

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

0/N18/21/Q4

The alkanes are a homologous series of saturated hydrocarbons.

(a) (i) Write the general formula for the alkane homologous series.

.....[1]

(ii) Each member of a particular homologous series has the same general formula.

Give one other characteristic of a homologous series.

.....[1]

(b) What is the meaning of the term *saturated*?

.....[1]

(c) Construct the equation for the complete combustion of pentane, C₅H₁₂.

.....[2]

(d) Draw the structure of a branched alkane with the formula C₅H₁₂. Show all of the atoms and all of the bonds.

[1]

(e) Chlorine reacts with pentane.



(i) What name is given to this type of chemical reaction?

.....[1]

(ii) What essential condition is needed for chlorine to react with pentane?

.....[1]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

(f) A hydrocarbon contains 90% carbon by mass.

(i) Deduce the empirical formula of this hydrocarbon.

empirical formula[2]

(ii) What additional piece of information is needed to deduce the molecular formula of this hydrocarbon?

.....[1]

[Total: 11]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

O/N18/21/Q7

The products of respiration are carbon dioxide and water.

(a) Complete the equation for respiration.



(b) Carbon dioxide and methane are greenhouse gases which contribute to global warming.

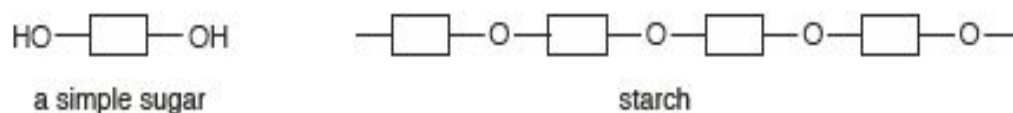
(i) State one effect on the environment of an increase in global warming.

.....[1]

(ii) Describe how the carbon cycle regulates the amount of carbon dioxide in the atmosphere.

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

(c) Simple sugars can be polymerised to form starch.



(i) Deduce the formula of the molecule eliminated when simple sugars polymerise to form starch.

.....[1]

(ii) State the reagent and conditions needed to hydrolyse starch into simple sugars.

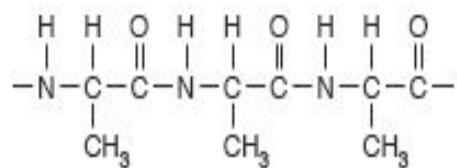
.....
.....[2]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

(d) The amino acid alanine can form polymers.

Part of the structure of poly(alanine) is shown.



- (i) On the diagram, draw a circle around all of the atoms in one amide linkage. [1]
- (ii) Draw the structure of the monomer used to make poly(alanine).

[1]

[Total: 10]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

O/N18/22/Q4

The alkenes are a homologous series of unsaturated hydrocarbons.

(a) Describe two characteristics of a homologous series.

1.

2.

[2]

(b) Construct the equation for the complete combustion of butene, C_4H_8 .

.....[2]

(c) Draw the structure of a branched alkene with the formula C_4H_8 . Show all of the atoms and all of the bonds.

[1]

(d) Butene reacts with hydrogen in the presence of nickel.

(i) Name the product formed.

.....[1]

(ii) What is the purpose of the nickel?

.....[1]

(iii) State one other condition needed for this reaction.

.....[1]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

(e) A hydrocarbon contains 85.7% carbon by mass.

(i) Deduce the empirical formula of this hydrocarbon.

[2]

(ii) What other piece of information is needed to deduce the molecular formula of this hydrocarbon?

.....[1]

[Total: 11]

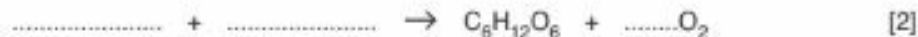
ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

O/N18/22/Q7

Plants remove carbon dioxide from the air during photosynthesis.

(a) (i) Complete the equation for photosynthesis.



(ii) State two conditions required for photosynthesis to happen.

1.
 2.
- [2]

(iii) Explain how photosynthesis can provide a renewable energy source.

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

(b) The structure of a simple sugar is shown.



Starch is made by the polymerisation of simple sugars.

During this polymerisation, water is formed.

(i) What type of polymerisation occurs?

..... [1]

(ii) Draw the partial structure of starch.

You must show at least two repeat units.

[2]

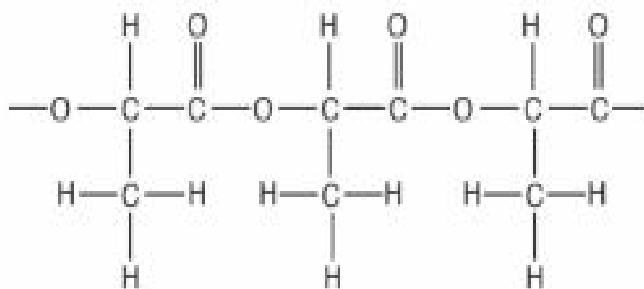
(iii) Name the process by which starch is converted into simple sugars.

..... [1]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

(c) The partial structure of poly(lactic acid) is shown.



On the diagram, draw a ring around all of the atoms in one ester linkage.

[1]

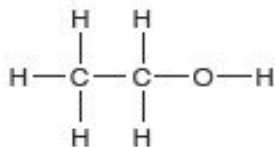
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ORGANIC CHEMISTRY P2 QUESTIONS

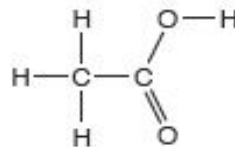
COMPILED BY: **Mustafa Asif**

M/J18/21/Q4

This question is about ethanol and ethanoic acid.



ethanol



ethanoic acid

- (a) Describe the manufacture of ethanol by fermentation.

.....
.....
.....
.....
.....
.....
..... [3]

- (b) Ethanol can be oxidised by oxygen to form ethanoic acid.

Construct the equation for this reaction.

..... [1]

- (c) A sample of ethanol is heated with ethanoic acid in the presence of concentrated sulfuric acid catalyst.

Draw the structure of the product of this reaction.

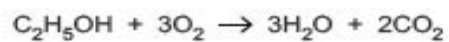
Show all of the atoms and all of the bonds.

[1]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

(d) Ethanol is used as a fuel.



The complete combustion of one mole of ethanol releases 1350 kJ of energy.

A sample of ethanol reacts with excess oxygen to make 0.240 dm³ of carbon dioxide, measured at room temperature and pressure.

Calculate the energy released, in kJ, in this reaction.

energy released kJ [2]

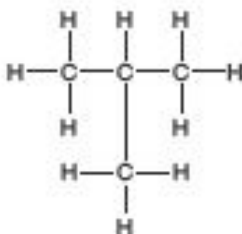
[Total: 7]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

M/J18/21/Q9

Methylpropane is a saturated hydrocarbon.



methylpropane

(a) Methylpropane reacts with chlorine in the presence of ultraviolet light to give several compounds.

(i) One of these compounds has a relative molecular mass of 127.

What is the molecular formula of this compound?

molecular formula

Suggest a structure for this compound. Show all of the atoms and all of the bonds.

[2]

(ii) Another compound formed has the percentage composition by mass:

29.7% carbon; 4.3% hydrogen; 65.9% chlorine.

Calculate the molecular formula for this compound.

molecular formula [2]

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ORGANIC CHEMISTRY P2 QUESTIONS

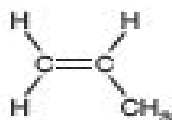
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- (iii) A compound is formed when one molecule of methylpropane reacts with five molecules of chlorine.

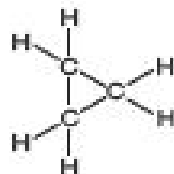
Write the molecular formula for this compound.

.....[1]

- (b) The structures of propene and cyclopropane are shown.



propene



cyclopropane

These two compounds are isomers of each other.

- (i) What is meant by the term *isomerism*?

