PEARSON EDEXCEL IGCSE CHEMISTRY · 4CH1

CHEMISTRY



MARK SCHEME

SECTION 1: PRINCIPLES OF CHEMISTRY (PACK 7)

SCORE	PERCENTAGE
/202	%

STEMUP

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Mark Scheme

Q1.

Question number	Answer	Notes	Marks
(a)	M1 solid M2 dark grey / black		2
(b) (i)	Example calculation M1 (51 × 79) + (49 × 81) **OR** 7998 M2 7998 ÷ 100 M3 80.0	80.0 with no working scores 3 79.9 with no working scores 1 79.98 or 80 with no working scores 2	3
(ii)	same electron configuration	**ALLOW** same (total) number of electrons **IGNORE** same number of electrons in the outer shell **IGNORE** references to same number of protons	1

(c)	(i)	An explanation that links the following three points M1 the order of reactivity is chlorine (most), bromine and iodine (least) M2 chlorine (is most reactive because it) displaces bromine and iodine/ oxidises bromide and iodide (ions) / reacts with sodium bromide and sodium iodide M3 bromine (is less reactive than chlorine since it) only displaces iodine / only oxidises iodide (ions) / only reacts with sodium iodide	**ACCEPT** bromine is only displaced by chlorine and iodine is displaced by chlorine and bromine scores M2 and M3 **ALLOW** chlorine has two reactions, bromine has one reaction and iodine no reactions for 1 mark out of M2 and M3 Deduct 1 mark for incorrect use of ine	3

		and ide e.g. bromine displaces iodide	
(ii)			1
	bromine cannot displace itself / bromine does not react with sodium bromide OWTTE	**ALLOW** there would be no reaction	2
(iii)			
	M1 bromine is reduced and iodide (ions)/I^- is oxidised		
	M2 bromine gains electrons and iodide (ions)/I^- loses electrons	Deduct 1 mark for mention of iodine (ions) being oxidised or losing electrons	
	OR		
	M1 bromine gains electrons so is reduced		
	M2 iodide (ions) /I^- loses electrons so is oxidised	**REJECT** iodine (ions) loses electrons so is oxidised	

12 marks

Q2.

Question number	Answer	Additional guidance	Marks
(a)		1 mark for each correct formula Penalise incorrect use of upper case and lower case letters, and incorrect use of subscripts once only **ACCEPT** correct formulae including correct charges on the ions	3

	Ca^{2+}	Al^{3+}	NH_4^+
F^-	CaF_2		
NO_3^-		$Al(NO_3)_3$	
SO_4^{2-}			$(NH_4)_2SO_4$

(b)	An explanation that links together the following points: **M1** the (electrostatic) forces (of attraction) between the aluminium ions and the fluoride ions / the oppositely charged ions in aluminium fluoride **M2** are strong **M3** the intermolecular forces/ forces (of attraction) between molecules in aluminium bromide	**M2** DEP on mention of correct forces (of attraction) in aluminium fluoride **ACCEPT (**ionic) bonds (in aluminium fluoride) are strong as an alternative to **M1** and **M2** for 1 mark only No **M1** or **M2** if reference to covalent/metallic bonds or intermolecular forces in aluminium fluoride **ALLOW** intermolecular bonds/ bonds between molecules / attraction between molecules	5

	M4 are weak **M5** (therefore) more energy is required to overcome the forces /break the bonds in aluminium fluoride **OR** (therefore) less energy is required to overcome the forces in aluminium bromide	**M4** DEP on mention of correct forces (of attraction) in aluminium bromide No **M3** or **M4** if reference to weak covalent /metallic / ionic bonds in aluminium bromide **ALLOW** heat as an alternative to energy **REJECT** less energy is required to break the covalent bonds in aluminium bromide	
		Total	**8**

Q3.

