THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
ADVANCED CERTIFICATE OF SECONDARY EDUCATTION EXAMINATION

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

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2024**

Instructions

1. This paper consists of sections **A** and **B**.
2. Answer **all** questions in section **A** and only **Three (3)** questions from section **B**.
3. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
4. Write your **examination Number** on every page of your answer booklet(s).

1. You are provided with cereal flour. Your required to perform the experiment by following the given procedures I to VII.

Procedure I

Place 25 g of flour and 15 ml of clean tap water in a small bowl and mix them.

Procedure II

Knead the mixture by hand for 5 minutes. Add a bit more flour if you find the mixture is too wet and add a bit more water if you find it tough and crumbly. Observe the characteristic of the mixture and give explanations.

Observation:

The mixture forms a sticky, elastic dough.

Explanation:

Water hydrates proteins (mainly glutenin and gliadin) in the flour, allowing them to interact and form a sticky, elastic network of gluten.

(a) Briefly explain two other factors that could have resulted into the characteristic of the mixture observed in step (ii).

- The type and quality of the cereal flour used — flours with high protein content form stronger, more elastic doughs.
- The temperature of the water used — warm water speeds up hydration of proteins and starches, improving dough elasticity.

Procedure III

Knead the mixture until a smooth ball of dough that springs back to the touch is obtained.

Procedure IV

The candidates were instructed to cover the dough with clean tap water and soak it for 10 minutes.

(b) Why was the dough soaked in water in step (iv)?

To soften and loosen the starch granules, making it easier to wash them out from the dough while leaving behind the insoluble gluten network.

Procedure V

Work on the dough through fingers. Serve some of the washing water in a clean beaker and allow it to stand for 15 minutes while observing.

Observation:

The washing water turns cloudy/milky, and a white sediment settles after standing.

Explanation:

Starch granules are washed out of the dough into the water, where they remain suspended and later settle.

Procedure VI

Replace with fresh water while discarding the washing water until substance Q that is more elastic is formed during the washing process. Strain the washing water to collect the scattered substance Q pieces.

Observation:

Water becomes clearer, and a yellowish, elastic, sticky mass (gluten) remains.

Explanation:

Continuous washing removes starch and soluble materials, leaving only gluten.

(c) Briefly explain:

(i) **What happened when the cereal flour and water were mixed and kneaded?**

The proteins glutenin and gliadin absorb water and, when kneaded, interact to form a cohesive, elastic gluten network trapping water inside.

(ii) **The role of starch in the baking process.**

Starch gelatinises during baking, absorbing water and swelling, helping to set the structure of baked goods as it cools, while contributing to texture and softness.

(iii) **The purpose of forming substance Q in the baking process.**

Gluten (substance Q) provides elasticity and strength to dough, enabling it to trap gases produced during fermentation and baking, which allows the dough to rise and form a soft, airy texture.

Procedure VII

The candidates were instructed to place substance Q in a petri dish and identify the substance.

Observation:

An elastic, yellowish, sticky mass remained.

Identification:

The substance is gluten.

2. You are provided with fresh milk, lemon juice, concentrated nitric acid (HNO_3), lime water, Ammonium solution, and red litmus paper.

Procedure A

(i) Place 20 ml of sample R into a clean and dry test tube.

(ii) Add 2 ml of sample S and allow the mixture to stand for 5 minutes.

Observation:
A white curdled mass forms and separates from a watery fluid.

Explanation:
The acid (lemon juice) coagulates the milk proteins (casein), causing them to curdle.

(iii) Separate the contents of the mixture.

(a) Identify the components of sample R obtained after adding sample S and allow the mixture to stand for 5 minutes.

Curdled mass: casein protein
Watery fluid: whey (contains water, lactose, and minerals)

(b) Identify the nature of food sample S.

Sample S is an acid (lemon juice).

Procedure B

Divide the fluid substance of the mixture obtained in procedure A into two equal portions.

(i) **Heat one portion in a porcelain dish over a flame.**

Observation:
The liquid reduces in volume, forming a thicker syrup with a caramel-like odour.

Explanation:
Lactose (milk sugar) caramelises and thickens upon heating.

(ii) **Evaporate the other portion almost to dryness in an evaporating dish placed in a water bath. Leave it to cool. Observe the odour and taste the remainders.**

Observation:

A sweet, concentrated residue with a caramel-like smell and taste remains.

Question: Explain what Procedure B demonstrates by giving two points.

- The presence of milk sugar (lactose) which caramelises upon heating.
- Concentration of soluble milk components by evaporation, leaving sugars and minerals.

Procedure C

Dry the thick substance obtained in Procedure A on a filter paper and divide it into three equal portions.

(i) **Place one portion on a porcelain dish and heat it on a flame.**

Observation:

A charring and burnt smell is produced.

Explanation:

The protein casein burns and decomposes, releasing nitrogenous fumes.

(ii) **Place the second portion into a dry test tube, cover it with 10 percent lime water, then gently warm it.**

Observation:

An ammonia-like odour is released and the red litmus paper turns blue.

Explanation:

On heating, proteins decompose to release ammonia gas, which is alkaline and turns red litmus paper blue.

(iii) **Place the third portion into a dry test tube; carefully cover it with concentrated nitric acid. Heat the mixture to boil while observing. Cool the mixture and slowly add ammonia solution.**

Observation:

The mixture turns yellow on heating and changes to orange upon addition of ammonia.

Question: Explain what steps (ii) and (iii) demonstrate.

(ii) Demonstrates the presence of nitrogen in proteins as they decompose into ammonia.

(iii) Demonstrates the presence of aromatic amino acids in proteins through the xanthoproteic reaction.

3. You are provided with sample P (Irish potato), and iodine solution. Perform experiment by following procedure (i) to (v). You are supposed to record the observations and provide inferences of what you have observed and answer the question that follow.

Procedures:

(i) Peel, wash and cut the food sample into two equal pieces using a clean knife.

(ii) Place one piece of the sample in a clean petri dish and cook the other piece in boiling water in a clean beaker for 15 minutes.

(iii) **Remove the piece of the sample from the boiling water and place it in another petri dish. Observe its odour.**

Observation:
A cooked, pleasant starchy odour is noticeable.

Explanation:
Starch gelatinises during cooking, producing a characteristic smell.

(iv) **Mash the two pieces of the sample by using a tablespoon.**

Observation:
The raw piece is hard and granular when mashed. The cooked piece is soft and smooth.

Explanation:
Cooking causes starch gelatinisation, softening the texture and making it easier to mash.

(v) **Half-fill a test tube with the water that was used to boil the piece of sample P and add few drops of iodine solution.**

Observation:
A blue-black colour appears.

Explanation:
This indicates the presence of starch that leached into the water during boiling, which reacts with iodine to form a blue-black complex.