

SMARTWIZ

GRADE12 LIFE SCIENCE EXAM

MARKS: 150

TIME: 2.5 HOURS

SCHOOL _____

CLASS (eg. 4A) _____

SURNAME _____

NAME _____

MARKS	
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Instructions for Learners:

- Read all instructions carefully before you begin the exam.
- Write your full name and student number clearly on the answer sheet/book.
- Answer all questions unless otherwise instructed.
- Show all your work/calculations where necessary.
- Write neatly and clearly.
- Use only a blue or black pen. Do not use correction fluid or tape.
- Electronic devices (calculators, cell phones, etc.) are not allowed unless explicitly permitted.
- Raise your hand if you have any questions.
- Do not talk to other learners during the exam.
- Any form of dishonesty will result in immediate disqualification from the exam.

This exam consists of Eight pages, including the cover page.

SECTION A: GENETICS AND BIOTECHNOLOGY (50 MARKS)

QUESTION 1: DNA and Protein Synthesis (25 marks)

1.1 Define the following terms:

a) Codon

b) Transcription

c) Mutation

1.2 Describe the steps of protein synthesis from DNA to a final protein. (6)

1.3 The sequence of DNA in a cell is:

TAC CGA GGA TTT

a) Write the corresponding mRNA strand. (2)

b) Provide the amino acid sequence using a codon table. (3)

1.4 Explain two ways a mutation can affect the structure and function of a protein. (4)

1.5 State two differences between DNA and RNA. (2)

1.6 What is the role of tRNA in protein synthesis? (2)

QUESTION 2: Genetic Engineering (25 marks)

2.1 Define the term “genetically modified organism (GMO)”. (2)

2.2 Describe two advantages and two disadvantages of using GMOs in agriculture. (4)

Advantages:

Disadvantages:

2.3 What is gene cloning and how is it different from reproductive cloning? (4)

2.4 Explain the role of restriction enzymes in genetic engineering. (3)

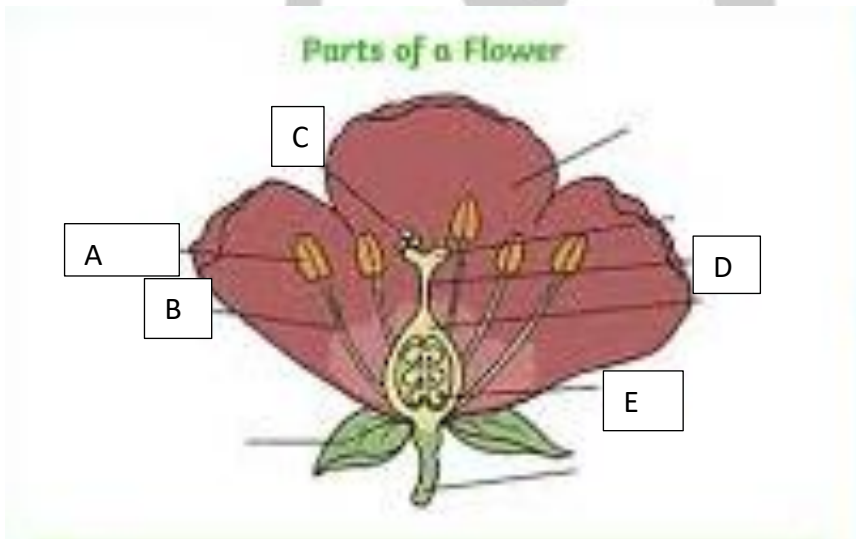
2.5 Name two products of biotechnology used in medicine. (2)

2.6 Discuss two ethical concerns associated with biotechnology. (4)

SECTION B: PLANT REPRODUCTION (50 MARKS)

QUESTION 3: Sexual Reproduction in Plants (25 marks)

3.1 Label parts A–E on the flower diagram provided.



A: _____
B: _____
C: _____
D: _____
E: _____

3.2 Describe the process of pollination and distinguish between self- and cross-pollination. (5)

3.3 Explain the steps of fertilisation in flowering plants. (5)

3.4 Define double fertilisation and state where it occurs. (3)

3.5 Name two agents of pollination and describe one structural adaptation in flowers that supports each. (4)

3.6 State two advantages of sexual reproduction in plants. (2)

QUESTION 4: Seed Germination and Development (25 marks)

