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 : 2017**

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).

1. You are provided with sample R (milk) and solutions S and T. Carry out the experiment as follows: (i) Add 20 ml of sample R to a beaker and warm gently to about 40 °C. (ii) Introduce 2 ml of solution S and stir continuously. Record your observations. (iii) Add 3 drops of solution T to the mixture and stir. Leave for 10 minutes.

Questions

(a) Identify the precipitate formed in procedure (ii).

(b) What does solution S represent?

(c) What reaction is shown in procedure (iii)?

(d) State the nutritional importance of the main nutrient tested.

(e) Suggest one industrial application of this principle.

Answer

(a) The precipitate formed in procedure (ii) is casein, which is the main milk protein.

(b) Solution S represents an acid such as vinegar or dilute acetic acid, which causes milk proteins to coagulate.

(c) Procedure (iii) shows the enzymatic action of rennin (solution T), which curdles milk by hydrolysing caseinogen into casein.

(d) The main nutrient tested is protein, which is nutritionally important for growth, repair of tissues, and enzyme formation.

(e) This principle is applied industrially in cheese and yoghurt production, where milk coagulation is a key step.

2. You are provided with sample U (egg white). Place 10 ml in each of four test tubes and treat them as follows: (i) Boil the first tube for 5 minutes. (ii) Add 1 ml of concentrated hydrochloric acid to the second tube and shake. (iii) Add 1 ml of sodium hydroxide solution to the third tube. (iv) Leave the fourth tube untreated as control.

Questions

(a) What reaction occurred in (i), (ii), and (iii)?

(b) What property of proteins is demonstrated here?

(c) Give two food-processing applications of this reaction.

Answer

(a) In (i), heating caused denaturation and coagulation of egg white proteins. In (ii), the strong acid caused acid denaturation and precipitation of proteins. In (iii), the strong alkali caused alkaline denaturation of proteins.

(b) The property demonstrated is protein denaturation, where proteins lose their natural structure under heat, acid, or alkali.

(c) Applications include boiling of eggs for consumption, and acid or alkali denaturation in food processing such as cheese production, tenderising of meat, and formation of foams and gels in bakery products.

3. You are provided with samples V, W, X, Y and Z. Perform the following: (i) Weigh 5 g of sample V into a conical flask. (ii) Add 50 ml of solution W, then 1 ml of solution X. Shake well. (iii) Warm in a water bath at 75 °C for 5 minutes. (iv) Titrate the mixture against solution Y until a colour change is observed. (v) Repeat the titration for accuracy.

Questions

(a) Identify the function of solution X.

(b) Calculate the iodine value of sample V.

(c) From literature, normal vegetable oils have iodine values between 90–110. Compare your result and interpret.

(d) State two uses of iodine value in food chemistry.

Answer

(a) Solution X acts as a catalyst (commonly iodine monochloride in Wijs solution) that facilitates the halogenation of double bonds in unsaturated fatty acids.

(b) The iodine value is calculated from the titre of solution Y (sodium thiosulphate). Since exact data is not given, the procedure involves:

Iodine value = (12.69 × N × V) / weight of oil

where N is normality of thiosulphate, V is volume used, and weight of oil is 5 g. The student should insert measured values to compute the iodine value.

(c) If the calculated iodine value lies between 90–110, the oil is a normal vegetable oil with typical unsaturation. If it is lower, the oil has fewer double bonds, indicating saturation or partial hydrogenation. If higher, it is highly unsaturated and more prone to oxidation.

(d) Iodine value is used to determine the degree of unsaturation in fats and oils, and to assess oil stability and suitability for applications such as margarine manufacture or industrial drying oils.