Question number	Answer	Mark
(a)	A description that makes reference to five of the following points: • crude oil is heated/vaporised (1) • the vapour enters the lower part of the column (1) • there is a temperature gradient up the column (1) • the vapour in the diesel fraction rises up the column until it condenses (1) • at a height where its boiling point is lower than the temperature in the column (1) • so the diesel fraction is removed (1)	5

Question number	Answer	Additional guidance	Mark
(b)	An explanation that makes reference to the following three points: • dodecane contains hydrogen and carbon (1) • only/and no other elements (1) • and contains only single bonds (1)	accept does not contain double bonds/multiple bonds	3

Question number	Answer	Mark
(c)	C	1

Question number	Answer	Mark
(d)	C_8H_{18}	1

Question number	Answer	Additional guidance	Mark
(e)(i)	Ultraviolet radiation	accept ultraviolet light	1

Question number	Answer	Mark
(e)(ii)	HCl	1

Question number	Answer	Additional guidance	Mark
(e)(iii)	• All 6 atoms with a dot and cross representing each bonding pair of electrons (1) • 3 lone pairs of electrons on Cl and none on any of the H atoms (1)	accept 2 dots or 2 crosses for each bond accept any combination of dots and crosses	2

Question number	Answer	Mark
(e)(iv)	Substitution	1

Question number	Answer	Mark
(f)(i)	D	1

Question number	Answer	Mark
(f)(ii)	• Dividing percentages by atomic masses (1) • Dividing results by smallest value OR obtaining ratio (1) • Writing empirical formula (1) Example calculation: C: 25.9 / 12 = 2.16 / 3 H: 5.0 / 1 = 5.0 / 7 Br: 57.6 / 80 = 0.72 / 1 O: 11.5 / 16 = 0.72 / 1 C_3H_7BrO accept symbols in any order	3

(Total for question = 19 marks)

Q4.

Question number	Answer	Notes	Marks
a	An explanation that links together the following two points: **M1** (silicon dioxide has) many/strong (covalent) bonds **M2** (therefore) a large amount of (heat/thermal) energy is required to break the bonds/ overcome the forces	**ACCEPT** strong (electrostatic) forces of attraction between the nuclei of atoms and the bonding electrons **IGNORE** more energy Any mention of intermolecular forces/forces between molecules or ions/ionic bonding /metallic bonding scores 0 out of 2	2

b	An explanation that links together the following two points: **M1** (graphite has) delocalised electron(s) **M2** that are able to flow (through the structure)	 **IGNORE** sea of electrons **IGNORE** free electrons **ACCEPT** are able to move / are mobile **IGNORE** references to carrying charge/ current **M2** dep on mention of electrons Any mention of ions in graphite scores 0 out of 2	**2**

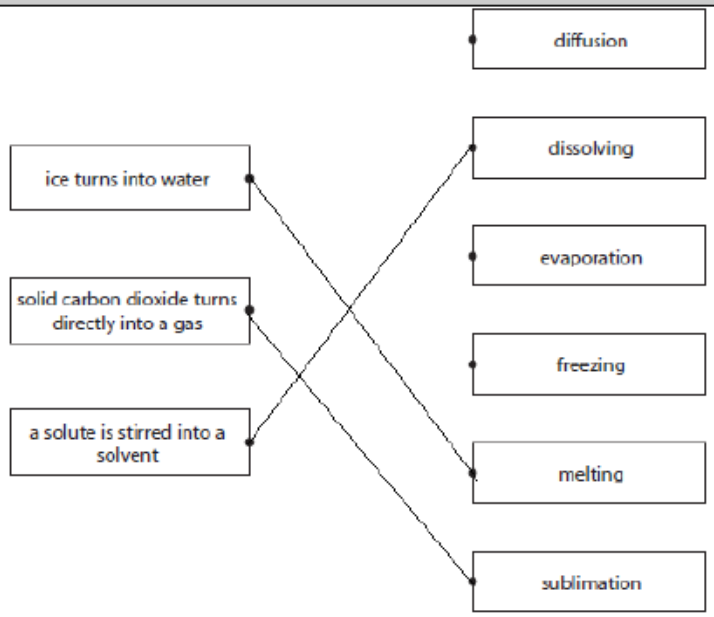
c	**M1** (diamond is hard because) it has a 3D lattice/rigid lattice /tetrahedral lattice /every carbon is bonded to four other carbons **M2** (graphite is soft because) the layers can slide over one another	**ALLOW** 3D/ rigid/ tetrahedral structure **REJECT** mention of intermolecular forces in diamond **IGNORE** mention of intermolecular forces between layers in graphite	**2**

Q5.

