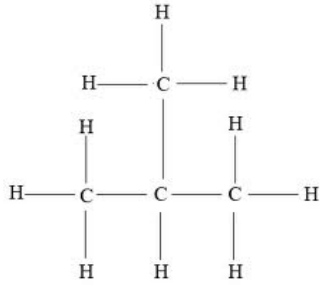
Question number	Answer	Notes	Marks
1 (a) (i)	(saturated) – <u>all</u> (carbon to carbon) bonds are single / no (carbon to carbon) double bonds	accept no (carbon to carbon) multiple bonds ignore any references to hydrogen	1
(ii)	**M1 -** (compounds/substances/molecules) containing hydrogen and carbon (atoms/elements)	reject atoms/elements/ions/mixture in place of compounds reject compounds/substances/molecules in place of atoms/elements	1
	M2 - only	accept other terms with same meaning, e.g. solely, exclusively, just **M2** DEP on mention of hydrogen and carbon / C and H and no other element	1
(iii)	**C** (C_5H_{12})		1
(b) (i)	$C_8H_{18} + 12.5O_2 \rightarrow 8CO_2 + 9H_2O$ **M1** – all formulae correct **M2** – balanced using correct formulae	accept multiples	2
(ii)	carbon monoxide	If both name and formula given, mark name only accept correct formula	1

Question number	Answer	Notes	Marks
1 (c) (i)	(provides an alternative pathway of) lower activation energy	Accept (molecules adsorb onto catalyst and covalent) bonds weakened	1
(ii)	silica/silicon dioxide/alumina/aluminium oxide	accept correct formulae accept aluminosilicate(s) accept zeolite(s) ignore silica oxide and alumina oxide If both name and formula given, mark name only	1
(iii)	C_2H_4	Accept structural or displayed formula	1
(iv)	ethene	accept ethylene	1

Question number	Answer	Accept	Reject	Marks
2 (a) (i)	A	Methane		1
(ii)	C	Ethene		1
(iii)	C	Ethene		1
(b)	**M1** – (molecular) C_4H_{10}	$H_{10}C_4$	$CH_3CH_2CH_2CH_3$	1
	M2 – (empirical) C_2H_5	H_5C_2		1
	ECF from molecular formula			
(c) (i)	**M1** – (name) alkane(s)			1
	M2 – (general formula) C_nH_{2n+2}			1
(ii)			missing Hs and bonds	1
	IGNORE bond angles			

(d)	**M1 –** incomplete combustion/insufficient oxygen **M2** – toxic/poisonous/causes death IGNORE dangerous/harmful **M3** – reduces the capacity of the blood to carry oxygen IGNORE references to suffocation/cannot breathe IGNORE blood carries no oxygen	lack of oxygen /less oxygen / <u>only</u> 1½ oxygen (in equation) correct references to haemoglobin /blood carries less oxygen/blood does not release oxygen as easily		1 1 1

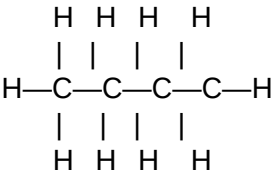
(Total marks for Question 2 = 11 marks)

Question number	Answer	Accept	Reject	Marks
3 (a)	large hydrocarbons/alkanes/molecules become small ones IGNORE references to forming alkenes/ethene/ more useful molecules	(large) hydrocarbons or alkanes or molecules become smaller ones long chains become short chains	references to polymers	1
(b)	**M1** – (add to) bromine (water)/Br_2 IGNORE Br **M2** – (bromine) decolourised/turns colourless IGNORE starting colour and clear **M2** dep on **M1**, but can be scored for a near miss in **M1**,eg Br or bromide (water)	(acidified) potassium manganate(VII) decolourised/turns colourless		1 1
(c)	**M1** – (catalyst) silica / silicon dioxide / alumina / aluminium oxide **N.B.** if both name and formula given, mark the name only **M2** – 600-700 ºC	correct formula aluminosilicate / zeolite any value or range within this range equivalent temperatures in Kelvin		1 1

