Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|
| | |

Centre Number | Candidate Number

# Pearson Edexcel Level 3 GCE

## Thursday 22 May 2025

Morning (Time: 1 hour 30 minutes)

Paper reference **8BN0/02**

# Biology A (Salters Nuffield)

## Advanced Subsidiary

## PAPER 2: Development, Plants and the Environment

**You must have:**
Scientific calculator, HB pencil, ruler

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided – *there may be more space than you need.*

## Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- You may use a scientific calculator.
- In questions marked with an **asterisk (*)**, marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

## Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over*


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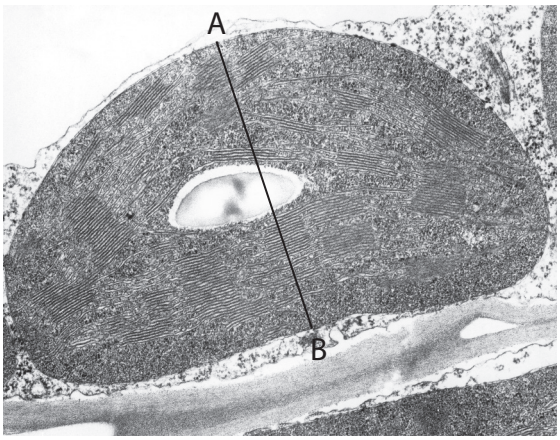
**Answer ALL questions. Write your answers in the spaces provided.**

**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

**1** All living organisms are made of cells.

(a) The image shows an electronmicrograph of an organelle found only in eukaryotic cells.




(Source: © Omikron/SCIENCE PHOTO LIBRARY)

magnification ×44 000

(i) This organelle is not found in prokaryotic cells.

Explain why this type of organelle is present only in eukaryotic cells and **not** in prokaryotic cells.

**(2)**

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(ii) Calculate the width of this organelle from A to B, as shown in the image.

Give your answer in micrometres (μm) to two significant figures.

**(2)**

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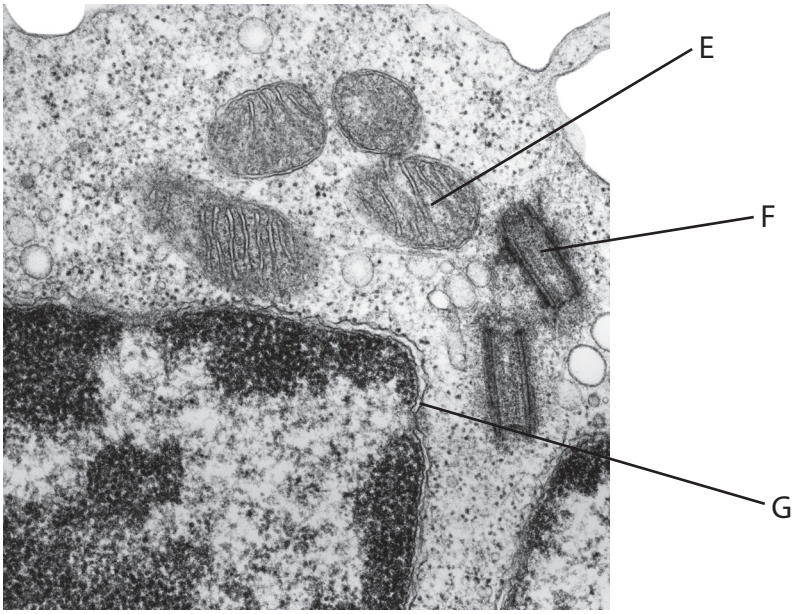
(b) The image shows an electronmicrograph of part of a eukaryotic cell.




(Source: © Don Fawcett/SCIENCE PHOTO LIBRARY)

(i) Which row in the table identifies structures E, F and G?

**(1)**

| | | Structure E | Structure F | Structure G |
|---|---|---|---|---|
| ☒ | **A** | chloroplast | centriole | nucleus |
| ☒ | **B** | chloroplast | Golgi apparatus | nuclear membrane |
| ☒ | **C** | mitochondrion | centriole | nuclear membrane |
| ☒ | **D** | mitochondrion | Golgi apparatus | nucleus |

(ii) Which row of the table shows the processes that involve structures E and F?

