PEARSON EDEXCEL IGCSE CHEMISTRY · 4CH1

CHEMISTRY



EXAM QUESTION PACK

SECTION 4: ORGANIC CHEMISTRY (PACK 2)

SCORE	PERCENTAGE
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Q1.

This question is about alkanes and alkenes.

(a) (i) Complete the boxes by giving the missing information about the alkane with the molecular formula C_2H_6

(3)

molecular formula	C_2H_6
name	
empirical formula	
displayed formula	

(ii) Complete the chemical equation for the complete combustion of the alkane C_2H_6

(1)

.....C_2H_6 + ...O_2 → .....CO_2 + ...H_2O

(iii) Incomplete combustion occurs when the air supply is limited.

Give the names of two products of incomplete combustion.

(2)

1 .....

2 .....

(b) An alkene with molecular formula C_4H_8 reacts with bromine to form a compound with molecular formula $C_4H_8Br_2$

(i) What is the name of this type of reaction?

(1)

☒ **A** addition

☒ **B** decomposition

☒ **C** precipitation

☒ **D** substitution

(ii) Draw displayed formulae for two different alkenes with the molecular formula C_4H_8

(2)

alkene 1	alkene 2

(iii) State the term used for compounds with the same molecular formula but different structural formulae.

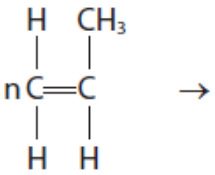
(1)

.....

(c) The alkene C_3H_6 can be polymerised to form the polymer poly(propene).

(i) Complete the equation for this polymerisation reaction.

(2)



(ii) Two ways of disposing of polymers such as poly(propene) are

- burying them in landfill sites
- burning them to release heat energy

Discuss the environmental problems caused by these two methods of disposal.

(3)

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(Total for question = 15 marks)

Q2.

This question is about alkanes and alkenes.

(a) The alkane C_5H_{12} has three isomers.

(i) State what is meant by the term **isomers**.

(2)

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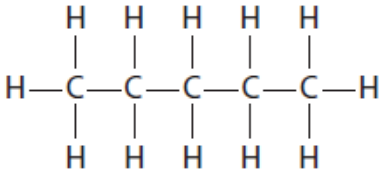
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(ii) Calculate the relative formula mass (M_r) of C_5H_{12}

(1)

M_r of C_5H_{12} = ...

(iii) This is the displayed formula of one of the isomers.



Give the name of this isomer.

(1)

.....

(iv) Draw the displayed formulae of the other two isomers.

(2)

Isomer 1	Isomer 2

(b) Ethane (C_2H_6) and ethene (C_2H_4) both react with bromine.

Describe the differences in the reactions of ethane and ethene with bromine.

Refer to the conditions, the products and the types of reaction involved.

(5)

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(Total for question = 11 marks)

Q3.

Crude oil is a mixture of organic compounds.

Most of these compounds are members of the same homologous series.

(a) State the name of this homologous series.

(1)

.....

(b) An industrial process is used to separate crude oil into fractions.

(i) The process depends on a difference in a property of the fractions.

What is this property?

(1)

☒ **A** boiling point

☒ **B** density

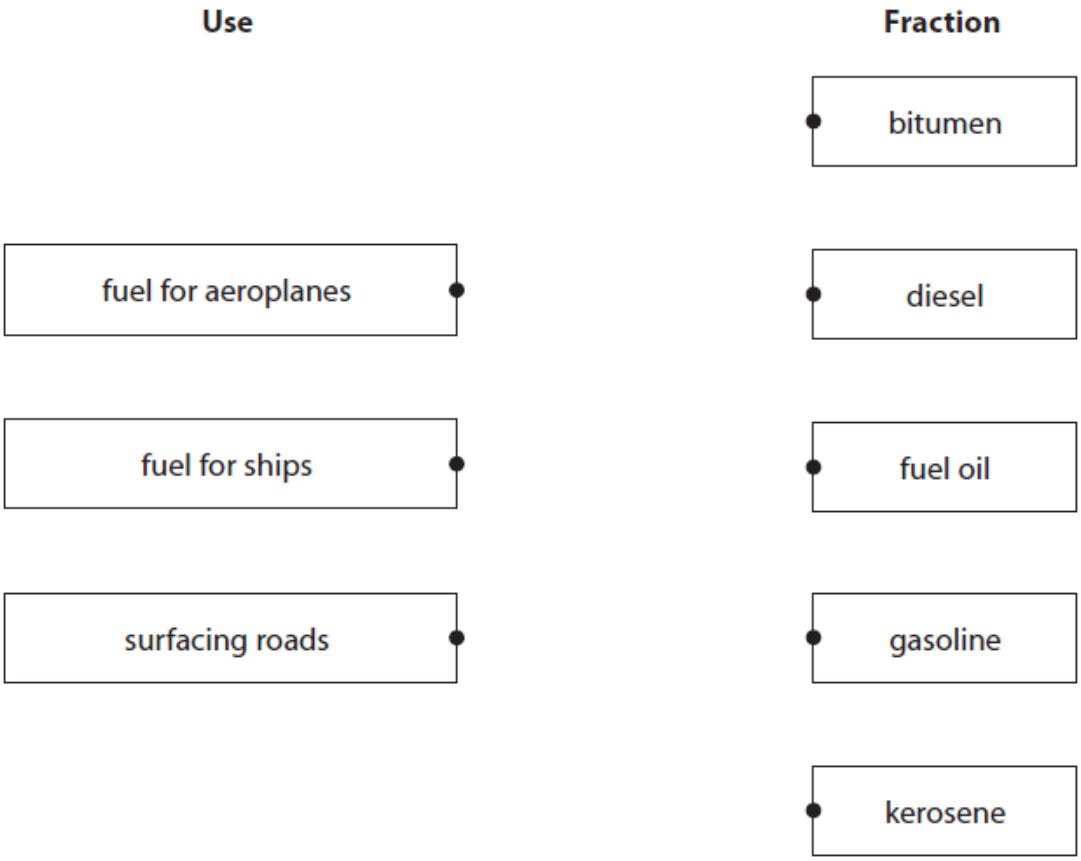
☒ **C** melting point

☒ **D** solubility

(ii) The boxes give some uses of fractions and some names of fractions.

