		Section A
A1	(a)	calcium chloride
	(b)	ammonium chloride
	(C)	hydrogen chloride
	(d)	aluminium chloride
	(e)	hydrogen chloride

A2	(a)	(i)	The catalyst provides an alternative pathway of lower activation energy for the
			reaction to occur.
			More molecules/particles have energy greater than or equal to the activation energy.
			This leads to a <u>higher frequency of effective collisions</u> , leading to a greater rate of reaction.
			<ul><li>[1] role of a catalyst</li><li>[1] explanation in terms of collisions and energy</li></ul>
			Discussion:
			Reject:
			more molecules have the minimum Ea (doesn't cover the idea of greater than or equal to; Ea is an indication of energy, not energy itself)
			Ignore:
			Greater frequency of collisions
		(11)	Catalysts are <u>not chemically changed</u> /regenerated at the end of the reaction so they can be reused infinitely. Hence, no additional cost is needed to purchase
			more new catalysts after each process.
			Catalysts provide an alternative pathway with lower activation energy for the
			reaction to occur, hence the reaction <u>consumes less energy</u> and lowers costs.
			[1] each - show an understanding of the workings of a catalyst:
			<ul> <li>regenerated at the end of the reaction,</li> </ul>
			• requires less energy to operate since the reaction occurs with a lower $E_a$ Note: student just needs to mention alternative pathway of lower $E_a$ in (i)
			Discussion:
			Reject:
			catalyst allows more hydrogen to be produced within a shorter period of time (does not relate to cost) unless they explain further about reduced
			manpower costs/labour costs
			only a small amount is needed
			and hence reused)
			(counter example: purchasing a catalyst requires a higher expenditure compared to when no catalyst is used)
			to include in Markers' report:
			<ul> <li>Students need to write in a concise manner to avoid contradicting</li> </ul>
			themselves in lengthy answers

<mark>(b)</mark>	The reaction removes carbon monoxide/CO. [1]
	It is important to remove carbon monoxide, which is toxic/poisonous/dangerous. It <u>reduces the ability</u> of haemoglobin/red blood cell/blood to transport/carry <u>oxygen to the</u> <u>rest of the body</u> [1]
	<ul><li>[1] highlight what Stage 2 removes</li><li>[1] impact of carbon monoxide on human health (don't need to mention toxicity)</li></ul>
	<ul> <li>Discussion:</li> <li>mark allocation <ul> <li>1<sup>st</sup> mark: purpose of reaction</li> <li>2<sup>nd</sup> mark: impact of CO on human health</li> </ul> </li> <li>allow: <ul> <li>any other that CO causes reduced oxygen carrying ability (accounts for explain)</li> <li>(TB pg 394)</li> <li>eg. "CO reduces the amount of oxygen in the body"</li> <li>eg. "Lowers the amount of oxygen in the blood"</li> </ul> </li> <li>reject: <ul> <li>no reference to oxygen carrying ability "CO can cause breathing problems and death in humans" (does not account for 'explain', but states the 'effect')</li> </ul> </li> </ul>
	<ul> <li>Follow up:</li> <li>check if 'toxicity' is required in the answer (2018/2/6b)</li> <li>(b) The gases from stage 1 are separated. The waste gas produced in stage 1 is burned as a</li> </ul>
	Explain why it is important that this gas is collected and burned.
	(b) Better performing candidates identified that the hazard was related to the carbon monoxide content of the waste gas and clearly discussed its toxicity. Few candidates discussed the importance of burning the gas. Candidates who performed less well discussed vague problems with 'waste gases' in general, which were not relevant.
	Markers' report implies that students need to elaborate on its toxicity
	Additional point for 2024 onwards (old syllabus uses 'poisonous') Key points to note – Maintaining Air Quality
	Describe carbon monoxide as "toxic" rather than "poisonous".
	<ul> <li>"Poisonous" is not a recognised hazard. Hence, the term "toxic" should be used instead.</li> </ul>
	USS (E/NA) Zonal Engagemen
(c)	Updated: 'change from +1 in H <sub>2</sub> O to 0 in H <sub>2</sub> ' 'change from +1 to 0' 'decreases from +1 to 0'
	<ul><li>Discussion:</li><li> 'change': if it is colour change, initial colour and final colour</li></ul>