.....[1]

- (ii) Both compounds are hydrocarbons.

What is meant by the term *hydrocarbons*?

.....[1]

- (iii) Propene is an unsaturated hydrocarbon and cyclopropane is a saturated hydrocarbon.

What is the difference between an unsaturated and a saturated hydrocarbon?

.....[1]

- (iv) Describe a chemical test to distinguish between unsaturated and saturated hydrocarbons.

.....[2]

[Total: 10]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

M/J18/22/Q5

Naphtha is a fraction obtained from petroleum (crude oil).

- (a) Explain how naphtha is obtained from petroleum (crude oil).

.....
.....
.....
.....
.....
..... [3]

- (b) One compound in the naphtha fraction has the formula $C_{12}H_{26}$.

- (i) From this formula, how can you deduce that this compound is an alkane?

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

- (ii) The alkane, $C_{12}H_{26}$, can be cracked to form an alkene that has six carbon atoms per molecule.

Construct the equation for this reaction.

..... [2]

- (c) Ethene, C_2H_4 , can be made by cracking hydrocarbons.

Draw a 'dot-and-cross' diagram for ethene.

You only need to show the outer shell electrons.

[2]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

(d) Chlorine reacts with both ethene and ethane.

(i) One molecule of ethene reacts with one molecule of chlorine.

Draw the structure of the product of this reaction. Show all of the atoms and all of the bonds.

[1]

(ii) One molecule of ethane can react with two molecules of chlorine.

What is the molecular formula of the organic product of this reaction?

.....[1]

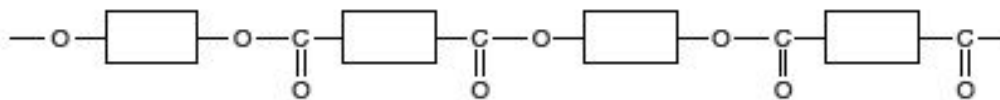
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ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

M/J18/22/Q6

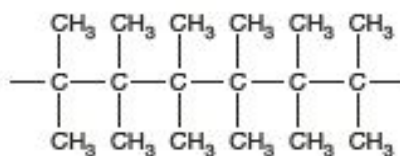
The diagram shows the partial structure of a polyester.



(a) Draw the partial structure of nylon.

[1]

(b) The diagram shows the partial structure of an addition polymer.



(i) What is meant by the term *addition polymerisation*?

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

(ii) Draw the structure of the alkene that can be used to make this addition polymer.

[1]

(iii) Describe one pollution problem associated with the disposal of this addition polymer.

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

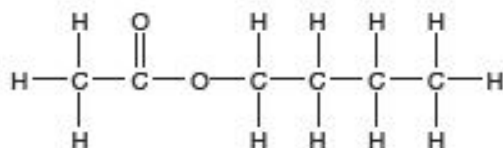
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ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

M/J18/22/Q10

Ester A has the structure shown.



(a) Name ester A.

.....[1]

(b) Ester A reacts with hot aqueous sodium hydroxide to give two compounds, B and C.

(i) Compound B has the percentage composition by mass:

29.3% carbon; 3.7% hydrogen; 39.0% oxygen; 28.0% sodium.

Calculate the empirical formula for this compound.

[2]

(ii) Compound C has a relative molecular mass of 74 and is oxidised by warm acidified potassium manganate(VII) to give butanoic acid.

Suggest a structure for C.

Give reasons for your answer.

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

ORGANIC CHEMISTRY P2 QUESTIONS

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(c) (i) What is meant by the term *isomerism*?

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

(ii) Draw an isomer of ester A.

[1]

(d) Explain why ester A is a saturated compound.

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

(e) Ester A can be used as a fragrance or perfume because it diffuses easily.

(i) Explain why the rate of diffusion of the ester decreases as the temperature decreases.

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

(ii) Suggest one other use for ester A.

..... [1]

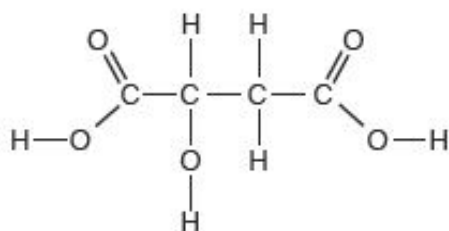
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ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

O/N17/21/Q4

The structure of malic acid is shown.



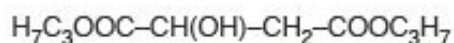
- (a) Malic acid is a carboxylic acid because it contains a -COOH group.

Malic acid also contains an -OH group.

Name the homologous series of compounds which contain the -OH group.

.....[1]

- (b) A diester of malic acid has the formula shown.



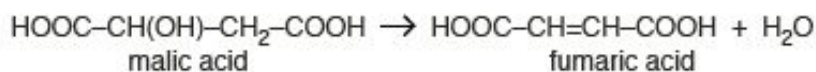
What reagent and conditions are needed to make this diester from malic acid?

reagent

conditions

[2]

- (c) When heated, malic acid forms fumaric acid.



How can aqueous malic acid and aqueous fumaric acid be distinguished when aqueous bromine is added to a sample of each?

.....

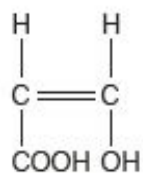
.....

.....[2]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

(d) The structure of compound A is shown.



Compound A can undergo two types of polymerisation.

(i) Name these two types of polymerisation.

1.

2.

[2]

(ii) For one of these types of polymerisation, draw a section of the polymer to show two repeat units.

[2]

[Total: 9]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

O/N17/21/Q5

Hydrocarbons undergo complete combustion to form carbon dioxide and water.

(a) Construct the equation for the complete combustion of butane, C_4H_{10} .

..... [2]

(b) The combustion of butane is exothermic.

Explain in terms of bond making and bond breaking why this reaction is exothermic.

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

(c) Petroleum (crude oil) fractions contain hydrocarbons.

Give one use of the paraffin (kerosene) fraction.

..... [1]

[Total: 5]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

O/N17/21/Q9

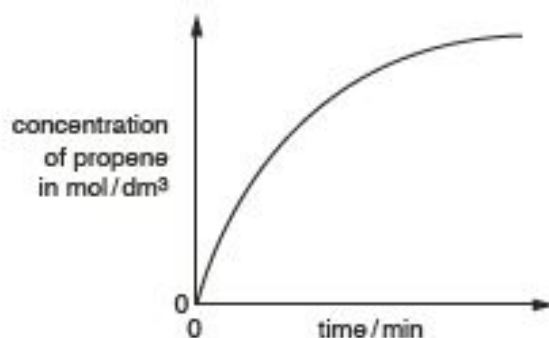
Cyclopropane is converted to propene when heated.



(a) Explain why cyclopropane and propene are isomers.

.....[1]

(b) The graph shows how the concentration of propene in this reaction changes with time.



Describe how the rate of this reaction changes with time. Explain your answer by referring to the graph.

.....[2]

(c) Describe and explain the effect of increasing the concentration of cyclopropane on the rate of this reaction.

.....[2]

(d) Describe and explain the effect of decreasing the temperature on the rate of this reaction.

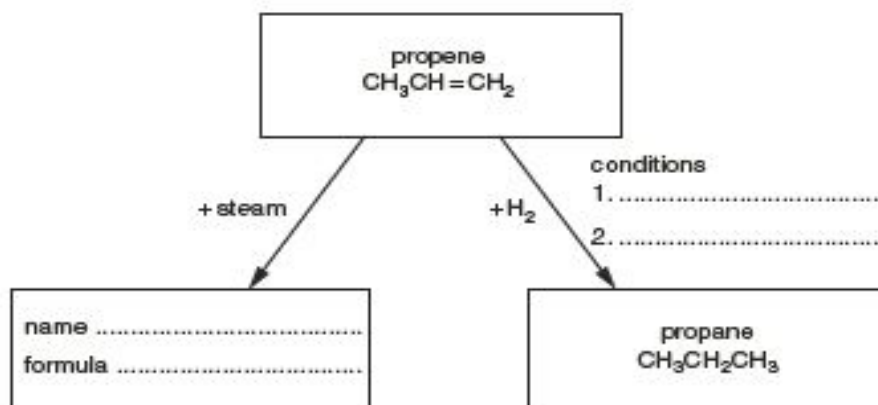
.....[2]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

- (e) Propene undergoes addition reactions. Two addition reactions of propene are shown in the diagram.