Draw one straight line from each use to its correct fraction.

(3)



(c) Fuels obtained from the fractions may contain impurities.

Explain how the combustion of a common impurity in fuels may cause an environmental problem.

(3)

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(d) Some of the fractions contain long-chain molecules which are not very useful.

(i) Give the name of the process used to convert long-chain molecules into more useful shorter-chain molecules.

(1)

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(ii) Give the catalyst and temperature used in the industrial process to convert long-chain molecules into
shorter-chain molecules.

(2)

catalyst .....

temperature. .....

(iii) When $C_{13}H_{28}$ is used in this process, three different molecules are formed.

Complete the equation for this reaction.

(2)

$$C_{13}H_{28} \rightarrow C_8H_{18} + \text{.....} + \text{.....}$$

(Total for question = 13 marks)

Q4.

(a) An alkane has the molecular formula C_3H_8

(i) Give the name of this alkane.

(1)

.....

(ii) Draw the displayed formula of this alkane.

(1)

(iii) Give the general formula for the alkanes.

(1)

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(b) The alkanes C_2H_6 and C_4H_{10} contain covalent bonds and have simple molecular structures.

(i) State what is meant by the term **covalent bond**.

(1)

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(ii) Explain why C_4H_{10} has a higher boiling point than C_2H_6

(3)

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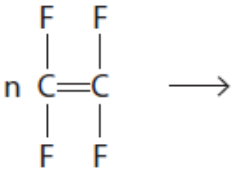
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(c) The organic compound tetrafluoroethene (C_2F_4) can be polymerised to form poly(tetrafluoroethene).

(i) Complete the equation for this polymerisation reaction.

(2)



(ii) Poly(tetrafluoroethene) is used as a coating on non-stick frying pans.

The C—F covalent bonds in poly(tetrafluoroethene) are very strong.

Suggest a reason why poly(tetrafluoroethene) is suitable as a coating on non-stick frying pans.

(1)

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(Total for question = 10 marks)

Q5.

This question is about alkenes and alkanes.

(a) Complete the table by giving the missing information about the alkene with the molecular formula C_3H_6

(4)

Molecular formula	C_3H_6
Name	
Empirical formula	
General formula	
Displayed formula	

(b) Alkenes are unsaturated compounds.

(i) State what is meant by the term **unsaturated**.

(1)

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(ii) Describe a test to show that a compound is unsaturated.

(2)

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(c) When the alkane methane reacts with chlorine, the products are chloromethane (CH_3Cl) and hydrogen chloride gas.

(i) Give a chemical equation for this reaction.

(1)

.....

(ii) What is the name of this type of reaction?

(1)

☒ **A** addition

☒ **B** decomposition

☒ **C** neutralisation

☒ **D** substitution

(iii) State the condition needed for this reaction to occur.

(1)

.....

(d) When ethane reacts with chlorine, one of the products of the reaction has the formula $C_2H_4Cl_2$

There are two isomers with this formula.

(i) State what is meant by the term **isomers**.

(2)

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(ii) Draw the displayed formulae of the two isomers with the formula $C_2H_4Cl_2$

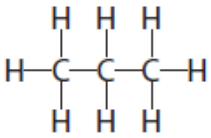
(2)

isomer 1	isomer 2

(Total for question = 14 marks)

Q6.

The table shows the formulae of six organic compounds, **A**, **B**, **C**, **D**, **E** and **F**.

A	**B**	**C**
CH_4	C_2H_4	C_2H_6
D	**E**	**F**
	$CH_2{=}CH{-}CH_3$	C_4H_{10}

(a) State why each of these compounds is a hydrocarbon.

(2)

.....

.....

(b) State why the formula given for **D** is called a displayed formula.

(1)

.....

.....

(c) Give the letters that represent the four compounds with the general formula C_nH_{2n+2}

(1)

.....

(d) Many of the compounds in the table are found in a fuel called shale gas.

Shale gas contains many different compounds, including methane, propane and hydrogen sulfide (H_2S).

(i) Complete the equation to show the complete combustion of propane.

(2)

$C_3H_8 + 5O_2 \rightarrow$ ..... + ...

(ii) When shale gas is burned, the hydrogen sulfide reacts with oxygen.

$$2H_2S + 3O_2 \rightarrow 2SO_2 + 2H_2O$$

Explain how the combustion of shale gas can lead to the formation of acid rain.

(2)