Question number	Answer	Notes	Marks
(a) (i)	6/six		1
(ii)	One of the following two points methanol/it) does not contain only carbon and hydrogen OR (methanol/it) contains (an atom of) oxygen		1
(b) (i)	M1 two/ pair of electrons M2 shared between two atoms	 **ACCEPT (electrons)** attracted to the nuclei (of the two atoms in the bond) **ACCEPT** M1 (electrostatic) attraction between two nuclei M2 (and the) shared pair(s) of electrons (between them)	2
(ii)	M1 4 pairs of electrons around central carbon atom, with one pair to O and 3 pairs to H M2 rest of molecule fully correct	**ALLOW** any combination of dots and crosses M2 DEP on M1	2

Question number	Answer	Notes	Marks
(c) (i)	• Divide percentages by relative atomic masses • Divide results by smallest value to obtain ratio • Write empirical formula Example calculation **M1** C: $\frac{38.7}{12}$ H: $\frac{9.7}{1}$ O: $\frac{51.6}{16}$ **M2** $\frac{3.225}{(3.225)}$ $\frac{9.7}{(3.225)}$ $\frac{3.225}{(3.225)}$ **OR** 1 3 1 **M3** CH_3O	0 marks if division by atomic numbers or upside-down calculation **M2** subsumes **M1** **ACCEPT** symbols in any order	3
(ii)	• Divide relative molecular mass by empirical formula mass • Write molecular formula Example calculation **M1** $\frac{62}{12 + 3 + 16}$ **OR** $\frac{62}{31}$ (= 2) **M2** $C_2H_6O_2$	**ACCEPT** symbols in any order Correct answer without working scores 2 marks	2
			Total 11

Q6.

Question number	Answer	Notes	Marks
(a)		1 mark for each correct line form boxes on left If more than one line from a box on left column do not award mark for that box	3 cler
(b)	a description including M1 measure the melting point M2 if fixed/sharp melting point the substance is pure M3 if melts over range of temperatures the substance is a mixture	 ALLOW measure boiling point for M1 and substitute b.p. for m.p in M2 and boils for melts in M3 ALLOW max 2 if reference to freezing point as opposed to melting point	3 grad
		Total for Q = 6 marks	

Q7.

Question number	Answer	Notes	Marks
(a) (i)	Boron/B		1 cler
(ii)	Na/Mg/Al		1 cler
(iii)	Silicon/Si		1 cler
(iv)	Nitrogen/N	ALLOW N_2	1 cler
(v)	aluminium oxide	ALLOW Al_2O_3	1 cler
(b) (i)	**D** Group 0 is correct because Group 0 contains elements that are all unreactive **A** is not correct because Group 2 does not contain elements that are all unreactive **B** is not correct because Group 5 does not contain elements that are all unreactive **C** is not correct because Group 6 does not contain elements that are all unreactive		1 comp
(ii)	**B** lithium is correct because lithhium is the least reactive element in Group 1 **A** is not correct because caesium is not the least reactive element in Group 1 **C** is not correct because potassium is not the least reactive element in Group 1 **D** is not correct because sodium is not the least reactive element in Group 1		1 comp
		Total for Q = 7 marks	

Q8.

Question number	Answer	Notes	Marks
(a)	copper		1
(b)	glucose/water		1
(c)	air		1
(d)	nitrogen/oxygen		1
(e)	copper		1
(f)	oxygen and sulfur	in either order	1
		(Total for Question = 6)	

Q9.

Question number	Answer	Notes	Marks
(a) (i)	**B** decomposition **A** is not correct because when sodium hydrogencarbonate is heated combustion does not take place C is not correct because when sodium hydrogencarbonate is heated oxidation does not take place D is not correct because when sodium hydrogencarbonate is heated reduction does not take place		1 comp
(ii)	(because) carbon dioxide/gas is produced/given off		1 grad
(b) (i)	to obtain a constant mass OWTTE / to show the reaction is complete OWTTE	ACCEPT to ensure only Na_2CO_3 is left (in crucible) ACCEPT to ensure all the $NaHCO_3$ has reacted /decomposed	1 exp
(ii)	M1 advantage: to stop any solid/Na_2CO_3/$NaHCO_3$ spitting out/being lost M2 disadvantage: the gas(es)/CO_2/H_2O/steam could not easily escape OWTTE	REJECT references to stopping gases escaping	2 exp