Complete the diagram to show the missing name, formula and conditions.



[3]

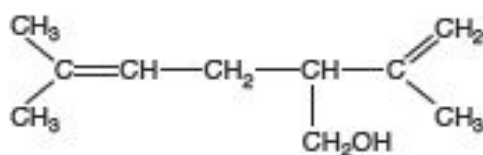
[Total: 10]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

O/N17/22/Q4

Lavandulol is found in lavender plants.



(a) (i) Give the molecular formula for lavandulol.

.....[1]

(ii) Lavandulol contains an -OH group.

Name the homologous series of compounds which contain the -OH group.

.....[1]

(b) Lavandulol is an unsaturated compound.

Describe a test for an unsaturated compound.

test

result

[2]

(c) Lavender flowers contain a variety of coloured compounds. These can be extracted from the flowers to give a solution of the coloured compounds.

Describe how to use paper chromatography to identify these coloured compounds.

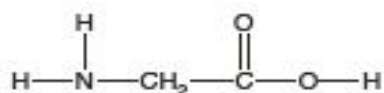
You may use a labelled diagram in your answer.

.....
.....
.....
.....[3]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

- (d) Compound G is found in the leaves of lavender plants.



Compound G can undergo polymerisation.

Draw a section of the polymer to show two repeat units.

[2]

[Total: 9]

O/N17/22/Q5

Dilute ethanoic acid reacts with sodium carbonate.

Sodium ethanoate, CH_3COONa , and two other compounds are formed.

- (a) Construct the equation for this reaction.

..... [2]

- (b) The reaction of dilute ethanoic acid with sodium carbonate is endothermic.

Explain in terms of bond making and bond breaking why this reaction is endothermic.

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

- (c) Ethanoic acid reacts with alcohols to form esters.

Give one use of esters.

..... [1]

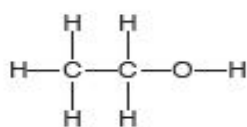
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ORGANIC CHEMISTRY P2 QUESTIONS

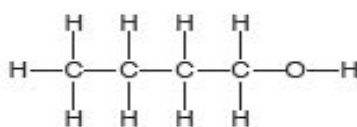
COMPILED BY: **Mustafa Asif**

M/J17/21/Q5

Ethanol and butanol are both alcohols.



ethanol



butanol

(a) Describe the manufacture of ethanol from ethene.

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

(b) Ethanol is used as a fuel and as a constituent of alcoholic beverages.

(i) State one **other** use of ethanol.

.....[1]

(ii) Construct an equation to show the **incomplete** combustion of ethanol.

.....[2]

(c) Ethanol can be oxidised to form ethanoic acid.

Name a reagent that can be used for this oxidation.

.....[1]

(d) Draw the structure of an alcohol that is an isomer of butanol.

Show all of the atoms and all of the bonds.

[1]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

- (e) Butanol can be converted into an alkene by loss of a molecule of water.

Draw the structure of the alkene formed.

Show all of the atoms and all of the bonds.

[1]

- (f) Butene can be polymerised to give poly(butene).

- (i) What type of polymerisation occurs?

.....[1]

- (ii) Poly(butene) is non-biodegradable.

What does the term *non-biodegradable* mean?

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

[Total: 10]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

M/J17/21/Q10

The table shows some information about the homologous series of unbranched carboxylic acids.

name	structure	boiling point/°C
methanoic acid	HCO_2H	101
ethanoic acid	$\text{CH}_3\text{CO}_2\text{H}$	118
propanoic acid	$\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$	141
butanoic acid	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$	164
pentanoic acid	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$	186

(a) A homologous series has a general formula.

(i) Deduce the general formula for the homologous series of unbranched carboxylic acids.

..... [1]

(ii) Describe two other properties of a homologous series.

1.

.....

2.

.....

[2]

(b) An aqueous solution of propanoic acid is a weak acid.

(i) What is the meaning of the term *weak acid*?

.....

..... [1]

(ii) Aqueous propanoic acid reacts with magnesium carbonate.

Construct the equation for this reaction.

..... [1]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

- (c) Butanoic acid reacts with ethanol to make an ester.

Name and draw the structure of this ester. Show all of the atoms and all of the bonds within the ester linkage.

name

structure

[2]

- (d) Ethanoic acid is a liquid at room temperature and has a boiling point of 118 °C.

Describe the changes in both the arrangement and movement of the molecules when ethanoic acid is heated from room temperature to 120 °C.

.....
.....
.....
.....
.....
.....
.....[3]

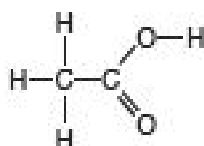
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ORGANIC CHEMISTRY P2 QUESTIONS

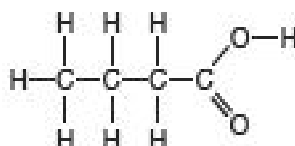
COMPILED BY: **Mustafa Asif**

M/J17/22/Q5

Ethanoic acid and butanoic acid are both carboxylic acids.



ethanoic acid



butanoic acid

(a) Name a reagent that can be used to make ethanoic acid from ethanol.

.....[1]

(b) Dilute ethanoic acid reacts with all carbonates and with some metals.

(i) Name one metal that will react with dilute ethanoic acid and name the products of this reaction.

name of metal

products

[2]

(ii) Construct an equation to show the reaction of dilute ethanoic acid with calcium carbonate.

.....[2]

(c) Draw the structure of a carboxylic acid that is an isomer of butanoic acid.

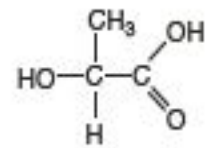
Show all of the atoms and all of the bonds.

[1]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

- (d) Lactic acid is both an alcohol and a carboxylic acid.



Lactic acid is a monomer that can be polymerised to form a polyester.

- (i) What type of polymerisation occurs during this reaction?

.....[1]

- (ii) This polyester is biodegradable.

Suggest an advantage of a polymer being biodegradable.

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

[Total: 8]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

M/J17/22/Q10

The table shows some information about the homologous series of unbranched alcohols.

name	structure	boiling point / °C
methanol	CH ₃ OH	65
ethanol	CH ₃ CH ₂ OH	79
propanol	CH ₃ CH ₂ CH ₂ OH	97
butanol	CH ₃ CH ₂ CH ₂ CH ₂ OH	117
pentanol	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ OH	138

(a) One of the characteristics of a homologous series is that it has a general formula.

(i) What is the general formula for the homologous series of unbranched alcohols?

.....[1]

(ii) Predict the boiling point of hexanol, an alcohol with six carbon atoms per molecule.

..... °C [1]

(b) Describe the manufacture of ethanol by the fermentation of aqueous glucose.

.....
.....
.....
.....
.....
.....
.....[3]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

- (c) Butanol reacts with ethanoic acid to make an ester.

Name and draw the structure of this ester.

Show all of the atoms and all of the bonds within the ester linkage.

name

structure

[2]

- (d) Ethanol is a gas at 100 °C.

Describe the changes in the arrangement and movement of the molecules when ethanol is cooled from 100 °C to 25 °C.

.....

.....

.....

.....

.....

[3]

[Total: 10]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

O/N16/21/Q3

The alcohols are a homologous series with the general formula $C_nH_{2n+1}OH$.

(a) Deduce the molecular formula of the alcohol having eight carbon atoms.

