

BIOLOGY BIO 01

14/07/2025 2:00 PM-5:00 PM

SUBJECT : BIOLOGY

OPTION :
SCIENCE AND MATHEMATICS EDUCATION
(SME)

DURATION: 3 HOURS

Names:
Index number:

S6 QUESTIONS and ANSWERS BOOKLET

TTC NATIONAL EXAMINATIONS, 2024-2025

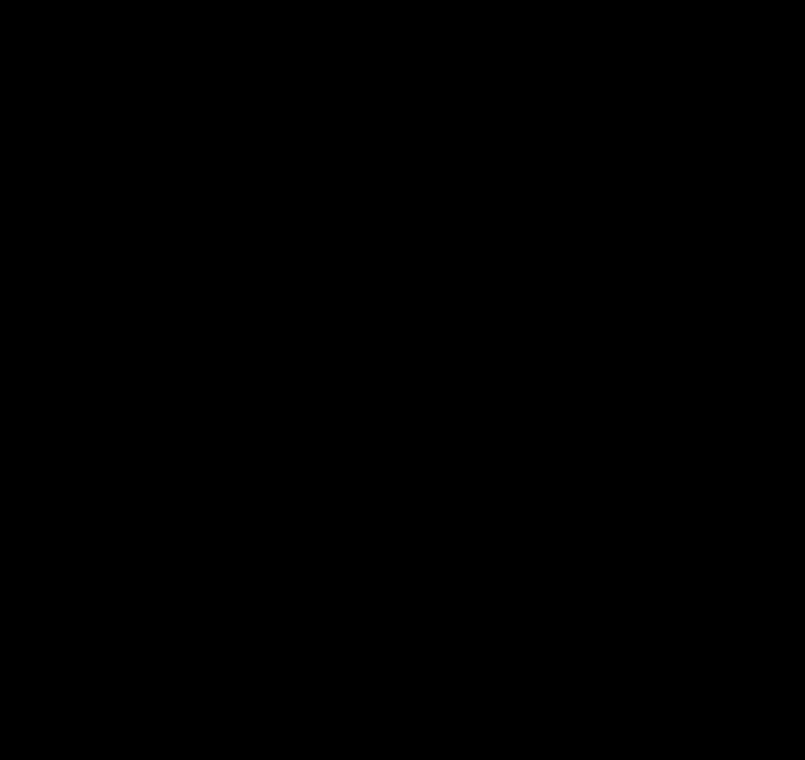
Instructions to candidates:

- 1) Write your names and index number on the answer booklet as written on your registration form.
- 2) Do not open this question paper until you are told to do so.
- 3) This paper consists of **two** sections: **A, B** and **C**.
Section A: Attempt **all** questions. (55 marks)
Section B: Attempt any **three** questions. (30 marks)
Section C: This section is **Compulsory**. (15 marks)
- 4) Use this question paper for answering
- 5) Use a **blue** or **black** pen.

FOR EXAMINER'S USE ONLY

Questions	Marks	Questions	Marks
1		16	
2		17	
3		18	
4		19	
5		20	
6		21	
7		22	
8		23	
9		24	
10		25	
11		26	
12		27	
13		28	
14		29	
15		30	

TOTAL MARKS...../ 100



Section A: Attempt all questions (55 marks)

For all multiple choice questions, circle a letter corresponding to the correct answer.

- 1) Which of the following is the highest rank in the biological classification system? **(1 mark)**
- a) Species.
 - b) Kingdom.
 - c) Genus.
 - d) Family.
- 2) What is the primary cause of malaria? **(2 marks)**
- a) Bacteria.
 - b) Virus.
 - c) Parasite.
 - d) Fungi.
- 3) During which stage of mitosis do sister chromatids separate and move toward opposite poles of the cell? **(2 marks)**
- a) Prophase.
 - b) Metaphase.
 - c) Anaphase.
 - d) Telophase.
- 4) A cell membrane is described as selectively permeable. Which of the following is an example of this property? **(2 marks)**
- a) Only water molecules can pass freely through the membrane
 - b) Small nonpolar molecules can pass through the membrane, while large polar molecules cannot
 - c) Oxygen molecules are blocked from entering the cell
 - d) All substances pass through the membrane equally
- 5) What would happen to the rate of photosynthesis in plants if the carbon dioxide concentration is reduced? **(2 marks)**
- a) The rate of photosynthesis would increase
 - b) The rate of photosynthesis would decrease
 - c) There would be no change in the rate of photosynthesis
 - d) The plants would begin to use nitrogen for energy
- 6) Which gland is known as the "master gland" because it regulates the activity of other endocrine glands? **(2 marks)**
- a) Thyroid gland
 - b) Pineal gland
 - c) Pituitary gland