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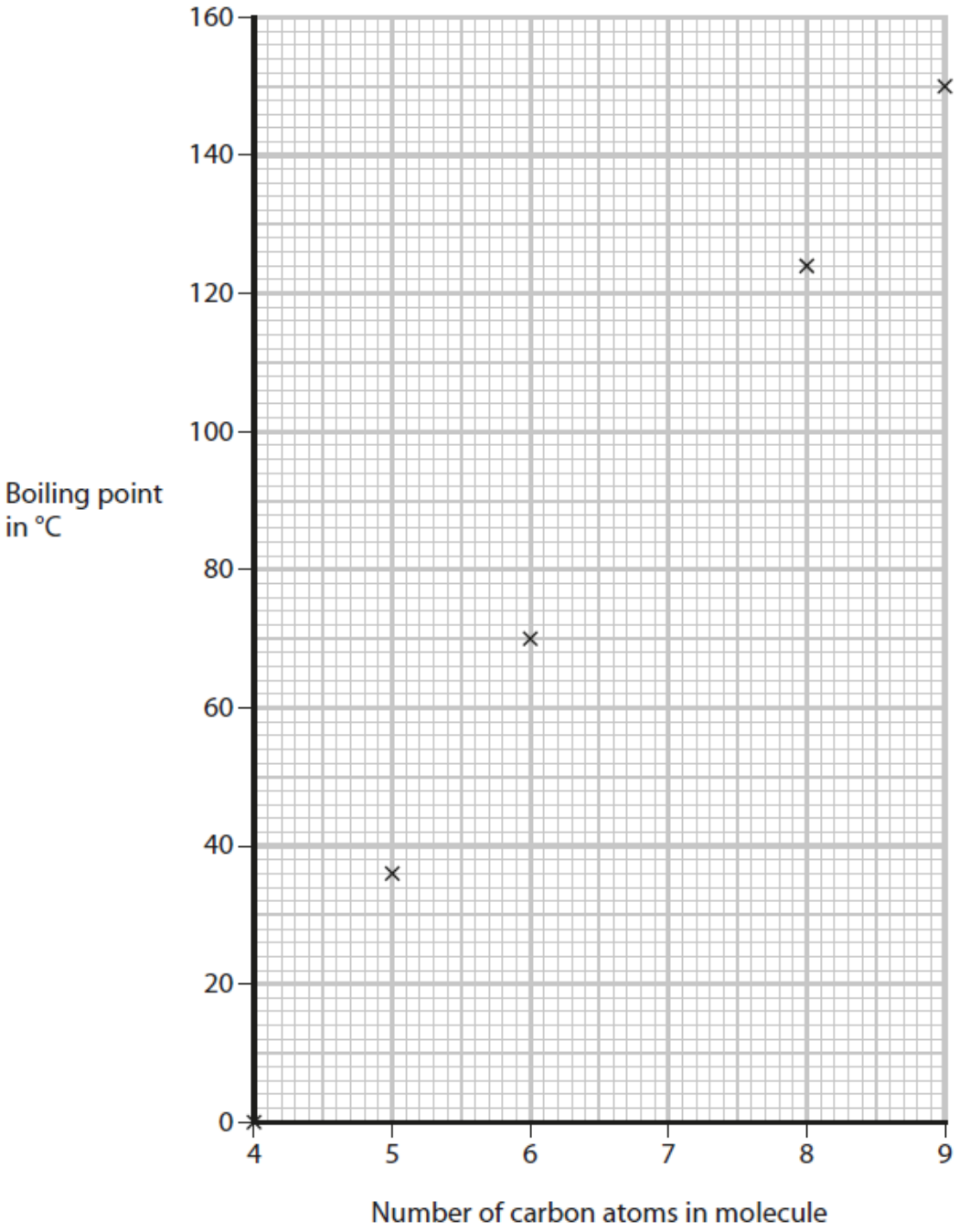
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(Total for question = 8 marks)

Q7.

This question is about alkanes.

(a) The graph shows the boiling points of several unbranched alkanes.



(i) Draw a curve of best fit.

(1)

(ii) Use the graph to find the boiling point of the alkane with 7 carbon atoms in its molecule.

Show on the graph how you obtain your answer.

(2)

boiling point = ... °C

(iii) Explain the trend shown by the graph.

(3)

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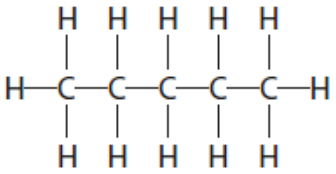
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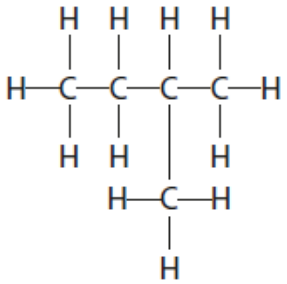
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(b) The diagram represents two isomers with the formula C_5H_{12}





Explain why these compounds are isomers.

(2)

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(c) (i) An alkane contains 82.8% carbon and 17.2% hydrogen by mass.

Show by calculation that the empirical formula of this alkane is C_2H_5

(2)

(ii) Deduce the molecular formula of this alkane.

(1)

.....

.....

(d) The equation for the complete combustion of one mole of an alkane can be represented by

$$\text{alkane} + ZO_2 \rightarrow XCO_2 + YH_2O$$

Complete combustion of one mole of the alkane produces 308 g of carbon dioxide and 144 g of water.

X, Y and Z are the numbers used to balance the equation.

Calculate the values of X, Y and Z.

[M_r of CO_2 = 44, M_r of H_2O = 18]

(3)

X = ...

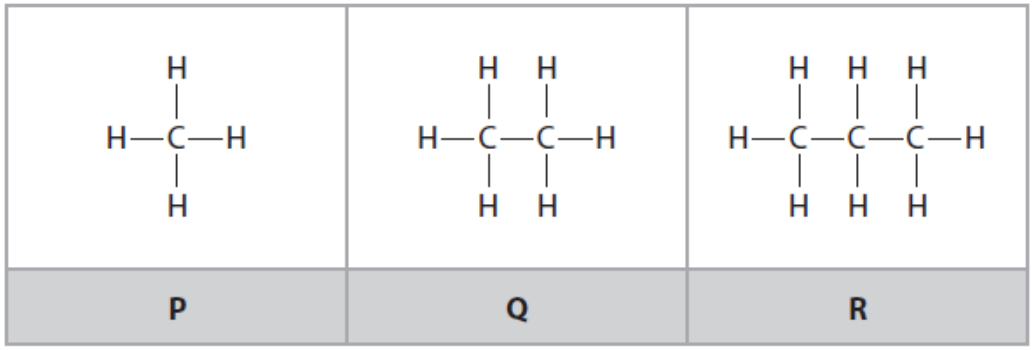
Y = ...

Z = ...

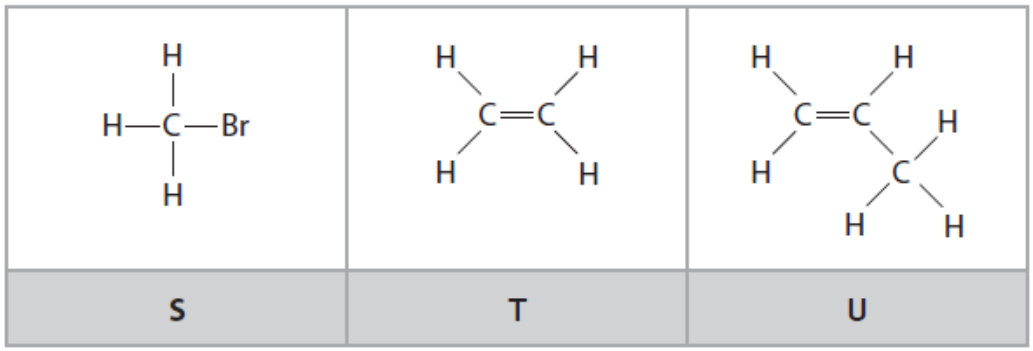
(Total for question = 14 marks)

Q8.

