

- Ethanol and propene have similar molecular masses but widely different boiling points.
 - What are the boiling points of ethanol and propene?
 - Explain why molecular masses are significant when comparing boiling points.
 - Explain why ethanol has a much higher boiling point than propene.
- Methanol is completely miscible with water in all proportions whilst pentanol is completely immiscible in water.
 - Explain what is meant by the term *immiscible*.
 - Explain why methanol is miscible in water whilst pentanol is immiscible.
- Name the alcohols which will be produced in the following reactions. Where two alcohols can be formed in a reaction be sure to name both.
 - chloromethane reacted with aqueous sodium hydroxide
 - acid catalysed addition of water to propene.
 - 2 chlorobutane reacted with aqueous sodium hydroxide.
 - acid catalysed addition of water to but-2-ene.
 - 2 iodopentane reacted with aqueous sodium hydroxide.
 - acid catalysed addition of water to pent-2-ene.
- Esters are the products of a condensation reaction between an alcohol and a carboxylic acid. Define a condensation reaction.
- In each of the questions below, draw extended structural formula of the ester produced on condensation, also name the ester.
 - Propanol and ethanoic acid
 - Ethanol and propanoic acid
 - Butanoic acid and ethanol
 - Methanol and ethanoic acid
- From the structural formulae below name the ester. It may be easier to draw out the extended structural formulae before trying to name the ester
 - $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_3$
 - $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
 - $\text{CH}_3\text{OOCCH}_2\text{CH}_3$
 - $\text{CH}_3\text{CH}_2\text{CH}_2\text{OOCCH}_2\text{CH}_3$
- When $\text{C}_2\text{H}_5\text{COCl}$ is reacted with ethanol an ester and white fumes are produced.
 - Name the ester produced in the above reaction.
 - Suggest what the white fumes produced in the reaction are.

ANSWERS 3.5

1.

(b) Van der Waals forces increase as molecular masses increase and the strength of van der Waals forces affect melting and boiling points when they are the main force of attraction between molecules.

(c) Ethanol has a much higher boiling pt. than propene because ethanol has hydrogen bonding between its molecules which propene does not have.

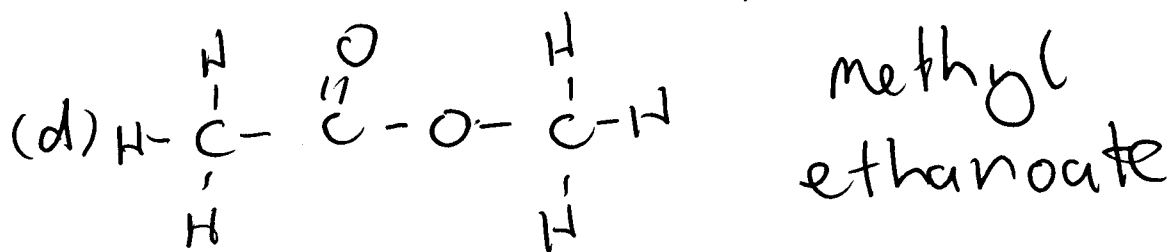
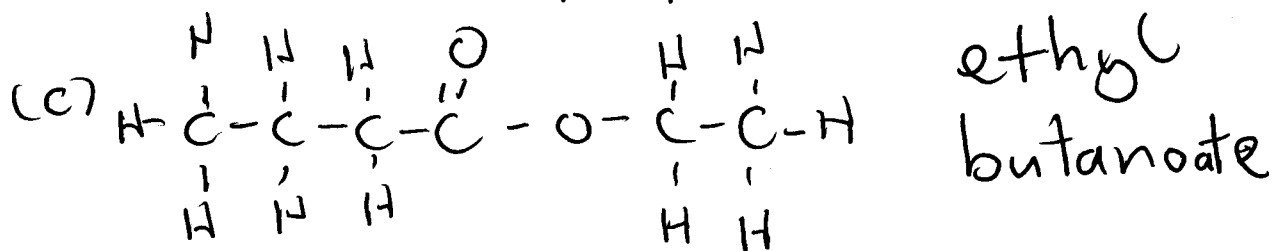
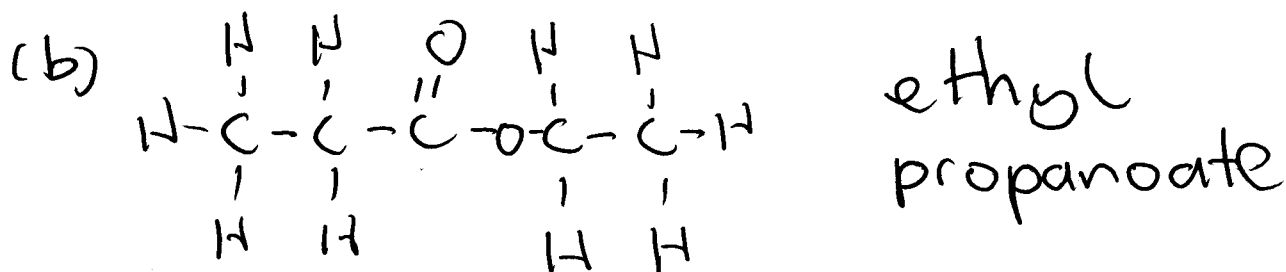
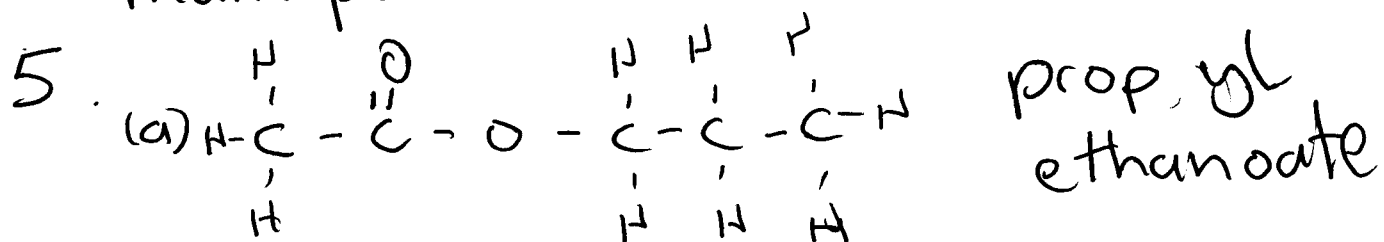
2. (a) immiscible means that two liquids do not mix and will separate into two separate layers.

