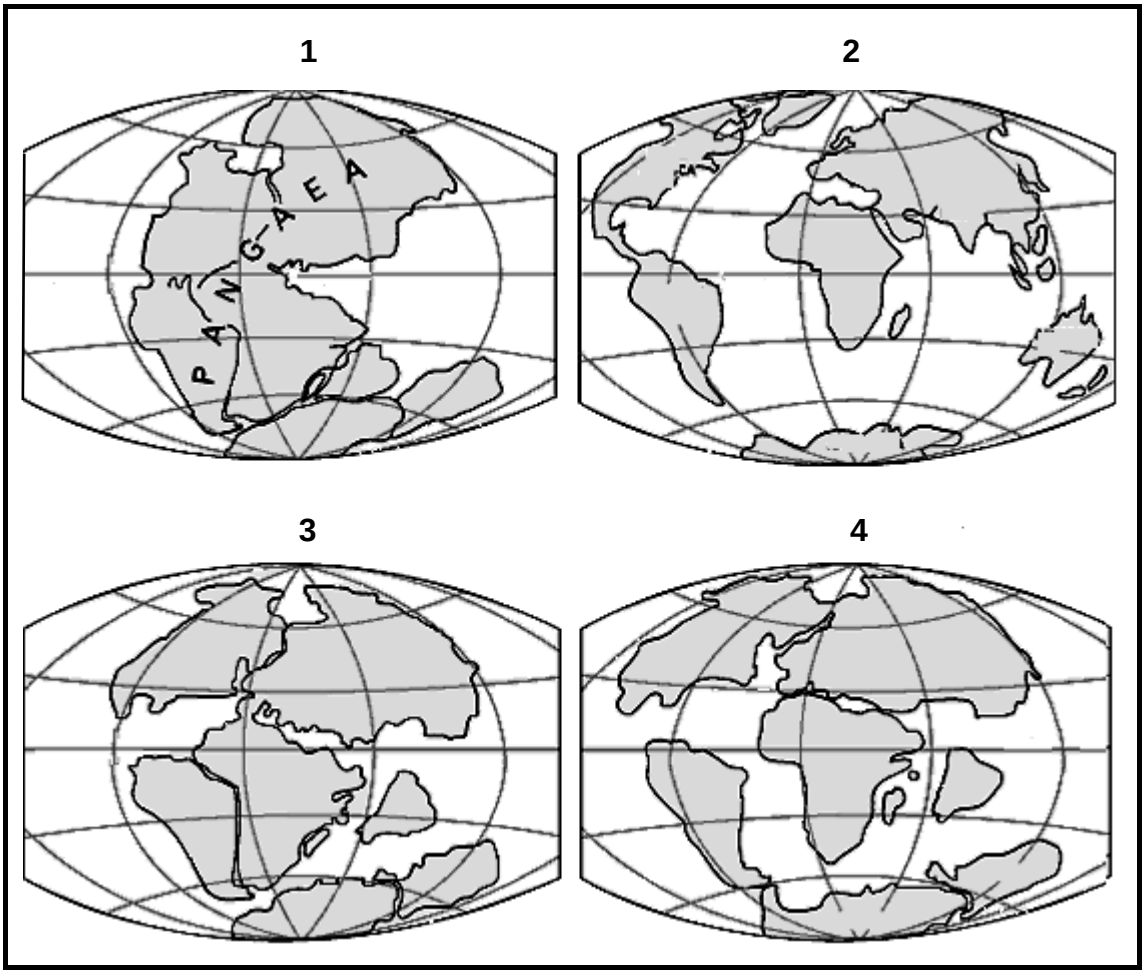
(i) Ice ages
(ii) Outbreeding
(iii) Volcanic activity
(iv) Disease

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

1.1.4 The evidence that related species in similar biomes across the world developed from a common ancestor, is obtained from …

A micro-evolution.
B embryology.
C biochemistry.
D biogeography.

