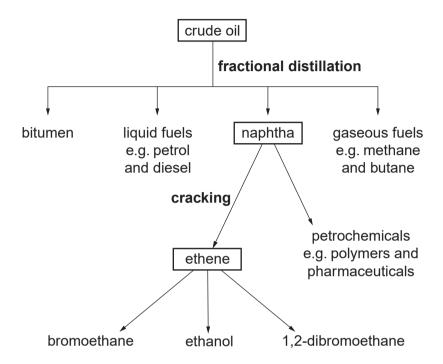
1 Crude oil is a source of many important petrochemicals.

The flow chart shows some of the petrochemicals that can be made and the processes used to make them.



(a)	
	[1]
(b)	Many scientists believe that we should use more fuels such as biodiesel or bio-ethanol rathe than petrol and diesel.
	Suggest one reason why these scientists take this view.
	[4]

(c)	Cracking converts the alkane dodecane, $\mathrm{C}_{12}\mathrm{H}_{26}$, into more useful short chain alkanes an alkenes.		
	(i)	When $\rm C_{12}H_{26}$ is cracked, a variety of alkanes and alkenes are formed with different chair lengths.	
		Explain why a variety of alkanes and alkenes are formed with different chain lengths.	
		[1]	
	(ii)	One molecule of $C_{12}H_{26}$ is cracked to produce one molecule of propane and severa molecules of an alkene, $\bf A$.	
		The mass spectrum of A contains peaks with the following m/z values: 15, 27 and 42. There are no m/z values above 42.	
		 Write the formula of the particle responsible for the peak at m/z = 27. Identify, with a reason, alkene A. Write an equation to show this cracking of C₁₂H₂₆ to form alkene A. 	
		F.4*	
		[4]	

Etherie can be converted into petrochemicals.
Describe how ethene can be converted into 1,2-dibromoethane, bromoethane and ethanol.
 Name and describe the mechanism for the conversion of ethene into 1,2-dibromoethane using the 'curly arrow' model. Include any relevant dipoles.
[9

(e)		w and explain the shape of an ethene molecule. te the H–C–H bond angle in ethene.	
			[3]
(f)	Add	ition polymers are made by the polymerisation of alkenes.	
	<i>E</i> -P	ent-2-ene can be made into an addition polymer.	
	(i)	Draw the structure of <i>E</i> -pent-2-ene.	
			- 4
	(ii)	Draw the structure of poly(pent-2-ene). Include two repeat units.	[1]

[Total: 21] [1]

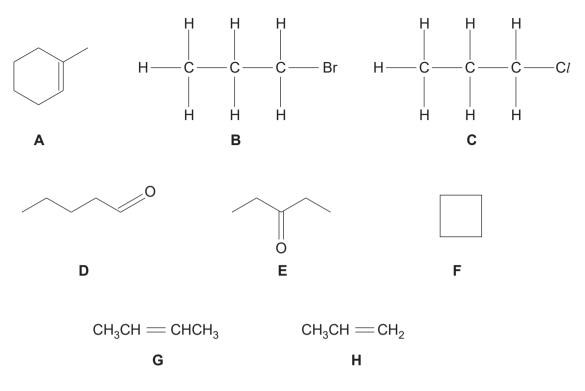
	Atom economy and percentage yield are important factors in deciding the sustainability of a manufacturing process.			
(a)	Complete the expression below for atom economy.			
	atom economy = sum of			1]
(b)	The	following	five reactions all represent important industrial processes.	
	Pro	cess 1	$CH_3CH_2CH_2CH_2CH_2CH_2CH_3 \to (CH_3)_2 CHCH_2CH_2CH_2CH(CH_3)_2$	
	Pro	cess 2	$CH_3CH_2OH \; + \; CH_3COOH \; \longrightarrow \; CH_3COOCH_2CH_3 \; + \; H_2O$	
	Pro	cess 3	$CH_2CH_2 + H_2O \rightarrow CH_3CH_2OH$	
	Pro	cess 4	$NH_3 + HNO_3 \rightarrow NH_4NO_3$	
Process 5 $C_8H_{18} \rightarrow C_2H_4 + C_6H_{14}$		$C_8H_{18} \rightarrow C_2H_4 + C_6H_{14}$		
	(i) Which process is an example of cracking?			
				1]
	(ii) Which process makes a structural isomer of the reactant?			
			[1	1]
	(iii)	Which p	rocess does not have an atom economy of 100%?	
	Explain your answer.			
			[2	2]

2

	$C_6H_{12}O_6(aq) \rightarrow 2C_2H_5OH(aq) + 2CO_2(g)$		
The	The atom economy is 51.1% and the percentage yield is 88.6%.		
(i)	Suggest two reasons why it is a good idea to find uses for the carbon dioxide produced.		
	[2]		
(ii)	Some scientists believe that it is more important to have a high percentage yield in fermentation but others think that a high atom economy is more important.		
	Is it more important to have high percentage yield or a high atom economy in fermentation?		
	Explain your answer.		
	[2]		
	[Total: 9]		

(c) The manufacture of ethanol by the fermentation of glucose can be represented by the following equation.

3 This question is about the following organic compounds.



You will have to refer to these compounds throughout the question.

(a) Explain why compound A is a hydrocarbon.

[1]

(b) Which compound is a saturated hydrocarbon?

[1]

(c) What is the molecular formula for compound E?

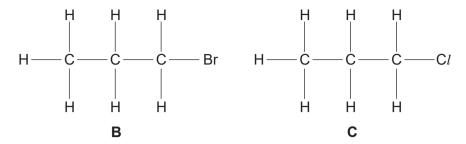
[1]

(d) Which compounds are structural isomers of one another?

[1]

(e)	e) In compound G , there are different shapes around different carbon atoms.		
	(i)	State and explain the shape around carbon atom number 1 in compound G.	
			[2]
	(ii)	State the shape around carbon atom number 2 in compound G.	
			[1]
(f)	(i)	Which compound shows <i>E</i> / <i>Z</i> isomerism?	
			[1]
	(ii)	Explain why some molecules show <i>E</i> / <i>Z</i> isomerism.	
			[2]

(g) Compounds **B** and **C** are halogenoalkanes. Both compounds can be hydrolysed with aqueous potassium hydroxide, KOH(aq).



Describe and explain the hydrolysis of **B** and **C**.

In your answer, include

- one equation including the structure of the organic product
- the reaction mechanism, using the curly arrow model, showing any relevant dipoles
- the type of bond fission that occurs
- the reasons for the difference in the rate of hydrolysis.

Your answer needs to be clear and well organised using the correct terminology.		

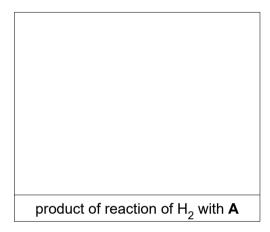
	٠.
[10])]

(h) Compound A is 1-methylcyclohex-1-ene.



Compound \mathbf{A} reacts with \mathbf{H}_2 to give one product and with HBr to give two products.

Draw the structures of the products of these reactions.



two products of reaction of HBr with A		

[3]

[Total: 23]