EXAM: Biology and Health Sciences I (Theory)

Date: 16th June 2025
Period: 08:30 AM – 11:30 AM

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

END OF TERM III EXAMINATION, SCHOOL YEAR: 2024-2025

QUESTION PAPER

GRADE: SENIOR TWO (S2)

LEVEL: ORDINARY LEVEL

0TION: ORDINARY LEVEL

DURATION: 3 HOURS

MARKS: ...../100 **CAMIS (Theory + Practical)**: ...../40

INSTRUCTIONS:

1) Do not open this question paper until you are told to do so.
2) This paper consists of **THREE** 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)**
3) The total marks on school report will be the results of adding Theory's and Practical Examination's marks then converted to **40 marks**.
4) Use only a **blue** or **black** pen.

Section A: Attempt all questions. (55 marks)

1) House fly and butterfly are grouped in the same phylum because of: **(1 mark)**

a) Bilateral symmetry.
b) Jointed legs.
c) Antennae.
d) Segmented body.

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2) Why are animals described as eukaryotic organisms? **(1 mark)**

a) They lack a nucleus in their cells.
b) They are single-celled organisms.
c) Their cells contain a defined nucleus and membrane-bound organelles.
d) They do not have a cell membrane.

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3) A group of senior two students discovered an unknown animal on their study trip with the following features: skin covered with scales, homodont dentition (uniform teeth), 2 pairs of limbs, no external earlap and use lungs for gaseous exchange. Answer the following questions by **true** or **false.** **(5 marks)**

a) The animal discovered by the students, can be classified under the phylum Chordata.
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b) Based on the characteristics provided, the animal is classified under the class Reptilia.
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c) The animal discovered by the students is likely to have mammary glands because it has homodont dentition and uses lungs for gaseous exchange.
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d) The animal discovered by the students belongs to the class Amphibia because it has 2 pairs of limbs and uses lungs for respiration.
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e) The animal discovered by the students would not have external earlaps because it is likely a reptile, and reptiles typically lack external ear structures.
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4) Match each of the terms about food chains to its definition. Write the term number and letter of correct definition. **(6 marks)**

Terms	Definition
1. Carnivore	**A.** An animal that gets its energy by eating plants.
2. Consumer	**B.** An organism that makes its own organic nutrients, usually through photosynthesis.
3. Decomposer	**C.** An animal that gets its energy by eating other animals.
4. Food web	**D.** An organism that gets its energy by feeding on other organisms.
5. Herbivore	**E.** An organism that gets its energy from dead or waste organic material.
6. Producer	**F.** A network of interconnected food chains.

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5) Identify how decomposers help other organisms in an ecosystem? **(2 marks)**

a) They break down dead organisms and add nutrients back to the soil that plants use.
b) They use the sunlight to make their own food that other organisms eat for energy.
c) They help disperse seeds for plant growth.
d) Decomposers do not help other organisms in an ecosystem.

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6) What happens to a plant cell when it is placed in a hypotonic solution? **(2 marks)**

a) The cell shrinks as water moves out of it.
b) The cell swells and becomes turgid as water moves into it.
c) The cell remains unchanged as water does not enter or leave.
d) The cell undergoes plasmolysis as water moves into it.

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7) Container **S** contains a **5%** salt solution while container **T** contains a **20%** salt solution. If the solutions are separated by a partially permeable membrane; net movement of water will occur from ..... to .....: **(1 mark)**

a) S to T.
b) T to S.
c) Both ways.
d) No movement will occur.

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8) Write **true** or **false** on each statement. **(5 marks)**

a) Active transport occurs against a concentration gradient.
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b) Active transport does not need energy.
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c) During active transport, materials move from high concentration to low concentration.
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d) Active transport involves protein carriers.
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e) Energy used during active transport is produced in the mitochondria.
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9) Which of the following food contains the highest concentration of proteins? **(1 mark)**

a) Irish potatoes.
b) Cabbages
c) Maize.
d) Milk.

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10) Why is it not advisable to consume excessive amounts of food containing lipids? **(2 marks)**

a) Excessive lipids can lead to an increased risk of heart disease and obesity.
b) Lipids are essential for the body and should be consumed in unlimited quantities.
c) Lipids can cause immediate digestive issues if consumed in excess.
d) High lipid intake is beneficial for maintaining energy levels.

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11) Why is amylase effective in the mouth but not in the stomach? **(2 marks)**

a) The mouth has a higher pH that activates amylase.
b) Amylase works best at a low pH.
c) The stomach produces more amylase.
d) The mouth has no other digestive enzymes.

