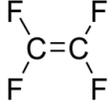


Question number	Answer	Notes	Marks
1 a	A (addition)		1
b	A (a molecule used to make a polymer)		1
c i	propene		1
ii		<p>M1 chain of two carbons joined by single bond AND both continuation bonds</p> <p>M2 one CH<sub>3</sub> group in any position AND three H atoms</p> <p>Do not penalise bond to H of CH<sub>3</sub> Reject any structure with double bond Allow multiple repeat units if correct Three or more CH<sub>2</sub> groups linked together scores 0/2 Ignore brackets and subscripted n</p>	2
d		<p>Accept Cl in any position Ignore bond angles Ignore brackets / n</p>	1

Question number	Answer	Notes	Marks
1 e i	<p>M1 (polymer) breaks down / decomposes / decays</p> <p>M2 by bacteria / microbes / microorganisms / decomposers /enzymes</p>	<p>Do not penalise compound / object / molecule / substance in place of polymer  Reject element in place of polymer  Ignore rots / degrades / digests / disintegrates  If reference to <u>not</u> breaking down etc, only M2 can be awarded</p> <p>Accept biologically / naturally</p> <p>M2 DEP on M1 or near miss</p>	2
ii	inert(ness) / unreactive / OWTTE	Ignore do not react with named chemical Ignore references to bond strengths / bond breaking	1
			<b>Total 9 marks</b>

Question number	Answer	Notes	Marks
2 (a) (i)		<p>ignore bond angles</p> <p>Ignore brackets and n</p> <p>Do not penalise FI</p>	1
(ii)	<p><b>M1</b> – a long chain (molecule)</p> <p><b>M2</b> – formed when (many) small molecules/monomers join (together)</p>	<p>accept large molecule / macromolecule</p> <p>Accept react/bond/add/link for join</p>	1
(iii)	poly(tetrafluoroethene)/poly(tetrafluoroethylene)	<p>accept names without brackets</p> <p>Ignore minor spelling errors</p> <p>Ignore PTFE</p> <p>accept Teflon</p>	1
(b)	<p><b>M1</b> (name) – ethene</p> <p><b>M2</b> (formula) – C<sub>2</sub>H<sub>4</sub></p>	<p>accept ethylene</p> <p>reject structural or displayed formula</p> <p>Penalise inappropriate use of upper and lower case letters or numbers</p> <p>No penalty for correct answers on wrong lines</p>	1

(c)	<b>M1</b> – (they) do not biodegrade	accept not broken down by bacteria / microbes / decomposers / microorganisms / enzymes	1
	<b>M2</b> – (because) they are inert / do not react / are unreactive	ignore do not react with any named chemical ignore references to bond strengths / bond breaking  Mark independently	1



(b)	<p>Any two from</p> <p><b>M1</b> – (many) small molecules/monomers join up</p> <p><b>M2</b> - double bond becomes single bond/ it becomes saturated</p> <p><b>M3</b> – increase in mass/chain length/size</p>	<p>OWTTE</p> <p>double bond breaks and single bond forms</p>		2
(c) (i)	<p>inert(ness)</p> <p>IGNORE strong bonds / long chains</p>	unreactive/non-polar		1
(ii)	<p><b>M1</b> – produces greenhouse gases/toxic gases/poisonous gases</p> <p><b>M2</b> – (landfill) uses up land / takes up space</p> <p>OR new sites hard to find</p>	carbon dioxide		1

(Total marks for Question 3 = 9 marks)

Question number	Answer	Notes	Marks
4 (a)	(the molecule) contains a (carbon to carbon) double bond	accept 'multiple bond' ignore refs to single bonds	1
(b) (i)	$C_8H_{18}$ <u>and</u> $C_2H_4$	Ignore names of compounds	1
(ii)	<b>M1</b> 600-700°C <b>M2</b> silica / alumina (catalyst)	accept 'aluminium oxide / silicon dioxide / aluminosilicate / zeolite' accept correct formulae	2
(c) (i)	<b>M1</b> (they have) the same <u>molecular</u> formula	allow 'both have same number of carbon and hydrogen (atoms as each other)'  accept 'the atoms are arranged differently'	2
(ii)	<b>M2</b> (but have) different structural formulae / displayed formulae / structures  $  \begin{array}{c}  \text{H} \\    \\  \text{CH}_3\text{CH}_2-\text{C}=\text{C} \\  \quad \quad   \quad \quad   \\  \quad \quad \text{H} \quad \quad \text{H}  \end{array}  $	accept $  \begin{array}{c}  \text{CH}_3 \quad \text{H} \\  \diagdown \quad / \\  \text{C}=\text{C} \\  / \quad \diagdown \\  \text{H} \quad \text{CH}_3  \end{array}  $ ignore bond angles accept fully displayed formula	1

4 (d) (i)	poly(propene) / polypropene  (ii) $  \begin{array}{c}  \text{CH}_3 \quad \text{H} \\    \quad   \\  -\text{C} - \text{C}- \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $ <p><b>M1</b> correct structure <b>M2</b> extension bonds</p>	accept 'polypropylene'  ignore brackets and 'n'  <b>M2</b> dep on <b>M1</b> except award <b>M2</b> if >1 repeat unit given	1  2
(e)	$  \begin{array}{c}  \text{H} \quad \text{COOCH}_3 \\    \quad   \\  \text{C} = \text{C} \\    \quad   \\  \text{H} \quad \text{CN}  \end{array}  $	penalise incorrect use of upper / lower case letters and subscripts penalise bonds to incorrect atoms	1

