THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

071 BIOLOGY 2

ALTERNATIVE TO PRACTICAL

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2005**

Instructions

1. This paper consists of sections Five questions. Answer all questions

2. Each question carries ten marks.

1. Five powdered foods: M, N, O, P, and Q were tested for starch, reducing sugar, and protein by using iodine, Benedict's reagent, and Biuret's test reagents respectively. The final color change for each test was recorded as shown in the table below.

Type of Test	M	N	O	P	Q
Starch test	Black	Black	Brown	Black	Brown
Benedict's test	Orange	Blue	Blue	Orange	Blue
Biuret's test	Green	Green	Purple	Purple	Blue

(a) Which powder contained

(i) protein only?

- Powder O contained protein only because it tested positive (purple) in Biuret's test, which indicates the presence of protein, but tested negative for starch and reducing sugars.

(ii) starch only?

- Powder N contained starch only because it turned black with iodine but did not react with Benedict's or Biuret's tests.

(iii) starch and reducing sugar?

- Powder M contained both starch and reducing sugar because it turned black in the iodine test (indicating starch) and orange in Benedict's test (indicating the presence of reducing sugars).

(iv) glucose, starch, and protein?

- None of the powders contained all three food substances because no sample tested positive for starch (black), reducing sugars (orange), and protein (purple) at the same time.

(v) none of the food substances tested?

- Powder Q contained none of the tested food substances because it remained brown with iodine, blue with Benedict's reagent, and blue with Biuret's test, indicating the absence of starch, reducing sugars, and protein.

(b) Which test required heating?

- Benedict's test required heating because it is used to detect reducing sugars. The test involves boiling the sample with Benedict's reagent to observe a color change from blue to green, yellow, or brick red, depending on the amount of sugar present.

(c) Describe two different procedures which can be used to test for the presence of fats in groundnut seeds.

- The emulsion test: The groundnut seeds are crushed and mixed with ethanol. The mixture is then added to water. If fats are present, a white emulsion forms.
- The grease spot test: A small amount of crushed groundnut is rubbed onto a piece of filter paper. If the paper becomes translucent and remains so after drying, this indicates the presence of fats.

(d) Is the fat present in groundnut water soluble or fat soluble?

- The fat present in groundnut is fat soluble. Fats and oils are hydrophobic, meaning they do not dissolve in water but can dissolve in organic solvents such as ethanol or ether.

2. Samples of animals living on the surface of logs in a woodland were collected. The animals found on the top and sides were brushed carefully into a tray. The animals found on the underside of the logs were brushed carefully into a second tray. The animals were identified, sorted into groups based on feeding habits, and recorded in the table below.

Animal Group	Feeding Group	Number of Animals
Snails	Herbivores	12
Mites	Herbivores	9
Woodlice	Detritivores	10
Centipedes	Carnivores	6
Spiders	Carnivores	2
Beetles	Carnivores	4
Millipedes	Detritivores	4

(a) (i) Copy and complete the table below to show the total number of animals in each feeding group expressed as a percentage of the total number of animals living on the underside of the logs.

Feeding Group	Number of Animals	Percentage %
Herbivores	20	(20/109) x 100 = 18.3
Carnivores	16	(16/109) x 100 = 14.7
Detritivores	14	(14/109) x 100 = 12.8

(ii) Construct a pie chart to show the proportion of herbivores, carnivores, and detritivores collected from the underside of the logs.

- The pie chart should be drawn using the percentage values calculated above, ensuring accurate proportional representation of each feeding group.

(b) Suggest two reasons why most animals were found on the underside of the logs.

- The underside of logs provides protection from predators, making it a safer environment for small organisms.
- It offers moist and cool conditions, which help prevent dehydration and overheating, especially in woodland habitats.

(c) Describe an investigation you could carry out to compare the number of animals living among fallen leaves in two different woodland habitats.

- Select two woodland areas with different environmental conditions (e.g., one with thick leaf litter and one with sparse leaf litter).
- Place a quadrat (e.g., 1m x 1m) in each area and carefully collect and count the animals found under the leaf litter.
- Repeat the sampling in multiple locations within each woodland to ensure accurate results.
- Compare the total number and diversity of animals found in each habitat to determine which supports more life.

3. An experiment was carried out to find out the effect of different concentrations of sucrose on the length of potato strips.

Five test tubes containing different concentrations of sucrose solution were set up. A sixth test tube containing distilled water was set up as a control. Potato strips of the same size (70 mm x 10 mm x 2 mm) were placed in each test tube.

The strips were left in the tubes for 30 minutes, removed, and measured. The results are shown in the table below.

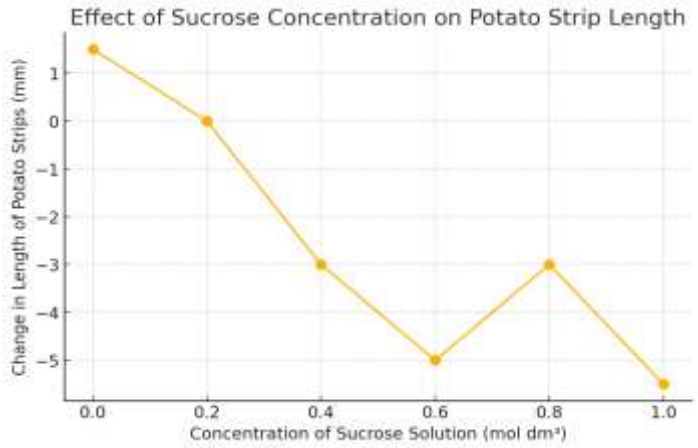
Concentration of Sucrose Solution (mol dm^3)	Initial Length (mm)	Final Length (mm)	Change in Length (mm)
0.0	70	71.5	+1.5
0.2	70	70.0	0.0
0.4	70	67.0	-3.0
0.6	70	65.0	-5.0
0.8	70	67.0	-3.0
1.0	70	64.5	-5.5

(a) (i) Copy and complete the table above to show the changes in length of each strip.

