education

MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES
JUNE 2026

MARKS: 150
TIME: 2½ HOURS

This question paper consists of 16 pages.

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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 to the numbering system used in the 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.

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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 numbers (1.1.1 to 1.1.10) in the ANSWER BOOK, e.g. 1.1.11 D

1.1.1 The process responsible for the growth of hair is…

A meiosis.
B reduction division.
C mitosis.
D aneuploidy.

1.1.2 In individuals with normal haemoglobin, the mRNA for haemoglobin includes the codon GAA. This sequence is changed in individuals with sickle cell anaemia so that their mRNA has a codon GUA at the same location. This suggests that the DNA has undergone a mutation involving a change of base sequence from…

A CAA to TAA.
B CTT to CAT.
C CUU to CAT.
D CTT to CTA.

1.1.3 A child has blood group AB and her mother's blood group is A.
We can reasonably conclude that the …

A mother's genotype is I^AI^B.
B child's genotype is I^AI^B and the mother's genotype is ii.
C father's genotype is I^AI^B or I^BI^B or I^Bi.
D father's genotype is I^AI^B and the mother's genotype is ii.

1.1.4 If a red coloured bull and a white coloured cow is crossed all the offspring is found to be roan (red and white patches). If there is a cross between a red bull and a roan cow, what percentage of their offspring will be roan?

A 0%
B 25%
C 50%
D 75%

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1.1.5 The law during which the two alleles for a characteristic will separate so each gamete contains one of the two alleles, are known as…

A Law of segregation.
B Law of dominance.
C Law of independent assortment.
D Law of gonosomes.

1.1.6 The part of the female reproductive system where meiosis occurs is the…

A fallopian tube.
B ovary.
C uterus.
D cervix.

1.1.7 The part of the ovum that is digested by enzymes during fertilization is the …

A cytoplasm.
B mitochondrion.
C jelly-like layer.
D nucleus.

1.1.8 When chased by a dog, the sympathetic nervous system will increase the …

A heart rate.
B flow of blood to the intestines.
C flow of CO_2 to the brain.
D conversion of glucose to glycogen.

1.1.9 When a person spends most of his/her time looking at a cell phone or a computer screen, the ciliary muscles of the eye are in a constant state of contraction. The muscles cannot return to their relaxed position.

As a result the muscles are unable to change the…

A shape of the lens to focus on a distant object.
B shape of the lens to focus on a nearby object.
C size of the pupil to let more light into the eye.
D size of the pupil to reduce the amount of light entering the eye.

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1.1.10 Which one of the following part of the ear is prone to middle ear infection?

A Oval window.
B Round window.
C Cochlea.
D Eustachian tube.

(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 numbers (1.2.1 to 1.2.9) in the ANSWER BOOK

1.2.1 Chromosomes of the same shape and size that codes for the same genes

1.2.2 Temporary molecule containing the coded message for protein synthesis.

1.2.3 Site of meiosis in male plants

1.2.4 The phase of meiosis characterised by the separation of chromosomes into chromatids

1.2.5 The blood group containing only recessive alleles

1.2.6 Gland responsible for controlling resting metabolic rate

1.2.7 A temporary, vascular organ on the inside of the uterus that consists of both maternal tissue and embryonic tissue.

1.2.8 Glandular and vascular inner wall of the uterus where implantation of the embryo occurs.

1.2.9 The shape of the lens in glasses that corrects long-sightedness.

(9 X 1) **(9)**

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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 numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 Monomers of proteins	A: Amino acids B: Polypeptide chains
1.3.2 Cells in the testes responsible for the secretion of testosterone during puberty.	A: Cells of Leydig B: Sertoli cells
1.3.3 Chromosomes found in male with down syndrome	A: 45 + XY B: 43 + XY

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

1.4 Sharks can be oviparous, ovoviviparous or viviparous. The table below shows a comparison in the amniotic egg as well as reproduction of three different species of shark.

