

Question number	Answer	Notes	Marks
1 (a)	C	Accept formula of C	1
1 (b) i	(compound/molecule/substance containing) carbon and hydrogen (atoms/elements)	Reject atom/element in place of compound/molecule Reject compound/molecule in place of atoms/elements Reject mixture	1
	Only	M2 dependent on mention of carbon and hydrogen even if M1 not awarded Accept other terms with same meaning, e.g. solely / exclusively / just	1
	A	M3 independent Accept name/formula of A	1
	ii contains a (C=C) double bond	Accept multiple bond Ignore references to type of compound, eg hydrocarbon Reject double bond between C and H Do not penalise incorrect terms such as atom or element Ignore not all bonds are single Accept can undergo addition reactions Accept does not contain the maximum number of hydrogens/hydrogen atoms	1
	B	M2 independent Accept name/formula of B	1

	Answer	Notes	Marks
1 b iii	(compounds / molecules / substances with) same molecular formula / same number of each type of atom	Ignore same (chemical) formula /same compound No penalty for reference to hydrocarbons Reject same empirical/general formula If atoms or elements instead of compounds or molecules, only 1 of M1 and M2 can be awarded	1
	different structures /different structural/displayed formulae OR atoms arranged differently	Ignore different molecular arrangement	1
	C and F	Accept in either order Accept formulae of C and F	1

Question number	Answer	Notes	Marks
1 c i	<p>same/similar chemical properties/reactions/behaviour/characteristics</p> <p>gradation / gradual change / trend / increase / decrease of physical properties</p> <p>same functional group</p> <p>same general formula</p>	<p>Ignore specific examples such as react with oxygen</p> <p>Ignore similar (type of) reactivity</p> <p>Do not penalise reference to trends</p> <p>Accept reference to specific property, eg boiling point</p> <p>Reject same / similar physical properties</p> <p>Ignore variable physical properties</p> <p>Ignore reference to specific group</p> <p>Accept alkanes have the (general) formula C_nH_{2n+2}</p> <p>Reject same empirical/molecular formula</p> <p>Any two for 1 each</p> <p>Accept two answers on one answer line</p> <p>Ignore any reference to properties not specified as physical or chemical</p>	2
ii	D AND E	<p>Reject any other combinations</p> <p>Accept correct formulae</p>	1

Question number	Answer	Notes	Marks
1 d i	<pre> H H H—C — C—H Br Br </pre>	Ignore bond angles and positioning of Br (as long as one on each C)	1
ii	<pre> H H—C—H H </pre>		1
		Total	14

Question number	Answer	Notes	Marks
2 (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
3 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																	
3 f i	<p>M1 for setting out calculation</p> <table style="margin-left: 40px;"> <tr> <td style="text-align: center;">C</td> <td style="text-align: center;">H</td> <td style="text-align: center;">Br</td> </tr> <tr> <td style="text-align: center;"><u>22.2</u></td> <td style="text-align: center;"><u>3.7</u></td> <td style="text-align: center;"><u>74.1</u></td> </tr> <tr> <td style="text-align: center;">12</td> <td style="text-align: center;">1</td> <td style="text-align: center;">80</td> </tr> </table> <p>If division upside down or division by one or more atomic numbers, then 0/3</p> <p>M2 for obtaining ratio Accept any number of sig figs except one Allow 0.92</p> <table style="margin-left: 40px;"> <tr> <td style="text-align: center;">1.85</td> <td style="text-align: center;">3.7</td> <td style="text-align: center;">0.93</td> </tr> </table> <p>M3 for whole number ratio M3 DEP on M2</p> <table style="margin-left: 40px;"> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">:</td> <td style="text-align: center;">4</td> <td style="text-align: center;">:</td> <td style="text-align: center;">1</td> </tr> </table> <p>allow alternative method:</p> <p>M1 calculation of $M_r C_2H_4Br = 108$</p> <p>M2 expression for % of <u>each</u> element eg C: $24/108 \times 100$</p> <p>M3 evaluation to show these equal 22.2%, 3.7%, 74.1%</p>	C	H	Br	<u>22.2</u>	<u>3.7</u>	<u>74.1</u>	12	1	80	1.85	3.7	0.93	2	:	4	:	1		3
C	H	Br																		
<u>22.2</u>	<u>3.7</u>	<u>74.1</u>																		
12	1	80																		
1.85	3.7	0.93																		
2	:	4	:	1																
ii	<p>M1 $((2 \times 12) + (4 \times 1) + (1 \times 80) =) 108$</p> <p>M2 $(216 \div 108 = 2)$ (so molecular formula is) $C_4H_8Br_2$</p>	correct answer with no working scores 2	2																	

Question number	Answer	Notes	Marks
4	a		
	i	fuel oil	1
	ii	fuel oil	1
	iii	gasoline	1
b	i	alumina / silica	1
	ii	M1 for correct formula - C_4H_8 M2 for correct coefficient - 2	2

Accept aluminosilicates/zeolites
Accept aluminium oxide/silicon dioxide/silicon oxide/silicon (IV) oxide

Accept correct formulae

Accept $C_4H_8 + C_4H_8$ for 2 marks

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
4 d	$ \begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{---C} & \text{---C} & \text{---C} & \text{---C} \text{---} \\ & & & \\ \text{H} & \text{CH}_3 & \text{H} & \text{CH}_3 \end{array} $	<p>M1 for only <u>two</u> (of the four) carbon atoms both with two H eg -CH₂-CH₂-CH₂-CH₂- scores 0</p> <p>M2 for (the other) <u>two</u> carbon atoms each with one H and one CH₃ No M2 if methyl groups on 1st + 2nd, or on 3rd + 4th carbons in chain</p> <p>Do not penalise bonds to H of CH₃</p> <p>Max 1 if chain extended correctly</p> <p>Ignore brackets and n</p> <p>each carbon must have four bonds eg -CH₂-CH-CH-CH₂- scores 0</p> <p>if terminal Hs added max 1</p> <p>0/2 if any double bonds shown</p>	2