(b) Animal hides decompose quickly unless they are cured to remove the water from the skin. The hide is first soaked in water to remove water-soluble substances. Hair is removed by soaking the hide in a mixture of lime and water, followed by an enzyme mixture. The hair and any remaining tissue is removed by machine, and the hide is washed and treated with tannic acid. The tannic acid displaces water from the spaces between the hide's protein fibres, allowing the fibres to cement together to form strong water-resistant leather.

3.14 ACTIVITY: SYNTHESIS OF ESTERS

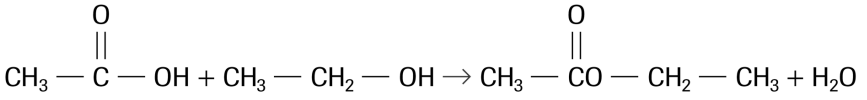
(Pages 226–227)

Analysis

(a) **Table 2** Summary of Condensation Reactions

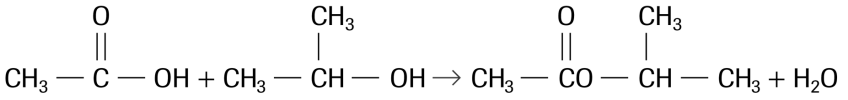
	Reaction 1	**Reaction 2**	**Reaction 3**
IUPAC name of alcohol used	ethanol	2-propanol	1-pentanol
Structural formula of alcohol used	CH_3CH_2OH	$CH_3CH(OH)CH_3$	$CH_3CH_2CH_2CH_2CH_2OH$
IUPAC name of carboxylic acid used	ethanoic acid	ethanoic acid	ethanoic acid
Structural formula of carboxylic acid used	CH_3COOH	CH_3COOH	CH_3COOH
IUPAC name of ester produced	ethyl ethanoate	isopropyl ethanoate	pentyl ethanoate
Structural formula of ester produced	$CH_3COOCH_2CH_3$	$CH_3COOCHCH_3CH_3$	$CH_3COOCH_2CH_2CH_2CH_2CH_3$
Odour of ester produced	fruity	fruity	banana

(b) **Reaction in Tube #1**



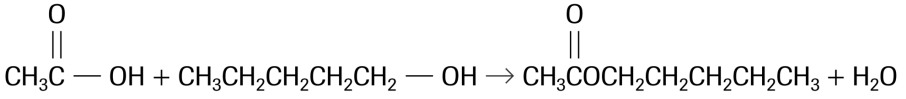
ethanoic acid ethanol ethyl ethanoate water

Reaction in Tube #2



ethanoic acid 2-propanol isopropyl ethanoate water

Reaction in Tube #3



ethanoic acid 1-pentanol pentyl ethanoate water

(c) The concentrated sulfuric acid acts as a catalyst.

(d) The esters are insoluble in aqueous solution because each ester formed a layer on top of the cold water in the evaporating dish. This effect is caused 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.