**(1)**

| | | Structure E | Structure F |
|---|---|---|---|
| ☒ | **A** | photosynthesis | mitosis |
| ☒ | **B** | photosynthesis | protein synthesis |
| ☒ | **C** | respiration | mitosis |
| ☒ | **D** | respiration | photosynthesis |

**(Total for Question 1 = 6 marks)**

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**2** The photograph shows a Pyrenean desman, a mammal that is endemic to fast-flowing mountain streams in Spain.

(Source: © BIOSPHOTO/Alamy Stock Photo)

(a) Which of the following is the correct definition of the term **endemic**?

**(1)**

☒ **A** found in only one type of habitat

☒ **B** found in only one geographical location

☒ **C** lives in many different locations

☒ **D** occupies a single niche

(b) The Pyrenean desman has a number of adaptations that allow it to survive in its habitat:

1. it feeds on insects
2. it has webbed feet to enable it to swim
3. it has a long snout that it can use to find food in between rocks
4. it has nostrils on the upper surface of the snout
5. it is nocturnal – feeding at night.

(i) Which adaptations from the list are all **anatomical** adaptations?

**(1)**

☒ **A** 1, 2 and 3

☒ **B** 1, 3 and 4

☒ **C** 2, 3 and 4

☒ **D** 3, 4 and 5

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(ii) The Pyrenean desman is thought to have evolved from a land-living animal similar to a mole.

Explain how the Pyrenean desman could have evolved by natural selection from a land-living animal similar to a mole.

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**(Total for Question 2 = 7 marks)**

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**3** The leaves of the pineapple plant provide long fibres that can be used in the production of textiles.

The photograph shows fibres being extracted from pineapple leaves.

(Source: © Jahangir Alam Onuchcha/Shutterstock)

(a) Leaves are organs that contain tissues.

Give **one** difference between an organ and a tissue.

**(1)**

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(b) (i) The fibres extracted from pineapple leaves contain cellulose and lignin.

Which of the following tissues contain **lignin**?

**(1)**

☒ **A** only phloem

☒ **B** only sclerenchyma

☒ **C** only xylem

☒ **D** sclerenchyma and xylem

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(ii) Explain how the features of xylem vessels are related to its functions.

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(c) Fibres for textiles can also be made from oil-based plastics.

Explain why the use of fibres from pineapple leaves is more sustainable than producing fibres from oil-based plastics.

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**(Total for Question 3 = 8 marks)**

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**4** Rockpools on the seashore contain seaweeds that provide habitats for other organisms.

The photograph shows *Fucus serratus*, a species of seaweed found in rockpools.

(Source: © NIGEL DOWNER/SCIENCE PHOTO LIBRARY)

(a) State what is meant by the term **species**.

**(2)**

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(b) The biodiversity of habitats can be measured and compared.

(i) One measure of biodiversity is species richness.

Describe how species richness can be used to compare the biodiversity of two habitats.

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(ii) Biodiversity can also be measured using an index of diversity.

The table shows data collected from one rockpool.

| Species of seaweed | Number of individuals (n) | n(n – 1) |
|---|---|---|
| *Chondrus crispus* | 5 | 20 |
| *Cladophora rupestris* | 5 | 20 |
| *Corallina officinalis* | 11 | 110 |
| *Fucus serratus* | 4 | 12 |
| *Fucus spiralis* | 9 | 72 |
| *Ulva lactuca* | 8 | 56 |
| **Total number of individuals (N)** | **42** | |

Calculate the index of diversity for this rockpool using the formula:

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

Give your answer to two decimal places.

**(2)**

Answer .....

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(iii) Explain why an index of diversity is more useful than species richness for determining biodiversity.

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**(Total for Question 4 = 8 marks)**

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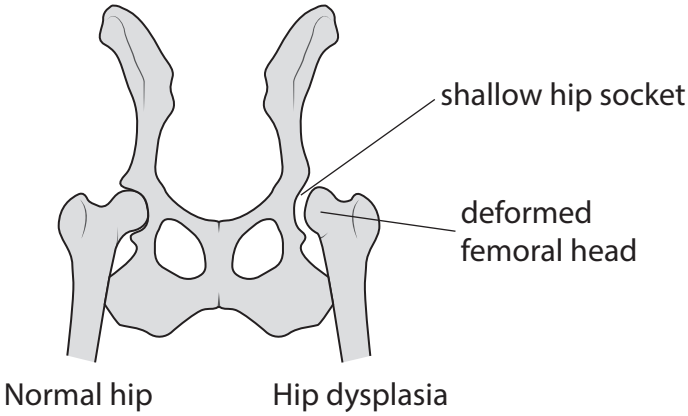
**5** Canine hip dysplasia is a polygenic disorder that affects dogs.