.....[1]

(b) The table shows some information about different alcohols.

alcohol	formula	melting point /°C	boiling point /°C	density in g/cm ³
ethanol	C ₂ H ₅ OH	-117	79	0.789
propanol	C ₃ H ₇ OH	-126	98	0.804
butanol	C ₄ H ₉ OH	-89	117	
pentanol	C ₅ H ₁₁ OH	-79	138	0.815
hexanol	C ₆ H ₁₃ OH	-47	158	0.820

(i) Describe how the boiling point changes with the number of carbon atoms in the alcohol.

.....[1]

(ii) Estimate the density, in g/cm³, of butanol.

.....[1]

(iii) What is the physical state of pentanol at room temperature and pressure? Explain your answer.

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

(c) How does viscosity change in the homologous series of alcohols?

Explain your answer.

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

(d) Construct the equation for the complete combustion of propanol.

.....[2]

(e) Propanol can be oxidised to propanoic acid.

(i) Suggest the oxidising agent and describe the conditions used for this reaction.

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

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

(II) Draw the structure of propanoic acid, showing all the atoms and all the bonds.

[1]

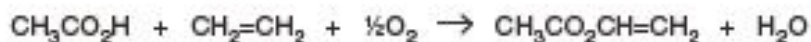
[Total: 11]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

O/N16/21/Q7

Ethenyl ethanoate, $\text{CH}_3\text{CO}_2\text{CH}=\text{CH}_2$, is manufactured by passing a mixture of ethanoic acid, ethene and oxygen over a catalyst at 200°C .

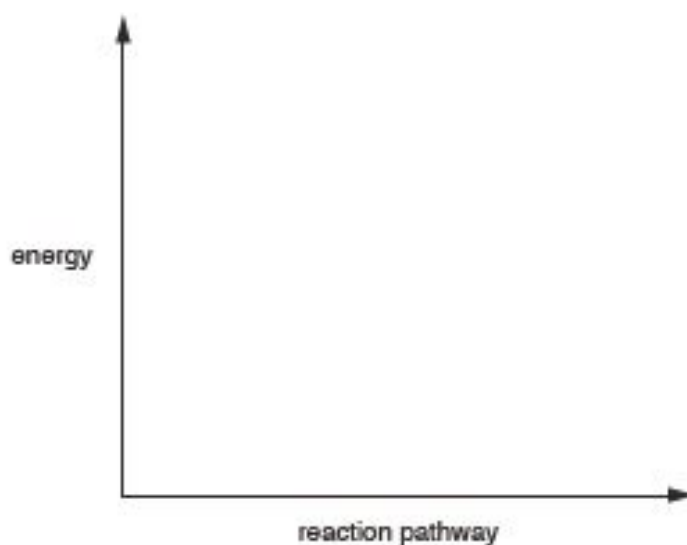


The reaction is exothermic.

(a) Draw an energy profile diagram for this reaction on the axes shown.

On your diagram label

- the reactants and products,
- the enthalpy change for the reaction,
- the activation energy.



[3]

(b) Ethenyl ethanoate is an unsaturated compound.

Describe a chemical test for an unsaturated compound.

test

observation

[2]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

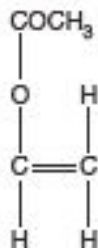
- (c) The catalyst used in the manufacture of ethenyl ethanoate contains copper.

Copper reacts with concentrated nitric acid.

Complete the equation for this reaction.



- (d) The structure of ethenyl ethanoate is shown.



Draw the structure of the addition polymer formed from ethenyl ethanoate.

[2]

- (e) State two pollution problems caused by non-biodegradable plastics.

.....

.....[2]

[Total: 10]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

O/N16/22/Q3

The alkanes are a homologous series of hydrocarbons.

- (a) State two properties of a homologous series.

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

- (b) Draw the structures of the branched and unbranched alkanes having four carbon atoms.

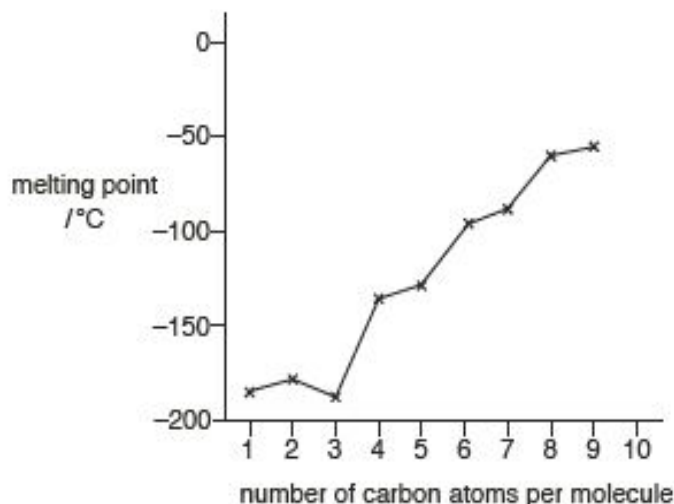
Show all the atoms and all the bonds.

[2]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

- (c) The graph shows how the melting points of the first nine unbranched alkanes vary with the number of carbon atoms per molecule.



- (i) Describe how the melting points of these alkanes change with the number of carbon atoms.
-
-
- [2]
- (ii) Use the graph to estimate the melting point of the unbranched alkane which has ten carbon atoms.
- °C [1]
- (d) (i) Construct the equation for the complete combustion of pentane, C_5H_{12} .
- [2]
- (ii) Name the products of the incomplete combustion of pentane and explain why the incomplete combustion of hydrocarbons is hazardous to health.
-
- [2]

[Total: 11]

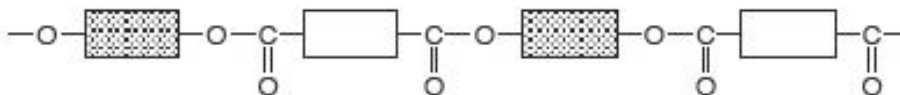
ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

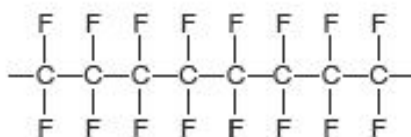
M/J16/21/Q1

Choose from the following polymers to answer the questions.

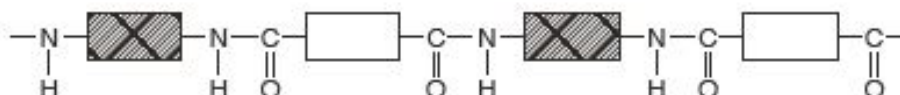
Terylene



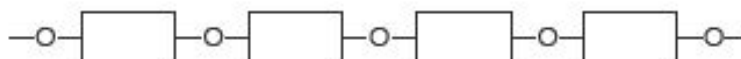
PTFE



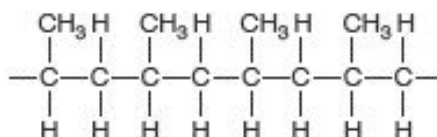
nylon



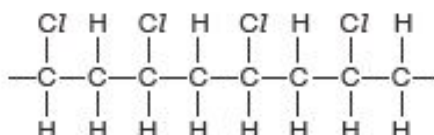
starch



poly(propene)



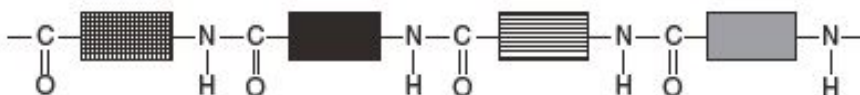
PVC



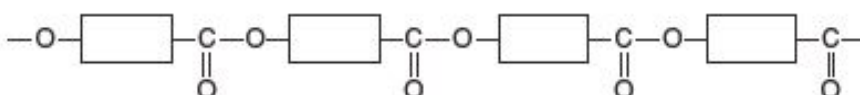
ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

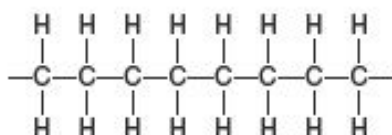
protein



polyester



poly(ethene)



Each polymer can be used once, more than once or not at all.

