2023 Ch H2 Q3(a)

Section: Nature’s Chemistry

Topic: Fats and Fatty Acids

Question Summary

Cheese chemistry — fats and fatty acids. Tasks include naming glycerol, identifying condensation (esterification), functional groups/transformations in a sequence, identifying a hydroxycarboxylic acid that cyclises, and interpreting gas chromatography (retention time and dilution).

Worked Solution

According to the SQA Marking Instructions for 2023 H2 Q3:

(i) (A) Glycerol’s systematic name is propane-1,2,3-triol. (B) Fats form by condensation (esterification) between glycerol and fatty acids.

(ii) (A) The circled group in X is a hydroxyl (–OH) group. (B) X → Y removes water to form an alkene (dehydration). (C) Y → Z is hydrogenation (addition of H_2 across the C=C). (D) Reaction 3 increases O:H ratio — this is oxidation.

(iii) The acid that cyclises to the shown ester has both –OH and –COOH in the correct positions: 4-hydroxybutanoic acid.

(iv) (A) Missing retention time in Chromatogram Y is 30 minutes. (B) For quantitation, dilute the sample so the peak lies within the calibration range.

Final Answer

(i) Propane-1,2,3-triol; condensation (esterification).

(ii) Hydroxyl group; alkene via dehydration; hydrogenation; oxidation.

(iii) 4-hydroxybutanoic acid.

(iv) 30 minutes; dilute the sample before GC analysis.

Revision Tips

• Fats/oils: glycerol + 3 fatty acids → triglyceride + 3H_2O (condensation).

• Dehydration (–H_2O) of alcohols gives alkenes; hydrogenation adds H_2 across C=C.

• Hydroxycarboxylic acids can form cyclic esters (lactones).

• In GC: identity from retention time; amount from peak area using calibration. Keep peaks within range by dilution.