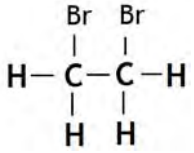
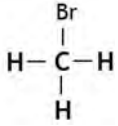
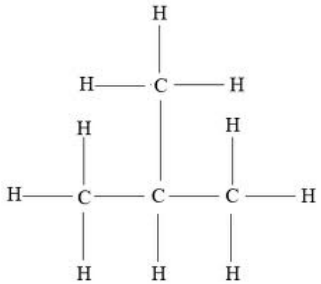
Question number	Answer	Notes	Marks
1 a i	C_5H_{12}	Accept $H_{12}C_5$ Ignore gap between C_5 and H_{12} Ignore names Ignore C_nH_{2n+2}	1
ii	CH_2Br	Accep elements in any order Ignore molecular formula Ignore $2CH_2Br$ Penalise inappropriate use of upper or lower case letters or numbers(eg CH2Br / CH_2BR / CH^2Br)	1
b i	R <u>and</u> U	Accept in either order	1
ii	D (C_nH_{2n})		1
c	C (compound R → compound Q)		1

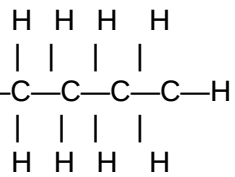
Question number	Answer	Notes	Marks
1 d	M1  M2 (1,2-)dibromoethane	Mark M1 and M2 independently Accept Br atoms in any positions so long as on different carbon atoms Ignore any numbers Accept ethylene dibromide	2
e i		Ignore balancing in equation Ignore molecular formula	1
ii	bromomethane		1
iii	UV or ultraviolet (light/radiation)	Accept sunlight Ignore all references to heat and temperature Ignore references to pressure	1
iv	D (substitution)		1

Question number	Answer	Notes	Marks
1 f i	M1 setting out division of each % by A_r OR evaluation C H F 36.4 6.0 57.6 12 1 19 OR 3 6 3	Award 0/3 if division by any atomic numbers / wrong way up / multiplication used Do not penalise roundings or minor misreads of % values (eg 56.7 for fluorine) Do not penalise use of Fl in (i) If molecular masses used for H and/or F, lose M1 but M2 and M3 can be awarded: using 2 and 38 gives C_2H_2F using 2 and 19 gives CHF Using 1 and 38 gives C_2H_4F Working required for these answers M2 subsumes M1 Accept elements in any order Award 3 marks for correct final answer with no working	3
	M2 simplest whole number ratio (1:2:1 or ratio shown in notes for M1) M3 CH_2F		
ii	$C_2H_4F_2$	Accept elements in any order Do not accept $C_2H_4Fl_2$	1
		Total 15 marks	

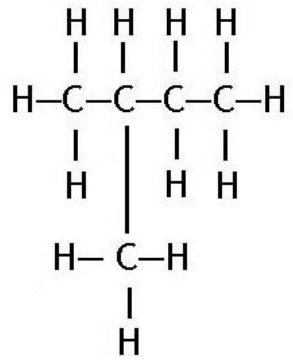
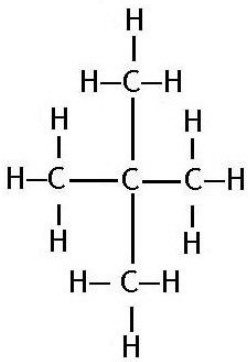
Question number	Answer	Accept	Reject	Marks
2 (a) (i)	A	Methane		1
(ii)	C	Ethene		1
(iii)	C	Ethene		1
(b)	**M1** – (molecular) C_4H_{10} **M2** – (empirical) C_2H_5 ECF from molecular formula	$H_{10}C_4$ H_5C_2	$CH_3CH_2CH_2CH_3$	1 1
(c) (i)	**M1** – (name) alkane(s) **M2** – (general formula) C_nH_{2n+2}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

(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

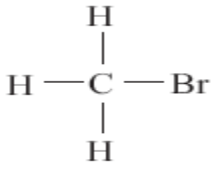
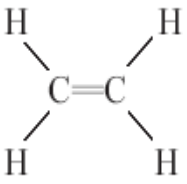
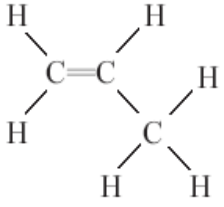
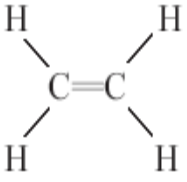
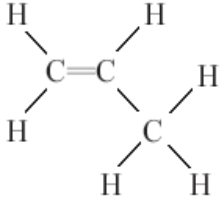
(Total marks for Question 2 = 11 marks)

Question number	Answer	Notes	Marks
3 (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

3 (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 carbon monoxide / CO	Accept soot Ignore graphite Reject coke Award 1 for both correct answers in wrong order	1 1

Question number	Answer	Notes	Marks
3 (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

Question number				Answer	Notes	Marks
4	a	i		S	Accept diagram: 	1
		ii	M1	T / U	Accept diagrams:  / 	1
		iii	M1	T / U	Accept diagrams:  /  Do not penalise if both T and U are given Do not award the mark if either or both of T or U is given and any other letter is included	1

Question number				Answer	Notes	Marks
4	b		M1	(add) bromine (water)	If bromide, then 0/2 Do not allow bromine in UV light, but M2 can be awarded	1
			M2	decolourised / goes colourless	Ignore starting colour of bromine Ignore clear / discolours Reject bleached	1
	c		M1	displayed formula of but-1-ene, but-2-ene or methylpropene	All atoms and bonds must be shown Allow dienes	1
	d	i	M1	C_nH_{2n+2}	Accept x and other letters in place of n Accept answers like $C_nH_{2n}+2$ Ignore brackets	1
		ii	M1	same/similar chemical properties / reactions / behaviour / characteristics	Ignore specific example such as react with oxygen Ignore similar (type of) reactivity	
			M2	gradation /gradual change / trend / increase / decrease of physical properties	Accept reference to specific property, eg boiling point Reject same / similar physical properties	
			M3	(neighbouring members) differ by CH_2		2
			M4	same functional group	Any two for 1 each Accept two answers on one answer line	

Question number				Answer	Notes	Marks
4	e		M1 M2	(compounds / molecules with) same molecular formula / same number of each type of atom different structures / structural formulae / atoms arranged differently / different displayed formulae	Ignore same chemical formula Ignore hydrocarbons If atoms or elements instead of compounds or molecules, max 1 for Q	1 1

Total 11 marks