The boxes show the displayed formulae of six organic compounds, P, Q, R, S, T and U.



P	Q	R



S	T	U

(a) Use the letters P, Q, R, S, T and U to answer these questions.

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

(i) Give the letter of the compound that is **not** a hydrocarbon.

(1)

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(ii) Give the letters of the two compounds that have the same empirical formula.

(1)

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(iii) Give the letter of the compound that is used to manufacture poly(propene).

(1)

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(b) Describe a test that can be used to distinguish between compounds Q and T.

(3)

test

.....

.....

result with compound Q

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result with compound T

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(c) Compounds P, Q and R are members of the same homologous series.

Give two characteristics of a homologous series.

(2)

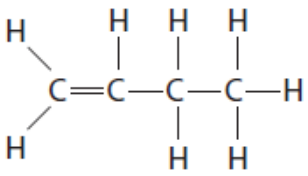
1 .....

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2 .....

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(d) This is the displayed formula of an alkene, V.



(i) Give the name of alkene V.

(1)

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(ii) Draw the displayed formula of another alkene that is an isomer of alkene V.

(1)

(e) An organic compound has the percentage composition by mass

C = 36.36% H = 6.06% F = 57.58%

(i) Show that the empirical formula of the compound is CH_2F

(2)

(ii) The relative molecular mass (M_r) of the compound is 66.

Determine the molecular formula of the compound.

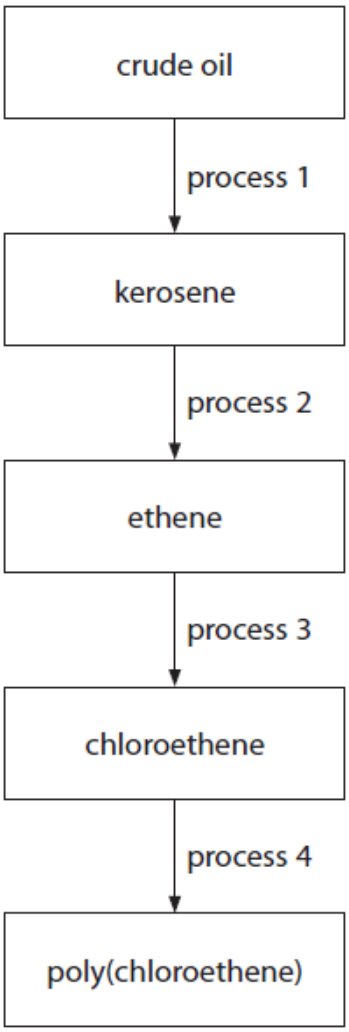
(2)

molecular formula = ...

(Total for question = 14 marks)

Q9.

The diagram shows some important conversion processes used in the oil industry.



(a) Describe how kerosene is produced from crude oil in process 1.

(5)

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(b) $C_{12}H_{26}$ is present in kerosene.

In process 2, $C_{12}H_{26}$ is cracked to produce two molecules of ethene and one molecule of another hydrocarbon.

(i) Complete the equation for the cracking of $C_{12}H_{26}$

(1)

$$C_{12}H_{26} \rightarrow 2C_2H_4 + \text{.....}$$

(ii) Explain why cracking is a useful process in the oil industry.

(4)

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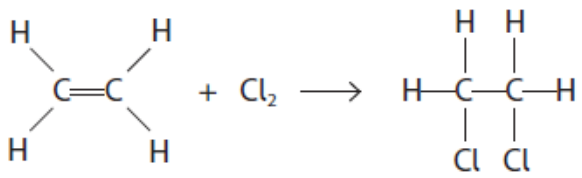
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(c) This is the equation for one of the reactions that may occur during process 3.



What is the name of this type of reaction?

(1)

☒ **A** addition

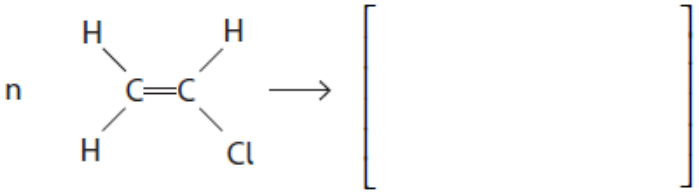
☒ **B** combustion

☒ **C** decomposition

☒ **D** substitution

(d)(i) Complete the equation for the polymerisation of chloroethene in process 4.

(2)



(ii) Explain why the disposal of polymers such as poly(chloroethene) is difficult.

(2)

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(Total for question = 15 marks)

Q10.

Ethene (C_2H_4) can be converted into chloroethene (C_2H_3Cl) in a two-stage process.

(a) The first stage is to convert ethene into 1,2-dichloroethane, $C_2H_4Cl_2$

Ethene is reacted with hydrogen chloride and oxygen.

Complete the chemical equation for this reaction.

(1)

..... C_2H_4 + ... HCl + ... O_2 → ..... $C_2H_4Cl_2$ + ... H_2O

(b) In the second stage, 1,2-dichloroethane is converted into chloroethene.

$$C_2H_4Cl_2 \rightarrow C_2H_3Cl + HCl$$

This is a thermal decomposition reaction.

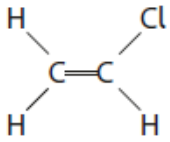
State what is meant by the term **thermal decomposition**.

(1)

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(c) The diagram shows the displayed formula of chloroethene.



(i) State why chloroethene is described as an unsaturated compound.

(1)

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(ii) Describe a test to show that chloroethene is unsaturated.

(2)

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(d) Name the polymer formed from chloroethene.

