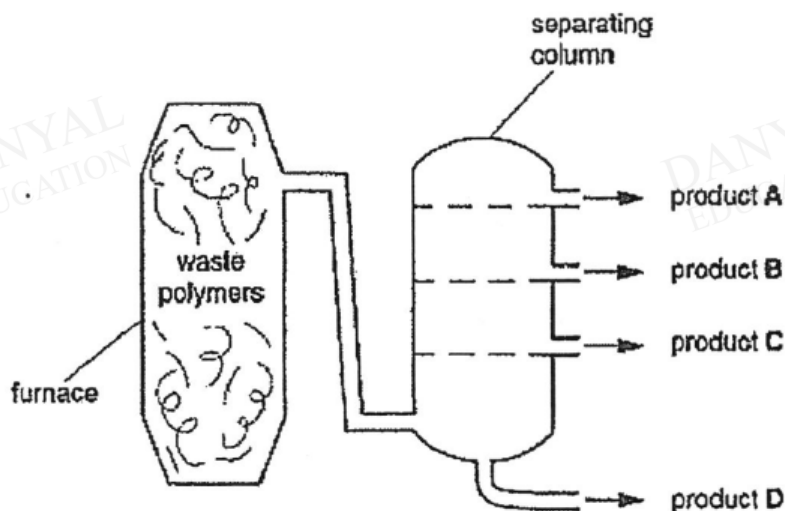


O Level Combined Chemistry Structured

Organic Chemistry Test 3.0

Q1

- 6 Some plastic waste can be recycled. One way of recycling plastic waste is by heating it in a furnace. The waste decomposes into a mixture of hydrocarbons which can be separated in a separating column.



- (a) Name the type of separation process that happens in the separating column. [1]

.....

- (b) Which of the products, A, B, C or D, has the lowest boiling point? [1]

- (c) It was found that the boiling point of the products increases as the number of carbon atoms in the molecules present increases. [2]

Suggest a reason for this.

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

- (d) The disposal of both plastics and iron or steel can cause pollution problems. An article made from plastics is likely to cause pollution for a longer period of time than a similar article made from iron or steel. [2]

Explain why.

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

Q2

10 In some countries, ethanol is used as a fuel instead of petrol. Glucose obtained from plants such as sugar cane can be converted into ethanol by fermentation.

(a) Describe, with the aid of an equation, how ethanol is manufactured by fermentation. [5]

.....

.....

.....

.....

.....

.....

.....

.....

(b) An environmentalist claims that ethanol as a fuel is 'carbon neutral' because using it does not add to the amount of carbon dioxide in the atmosphere. [1]

Explain why this is true.

.....

.....

(c) Besides fermentation, ethanol can be formed by the addition reaction of ethene with a gaseous compound.

(i) Use your knowledge of addition reaction to name this gaseous compound and write a balanced chemical equation for the reaction. [2]

.....

.....

(ii) Use your knowledge of collisions between reacting particles to explain how and why the rate of the reaction between these two substances changes with decreasing pressure. [2]

.....

.....

.....

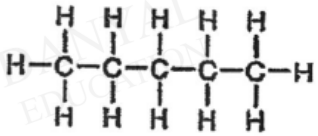
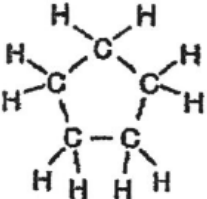
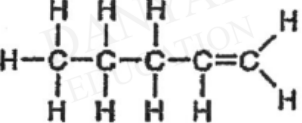
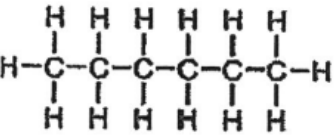
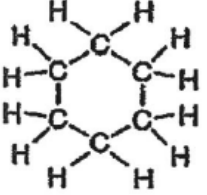
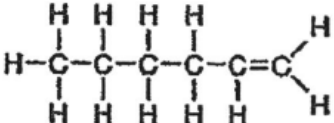
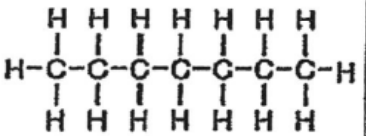
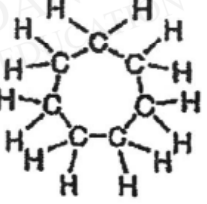
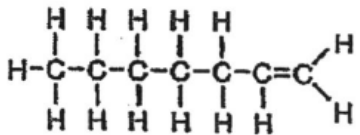
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Q3

Table 10.1 shows the names and structures of some hydrocarbons.