The diagram shows the effect of this disorder on the hip joint of a dog.




(a) Canine hip dysplasia is a polygenic disorder showing continuous variation.

(i) Describe what is meant by the term **continuous variation**.

**(2)**

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(ii) Explain how **polygenic inheritance** can give rise to continuous variation in characteristics such as eye colour in humans.

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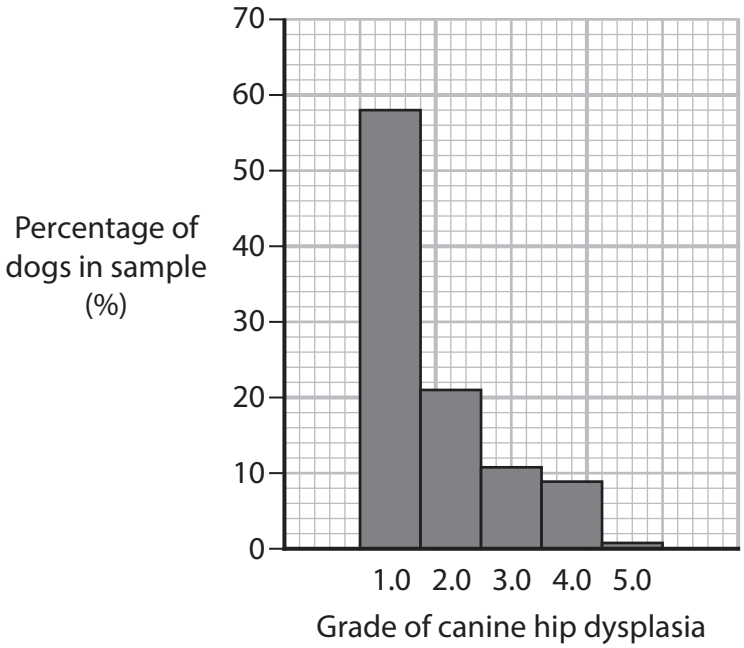
(b) Canine hip dysplasia affects the hip joint of dogs causing pain and difficulty walking. Canine hip dysplasia is more common in larger dogs.

A study of the incidence of this disorder in dogs was carried out.

The table shows how the severity of this disorder is graded.

| Grade of severity | Description |
|---|---|
| 1.0 | Normal hip joint |
| 2.0 | Borderline dysplasia |
| 3.0 | Mild dysplasia |
| 4.0 | Moderate dysplasia |
| 5.0 | Severe dysplasia |

The graph shows the percentage of Labrador dogs with canine hip dysplasia of different grades.

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Identify the evidence that canine hip dysplasia is a polygenic condition and not one caused by environmental factors.

Use the information provided and your own knowledge to answer the question.

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**(Total for Question 5 = 10 marks)**

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**6** The phenotype of an organism can be affected by its genotype and the environment.

(a) (i) Which of the following is the definition of the term **phenotype**?

**(1)**

☒ **A** the alleles inherited by an organism

☒ **B** the characteristics shown by an organism

☒ **C** the genes inherited by an organism

☒ **D** the physical environment of an organism

(ii) The photograph shows a Siamese cat.

(Source: © DK IMAGES/SCIENCE PHOTO LIBRARY)

This breed of cat has darker fur on the face, tail and feet.

If a Siamese cat spends more time outdoors, it may grow darker fur in other places on its body.

Which factors are most likely to affect the pattern of fur colour of Siamese cats?