1.1.5 Study the diagram below showing stages in continental drift.



The correct sequence of events during continental drift is …

A 1 → 2 → 3 → 4
B 1 → 4 → 2 → 3
C 1 → 3 → 4 → 2
D 1 → 4 → 2 → 3 (5 x 2) (10)

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 Harmful substances that disturb the natural balance of the environment

1.2.2 Entry of sewage and fertilisers into water, causing a massive growth of algae

1.2.3 Differences among organisms of the same species

1.2.4 The remains or traces of prehistoric life preserved in rocks of the Earth's crust

1.2.5 Remains of non-functional organs in certain organisms

1.2.6 A diagrammatic representation of possible ancestral relationships between organisms

1.2.7 The process that causes a sudden and unpredictable change in the genetic information of an organism

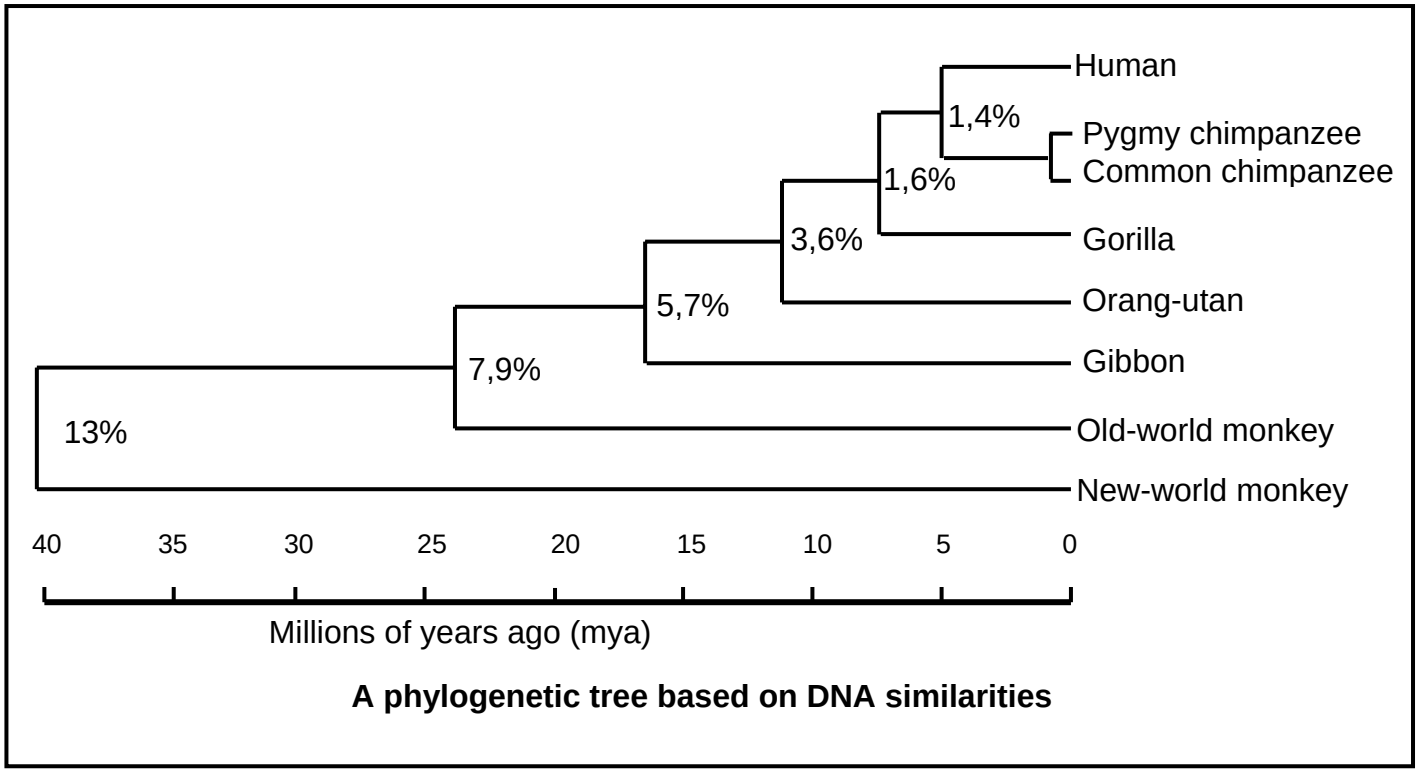
1.2.8 The exchange of genes between homologous chromosomes that brings about variation (8 x 1) (8)

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 – 1.3.7) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 Influenced by environmental change	A speciation B extinction of species
1.3.2 The formation of new groups of organisms over time	A macro-evolution B comparative anatomy
1.3.3 Reduce(s) variation in offspring	A inbreeding B outbreeding
1.3.4 The study of gill slits in the neck region in the early stages of development of different organisms	A biogeography B comparative embryology
1.3.5 Structures with the same function but different origin	A homologous B analogous
1.3.6 Study of ancient humans and their cultural activities	A palaeontology B archaeology
1.3.7 Evidence for evolution from comparative biochemistry	A protein synthesis B metabolic pathways

(7 x 2) (14)

1.4 The diagram below shows a phylogenetic tree based on DNA similarities. The percentage next to each branch shows the amount of difference in the genome (DNA nucleotide sequence) of the two relevant groups.



