THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

033/2 **BIOLOGY 2**

ALTERNATIVE TO PRACTICAL

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2001**

Instructions

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

2. Each question carries ten marks.

1. During a Biology practical lesson, students were provided with extracts M_1, M_2, and M_3 obtained from a coconut, an Irish potato, and an egg white. They were asked to carry out food tests so as to determine which of M_1, M_2, and M_3 was a coconut, a potato, or an egg white extract.

a) Using a table as shown below (Table 1) write down the experimental work which leads to the identification of M_1, M_2, and M_3.

Test	Procedure	Observation	Inference
Test for starch	Add iodine solution to the extract	Blue-black color appears	Presence of starch (Potato)
Test for proteins	Add Biuret reagent to the extract	Purple color appears	Presence of proteins (Egg white)
Test for fats	Rub extract on filter paper and let it dry	Translucent spot appears	Presence of fats (Coconut)

b) i) What is the importance of the food substances identified in (a) above in the human body?

- Starch (Carbohydrates) provides energy to the body.
- Proteins help in body growth, repair of tissues, and enzyme formation.
- Fats provide long-term energy storage and help in insulation.

ii) In what form and where are these foods stored in the human body?

- Starch is stored as glycogen in the liver and muscles.
- Proteins are not stored but are used for tissue formation and repair.
- Fats are stored in adipose tissue under the skin and around organs.

2. 10 cm^3 (mls) of yeast suspension was added to 30 cm^3 of 10% glucose solution in a boiling test tube. The test tube was stoppered with a cork fitted with a delivery tube leading to test tube X containing clear lime water. Duplicates of this apparatus were prepared and maintained at different temperatures. The number of gas bubbles seen in each test tube after 10 minutes was recorded as follows:

Temperature (°C)	10	20	30	40	50	60
Number of gas bubbles per minute	5	13	21	25	27	11

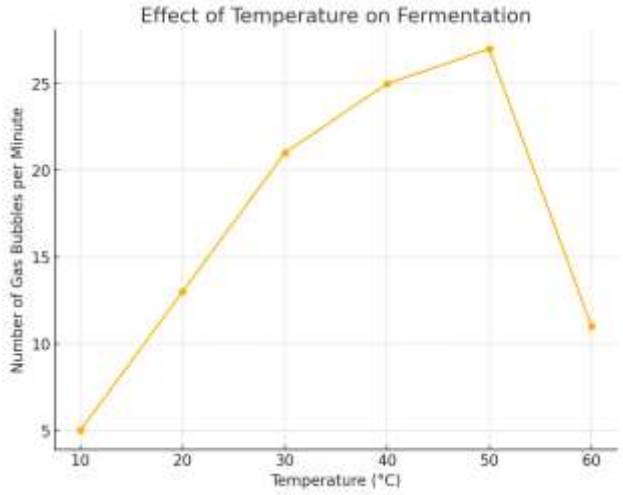
a) What reaction occurred in the boiling test tube?

The reaction that occurred was anaerobic respiration (fermentation) by yeast, breaking down glucose to produce carbon dioxide and ethanol.

b) What substance was formed in the boiling test tube?

Ethanol and carbon dioxide were formed during fermentation.

c) Plot a graph of Number of gas bubbles per minute (Y axis) against Temperature (X axis).
Here is the graph showing the effect of temperature on fermentation, with the number of gas bubbles per minute plotted against temperature.



d) What was the best temperature range for the reaction?

The best temperature range for the reaction was between 40°C and 50°C, as this is where the highest number of gas bubbles was observed.

e) i) State the changes observed in the lime water in test tube X.

The lime water turned milky.

ii) What gas brought about these changes?

Carbon dioxide (CO_2) brought about the changes by reacting with calcium hydroxide in the lime water to form calcium carbonate.

f) Explain why the number of bubbles at 10°C and 60°C was small.

- At 10°C, the enzyme activity of yeast is very low, leading to a slow fermentation rate and minimal carbon dioxide production.
- At 60°C, the high temperature denatures the yeast enzymes, stopping fermentation and reducing the number of gas bubbles.

3. The diagrams below (Figure 1 – 4) represent four organisms. Study them and answer the questions which follow.

a) i) Identify the organisms in figures 1, 2, 3, and 4 by their common names.

- Figure 1: Bacteria
- Figure 2: Euglena
- Figure 3: Fern plant
- Figure 4: Owl

ii) Place organisms 1, 2, 3, and 4 in their kingdoms.

- Figure 1 (Bacteria): Kingdom Monera
- Figure 2 (Euglena): Kingdom Protista
- Figure 3 (Fern plant): Kingdom Plantae
- Figure 4 (Owl): Kingdom Animalia

b) i) Write down two features which place the organisms in figures 1 and 2 into their respective kingdoms.

