basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P1

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, flow charts or tables 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 answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.9) in the ANSWER BOOK, for example 1.1.10 D.

1.1.1 The structure that enables the sperm to move through the Fallopian tube is the …

A tail.
B nucleus.
C middle piece.
D head.

1.1.2 The pupil of a human eye is covered by the ...

A cornea and retina.
B conjunctiva and cornea.
C conjunctiva and sclera.
D retina and sclera.

1.1.3 Which ONE of the following is the correct sequence of events during human reproduction?

A Oogenesis → ovulation → fertilisation → implantation
B Oogenesis → ovulation → implantation → fertilisation
C Ovulation → oogenesis → fertilisation → implantation
D Ovulation → oogenesis → implantation → fertilisation

1.1.4 The following blood vessels lead to and from the placenta in a pregnant female:

(i) Umbilical arteries
(ii) Umbilical vein
(iii) Mother's artery
(iv) Mother's vein

Which ONE of the following sets of blood vessels transport blood with a high amount of oxygen and nutrients?

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

1.1.5 The advantage of the testes located in the scrotum, outside the body cavity:

A More sperm can be stored in the scrotum.
B Sperm development is more efficient at temperatures below 36 °C.
C Testes are better protected in the scrotum than in the body cavity.
D There is more time for prostate secretions to be added to sperm.

1.1.6 The following relates to meiosis and reproduction:

(i) Prophase I
(ii) Metaphase I
(iii) Prophase II
(iv) Fertilisation

Which ONE of the following combinations is most likely to contribute to genetic variation amongst offspring?

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

1.1.7 Which ONE of the following pairs CORRECTLY matches a reproductive structure and its function?

A Fallopian tube – maturation of sperm
B Vagina – fertilisation
C Urethra – release of sperm
D Seminal vesicles – ovum development

1.1.8 The hormone that stimulates the development of the male sex organs:

A Prolactin
B Thyroxin
C Testosterone
D Aldosterone

1.1.9 Which ONE of the following CORRECTLY matches a visual defect and its corrective treatment?

A Cataracts – concave lens
B Short-sightedness – convex lens
C Astigmatism – concave lens
D Long-sightedness – convex lens (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 to 1.2.8) in the ANSWER BOOK.

1.2.1 The type of development in birds in which the young is capable of moving around on its own soon after hatching

1.2.2 A disorder which results in the myelin sheath of the neurons being damaged

1.2.3 A liquid between the cornea and lens in the human eye

1.2.4 The formation of ova by meiosis

1.2.5 The gland in human males which secretes an alkaline fluid to protect sperm against the acidic environment of the vagina

