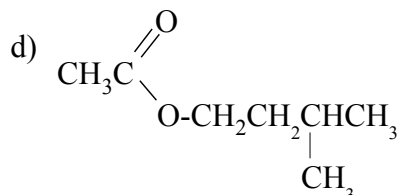
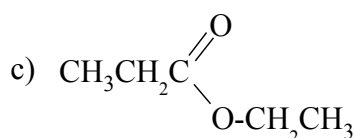
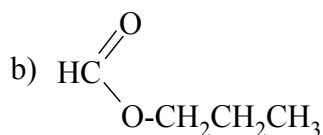
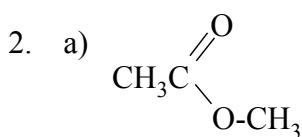


## Chemguide – answers

### ALCOHOLS: ESTERIFICATION

1. a) ethyl ethanoate  
b) methyl propanoate  
c) ethyl methanoate  
d) methyl butanoate



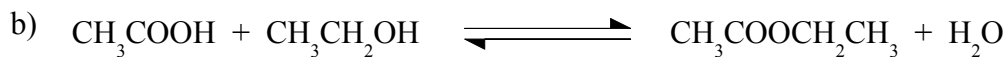
(You first need to work out the structure of the alcohol from its name:  $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{OH}$ )

Then attach that to the acid part exactly as you have done in all the other cases.)

If you haven't been successful with questions 1 and 2, spend some more time on this before you go on to anything new. Don't leave it and hope that it will miraculously get better at some time in the future – it won't! But if you get it sorted now, it will be a major boost to your confidence.

3. a) The esterification reaction is reversible, and so you are going to have a mixture of the original alcohol and ethanoic acid as well as a little bit of ester. The smell of the ethanoic acid and alcohol tend to confuse the smell of the ester. The ethanoic acid and the alcohol dissolve in the water, but the ester doesn't and so forms a layer on the top which you can easily smell. (3-methylbutan-1-ol isn't very soluble in water, but you are talking about quite small quantities of reaction mixture poured into quite a lot of water.)

## Chemguide – answers



(If you are writing an equation, using these condensed forms of structural formulae is usually acceptable rather than showing the bonds in full. If you add the sulphuric acid catalyst to the equation, it must be over the top of the reversible sign and *not* into the equation itself.)

c) You distill off the ethyl ethanoate as soon as it forms, and that stops the back reaction. Everything else in the reaction forms hydrogen bonds as well as the various sorts of van der Waals attractions, but ethyl ethanoate doesn't, and so has the lowest boiling point in the mixture.

4. a) The reaction is violent and produces clouds of acidic steamy (and poisonous!) fumes of hydrogen chloride.

b) It is much faster, doesn't need a catalyst, and isn't reversible.