	Shark species		
	1	**2**	**3**
York (%) of amniotic egg	0	30	40
Gestation period (months)	10	15	9
Number of pups born	1 to 13	30 to 35	1 to 8

1.4.1 Which ONE of the shark species is (**1**, **2**, or **3**) is more likely viviparous? (1)

1.4.2 Provide ONE reason from the table for your answer in QUESTION 1.4.1. (1)

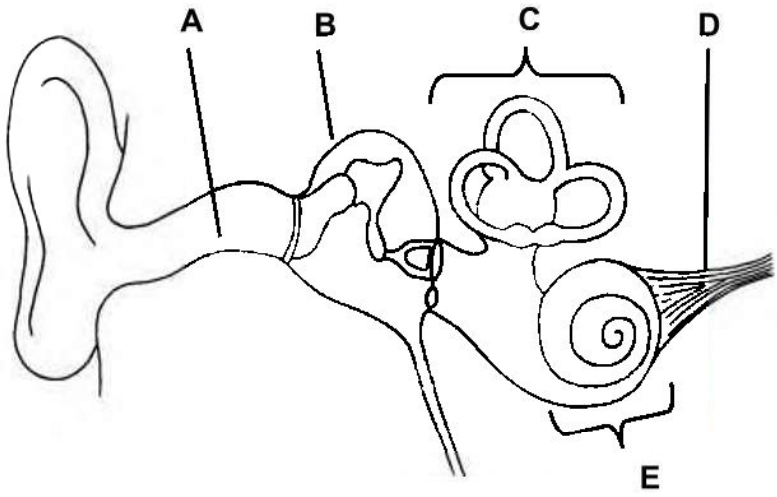
1.4.3 Which ONE of the shark species (**1**, **2** or **3**) most likely shows precocial development strategy? (1)

1.4.4 Explain your answer in QUESTION 1.4.3. (2)

1.4.5 Which ONE of the shark species (**1**, **2** or **3**) will possibly produce offspring requiring the highest degree of parental care? (1)
(6)

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1.5 The diagram below represents the human ear.



The structure of human ear

Give the LETTER and the NAME of each of the following which:

1.5.1 (a) Contains receptors for hearing. (2)

(b) Contains mechanoreceptors. (2)

(c) Transmit sound waves to the tympanic membrane. (2)

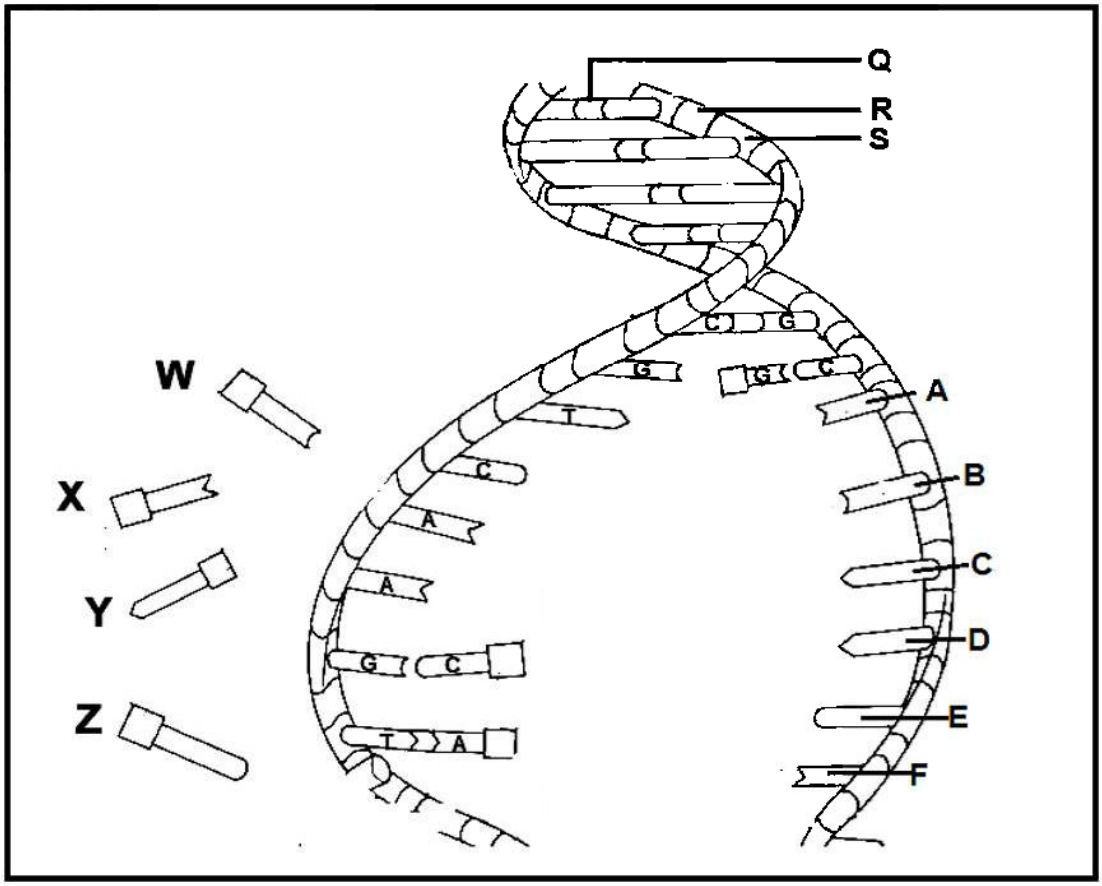
(d) Amplifies and transmit sound vibrations. (2)