(1)

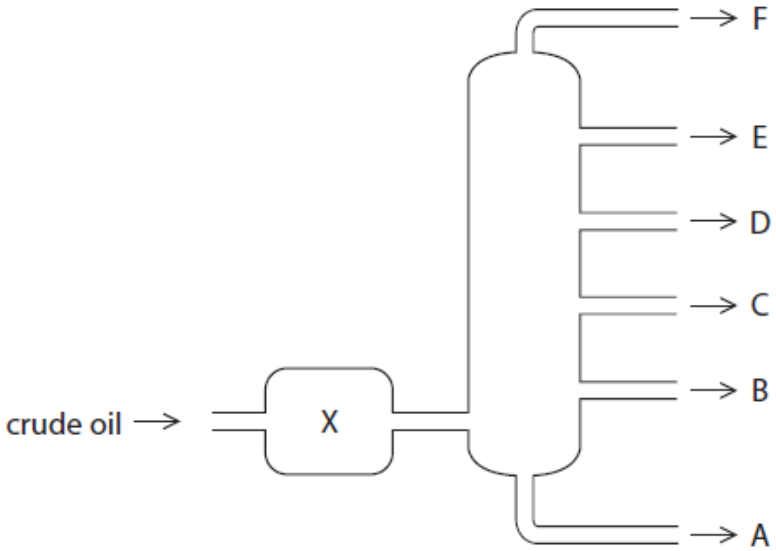
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(Total for question = 6 marks)

Q11.

Crude oil is an important source of organic compounds.

(a) The diagram shows how crude oil can be separated into fractions by fractional distillation.



(i) State what happens to the crude oil when it is in X.

(1)

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.....

(ii) Give the name of fraction E.

(1)

.....

(iii) Give a use for fraction A.

(1)

.....

(b) One of the compounds in fraction D is tridecane ($C_{13}H_{28}$) which can be cracked to form shorter-chain hydrocarbons.

(i) State the catalyst and temperature used in this cracking reaction.

(2)

catalyst

.....

temperature

.....

(ii) The equation shows an example of a catalytic cracking reaction.

$$C_{13}H_{28} \rightarrow C_8H_{18} + C_2H_4 + C_3H_6$$

Give two reasons why this reaction is important.

(2)

1 .....

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2 .....

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(c) Sulfur is an impurity in crude oil.

Explain why this is a problem for the environment.

(3)

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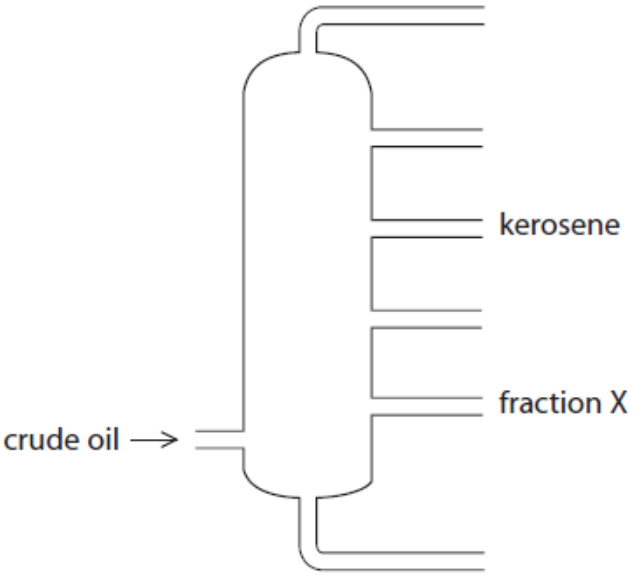
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(Total for question = 10 marks)

Q12. This question is about fractions obtained from crude oil.

(a) The diagram shows a fractional distillation column and two of the fractions obtained from crude oil.



Describe how the colour, boiling point and viscosity of fraction X differs from the kerosene fraction.

(3)

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(b) Octane (C_8H_{18}) is part of the gasoline fraction.

In a limited supply of air, octane undergoes incomplete combustion.

(i) Complete the chemical equation for the incomplete combustion of octane.

(2)

C_8H_{18} + ...O_2 → 5CO + ...CO_2 + ...H_2O

(ii) Give a reason why carbon monoxide (CO) gas is poisonous.

(1)

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(iii) Explain how the combustion of a common impurity in gasoline may cause an environmental problem.

(3)

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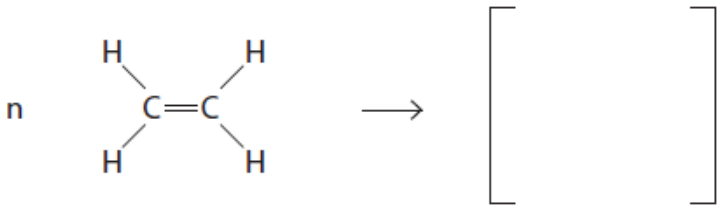
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(c) Ethene is obtained from one of the fractions in crude oil.

Ethene is used to make the polymer poly(ethene).

(i) Complete the equation for the conversion of ethene to poly(ethene).

(2)



(ii) Explain why poly(ethene) is difficult to dispose of in landfill sites.

(2)

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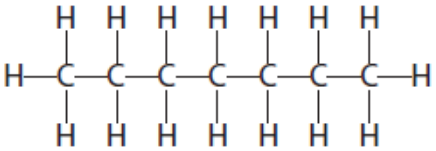
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(Total for question = 13 marks)

Q13.

(a) Two of the fractions obtained from crude oil are gasoline and bitumen.

(i) This is the displayed formula for one of the alkanes in the gasoline fraction.



Determine the molecular formula of this alkane.

(1)

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(ii) Give a use of bitumen.

(1)

.....

(iii) Describe the differences between the gasoline and bitumen fractions, in terms of colour, boiling point
and viscosity.

(3)

colour .....

.....

boiling point .....

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viscosity .....

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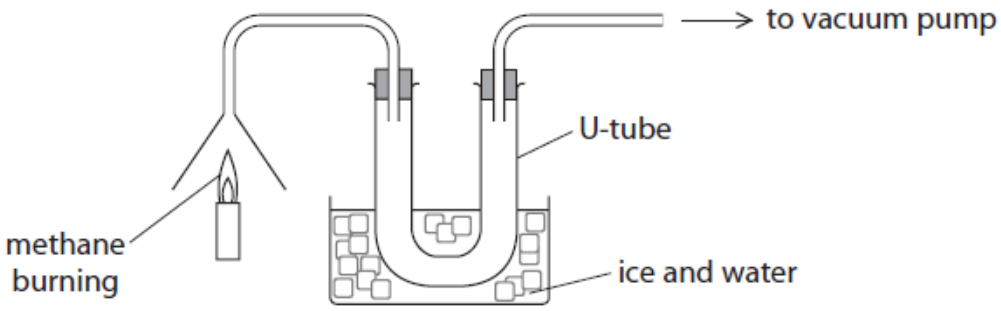
(b) Methane is an alkane used as a fuel.