A phylogenetic tree based on DNA similarities

[Adapted from: *Senior Biology 2*]

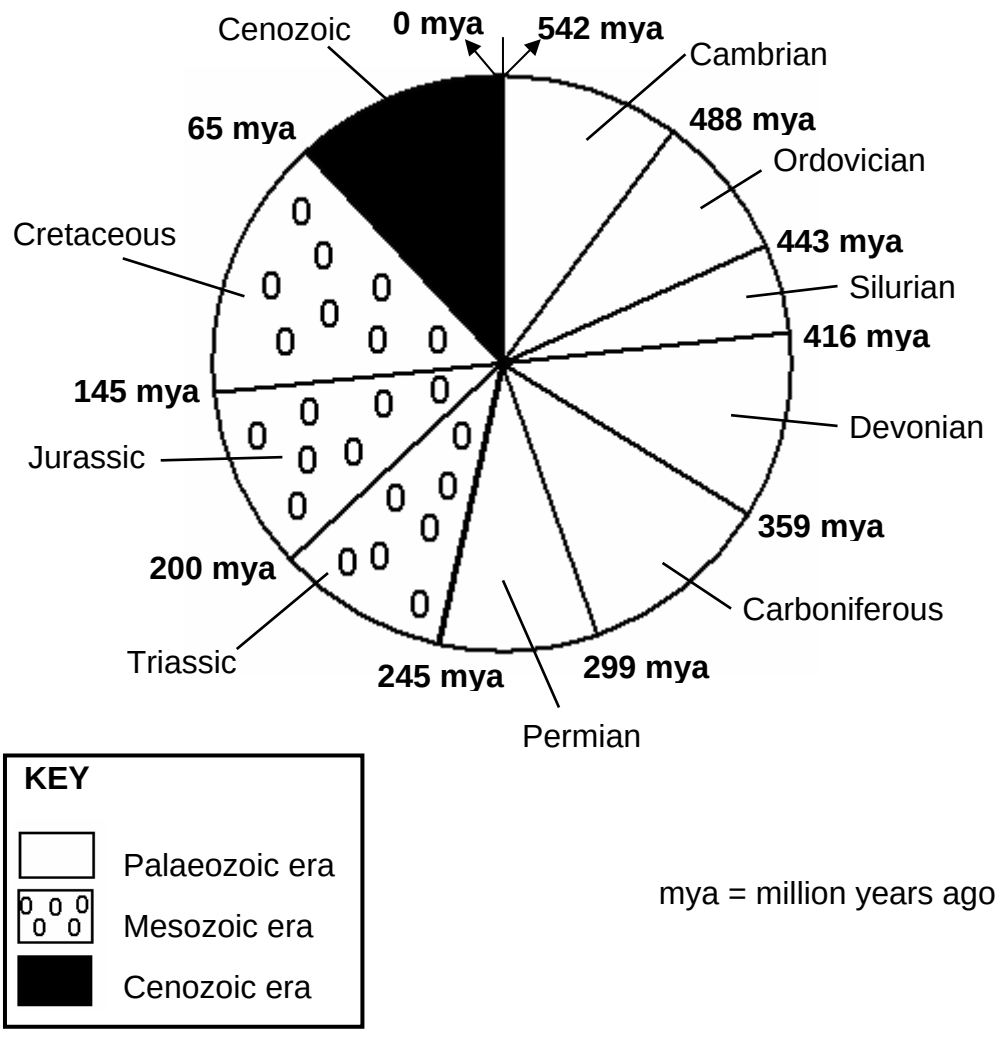
1.4.1 From the diagram, determine how long ago the chimpanzees split from the line to humans. (2)

1.4.2 Which organism is most closely related to humans? (1)

1.4.3 Calculate the DNA similarity between the genome of the chimpanzee and the human. (2)

1.5 Study the pie chart below which shows some geological periods of the three eras and answer the questions that follow.

