Mark Scheme

Q1.

Question Number	Acceptable Answers	Additional Guidance	Mark
(i)	$S_8 + 8AgF_2 \rightarrow 4S_2F_2 + 8AgF$	Allow multiples	(1)

Question Number	Acceptable Answers	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following points: • the oxidation number of sulfur increases from 0 to +1 and so is oxidation **(1)** • the oxidation number of silver decreases from +2 to +1 and so is reduction **(1)** • fluorine does not change from −1 **and** it is a redox reaction **(1)**	Check for any oxidation numbers which may be written near the equation if not given on the lines provided. Omission of reduction and oxidation scores max 1 for MP1 and MP2	(3)

Q2.

Question Number	Answer	Additional Guidance	Mark
(i)	• balanced equation	Example of equation $3Cl_2 + 6OH^- \rightarrow 5Cl^- + ClO_3^- + 3H_2O$ Allow multiples Ignore state symbols even if incorrect	(1)

Question Number	Answer	Additional Guidance	Mark
(ii) Clip with (i)	An explanation that makes reference to the following points: • oxidation number for chlorine changes from 0 to -1 so it is **reduced** **(1)** • oxidation number for chlorine changes from 0 to +5 so it is **oxidised** **(1)**	Ignore general definitions of disproportionation Accept oxidation numbers and their changes shown with equation Allow 1 out of 2 marks for three correct oxidation numbers of the chlorine	(2)

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	• four correct species (1) • balancing and the correct number of electrons (1)	An example of equation $[Cr(OH)_6]^{3-} + 2OH^- \rightarrow CrO_4^{2-} + 4H_2O + 3e^-$ Accept multiples	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	• equation	An example of equation $2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$ Accept $\rightleftharpoons$ / multiples	(1)

Question Number	Answer	Additional Guidance	Mark
(iii)	• oxidation half equation (1) • reduction half equation (1) • overall equation (1)	$H_2O_2 \rightarrow 2H^+ + O_2 + 2e^-$ $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ $Cr_2O_7^{2-} + 8H^+ + 3H_2O_2 \rightarrow 2Cr^{3+} + 7H_2O + 3O_2$ for M3 do not award if H^+/ e^- left on both sides Accept multiples Allow $\rightleftharpoons$ Ignore state symbols even if incorrect Oxidation and reduction half equations scores (2) if not identified but in correct order Award (1) only for M1 and M2 if half equations are not in correct order No TE on incorrect half equations	(3)

Q4.

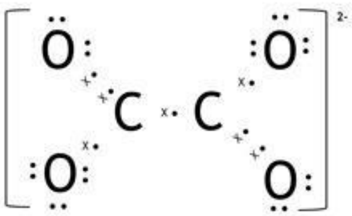
Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following points: • oxidation numbers of Br identified as (+)5 for BrO_3^-, −1 for Br^- and 0 for Br_2 **(1)** • this is not disproportionation because: two different species of bromine / reactants are oxidised and reduced / not one species oxidised and reduced **or** only one species containing bromine is produced / two different species containing bromine in two different oxidation states are not produced **(1)**	These may be shown in the equation Allow 5+ / V / 1− / −I Do not award any change in oxidation numbers of oxygen and or hydrogen Allow bromine is oxidised and reduced in the reverse reaction Allow this is reverse disproportionation / comproportionation	**(2)**

Question number	Answer	Mark
(ii)	**The only correct answer is D** (cannot tell from this information) ***A*** *is incorrect because there are 3 reactant species but the overall order of a reaction can only be determined by experiment* ***B*** *is incorrect because there is 1 bromate ion and 5 bromide ions but the overall order of a reaction can only be determined by experiment* ***C*** *is incorrect because there are 12 reactant particles but the overall order of a reaction can only be determined by experiment*	**(1)**

Q5.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following points: • calcium is oxidised as it loses electrons **(1)** • Chlorine / Cl_2 / Cl is reduced as it gains electron(s) **(1)**	Allow $Ca \rightarrow Ca^{2+} + 2e^-$ / $Ca - 2e^- \rightarrow Ca^{2+}$ **and** oxidation Do not allow calcium loses 1 electron Allow $Cl_2 + 2e^- \rightarrow 2Cl^-$ **and** reduction	**(2)**

Q6.

