

Question number	Answer	Notes	Marks
1 (a)	nitrogen / N ₂	accept N	1
(b)	oxygen AND water	accept steam	1
(c)	incomplete combustion (of the octane / fuel)	accept '(burns in a) limited supply / shortage of oxygen/air' reject 'no oxygen'	1
(d) (i)	$N_2 + 2O_2 \rightarrow 2NO_2$	accept halves and multiples accept as two correct equations via NO	1
(ii)	(It produces) acid rain OR (it causes) breathing problems / asthma	accept 'photochemical smog' ignore refs to greenhouse gas / global warming / climate change ignore refs to pollution	1

Question number	Answer	Notes	Marks
2 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	$ \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} & -\text{C} & \cdots \\ & & & \\ \text{H} & \text{H} & \text{H} & \text{CH}_3 \end{array} $	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	$ \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
2 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			

Question number	Answer	Accept	Reject	Marks
3 (a)	<p>M1 C₆H₁₄</p> <p>M2 58</p> <p>M3 any value in the range 25 to 45</p>			1 1 1
(b)	boiling point/it <u>increases</u> as <i>M_r</i> <u>increases</u>	reverse argument positive correlation as one increases the other increases	directly proportional	1
(c)	<p>different <u>general</u> formulae /</p> <p>OR</p> <p>(general) formula of ethene is <u>not</u> C_nH_{2n+2} / (general) formula of ethane is <u>not</u> C_nH_{2n}</p> <p>OR</p> <p>use of/ mention of displayed formulae to show/indicate double (C to C) bond in ethene <u>and</u> single (C to C) bond in ethane</p>	same number of carbon atoms but different number of hydrogen atoms	just different number of hydrogen atoms	1
(d) (i)	<p>M1</p> <pre> H H H H H - C - C - C - C - H H H H H </pre> <p>M2</p> <pre> H H H H - C - C - C - H H C H H </pre> <p>penalise one missing H or one missing bond once only accept answers in either order</p>			1 1
(ii)	(structural) isomer(s)	isomerism		1

3	(e)	(i)	$C_2H_6 + Br_2 \rightarrow C_2H_5Br + HBr$ M1 – C_2H_5Br M2 – rest of equation correct M2 dep on M1 IGNORE state symbols	further substituted formula structural or displayed formulae		2	
		(ii)	substitution	bromination/halogenation		1	
		(iii)	ultraviolet/uv (radiation)	uv light sunlight	light on its own	1	
						Total	12

Question number		Answer	Notes	Marks
4 a	M1	(compound/molecule/substance containing) carbon and hydrogen (atoms)	Reject atoms/elements in place of compounds Reject molecules in place of atoms Reject mixture Accept C and H in place of carbon and hydrogen	1
	M2	only	M2 dependent on M1 or near miss, eg mixture of C and H Accept equivalent wording such as alone / purely / solely	1
b		contains (C=C) double bonds	Accept multiple bonds Reject implied C=H	1

Question number		Answer	Notes	Marks
4	c	i	alkene(s)	1
		ii	C_nH_{2n}	1
		iii	M1 same/similar chemical properties	2
		M2	trend/gradation in physical properties	
		M3	same functional group	
		M4	(neighbouring) members differ by CH_2	
				Any two for 1 each

Question number			Answer	Notes	Marks
4	d	i	but-1-ene	Accept butene Ignore mention of cis or trans	1
		ii	C_4H_8		1
		iii	M1 (compounds/molecules with) same molecular formula / same number of each type of atom	Do not penalise specific compound types, eg hydrocarbons / alkenes If elements/atoms in place of compounds, max 1 for Q Ignore references to chemical/general/empirical formula	1
			M2 different structure(s) / different structural formula(e) / different displayed formula(e)	Ignore atoms in a different order	1
		iv	displayed formula of but-2-ene or methylpropene	Accept cyclobutane or methylcyclopropane Ignore but-1-ene structure	1
	e	i	colourless / decolorised	Ignore clear	1
		ii	$C_2H_4Br_2$	Insist on correct use of subscripts and cases of letters Do not penalise elements in different order Accept correct structural/displayed formula	1
Total					14