

O Level Combined Chemistry Structured

Organic Chemistry Test 2.0

Q1

Aldehydes are a homologous series of organic compounds like alkanes and alkenes. The table shows the names, formulae and boiling points of some aldehydes.

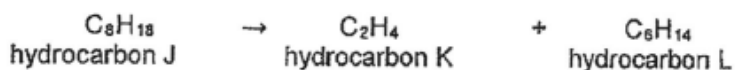
name	formula	boiling point (°C)
methanal	HCHO	-19
ethanal	CH ₃ CHO	20
propanal	C ₂ H ₅ CHO	49
pentanal	C ₄ H ₉ CHO	103

- (a) Use the information in the table to give two pieces of evidence that suggest that the aldehydes are a homologous series.

.....
.....
.....

[2]

- (b) The equation shows a reaction involving hydrocarbons.



Choose the correct processes from the box to complete the sentences below.

combustion hydration cracking polymerisation

Each word may be used once, more than once or not at all.

- (i) Hydrocarbons K and L are produced from hydrocarbon J by

[1]

- (ii) Poly(ethene) can be produced from hydrocarbon K by

[1]

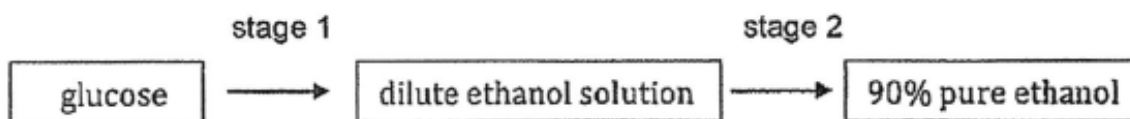
- (iii) Describe a test to distinguish between hydrocarbons K and L and give the results of the test.

.....
.....
.....

[2]

(c) In some countries, ethanol is made from glucose for use as a fuel.

The flow chart summarises the production process for ethanol.



(i) Name the processes that take place at stage 1 and 2

stage 1:

stage 2: [2]

(ii) Write a balanced equation for the reaction in stage 1.

..... [1]

(iii) State two conditions for the reaction to occur.

.....

..... [2]

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Q2

- (a) Table 11.1 shows some information about a homologous series of organic compounds called aldehydes.

Table 11.1

name	number of carbon atoms	full structural formula	boiling point / °C
methanal	1		- 19.0
ethanal	2		20.2
propanal	3		48.8

- (i) State and explain the trend of the boiling points of the molecules in the aldehyde homologous series.

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

- (ii) Draw the structural formula of butanal, which contains four carbon atoms.

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[1]

- (iii) Carboxylic acids have a carboxyl functional group, which contains the structure -COOH.

Suggest the structure of the carbonyl functional group of aldehydes.

.....[1]

(b) Fig. 11.2 shows some reactions involving ethene.

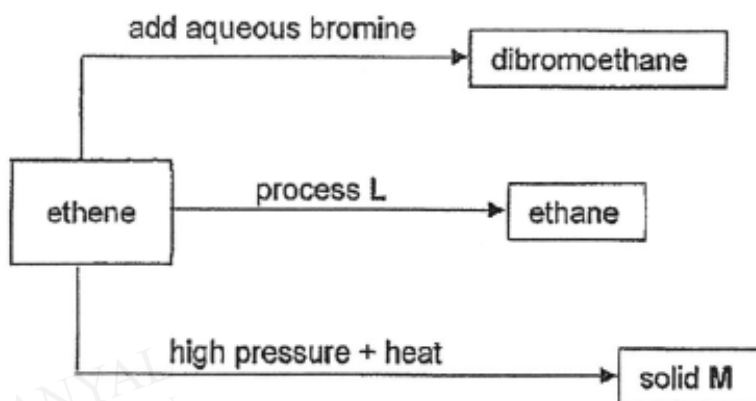


Fig. 11.2

(i) State one use of adding aqueous bromine.

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

(ii) Name process L and state the conditions required for this reaction to occur.

process:.....
conditions:.....
.....[2]

(iii) Solid M is commonly known as plastic.

State the chemical name of solid M, including the structural formula of solid M.

name:.....

[2]

(iv) Explain why land pollution can be caused by the increased use of solid M.

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

Q3

Fig. 9.1 describes some of the reactions of the hydrocarbon P.