1.5.2 Give the name of the neuron found in part **D.** (1)
(9)

TOTAL SECTION A: [50]

SECTION B
QUESTION 2

2.1 The diagram below represents a process taking place in a human nucleus.



2.1.1 Identify the process taking place above. (1)

2.1.2 Name the phase of the cell cycle during which the process above will take place. (1)

2.1.3 Identify parts:

(a) **Q** (1)

(b) **R** (1)

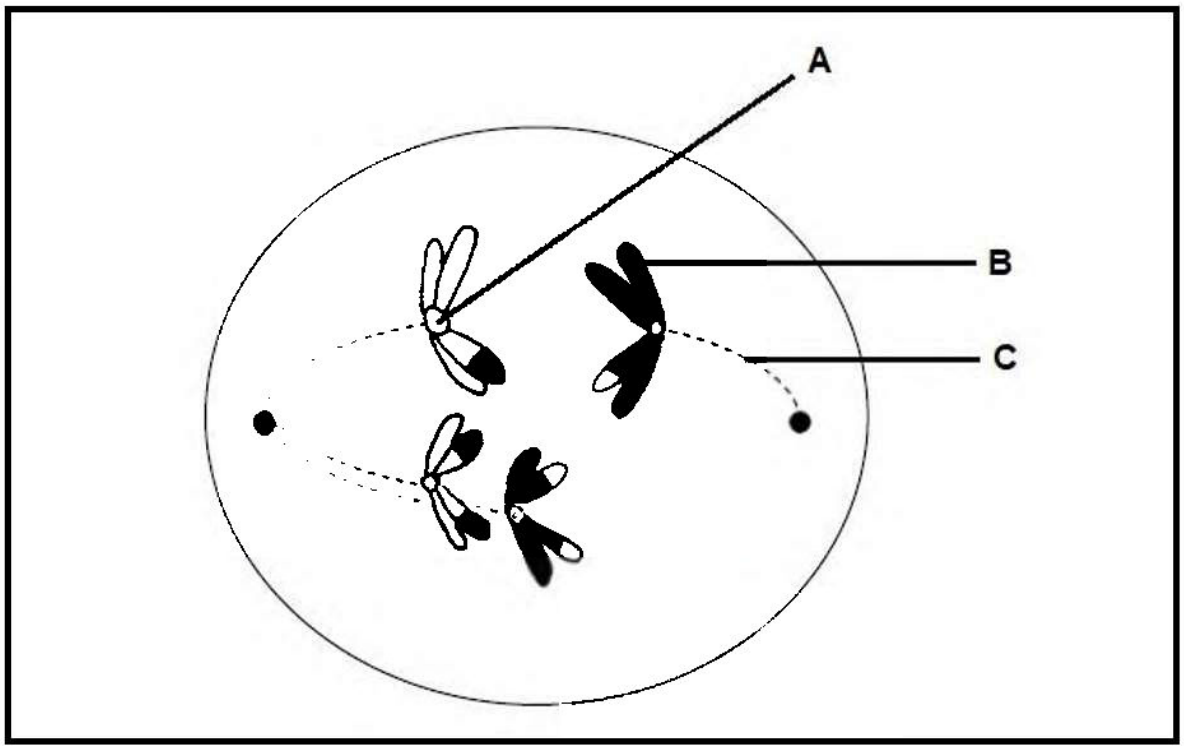
(c) **S** (1)