1.2.6 The outermost membrane that surrounds the human embryo

1.2.7 A long coiled tube in human males that lies at the top of the testes, which stores sperm

1.2.8 A hormone that promotes the absorption of water in the kidneys

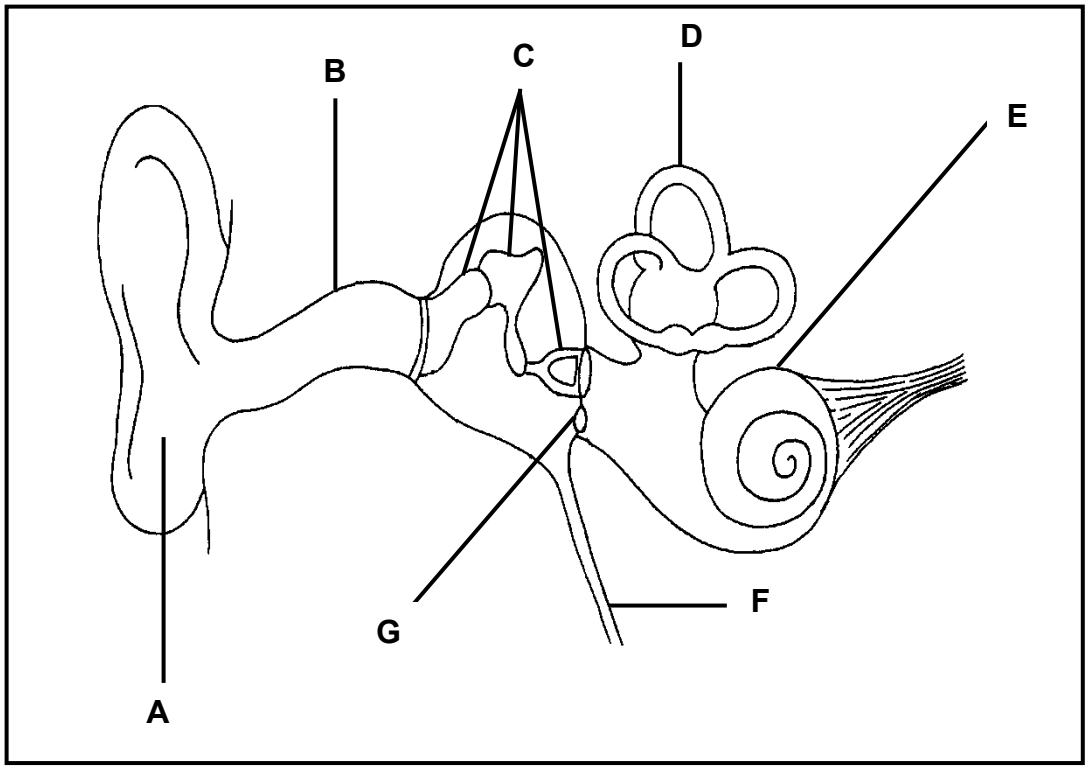
(8 x 1) **(8)**

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 Only cones are present	A: Blind spot B: Yellow spot
1.3.2 Occurs in the iris in bright light	A: Radial muscles contract B: Circular muscles relax
