THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

155/2 **FOOD AND HUMAN NUTRITION 2**

(For Both School and Private Candidates)

Time : 3 Hours **ANSWERS** **Year : 2012**

Instructions

1. This paper consists of sections **A** and **B**.
2. Answer all questions in section **A** and only **two (2)** question from section **B**.
3. Non-programmable calculators may be used.
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).

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1. You are provided with sample A and solutions B and C. Carry out the following experiment: (i) Put 10 ml of sample A in a boiling tube and add 2 ml of solution B. Heat gently in a water bath and record your observations. (ii) To another 10 ml of sample A, add 2 ml of solution C and shake. Leave for 5 minutes and observe. (iii) Pour 10 ml of sample A into a beaker and heat strongly until boiling. Stir and note the changes.

Questions (a) Identify sample A. (b) What nutrient is being tested in procedure (i)? (c) What does the change observed in procedure (ii) demonstrate? (d) Explain scientifically what occurred in procedure (iii). (e) State two nutritional values of the main nutrient present in sample A.

(a) Sample A is milk. This conclusion is based on the reactions with solutions B and C, which are typically reagents used to test proteins and fats in milk.

(b) The nutrient being tested in procedure (i) is protein. When milk is treated with solution B (biuret reagent), heating causes a colour change that confirms the presence of proteins.

(c) The change observed in procedure (ii), when solution C is added and left to stand, demonstrates the presence of fats. The solution likely forms an emulsion with the fat content in milk, showing a milky or cloudy appearance.

(d) In procedure (iii), when milk is heated strongly, proteins such as casein coagulate due to denaturation. The fat globules also separate, leading to curdling or scum formation on the surface. Scientifically, this occurs because heating disrupts the weak hydrogen and ionic bonds in protein structure.

(e) The main nutrient present in sample A, which is protein, has two nutritional values. First, proteins provide amino acids that are essential for growth and repair of body tissues. Second, proteins are important in the synthesis of enzymes and hormones that regulate body functions.

2. You are provided with sample D (fresh potato). Using a sharp knife, cut thin slices and perform the following: (i) Leave one slice untreated on a plate. (ii) Dip the second slice in iodine solution for 2 minutes. (iii) Soak the third slice in hot water (80 °C) for 5 minutes, then add iodine solution. (iv) Dry the fourth slice and expose it to air for 20 minutes. Record your observations in each case. Questions (a) What nutrient is present in sample D? (b) Why did the slice in (ii) show a strong colour? (c) Why was there a difference between (ii) and (iii)? (d) State two industrial uses of the nutrient tested.

(a) The nutrient present in sample D (potato) is starch, which is a polysaccharide carbohydrate.

(b) The slice in (ii) showed a strong blue-black colour because starch was present in high concentration, and iodine solution reacts specifically with starch molecules to produce that characteristic colour.

(c) There was a difference between (ii) and (iii) because heating the slice in hot water at 80 °C gelatinised the starch granules, disrupting their structure. This reduced the ability of iodine to bind strongly, leading to a weaker or altered colour compared to the untreated slice.

(d) Starch has two main industrial uses. First, it is used in the food industry as a thickening agent in soups, sauces, and puddings. Second, starch is used in the textile and paper industries for stiffening fabrics and as a binding material in paper production.

3. You are provided with samples E, F, G, H and I. Perform the following: (i) Weigh 10 g of sample E into a flask. (ii) Add 20 ml of solution F and stir thoroughly. (iii) Add 2 ml of solution G, shake, and warm in a water bath at 60 °C. (iv) Add solution H drop by drop while stirring until a colour change is observed. (v) Titrate the mixture against solution I while hot.
Questions (a) Identify solution H and explain its role in the titration. (b) Calculate the peroxide value of sample E. (c) State the significance of peroxide value in food analysis. (d) Give two limitations of peroxide value determination.

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(a) Solution H is potassium iodide (KI). Its role in the titration is to react with peroxides present in sample E, liberating iodine which is then titrated with solution I (sodium thiosulphate).

(b) To calculate the peroxide value of sample E, the formula used is:

Peroxide value (meq/kg) = (S × N × 1000) / W

where S is the volume of sodium thiosulphate used (ml), N is its normality, and W is the weight of sample in grams. Assuming the titration used 2.5 ml of 0.01 N sodium thiosulphate for 10 g of sample E:

Peroxide value = (2.5 × 0.01 × 1000) / 10

Peroxide value = 2.5 meq/kg.

(c) The significance of peroxide value in food analysis is that it measures the extent of primary oxidation of fats and oils. A low peroxide value indicates freshness and stability of the oil, while a high value shows rancidity or deterioration.

(d) Two limitations of peroxide value determination are: First, it only measures primary oxidation products and does not indicate secondary oxidation compounds such as aldehydes or ketones. Second, the test can give inaccurate results if the sample contains natural pigments or antioxidants that interfere with iodine liberation.

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