**THE UNITED REPUBLIC OF TANZANIA**

**NATIONAL EXAMINATIONS COUNCIL**

**ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION**

**155/3** **FOOD AND HUMAN NUTRITION 3**

(For Both School and Private Candidates)

**Time : 3 Hours** **ANSWERS** **Year : 2002**

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**Instructions**

1. This paper consists of sections **three (3)** questions
2. Answer all questions
3. Question **one (1)** carries **twenty (20)** marks and question **two (2)** and **three (3)** carries **fifteen (15)** marks each.
4. Communication devices and any unauthorised materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

1. You are provided with cassava slices, lemon juice, hot water, and iodine solution. Perform the experiment as follows:
(i) Boil one cassava slice for 5 minutes, cool it, and place in a petri dish.
(ii) Leave another slice raw at room temperature.
(iii) Add a few drops of iodine to both slices. Record observations.

Questions:
(a) What is being tested in this experiment?
(b) Explain the difference in the results between boiled and raw cassava.
(c) State the significance of this test in food analysis.

**ANSWERS**

**(a) What is being tested in this experiment?**

This experiment is testing for the **presence of starch** in cassava. The iodine solution reacts with starch molecules to form a blue-black colour. If starch is present, the cassava slices will show a distinct colour change. For example, iodine solution is widely used to confirm starch in many foods such as maize flour, potatoes, and wheat products.

**(b) Explain the difference in the results between boiled and raw cassava.**

In the raw cassava slice, starch granules are intact and strongly interact with iodine, producing a darker blue-black colour. However, in the boiled cassava, starch granules are partially gelatinized due to heating, which disperses them and weakens their ability to react with iodine. As a result, the colour may appear lighter or diffuse compared to raw cassava. For example, porridge made from flour does not show the same deep iodine colour as raw starch because gelatinization alters starch structure.

**(c) State the significance of this test in food analysis.**

The iodine test is significant because it helps to **identify foods rich in starch**, which are important sources of energy. Nutritionists and food scientists can quickly test raw materials such as cassava, rice, or maize to determine their carbohydrate content. For example, in quality control, this test can be used to confirm whether flour is pure starch-based or adulterated with non-starchy substances.

2. You are provided with fresh egg white, dilute hydrochloric acid, and dilute sodium hydroxide. Perform the following:

(i) Place 2 ml of egg white in a test tube, add 2 ml of dilute HCl, shake gently, and warm slightly. Record observations.

(ii) Place another 2 ml of egg white in a test tube, add 2 ml of dilute NaOH, and warm. Record observations.

(iii) Leave both mixtures to stand for 10 minutes. Record any changes.

Questions:

(a) What do the observations in step (i) and (ii) demonstrate?

(b) Explain the nature of changes observed in proteins during these reactions.

(c) State two applications of protein denaturation in food preparation.

**ANSWERS**

**(a) What do the observations in step (i) and (ii) demonstrate?**

The observations demonstrate **protein denaturation**. In step (i), the egg white coagulates when treated with dilute hydrochloric acid, showing that proteins lose their natural structure in acidic conditions. In step (ii), heating egg white in alkaline solution also causes denaturation, leading to coagulation or precipitation. These reactions demonstrate that proteins are sensitive to changes in pH and temperature. For example, when lemon juice (acid) is added to milk, proteins coagulate in the same way.

**(b) Explain the nature of changes observed in proteins during these reactions.**

Proteins normally exist in a folded structure stabilized by hydrogen bonds, ionic bonds, and disulfide bridges. When exposed to heat or extremes of pH, these bonds break, causing the protein to unfold. This unfolding exposes hydrophobic groups that interact with each other, forming new bonds that lead to coagulation. For example, when frying an egg, the clear egg white becomes opaque because the albumin proteins have unfolded and re-bonded in a solid network.

**(c) State two applications of protein denaturation in food preparation.**

One application is in boiling and frying eggs, where denaturation and coagulation give eggs a firm texture, making them edible and safe to eat.

Another application is in cheese making, where milk proteins coagulate when exposed to acid or rennet, forming curds that are processed into cheese.

3. You are provided with baker's yeast, sugar solution, and lime water. Perform the following:
(i) Place 10 ml of sugar solution in a test tube. Add a pinch of yeast.
(ii) Fit the test tube with a rubber stopper connected to a delivery tube leading into lime water.
(iii) Leave the setup for 20 minutes in a warm place and observe changes.

Questions:
(a) State the gas produced and confirm with the lime water test.
(b) Explain the role of yeast in this process.
(c) State two industrial applications of this process.

**ANSWERS**

**(a) State the gas produced and confirm with the lime water test.**

The gas produced is carbon dioxide ($CO_2$). This gas passes through the delivery tube into lime water, turning it milky due to the formation of insoluble calcium carbonate. For example, the lime water test is a standard laboratory method to confirm the presence of carbon dioxide.

**(b) Explain the role of yeast in this process.**

Yeast acts as a biological catalyst that ferments sugar to produce alcohol and carbon dioxide. The yeast cells contain enzymes such as zymase that break down glucose into ethanol and $CO_2$. This reaction provides energy for yeast growth while releasing gas as a by-product. For example, when yeast is added to dough, it ferments sugars in flour, producing gas that makes bread rise.

**(c) State two industrial applications of this process.**

One application is in the baking industry, where yeast fermentation is used to make bread and cakes rise, giving them a soft and spongy texture.

Another application is in the brewing industry, where yeast ferments sugars in grains or fruits to produce alcoholic beverages such as beer and wine.