Question number		Answer	Notes	Marks
(c)	(i)	3.25 (g)		1 exp
	(ii)	• calculate moles of $NaHCO_3$ • use equation to determine moles of Na_2CO_3 • multiply by M_r to find mass of Na_2CO_3 Example calculation: M1 3.25 ÷ 84 **OR** 0.0387 (mol) M2 0.0387 ÷ 2 **OR** 0.01935 (mol) M3 0.01935 x 106 = 2.05 (g) **OR** • use of equation to relate mass of $NaHCO_3$ to mass of Na_2CO_3 • shows how to find mass of Na_2CO_3 using 3.25g $NaHCO_3$ • correct evaluation of answer Example calculation: M1 (2x84)/168 (g) $NaHCO_3$ → 106 (g) Na_2CO_3 M2 3.25 (g $NaHCO_3$)→ (106÷168) x 3.25 (g Na_2CO_3) M3 2.05 (g Na_2CO_3)	mark CQ on (i) ALLOW any number of sig figs except 1 2.05 (g) without working scores 3 marks 4.1 (g) without working scores 2 marks mark CQ on (i)	3 exp

(d)	(i)	M1 percentage yield = 4.2÷4.8 **OR** 0.875 M2 = (0.875 x 100) = 87.5 (%)	 ACCEPT 88 (%) Correct answer without working scores 2	2 grad
	(ii)	any one from M1 sodium hydrogencarbonate was impure M2 not all sodium hydrogencarbonate reacted/decomposed		1 grad
			Total Q = 12 marks	

Q10.

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>(a) (i)</td><td>→ magnesium chloride + hydrogen</td><td>ACCEPT in either order</td><td>1</td></tr>
<tr><td>(b) (i)</td><td><table><tr><td>temperature of the acid at the start in °C</td><td>22.4</td></tr><tr><td>highest temperature reached in °C</td><td>43.2</td></tr><tr><td>temperature rise in °C</td><td>20.8</td></tr></table></td><td>ALLOW ECF from incorrect starting temperature</td><td>2</td></tr>
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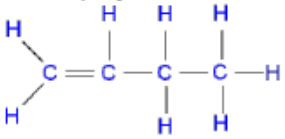
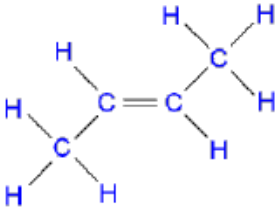
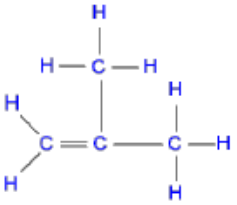
(ii)	• substitute correct values into $Q = mc\Delta T$ • evaluation Example calculation **M1** $Q = 25 \times 4.2 \times 20.8$ **M2** 2184 (J)	Correct answer of 2184 or 2194 without working scores 2 **ALLOW** 25.12g for m **ACCEPT** any number of sig figs except 1 **ALLOW** ECF from M1	2
(iii)	• find the amount of magnesium in moles • divide Q by n • convert answer in J/mol to kJ/mol • answer including sign Example calculation **M1** $n(Mg) = 0.12 \div 24$ **OR** 0.005(0) **M2** $Q \div n$ **OR** $2184 \div 0.005(0)$ **OR** 436,800 (J/mol) **M3** $436{,}800 \div 1000$ **OR** 436.8 (kJ/mol) **M4** – 436.8 (kJ/mol)	 **ACCEPT** use of 2180 or 2200 **ALLOW** ECF on incorrect answer to (ii) and/or **M1** **ALLOW** ECF on incorrect answer to **M2** **ALLOW** ECF on incorrect answer to **M3** Correct answer with minus sign and without working scores 4 Correct answer without minus sign and without working scores 3 **ACCEPT** any number of sig figs except 1 throughout (ii) -438.8 or-438.9 also scores 4 (from 5.12g and 2194J in (ii))	4 **Total 9**

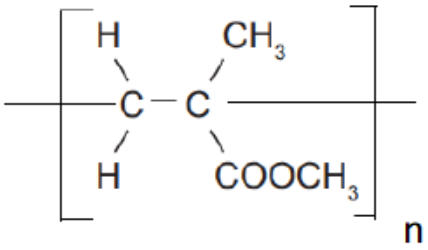
Q11.