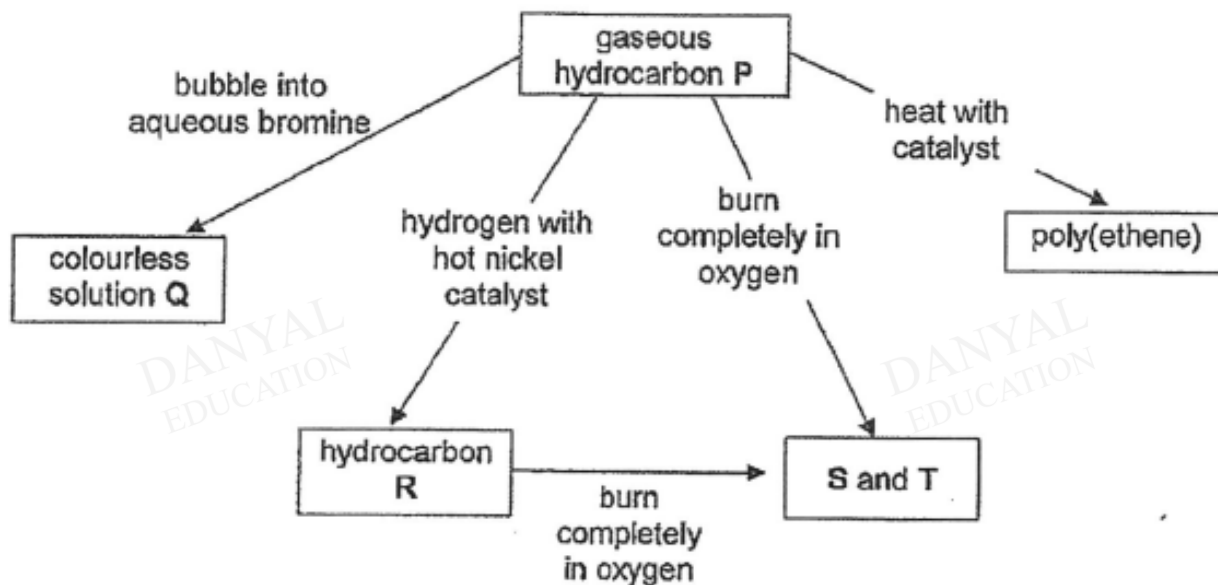


Fig. 9.1

(a) What does the reaction with aqueous bromine tell you about hydrocarbon P?

..... [1]

(b) Draw the full structural formula of compound Q.

(c) Name hydrocarbon R.

..... [1]

(d) Write a chemical equation for the formation of S and T in Fig. 9.1.

..... [1]

[Total: 4]

Q4

(a) Organic compounds are placed in a homologous series.

(i) Give two general properties of a homologous series.

- 1.....
.....
2.....
.....[2]

(ii) Write the general formula for the homologous series of alkanes.

.....[1]

(iii) Name and write the chemical formula for the third member of the alkanes.

.....[2]

(b) Fig. 12.1 shows the structure of fumaric acid. It is produced by human skin when exposed to sunlight and is a food additive generally used in beverages and baking powders.

Fig. 12.2 shows the structure of malic acid. It is made by all living organisms and is used as a food additive too. Malic acid contributes to the pleasantly sour taste of fruits.

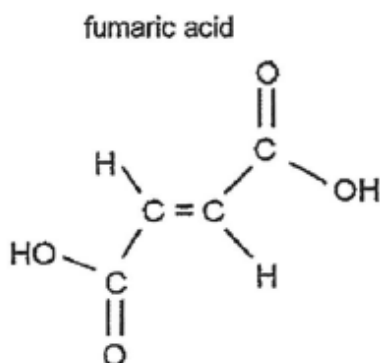


Fig. 12.1

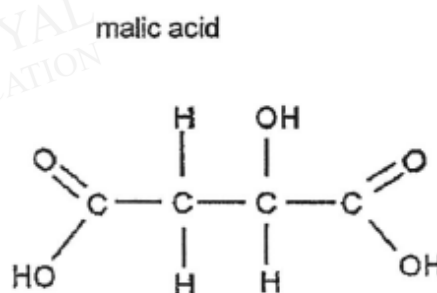


Fig. 12.2

(i) Other than the test for carbon-carbon double bond, suggest one chemical test to distinguish between fumaric and malic acids.

chemical test

.....[1]

results

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

(b) (ii) Predict which acid, fumaric or malic acid, can form a polymer.

.....[1]

(iii) Draw the repeat unit and structural formula of the polymer in (b)(ii).

[2]

[Total: 10]

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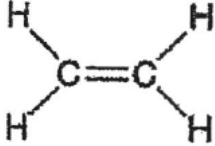
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Q5

4 The table below shows information about some organic compounds.

(a) Complete the table by filling in the missing names, formulae and by completing the description of the processes. [3]

name of compound	structural formula	process used to manufacture the compound
	 of long chain alkanes
poly(ethene)	 of ethene
ethanoic acid	 of ethanol

(b) Ethanol is a member of the alcohol homologous series. [2]

Describe a chemical test to distinguish between ethanol and ethanoic acid and the result you would expect.

method

result for ethanol

result for ethanoic acid

Answers

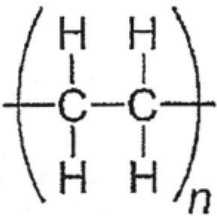
Organic Chemistry Test 2.0

Q1

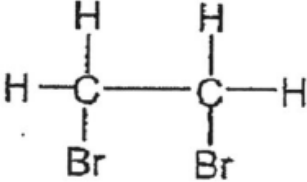
(a)	Has general formula/ functional group present/Boiling point shows gradation.	2
(b)	(i) fermentation	1
	(ii) polymerisation	1
	(iii) Add aqueous bromine. K decolourises it. Remains reddish brown in L	1
(c)	(i) Fermentation and Fractional distillation	1
	(ii) $C_6H_{12}O_6 \longrightarrow 2CO_2 + 2C_2H_5OH$	1
	(iii) yeast, temperature of 37 °C	2