1.3.3 High concentration of auxins stimulate growth	A: Stem B: Root
1.3.4 A hollow ball of cells	A: Morula B: Blastocyst/Blastula

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

1.4 The diagram below represents a human ear.



1.4.1 Identify parts **A** and **D**. (2)

1.4.2 Write down the LETTER ONLY of the part which:

(a) Conducts sound waves towards the middle ear (1)

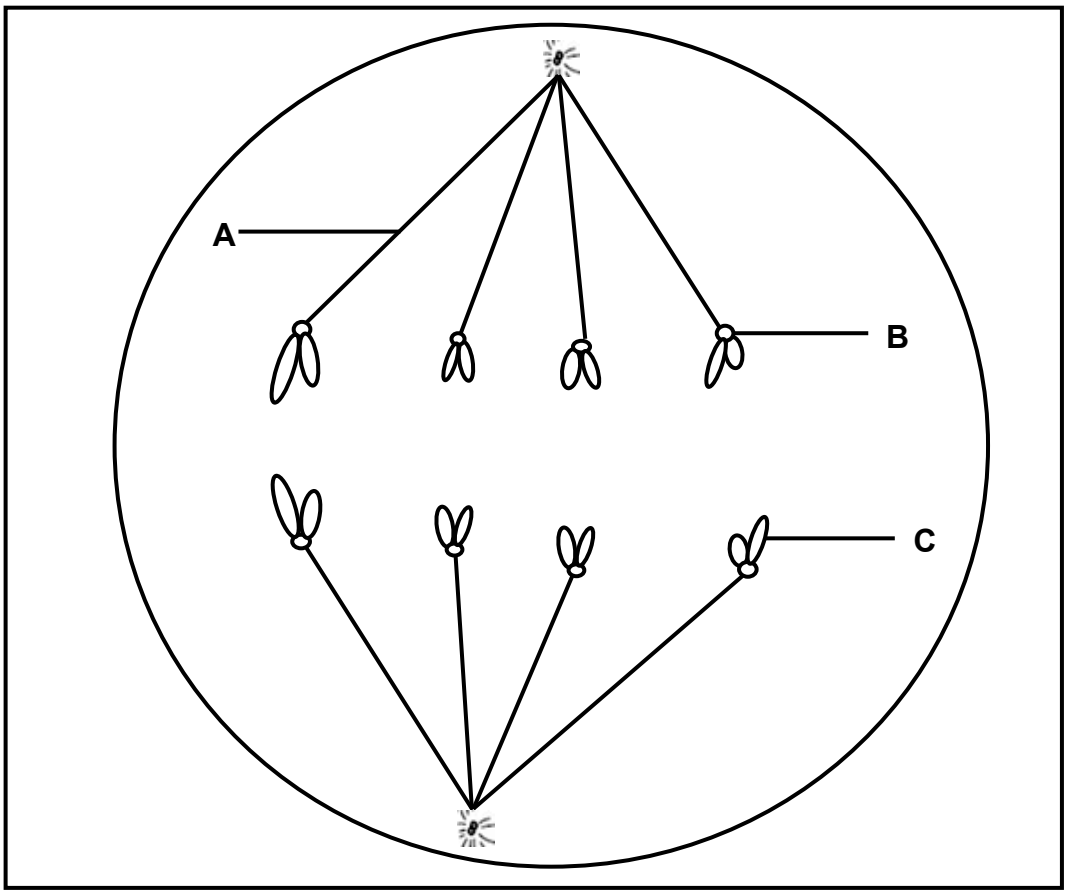
(b) Absorbs pressure from the inner ear (1)