Question number	Answer	Notes	Marks
(a) (i)	M1 and M2 all points correctly plotted to the nearest half a square	deduct 1 mark for each error	2
(ii)	smooth curve of best fit		1
(iii)	An explanation that links any **two** of the following points M1 polystyrene is an insulator M2 reduces thermal energy/heat coming in from the surroundings OWTTE M3 temperature decrease will be closer to true value OWTTE	 **ALLOW** results will be more accurate	2
(iv)	Any one from: M1 the student recorded the temperature before adding the sodium carbonate /the temperature had not stopped decreasing OWTTE M2 the student forgot to the stir the mixture	 **ALLOW** less than 0.5 g of/not enough sodium carbonate was added	1
(v)	(two) results at the end are the same	**ALLOW** the temperature stops decreasing	1
(vi)	An explanation that links together M1 the reaction is endothermic and either of the following points M2 it takes in thermal energy/heat from the surroundings **OR** M3 as shown by the temperature decrease (of the reaction mixture)	 **REJECT** exothermic for both marks **ALLOW** references to cooling No **M2** or **M3** if the statements contradict one another	2

Question number	Answer	Notes	Marks
(b) (i)	to prevent acid / liquid / solution splashing out		1
(ii)	M1 (M_r of sodium carbonate) = 106		3
	M2 (moles of sodium carbonate 2.12 ÷ 106 =) 0.02	ALLOW ecf from M1 M2 subsumes M1	
	M3 (mass of carbon dioxide 0.02 × 44 =) 0.88 (g)	ALLOW answer from M2 x 44 answer of 0.88 (g) with or without working scores 3	
(iii)	Any one from: M1 the sodium carbonate is impure M2 some of the carbon dioxide dissolves in the acid/solution		1
			14

Q12.

Question number	Answer	Notes	Marks
(a) (i)	explanation linking M1 (molecules/compounds) having same molecular formulae M2 but different structural/displayed formulae	 ALLOW different structures ALLOW different arrangement of atoms	2
(ii)	M1 displayed formula of but-1-ene  M2 displayed formula of but-2-ene 	IGNORE bond angles ALLOW displayed formula of methylpropene 	2

Question number	Answer	Notes	Marks
(b) (i)	explanation linking M1 molecule is unsaturated as contains (carbon to carbon) double bond M2 molecule not a hydrocarbon as contains oxygen	 ACCEPT does not contain hydrogen and carbon only	 2
(ii)	addition		1
(iii)	 M1 correct repeat unit structure M2 extension bonds, brackets and n	 n can be anywhere after bracket extension bonds do not have to go through brackets M2 DEP M1 or near miss	2

Question number	Answer	Notes	Marks
(c) (i)	M1 calculation of mass of octane M2 calculation of Mr of C_8H_{18} and CO_2 M3 link between mass/mol C_8H_{18} and mass/mol CO_2 M4 calculation of mass CO_2 in g M5 calculation of mass CO_2 in kg Example calculation: M1 50 x 700 = 35000 (g) M2 M_r of C_8H_{18} = 114 and M_r CO_2 = 44 M3 114g C_8H_{18} produces (8 x 44 =) 352 (g) CO_2		5

	M4 35000 g C_8H_{18} produces $\frac{35000 \times 352}{114}$ = 108070.2 (g) CO_2 M5 = 108 (kg) Alternative method using mol: M1 50 x 700 = 35000 (g) M2 M_r of C_8H_{18} = 114 and Mr CO_2 = 44 M3 n (C_8H_{18}) = $\frac{35000}{114}$ = 307.0175 mol so n (CO_2) = 8 x 307.0175 = 2456.14 mol M4 mass CO_2 = 2456.14 x 44 = 108070.2 (g) M5 = 108 (kg)	ALLOW 2 sig fig or more in M4 and M5 ALLOW 2 sig fig or more in M3 M4 and M5 MARK CSQ in both methods correct answer without working scores 5	
(ii)	global warming/climate change	IGNORE greenhouse effect	1
			(Total for Question = 15)

Q13.

Question number	Answer	Notes	Marks
(a)	74		1 Cler
(b) (i)	M1 flame test	**ALLOW** any description of a flame test	2 Grad
	M2 (flame colour is) red	**ALLOW** crimson or crimson red **M2** is dependent on **M1**	
(ii)	M1 add (dilute) hydrochloric acid	**ALLOW** any acid **IGNORE** refs to concentration **REJECT** additional reagents	3 Exp
	M2 bubble the gas/CO_2 produced through limewater / test the gas/CO_2 with limewater	**ALLOW** calcium hydroxide	
	M3 which turns cloudy / milky / white precipitate	**M3** is dependent on use of limewater	
(c)	$Li_2O + CO_2$		1 Grad
		Total for question	7

Q14.