4.1 Define seed germination. (2)

4.2 List three environmental conditions necessary for germination. (3)

4.3 Describe what happens inside the seed during germination. (5)

4.4 Explain how plant hormones such as auxins affect growth. (4)

4.5 Distinguish between epigeal and hypogeal germination. (4)

4.6 Draw and label a diagram of a germinating seed. (Draw in the space below.)
(5 marks – correct structure and labels)

SECTION C: POPULATION ECOLOGY (50 MARKS)

QUESTION 5: Population Dynamics (25 marks)

5.1 Define the following terms:

a) Population density

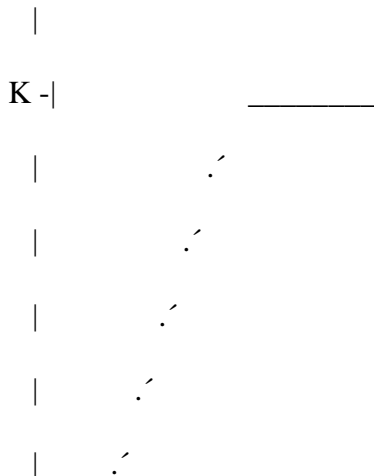
b) Carrying capacity

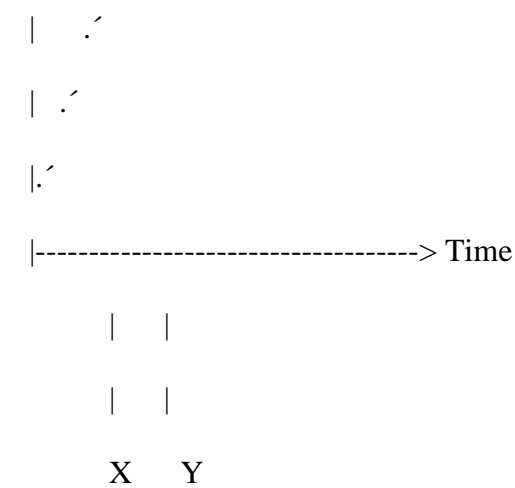
c) Limiting factor

5.2 Describe how birth rate, death rate, immigration, and emigration affect population size. (4)

5.3 Interpret the graph of population growth

Population





a) Identify the growth phase labeled X. (1)

b) What causes the plateau at the top of the curve? (2)

5.4 Differentiate between r-strategists and K-strategists using two examples. (4)

5.5 Name two methods of estimating population size in ecology. Briefly explain one. (4)

QUESTION 6: Human Impact on Ecosystems (25 marks)

6.1 Describe how overfishing impacts marine ecosystems. (4)

6.2 Suggest two ways governments can reduce overfishing. (2)

6.3 Explain the effect of invasive species on native biodiversity. (4)

6.4 What is sustainable development? Why is it important? (4)

6.5 Explain how ecotourism can contribute to conservation efforts. (4)

6.6 Describe two effects of landfills on the environment. (4)

MEMO**SECTION A: GENETICS AND BIOTECHNOLOGY (50 marks)**

QUESTION 1: DNA & Protein Synthesis (25)**1.1**

- a) Codon – A sequence of three nitrogenous bases on mRNA that codes for a specific amino acid. (2)
- b) Transcription – The process by which a segment of DNA is copied into mRNA. (2)
- c) Mutation – A change in the nucleotide sequence of DNA. (2)

1.2

Steps:

1. DNA unzips.
2. mRNA is transcribed from the DNA template.
3. mRNA moves to the ribosome.
4. tRNA brings amino acids.
5. Codons on mRNA match with anticodons on tRNA.
6. Amino acids are linked into a polypeptide chain. (6)

1.3

- a) AUG GCU CCU AAA (2)
- b) Amino acids: Methionine – Alanine – Proline – Lysine (3)