Table 10.1

number of carbon atoms	alkane	cycloalkane	alkene
5	<p>pentane</p> 	<p>cyclopentane</p> 	<p>pentene</p> 
6	<p>hexane</p> 	<p>cyclohexane</p> 	<p>hexene</p> 
7	<p>heptane</p> 	<p>cycloheptane</p> 	<p>heptene</p> 

(a) Cycloalkanes are an example of a homologous series.

(i) Explain how the formulae of the cycloalkanes in Table 10.1 show this.

.....
 [1]

(ii) State two other general properties of a homologous series.

1
 2 [2]

- (b) The percentage of carbon and hydrogen in some molecules are shown in the Table 10.2.

Table 10.2

name of molecules	percentage of carbon by mass	percentage of hydrogen by mass
hexane	84	16
hexene	86	14
cycloheptane	86	14

Explain why the percentages of carbon and hydrogen are the same for hexene and cycloheptane but different for hexane.

.....

.....

.....

..... [2]

- (c) Bromine water can be used in a test to distinguish between alkanes and alkenes.

Describe the results that would be obtained if this test is carried out on separate samples of hexane and hexene.

.....

.....

..... [2]

- (d) Pentene undergoes addition polymerisation to form addition polymers.

Use the structural formula of pentene to explain how it can form addition polymers.

.....

.....

.....

..... [3]

Q4

Fig. 6.1 describes the formation and oxidation of an organic compound, M.

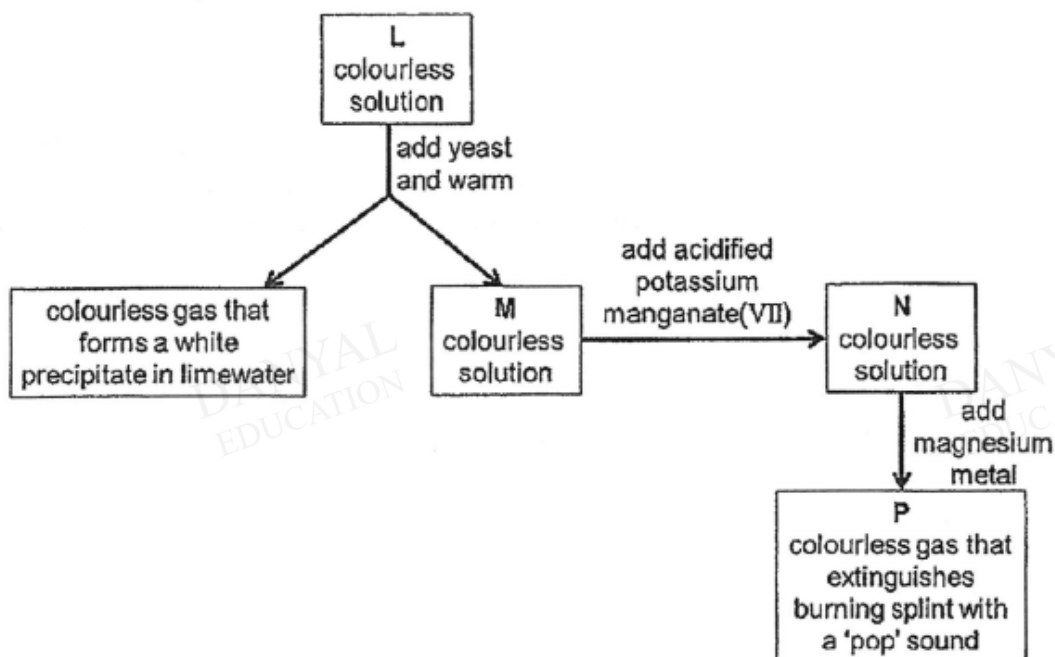


Fig. 6.1

(a) Identify L and P.

L is

P is

[2]

(b) Draw the structural formulae of M and N.

M:	N:
----	----

[2]

(c) With reference to (b), explain why the conversion of M to N is an oxidation.

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

(d) Describe what is observed when M is converted to N in the presence of acidified potassium manganate(VII).

.....[1]

(e) Explain why the temperature of reactants L must not be allowed to rise much above 45 °C.

.....[1]

Q5

Cooking oils contain a mixture of water, saturated fats and *polyunsaturated* fats. The ratio of the various components can vary.

(a) Explain the term *polyunsaturated*.

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

(b) Cooking oil can be converted to margarine.

A chef prepared four samples of cooking oils, Q, R and S of 10 g each. He tried to convert each sample of cooking oil to margarine by bubbling 100 cm³ of hydrogen gas through each sample for ten minutes. He recorded the final volume of hydrogen gas remaining after ten minutes, as shown in Table 8.1.

sample	initial volume of hydrogen gas / cm ³	final volume of hydrogen gas / cm ³
Q	100	58
R	100	100
S	100	0

Table 8.1

(i) State the conditions needed for the conversion of cooking oil to margarine.

.....

