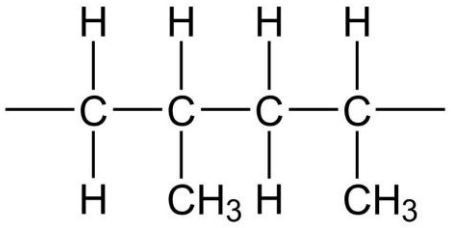
Question number	Answer	Notes	Marks
1 (a) (i)	Q R S P M1 Q and P correct M2 R and S correct		2
(ii)	M1 magnesium chloride M2 hydrogen M1 and M2 can be in either order	ACCEPT correct formulae IGNORE incorrect formulae	2
(b)	M1 (add) (aqueous) silver nitrate / $AgNO_3$ M2 white precipitate (forms)	IGNORE refs to nitric acid do not award M1 if hydrochloric acid also added M2 dep on mention of silver nitrate in M1	2

Question number	Answer	Notes	Marks
2 a	M1 (they/all) contain hydrogen and carbon (atoms) M2 only	Accept H and C Accept particles/elements in place of atoms Reject ions/molecules/compounds in place of atoms Reject element instead of they/all Reject H_2 Reject mixture Accept words with other meaning (eg solely/ exclusively) M2 DEP on reference to hydrogen and carbon even if M1 not awarded	2
b	double bond	Accept multiple in place of double Accept contain C=C Ignore references to single bonds	1
c	A		1
d	B and E and F	All three correct scores 2 marks Two correct scores 1 mark If more than three answers given lose one mark for each error eg BCEF scores 1 mark	2
e	because it has no double bond(s) / has only single bonds / is saturated	Accept because only unsaturated compounds decolourise bromine water Accept because only alkenes decolourise bromine water Accept because it's not an alkene Accept because it's not unsaturated Accept because it's a (cyclo)alkane	1

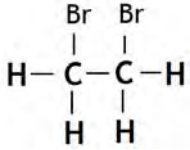
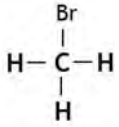
Question number	Answer	Notes	Marks
2 f i	M1 for setting out calculation If division upside down or division by one or more atomic numbers, then 0/3	C H Br 22.2 / 12 : 3.7 / 1 : 74.1 / 80	
	M2 for obtaining ratio Accept any number of sig figs except one Allow 0.92	1.85 : 3.7 : 0.93	
	M3 for whole number ratio M3 DEP on M2	2 : 4 : 1	
	allow alternative method: M1 calculation of M_r C_2H_4Br = 108 M2 expression for % of <u>each</u> element eg C: 24/108 x100 M3 evaluation to show these equal 22.2%, 3.7%, 74.1%		3
ii	M1 ((2×12) + (4×1) + (1×80) =) 108 M2 (216 ÷ 108 = 2) (so molecular formula is) $C_4H_8Br_2$	correct answer with no working scores 2	2

Question number	Answer	Notes	Marks
3 a i	fuel oil		1
ii	fuel oil		1
iii	gasoline		1
b i	alumina / silica	Accept aluminosilicates/zeolites Accept aluminium oxide/silicon dioxide/silicon oxide/silicon (IV) oxide Accept correct formulae	1
ii	M1 for correct formula - C_4H_8	Accept C_4H_8 + C_4H_8 for 2 marks	2
	M2 for correct coefficient - 2	Award 1 mark for $4C_2H_4$ Award 1 mark for C_8H_{16} Award 1 mark for two alkenes which have a total of 8C and 16H eg C_3H_6 + C_5H_{10}	

iii	M1	over/greater supply of long-chain hydrocarbons/molecules/ heavy/heavier fractions / OWTTE	Accept long chain hydrocarbons/molecules heavy/heavier fractions are of less use (as fuels)	3
	M2	high demand/more use for short-chain/small hydrocarbons/ light/lighter fractions / OWTTE	Accept answers in terms of petrol / fuel (for cars) Short chain hydrocarbon molecules are more useful/in greater demand than long chain hydrocarbons/molecules scores M1 and M2	
	M3	Alkenes used to make polymers	Accept specific alkene and product eg ethene to make poly(ethene)/ethanol/alcohol	
c	M1	forms sulfur dioxide (when burned)		2
	M2	which causes specified problem for environment OR specified problem for humans	eg acid rain / damages trees / kills fish eg toxic / respiratory irritant / triggers asthma attacks Ignore harmful gas	

Question number	Answer	Notes	Marks
3 d		M1 for only <u>two</u> (of the four) carbon atoms both with two H eg $-CH_2-CH_2-CH_2-CH_2-$ scores 0 M2 for (the other) <u>two</u> carbon atoms each with one H and one CH_3 No M2 if methyl groups on 1st + 2nd, or on 3rd + 4th carbons in chain Do not penalise bonds to H of CH_3 Max 1 if chain extended correctly Ignore brackets and n each carbon must have four bonds eg $-CH_2-CH-CH-CH_2-$ scores 0 if terminal Hs added max 1 0/2 if any double bonds shown	2

Question number	Answer	Notes	Marks
4 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 and U	Accept in either order	1
ii	D (C_nH_{2n})		1
c	C (compound R → compound Q)		1

Question number	Answer	Notes	Marks
4 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
4 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 M2 simplest whole number ratio (1:2:1 or ratio shown in notes for M1) M3 CH_2F	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
ii	$C_2H_4F_2$	Accept elements in any order Do not accept $C_2H_4Fl_2$	1
		Total 15 marks	