Question Number	Answer	Additional Guidance	Mark
(i)	• double C=O bond on left and right hand side **(1)** • rest of diagram **(1)**		**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	• (+) 3	Allow 3+ / +III / III+ / III / three Ignore working out Do not award ±3	**(1)**

Q7.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	• half-equation	Example of half-equation $2Cl^- \rightarrow Cl_2 + 2e^{(-)}$ Allow multiples Allow $2Cl^- - 2e^{(-)} \rightarrow Cl_2$ Ignore state symbols even if incorrect DNA reverse equation	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to the following points: • calculation of moles of HCl **(1)** • calculation of theoretical moles of Cl_2 produced **(1)** • calculation of theoretical volume of Cl_2 **(1)** • calculation of % yield **and** comparison with expected yield **(1)**	Example of calculation (5.0 x 5.0)÷1000 = 0.025 / 2.5 x 10^{-2} (mol) 0.025÷4 = 0.00625 /6.25 x 10^{-3} (mol) 0.00625 x 24000 = 150 (cm^3) % yield = (70÷150) x 100 = 46.7/47(%) **and** less than expected / did not achieve expected yield / expected yield is 75% of 150 =112.5 cm^3 Allow calculation of actual moles of Cl_2 for MP3, then calculation of yield based on moles for MP4: 70÷24000 = 2.9167 x 10^{-3} (mol) then % yield and comparison for MP4 (2.9167 x10^{-3} ÷ 0.00625) x 100 = 46.7/47(%) Ignore SF except 1 Allow TE at each stage	(4)

Q8.

Question Number	Acceptable Answers	Additional Guidance	Mark
	• phosphate(III) (ion)	Name **and** oxidation number are required Allow gap between name and oxidation number Allow phosphate and +3 Ignore missing brackets around oxidation number Do not award phosphorus / trioxide / phosphite(III)	**(1)**

Q9.

Question Number	Acceptable Answers	Additional Guidance	Mark
(i)	• MnO_2, MnO_4^-, OH^- and MnO_4^{2-} species correct in a single equation **(1)** • H_2O on right **and** balancing **(1)**	<u>Example of equation</u> $MnO_2 + 2MnO_4^- + 4OH^- \rightarrow 3MnO_4^{2-} + 2H_2O$ Ignore state symbols, even if incorrect Do not award M1 if H^+ is on the left Allow cancelled electrons Allow multiples	**(2)**

Question Number	Acceptable Answers	Additional Guidance	Mark
(ii)	An answer that makes reference to: • 2 different species are oxidised and reduced (to form the same species) **or** there is not 1 species that is being oxidised and reduced **or** 2 different oxidation states are not produced from one oxidation state **or** only 1 oxidation state / +6 is formed as a product **or** Mn changes from +4 and +7 to +6 (only)	This mark can be awarded even if (i) is incorrect Allow manganate(VI) / MnO_4^{2-} is oxidised and reduced in the reverse reaction Allow Mn in the same species is not being oxidised and reduced Ignore just 'Mn is not simultaneously oxidised and reduced' Ignore this is reverse disproportionation / comproportionation Do not award O / H is oxidised / reduced Do not award molecules / compounds for species	(1)

Q10.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	$Cl_2 + 2e^{(-)} \rightarrow 2Cl^-$	Allow multiples Ignore state symbols even if incorrect	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	$Cl_2 + 4OH^- \rightarrow 2ClO^- + 2H_2O + 2e^{(-)}$	Allow multiples $Cl_2 + 2OH^- \rightarrow 2ClO^- + 2H^+ + 2e^{(-)}$ Ignore state symbols even if incorrect	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(iii)	$Cl_2 + 2OH^- \rightarrow Cl^- + ClO^- + H_2O$	Allow multiples Ignore state symbols even if incorrect Do not award mark if electrons are un-cancelled	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(iv)	An explanation that makes reference to the following points: • (disproportionation is simultaneous) oxidation and reduction of an element (in the same species) **(1)** • chlorine changes from 0 to -1 **and** +1 **(1)**	Allow statement that chlorine is oxidised **and** reduced This can be shown on the equation in (iii)	**(2)**

Q11.

Question Number	Answer	Additional Guidance	Mark
	• $KClO_3$	Allow $K^+ClO_3^-$	(1)

Q12.

Question Number	Answer	Mark
	The only correct answer is C ***A*** *is not correct because it is +1 not +3* ***B*** *is not correct because it is +2 not +3* ***D*** *is not correct because it is +2 not +3*	**(1)**

Q13.