When methane burns in a plentiful supply of air, carbon dioxide and water vapour form.

The equation for the reaction is

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

The diagram shows how water can be collected when methane burns in the air.



(i) Water freezes at 0 °C and boils at 100 °C.

Carbon dioxide sublimes at −78 °C.

Explain why water collects in the U-tube, but carbon dioxide does not.

(4)

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(ii) Describe how anhydrous copper(II) sulfate can be used to show that the U-tube contains water.

(2)

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(Total for question = 11 marks)

Q14.

This question is about gases in the atmosphere.

(a) The box gives the names of some gases in the atmosphere.

argon	carbon dioxide	helium	nitrogen	oxygen

Choose gases from the box to answer these questions.

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

(i) Identify a noble gas.

(1)

.....

(ii) Identify a gas that makes up about 78% of the atmosphere.

(1)

.....

(iii) Identify a greenhouse gas.

(1)

.....

(iv) Identify a gas produced by the thermal decomposition of calcium carbonate.

(1)

.....

(b) Sulfur reacts with oxygen to produce sulfur dioxide gas.

(i) Write a chemical equation for this reaction.

(1)

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(ii) State an environmental problem caused when sulfur dioxide gas dissolves in water in the atmosphere.

(1)

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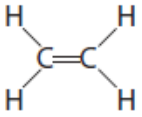
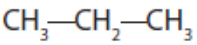
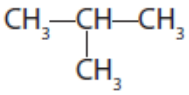
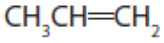
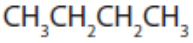
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(Total for question = 6 marks)

Q15.

This question is about hydrocarbons.

(a) The table shows the formulae of some hydrocarbons.

A 	**B** 	**C** 
D 	**E** 	**F** 

(i) Give the letters that represent hydrocarbons with the general formula C_nH_{2n}

(1)

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(ii) State why **B** is the only hydrocarbon shown as a displayed formula.

(1)

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(iii) Explain which **two** letters represent isomers.

(3)

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(iv) How many of the hydrocarbons are members of the homologous series of alkanes?

(1)

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(b) Many hydrocarbons are used as fuels. There are problems associated with this use.

(i) Explain how the combustion of a hydrocarbon can lead to the formation of a poisonous gas.

(2)

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(ii) State why this gas is poisonous to humans.

(1)

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(c) Fuels used in cars often have sulfur compounds removed.

Explain how the combustion of these fuels in car engines still leads to the formation of acid rain.

(4)

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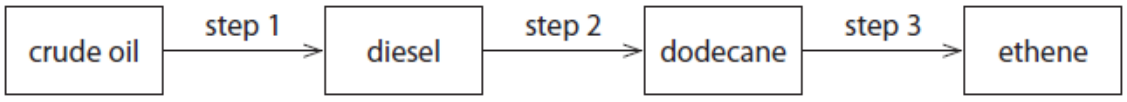
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(Total for question = 13 marks)

Q16.

The flow chart shows how ethene can be obtained industrially from crude oil.



(a) Step 1 involves the use of a tall column.

Describe how the diesel fraction is obtained from the crude oil in step 1.

(5)

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(b) In step 2, saturated compounds such as dodecane are obtained from the mixture of hydrocarbons in the diesel fraction.

Explain why dodecane is described as a **saturated hydrocarbon**.

(3)

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(c) Which of these formulae is that of an alkane?

(1)

☒ **A** C_7H_{12}

☒ **B** C_9H_{18}

☒ **C** $C_{11}H_{24}$

☒ **D** $C_{13}H_{30}$

(d) In step 3, cracking is used to convert alkanes into alkenes.

Complete the equation to show the reaction in which one molecule of dodecane is converted into two molecules of ethene and one molecule of another hydrocarbon.

(1)

$$C_{12}H_{26} \rightarrow 2C_2H_4 + ...$$

(e) Alkanes and alkenes both react with halogens, but in different ways.

The equations for two examples of these different reactions are shown.

equation 1 $C_2H_6 + Cl_2 \rightarrow C_2H_5Cl$ + compound X

equation 2 $C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$

(i) State the condition needed for the reaction in equation 1 to occur.

(1)

.....

(ii) Deduce the formula of compound X.

(1)

.....

(iii) Draw a dot-and-cross diagram to represent a molecule of C_2H_5Cl

Show only the outer electrons of each atom.

(2)

(iv) Equation 2 shows an example of an addition reaction.

State the type of reaction shown by equation 1.

(1)

.....

(f) Alkenes can be distinguished from alkanes using bromine water.

(i) What colour change occurs in the reaction between propene and bromine water?

(1)

☒ **A** colourless to orange

☒ **B** colourless to green

☒ **C** green to colourless

☒ **D** orange to colourless

(ii) A compound formed in the reaction between propene and bromine water has the percentage composition by mass

C = 25.9%, H = 5.0%, Br = 57.6% and O = 11.5%

Calculate the empirical formula of this compound.

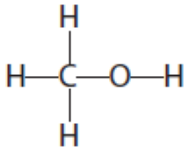
(3)

empirical formula = ...

(Total for question = 19 marks)

Q17.

(a) The diagram shows the displayed formula of the organic compound methanol, CH_3OH



(i) Determine the number of atoms in one molecule of methanol.

(1)

.....

(ii) State why methanol is not a hydrocarbon.

(1)

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(b) The atoms in methanol are held together by covalent bonds.

(i) State what is meant by the term **covalent bond**.

(2)

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(ii) Draw a dot-and-cross diagram to show the bonding in a molecule of methanol.

Show only the outer electrons of each atom.

(2)

(c) Another organic compound has the percentage composition by mass

C = 38.7% H = 9.7% O = 51.6%

(i) Calculate the empirical formula of this compound.