	• 'change in oxidation state': if it is numerical? (ref: 2012/2/3bi, 2022/2/6bii)
	From 2022:
	(ii) Deduce the change in oxidation state of nitrogen and sulfur in process 2.
	nitrogen
	sulfur
	[2]
	gave +2 for the final oxidation state of sulfur.
	Marker's report implies that students need to work out both initial and final oxidation states
	From 2012:
	(b) Nitrogen monoxide, NO, damages the ozone layer by reacting with ozone in a two step reaction.
	$NO + O_3 \rightarrow NO_2 + O_2$ step 1
	$NO_2 + O_3 \rightarrow NO + 2O_2$ step 2
	(i) Use oxidation states to identify which element is <b>oxidised</b> in step 1.
	element
	change in oxidation state
	(b) Candidates showed sound understanding of working out oxidation states, with most gaining full credit for showing the oxidation state change of nitrogen during the reaction.
	Marker's report implies that students need to work out both initial and final oxidation states
(0	$2H_2 + O_2 \rightarrow 2H_2O$ [1]
	Only water is produced from the combustion of hydrogen, which <u>does not cause</u> <u>pollution.</u> [1]
	[1] chemical equation for the combustion of hydrogen
	[1] comment on water formed which is harmless [need to relate the product]
	Reject:
	No "harmful products" are produced
(e	No. of moles of hydrogen = $\frac{1000}{2}$ = 500 mol [1]
	Enthalpy change in kJ/kg = $-286 \times 500 = -143\ 000\ kJ/kg$ [1]
	[1] calculate no. of moles of hydrogen from the given mass
	Note: no penalty if no units are given, but annotate on the script
	Include in markers' report:
	Need to have clear statements and working

A3	(a)	$I^{-}(aq) + Ag^{+}(aq) \rightarrow AgI(s)$
		[1] correct equation
		Accept:
		State symbols all correct if correct chemical equation is given
	(b)	Step 2:
		Iron is more reactive than silver.
		Iron displaced silver from silver iodide to form iron(II) iodide and silver (product A)
		Step 3.
		Chlorine is more reactive than iodine
		Chlorine displaced jodine from iron(II) jodide to form jodine and iron(II) chloride
		(product B).
		[1] relative reactivity of iron and silver
		[1] explain what has been displaced and identify product A
		[1] relative reactivity of chlorine and iodine
		[1] explain what has been displaced and identify product B
		Note:
		<ul> <li>Reject: comparison between reactivity of halogen and halides (eg. chlorine is more reactive than iodide)</li> </ul>
		Reject: incorrect terms (eqdisplaced iodide from)
		Reject: "greater distance in reactivity", "higher up in the reactivity series"
	(c)	Sublimation
		Reject: "heating"