2.1.4 Describe this process identified in QUESTION 2.1.1. (6)

2.1.5 Match the free floating nucleotides (**W**, **X**, **Y, Z**) to the corresponding template (**A – F**). Write down the nucleotides (**W-Z**) to show their sequence on the complementary strand. (2)
(13)

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2.2 The diagram below represents the meiotic division of chromosome pair 12 and 13 in a human somatic cell.



2.2.1 Identify the phase of meiosis represented in the diagram above. (1)

2.2.2 Provide labels:

(a) **B** (1)

(b) **C** (1)

2.2.3 Give ONE function of structure **A**. (1)

2.2.4 Make a neat labelled drawing of the diagram above during prophase I as it would have appeared before the process responsible for genetic variation took place. (3)

2.2.5 How many chromosomes will be present in each cell during:

(a) Metaphase I (1)

(b) Telophase II (2)

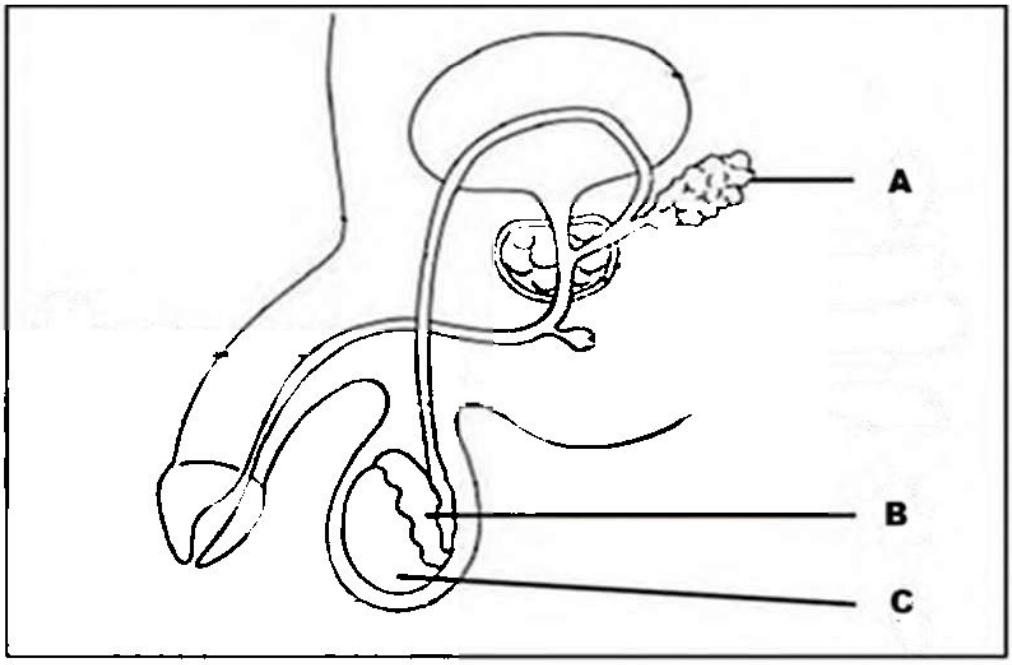
(c) Zygote formed between the gamete containing structure **B** and a normal gamete. (1)

