

OCR AS CHEMISTRY
UNIT 2 MODULE 1

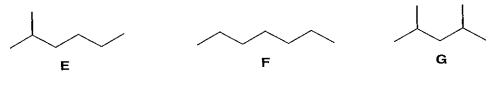
**ASSESSMENT POINT 2** 

85 MINUTES 76 MARKS

## Answer all the questions.

1	Fuels are an important part of our everyday life. Crude oil is a source of hydrocarbons such as $\rm C_{14}H_{30}$ .				
	${ m C_{14}H_{30}}$ is cracked into octane which can be used as a fuel. To improve its efficiency as a octane is processed into branched chain alkanes and cycloalkanes.				
	(a)	What is meant by a <i>hydrocarbon</i> ?			
			[1]		
	(b)	Writ	e an equation for the cracking of C <sub>14</sub> H <sub>30</sub> to form octane.  [1]		
	(c)				
		(i)	Draw the structure of 1,2-dimethylcyclohexane.		
			[1]		
		/IIX			
		(ii)	Identify the other product formed.  [1]		
	(d)	lsor	merisation of octane can produce 2,2,3-trimethylpentane.		
	(-)		Draw the structure of 2,2,3-trimethylpentane.		
			[1]		
		(ii)	Write an equation for the complete combustion of 2,2,3-trimethylpentane.		
			[2]		

Each of the compounds, E, F and G, has the formula C<sub>7</sub>H<sub>16</sub>. 3



- .....[1] Which of E, F or G has the highest boiling point? State the type of intermolecular forces present in all three compounds. (ii) Identify another isomer of C<sub>7</sub>H<sub>16</sub> that is likely to have a boiling point lower than the boiling
  - points of E, F or G.

[1]

(b) E, F and G all react with chlorine as shown below.

$$C_7H_{16} + Cl_2 \rightarrow C_7H_{15}Cl + HCl$$

The reaction is initiated by the formation of chlorine free-radicals.

- What is meant by the term free-radical?
- Write an equation to show the formation of chlorine free-radicals. (ii)
  - \_\_\_\_\_\_[1]
- State the type of bond breaking involved in the formation of chlorine free-radicals. (iii) \_\_\_\_\_[1]
- Write equations to show the two propagation steps that lead to the formation of (iv)  $C_7H_{15}Cl.$

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

Explain, with the aid of an equation, how  $C_{14}H_{30}$  could be formed in this reaction.

(c)	Compounds E and G can react with chlorine to form a mono-chloro compound, $C_7H_{15}Cl$ .  Deduce the number of possible structural isomers, each with formula $C_7H_{15}Cl$ , that could made by the reaction of chlorine with			<sub>7</sub> H <sub>15</sub> C <i>l</i> .
				nat could be
	(i)	compound E,		[1]
	(11)	compound G.		[1]
				[Total: 11]

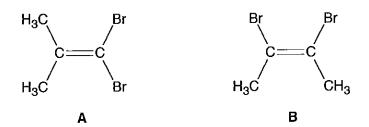
5	(a)	Explain why alkanes, such as pentane, do not react with reagents such as nuclear titles and electrophile.			
	(				
	(b)	In this question, one mark is available for the quality of use and organisation of scientific terms.			
		<ul> <li>Name and describe the mechanism for the reaction between pentane and bromine.</li> <li>State the type of bond fission involved in this mechanism.</li> <li>Explain why it is difficult to produce a single organic product.</li> </ul>			
		In your answer, include any relevant equations and conditions.			
		,			
		[10]			
		Quality of Written Communication [1]			

[Total: 1

2	The chlorinated alkene, $C_3H_4Cl_2$ , has five structural isomers that are alkenes and two oth structural isomers that are not alkenes.						
	(a) (i)	What is meant by t	ne term <i>structural isomer</i> ?				
			••••••	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		***************************************	•••••		
				***************************************	[2]		
	(ii)	Two of the structure	Two of the structural isomers of $C_3H_4Cl_2$ are drawn below.				
		H C=	Cl =c	HC	CI		
		H <sub>3</sub> C	CI	CH₂C≀ }	1		
		isom	er 1	isomer 2			
	Drav	enes.					
		isomer 3	isomer 4		isomer 5		
					[3]		
	(iii)	Name isomer 1		*******************************	[1]		
	(iv)	Draw one structure	al isomer of $\mathrm{C_3H_4Cl_2}$ that is	not an alkene.			