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12) Why do enzymes work best at their optimum temperature? **(2 marks)**

a) At higher temperatures, enzymes become more active.
b) At the optimum temperature, enzymes have the ideal shape for substrate binding.
c) Enzymes only function at low temperatures.
d) Temperature has no effect on enzyme activity.

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13) The raw materials for photosynthesis are: **(1 mark)**

a) Carbon dioxide and nitrate ions.
b) Light energy and water.
c) Light energy, carbon dioxide and water.
d) Water and carbon dioxide.

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14) Which limiting factor of photosynthesis is likely to have the greatest effect on plants growing in an open field during a hot summer day? **(2 marks)**

a) Carbon dioxide concentration.
b) Oxygen concentration.
c) Temperature.
d) Water concentration.

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15) What is the path of water through a plant? **(2 marks)**

a) Cortex cells → xylem → stomata → roots.
b) Root hair → xylem → mesophyll cells → stomata.
c) Roots → cortex cells → stomata → phloem.
d) Roots → root hair → stomata → xylem.

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16) Why is it recommended to irrigate vegetables in the evening rather than the afternoon in a school garden? **(2 marks)**

a) To reduce water evaporation due to cooler temperatures.
b) To prevent the plants from becoming too cold.
c) To avoid over-watering during the night.
d) To promote faster growth of vegetables.

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17) Which of the following correctly describes the sequence of events that occur during breathing? **(2 marks)**

a) Oxygen is absorbed into the blood, and carbon dioxide is exhaled through the mouth and nose, with no involvement of the diaphragm.
b) The diaphragm contracts, expanding the chest cavity, causing air to be drawn into the lungs, and then it relaxes, expelling air as carbon dioxide is exhaled.
c) The lungs expand without the diaphragm's involvement, and oxygen is transferred to the blood through the walls of the lungs.
d) Air is drawn into the lungs without the need for muscle contraction, and oxygen is immediately transferred to the blood.

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18) Which of the following is the most likely impact of not drinking water for an entire day?

a) Increased urine production and rapid hydration of the body. **(2 marks)**
b) Dehydration leading to impaired body functions such as digestion and temperature regulation.
c) Improved energy levels due to reduced fluid intake.
d) No noticeable effects on the body as long as food intake is maintained.

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19) Which two joints move in the same way? **(1 mark)**

a) Knee joint and shoulder joint.
b) Knee joint and elbow joint.
c) Neck joint and knee joint.
d) Neck joint and ankle joint.

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20) Which of the options below is an example of a transmissible disease? **(1 mark)**

a) Obesity.
b) Tooth decay.
c) Cholera.
d) Rickets.

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21) Which of the following is an effective method to prevent infectious diseases in the home? **(2 marks)**

a) Regular handwashing with soap and water.
b) Keeping windows closed to prevent airflow.
c) Sharing personal items like towels and razors.
d) Limiting the use of disinfectants and cleaning products.

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22) Which of the following plays a role in human body's immunity? **(1 mark)**

a) Red blood cells.
b) Platelets.
c) Muscle cells.
d) Lymphocytes.

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23) Which of the following statements accurately describes artificial passive immunity? **(2 marks)**

a) It is immunity acquired through vaccination, where the body produces its own antibodies.
b) It involves the transfer of antibodies from another individual or animal to provide temporary immunity.
c) It is immunity acquired naturally through exposure to pathogens in the environment.
d) It involves the production of antibodies by the individual's immune system in response to an infection.

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24) Which of the following strategies can help in avoiding unnecessary sexual stimulation? **(2 marks)**

a) Engaging in deep relaxation techniques and mindfulness practices.
b) Increasing exposure to sexual content in the media.
c) Ignoring feelings of arousal and avoiding any form of self-awareness.
d) Focusing only on physical exercise and avoiding mental well-being practices.

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25) Answer by **true** or **false**. **(5 marks)**

a) HIV can be transmitted through sex-anus connection.
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b) STIs are commonly transmitted through sexual intercourses.
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c) An infected mother can have a safe baby.
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d) People living with STIs can give birth to HIV-infected babies.
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e) All STIs can be prevented at maximum.
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Section B: Attempt any three questions. (30 marks)

26) A good blood supply is essential to effective function of the lungs in mammals. Evaluate other features of the gas exchange system that enable a fast rate of gas exchange within the lungs. **(10 marks)**

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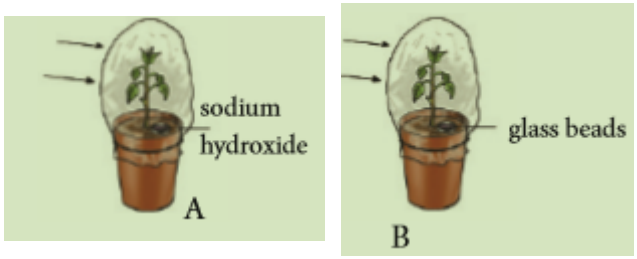
27) Do you think the government of Rwanda should ban the sale of cigarettes? Suggest a solution. **(10 marks)**