Which is a polymer that

(a) is made from propene,

..... [1]

(b) will form hydrogen chloride when combusted,

..... [1]

(c) can be hydrolysed to form amino acids,

..... [1]

(d) can be hydrolysed to make simple sugars,

..... [1]

(e) contains the same linkage as that present in a fat?

..... [1]

[Total: 5]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

M/J16/21/Q3

Esters, such as propyl ethanoate, are often used as solvents.

(a) Give **one** other use for esters such as propyl ethanoate.

..... [1]

(b) Draw the structure of propyl ethanoate, showing all of the atoms and all of the bonds.

[1]

(c) A bottle of propyl ethanoate is opened in a room. Some of the propyl ethanoate evaporates and then diffuses into the room.

(i) What is meant by the term *diffusion*?

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

(ii) What happens to the rate of diffusion of propyl ethanoate as the temperature of the room increases?

Explain your answer in terms of the kinetic particle theory.

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

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

(iii) The table shows some information about different esters.

name	structure	relative molecular mass (M_r)
methyl methanoate	HCO_2CH_3	60
ethyl methanoate	$\text{HCO}_2\text{C}_2\text{H}_5$	74
propyl methanoate	$\text{HCO}_2\text{C}_3\text{H}_7$	88
butyl methanoate	$\text{HCO}_2\text{C}_4\text{H}_9$	102
pentyl methanoate	$\text{HCO}_2\text{C}_5\text{H}_{11}$	116

Which ester has the **greatest** rate of diffusion at room temperature and pressure?

.....

Explain your answer.

.....

.....

[2]

[Total: 7]

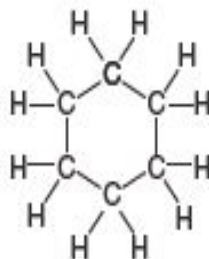
ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

M/J16/21/Q8

Cyclohexane, C_6H_{12} , is a cycloalkane.

Cycloalkanes react in a similar way to alkanes.



cyclohexane

(a) Cyclohexane is a saturated hydrocarbon.

(i) What is the meaning of the term *saturated*?

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

(ii) What is the meaning of the term *hydrocarbon*?

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

(b) Construct the equation for the complete combustion of cyclohexane.

..... [1]

(c) Cyclohexane reacts with chlorine in the presence of ultraviolet light.

This is a substitution reaction.

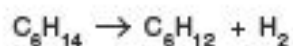
Write the molecular formulae of **two** products of this reaction.

..... [2]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

- (d) Cyclohexane can be manufactured from hexane as shown in the equation.



Calculate the mass of cyclohexane that can be made from 258 g of hexane.
[M_r of cyclohexane = 84]

mass of cyclohexane = g [2]

- (e) Another cycloalkane has the following percentage composition by mass.

C, 85.7%; H, 14.3%

- (I) Use the percentage composition by mass to show that the empirical formula of the cycloalkane is CH_2 .

[2]

- (II) Draw the structure of the cycloalkane with an M_r of 56, showing all of the atoms and all of the bonds.

[1]

[Total:10]

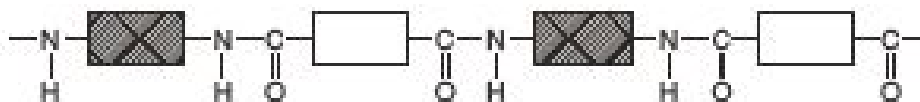
ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

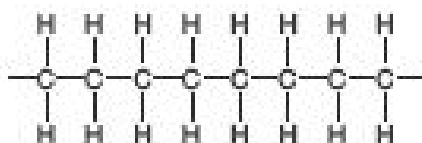
M/J16/22/Q1

Choose from the following polymers to answer the questions.

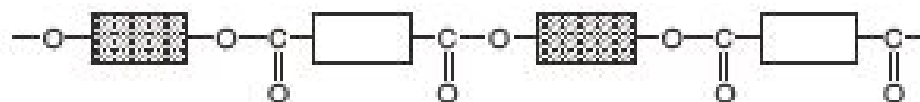
polymer A



polymer B



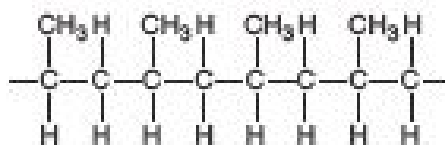
polymer C



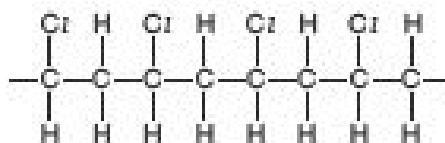
polymer D



polymer E



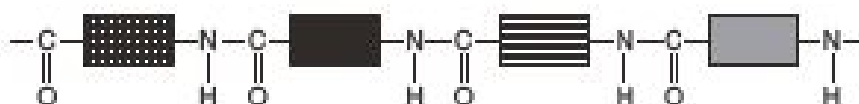
polymer F



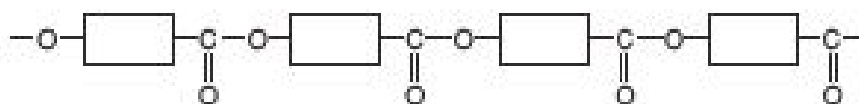
ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

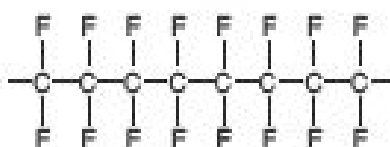
polymer G



polymer H



polymer I



Each polymer can be used once, more than once or not at all.

(a) Which two polymers are polyesters?

..... and

[1]

(b) Which polymer is used to make both clingfilm and plastic bags?

.....

[1]

(c) Give the letter of an addition polymer.

Give the letter of a condensation polymer.

[1]

(d) Give the letter of a polymer that is a saturated hydrocarbon.

.....

[1]

(e) Which polymer could be part of a protein?

.....

[1]

[Total: 5]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

M/J16/22/Q3

Esters are used as food flavourings and solvents.

(a) Draw the structure of ethyl methanoate, showing all of the atoms and all of the bonds.

[1]

(b) Ethyl ethanoate evaporates at room temperature.

(i) What is meant by the term *evaporation*?

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

(ii) A sample of ethyl ethanoate in a beaker is moved into a colder room.

Explain, in terms of the kinetic particle theory, why this results in a decrease in the rate of evaporation.

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

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

(III) The table shows some information about different esters.

name	structure	relative molecular mass (M_r)
methyl ethanoate	$\text{CH}_3\text{CO}_2\text{CH}_3$	74
ethyl ethanoate	$\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$	88
propyl ethanoate	$\text{CH}_3\text{CO}_2\text{C}_3\text{H}_7$	102
butyl ethanoate	$\text{CH}_3\text{CO}_2\text{C}_4\text{H}_9$	116
pentyl ethanoate	$\text{CH}_3\text{CO}_2\text{C}_5\text{H}_{11}$	130

Which ester has the **lowest** rate of evaporation at room temperature and pressure?

.....

Explain your answer.

.....

.....