(b) Because methanol has the polar OH group it will be strongly attracted to water molecules and therefore be able to mix and bond with the water molecules.

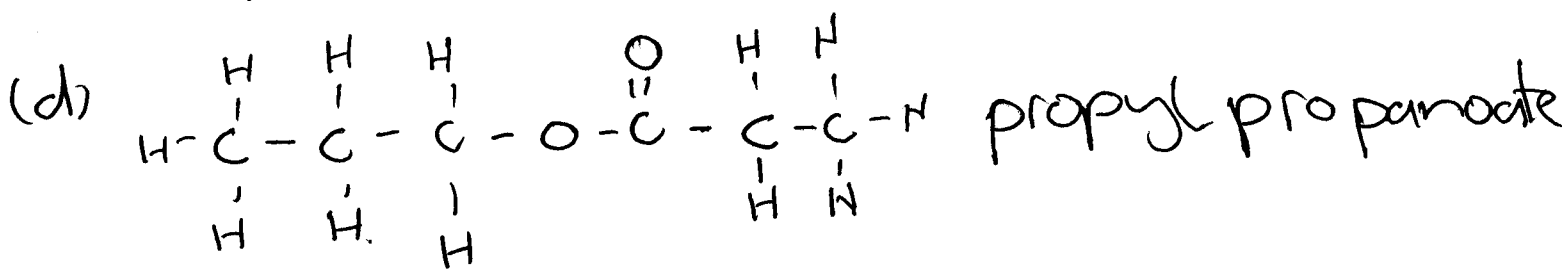
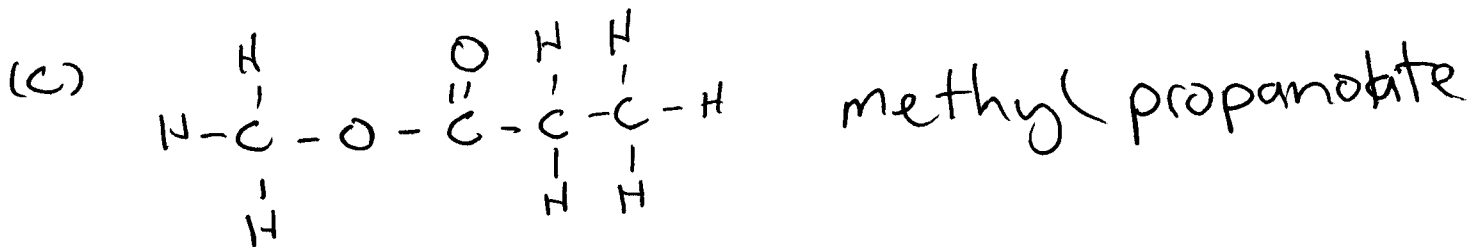
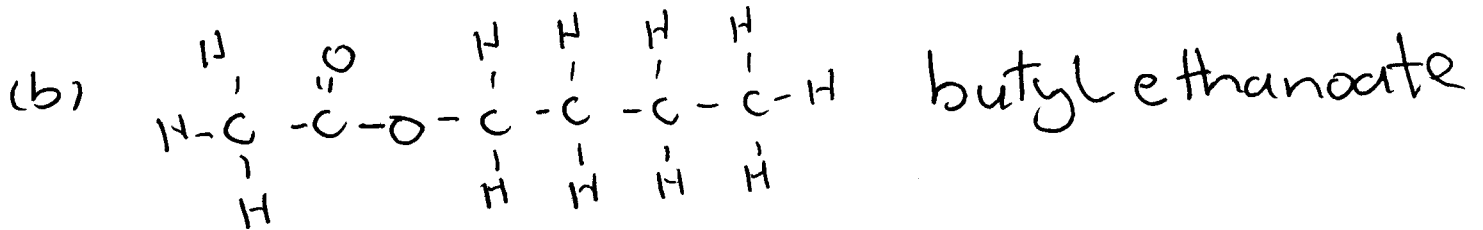
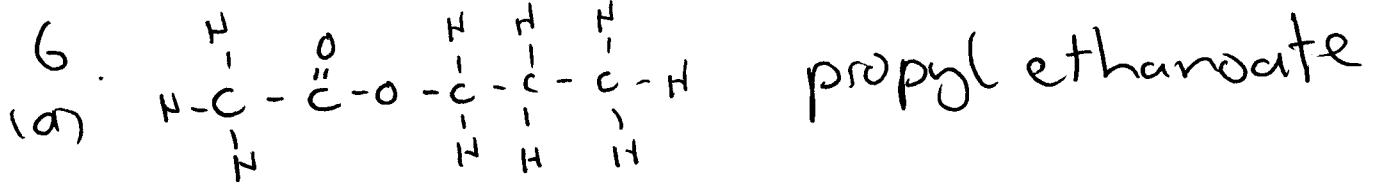
propanol is less polar due to the fact that it has a larger hydrocarbon section (C_3H_7) which donates negative charge. Therefore propanol is only weakly attracted to water molecules and cannot mix with them.

