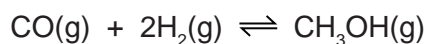


1 (a) Methanol can be made from a mixture of carbon monoxide and hydrogen.



The forward reaction is exothermic.

(i) Explain why the concentration of methanol at equilibrium does not change.

.....
 [2]

(ii) Suggest conditions, in terms of temperature and pressure, which would give a high yield of methanol.

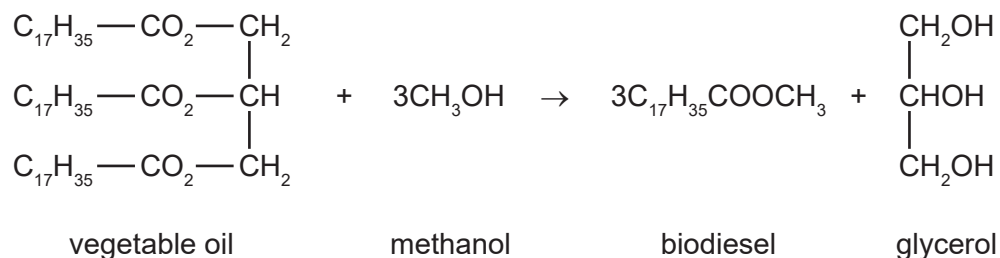
.....
 [2]

(iii) How would the conditions used in practice compare with those given in (ii)? Give an explanation of any differences.

.....

 [2]

(b) Biodiesel is made from a vegetable oil by the following reaction.



(i) What type of compound are vegetable oil and biodiesel?

..... [1]

(ii) What other useful product is made from vegetable oil by heating it with aqueous sodium hydroxide?

..... [1]

(iii) Suggest an explanation why making and using biodiesel has a smaller effect on the percentage of carbon dioxide in the atmosphere than using petroleum-based diesel.

.....

(c) Petroleum-based diesel is a mixture of hydrocarbons, such as octane and octene.

(i) 'Oct' means eight carbon atoms per molecule. Draw a structural formula of an octene molecule.

[1]

(ii) Describe a test which would distinguish between octane and octene.

test

result with octane

result with octene [3]

[Total: 14]

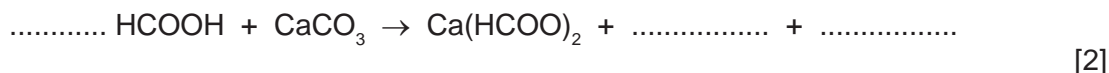
2 Methanoic acid is the first member of the homologous series of carboxylic

(a) Give **two** general characteristics of a homologous series.

.....
.....
..... [2]

(b) In some areas when water is boiled, the inside of kettles become coated with a layer of calcium carbonate. This can be removed by adding methanoic acid.

(i) Complete the equation.



(ii) Methanoic acid reacts with most metals above hydrogen in the reactivity series. Complete the word equation.

zinc + methanoic acid \rightarrow + [2]

(iii) Aluminium is also above hydrogen in the reactivity series. Why does methanoic acid not react with an aluminium kettle?

.....
..... [1]

(c) Give the name, molecular formula and empirical formula of the fourth acid in this series.

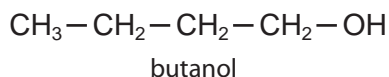
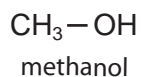
name [1]

molecular formula [1]

empirical formula [1]

[Total: 10]

- 3 The alcohols form a homologous series. The first member is methanol and the fourth is butanol.



- (a) Give **two** general characteristics of a homologous series.

.....
.....
..... [2]

- (ii) Calculate the mass of one mole of the C₈ alcohol.

.....
..... [2]

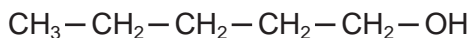
- (b) Give the name and structural formula of the third member of this series.

name

structural formula

[1]

- (c) The structural formula of the fifth member, pentan-1-ol, is drawn below.



- (i) Draw the structural formula of an isomer of this alcohol.

[1]

(ii) Predict the names of the product(s) formed when pentan-1-ol

- reacts with an excess of oxygen,

..... and [1]

- is dehydrated to form an alkene,

..... [1]

- is oxidised by acidified potassium dichromate(VI).

..... [1]

4 Alkenes are unsaturated hydrocarbons. They show structural isomerism. Alkenes take part in addition reactions and form polymers.

(a) Structural isomers have the same molecular formula but different structural formulae. Give an example of structural isomerism.

molecular formula

two structural formulae

[3]

(b) Ethene reacts with each of the following. Give the name and structural formula of each product.

(i) steam

name of product

structure of product

[2]

(ii) hydrogen

name of product

structure of product

[2]

(c) Alkenes polymerise by addition.

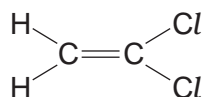
(i) Explain the term *polymerise*.

.....
.....[2]

(ii) What is the difference between addition polymerisation and condensation polymerisation?

.....
.....[2]

(iii) Poly(dichloroethene) is used extensively to package food. Draw its structure. The structural formula of dichloroethene is drawn below.



[2]

(d) Steel may be coated with another metal, eg zinc or chromium, or with a polymer, eg poly(chloroethene), to prevent rusting.

(i) Suggest a property of poly(chloroethene) that makes it suitable for this purpose.

.....[1]

(ii) Explain why the steel will rust when the protective coating of chromium or polymer is broken.

.....[1]

(iii) When the protective layer of zinc is broken, the steel still does not rust. Suggest an explanation.

.....
.....
.....[2]