A4	(a)				metal	positive or negative electrode	
				cathode	copper	positive	
				anode	zinc	negative	
			[1] one i	mark for any tw	vo boxes		
	(b)	The	size of the	e <u>copper discs</u>	will increase and	d the size of <u>zinc discs will decrea</u>	ise. [1]
		Zinc Copr copp	<u>will be ox</u> <u>per(II)_ior</u> er. [1] escribe th	<u>kidised</u> to form <u>ns will be <b>redu</b></u> ne effect on ma	zinc ions as it is uced/preferentians ss of individual of	more reactive than copper. [1] ally discharged/gain electrons	to form
		[1] si relati [1] si elect	tate what ive position tate is re- trochemic	is oxidised and on in the reactive educed and e al series for ca	d explain based vity series) xplain based o tions	on relative reactivity of metals (n n the ease of discharge based	ot about on the
		Reje •	ct: "Zinc i	s discharged"			
		Disc	ussion: If stude of the But – a discha	ents mix up me chemistry behi award mark for rged)	tals at the electr nd it specific chemist	odes, they would have the wrong ry (Eg. copper(II) ions being prefe	analysis erentially
	(c)	Thor	o is a ara	ator difforence	in reactivity betw	waan silvar and zing compared to l	ootwoon
	(0)	copp	er and zi	nc.		veen silver and zinc compared to i	Jeiween
		[1] co Disco	ompare b ussion:	etween Zn and	I Ag vs Zn and C	Cu; not between Cu and Zn	
		•	Allow: Silver i and ziu 'Furthe	is less reactive nc er apart in react	than copper. Gre	eater difference in reactivity betwe stance between the metal reactivit	en silver y series'
		•	Reject 'higher "silver "silver	: or lower in the is lower than z is lower in the	e reactivity series inc in the reactiv reactivity series'	s' instead of 'relative reactivity' 'ity series"	
	(d)	(i)	Positive	electrode: 2C/	$(aq) \rightarrow Cl_2(q) +$	2e-[1]	
	()	(-)	Negative	e electrode: 2H	$I^+(aq) + 2e^- \rightarrow H$	2(g) [1]	
			Discuss •	ion: Missing or inco	rrect state symb	ols or "aqueous electrons" (-1 ove	erall)
		(ii)	The volu	ume of gases o	collected will be t	he <u>same</u> .	
			In the ov the sam	verall equation e/ratio of chlor	, the molar <u>ratio</u> ine gas: hydroge	of chlorine gas to hydrogen gas fo en gas = 1:1	ormed is
			[1] conc	lusion and exp	lanation on the r	atio of products formed	

<ul> <li>Allow: because implies that the same ratio of products would be formed</li> <li>mole ratio of electrons in half-equation are the same</li> </ul>	
<ul> <li>Reject: incorrect because they should focus on the products</li> <li>mole ratio of chloride ions and hydrogen ions is the same</li> <li>ratio of H to Cl in concentrated hydrochloric acid is 1:1</li> </ul>	

	(iii)	Chlorine gas is soluble in water
		OR some chlorine gas <u>dissolved</u> in water
		[1] answers must relate to solubility of chlorine in water.
		Allow:
		<ul> <li>soluble/dissolved in acid/electrolyte (because links to context)</li> </ul>
		Reject:
		chloride gas
		<ul> <li>soluble in solvents (too generic; not linked to question)</li> </ul>
		chlorine gas is more dense/diffuse out
	(iv)	The white precipitate is <u>silver chloride/AgC/</u> . [1]
		Silver anode was <u>oxidised/lose electrons</u> to form <u>silver ions</u> . Silver ions <u>react</u> with
		<u>chionde</u> ions to form sliver chionde. [1]
		[1] identity of the white precipitate
		[1] explanation for the formation of silver chloride
		Reject:
		• AgCl <sub>2</sub>
		"silver chlorine"
		chlorine ions
		<ul> <li>'silver' reacts with chloride ions</li> </ul>