[2]

[Total: 6]

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

MARK SCHEME

O/N18/21/Q4

(a)(i) C_nH_{2n+2}

4(a)(ii) **Any one from:**

same functional group (1)

similar chemical properties / react similarly (1)

trend in physical properties (1)

successive members differ by CH_2 (1)

4(b) all the carbon-carbon bonds are single bonds

4(c) $C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$

correct formulae for reactants and products (1)

balanced equation – dependent on formulae (1)

4(d) any branched chain isomer of pentane drawn

4(e)(i) substitution

4(e)(ii) light / uv

4(f)(i) mole ratio C = 90 / 12 **AND** mole ratio H = 10 / 1

OR C = 7.5 **AND** H = 10 (1)

empirical formula = C_3H_4 (1)

4(f)(ii) (relative) molecular mass

O/N18/21/Q7

7(a) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

correct formulae for reactants and products (1)

balanced equation – dependent on formulae (1)

7(b)(i) rise in sea levels / melting of polar ice caps / desertification / more extreme weather patterns (1)

7(b)(ii) photosynthesis absorbs carbon dioxide **AND** respiration releases carbon dioxide (1)

the amount of carbon dioxide absorbed is roughly equal to the amount of carbon dioxide released (1)

7(c)(i) H_2O (1)

7(c)(ii) (dilute) sulfuric acid (1)

heat / reflux (1)

7(d)(i) ring around the CONH group (1)

7(d)(ii) $NH_2CH(CH_3)CO_2H$ (1)

O/N18/22/Q4

4(a) Any two from:

• same functional group (1)

• same general formula (1)

• similar chemical properties / react similarly (1)

• trend in physical properties (1)

• successive members differ by CH_2 (1)

4(b) $C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$ (2)

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

1 mark for correct reactants and products if equation not balanced

4(c) structure of 2-methylpropene drawn showing all atoms and all bonds

4(d)(i) butane 1

4(d)(ii) catalyst / to speed up the reaction / to increase the rate of reaction

4(d)(iii) heat / high temperature 1

4(e)(i) mole ratio C = 85.7 / 12 AND mole ratio H = 14.3 / 1

OR

C = 7.14 AND H = 14.3 (1)

empirical formula = CH₂ (1)

4(e)(ii) (relative) molecular mass

O/N18/22/Q7

7(a)(i) $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}$

$\text{O}_6 + 6\text{O}_2$ (2)

If 2 marks not scored, award one mark for correct formulae (1)

7(a)(ii) (sun)light (1)

chlorophyll (1)

7(a)(iii) glucose can be used to make a fuel / glucose (can be fermented) to make ethanol 1

7(b)(i) condensation 1

7(b)(ii) 2 or more units polymerised

(2) If two marks not scored, award 1 mark for:

– O – linking two squares / rectangles but no extension bonds

7(b)(iii) hydrolysis 1

7(c)(i) ring around the COO group

M/J18/21/Q4

4(a) use of glucose **AND** yeast (1)

any **TWO** correct conditions from – aqueous conditions / temperature between 10 and 45 °C / absence of oxygen / any pH

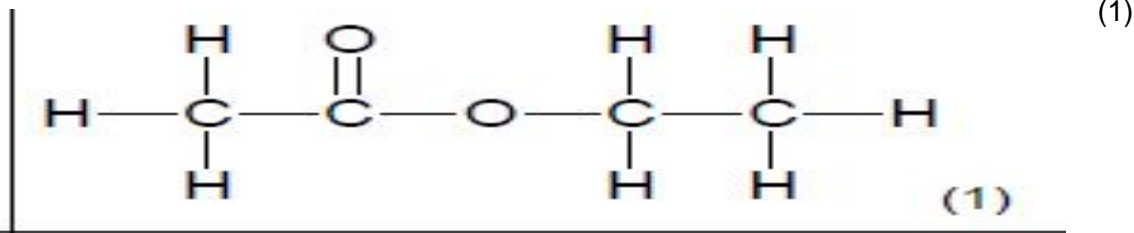
ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

between 6 to 8 (1)
(fractionally) distil reaction mixture (to get ethanol) (1)

4(b) $\text{CH}_3\text{CH}_2\text{OH} + \text{O}_2 \rightarrow \text{CH}_3\text{COOH} + \text{H}_2\text{O}$ (1) **1**

4(c)



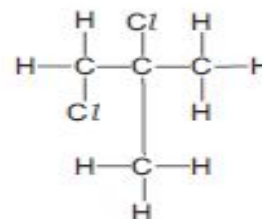
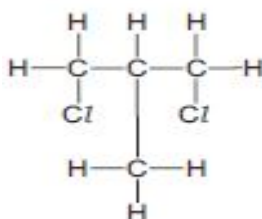
4(d) (moles of $\text{CO}_2 = 0.01$ so) moles of $\text{C}_2\text{H}_5\text{OH} = 0.005$ (1)

energy released = (moles of $\text{C}_2\text{H}_5\text{OH} \cdot 1350$) = 6.75 (1)

M/J18/21/Q9

9(a)(i) $\text{C}_4\text{H}_8\text{Cl}_2$ (1)

Structure showing all atoms and all of the bonds of a compound having two chlorine atoms substituted and based on methylpropane skeleton e.g.



(1)

9(a)(ii) molecular formula is $\text{C}_4\text{H}_7\text{Cl}_2$ (2)

If two marks not scored:

1 mark for mole ratio C : H : Cl is 2.475 : 4.30 : 1.856

OR

1 mark for C = 29.7 / 12, H = 4.3 / 1 and Cl = 65.9 / 35.5

9(a)(iii) $\text{C}_4\text{H}_5\text{Cl}$ (1)

9(b)(i) same molecular formula but different structures / same molecular formula but different arrangement of atoms (1)

9(b)(ii) (compounds) containing only hydrogen and carbon (1)

9(b)(iii) unsaturated contains a carbon-carbon double bond / saturated does not contain carbon-carbon double bond (1) **1**

9(b)(iv) add (aqueous) bromine (1)

unsaturated goes colourless and saturated stays orange (1)

M/J18/22/Q5

5(a) petroleum is heated / crude oil is heated (1)

fractional distillation / fractionating column (1)

idea that separation works because naphtha has different boiling point to other fractions / idea of different boiling points at

different places in the column / naphtha comes off at particular height in the column (1)

5(b)(i) (molecular formula) fits the (general) formula $\text{C}_n\text{H}_{2n+2}$ (1)

5(b)(ii) $\text{C}_{12}\text{H}_{26} \rightarrow \text{C}_6\text{H}_{12} + \text{C}_6\text{H}_{14}$ / $\text{C}_{12}\text{H}_{26} \rightarrow 2\text{C}_6\text{H}_{12} + \text{H}_2$

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

formula for C_6H_{12} (1)

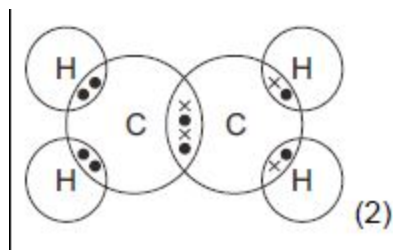
equation balanced dependent on alkene formula (1)

5(c)

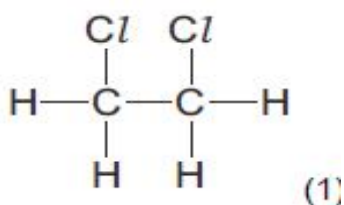
f 2 marks not obtained, **one mark** for:

EITHER two shared pairs of electrons between the two carbon atoms

OR incorrect number of electrons in carbon-carbon bond (or bond shown by line) BUT one electron pair between each of the two carbon-hydrogen atoms on each of the two carbon atoms (four electron pairs)



5(d)(i)



5(d)(ii) $C_2H_4Cl_2$ (1)