Question Number	Answer	Additional Guidance	Mark
(i)	• chlorine is oxidised **and** from 0 to +1 (in NaClO) (1) • chlorine is reduced **and** from 0 to -1 (in NaCl) (1)	Check the equation Allow (1) for three correct oxidation numbers if no other mark is awarded. Allow (1) max for general definition of disproportionation	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	• equation	$6\,NaOH + 3\,Cl_2 \rightarrow NaClO_3 + 5\,NaCl + 3\,H_2O$ Allow multiples	(1)

Question Number	Answer	Mark
(iii)	**The only correct answer is C** (hot alkali) **A** *is not correct because high temperature is required* **B** *is not correct because high temperature is required* **D** *is not correct because high temperature and not excess chlorine is required*	(1)

Q14.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to the following points: • chlorine / Cl_2 is simultaneously oxidised and reduced (1) • the oxidation number of chlorine changes from 0 to –I and (+)I / 0 to –1 and (+)1 / increases by 1 and decreases by 1 (1)	Allow oxidation numbers underneath or above the equation	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	• substances correct in equation (1) • equation is balanced (1)	Example of equation $3Cl_2 + 6NaOH \rightarrow NaClO_3 + 5NaCl + 3H_2O$ Ignore state symbols even if incorrect	(2)

Q15.

<table>
<tr><th>Question Number</th><th>Acceptable Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>(i)</td><td>Any two correct
(1)

Third also correct
(1)</td><td><table><tr><td>Ion</td><td>Oxidation number of sulfur</td></tr><tr><td>$S_2O_3^{2-}$</td><td>+2 / 2+ / +II / II+</td></tr><tr><td>SO_4^{2-}</td><td>+6 / 6+ / +VI / VI+</td></tr><tr><td>$S_4O_6^{2-}$</td><td>+2.5 / 2.5+ / $+\frac{10}{4}$ / $\frac{10}{4}+$</td></tr></table>Allow any equivalent fractions e.g. 5/2+

Penalise missing + once only</td><td>(2)</td></tr>
</table>

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to: • gain of electrons (by iodine / I_2)	Allow thiosulfate ion has lost electrons / sulfur has lost electrons Ignore reference to oxidation numbers	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to: • chlorine oxidises sulfur (from +2) to +6 whereas iodine only oxidises sulfur (from +2) to +2.5	Allow chlorine causes a greater increase in oxidation number (than iodine) OR chlorine causes loss of more electrons (from sulfur than iodine) Do not award chlorine gains more electrons Award mark for a greater increase in oxidation number, even if the stated oxidation numbers are incorrect	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(iv)	• correct species (1) • balancing of correct species (1)	Example of equation $S_2O_3^{2-} + 5H_2O \rightarrow 2SO_4^{2-} + 10H^+ + 8e^-$ Allow for one mark: $S_2O_3^{2-} + 10OH^- \rightarrow 2SO_4^{2-} + 5H_2O + 8e^-$ Ignore state symbols even if incorrect	(2)

Question Number	Acceptable Answer	Additional Guidance	Mark
(v)	• correct equation	Example of equation $4Cl_2 + S_2O_3^{2-} + 5H_2O \rightarrow 8Cl^- + 2SO_4^{2-} + 10H^+$ Allow HCl in place of H^+ and Cl^- as long as balanced ($8HCl + 2H^+$) Allow $4Cl_2 + S_2O_3^{2-} + 10OH^- \rightarrow 8Cl^- + 2SO_4^{2-} + 5H_2O$ From $S_2O_3^{2-} + 10OH^- \rightarrow 2SO_4^{2-} + 5H_2O + 8e^-$ in (b)(iv) Do not award equations with electrons not cancelled Ignore state symbols even if incorrect	(1)

Q16.

Question Number	Acceptable Answers	Additional Guidance	Mark
	+5	Allow 5+ / +V / V+ / (V) / 5 Do not award V^+	(1)

Q17.