(11)

2.3 Peter and Mary have two children. The oldest is Patrick followed by Anne, a girl. Mary is pregnant again with a girl. Mary and Peter's first child is a haemophiliac and they are afraid that their third child may also have the disorder. Mary is a carrier of haemophilia and John has the normal clotting factor.

2.3.1 Construct a simple pedigree diagram showing the inheritance of haemophilia in this family and indicate each person's genotype on the diagram. **(5)**

2.4 The diagram below represents the male reproductive system:



2.4.1 Give the LETTER and the NAME of the part where spermatogenesis occur. (2)

2.4.2 Give the function of part labelled **B.** (1)

2.4.3 Give the name of part labelled **A** and explain its impact on the sperm cell if this part is blocked during reproduction (7)
(10)

2.5 A team of researchers in Hawaii IVF (in vitro fertilisation) centre investigated the relationship between different concentration of Follicle stimulating hormone (FSH) and the growth rate of the ovarian follicles.

The procedure was as follows:

- 90 healthy, non-smoking females between the ages of 25-30 years participated
- The females were divided into 3 groups of 30 participants each.
- Group A shows steady natural growth of the follicles with low FSH (5mIU/mL), Group B received a moderate dosage of FSH (12mIU/mL), and Group C received a high dosage of FSH
- (20mIU/mL)
- The follicle diameter was measured at the same time every day for 5 days

The table below shows the average follicle diameter (mm) over 10 days.

Day	Group A (5mIU/mL)	Group B (12mIU/mL)	Group C (20mIU/mL)
1	2.1	2.2	2.1
2	3.2	4.0	2.3
3	4.3	5.8	6.5
4	5.4	7.6	8.7
5	6.5	9.4	10.9

2.5.1 Identify the:

(a) Independent variable. (1)

(b) Dependent variable. (1)

2.5.2 List TWO ways at which validity was ensured in this investigation. (2)

2.5.3 Give the purpose of **Group A** in this investigation. (2)

2.5.4 Calculate the average follicle diameter of **Group B.** (3)

2.5.5 Provide a conclusion for the above investigation. (2)

(11)

[50]

QUESTION 3

3.1 Dogs have been selectively bred for centuries to satisfy human's desire for various characteristics. Ear shape and coat texture is controlled by different genes. Dogs can have Pointy ears (E) or Floppy ears (e). There are three possible coat textures: Smooth (S), Curly (C) and Wavy (SC).

3.1.1 Identify the type of dominance displayed by the inheritance of ear shape. (1)

3.1.2 How many genes are responsible for ear shape? (1)

3.1.3 How many alleles controls coat texture? (1)

3.1.4 A male dog with pointy ears and smooth coat was bred with a female dog with floppy ears and wavy coat. Using a genetic cross it is predicted that there are 4 possible combinations of characteristics for the puppies to be produced.

Possible puppies	Posible genotypes
1	EeSS
2	EeSC
3	eeSS
4	eeSC

(a) Give the genotype of the male dog bred. (1)

(b) Provide the gametes produced by the female dog bred. (2)

(c) Write down the phenotype of puppy number **3**. (1)

3.1.5 Many people indicated that they want puppies with floppy ears and curly coats. Explain why the male dog used will never be able to produce curly coat puppies. (2)

3.1.6 If the farmer wants to continue breeding with the female above, what must be the genotype of the male dog be, to ensure her next litter has the highest chance of producing the desired puppies mentioned in QUESTION 3.1.5? (1)

(10)

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3.2 Read the extract below explaining the relationship between picky eating and genes.