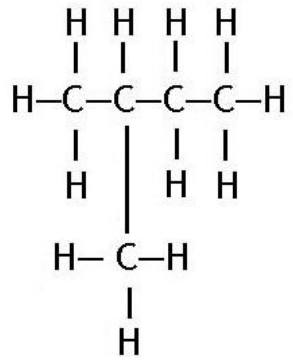
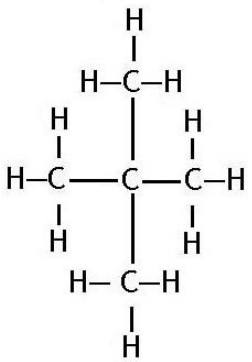
(Total marks for Question 3 = 5 marks)

Question number	Answer	Accept	Reject	Marks
4 (a)	**M1** (molecules/compounds/substances) with the same molecular formula/number of each type of atoms	hydrocarbons	elements/atoms general formula/empirical formula for **M1** only	1
	IGNORE chemical formula/same compound	atoms arranged differently		1
	M2 (but) different structural formulae/different displayed formulae/different structures			
(b)	D			1
(c) (i)	**M1** C_nH_{2n}	letters other than n, e.g.	C_n+H_{2n}	1
(ii)	**M1** double bond between two left hand end carbon atoms			1
	M2 single bond between each pair of rest of carbon atoms			1
	Penalise max 1 mark for any extra bond shown			
(d)	**M1** addition	additional		1
	M2 orange	yellow/brown	red, either on its own or in combination with	1
	M3 colourless **IGNORE** clear/transparent/looks like water		any other colour	1
(e)	**M1** saturated – all (carbon to carbon) bonds are single /contains only (carbon to carbon)	does not contain any multiple/double bonds		1

	single bonds **M2** unsaturated - contains (carbon to carbon) double/multiple bond(s)			1
			Total	**11**

Question number	Answer	Notes	Marks
5 (a) (i)	CH_4	Accept H_4C	
(ii)	C_2H_6	Accept H_6C_2	1
(iii)	$CH_3CH_2CH_3$	Accept CH_3-CH_2-CH_3 / H_3C-CH_2-CH_3	1
(iv)			1
(b) (i)	alkane(s)		1
(ii)	C_nH_{2n+2}	Accept x and other letters in place of n Accept answers like $C_nH_{2n}+2$ Ignore brackets that still give same answer	1
(iii)	similar chemical properties / characteristics / reactions / behaviour	Accept 'same chemical properties' but ignore a specific example, eg all react with oxygen	
	same functional group		
	(neighbouring members) differ by CH_2	Accept 'methylene group'	
	gradation/gradual change/trend in physical properties	Accept gradation/gradual change/increase/decrease in specified property, eg boiling point Reject same / similar physical properties	
		Accept any two for 1 mark each Accept two answers in lines 1 or 2	2

5 (c) (i)	$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$	All formulae correct Ignore balanced nitrogen on both sides Balancing dep on M1 Ignore state symbols Accept fractions and multiples	1 1
(ii)	carbon / C	Accept soot Ignore graphite Reject coke	1
	carbon monoxide / CO	Award 1 for both correct answers in wrong order	1

Question number	Answer	Notes	Marks
5 (d)		Accept in either order Award 1 mark for two correct isomers as structural formulae Award 1 mark for two correct isomers as skeletal formulae Ignore names	1
			1
(e) (i)	UV (light) / ultraviolet (light)	Accept sunlight Ignore ref to temperature	1
(ii)	bromomethane	Accept 1-bromomethane / methyl bromide / monobromomethane Ignore hyphens / spaces	1
(iii)	$CH_4 + Br_2 \rightarrow CH_3Br + HBr$	Award M1 for CH_3Br Award M2 for other formulae and correct balancing Max 1 for error in symbol e.g. BR, br Ignore state symbols Accept further bromination in (ii) and (iii)	1 1

Total 18 marks