(b)	Another type of isomerism is cis-trans isomerism.
	Why can some alkenes have cis and trans isomers?
	***************************************
	[2]
	[Total: 9]

Compounds  ${\bf A}$  and  ${\bf B}$  are both dibromoalkenes with the molecular formula,  ${\bf C_4H_6Br_2}$ . Compounds A and B are isomers.



(a)	(i)	Name compound A.
		[1]
	(ii)	Calculate the percentage, by mass, of Br in compound A.
		answer =% [2]
	(iii)	Draw another structural isomer of C <sub>4</sub> H <sub>6</sub> Br <sub>2</sub> .

[1] (b) The reaction between isomer  ${\bf B}$  and  ${\bf Br_2}$  can be used to show the presence of the C=C double bond. State what you would see when isomer B reacts with Br<sub>2</sub>. State the type of reaction mechanism for this reaction. .....[1] (iii) What is the molecular formula and the empirical formula of the organic product? [2]

molecular formula = ..... empirical formula = .....

(c) For the reaction between isomer A and H<sub>2</sub>, identify the organic product and state the conditions used.

$$H_3C$$
 $C = C$ 
 $H_3C$ 
 $Br$ 
 $H_3C$ 
 $Br$ 

conditions.....[2]

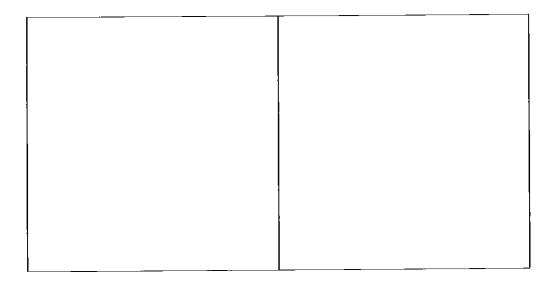
(d) Isomers A and B, shown below, both react with HBr.

$$H_3C$$
 $C$ 
 $Br$ 
 $A$ 

$$Br$$
 $C = C$ 
 $CH_3$ 
 $B$ 

(i) Explain why A can produce two different structural isomers but B only one.

(ii) Identify the two structural isomers formed when A reacts with HBr.



[2]

(e) Isomer B, shown below, can be converted into 2,3-dibromobutan-2-ol.

$$C \longrightarrow C$$
 $C \mapsto C$ 
 $C \mapsto C$ 
 $C \mapsto C$ 
 $C \mapsto C$ 

(i) Draw the skeletal formula of 2,3-dibromobutan-2-ol.

[2]

(f) Isomer A, shown below, can form an addition polymer.

$$H_3C$$
 $C = C$ 
 $Br$ 
 $A$ 

Draw a section of the polymer including two repeat units.

[2]

[1]

[Total: 18]

- 5 In this question, one mark is available for the quality of use and organisation of scientific terms.
  - (a) Crude oil is a complex mixture of hydrocarbons which is initially separated by fractional distillation. Some of the resultant fractions are then further refined by cracking, isomerisation or reforming.
    - Explain why the crude oil can be separated into fractions by using fractional distillation.
       Outline, with the aid of equations, the three processes in the refining of the fractions.
       Explain why the three processes are necessary in the production of fuels.
    - Explain why, in the long term, ethanol could supplement the use of oil-based fuels.
       Write an equation for the combustion of ethanol

Title an equation for the combaction of cultures.
[13
[13

(b)	) Propene is a by-product of the refining of oil fractions.			
	Pro	pene undergoes addition polymerisation to form poly(propene).		
	(i) Write an equation for the formation of poly(propene).			
			[1]	
	(ii)	Draw a section of the polymer formed from propene. Show two repeat units.		
			[1]	
, ,	_		r.,	
(c) Propene can also be converted into alcohols.				
State the reagents and conditions for this conversion and identify the organic p				
	(i) reagents and conditions,			
			[2]	
	(ii)	organic products.		

**END OF QUESTION PAPER** 

[2]

[Total: 20]