3. (a) methanol
 (b) main product propan-2-ol
 minor product propan-1-ol
 (c) Butan-2-ol
 (d) Butan-2-ol
 (e) pentan-2-ol
 (f) main product - pentan-3-ol
 minor product - pentan-2-ol

4. A condensation reaction is a reaction in which a small molecule is produced in addition to the main product.

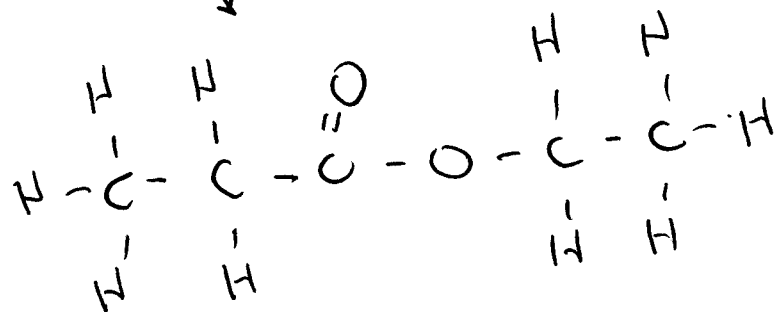
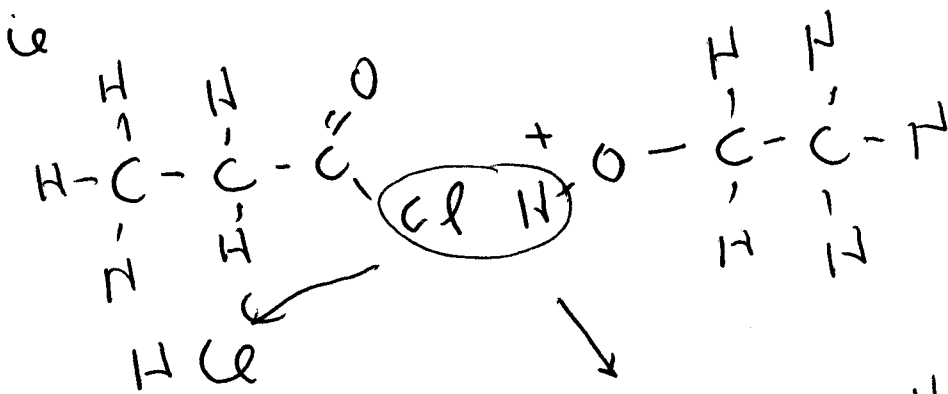