Question number	Answer	Notes	Marks
(a)	M1 two lithium atoms each lose one electron /give one electron to oxygen M2 oxygen gains two electrons M3 lithium (ion) has an electron configuration of 2 and oxide (ion) is 2,8	ALLOW lithium loses one electron /gives one electron to oxygen ALLOW oxygen becomes 2,8 All 3 marks can be scored from diagrams showing the electron configurations of the ions 0 marks if reference to sharing electrons	3

(b)	(i)	M1 (temperature after) = 27.7°C M2 temperature rise = 10.4 °C	 ALLOW ecf from M1	2
	(ii)	Example calculation M1 Use of 100 in Q = m x c (x ΔT) M2 Use of 10.4 in Q = (m x) c x ΔT M3 4368J M4 4400J	Correct answer of 4400J with or without working scores 4 ALLOW ecf from (b)(i) 100 x 4.2 x 10.4 scores M1 and M2 ALLOW ecf from M1 and M2 ALLOW ecf from M3 IGNORE + or - sign in front of answer	4
	(iii)	Example calculation M1 5210 ÷ 1000 or 5.21 M2 5.21 ÷ 0.0580 M3 -89.8(kJ/mol)	Correct answer of -89.8 (kJ/mol) scores 3 ALLOW -90 (kJ/mol) or any number of sig figs as long as correctly rounded.	3
	(iv)	polystyrene is a good insulator /poor conductor (of heat) OR to minimise/reduce heat loss	ALLOW prevent heat loss	1
				13 marks

Q15.

Question number	Answer	Notes	Marks
(a) (i)	A A is the correct answer because 100°C is above the boiling point of W B is not the correct answer because X is a solid at 100°C C is not the correct answer because Y is a solid at 100°C D is not the correct answer because Z is a solid at 100°C		1
(ii)	B B is the correct answer because X is a liquid for 1840°C A is not the correct answer because W is a liquid for 67°C C is not the correct answer because Y is a liquid for 1150°C D is not the correct answer because Z is a liquid for 330°C		1
(iii)	C C is the correct answer because Y is a liquid at 1000°C and a gas at 2000°C A is not the correct answer because W is a gas at 1000°C and at 2000°C B is not the correct answer because X is a liquid at 1000°C and 2000°C D is not the correct answer because Z is a gas at 1000°C and at 2000°C		1
(b)	ionic	**ALLOW** electrovalent	1
(c)	the (impure) substance will melt over a range of temperatures	**ALLOW** the (impure) substance will have a lower melting point	1
			5 marks

Q16.

Question number	Answer	Notes	Marks
(a)	M1 (put the carbonate in the boiling tube) and the limewater in the test tube M2 heat the carbonate and time how long it takes for the limewater to turn cloudy OWTTE M3 repeat with the same mass / amount / number of moles of another carbonate M4 (the carbonate which decomposes the fastest) will turn the limewater cloudy in the least time	 **ACCEPT** repeat with another carbonate using same volume of limewater OWTTE To score M4 reference to limewater turning cloudy must be mentioned at least once somewhere in answer	4
(b) (i)	to prevent loss of solid/XCO_3/carbonate/XO	**ALLOW** so only carbon dioxide/gas can escape	1
(ii)	0.05		1
(iii)	0.05	**ALLOW** ECF from (ii)	1
(iv)	M1 7.40 ÷ 0.05 M2 148	correct answer with or without working scores 2 **ALLOW** ECF from (iii)	2
(v)	M1 A_r of metal = 148-60 **OR** 88 M2 metal is strontium / Sr	If (iv) correct strontium/Sr scores 2 without working **ALLOW** ECF from (iv) **ALLOW** ECF from M1 as long as answer is nearest Group 2 metal	2
		Total for question = 11 marks	

Q17.

Question number	Answer	Notes	Marks
(a)	(good) conductors of electricity / malleable	**ACCEPT** (good) conductors of heat/ductile/have basic oxides/hydroxides **ALLOW** high density/ high melting point/ sonorous/shiny/hard/ strong	1
(b)	**M1** (in mercury) particles can move/flow OWTTE	**IGNORE** references to spacing/gaps between particles / energy of particles	2
	M2 (in solid metal) particles do not move /are in fixed positions	**ACCEPT** particles vibrate (about fixed position)	
(c) (i)	(bright) white flame	**ALLOW** white light **ACCEPT** white solid/ash/powder (formed)	1
(c) (ii)	(product/magnesium oxide is) basic / a base	**ALLOW** (product/magnesium oxide) neutralises acid / dissolves in/reacts with acid /(produces) alkali (when added to water) **REJECT** if incorrect product given	1
(d) (i)	magnesium/sulfur would react with/ burn in oxygen	**ACCEPT** magnesium oxide (not magnesium sulfide) would be formed **ALLOW** sulfur dioxide would be formed	1
(d) (ii)	**M1** magnesium (atom) loses two electrons **M2** sulfur (atom) gains two electrons (from magnesium) **M3** charge on magnesium (ion) $2^+/Mg^{2+}$ AND charge on sulfur/sulfide (ion) $2^-/S^{2-}$	two electrons transferred from magnesium (atom) to sulfur (atom) scores **M1** and **M2**	3