A5	(a)	Effervescence/bubbles of gas was observed. [1] Blue/green solid dissolved to form a <u>blue solution</u> . [1] Alternative answer: reaction mixture feels warm, solid decreases in size
		"solid dissolved" $\rightarrow$ accept, but prompt
		<ul> <li>[1] description of the <u>observation</u> due to formation of gas</li> <li>[1] description of the <u>colour</u> of the solution formed</li> </ul>
		<ul> <li>Discussion:</li> <li>Reject: Solution becomes less acidic Test for carbon dioxide gas "white ppt" formed in solution "solid dissolved to form a reddish-brown solution"</li> </ul>
	(b)	$CuCO_3 \bullet Cu(OH)_2 + 4HNO_3 \rightarrow 2Cu(NO_3)_2 + CO_2 + 3H_2O$
		<ul><li>[1] correct formula of the products</li><li>[1] correctly balanced chemical equation</li></ul>
		<ul> <li>To include in markers' report:</li> <li>need to write the formula of copper(II) nitrate correctly</li> </ul>
	(c)	Step 1: No. of moles of carbon dioxide = $\frac{96}{24000}$ = 0.004 mol [1] No. of moles of carbonate = 0.004 mol Formula mass of carbonate = 12 + 3(16) = 60 [1] Mass of carbonate = 0.004 x 60 = 0.240 g [1]
		<ul> <li>[1] calculate number of moles of carbon dioxide</li> <li>[1] calculate formula mass of carbonate (this working can be merged with the third mark)</li> <li>[1] calculate mass of carbonate present</li> </ul>
		Discussion: <ul> <li>Allow full ecf from (b)</li> <li>Allow full ecf from step 1</li> </ul>

A6	(a)	Exot Incre	hermic. ased in temperature/temperature change is positive.
		[1] sł in ter	now an understanding of exothermic reaction by making reference to the increase mperature
		Reje •	ct: Endothermic
		Allov	<ul> <li>"temperature of reactants is lower than the products" – misinterpretation of the graph, thinking that it is an energy profile diagram</li> </ul>
	(b)	(i)	$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
			Reject:
		(ii)	No. of moles of $H_2SO_4 = 100/1000 \times 1 = 0.1 \text{ mol}$ [1]
			<u>Mole ratio of NaOH: <math>H_2SO_4 = 2:1</math></u> OR: If 0.1 mol of NaOH was used, 0.05 mol of $H_2SO_4$ is required. <u>NaOH is the limiting reactant</u>
			[1] correct calculation of number of moles of NaOH and $H_2SO_4$ to reflect the mole ratio of 1:1 [1] correct conclusion by using the reacting ratio in the equation to show that
			NaOH is the limiting reactant (source: 2021 B8 OR)
			<ul> <li>Allow:</li> <li>Full ecf from (b)(i)</li> <li>ecf for second mark only if NaOH is the LR (Eg. no credit if H<sub>2</sub>SO<sub>4</sub> is the</li> </ul>
			<ul> <li>urrong equation for (b)(i) and conclude that BOTH are limiting</li> </ul>
			<ul> <li>reject:</li> <li>wrong equation for (b)(i) and conclude that NEITHER are limiting</li> </ul>
	(c)	(i)	Since the temperature change of $+4.8  ^{\circ}C$ is the <u>same</u> for both experiments, the same quantity of reactants were used.
			[1] calculated the temperature change <b>and</b> mention that it is the 'same' (allow a range of 4.7 to 4.9 $^{\circ}$ C)
			Allow: • temperature 'rise', gain
			<ul> <li>no mention of data '4.8'</li> </ul>
		(ii)	• Only mention hearly the same, "almost the same – no mention of data The <u>gradient/slope</u> of the graph is <u>steeper</u> for <u>experiment 1</u> compared to experiment 2.
			Sodium hydroxide of a <u>smaller particle size/powdered form</u> could be used in experiment 1 compared to experiment 2.
			200 cm <sup>3</sup> of 0.5 mol/dm <sup>3</sup> of sulfuric acid was used in experiment 2.
			<ul> <li>[1] description of the gradient of the graph</li> <li>[1] explanation wrt particle size since sodium hydroxide used is a solid</li> <li>OR explanation wrt different concentration of acid used in Experiment 2 (better if specify volume to align with 'same quantity of reactants')</li> </ul>

