Alcohols & Carboxylic Acids

Question Paper 7

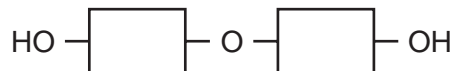|	
Level	IGCSE
Subject	Chemistry
ExamBoard	CIE
Topic	Organic Chemistry
Sub-Topic	Alcohols & Carboxylic Acids
Paper	(Extended) Theory
Booklet	Question Paper 7

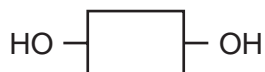|	
TimeAllowed	**65 minutes**
: Score:	**/54**
Percentage:	**/100**

1   The three types of food are carbohydrates, proteins and fats.

(a) Aqueous starch is hydrolysed to maltose by the enzyme amylase.
The formula of maltose is:

$$HO - \boxed{} - O - \boxed{} - OH$$

Starch is hydrolysed by dilute sulphuric acid to glucose.

$$HO - \boxed{} - OH$$

(i) What is an enzyme?

.... [1]

(ii) Draw the structure of starch.

[1]

(iii) Name the technique that would show that the products of these two hydrolyses are different.

.... [1]

(b) Proteins have the same linkage as nylon but there is more than one monomer in the macromolecule.

(i) Draw the structure of a protein.

[2]

(ii) What class of compound is formed by the hydrolysis of proteins?

.... [1]
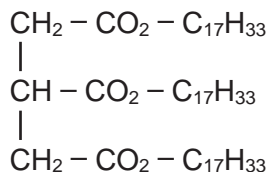
(c) Fats are esters. Some fats are saturated, others are unsaturated.

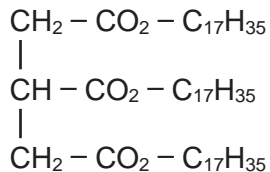**(i)** Write the word equation for the preparation of the ester, propyl ethanoate.

.... [2]

(ii) Deduce the structural formula of this ester showing each individual bond.

[2]

(iii) How could you distinguish between these two fats?
Fat 1 has the formula

$CH_2 - CO_2 - C_{17}H_{33}$
|
$CH - CO_2 - C_{17}H_{33}$
|
$CH_2 - CO_2 - C_{17}H_{33}$

Fat 2 has the formula

$CH_2 - CO_2 - C_{17}H_{35}$
|
$CH - CO_2 - C_{17}H_{35}$
|
$CH_2 - CO_2 - C_{17}H_{35}$

test ....

result with fat 1 ....

result with fat 2 .... [3]

(iv) Both of these fats are hydrolysed by boiling with aqueous sodium hydroxide. What type of compounds are formed?

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

2   A South Korean chemist has discovered a cure for smelly socks. Small particles of silver are attached to a polymer, poly(propene), and this is woven into the socks.

(a)   Give the structural formula of the monomer.

[1]

(ii)   Draw the structural formula of the polymer.

[2]

(iii) Suggest which one, monomer or polymer, will react with aqueous bromine and why?

....

.... [2]

(b) To show that the polymer contains silver the following test was carried out.

The polymer fibres were chopped into small pieces and warmed with nitric acid. The silver atoms were oxidised to silver(I) ions. The mixture was filtered. Aqueous sodium chloride was added to the filtrate and a white precipitate formed.

(i) Why was the mixture filtered?

.... [1]

(ii) Explain why the change of silver atoms to silver ions is oxidation.

.... [1]

(iii) Give the name of the white precipitate.

.... [1]

(c) The unpleasant smell is caused by carboxylic acids. Bacteria cause the fats on the skin to be hydrolysed to these acids. Silver kills the bacteria and prevents the hydrolysis of the fats.

(i) Fats are esters. Give the name and structural formula of an ester.

name .... [1]

structural formula

[1]

(ii) Complete the word equation.

Ester + water ⟶ carboxylic acid + ... [1]

(d) Propanoic acid is a weak acid.

(i) The following equation represents its reaction with ammonia.