**(1)**

☒ **A** body temperature only

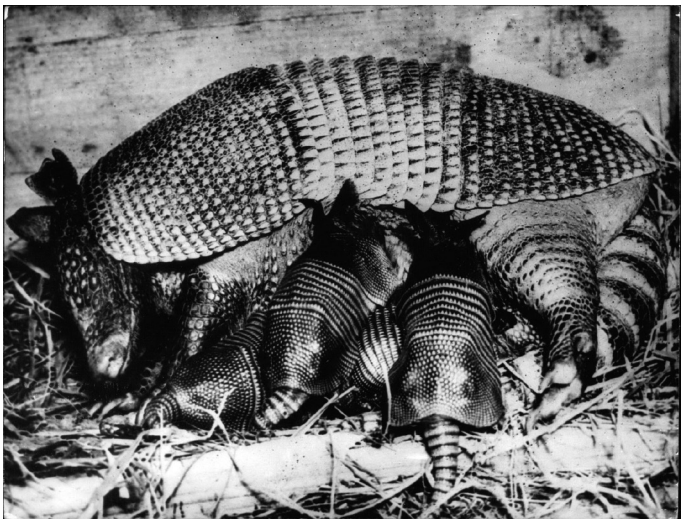
☒ **B** environmental temperature only

☒ **C** genotype and environmental temperature

☒ **D** genotype only

(b) An armadillo is a mammal that can produce litters of four genetically identical offspring.

The photograph shows an armadillo with a litter of four offspring.



(Source: © Keystone Press/Alamy Stock Photo)

(i) Which of the following describes how these four genetically identical offspring are produced?

**(1)**

☒ **A** a fertilised egg divides by meiosis to produce four embryos

☒ **B** a fertilised egg divides by mitosis to produce four embryos

☒ **C** an egg cell divides by mitosis and is then fertilised by four sperm cells

☒ **D** four egg cells are fertilised by four sperm cells

(ii) Deduce why armadillos have been used to investigate the effects of the environment on phenotype.

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(c) Epigenetic factors, such as DNA methylation, can affect the phenotype of an organism.

Explain how DNA methylation can affect the activation of a gene.

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(d) In mice, fur colour is determined by genetic and by epigenetic factors.

The photograph shows a litter of mice.

(Source: © Floris Slooff/Shutterstock)

All these mice

- have a gene that produces brown fur and this gene is always switched on
- have the agouti gene that can produce yellow fur.

In an investigation, female agouti mice with yellow fur were placed in two groups, A and B. The mice were fed different diets.

The table shows the features of their offspring.

| Group | Diet | Features of offspring produced | |
|---|---|---|---|
| | | Fur colour | Health |
| A | Rich in sources of methyl groups | Most had brown fur | Most had good health |
| B | Low in sources of methyl groups | Most had yellow fur | Most had poor health |

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(i) Deduce the effect of methyl groups in the diet on the features of the offspring of these mice.

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(ii) Epigenetic changes to the DNA of the offspring happen during their development inside the mother.

Explain how the results of this investigation support this statement.

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**(Total for Question 6 = 13 marks)**

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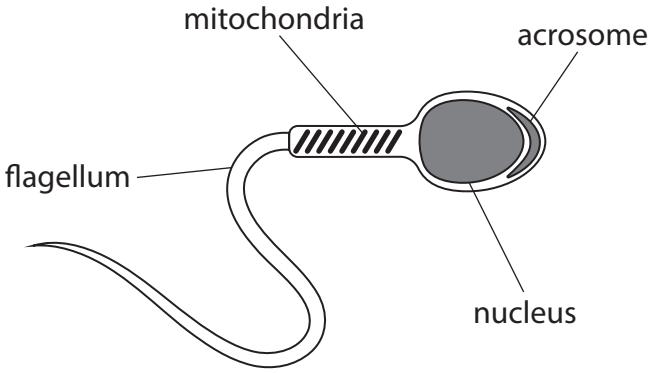
**7** Sperm cells are gametes produced by animals.

The diagram shows the structure of a sperm cell.




(a) Describe how the structure of the sperm cell allows it to reach the surface membrane of an egg cell.