d) Adrenal gland

7) During heavy exercise, a person's body temperature increases. Which of the following physiological responses helps maintain homeostasis? **(2 marks)**

- a) The body reduces blood flow to the skin to conserve heat
- b) Sweat glands secrete sweat, which evaporates and cools the body
- c) The kidneys increase urine production to cool the body
- d) Blood vessels constrict to preserve body heat

8) Imagine you were genetically engineering a plant to increase its rate of transpiration. Which change would most likely contribute to this process? **(2 marks)**

- a) Increase the number of phloem cells in the leaf.
- b) Enhance the efficiency of the stomata in closing during the day.
- c) Develop larger xylem vessels for faster water transport.
- d) Alter the leaf structure to reduce surface area.

9) Imagine you are designing a new plant species with a higher resistance to disease. Which genetic modification would you incorporate to ensure the plant inherits this trait consistently across generations? **(2 marks)**

- a) Introducing a gene for disease resistance into the plant's dominant allele for growth.
- b) Creating a mutation in the plant's DNA to make it susceptible to more diseases.
- c) Crossing the plant with another species to ensure genetic diversity.
- d) Inducing a recessive gene for disease resistance to express itself in the next generation.

10) Which of the following is the main concept behind the theory of evolution? **(2 marks)**

- a) Organisms evolve due to the direct influence of environmental factors.
- b) Organisms inherit acquired characteristics from their parents.
- c) Species change over time due to variations and natural selection.
- d) All organisms have remained the same since their origin.

11) What is the main difference between asexual and sexual reproduction in plants? **(2 marks)**

- a) Asexual reproduction produces offspring that are genetically identical to the parent, while sexual reproduction results in genetic variation.
- b) Asexual reproduction requires pollinators, while sexual reproduction does not.
- c) Sexual reproduction produces only one offspring, whereas asexual reproduction produces multiple offspring.

d) Asexual reproduction occurs only in flowers, while sexual reproduction occurs in leaves and roots.

12) What is the magnification of an image where the image size is 50 mm and the object size is 5 μm ? **(2 marks)**

- a) 1000
- b) 10000
- c) 100000
- d) 1000000

13) Which of the following theories explains stomatal closure during water stress, where guard cells lose turgidity? **(2 marks)**

- a) Ion Leak Theory.
- b) Proton Pump Inhibition Theory.
- c) Cellular Shrinkage Theory.
- d) Aquaporin Theory.

14) Which of the following is a key feature of ATP that makes it suitable as the universal energy currency? **(2 marks)**

- a) It has a long-lasting energy storage capacity.
- b) It contains high-energy bonds between phosphate groups.
- c) It is only used in plant cells.
- d) It is a stable molecule that does not break down easily.

15) State whether each of the following statements about ATP is **True** or **False**. **(4 marks)**

a) ATP consists of an adenine base, ribose sugar, and three phosphate groups.

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b) ATP releases energy when a phosphate bond is formed.

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c) ATP acts as the main energy currency of the cell.

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d) ATP can be synthesized through oxidative phosphorylation, substrate-level phosphorylation, and photophosphorylation.

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16) A couple decides to use an IUD (Intrauterine device) as a method of birth control. Which of the following is a key benefit of this method? **(2 marks)**

- a) It needs to be used during each sexual act.
- b) It is a long-term, reversible form of contraception.
- c) It is effective only for a few weeks.
- d) It protects against sexually transmitted infections.