Some geological periods of the three eras



1.5.1 Which of the three eras had the longest duration? (1)

1.5.2 The biggest mass-extinction took place 250 million years ago.

(a) State in which era this occurred. (1)

(b) State in which period this occurred. (1)

1.5.3 In which era did modern humans first appear on Earth? (1)

1.5.4 Scientists think that 'something large' from outer space struck the Earth when the Cretaceous period ended.

(a) How many years ago did this 'something large' strike the Earth? (1)

(b) Name a possible structure that hit the Earth at the end of the Cretaceous period. (1)

(c) Describe how this structure named in QUESTION 1.5.4(b) could have caused the mass extinction of many species. (4)

1.5.5 The half-life of C^{14} is 5 730 years and the half-life of uranium is 700 million years. Explain which of C^{14} or uranium should be used to calculate the age of dinosaur fossils. (3)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Study the diagram of a duck's foot below.

Webbed foot of a duck

Ancestors of ducks did not have webbed feet. In terms of natural selection, explain how the webbed feet could have evolved. (7)

2.2 The following questions refer to Lamarck's explanation of evolution:

2.2.1 Describe the idea proposed by Lamarck to explain evolution. (4)

2.2.2 State why Lamarck's explanation is not accepted by most scientists today. (2)

2.3 Read the passage below concerning the shortage of fuel in Rwanda and answer the questions that follow.

Going bananas for sustainable resources – scientists create fuel from African crop waste

A big problem in the developing world is the availability of firewood. Huge areas of land are deforested every year. People need fuel to cook and stay warm, but they can't afford the more expensive types of fuel, like gas.

Bananas are an important source of food for Rwandans. The fruit of the banana tree is eaten raw, fried or baked. The rest of the banana plant – skins, leaves and stems – is left to rot as waste.

Scientists are looking at ways to use the waste to produce fuel, by producing banana bricks that could be burnt for cooking and heating.

Once dried, the bricks form an ideal fuel which, when burnt, release steady heat, suitable for cooking.

2.3.1 Give ONE reason, according to the passage, why deforestation takes place in Africa. (1)

2.3.2 Explain THREE ways in which the making of fuel from banana plants benefits humans and/or the environment. (6)

2.3.3 Give TWO reasons why it is necessary for scientists to do research before the commercial production of the banana bricks can take place. (2)

2.4 The table below contains information on changes that occur in a river, downstream from a sewage outflow.

Distance downstream from the point of entry of sewage (m)	Concentration of dissolved oxygen (%)	Number (arbitrary units)		
		Bacteria	Algae	Fish
0	95	88	20	20
100	30	79	8	6
200	20	74	7	1
300	28	60	21	0
400	42	51	40	0
500	58	48	70	0
600	70	44	83	0
700	80	42	90	0
800	89	39	84	0
900	95	36	68	4
1 000	100	35	55	20

2.4.1 Explain why the number of bacteria was the highest at 0 metres. (1)

2.4.2 Describe the changes in the concentration of oxygen dissolved in the water downstream from the point of sewage entry. (2)

2.4.3 Explain what might have caused changes in the oxygen concentration downstream from the point of sewage entry. (3)

2.4.4 State TWO ways in which the degree of water pollution caused by sewage can be reduced. (2)
[30]

QUESTION 3

3.1 Study the passage below and answer the questions that follow.

DEVIL'S CLAW

Devil's claw (*Harpagophytum procumbens*) is an indigenous plant found in Southern Africa. Devil's claw is so called because of the small hooks that cover its fruit. It is a leafy perennial with branching roots and it thrives in clay or sandy soils.

For many years the Khoisan people have used the roots as a cure for a variety of illnesses, such as treatment for pain, complications of pregnancies and as an ointment to heal sores and other skin problems. Nowadays, the dried roots of devil's claw are produced commercially to restore appetite, relieve heartburn and reduce pain and inflammation.