(c) Ensures equal pressure on either side of the tympanic membrane (1)

(d) Transmits vibrations to the inner ear (1)

(e) Contains the organ of Corti (1)
(7)

1.5 The diagram below shows a phase during meiosis.



1.5.1 Identify part:

(a) **A** (1)

(b) **B** (1)

(c) **C** (1)

1.5.2 Name the phase illustrated in the diagram above. (1)

1.5.3 How many chromosomes were present in the phase before the one shown in the diagram above? (1)

1.5.4 How many chromosomes would be found in each gamete at the end of this division? (1)

1.5.5 Explain why the diagram above is NOT representative of a cell from a human being. (2)

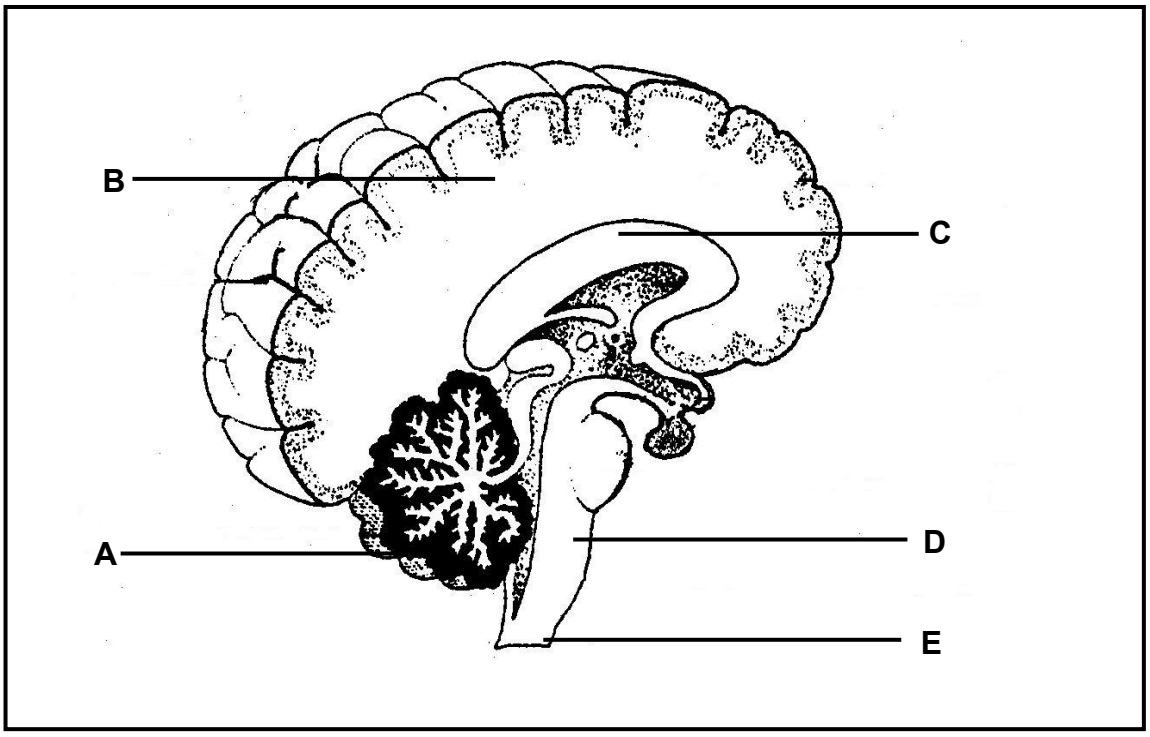
1.5.6 State ONE place where meiosis takes place in the human male. (1)
(9)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below shows a longitudinal section of the human brain.