(3)

empirical formula = ...

(ii) The relative molecular mass (M_r) of the compound is 62

Determine the molecular formula of the compound.

(2)

molecular formula = ...

(Total for question = 11 marks)

Q18.

Dilute hydrochloric acid reacts with a solution of sodium thiosulfate ($Na_2S_2O_3$) to form a precipitate.

The equation for the reaction is

$$Na_2S_2O_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + S(s) + H_2O(l) + SO_2(g)$$

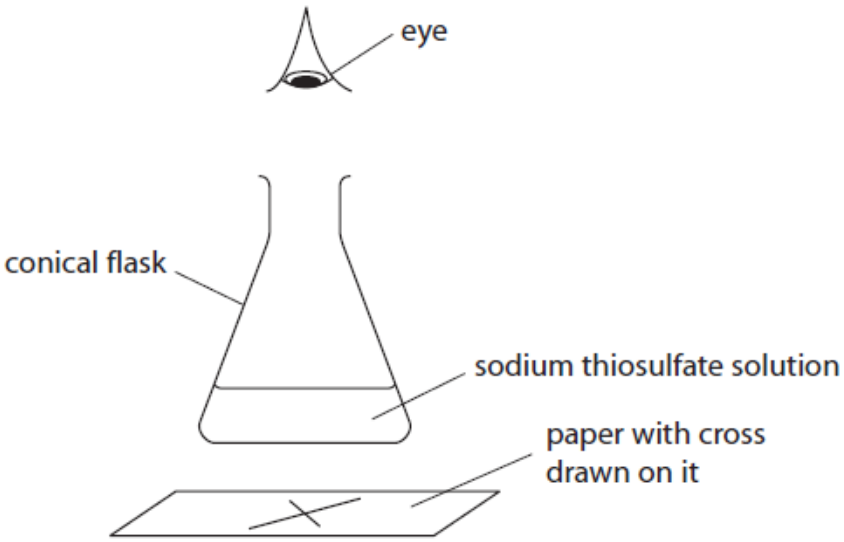
(a) State the name of the precipitate that forms.

(1)

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(b) The reaction is often used to investigate rates of reaction.

The diagram shows the apparatus a student uses to investigate the effect of temperature on the rate of the reaction.



This is the student's method.

- pour 50 cm^3 of cold sodium thiosulfate solution into a conical flask and heat it to 20 °C
- draw a cross (X) on a piece of paper and place it under the flask
- add 5 cm^3 of dilute hydrochloric acid to the flask
- look at the cross from above and record the time taken until the cross cannot be seen

The student repeats the experiment four times, using sodium thiosulfate solution at a different temperature each time.

He keeps the volumes of sodium thiosulfate solution and hydrochloric acid constant in each experiment.

Give two other factors that the student should keep constant.

(2)

1 .....

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2 .....

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(c) The table shows the student's results.

Temperature in °C	Time until cross cannot be seen in s
20	400
30	188
40	84
50	44
60	24

The highest temperature the student uses is 60 °C because he thinks the results might not be as accurate at temperatures higher than 60 °C.

Suggest a reason why the results might not be as accurate at temperatures higher than 60 °C.

(1)

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(d) The student wants to compare the rates of the reaction at the different temperatures.

He uses this formula to obtain a value for each rate of reaction

$$\text{rate} = \frac{1}{\text{time in s}}$$

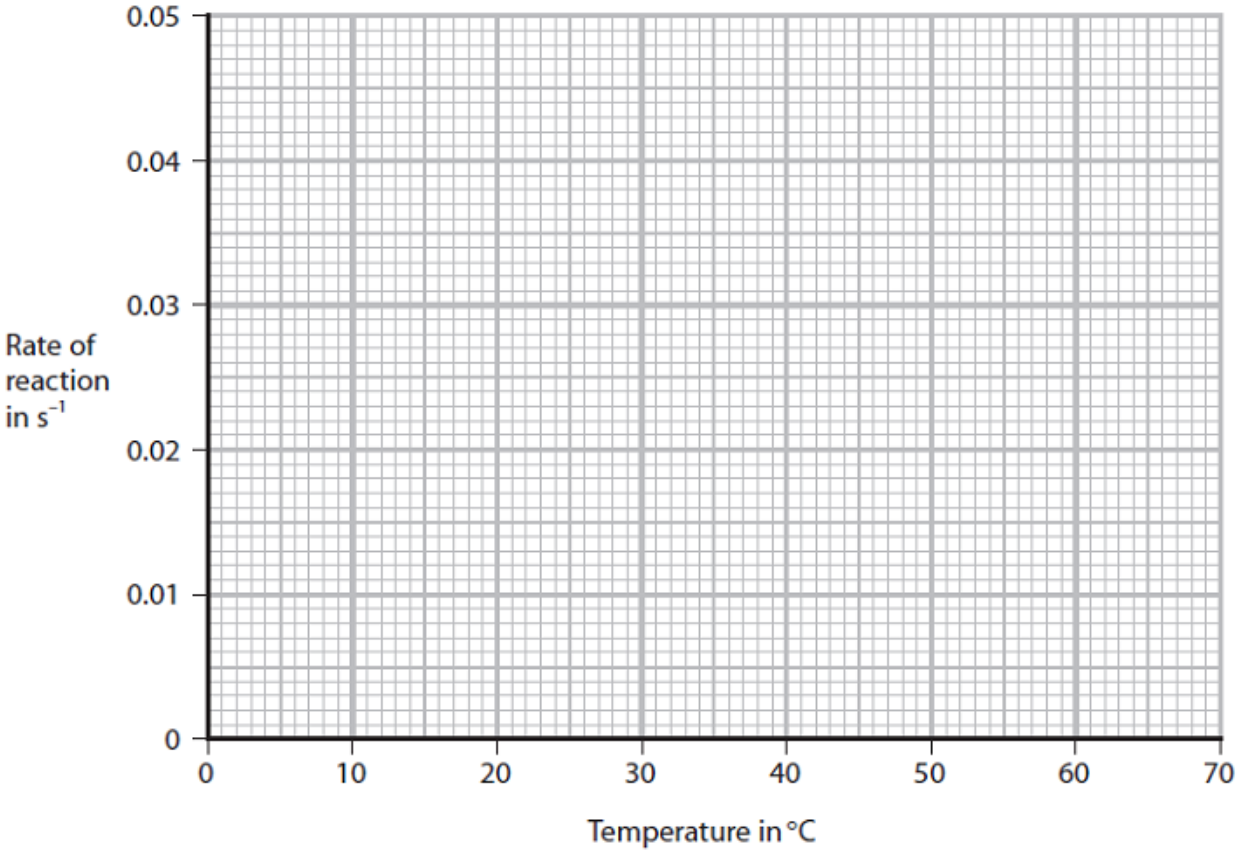
The table shows the value of the rate of reaction at each temperature.