1.4

- A mutation may alter the amino acid sequence, changing protein shape.
- This can render a protein non-functional or change its activity. (Any 2 points × 2) (4)

1.5

- DNA has thymine; RNA has uracil.
- DNA is double-stranded; RNA is single-stranded. (2)

1.6

tRNA transports specific amino acids to the ribosome during translation. (2)

QUESTION 2: Genetic Engineering (25)**2.1**

A GMO is an organism whose genetic material has been altered using genetic engineering. (2)

2.2

Advantages:

- Higher crop yields
 - Pest/disease resistance (2)
- Disadvantages:
- Environmental impact
 - Unknown health effects (2)

2.3

Gene cloning: Copying a gene.

Reproductive cloning: Creating a full organism genetically identical to the donor. (4)

2.4

Restriction enzymes cut DNA at specific sequences, allowing insertion of genes. (3)

2.5

Examples:

- Insulin
- Human growth hormone (2)

2.6

- Tampering with nature
- Ownership of genetic material
(Any valid ethical concern \times 2) (4)

SECTION B: PLANT REPRODUCTION (50 marks)

QUESTION 3: Flowering Plant Reproduction (25)

3.1

- A: Anther
B: Filament
C: Stigma
D: Style
E: Ovary (5)

3.2

Pollination is the transfer of pollen to the stigma.

- Self-pollination: Same flower or same plant
- Cross-pollination: Between different plants (5)

3.3

1. Pollen lands on stigma
2. Pollen tube grows toward ovule
3. Sperm cells travel through tube
4. One sperm fertilizes egg → zygote
5. Other sperm forms endosperm (5)

3.4

Double fertilisation: One sperm fertilises the egg; another fuses with polar nuclei → endosperm. Occurs in angiosperms. (3)

3.5

- Bee pollination: Bright petals, nectar
- Wind pollination: Light pollen, exposed anthers (4)

3.6

- Produces variation
- Adaptation to environment (2)

QUESTION 4: Seed Germination (25)

4.1

Germination: Process where a seed resumes growth after dormancy. (2)

4.2

- Water
- Oxygen
- Suitable temperature (3)

4.3

- Seed absorbs water
- Enzymes activate
- Food reserves are broken down
- Radicle (root) and plumule (shoot) emerge
- Growth continues using stored food (5)

4.4

Auxins promote cell elongation in stems, root growth, and phototropism. (4)

4.5

- Epigeal: Cotyledons emerge above ground
- Hypogeal: Cotyledons stay underground (4)

4.6

Diagram should show:

- Seed coat
 - Cotyledons
 - Radicle
 - Plumule
 - Embryo axis
- (5 marks for accuracy, labels)

SECTION C: POPULATION ECOLOGY (50 marks)

QUESTION 5: Population Dynamics (25)

5.1

- a) Population density: Number of individuals per unit area. (2)
- b) Carrying capacity: Max number the environment can support. (2)
- c) Limiting factor: Factor that restricts population growth (e.g., food, space). (2)

5.2

- Births and immigration increase size.
- Deaths and emigration decrease size. (4)

5.3

- a) Exponential phase (1)
- b) Resource limitation and environmental resistance (2)

5.4

- r-strategists: Many offspring, low survival (e.g., insects)
- K-strategists: Few offspring, high parental care (e.g., elephants) (4)

5.5

- Quadrat method
- Mark-recapture (explained: tag, release, recapture, use formula) (4)

QUESTION 6: Human Impact on Ecosystems (25)

6.1

Overfishing depletes fish stocks, disrupts food chains, affects biodiversity. (4)

6.2

- Fishing quotas
- Seasonal bans or protected areas (2)

6.3

Invasive species outcompete natives, disrupt ecosystems, reduce biodiversity. (4)

6.4

Sustainable development meets present needs without harming future resources. (4)

6.5

Ecotourism generates funds for conservation, raises awareness, involves communities. (4)

6.6

Landfills cause:

- Groundwater pollution
- Air pollution (methane) (4)

✓ **TOTAL: 150 MARKS**