2.1.1 Identify parts **A** and **B**. (2)

2.1.2 Write down the LETTER ONLY of the part that:

(a) Interprets sound (1)

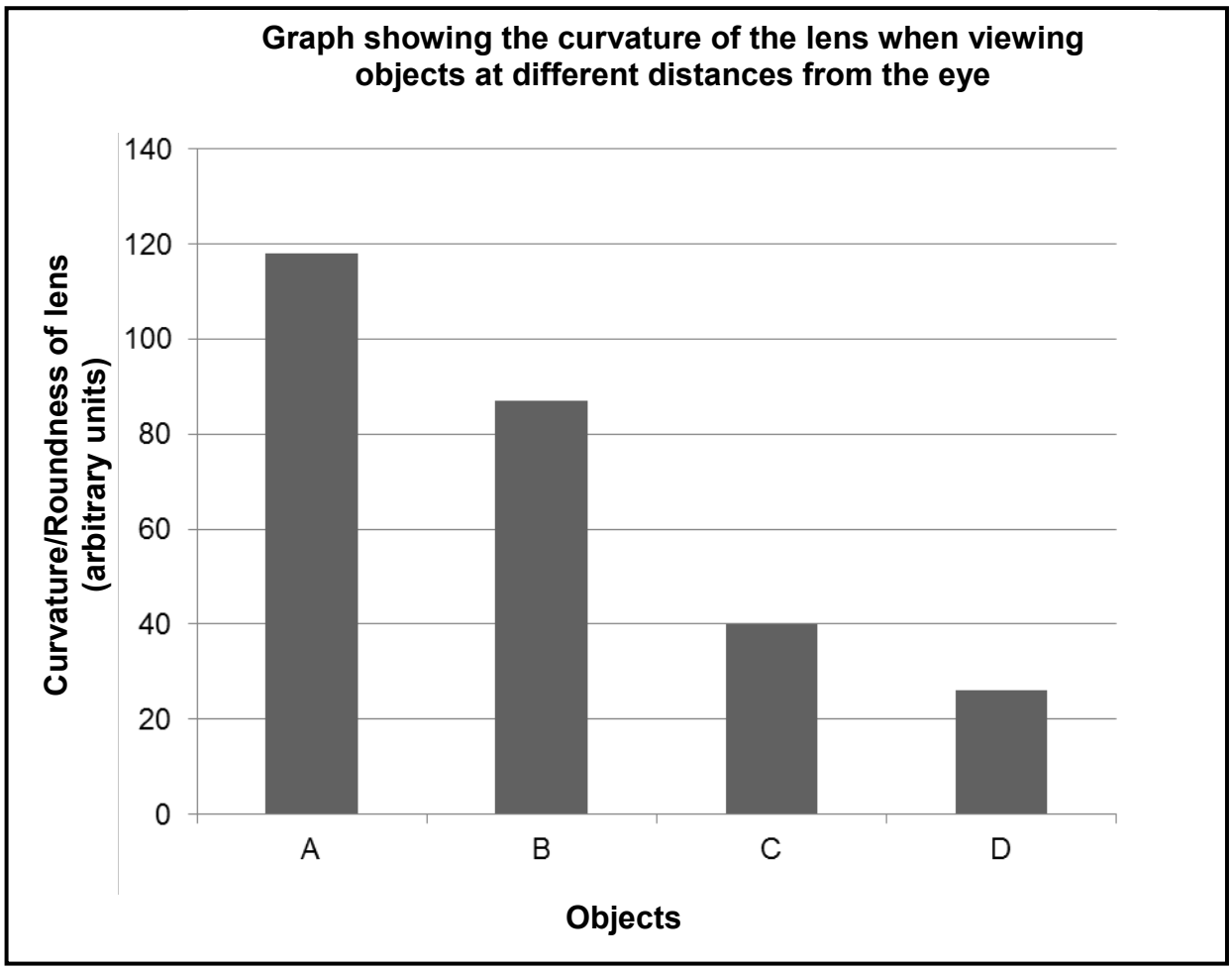
(b) Connects the two hemispheres of the brain (1)