Q2

(a)(i)	As the number of carbon atoms increases, <u>boiling point increases</u> .	[1]
	As the <u>molecular size increases</u> , the <u>forces of attractions between the molecules increase</u> , thus <u>more energy is needed to overcome the forces of attraction</u> . [accept: intermolecular forces of attraction increases] [MR: explanation was not well done – many students missing out key points (e.g. only talking about forces of attraction increasing, or molecular size increasing, but not both); some students also talked about the percentage of carbon (related to flammability)]	[1]
(ii)	$ \begin{array}{ccccccc} & H & H & H & & & \\ & & & & & & \\ H & -C & -C & -C & -C & =O & \\ & & & & & \backslash & \\ & H & H & H & & & H \end{array} $ [MR: generally well done]	[1]
(iii)	-CHO / - COH [MR: some students did not understand the question, either restating the question; or attempting to write the general formula]	[1]
(b)(i)	To <u>distinguish</u> between saturated and unsaturated hydrocarbons / alkanes and alkenes. [accept: to identify/to test if it is alkane or alkene] [MR: a number of students wrote ethene and ethane specifically; some students also wrote about converting alkenes to alkanes]	[1]

(b)(ii)	process: hydrogenation/addition of hydrogen [MR: some students wrote cracking instead] conditions: high temperature of 200 °C, nickel catalyst [accept: if students wrote process as addition] [MR: no marks awarded if process is wrong but conditions is correct; some students spelt nickel as nickle]	[1] [1]
b)(iii)	name: polyethene / poly(ethene) <div style="text-align: center;">  </div>	[1] [1] At least 3 repeating units
(iv)	[MR: a number of students did not put the n at the bottom; some students drew the monomer] Plastics are <u>non-biodegradable/do not decompose</u> , thus, will not break down. [accept: hard to break down, difficult/long time to decompose] [do not accept: decay] [MR: some students spelt non-biodegradable as non-biodegradable]	[1]

Q3

(a)	P is unsaturated or it contains carbon-carbon double bond.	[1]
(b)	<div style="text-align: center;">  </div>	[1]
(c)	ethane	[1]
(d)	$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$ Or $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$ * state symbols not required. State symbols must be correct if students give state symbols. $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$	[1]

Q4

2(a)(i)	<ol style="list-style-type: none">1. have the same functional group,2. have similar chemical properties,3. show a gradual change in their physical properties,4. have the same general formula,5. each member of the series differs from the next by a $-\text{CH}_2-$ unit.	[2] any 2 answers
(a)(ii)	$\text{C}_n\text{H}_{2n+2}$	[1]
(a)(iii)	Propane C_3H_8	[1] [1]
(b)(i)	Acidified potassium manganate (VII) Solution turns from purple to colourless in malic acid but remains purple in fumaric acid.	[1] [1]
(b)(ii)	fumaric acid	[1]
b)(iii)	Repeat unit $\begin{array}{c} \text{H} \quad \text{COOH} \\ \quad \\ \text{--- C} - \text{C ---} \\ \quad \\ \text{HOOC} \quad \text{H} \end{array}$ Structural formula $\left[\begin{array}{c} \text{H} \quad \text{COOH} \\ \quad \\ \text{--- C} - \text{C ---} \\ \quad \\ \text{HOOC} \quad \text{H} \end{array} \right]_n$	[1] [1]

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Q5

<p>(a)</p>	<p>Ethene; cracking</p> $\left(\begin{array}{cc} \text{H} & \text{H} \\ & \\ -\text{C} & -\text{C}- \\ & \\ \text{H} & \text{H} \end{array} \right)_n$ <p>; addition polymerisation</p> $\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{C} \\ \quad \quad \quad // \\ \text{H} \quad \quad \quad \text{O} \\ \quad \quad \quad \quad \quad \\ \quad \quad \quad \quad \quad \text{O}-\text{H} \end{array}$ <p>; oxidation</p> <p>1 mark for 2 correct entries; no 1/2 mark</p>	<p>[3]</p>
<p>(b)</p>	<p>Method: Add magnesium strip to both organic compounds. result for ethanol: no visible change / result for ethanoic acid: effervescence observed/ hydrogen produced</p> <p>OR</p> <p>Method: Add calcium carbonate to both organic compounds. result for ethanol: no visible change result for ethanoic acid: effervescence observed/ carbon dioxide produced</p> <p>[1m] for correct method [1m] for correct result for both ethanol and ethanoic acid.</p> <p>Accept other possible chemical tests such as use of oxidising agents; Reject test using pH Indicator</p>	<p>[2]</p>