(ii) Which sample of cooking oil did not contain any polyunsaturated fats? Explain your answer.

.....

.....

[3]

(c) Suggest another laboratory test to distinguish between cooking oils containing polyunsaturated fats and those without polyunsaturated fats. Describe the observations.

test:

observation for cooking oil with polyunsaturated fats:

.....

observation for cooking oil without polyunsaturated fats:

.....

[2]

(d) Briefly describe the manufacture of smaller alkenes from long-chain alkanes.

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

(e) Explain why the burning of sulfur- and nitrogen-containing substances can eventually damage buildings.

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

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Answers

Organic Chemistry Test 3.0

Q1

(a)	Fractional distillation	[1]
(b)	A	[1]
(c)	As the molecules get bigger/heavier, the <u>intermolecular forces present become stronger.</u> The boiling point hence increases as <u>more energy will be needed to overcome the forces.</u>	[2]
(d)	Plastics are non-biodegradable and hence will not decompose easily/naturally when disposed. Iron or steel however will rust/corrode away when exposed to air and water.	[2]

Q2

(a)	<p><u>Yeast</u> is added to <u>glucose solution</u> and kept at <u>37 °C</u> in the <u>absence of air</u>.</p> <p>During the process <u>ethanol and carbon dioxide</u> is formed.</p> <p>Ethanol is extracted from the mixture by filtration followed by <u>fractional distillation</u> of the filtrate.</p> $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ <p>[1m for each description above] [2m for correct equation; 1m for all correct formulae + 1m for correct balancing (award only when all formulae are correct)]</p>	[5]
(b)	Carbon dioxide produced from the burning of ethanol is used/removed by the plants during photosynthesis.	[1]
(c)(i)	Steam [1m] $C_2H_4 + H_2O \rightarrow C_2H_5OH$ [1m]	[2]
(c)(ii)	As pressure decreases, the rate of reaction also decreases. [1m] This is because at lower pressure, the reacting gaseous particles are further apart. This reduces the frequency of successful collision between the reacting gaseous particles to form the product. [1m]	[2]

Q3

(a) (i) C_5H_{10} , C_6H_{12} , and C_7H_{14} have a general formula of C_nH_{2n}

(ii) 1) Same functional group

2) Gradual change in physical properties

Reject: if listed out individual physical properties

3) Successive members differ by a $-CH_2-$ group

4) undergoes similar chemical reactions

Any 2 – 2m

(b) Hexene (C_6H_{12}) and cycloheptane (C_7H_{14}) have the same ratio of carbon:hydrogen of 1:2 and hence, their percentages by mass of carbon and hydrogen are the same. [1] [2]

Hexane (C_6H_{14}) has a different ratio of carbon:hydrogen from hexene and cycloheptane, thus the percentages by mass of carbon and hydrogen will be different. [1]

(c) Bromine water remains reddish-brown when hexane, is added. [1] [2]
Reddish-brown bromine water decolourises / turns colourless in the presence of hexene. [1]

(d) Pentene is unsaturated. It has a carbon-carbon double bond [1] which enables pentene to undergo addition reaction with another pentene molecule [1]. [3]

When many thousands pentene molecules (monomers) are added together, poly(pentene) is formed [1].

Q4

(a)

L is glucose ($C_6H_{12}O_6$); [1]

P is hydrogen gas (H_2). [1]

(b)

M is ethanol [correct drawing – 1]

N is ethanoic acid [correct drawing – 1]

(c)

Ethanol gains 1 oxygen atom and/or loses 2 hydrogen atoms. [1]

(d)

Purple potassium manganate decolourises. [1]

**Starting colour of manganate must be given to get credit.*

(e)

Too high temperatures would cause enzymes in yeast to denature. [1] Fermentation hence cannot occur.

Q5

(a)

Polyunsaturated means that there are many C=C double covalent bonds present in the organic compound. [1]

(b) (i)

Nickel catalyst; 200 °C [1]

(b) (ii)

Sample R. [1]

The volume of hydrogen gas remains unchanged, which meant that there are no C=C bonds present in R to undergo addition reaction with hydrogen gas. [1]

(c)

Test: Add aqueous bromine/ bromine solution dropwise [1]

Observation for cooking oil with polyunsaturated fat:

Reddish-brown bromine decolourises;

Observation for cooking oil without polyunsaturated fat:

Reddish-brown bromine remains. [1]

(d)

Long-chain alkanes can undergo cracking [1], where they are broken down into smaller alkanes and alkenes. Conditions required are 500 °C and Al₂O₃ / SiO₂ catalyst. [1]

(e)

Burning of these substances produce sulfur dioxide and nitrogen dioxide, which dissolve in rain water to form sulfuric acid and nitric acid, leading to acid rain [1].

Acid rain corrodes buildings. [1]