3.1.1 Name TWO medical conditions that the Khoisan people treated with devil's claw. (2)

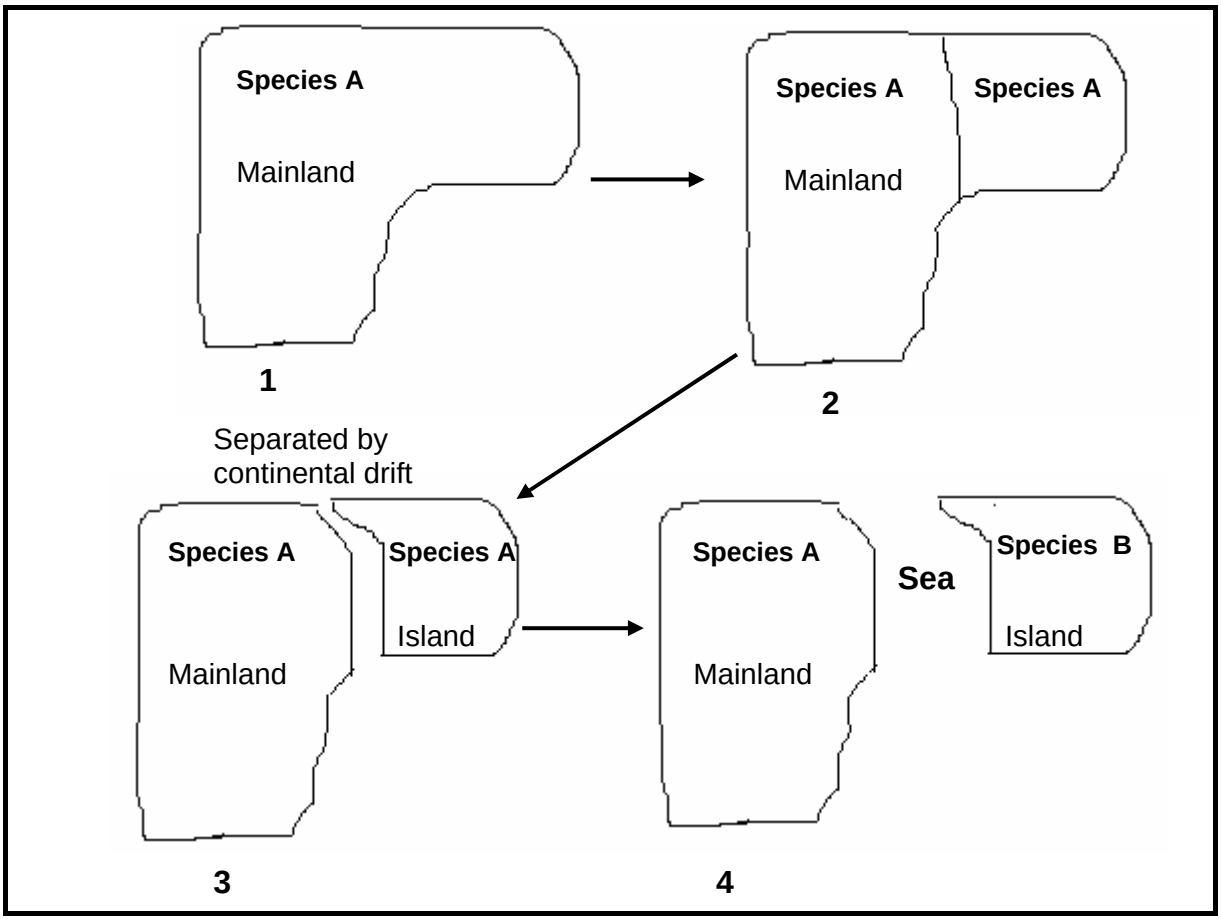
3.1.2 Explain how a reduction in the number of devil's claw plants could change the energy flow and energy relationships in an ecosystem. (3)

3.1.3 State TWO ways in which the devil's claw plant could be saved from extinction. (2)

3.1.4 Pharmaceutical companies are making a large profit by using devil's claw to produce medicine.

Explain why these companies should share their profits with the Khoisan people. (2)

3.2 Study the following diagrams which show different stages (1 to 4) of a process in evolution.



3.2.1 Name the evolutionary process that resulted from the continental drift shown. (1)

3.2.2 Describe how the original population of species A split to become two species as indicated in the diagrams above. (5)

3.3 Farmers often add chemical fertilisers to their land to increase the yield of their crops. Sometimes they over-use chemical fertilisers which could lead to soil pollution.

The table below shows how the addition of a phosphate fertiliser to land on which crops of potatoes and barley are grown, affected their yield.

The yield is the amount of food harvested from the crop.