		<ul> <li>Note: do not accept ideas such as</li> <li>Larger mass of sodium hydroxide (since same quantity was used)</li> <li>Conducted at a higher temperature (this would go against the aim of the experiment which is to collect information about temperature)</li> </ul>
		Conducted at higher pressure (solid and aqueous reactants were used)
		<ul> <li>"graph is" instead of gradient</li> <li>"rate of increase of T" instead of gradient</li> <li>Experiment 1 takes a shorter <u>time (need to refer to the shape of the graph to justify)</u></li> </ul>
		<ul> <li>Reject (wrt reason):</li> <li>Catalyst was used in experiment 1 (neutralisation rxn usually doesn't involve catalyst. Details for experiment 1 has been given in A6b)</li> <li>Specifying different concentration of Experiment 1 (given in question as 1.0 mol/dm<sup>3</sup>)</li> </ul>
		<ul><li>Allow (wrt reason):</li><li>An "inhibitor" was used in experiment 2</li></ul>
(4	d) 8 [ ii a	30 seconds 1] any value more than 50 seconds (as it demonstrates an understanding that the <i>nitial</i> concentration of hydrogen ions is lower in ethanoic acid compared to sulfuric acid, hence a slower rate of reaction
	۲ د	Note: though the amount of H <sup>+</sup> ions added is different, when ethanoic acid is used, both reactants will be completely used up.
	C	Discussion:
		<ul> <li>3600 s as an upper limit (ref from student 240 min – "BOD" for min)</li> </ul>

	Section B
(a)	Potassium oxide/ K <sub>2</sub> O
	To share in Markers' Report:
	Address the misconception of SiO <sub>2</sub> as a compound of alkali metals
(b)	The forces of attraction are <b>weak</b> enough to:
	<ul> <li>allow the layers of clay to <u>slide</u> past each other when a force is applied</li> <li>OR allow the clay to be <u>moulded</u> into shape/shape easily</li> </ul>
	<ul> <li>The forces of attraction are <b>useful</b> to:</li> <li><u>keep/maintain/hold the shape</u> of the clay object once shaped/when the force is removed</li> </ul>
	<ul><li>[1] why the intermolecular forces of attraction are weak</li><li>[1] why the intermolecular forces of attraction are <u>useful</u></li></ul>
	<ul> <li>To share in Markers' Report:</li> <li>"application" of weak intermolecular forces of attraction where it can be useful (shaping clay, use of blue tac, hair curlerspractical scenarios in daily life)</li> </ul>
(c)	Water boils to form water vapour/steam when heated above boiling point. [1]
	Steam/water vapour expands when heated/occupies a large volume [1].
	The clay pot will explode if heated too quickly, destroying the ceramic.
	[1] behaviour of particles in a change of state (move rapidly, random direction, high speed)
	[1] behaviour of particles in gaseous state (expansion in volume, increase pressure against the clay, force against the clay particles)
	Discussion: take reference to Chapter 1 WS(B) – a better answer because it covers concepts of Kinetic Particle Theory (microscopic perspective) Original answer: macroscopic perspective
	Allow:
	1 <sup>st</sup> mark: Description of how liquid water has changed to gaseous state
	2 <sup>nd</sup> mark: Steam occupies a larger volume than liquid water/ larger space between particles of water/
	clear explanation of increased pressure as a result of expansion of gas/ increased pressure
	• Reject: particles move at great speed and move randomly, gain kinetic energy, Gas particles have no fixed volume, acts against inside of the clay, leading to explosion (doesn't imply that it has expanded, because gas an be compressed),
	<ul> <li>To share in Markers' Report:</li> <li>Not to blindly use change in state in KPT (describe the behaviour of steam/particles of water vapour)</li> </ul>
	(a) (b)