M/J18/22/Q6

6(a)	$ \begin{array}{c} \text{---N---} \square \text{---N---C---} \square \text{---C---N---} \square \text{---} \\ \quad \quad \quad \quad \quad \quad \quad \quad \\ \text{H} \quad \quad \text{H} \quad \text{O} \quad \quad \text{O} \quad \text{H} \end{array} $ <p style="text-align: center;">OR</p> $ \begin{array}{c} \text{---N---} \square \text{---C---N---} \square \text{---C---N---} \square \text{---} \\ \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \\ \text{H} \quad \quad \quad \quad \quad \text{O} \quad \text{H} \quad \quad \quad \quad \quad \text{O} \quad \text{H} \end{array} \quad (1) $	1
6(b)(i)	monomers react together / monomers combine / monomers add together / monomers join / monomers link (1) to form only one product / to give one product and no other molecule / no by-product formed (1)	2
6(b)(ii)	$ \begin{array}{c} \text{CH}_3\text{CH}_3 \\ \quad \\ \text{C}=\text{C} \\ \quad \\ \text{CH}_3\text{CH}_3 \end{array} \quad (1) $	1
6(b)(iii)	non-biodegradable / causes litter / fills land-fill sites / incineration produces atmospheric pollutants (1)	1

ORGANIC CHEMISTRY P2 QUESTIONS

COMPILED BY: **Mustafa Asif**

M/J18/22/Q9

10(a) butyl ethanoate / butyl acetate (1)

10(b)(i) empirical formula is $C_2H_3O_2Na$ (2)

If two marks not scored:

1 mark for mole ratio C : H : O : Na is 2.44 : 3.70 : 2.44 : 1.22

OR

1 mark for C = 29.3 / 12 H = 3.7 / 1 O = 39.0 / 16 Na = 28.0 / 23

10(b)(ii) $CH_3CH_2CH_2CH_2OH$ (1)

idea that it must be an alcohol since it can be oxidised / must be butanol since it is oxidised to butanoic acid (1)

10(c)(i) (compounds with) the same molecular formula but different structures / (compounds with) the same molecular formula but different arrangements of atoms (1)

10(c)(ii) any isomer of butyl ethanoate, e.g. $CH_3CH_2CO_2CH_2CH_2CH_3$ (1)

10(d) does not contain a carbon-carbon double bond / has **only** single carbon-carbon bonds (1)

10(e)(i) molecules move slower / molecules have less kinetic energy (1)

10(e)(ii) solvent / flavourings (1)

O/N17/21/Q4

A4(a) alcohol (1)

A4(b) propanol (1)

reflux / heat (with sulfuric / strong acid / conc acid) (1)

A4(c) bromine decolourised by fumaric acid / colour of bromine goes (brown to) colourless with fumaric acid (1)

no colour change with malic acid / bromine remains brown with malic acid / bromine remains the same colour with malic acid (1)

A4(d)(i) addition (1)

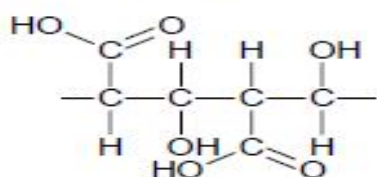
condensation (1)

A4(d)(ii)

ORGANIC CHEMISTRY P2 QUESTIONS

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for addition polymer:

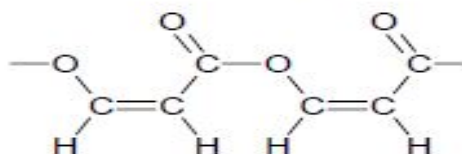


two (or more) repeat units with single bonds between carbon atoms (1)

continuation bonds dependent on correct structure (1)

OR

for condensation polymer:



two (or more) repeat units with ester link and continuation bonds (2)

if 2 marks not awarded, 1 mark for ester link drawn correctly

O/N17/21/Q5



correct reactants and products (1)

balancing dependent on correct formulae (1)

A5(b) bond breaking is endothermic **and** bond making is exothermic (1)

more energy released (in bond making) than absorbed (in bond breaking) (1)

2A5(c) jet fuel, heating oil (1)

O/N17/21/Q9

B9(a) they have the same molecular formula but the atoms are arranged differently (1)

B9(b) rate decreases (1)

ORGANIC CHEMISTRY P2 QUESTIONS

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the gradient of the graph decreases / slope of the graph decreases (1)

B9(c) increases rate (no marks)

particles closer together / more particles in a given volume / more crowded particles (1)

greater collision frequency / more collisions per second / rate of collisions increases (1)

B9(d) decreases rate (no marks)

particles move more slowly / particles have less kinetic energy (1)

number of particles with energy equal to or greater than the activation energy is decreased / fewer successful collisions / fewer

effective collisions (1)

B9(e) left hand box:

propanol (1)

C₃H₇OH (1)

right hand conditions:

catalyst / Ni **AND** heat / high temperature / high pressure (1)

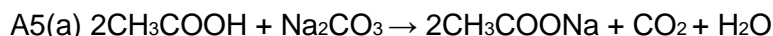
O/N17/22/Q4

A4(a)(i)	C ₁₀ H ₁₈ O (1)	1
A4(a)(ii)	Alcohol (1)	1
A4(b)	Bromine / bromine water (1) Turns colourless (1)	2
A4(c)	1 mark each for any three of: <ul style="list-style-type: none">• Pigment(s) / dyes / coloured compounds on paper and paper (dipping) in solvent• Spot of dye above solvent level• Measure distance moved by dye and solvent (front)• Calculate R_f value• Compare with known R_f value(s)	3
A4(d)	Two correct repeat units with amide link (2 marks) e.g. $-\text{NH}-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-$ If 2 marks not awarded, 1 mark for two amide links drawn correctly	2

ORGANIC CHEMISTRY P2 QUESTIONS

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O/N17/22/Q5



Correct formulae (1)

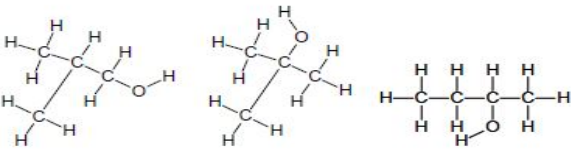
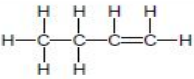
Correct balance (1)

A5(b) Bond breaking is endothermic and bond making is exothermic (1)

Less energy released (in bond making) than absorbed (in bond breaking) (1)

A5(c) Solvents / flavourings / perfumes (1)

M/J17/21/Q5

A5(a)	Reaction with steam (1) In presence of a catalyst (1)	2
A5(b)(i)	Solvent / making vinegar	1
A5(b)(ii)	$\text{C}_2\text{H}_5\text{OH} + \text{O}_2 \rightarrow 2\text{C} + 3\text{H}_2\text{O}$ OR $\text{C}_2\text{H}_5\text{OH} + 2\text{O}_2 \rightarrow 2\text{CO} + 3\text{H}_2\text{O}$ Correct products (1) Balancing (1)	2
A5(c)	(Acidified) potassium manganate(VII) / oxygen	1
A5(d)	ANY ONE FROM 	1
A5(e)		1
A5(f)(i)	Addition	1
A5(f)(ii)	Do not decay / do not decompose naturally / not attacked by bacteria or microbes	1

M/J17/21/Q10

ORGANIC CHEMISTRY P2 QUESTIONS

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B10(a)(i)	$C_nH_{2n+1}COOH / C_nH_{2n}O_2$	1
B10(a)(ii)	ANY TWO FROM: Same functional group (1) Idea that each member varies by a CH_2 group (1) Same or similar chemical properties (1) Physical properties change with a trend (1)	2
B10(b)(i)	An acid that partially ionises / partially dissociates	1
B10(b)(ii)	$MgCO_3 + 2CH_3CH_2CO_2H \rightarrow Mg(CH_3CH_2CO_2)_2 + CO_2 + H_2O$	1
B10(c)	Ethyl butanoate (1) <p style="text-align: center;">(1)</p>	2
B10(d)	(Molecules) move faster / have more kinetic energy (as temperature increases) (1) (Molecules) are further apart (as temperature increases) (1) (Molecules) are arranged more randomly / more irregularly (as temperature increases) (1)	3