28) A woman has been using contraceptives to prevent unwanted pregnancy. She was shocked recently to discover she was pregnant. Evaluate the key causes. **(10 marks)**

29) Design a comprehensive public health campaign aimed at reducing the risk of STIs and HIV in a community. **(10 marks)**

Section C: This question is compulsory. (15 marks)

30) An experiment was carried out to find out if carbon dioxide is necessary for photosynthesis. Two plants of the same species were de-starched. The plants were then placed in sealed glass containers for 24 hours as shown in figures below and exposed to sunlight. Sodium hydroxide pellets were placed in glass container of plant **A** while glass beads were placed in the glass container of plant **B**. After 24 hours, starch test was carried out on plants **A** and **B**.



a) Explain why the plants were de-starched before beginning the experiment. **(1 mark)**

b) Why is chlorophyll removed from the leaves before carrying out a starch test? **(2 marks)**

c) What is the role of sodium hydroxide in the experiment? **(2 marks)**

d) State the expected results of the starch test. **(2 marks)**

e) Account for the results stated in (d). **(2 marks)**

f) Why was plant **B** included in the experiment? **(2 marks)**

g) What role is played by magnesium and nitrate ions in plants? **(4 marks)**

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EXAM: Biology and Health Sciences I (Practical Examination)

Date: 24th June 2025
Period: 08:30 AM – 10:00 AM

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

END OF TERM III EXAMINATION, SCHOOL YEAR: 2024-2025

MARKING GUIDE

GRADE: SENIOR TWO (S2)

LEVEL: ORDINARY LEVEL

OTION: ORDINARY LEVEL

DURATION: 1:30 MINUTES

MARKS: ...../20

CAMIS (Theory + Practical): ...../40

INSTRUCTIONS:

1) Do not open this question paper until you are told to do so.
2) This paper consists of only one question, and it is marked on a total of **20 marks.**
3) The total marks on school report will be the results of adding Theory's and Practical Examination's marks then converted to **40 marks**.
4) Use only a **blue** or **black** pen.

Question:
You are provided with materials and reagent to carry out an active transport of dye across cell membranes in potato tissue using different conditions.

- **Materials and Reagents Needed:**
  - ✓ Fresh potatoes
  - ✓ Scalpel or knife
  - ✓ Ruler (for consistent potato piece sizes)
  - ✓ Beakers or test tubes
  - ✓ Methylene blue dye
  - ✓ Distilled water
  - ✓ Water bath (for setting different temperatures)
  - ✓ Ice bath or refrigerator
  - ✓ Source of heat
  - ✓ Timer or stopwatch
  - ✓ Spatula
  - ✓ Paper towels
  - ✓ Gloves and goggles (safety equipment)
- **Objective:**

To determine how active transport operates in living cells by observing dye uptake in potato tissue under different environmental conditions such as temperature and the presence or absence of metabolic inhibitors.

- **Experimental Procedure:**

❖ **Preparation of Potato Samples:**

✓ Use the scalpel and ruler to cut equal-sized pieces of potato (e.g., 1 cm^3 cubes).
✓ Rinse the pieces to remove excess starch or debris.

❖ **Preparation of dye Solution:**

✓ Prepare a dilute solution of methylene blue (around 0.1% concentration)**.**

❖ **Experimental Groups:**

Set up 5 groups of beakers or test tubes, each with a different condition, and place one piece of potato into each.(Name them: **A, B, C, D, E).**

Group	Condition	Purpose
A	Water only	A control sample
B	Room temperature dye solution	Control
C	Dye solution at 40–45°C	High temperature (increased activity)
D	Dye solution at 0–5°C	Low temperature (reduced activity)
E	Dye with metabolic inhibitor (boiled potato)	The boiled potato serves as a negative control.

❖ **Incubation:**

✓ Place equal numbers of potato pieces in each beaker/test tube.
✓ Allow them to incubate for 30–60 minutes under the assigned conditions.
✓ After incubation, remove the potato pieces, blot dry gently with paper towels.