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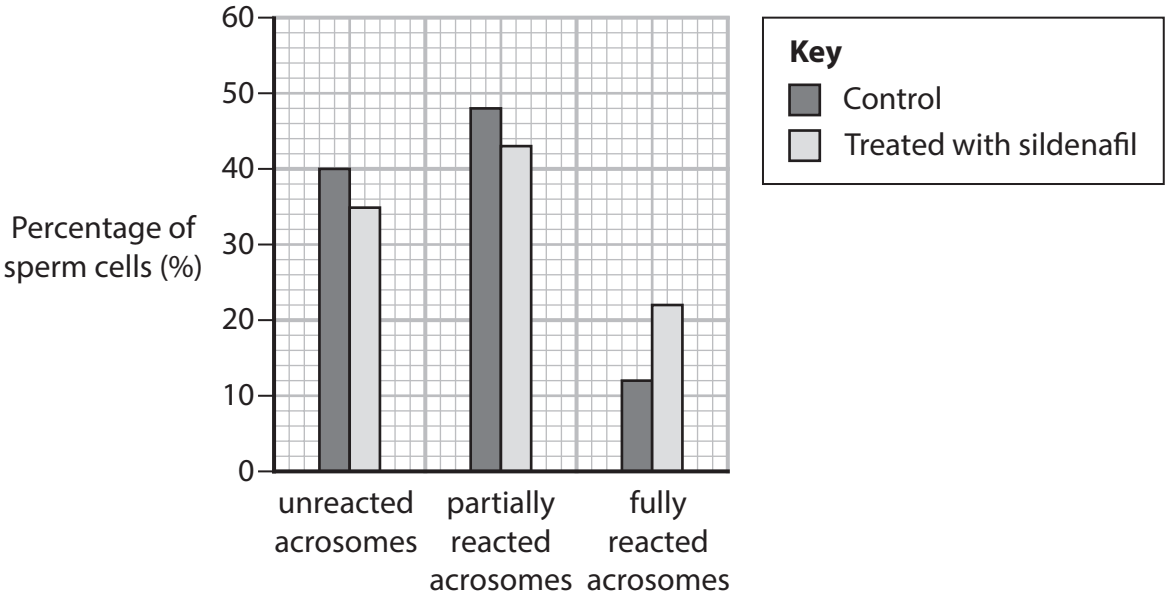
(b) The effect of the drug sildenafil on sperm cells was investigated.

In one investigation, the state of the acrosome was observed after sperm cells were treated with sildenafil. Unreacted acrosomes had not fused with the sperm cell surface membrane. Partially or fully reacted acrosomes had fused with the sperm cell surface membrane.

The percentage of sperm cells with unreacted, partially reacted and fully reacted acrosomes was calculated. This was compared with sperm cells not treated with sildenafil.

The graph shows the results of this investigation.




Deduce how sildenafil could affect fertility.

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(c) In an investigation, the velocity of the sperm cells was measured from 0 to 90 minutes after being treated with sildenafil.

A control group was not given sildenafil.

The table shows the results of this investigation.

| Time / minutes | Velocity of sperm cells / $\mu m\ s^{-1}$ | |
|---|---|---|
| | Control | Treated with sildenafil |
| 0 | 33 | 33 |
| 15 | 32 | 38 |
| 30 | 31 | 39 |
| 60 | 30 | 38 |
| 90 | 29 | 33 |

(i) Plot the data to show the results of this investigation in a suitable graphical form.

**(4)**

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(ii) It has been stated that sildenafil improves the functioning of mitochondria.

Discuss how these results support this statement.

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**(Total for Question 7 = 14 marks)**

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**8** The conservation of plant species includes storing seeds in seedbanks.

(a) The photograph shows some seed samples prepared for storage.

(Source: © WLADIMIR BULGAR/SCIENCE PHOTO LIBRARY)

(i) Explain why seeds are dried before being stored.

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(ii) The seeds of many plants are stored at very low temperatures.

Explain the effect of temperature on bacterial growth.

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(b) Coffee beans are the seeds of the coffee plant.

The photograph shows seeds, leaves and fruits of the coffee plant.

(Source: © Subbotina Anna/Shutterstock)

In an investigation, extracts from different parts of the coffee plant were tested for antimicrobial properties.

*Vibrio cholerae*, a species of bacteria that causes the disease cholera, was used in this investigation.

The results of the investigation are shown in the table.

| Extract from | Mean diameter of inhibition zone / mm ± SD |
|---|---|
| Seed | 12.33 ± 0.58 |
| Fruit | 11.33 ± 4.04 |
| Leaf | 16.67 ± 1.15 |

Comment on the antimicrobial properties of the parts of the coffee plant tested.

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*(c) It has been suggested that the antimicrobial properties of seeds are reduced during long periods of time in storage.

Devise an investigation to determine the effect of storage time on the antimicrobial properties of coffee seeds stored in a seed bank.

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**(Total for Question 8 = 14 marks)**

**TOTAL FOR PAPER = 80 MARKS**

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