2.1.3 Explain why damage to part **D** leads to death almost instantly. (2)

2.1.4 Thabo accidentally stepped with his bare foot on a piece of broken glass. He immediately lifted his foot.

Describe the reflex action involving part **E** in the diagram above that took place from the moment Thabo stepped on the piece of broken glass until he lifted his foot. (6)
(12)

2.2 The bar graph below illustrates the curvature/roundness of the lens in the eye of a human while viewing four objects (**A** to **D**) at different distances from the eye.

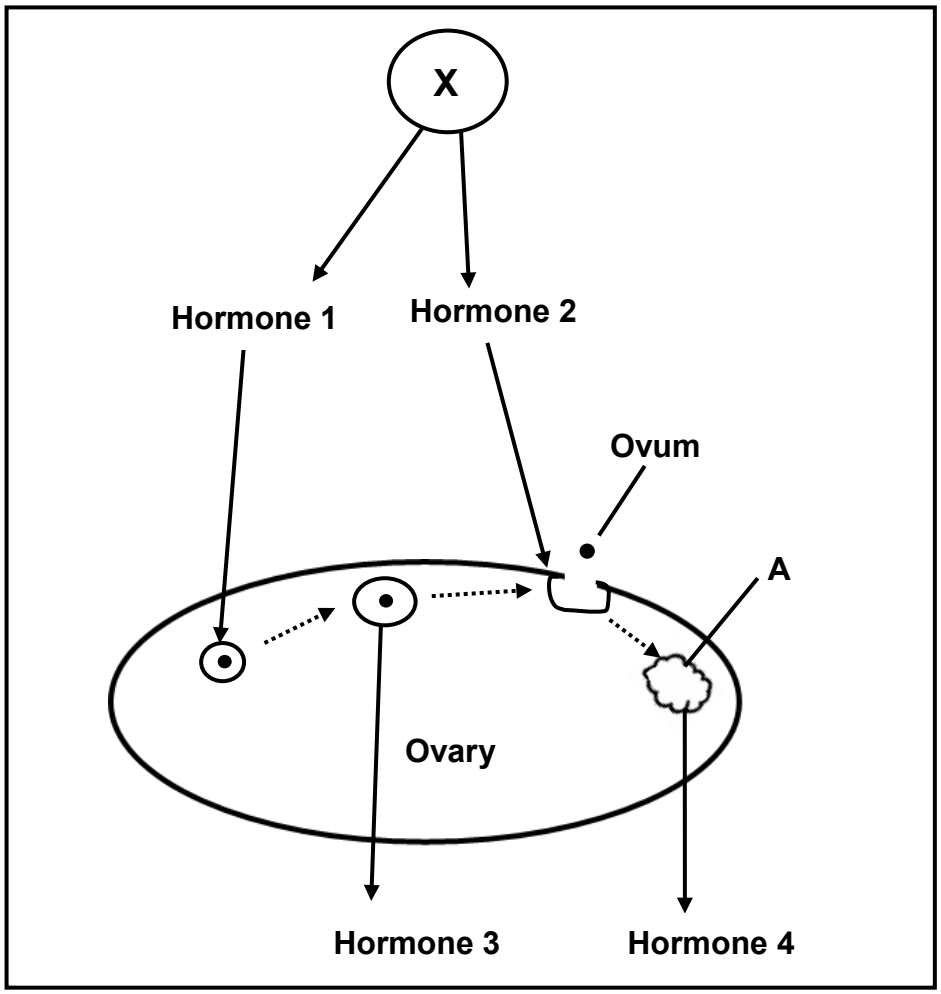


2.2.1 What is the curvature of the lens (in arbitrary units) when viewing object **C**? (1)

2.2.2 Using the information in the graph, explain the changes that will occur if a person wanted to get a clear image of object **D** a few seconds after looking at object **A**. (6)
(7)

2.3 Describe how the sacculus and utriculus in the ear maintain balance in the human body. **(5)**

2.4 The diagram below shows the interaction between two endocrine glands (**X** and the **ovary**) during the menstrual cycle in a human female.



2.4.1 Name the endocrine gland, labelled **X**, which is a part of the brain. (1)

2.4.2 Which hormone (**1**, **2**, **3** or **4**) will have to be in high concentration in a contraceptive pill (pill to prevent pregnancy) in order to stop ovulation? (1)

2.4.3 Explain your answer to QUESTION 2.4.2. (2)

2.4.4 Explain what will happen if structure **A** disintegrates in the first week of pregnancy. (3)

2.4.5 Describe the events that would lead to the fertilisation of the ovum, as shown in the diagram above, until the formation of a zygote. (4)
(11)

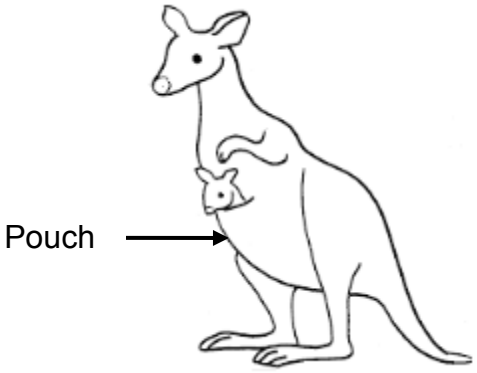
2.5 Read the passage below.

REPRODUCTIVE STRATEGY IN KANGAROOS

The red kangaroo reproduces by sexual reproduction. After mating, the fertilised egg undergoes gestation in the uterus. After 33 days of gestation, the red kangaroo gives birth to an offspring that is hairless, blind and only a few centimetres long.

The offspring moves from the vagina by following a trail of saliva secreted by the mother to a protective pouch where it remains for a year. During this time the offspring drinks milk from the mother who has teats in her pouch.

After 190 days it leaves the pouch.



[Adapted from *www.livescience.com*]

2.5.1 State whether:

(a) Fertilisation in the red kangaroo species is INTERNAL or EXTERNAL (1)

(b) The red kangaroo species is OVIPAROUS, OVOVIVIPAROUS or VIVIPAROUS (1)

2.5.2 Give a reason for your answer to QUESTION 2.5.1(b). (1)

2.5.3 State TWO ways in which the survival of the offspring immediately after birth is ensured in the red kangaroo species. (2)
(5)
[40]

QUESTION 3

3.1 An investigation was conducted to determine the effect of different concentrations of gibberellins on the average percentage and rate of seed germination in *Penstemon digitalis* (a garden plant).