Temperature in °C	Time until cross cannot be seen in s	Rate of reaction in s^{-1}
20	400	0.0025
30	188	0.0053
40	84	0.012
50	44	0.023
60	24	0.042

Plot the values of temperature and rate of reaction on the grid.

Draw a curve of best fit through the points.

(2)



(e) (i) Use the graph to determine a value for the rate of the reaction at 45 °C.

Show on the graph how you obtained your answer.

(2)

rate of reaction = ... s^{-1}

(ii) Calculate the time that it would take for the cross not to be seen at 45 °C.

(2)

time = ... S

(iii) Describe the relationship between rate of reaction and temperature shown by the graph.

(1)

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(f) Explain, in terms of particle collision theory, the effect that increasing the temperature has on the rate of a reaction.

(3)

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(Total for question = 14 marks)

Q19.

Sodium hydrogencarbonate ($NaHCO_3$) is also known as baking soda.

Baking soda can be used to make cakes increase in size in an oven.

This is the equation for the reaction that takes place when baking soda is heated.

$$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$$

(a) (i) What type of reaction is this?

(1)

☒ **A** combustion

☒ **B** decomposition

☒ **C** oxidation

☒ **D** reduction

(ii) Suggest why the reaction makes the cakes increase in size.

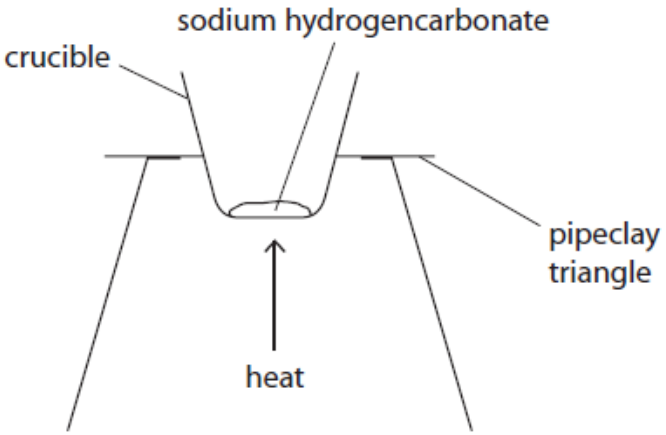
(1)

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(b) A student uses this apparatus to investigate the reaction that takes place when sodium hydrogencarbonate is heated.



This is the student's method.

- weigh a crucible and record the mass
- add some sodium hydrogencarbonate to the crucible, reweigh it and record the mass
- heat the crucible and contents for five minutes, then allow to cool before weighing and recording the mass
- heat the crucible and contents again for a further three minutes, then allow to cool before weighing and recording the mass

(i) Give a reason why the crucible and contents are heated for a further three minutes.

(1)

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(ii) The student considered using a lid on the crucible in the experiment.

Suggest an advantage and a disadvantage of using a lid on the crucible.

(2)

advantage

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.....

disadvantage

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(c) The table shows some of the student's results.

mass of crucible and sodium hydrogencarbonate in g	29.75
mass of empty crucible in g	26.50

(i) Calculate the mass of sodium hydrogencarbonate that the student uses.

(1)

mass = ... g

(ii) Using this equation, calculate the maximum mass of sodium carbonate (Na_2CO_3) that could form in the student's reaction.

$$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$$

[M_r of $NaHCO_3$ = 84 M_r of Na_2CO_3 = 106]

(3)

maximum mass = ... g

(d) In a second experiment, the student uses a larger mass of sodium hydrogencarbonate.

She calculates that she should obtain 4.8 g of sodium carbonate.

She actually obtains 4.2 g of sodium carbonate.

(i) Calculate the percentage yield from the student's experiment.

(2)

percentage yield = ... %

(ii) Other than spillages, suggest a possible reason why the student's actual yield is less than expected.

(1)

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(Total for question = 12 marks)

Q20.

(a) (i) Organic compounds can exist as isomers.

Explain what is meant by the term **isomers**.

(2)

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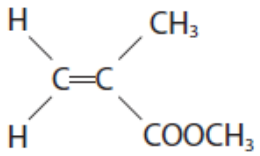
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(ii) Organic compound Q reacts with bromine, without the presence of ultraviolet radiation, to form the
compound $C_4H_8Br_2$

Draw the displayed formulae of two isomers of Q.

(2)

(b) An acrylic polymer can be formed from molecules with this structure.



(i) A student describes the molecule as an unsaturated hydrocarbon.

Explain whether this is a correct description.

(2)

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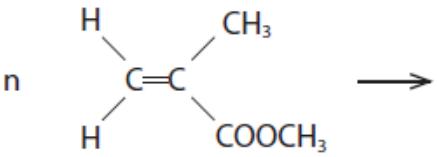
(ii) Name the type of polymerisation that occurs in the formation of the polymer.

(1)

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(iii) Complete the equation for the polymerisation reaction.

(2)



(c) Octane is a compound in petrol.

The equation for the complete combustion of octane is

$$C_8H_{18} + 12.5\ O_2 \rightarrow 8\ CO_2 + 9\ H_2O$$

(i) The fuel tank of a car contains 50.0 dm^3 of octane.

Calculate the mass, in kg, of carbon dioxide formed if all the octane in the fuel tank undergoes complete combustion.

[mass of 1 dm^3 of octane = 700 g]

(5)

mass = ... kg

(ii) State an environmental problem caused by carbon dioxide.

(1)

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.....

(Total for question = 15 marks)