M/J17/22/Q5

A5(a)	(Acidified) potassium manganate(VII) / oxygen	1
A5(b)(i)	Lithium / sodium / potassium / calcium / magnesium (1) Corresponding ethanoate AND hydrogen (1)	2
A5(b)(ii)	$CaCO_3 + 2CH_3CO_2H \rightarrow Ca(CH_3CO_2)_2 + H_2O + CO_2$ (2) IF: two marks not scored H_2O and CO_2 as products = 1 mark	2
A5(c)	<p style="text-align: center;">(1)</p>	1
A5(d)(i)	Condensation	1
A5(d)(ii)	Decomposes / decays / will not fill up land-fill sites / less litter / no need for incineration	1

M/J17/22Q10

ORGANIC CHEMISTRY P2 QUESTIONS

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B10(a)(i)	$C_nH_{2n+1}OH / C_nH_{2n+2}O$	1
B10(a)(ii)	Any value between 154 – 164 (°C) (inclusive of these values)	1
B10(b)	(Add) yeast (1) Temperature between 5 and 40 °C / no oxygen present / anaerobic (1) (Fractionally) distil (to get ethanol) (1)	3
B10(c)	Butyl ethanoate (1) $ \begin{array}{ccccccc} & H & O & & H & H & H & H \\ & & & & & & & \\ H & - C & - C & - O & - C & - C & - C & - C - H \\ & & & & & & & \\ & H & & & H & H & H & H \end{array} $ (1)	2
B10(d)	They get slower / they move less rapidly (when temperature decreases) / molecules slow down (when temperature decreases) / molecules have less kinetic energy (when temperature decreases) (1) They / molecules get closer together (when temperature decreases) (1) They / molecules arranged less randomly / less irregularly (when temperature decreases) (1)	3

O/N16/21/Q3

A3(a)	$C_8H_{18}O$ (1)	1
A3(b)(i)	increases with increased number of carbon atoms (1)	1
A3(b)(ii)	values between 0.806 and 0.813 (inclusive) (1)	1
A3(b)(iii)	<u>liquid</u> because melting point is below room temperature and boiling point is above room temperature (1)	1
A3(c)	(viscosity) increases as number of C atoms increases / increases down the alcohols (1) any correct answer related to length / size / mass of molecule e.g. size of molecule increases / length of carbon chain increases / chains get more tangled / van der Waals' forces increase / intermolecular forces increase (1)	2
A3(d)	$C_3H_7OH + 4\frac{1}{2}O_2 \rightarrow 3CO_2 + 4H_2O$ correct formulae for reactants and products (1) correct balancing, dependent on correct formulae (1)	2
A3(e)(i)	(acidified) potassium manganate(VII) / potassium permanganate (1) heat / reflux (1)	2
A3(e)(ii)	$ \begin{array}{c} H & H & H \\ & & \\ H - C & - C & - C - O - H \\ & & \\ H & H & O \end{array} $ (1)	1
Total:		11

O/N16/21/Q7

B7(a) reactants labelled on left and products labelled on right AND product level below reactant level (1)

ORGANIC CHEMISTRY P2 QUESTIONS

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enthalpy change labelled and shown by downward arrow (1)
activation energy as upward arrow from left hand energy level to energy 'hump' above the highest energy level of both products and reactant (1)

B7(b) bromine water / aqueous bromine / bromine (1)
turns colourless (1)

B7(c) $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$ (1) 1

B7(d) OCOCH_3

CH—CH₂ (1)

extension bonds shown (1)

B7(e) One mark each for any **two** suitable points e.g. :

- fills landfill sites
- litter
- when burnt greenhouse gases given off / burning produces poisonous gases
- get caught in birds / fish gullets (causing choking / death)

Total: 10

O/N16/22/Q3

A3(a)	One mark each for any two of : <ul style="list-style-type: none">• same functional group• (same) general formula• similar chemical properties/react similarly• trend in physical properties• each differs by CH₂	2
A3(b)	$\begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{H}-\text{C}- & \text{C}- & \text{C}- & \text{C}-\text{H} \quad (1) \\ & & & \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array} \quad \begin{array}{ccc} \text{H} & \text{H} & \text{H} \\ & & \\ \text{H}-\text{C}- & \text{C}- & \text{C}-\text{H} \quad (1) \\ & & \\ \text{H} & \text{C} & \text{H} \\ & & \\ \text{H} & & \end{array}$	2
A3(c)(i)	One mark each for any two of: <ul style="list-style-type: none">• (generally) increases as number of carbon atoms increases• increases in zigzag way/idea of going up irregularly/idea of going up unevenly• decreases between C2 and C3 compound (or words to that effect)	2
A3(c)(ii)	any value between -25(°C) and -45(°C) (inclusive of these values) (1)	1
A3(d)(i)	$\text{C}_5\text{H}_{12} + 8\text{O}_2 \rightarrow 5\text{CO}_2 + 6\text{H}_2\text{O}$ correct formulae (1) correct balance dependent on correct formulae (1)	2

A3(d)(ii) Any **two** of: carbon monoxide/carbon/water (1)
carbon monoxide is toxic/carbon monoxide is poisonous (1)

2

Total: 11

M/J16/21/Q1

A1(a) Poly(propene) (1) 1

A1(b) PVC (1) 1

A1(c) Protein (1) 1

A1(d) Starch (1) 1

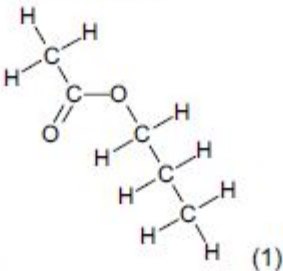
A1(e) Terylene / polyester (1) 1

Total: 5

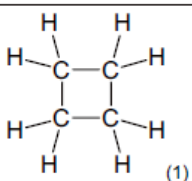
ORGANIC CHEMISTRY P2 QUESTIONS

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M/J16/21/Q3

A3(a)	Flavouring (1)	1
A3(b)	 <p style="text-align: right;">(1)</p>	1
A3(c)(i)	(Net) movement of a substance from a region of high concentration to low concentration (1)	1
A3(c)(ii)	Rate of diffusion increases (1) Particles have more energy/particles are moving faster (1)	2
A3(c)(iii)	Methyl methanoate / HCO_2CH_3 (1) Lowest relative formula mass (1)	2
Total:		7

M/J16/21/Q8

B8(a)(i)	Contains only carbon-carbon single bonds (1)	1
B8(a)(ii)	Contains only carbon and hydrogen (1)	1
B8(b)	$\text{C}_8\text{H}_{12} + 9\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$ (1)	1
B8(c)	HCl (1) $\text{C}_8\text{H}_7\text{Cl}$ (1)	2
B8(d)	Moles of $\text{C}_8\text{H}_{14} = 3.0$ (1) Mass of $\text{C}_8\text{H}_{12} = 252$ (g) (1)	2
B8(e)(i)	Mole ratio C: H = 7.14: 14.3 or 85.7/12 and 14.3/1(1) Divide by 7.14 to get empirical formula (1)	2
B8(e)(ii)	 <p style="text-align: right;">(1)</p>	1
Total:		10

M/J16/22/Q1

A1(a) C and H (1) 1

A1(b) B (1) 1

A1(c) Addition - B / E / F / I

AND

Condensation - A / C / D / G / H

(1)

1

ORGANIC CHEMISTRY P2 QUESTIONS

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A1(d) B / E (1) 1

A1(e) G (1) 1

Total 5

M/J16/22/Q3

A3(a)	<p>(1)</p>	1
A3(b)(i)	Changing of a liquid into a gas/changing liquid to vapour (happening at any temperature) (1)	1
A3(b)(ii)	Molecules have less energy/molecules move slower (1) Molecules don't have enough energy to overcome force between molecules/ molecules don't have enough energy to escape (into the air) (1)	2
A3(b)(iii)	Pentyl ethanoate / $\text{CH}_3\text{CO}_2\text{C}_5\text{H}_{11}$ (1) Highest relative formula mass (1)	2
Total		6