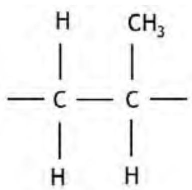
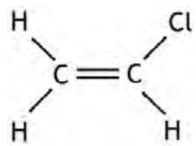
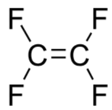
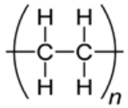
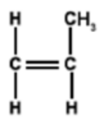
Question number	Answer	Notes	Marks
1 a	A (addition)		1
b	A (a molecule used to make a polymer)		1
c i	propene		1
ii		M1 chain of two carbons joined by single bond AND both continuation bonds M2 one CH_3 group in any position AND three H atoms Do not penalise bond to H of CH_3 Reject any structure with double bond Allow multiple repeat units if correct Three or more CH_2 groups linked together scores 0/2 Ignore brackets and subscripted n	2
d		Accept Cl in any position Ignore bond angles Ignore brackets / n	1

Question number			Answer	Notes	Marks
1	e	i	M1 (polymer) breaks down / decomposes / decays M2 by bacteria / microbes / microorganisms / decomposers /enzymes	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 Accept biologically / naturally M2 DEP on M1 or near miss	2
		ii	inert(ness) / unreactive / OWTTE	Ignore do not react with named chemical Ignore references to bond strengths / bond breaking	1
					Total 9 marks

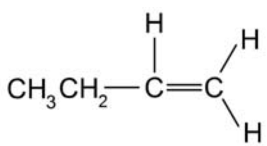
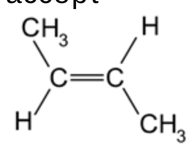
Question number	Answer	Notes	Marks
2 (a) (i)		ignore bond angles Ignore brackets and n Do not penalise Fl	1
(ii)	**M1** – a long chain (molecule)	accept large molecule / macromolecule	1
	M2 – formed when (many) small molecules/monomers join (together)	Accept react/bond/add/link for join	1
(iii)	poly(tetrafluoroethene)/poly(tetrafluoroethylene)	accept names without brackets Ignore minor spelling errors Ignore PTFE accept Teflon	1
(b)	**M1** (name) – ethene	accept ethylene	1
	M2 (formula) – C_2H_4	reject structural or displayed formula Penalise inappropriate use of upper and lower case letters or numbers No penalty for correct answers on wrong lines	1

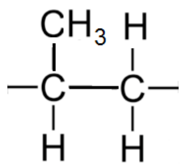
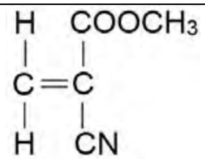
(c)	**M1 –** (they) do not biodegrade **M2 –** (because) they are inert / do not react / are unreactive	accept not broken down by bacteria / microbes / decomposers / microorganisms / enzymes ignore do not react with any named chemical ignore references to bond strengths / bond breaking Mark independently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

Question number	Answer	Accept	Reject	Marks
3 (a)	M1 – 	continuation bonds not going through brackets		1
	M2 – any suitable use, eg: • plastic bags • buckets/bowls • storage bottles (for food, drinks, chemicals) • garden furniture • gas pipes • rubbish bins • storage tanks for fuel • cling film • packaging • clothing • insulation (for electric cables) Please research any unfamiliar use		just plastic	1
	M3 – poly(propene)	polypropene polypropylene		1
	M4 -  IGNORE bond angles	methyl group attached to any carbon methyl group displayed		1

(b)	Any two from M1 – (many) small molecules/monomers join up M2 - double bond becomes single bond/ it becomes saturated M3 – increase in mass/chain length/size	OWTTE double bond breaks and single bond forms		2
(c) (i)	inert(ness) IGNORE strong bonds / long chains	unreactive/non-polar		1
(ii)	M1 – produces greenhouse gases/toxic gases/poisonous gases	carbon dioxide		1
	M2 – (landfill) uses up land / takes up space OR new sites hard to find			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)	M1 600-700°C M2 silica / alumina (catalyst)	accept 'aluminium oxide / silicon dioxide / aluminosilicate / zeolite' accept correct formulae	2
(c) (i)	M1 (they have) the same <u>molecular</u> formula M2 (but have) different structural formulae / displayed formulae / structures	allow 'both have same number of carbon and hydrogen (atoms as each other)' accept 'the atoms are arranged differently'	2
(ii)		accept  ignore bond angles accept fully displayed formula	1

4 (d) (i)	poly(propene) / polypropene	accept 'polypropylene'	1
(ii)	 M1 correct structure M2 extension bonds	ignore brackets and 'n' M2 dep on M1 except award M2 if >1 repeat unit given	2
(e)	 	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	Accept acid-base / acid-alkali	1
			endothermic	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

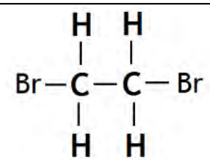
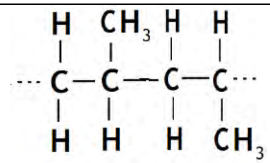
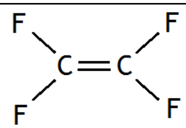
Question number	Answer	Notes	Marks
5 d i	product formulae or names / products (word) above reactants	Horizontal line not needed Ignore formula errors and one or two missing product(s) Ignore curves and intermediates	1
ii	(approximately) vertical line between reactants and products / between two levels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

Question number	Answer	Notes	Marks
5 (e) i	temperature change = (–)5.5 (°C) heat change (= 100 × 4.2 × 5.5) = 2310/2300 (J)	Award M1 for 5.5 anywhere 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 1
ii	concentration (of vinegar / (ethanoic) acid / CH_3COOH)	Ignore strength Ignore reference to M_r Accept concentration even if in an incorrect expression	1
		Total	10

EXAM PAPERS PRACTICE

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_2 / 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)	$C_{10}H_{22}$ IGNORE structural formula	$H_{22}C_{10}$	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 changes (from unsaturated) to saturated		1
	M2 (many) <u>ethene(s)</u>/<u>molecules</u>/<u>monomers</u> join (together) OR (many) <u>ethene(s)</u>/<u>molecules</u>/<u>monomers</u> form a chain			1

Question number	Expected Answer	Accept	Reject	Marks
6 (c)	Any 4 from: • produces smaller / shorter (chain) molecules • smaller / shorter (chain) molecules more useful (as fuels) / have greater demand • smaller / shorter (chain) molecules burn more cleanly /are used to make petrol/diesel/fuel for vehicles • crude oil richer in / has a surplus of long (chain) molecules • produces alkenes / any named alkene • alkenes used to make alcohol / polymers / plastics / chemical feedstock / any named addition polymer	ORA low(er) demand products converted to high(er) demand products ORA		4

Question number			Answer	Notes	Marks
7	a		hydrogen / H_2	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		Accept Br atoms in any position provided one on each carbon	1
		ii	C (the product of the reaction is colourless)		1
	d			M1 for 4 × C AND 6 × H and 2 × CH_3 M2 for extension bonds and two CH_3 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_3 Ignore brackets and subscripted n If any double bond shown, then 0/2	2
	e			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
			Total 10 marks