> If you find most green vegetables horribly bitter, research has found it could be more than just picky eating. During a study conducted on our tasting gene, it was found to carry mutations leading to variety in how we perceive the taste of especially green vegetables. Some people has developed a mutation in their taste gene that makes them overly sensitive to the bitterness found in green plants. This is believed to be beneficial in early years where people gathered vegetables from nature and they had to be sensitive to bitter tastes which could indicate a possible poisonous plant. These bitter tasting chemicals were protecting the plant against pests and herbivores.
>
> These days farming research uses biotechnological processes of genetic engineering to alter the genes in green plants causing them to produce less bitter tasting chemicals in order to make them more palatable to sensitive individuals.

3.2.1 Define the term biotechnology. (1)

3.2.2 The mutation causing humans to experience vegetables as having a bitter taste affects one tasting gene. (1)

Identify this type of mutation.

3.2.3 Explain the effect of this mutation on early humans. (3)

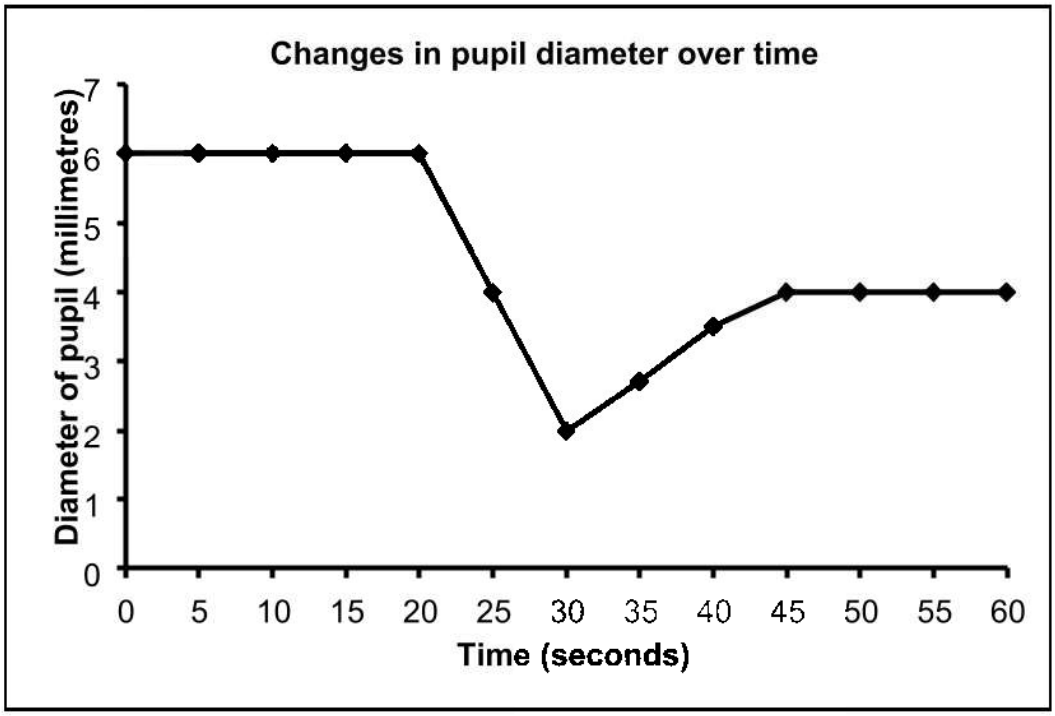
3.2.4 Why would researchers want to make these vegetables more palatable for sensitive individuals? (1)

3.2.5 Give TWO benefits, other than that mentioned in Question 3.2.4 of genetic engineering of plants for farming. (2)

3.2.6 Explain how this genetic engineering could be harmful to plants. (2)
(10)

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3.3 The graph below indicates the changes in diameter of the pupil of the human eye.