$CH_3-CH_2-COOH + NH_3 \longrightarrow CH_3-CH_2-COO^- + NH_4^+$

Explain why propanoic acid behaves as an acid and ammonia as a base.

....

.... [3]

(ii) Explain the expression *weak acid*.

.... [1]
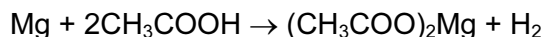
3   Chemists use the concept of the mole to calculate the amounts of chemicals involved in a reaction.

(a) Define *mole*.

.... [1]

(b) 3.0 g of magnesium was added to 12.0 g of ethanoic acid.

$Mg + 2CH_3COOH \rightarrow (CH_3COO)_2Mg + H_2$

The mass of one mole of Mg is 24 g.

The mass of one mole of CH_3COOH is 60 g.

(i) Which one, magnesium or ethanoic acid, is in excess? You must show your reasoning.
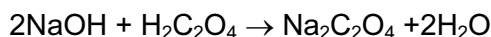
.... [3]

(ii) How many moles of hydrogen were formed?

.... [1]

(iii) Calculate the volume of hydrogen formed, measured at r.t.p.

.... [2]

(c) In an experiment, 25.0 cm^3 of aqueous sodium hydroxide, 0.4 mol/dm^3, was neutralised by 20.0 cm^3 of aqueous oxalic acid, $H_2C_2O_4$.

$$2NaOH + H_2C_2O_4 \rightarrow Na_2C_2O_4 + 2H_2O$$

Calculate the concentration of the oxalic acid in mol/dm^3.

(i) Calculate the number of moles of NaOH in 25.0 cm^3 of 0.4 mol/dm^3 solution.

.... [1]

(ii) Use your answer to **(i)** and the mole ratio in the equation to find out the number of moles of $H_2C_2O_4$ in 20 cm^3 of solution.
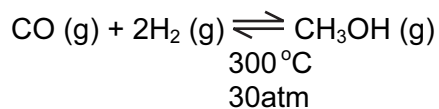
.... [1]

(iii) Calculate the concentration, mol/dm^3, of the aqueous oxalic acid.

.... [2]

4   The simplest alcohol is methanol.

   (a) It is manufactured by the following reversible reaction.

$$CO\ (g) + 2H_2\ (g) \rightleftharpoons CH_3OH\ (g)$$
300 °C
30atm

     (i) Reversible reactions can come to equilibrium. Explain the term *equilibrium*.

....

[1]

     (ii) At 400 °C, the percentage of methanol in the equilibrium mixture is lower than at 300 °C. Suggest an explanation.

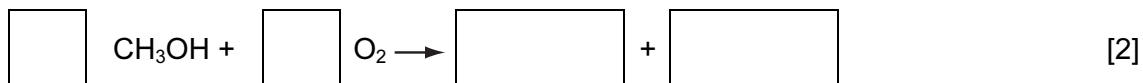..

[2]

     (iii) Suggest two advantages of using high pressure for this reaction.
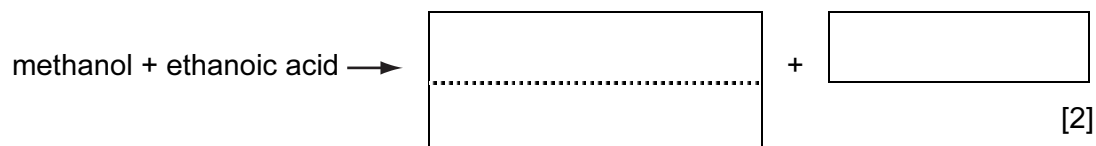Give a reason for each advantage.

advantage	....
reason	....

advantage	....
reason	....

[5]

(b) (Complete the equation for the combustion of methanol in an excess of oxygen.

| | CH_3OH + | | $O_2 \longrightarrow$ | | + | | [2]

(ii) Complete the word equation.

methanol + ethanoic acid $\longrightarrow$ [................................] + [ ]

[2]

(iii) Methanol can be oxidised to an acid. Name this acid.

[ ] [1]