- Figure 1 (Bacteria):
  - It is unicellular.
  - It lacks a true nucleus (prokaryotic).

- Figure 2 (Euglena):
  - It has characteristics of both plants and animals (can photosynthesize and move using a flagellum).
  - It is unicellular and has a well-defined nucleus (eukaryotic).

ii) State the economic importance of the organism shown in figure 2.

- Euglena is used in scientific research as a model organism for studying both plant and animal characteristics.
- It contributes to the aquatic food chain by serving as food for small aquatic organisms.
- Some species help in oxygen production through photosynthesis.

c) i) List two general characteristics of the organism in figure 3 which place it in its respective kingdom.

- The fern plant is multicellular.
- It has chlorophyll and undergoes photosynthesis.

ii) What is the importance of each characteristic named in (c) (i) above in the life of the organism?

- Being multicellular allows the fern plant to develop specialized tissues for support and transport of nutrients.
- The presence of chlorophyll enables the plant to manufacture its own food through photosynthesis.

4. Figure 5 and 6 are photographs of seedlings of two varieties of beans, A and B respectively.

a) i) Make large labeled drawings of the two varieties.

The drawings should be made clearly, labeling the following parts:
- Cotyledon
- Primary root
- Shoot
- Root hairs

ii) In a table form, as shown below, show three visible differences, other than size, between seedlings A and B.

Seedling A	Seedling B
Cotyledons remain above the soil level	Cotyledons remain below the soil level
Hypocotyl elongates to push the cotyledons above the ground	Epicotyl elongates, keeping cotyledons underground
Green cotyledons contribute to photosynthesis	Cotyledons do not turn green and do not photosynthesize

(b) Figure 7 shows a food web for a freshwater pond. For each of the trophic levels listed below, name two examples of organisms (identify them by numbers).

a) i) Primary consumers (herbivores)

- Organism 11
- Organism 14

ii) Secondary consumers (carnivores)

- Organism 7
- Organism 9

b) Using only the numbers in Figure 7, construct a simple food chain involving four stages.
Example food chain:
Organism 16 ----> Organism 11 ----> Organism 9 ----> Organism 2

5. The experiment was set up to investigate how the rate of photosynthesis of an aquatic plant changed between 1300 hours and 2100 hours on a sunny day.

a) Suggest why the funnel was supported at the bottom of the beaker as shown in the diagram.

The funnel was supported at the bottom of the beaker to ensure that the aquatic plant remains submerged in water, allowing it to receive adequate light and carbon dioxide for photosynthesis.

b) i) Name the gas which collected in the graduated tube.

The gas collected in the graduated tube was oxygen.

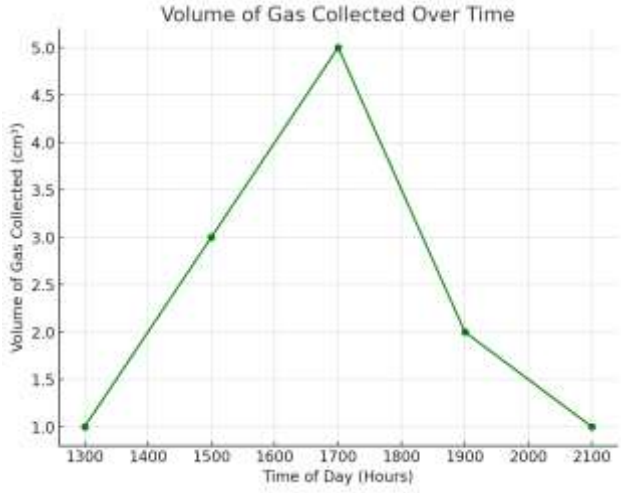
ii) Describe how you would test this gas and the observations you would make.

- A glowing splint is introduced into the test tube containing the collected gas.
- If the gas is oxygen, the glowing splint relights.

c) Every two hours, the student recorded the volume of gas which had collected in the graduated tube. The diagrams below (Figure 9) show the volume of the gas that collected in the tube at different times.

Time (hours)	Volume of gas (cm^3)
1300	1
1500	3
1700	5
1900	2
2100	1

d) Plot a line graph of volume of gas collected against time of the day.



e) Suggest an explanation for the shape of the graph you have drawn in b(ii) above.

- The volume of gas increases from 1300 hours to 1700 hours because the intensity of sunlight is increasing, leading to a higher rate of photosynthesis and oxygen production.

- After 1700 hours, the volume of gas decreases as the intensity of sunlight decreases, reducing the rate of photosynthesis.
- By 2100 hours, the gas production is very low because there is little or no sunlight available for photosynthesis.