3.3.1 Which structure in the human eye **is responsible** for the changes indicated in the graph? (1)

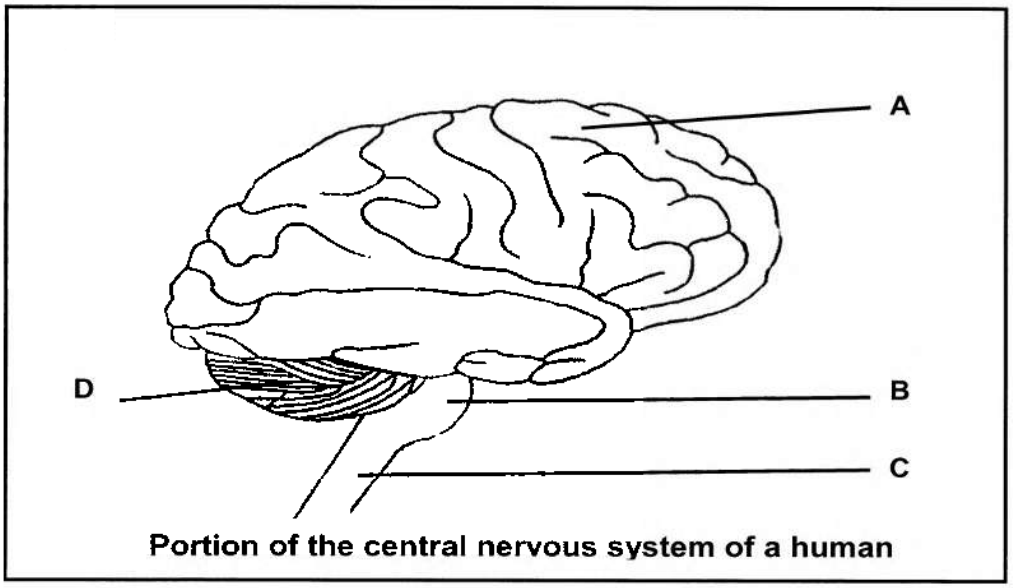
3.3.2 During which period of time was the person moving from **dim** light to bright **light**? (1)

3.3.3 Describe the changes that took place in the eye that led to the diameter change indicated from 30 to 35 seconds (3)

3.3.4 Draw a labelled diagram of the front view of the eye to show the exact size of the pupil at 20 seconds as indicated in the graph (5)
(10)

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3.4 The diagram below represents a portion of the central nervous system.



Portion of the central nervous system of a human

3.4.1 Give the LETTER and the NAME of the part that:

(a) coordinates voluntary movements. (2)

(b) degenerate and leads to Alzheimer's disease. (2)

(c) has receptors for the heart muscles. (2)

3.4.2 List TWO ways at which part **C** is protected. (2)

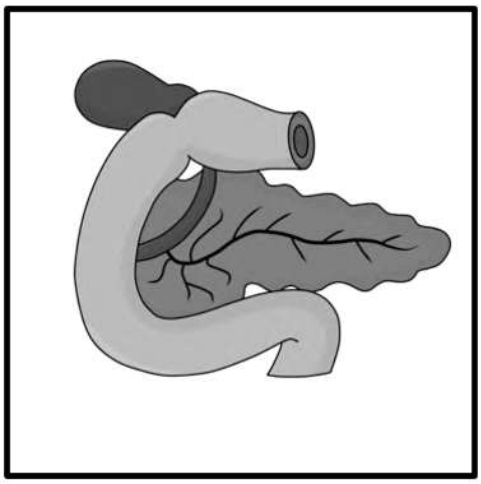
3.4.3 A haemorrhage (excessive bleeding due to rupture of a blood vessel) at part **A** can cause permanent dysfunction.

State THREE possible consequences for a patient who suffered damage to part **A** (3)

3.4.4 Concussion is a type of traumatic brain injury because of a blow in to the head especially part **B.**

Briefly explain why concussion does influence breathing. (2)
(13)

3.5 The diagram below represents a gland found in the human body.



3.5.1 Identify the gland above. (1)

3.5.2 Explain why this gland can be considered both endocrine and exocrine. (6)
(7)

[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

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