Answers 3-5



7. (a) ethyl propanoate

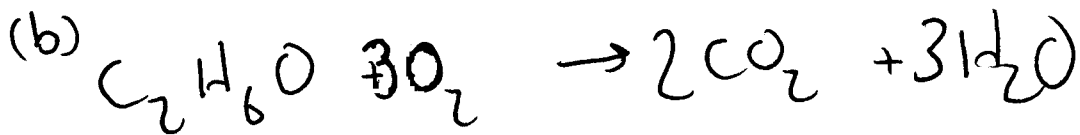
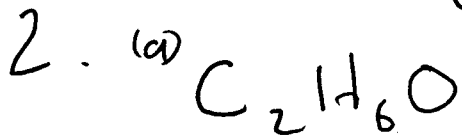
(b) HCl



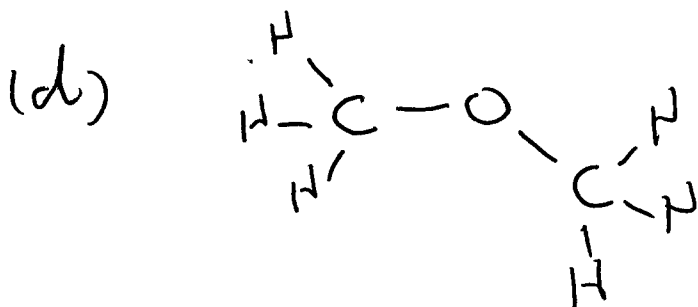
1. Name the following ethers.
 - (a) CH_3OCH_3
 - (b) $\text{CH}_3\text{OC}_2\text{H}_5$
 - (c) $\text{C}_3\text{H}_7\text{OC}_2\text{H}_5$
 - (d) $\text{C}_4\text{H}_9\text{OC}_2\text{H}_5$
 - (e) $\text{C}_4\text{H}_9\text{OC}_4\text{H}_9$
 - (f) $\text{C}_3\text{H}_7\text{OC}_4\text{H}_9$
2. Dimethyl ether, a substance now known as methoxymethane, was formerly used as an anaesthetic. Although it was a useful anaesthetic it suffered from two major problems.
 - A it was extremely volatile and flammable
 - B if not stored properly it formed an unstable explosive substancePerhaps surprisingly dimethyl ether was miscible with water.
 - (a) Give the molecular formula of dimethyl ether.
 - (b) Give a balanced equation for the combustion of dimethyl ether.
 - (c) Explain why improper storage of ethers can lead to formation of unstable explosive substances.
 - (d) Draw the shape of a molecule of dimethyl ether.
 - (e) Use your answer to part (d) to explain why dimethyl ether is miscible with water.
3. Ethers can be formed by nucleophilic substitution reactions of alkoxide ions with halogenoalkanes. An example of this is the reaction of sodium ethoxide with 1-chloropropane.
 - (a) What is the ionic formula of sodium ethoxide?
 - (b) Explain why ethoxide ions can act as nucleophiles.
 - (c) Explain, in terms of electronegativity, why 1-chloropropane is susceptible to nucleophilic attack.
 - (d) Name the ether produced when 1-chloropropane is reacted with sodium ethoxide.

ANSWERS 3.6

1. (a) methoxymethane (b) methoxyethane
(c) ethoxypropane (d) ethoxybutane
(e) butoxybutane (e) propoxybutane



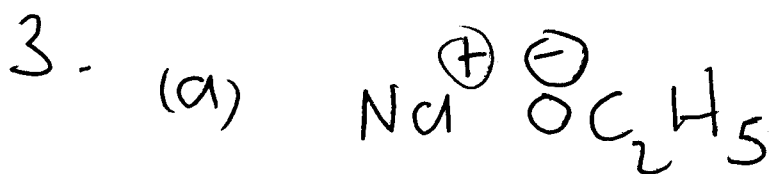
(c) IN the presence of light they can form explosive peroxides



(e) water molecules can form hydrogen bonds to the exposed oxygen atom which has a negative charge.

Similar shape to H_2O molecules therefore can easily interact with water molecules via polar-polar attractions.

ANSWERS 3.6



(b) They can act as nucleophiles because the oxygen atom has lone pairs of electrons which will be attracted to positive charges.

(c) The C-Cl bond is a polar bond due to the difference in electronegativity between the two elements. This means that the chlorine atom will have a slight negative charge while the carbon atom will have a slight positive charge and thus will attract nucleophiles.

(d) ethoxypropane