	(d)	The removal of chemical water requires <u>more energy</u> because of the <u>strong covalent</u> <u>bonds</u> that require much more energy to overcome. [1] Hence a higher temperature is
		required.
		The removal of free water via evaporation requires less energy because of the weak
		[1] Hence a lower temperature is required.
		Or one mark for bonding and another mark for energy
		Alternative:
		Compare physical change vs chemical change [1]
		[1] explain the energy required to overcome strong covalent bonds in stage 2 [1] energy required to overcome weak intermolecular forces of attraction in stage 1
	(e)	Sulfur dioxide/sulfur trioxide
		Reject: need to talk the nature of the gas     Harmful gas
	(f)	As quartz malta, the particles change from vibrating and rotating from fixed positions to
	(1)	slipping and sliding over one another. [1]
		In the liquid state, quartz can <u>flow freely throughout/move freely</u> , filling up spaces/gap between the clay particles. [1]
		[1] description of the change in arrangement from solid to liquid
		[1] description of movement of liquid particles in the context of filling up spaces between the clay particles
	(g)	coloured/colourful oxides
		Note: do not accept generic properties of transition metal oxides
		high melting/boiling point

<b>B</b> 8	(a)	2Fe	+ $3/2O_2 + nH_2O \rightarrow Fe_2O_3.nH_2O$ or $4Fe + 3O_2 + 2nH_2O \rightarrow 2Fe_2O_3.nH_2O$				
		Iron	Iron reacts with oxygen in the presence of water to form rust				
		[4]	correctly belonged equation				
		[1] -	[1] – correctly balanced equation				
		1.1	$[1]$ – correct description of rusting, stating conditions (i.e., $O_2$ and $H_2O$ )				
		Reje	ct: because BOTH water and oxygen are reactants				
		•	iron reacts with oxygen and it is "hydrated" by water				
		•	water "hydrates" the rust				
	(h)	<i>(</i> i)	$Y < F_{\Theta} < X$ [1]				
	(6)	(ii)	In beaker <b>3</b> , iron nail does not rust shows that metal <b>X</b> is more reactive than Fe				
		()	as X is oxidised instead of Fe/metal X corrodes in place of/preferentially to Fe				
			In beaker 4, iron nail rusts completely shows that Fe is more reactive than metal $\mathbf{Y}$ has a finite protocological to $\int e^{3t} \sqrt{2}e^{-3t}$				
			f, hence <u>re is preferentially oxidised to re rusis/conodes in place</u>				
			<u>or protocontiality to metal 17</u>				
			[1m each] - correctly linking observations to relative reactivity of metals or stating				
			which metal is preferentially oxidised] (see answer examples above)				
			Allow:				
			<ul> <li>Iron metal went through oxidation, acting as sacrificial metal for Y (BOD)</li> </ul>				
		(iii)	<b>X</b> can be either Mg, Zn or any metal above Fe in reactivity series [1]				
			(reject Na, K as they will react explosively in cold water).				
	(2)	la cu	allow the stores of the different metals on elements have different sizes. The				
	(C)	in ar	a alloy, the <u>atoms</u> of the different metals or elements have <u>different sizes</u> . The				
		regu	ar <u>analigement of atoms</u> in the pare metal is <u>disrupted</u> .				
		The layers of atoms of different sizes cannot slide over each other easily when a force					
		<u>is ap</u>	plied. As a result, an alloy is stronger and harder than pure iron metal.				
		(asympton Taythask pg 240)					
		(Source: Texibook pg 249)					
		[1] correct description of atoms in an alloy and how the arrangement is disrupted					
		[1] impact of layers of atoms having different sizes					