- The completed table is shown above with the calculated changes in length.

(ii) Draw a graph of change in length against the concentration of sucrose solution.

- The graph should show how the length of the potato strips changes with increasing sucrose concentration.



(b) What conclusion can you draw from these results?

- When the potato strips were placed in distilled water, they gained length due to osmosis, as water moved into the cells.
- At 0.2 mol dm^3 sucrose concentration, there was no change in length, indicating an isotonic solution, where the water potential inside and outside the cells was equal.
- At higher sucrose concentrations, the strips lost length as water moved out of the cells, causing plasmolysis.

(c) Name the process that has taken place to bring about these changes in the lengths of the potato strips.

- The process is osmosis, which involves the movement of water molecules across a semi-permeable membrane from a region of high water potential to a region of low water potential.

(d) State two improvements to this experiment which could increase the reliability of these results.

- Increase the number of trials and take an average measurement to reduce experimental error.
- Use more precise measuring instruments, such as digital calipers, to ensure accurate length measurements.

4. Study the organisms represented by figures 1, 2, 3, and 4. Then answer the questions that follow.

(a) Provide common names for the organisms represented by figures 1 to 4.

- Figure 1: Snail
- Figure 2: Virus
- Figure 3: Maize plant

- Figure 4: Paramecium

(b) (i) Name the kingdom to which each organism in figures 1, 3, and 4 belong.

- Figure 1 (Snail): Kingdom Animalia
- Figure 3 (Maize plant): Kingdom Plantae
- Figure 4 (Paramecium): Kingdom Protista

(ii) State two general features of the organisms in figures 1 and 3.

- They are both multicellular organisms, meaning they are made up of many cells.
- They both require water, nutrients, and energy for growth and survival, but obtain these in different ways (plants via photosynthesis and animals via feeding).

(c) State reasons why the organism in Figure 2 is considered to be both living and non-living.

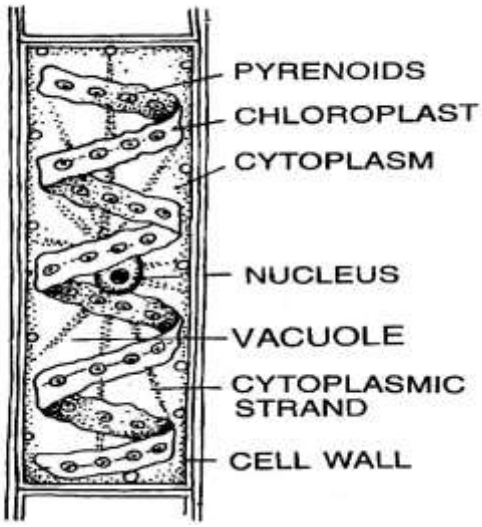
- The virus is considered living because it can reproduce, but only inside a host cell.
- It is considered non-living because it does not have cellular structures like cytoplasm or organelles and cannot carry out metabolic processes independently.

(d) In which way is the organism in Figure 3 similar and yet different from the organism in Figure 4?

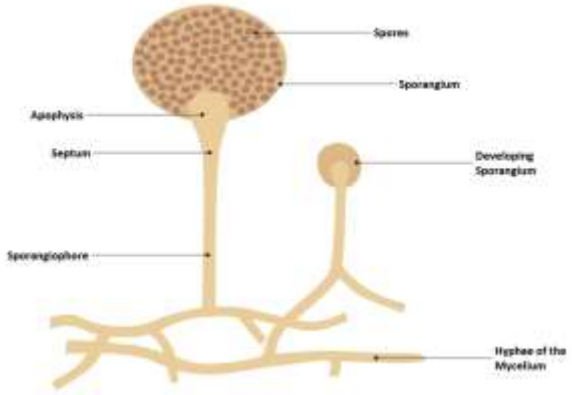
- Similarity: Both organisms carry out metabolic processes like respiration and excretion.
- Difference: The maize plant (Figure 3) is a multicellular autotroph that produces its own food through photosynthesis, whereas the paramecium (Figure 4) is a unicellular heterotroph that ingests food from its surroundings.

5. (a) Draw neat and large diagrams of spirogyra and mucor and label them fully.

- Spirogyra is a filamentous green algae with spiral-shaped chloroplasts, whereas Mucor is a fungus with filamentous hyphae and spore-producing structures.



- The diagram should clearly show the structural differences, including the presence of chloroplasts in Spirogyra and spores in Mucor.



(b) List down the structural differences between the two organisms in 5(a) above.

- Spirogyra is an autotrophic green alga that contains chlorophyll, whereas Mucor is a heterotrophic fungus that lacks chlorophyll.
- Spirogyra has a filamentous structure with spiral-shaped chloroplasts, whereas Mucor consists of hyphae and reproduces through spores.
- Spirogyra reproduces mainly through fragmentation and conjugation, whereas Mucor reproduces both asexually via spores and sexually through zygospores.
- The cell walls of Spirogyra are made of cellulose, while those of Mucor are composed of chitin.