- 17) Which of the following is a primary factor that affects population density? **(2 marks)**
- a) Climate.
 - b) Transportation systems.
 - c) Birth rate.
 - d) Population age structure.
- 18) In a photomicrograph showing a microorganism with a rigid outer capsule and long flagella, what is the most likely function of the flagella? **(2 marks)**
- a) To protect the microorganism from environmental stress.
 - b) To allow the microorganism to attach to surfaces.
 - c) To enable the microorganism to move towards nutrients or away from toxins.
 - d) To assist in reproduction.
- 19) State whether each of the following statements about Enzyme technology is **True** or **False**. **(5 marks)**
- a) Enzyme technology is commonly used in the production of biofuels to break down complex carbohydrates into simpler sugars.
 - b) Enzymes used in food processing can help extend the shelf life of products by slowing down spoilage.
 - c) Enzyme technology is not applicable in the textile industry as it cannot be used to soften fabrics.
 - d) Enzyme-based detergents are more efficient in cleaning at lower temperatures compared to traditional chemical detergents.
 - e) The use of enzymes in the pharmaceutical industry is limited to the production of antibiotics only.

20) Match the type of natural selection with the appropriate example. (3 marks)

Type of Selection	Example
A) Stabilizing Selection	1) A population of birds has medium-sized beaks as they are more efficient in cracking seeds.
B) Directional Selection	2) A population of giraffes with longer necks are more likely to survive due to food scarcity at lower heights.
C) Disruptive Selection	3) A population of fish that exhibit both dark and light colors to match their environment.

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21) State whether each of the following statements about the contribution of genetic recombination to genetic variation is **True** or **False**. (4 marks)

- a) Genetic recombination ensures that offspring inherit identical genetic traits from both parents.
- b) The process of genetic recombination increases genetic variation by producing new combinations of alleles that were not present in either parent.
- c) Genetic recombination only occurs in asexual reproduction.
- d) The genetic variation introduced by recombination is important for evolution because it provides a population with a range of traits that might be beneficial in changing environments.

22) What is the primary source of variation in a population? (2 marks)

- a) Genetic drift.
- b) Mutation.
- c) Natural selection.
- d) Bottleneck effect.

23)How does an increase in cholesterol content affect the ability of the plasma membrane to accommodate proteins? **(1 mark)**

- a) It decreases the membrane's ability to host proteins.
- b) It increases the membrane’s ability to host proteins.
- c) It has no effect on protein accommodation.
- d) It helps to segregate proteins into specific domains.

24)A farmer notices that crops produced through vegetative reproduction are less resistant to diseases compared to seed-grown crops. What is the most likely explanation? **(1 mark)**

- a) Vegetative reproduction accelerates nutrient uptake.
- b) Lack of genetic variation makes the plants vulnerable to pathogens.
- c) Seed-grown crops mature faster than vegetative crops.
- d) Pollination failures affect vegetative reproduction.

25)If you were designing a plant in a dry environment, which adaptation would help improve gas exchange? **(2 marks)**

- a) Increase the number of stomata to maximize CO₂ intake.
- b) Decrease the size of leaves to reduce transpiration.
- c) Increase the size of roots to enhance water absorption.
- d) Increase the amount of chlorophyll to enhance photosynthesis.

Section B: Attempt any three questions (30 marks)

26)How do different methods of regulating body temperature help conserve heat during cold weather? **(10 marks)**

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27) Why is the rate of energy assimilation at the herbivore level referred to as secondary productivity, and what makes nutrient cycles in nature known as biogeochemical cycles? **(10 marks)**

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28) What factors would guide your decision in selecting the type of genetic material to analyze when designing a genetic screening test for identifying carriers of a recessive genetic disorder? **(10 marks)**

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29) What modifications can be made to a standard electrophoresis procedure to improve the separation of proteins with similar molecular weights, and what factors should be considered in making these adjustments? **(10 marks)**

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Section C: Compulsory Question (15 marks)

30) As a researcher developing a gene therapy for cystic fibrosis, what strategies would you consider for efficiently delivering the functional gene to the affected cells in the lungs, and how would you address potential challenges? **(15 marks)**

[illegible]

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