<b>B9 E</b>	(a)	(i)	ethyl ethanoate [1]
		(ii)	Add Na <sub>2</sub> CO <sub>3</sub> or any other metal carbonate [reject Mg, Na as they react with water,
			not just acids]
			Effervescence of carbon dioxide that forms a white precipitate in limewater
			[1] – correct chemical test
			[1] – correct observations
			Allow:
			Add "metal carbonate" (BOD)
		(iii)	Reactants side – break 1 C-O bond in ester A and 1 O-H bond in water
			Products side – form 1 C-O bond in ethanoic acid and 1 O-H bond in ethanol
			Same number and same type of bonds broken and formed so net enthalpy
			change is zero as $\Delta H = \Sigma BE$ (bonds broken) - $\Sigma BE$ (bonds formed)
			[1] – for correcting stating the type of bonds broken and bonds formed
			[1] – for explaining net change is zero due to same number and same bonds
		<i>(</i> ) \	broken and formed or using equation for $\Delta H$ to explain.
		(IV)	Oxidation. [1]
	(h)	(i)	
	(u)	(1)	но но нно но
			́Н Н—Ċ—Н ́Н ́О́Н́
			н н
			(-COOH from glycolic acid with -OH from lactic acid) (-COOH from lactic acid with -OH from glycolic acid)
			Allow: $-OH$ , $-CH_3$ or $-COOH$ , $-CH_2-$ , $-COO-$ allowed. Not all bonds need to be
			snown as question asks for structural formula, not displayed / full structural
		/ii)	The polyesters formed will bydrolyse / break up / react with water to form
		(")	constituent diveolic acid and lactic acid which are highly soluble in water and are
			natural compounds found in the body
			[1] - any possible answer showing understanding of hydrolysis in body either to
			form soluble compounds or natural compounds

B9 OR	(a)	Alkanes [1]	
	(b)	(i)	mass of kerosene = 10.8 x 10700 = 115 560 kg $\approx$ 116 000 kg (3sf) [1]
			Accept:
			• "115 560 kg"
		(ii)	Step 1: number of mol of kerosene = $\frac{115560 \times 10^3}{(14 \times 12) + 30}$ = 583636.36 mol [1]
			Step 2: number of mol of CO <sub>2</sub> = $\frac{58363636}{2} \times 28 = 8170909.09$ mol [1]
			Step 3: mass of $CO_2 = 8170909.09 x^2 (12+32)$
			= 359520000 g - 359 520 kg
			$\approx 360\ 000\ \text{kg}\ (3\ \text{sf})\ [1]$
			Motes:     Marks should be awarded for correct method and computation.
			[Errors to look out for:
			<ul> <li>Step 1: correct conversion of kg to g before calculation of mole</li> <li>Step 2: use correct mol ratio (i.e. multiply by 1/2)</li> </ul>
			<ul> <li>Allow ecf marking from (i) / or any other mistakes made in Step 1 &amp; 2</li> </ul>
			<ul> <li>Punch in data from ECF to check whether computation is correct before</li> </ul>
	(0)	(1)	awarding ecf mark.
	(C)	(1)	Identified compound. CH <sub>3</sub> CHBICH <sub>2</sub> BI
			Hence, E is propene / $CH_3CH=CH_2$ [reject molecular formula, $C_3H_6$ ] + [1]
			<u>E has molecular formula <math>C_3H_6</math> as deduced from the cracking of Kerosene</u>
			E must be alkene which <u>undergoes addition reaction</u> with bromine to form <u>dibromoalkane with 2 bromine atoms attached to adjacent C</u> .
			[1] – correct identification of CH <sub>3</sub> CHBrCH <sub>2</sub> Br and correct identify of E.
			[No mark awarded for molecular formula given]
			[1] – correct reasoning to <u>why E is alkene</u> , either from molecular formula of E deduced from cracking equation or from addition reaction to form dibromoalkane
			[1] – correctly stating type of reaction (i.e., <u>Addition reaction</u> ) and correct description to form dibromoalkane with 2 bromine atoms attached to adjacent C [correct description can be exemplified by using relevant equation shown]
		(ii)	H CH-
			H H
			[1] - correct structure of polypropene, showing at least 1 repeating unit (allow ecf from
			(c)(i)
			[1] - any possible environment consequence (cannot be a general statement eg 'pollution', 'water pollution'
			Possible environmental consequence: focus on the disposal of plastic (TB Pg 479)
			Land pollution: Plastics are non-biodegradable, hence filling up landfill.
			<ul> <li>Air pollution: Burning / incinerating plastics produce poisonous / toxic gases.</li> <li>Water pollution: endanger marine sea animals who may mistake plastic bags</li> </ul>
			for food and consume them