❖ **Observation:**

- ✓ Visually inspect the intensity of blue coloration in the potato pieces.
- ✓ Optionally, cut open the pieces to observe the penetration depth of the dye.
- ✓ Record qualitative data (colour intensity, distribution).

a) Using the colour changes you observed during the experiment, fill out the table below. **(10 marks)**

Group	Observed Coloration	Deduction
A	No color change	Confirms that dye is necessary for visible uptake; control for comparison
B	Slight blue colour	Normal active transport
C	Intense and deeper blue coloration	Increased active transport due to higher temperature (more metabolic activity)
D	Minimal coloration	Reduced active transport due to low temperature
E	Very minimal or no coloration	Inhibition of active transport due to metabolic inhibitor (boiling).

b) Based on your findings, suggest how you can interpret the results you observed for each group you identified. **(5 marks)**

Active transport requires energy (**ATP**), which is produced through cellular respiration.

- **In Group A,** there is no colour change in the water-only sample, it shows what the potato tissue looks like when no dye is added, helping confirm that any colour change in other samples is due to dye uptake, not natural pigmentation or contamination; this supports the conclusion that dye uptake is due to active transport processes.
- **In Group B,** the dye enters cells normally, suggesting that the membrane transport mechanisms are functioning.
- **In Group C,** increased temperature enhances enzyme activity and cellular metabolism, leading to greater ATP production and more efficient active transport.
- **In Group D,** cold temperature slows metabolic reactions, reducing ATP production and hence the ability of cells to actively transport the dye.
- **In Group E,** boiling denatures proteins/enzymes; active transport cannot occur.

c) Based on your findings, draw a conclusion about which sample is best suited for active transport. **(5 marks)**

The sample with living (unboiled) potato tissue under normal conditions, without metabolic inhibitors and at an optimal temperature, is best suited for active transport. This is because active transport in living cells depends on metabolic energy (ATP). The greater uptake of dye in this sample shows that the process is energy-dependent, as other conditions like boiling or the presence of inhibitors reduce dye uptake. This confirms that the movement of substances across cell membranes in plant cells involves active transport, not just passive diffusion.

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EXAM: Biology and Health Sciences I
(Alternative to Practical Examination)

Date: 24th June 2025
Period: 08:30 AM – 10:00 AM

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

END OF TERM III EXAMINATION, SCHOOL YEAR: 2024-2025

MARKING GUIDE

GRADE: SENIOR TWO (S2)

LEVEL: ORDINARY LEVEL

OTION: ORDINARY LEVEL

DURATION: 1:30 MINUTES

MARKS: ...../20

CAMIS (Theory + Practical): ...../40

INSTRUCTIONS:

1) Do not open this question paper until you are told to do so.
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S.2 BIOL MARKING SCHEME FOR END OF TERM 3 EXAMINATION 2025

SUBJECT: BIOLOGY AND HEALTH SCIENCES (ALTERNATIVE TO PRACTICAL)

Question:

An experiment was carried out to investigate whether **active transport** is involved in the **uptake of mineral ions** in plants. Two seedlings of the same species were used. One seedling **(Plant A)** was placed in a solution containing potassium ions and kept at room temperature. Another seedling **(Plant B)** was placed in an identical solution but at **low temperature (ice bath)** to slow down metabolic activity. After 30 minutes, both seedlings were removed, and their tissues were tested for potassium ion concentration.

Answer the following questions:

a) Explain why both plants were placed in the same potassium ion solution. **(3 marks)**
Answer: To ensure that **both plants were exposed to the same external concentration of potassium ions**, allowing a fair test of whether temperature (and thus respiration) affects **ion uptake**.

b) Why was one plant kept at low temperature during the experiment? **(3 marks)**
Answer: Low temperature **slows down enzyme activity** and **cellular respiration**, which reduces ATP production. If uptake of potassium ions is an active process, it would be inhibited at low temperature due to **lack of energy (ATP)**.

c) What is the expected result regarding potassium ion concentration in Plant A and Plant B? **(3 marks)**
Answer: Plant A is expected to **absorb more potassium ions** due to normal metabolic activity. Plant B, kept in cold conditions, is expected to **absorb fewer ions** due to reduced active transport.

d) What conclusion can be drawn from the result of this experiment? **(3 marks)**
Answer: The experiment suggests that **active transport is involved** in the uptake of potassium ions, as ion absorption decreases significantly when **ATP production is suppressed** by low temperature.

e) Why was it important that both plants were of the same species and size? **(4 marks)**
To ensure that both plants had **similar metabolic demands, surface area, and uptake capacity**, making the experiment a **fair comparison** and minimizing variability.

f) What role is played by magnesium and nitrate ions in plants? **(4 marks)**
Answer:

- **Magnesium ions** are essential for the **formation of chlorophyll**, which is vital for photosynthesis.
- **Nitrate ions** are required for the **synthesis of amino acids and proteins**, which are necessary for **growth and repair** of plant tissues.