Question number	Answer	Notes	Marks
(d) (iii)	**M1** strong (electrostatic) force of attraction	**ALLOW** strong ionic bonds but No **M1** or **M2** if between atoms/molecules or any reference to intermolecular forces / covalent bonds	3
	M2 between magnesium ions/Mg^{2+} and sulfide ions/S^{2-} ions	**ACCEPT** between oppositely charged ions **ACCEPT** between positive and negative ions	
	M3 large amount/lot of (heat/thermal) energy needed to overcome forces/attraction	**ACCEPT** large amount/lot of (heat/thermal) energy needed to break the bonds **IGNORE** more energy No **M3** if reference to overcoming / breaking intermolecular forces / covalent bonds	
(d) (iv)	$MgS + 2HCl \rightarrow MgCl_2 + H_2S$ **M1** all formulae correct **M2** correctly balanced	IGNORE **state symbols** **M2 DEP M1** **ACCEPT** multiples and fractions	2

Q18.

Question number	Answer	Notes	Marks
(a) (i)	Q		1 cler
(ii)	might be explosive/dangerous/unsafe		1 grad
(iii)	R S P Q		1 cler
(b) (i)	galvanising/galvanisation		1 grad
(ii)	Any one from paint/oil/grease/sacrificial protection OWTTE	IGNORE barrier method If answer to (i) missing or incorrect credit galvanising in (ii)	1 grad
(c) (i)	zinc displaces copper	ALLOW zinc replaces copper/zinc takes oxygen from copper	1 grad
(ii)	M1 copper(II) oxide/CuO M2 because copper(II) oxide/CuO/it loses oxygen	ALLOW because copper(II) oxide/CuO/it gives oxygen to zinc/is reduced M2 DEP M1 or near miss e.g. Cu as it gives oxygen to zinc scores 1 mark for M2 IGNORE references to electrons	2 expert
		Total for Q = 8 marks	

Q19.

Question number	Answer	Notes	Marks
(a) (i)	simple distillation	**REJECT** fractional distillation **REJECT** distillation	1
(ii)	chromatography		1
(iii)	fractional distillation		1
(b)	**M1** dissolve **M2** solute **M3** solvent		3 **Total 6**

Q20.

Question number	Answer	Notes	Marks
(a)	136		1
(b)	**M1** simplest (whole number) ratio of atoms present (in a compound) **M2** empirical formula (of ocimene / $C_{10}H_{16}$) is C_5H_8	**ALLOW** elements for atoms **ALLOW** C : H ratio 5:8	2

Question number	Answer	Notes	Marks
(c)	unsaturated hydrocarbon because M1 contains (carbon to carbon) double bond(s) M2 contains carbon and hydrogen (atoms) M3 only	 **REJECT** molecules M3 DEP on mention of carbon and hydrogen	3
(d) (i)	**A** addition B is incorrect because the type of reaction between an alkene and bromine is addition not polymerisation C is incorrect because the type of reaction between an alkene and bromine is addition not precipitation D is incorrect because the type of reaction between an alkene and bromine is addition not substitution		1

Question number	Answer	Notes	Marks
(d) (ii)	ocimene contains more than one double bond /three double bonds		1

Question number	Answer	Notes	Marks
(e)	$C_{10}H_{16} + 14\,O_2 \rightarrow 10\,CO_2 + 8\,H_2O$ M1 $CO_2 + H_2O$ M2 correctly balanced	 **ACCEPT** in either order M2 **DEP** M1 **ACCEPT** multiples or fractions	2
(f) (i)	M1 carbon/C/soot M2 carbon monoxide/CO	**ACCEPT** M1 M2 in either order	2
(ii)	(carbon monoxide/CO) reduces capacity of blood to carry oxygen OWTTE	**ACCEPT** correct references to haemoglobin / carboxyhaemoglobin	1