Amount of phosphate fertiliser added to soil (kg/hectare)	**Yield of potato crop (ton/hectare)**	**Yield of barley crop (ton/hectare)**
0	13	2
4	18	4
8	22	6
12	26	8
16	28	8
20	28	8

3.3.1 Plot TWO line graphs on the same system of axes to illustrate how the addition of fertiliser influenced the yield of the two crops. (11)

3.3.2 What is the minimum amount of fertiliser that had to be added to the barley crop to achieve the maximum yield? (2)

3.3.3 State TWO disadvantages of adding more than 16 kg/hectare phosphate fertiliser to the soil. (2)
[30]

TOTAL SECTION B: 60

SECTION C

QUESTION 4

4.1 Two students decided to investigate the effect of different concentrations of sulphur dioxide on the germination of oats seeds. They set up trays of germinating seeds under a clear plastic cover along with five different concentrations of sodium disulphate(IV) solution.

Sodium disulphate(IV) breaks down to release sulphur dioxide into the atmosphere.

The table below shows the results after one week.

Concentration of sodium disulphate (IV) (%)	Number of seeds germinated out of 20 (five replications)					Percentage germination
0,00	19	19	17	20	18	93
0,05	16	17	15	15	17	80
0,10	12	13	14	11	12	
0,50	0	1	0	0	1	2
2,50	0	0	0	0	0	0

4.1.1 Formulate a possible hypothesis for this investigation. (2)

4.1.2 State the independent variable in this investigation. (1)

4.1.3 Name TWO factors which might affect seed germination and which must be kept constant. (2)

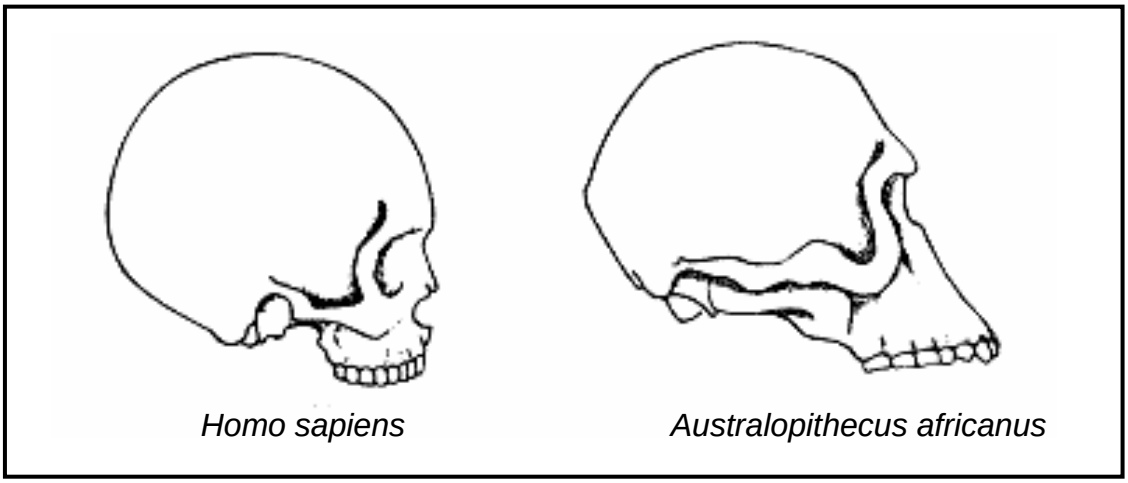
4.1.4 Why was the investigation repeated five times at each concentration? (2)

4.1.5 Calculate the percentage of germination using a 0,10% concentration of sodium disulphate(IV). (2)

4.1.6 What evidence from the results in the table shows that sodium disulphate(IV) does affect the germination of oats seeds? (2)

4.1.7 Draw a conclusion for this investigation from the results provided. (2)

4.2 Study the two skulls below (drawn to the same scale) and answer the questions that follow.



Homo sapiens *Australopithecus africanus*

4.2.1 Tabulate THREE visible differences from the two skulls shown above that scientists have used to differentiate between *Homo sapiens* and other primates. (7)

4.2.2 Give THREE examples of fossils of *Australopithecus* that were discovered in Southern Africa. (3)

4.2.3 Explain the importance of the discoveries of the skulls of *Australopithecus* in understanding the evolutionary development of humans. (2)

4.3 State FOUR consequences of overfishing to humans and to the environment and explain FOUR management strategies that the government could employ to prevent overfishing. (12)

Synthesis (3)

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

TOTAL SECTION C: 40

GRAND TOTAL: 150