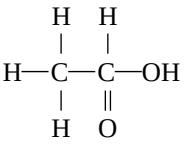
(f) Acetic acid is more soluble in water than is stearic acid, and less soluble in oil; stearic acid, with its long hydrocarbon component, has a longer nonpolar component and is thus more soluble in the nonpolar oil.
(g) Acetic acid reacts with sodium hydrogen carbonate, as acids do; stearic acid is not soluble in water and does not show a reaction with the aqueous sodium hydrogen carbonate.
(h) $CH_3COOH_{(aq)} + NaHCO_{3(aq)} \rightarrow CH_3COONa_{(aq)} + CO_{2(g)} + H_2O_{(l)}$
(i) Carboxylic acids do not undergo controlled oxidation reactions; the C atom to which the OH group is attached is not bonded to an H atom to allow further oxidation of the OH group to a C=O group.



ethanoic acid

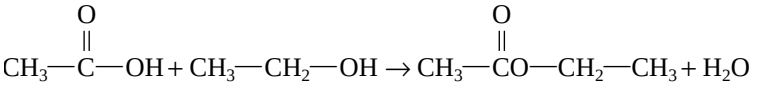
Evaluation

(j) (Sample answer) Yes, the Experimental Design allowed the collection of appropriate evidence regarding all aspects of this investigation except for the reaction with sodium hydrogen carbonate; since the stearic acid was not highly soluble in water, it is inconclusive whether it reacts with sodium hydrogen carbonate.
(k) (Sample answer) Answers obtained in the Analysis are in agreement with the Prediction.
(l) (Sample answer) The theoretical model of carboxylic acids did help in the prediction of the chemical properties of these acids. The effect of the polar and nonpolar components of each acid could be used to predict physical and chemical properties of the compounds.

ACTIVITY 1.7.2 SYNTHESIS OF ESTERS

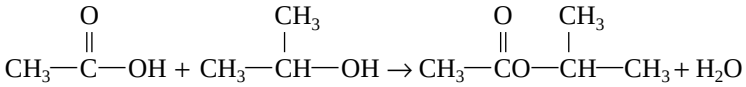
(Page 89)

(a) Both ethanol and 2-propanol reacted with glacial acetic acid to form products with fruity odours. 1-pentanol reacted with glacial acetic acid to form a product with an odour like bananas.
(b) Reaction in Tube #1



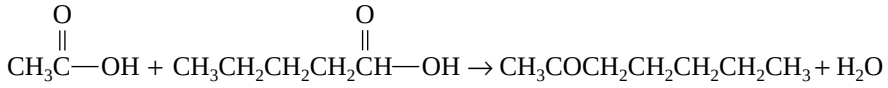
ethanoic acid ethanol ethyl ethanoate water

Reaction in Tube #2



ethanoic acid 2-propanol isopropyl ethanoate water

Reaction in Tube #3



ethanoic acid 1-pentanol isopentyl ethanoate water

(c) The concentrated sulfuric acid acts as a catalyst.
(d) The glacial acetic acid mixed with the aqueous sulfuric acid to form a homogeneous mixture; acetic acid is thus soluble in aqueous solution. This is explained by the presence of its polar carboxylic group which can hydrogen bond with water.
(e) The esters are insoluble in aqueous solution because each one formed a layer on top of the cold water in the evaporating dish. This is explained by the loss of the hydroxyl group from the carboxyl group when the ester bond is formed; thus, the ability to hydrogen bond with water is lost.