Question number	Answer	Notes	Marks
5 a	reference to line/curve/temperature /graph/it AND not reached minimum / not constant / not level /not horizontal /still falling /decreasing/changing	Ignore reference to correlation Ignore has not reached zero / x-axis Ignore does not become	1
b	(better) insulator (than glass) OR poor conductor (of heat)	Accept equivalents such as prevents heat from entering / keeps out heat better Allow stops heat escaping / traps heat Reject references to keeping temperature constant Ignore references to breaking glass	1
c i	effervescence / fizzing / bubbles OR colourless solution/liquid formed	Accept carbon dioxide <u>gas</u> Accept gas given off/evolved/formed Ignore identity of gas Accept solid disappears/dissolves Ignore hissing and other sounds	1
ii	Neutralisation  endothermic	Accept acid-base / acid-alkali  M1 and M2 independent Accept answers in either order Do not penalise contradictions such as exothermic and endothermic – this answer is worth 1 mark	1  1

Question number	Answer	Notes	Marks
5 d i	product formulae or names / products (word) above reactants	Horizontal line not needed Ignore formula errors and one or two missing product(s) Ignore curves and intermediates	1
ii	(approximately) vertical line between reactants and products / between two levels AND labelled $\Delta H$ / energy change / heat change / enthalpy change	Ignore arrowheads on vertical line Ignore sign of $\Delta H$ Mark can be awarded for exothermic reaction Accept 2310 or any other number in place of $\Delta H$	1

Question number	Answer	Notes	Marks
5 (e) i	temperature change = (-)5.5 (°C)	Award M1 for 5.5 anywhere	1
	heat change (= $100 \times 4.2 \times 5.5$ ) = 2310/2300 (J)	CQ on candidate temperature change, provided other values correct Accept answer in kJ Ignore signs Correct final answer scores 2 2.31 (J) scores 1 mark if M1 not awarded	1
ii	concentration (of vinegar / (ethanoic) acid / $\text{CH}_3\text{COOH}$ )	Ignore strength Ignore reference to $M_r$ Accept concentration even if in an incorrect expression	1
		<b>Total</b>	<b>10</b>

Question number	Expected Answer	Accept	Reject	Marks
6 (a) (i)	M1 contains carbon and hydrogen (atoms / elements / particles)	C and H for carbon and hydrogen	ions / carbon molecules / hydrogen molecules / H <sub>2</sub> / mixture of C and H	1
	M2 only	other equivalent words, eg solely / entirely / completely		1
	M2 DEP on M1, but allow M2 if molecules / ions / mixture used in M1			
(ii)	C <sub>10</sub> H <sub>22</sub> IGNORE structural formula	H <sub>22</sub> C <sub>10</sub>	Reject superscripts / lower case c or h / full size numbers	1
(b) (i)	addition	additional		1
(ii)	M1 one of the bonds in the double bond breaks	double bond breaks / double bond becomes single bond		1
	M2 (many) <u>ethene(s)/molecules/monomers</u> join (together)  OR  (many) <u>ethene(s)/molecules/monomers</u> form a chain	changes (from unsaturated) to saturated		1

Question number	Expected Answer	Accept	Reject	Marks
6 (c)	<p>Any 4 from:</p> <ul style="list-style-type: none"> <li>• produces smaller / shorter (chain) molecules</li> <li>• smaller / shorter (chain) molecules more useful (as fuels) / have greater demand</li> <li>• smaller / shorter (chain) molecules burn more cleanly / are used to make petrol/diesel/fuel for vehicles</li> <li>• crude oil richer in / has a surplus of long (chain) molecules</li> <li>• produces alkenes / any named alkene</li> <li>• alkenes used to make alcohol / polymers / plastics / chemical feedstock / any named addition polymer</li> </ul>	<p>ORA low(er) demand products converted to high(er) demand products</p> <p>ORA</p>		4

Question number	Answer	Notes	Marks
7 a	hydrogen / H <sub>2</sub>	Ignore H	1
b	<u>only</u> single bonds (between carbon atoms) /single bond(s) between carbon atoms	ignore between C and H Accept no double bond(s) / no multiple bond(s) Ignore answers that refer to numbers of hydrogens	1
c i	$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{Br}-\text{C}-\text{C}-\text{Br} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $	Accept Br atoms in any position provided one on each carbon	1
ii	C (the product of the reaction is colourless)		1
d	$  \begin{array}{cccc}  \text{H} & \text{CH}_3 & \text{H} & \text{H} \\    &   &   &   \\  \cdots & \text{C} & -\text{C} & -\text{C} & \cdots \\    &   &   &   \\  \text{H} & \text{H} & \text{H} & \text{CH}_3  \end{array}  $	M1 for 4 × C AND 6 × H and 2 × CH <sub>3</sub> M2 for extension bonds and two CH <sub>3</sub> groups on alternate carbon atoms (can be both above or both below carbon chain) M2 DEP on M1 Do not penalise bonds to H of CH <sub>3</sub> Ignore brackets and subscripted n If any double bond shown, then 0/2	2
e	$  \begin{array}{c}  \text{F} \quad \quad \text{F} \\  \diagdown \quad / \\  \text{C} = \text{C} \\  / \quad \quad \diagdown \\  \text{F} \quad \quad \text{F}  \end{array}  $	Reject any extension bonds Ignore bond angles Do not penalise more than one correct structure	1

Question number	Answer	Notes	Marks
7 f i	(polymer) breaks down / decomposes / decays  by bacteria / microbes / microorganisms	Do not penalise compound / object / molecule / substance in place of polymer Reject element in place of polymer Ignore rots / degrades / digests / disintegrate If reference to <u>not</u> breaking down etc, only M2 can be awarded Ignore naturally / enzymes	1  1
ii	inert / unreactive / OWTTE	Ignore do not react with named chemical Ignore references to bond strengths / bond breaking	1
<b>Total 10 marks</b>			