The following procedure was followed:

- Thirty seeds of *P. digitalis* were used.
- The seeds were divided into three groups of ten (groups **A**, **B** and **C**).
- The seeds in each group were soaked in different concentrations of gibberellins for 24 hours, as shown in the table below:

GROUP	CONCENTRATION OF GIBBERELLINS (mg/ℓ)
A	0
B	500
C	1 000

- The seed mixtures were then filtered and rinsed under cold, distilled water for 2 minutes.
- The three groups of seeds were then placed in a dark growth chamber at a temperature of 21,3 °C.
- Each day for 10 days, the groups of seeds were given the same amount of water.

The seeds were observed each day. They were considered to have germinated as soon as the shoots and roots first appeared.

The average percentage and rate of seed germination was calculated for each day.

3.1.1 Identify the TWO dependent variables in the investigation above. (2)

3.1.2 State THREE factors not related to gibberellins that were kept constant in this investigation. (3)

3.1.3 State ONE factor that should have been kept constant with regard to the gibberellins during the investigation. (1)

3.1.4 Explain the advantage of including many seeds in each group of seeds. (2)

3.1.5 Explain why the seeds were left to germinate in a dark growth chamber. (2)
(10)

3.2 Describe the negative feedback mechanism that occurs when the thyroxin level decreases below normal. **(5)**

3.3 The table below shows the percentage of carbon dioxide (CO_2) emitted by different sectors in a certain city in South Africa.

SECTOR	**CO_2 EMISSION (%)**
Transport	25
Residential	27
Industrial	15
Commercial	28
Other	5

[Adapted from *Energy scenarios for CT to-2050,* 2011]

3.3.1 Draw a pie chart to represent the data in the table above. Show ALL calculations. (7)

3.3.2 Which TWO sectors in the table above should NOT be included in the determination of carbon emissions in a rural area? (2)

3.3.3 Explain how the planting of trees can assist in reducing the CO_2 concentration in the atmosphere. (2)

3.3.4 Describe how an increase in the CO_2 concentration can lead to global warming. (3)
(14)

3.4 Read the passage below.

IS FRACKING THE SOLUTION TO OUR ENERGY PROBLEMS?

It is said that natural gas is cheaper than oil and cleaner than coal. South Africa potentially has the eighth largest natural gas reserves in the world, lying beneath the delicate ecosystem of the Karoo. This abundance of natural gas reservoirs in South Africa means that there will be a plentiful supply for the future. However, the extraction of the gas may have a negative impact on the environment.

To extract natural gas, a method called hydraulic fracturing is used. Hydraulic fracturing is commonly known as fracking. Millions of litres of water, combined with sand and chemicals like benzene, are pumped under high pressure into horizontally drilled wells. This causes the rock to crack and allows the gas to be extracted. To frack just one well, 20 million litres of water mixed with chemicals and sand is needed.

It is believed that fracking will cause irreversible damage to biodiversity, the water supply and the quality of water. The Karoo is regarded as one of the driest places in the world and therefore water is in short supply.

[Adapted from *Sawubona*, March 2014]

3.4.1 Describe how gas is extracted from rocks using the hydraulic fracturing/fracking method. (2)

3.4.2 Describe what is meant by the statement *cleaner than coal*. (2)

3.4.3 Explain how fracking affects the quality of water. (2)

3.4.4 Explain how fracking contributes to a decrease in biodiversity. (2)

3.4.5 Suggest ONE solution to the problem of using large amounts of water for the fracking process. (1)

3.4.6 Suggest TWO ways in which fracking can benefit the communities in the area. (2)

(11)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

An athlete ran a 21 km race on a hot summer's day.

Explain the changes in the levels of carbon dioxide, glucose and body temperature you would expect during the race and describe how the various negative feedback mechanisms bring the situation back to normal within a few hours after the race.

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
GRAND TOTAL: 150