Question Number	Answer	Mark
(i)	**The only correct answer is A** ***B*** *is not correct because Cl^- is not an oxidising agent* ***C*** *is not correct because I_2 is not a powerful enough oxidising agent* ***D*** *is not correct because* Mn^{2+} is not an oxidising agent	**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	• all species on correct sides of equation **and** no electrons / electrons cancelled **(1)** • balancing correct species **(1)** • E°_{cell} value **(1)**	Example of ionic equation $2MnO_4^- + 16H^+ + 10Br^- \rightarrow 2Mn^{2+} + 8H_2O + 5Br_2$ Allow $\rightleftharpoons$ Allow correct species if shown in working with half-equations but slip made in final equation e.g. charge missing Ignore state symbols Allow multiples Allow M2 for almost correct species E°_{cell} (= 1.51 − 1.09) = (+)0.42 (V) No TE on incorrect equation	**(3)**

Q18.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An answer that makes reference to the following points • recognises/states that disproportionation reactions contain one element that is both reduced and oxidised **(1)** • identifies the relevant oxidation number changes in chlorine **(1)**	Allow answers in terms of just Chlorine i.e. Chlorine is both oxidised and reduced Do not award: Chlorine **molecule** both oxidised and reduced Cl changes from 0 in Cl_2 to -1 in NaCl **and** 0 in Cl_2 to +5 in $NaClO_3$ Allow oxidation numbers shown on equation	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to the following points • all molar masses correct **(1)** • correct use of multiples **(1)** • calculation of atom economy **(1)**	<u>Example of calculation</u> $NaClO_3$ = 106.5 NaCl = 58.5 H_2O = 18 Allow calculation of molar masses of left-hand side Cl_2 = 71, NaOH = 40 (5 x 58.5 and 1 x 106.5 and 3 x 18) or (3 x 71 and 6 x 40) M1 and M2 may be combined: total molar mass = 453 = 106.5 x 100 ÷ ((5 x 58.5) + 106.5 + (3 x 18)) = 23.51% Ignore SF except 1 SF TE on molar masses and multiples	**(3)**

Q19.

Question Number	Answer	Mark
(i)	**The only correct answer is C** (Disproportionation) *A is not correct because oxidation and reduction are occurring* *B is not correct because oxidation and reduction are occurring* *D is not correct because two reactants are involved*	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to the following points: • (trigonal) pyramidal **(1)** • (predicted bond angle) 107° **(1)** • three groups / three pairs of bonding electrons and one lone pair **OR** lone pair – bond pair repulsion > bond pair – bond pair repulsion **(1)** • (electron pairs / groups repel to positions of) minimum repulsion / maximum separation **(1)**	For M1, this shape must be **named** Allow answers in the range 106.5° to 107.5° (allow actual value 110°) Allow M2 on an annotated diagram Allow 'regions' for 'groups' or 'pairs' Allow statements such as "lone pair repulsion greater than bond pair repulsion"	(4)

Q20.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	• 4 $KClO_3 \rightarrow$ 1 KCl + 3 $KClO_4$	Allow just KCl with no number in front Allow multiples	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to the following points: • use of **water only** as solvent **(1)** • add the mixture of solids / products to any one of the following : water only **or** ethanol only **or** a water plus ethanol mixture **or** water followed by ethanol **or** ethanol followed by water **(1)** • **filter** off the undissolved potassium chlorate(VII) $KClO_4$ **(1)**	Use of separating funnel or electrolysis scores (0) overall NB: If water **only** used as the solvent, both M1 and M2 are awarded Allow 'insoluble solid' / 'less soluble solid' / 'the precipitate' for $KClO_4$ Allow salt for solid	**(3)**

Q21.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)(i)	correct equation	Example of equation: $2NaN_3 \rightarrow 2Na + 3N_2$ Allow multiples Ignore state symbols even if incorrect	**(1)**

Question Number	Acceptable Answer	Additional guidance	Mark
(a)(ii)	• conversion of volume and temperature to correct units (1) • rearrangement of ideal gas equation so $n=pV \div RT$ and calculation of $n(N_2)$ in moles (1) • evaluation of $n(NaN_3)$ (1) • answer converted into mass to 2/3 SF (1) Allow TE at each stage	Example of calculation: 67 dm^3 = 0.067 m^3, 300°C = 573 K $n(N_2) = \frac{140\ 000 \times 0.067}{8.31 \times 573}$ = 1.9699.....(mol) $n(NaN_3)$ = (2/3 x 1.9699.....=) 1.313.... (mol) m= (1.313 .... x 65 = 85.3629..=) = 85.4 / 85 (g) Correct answer without working scores (4)	(4)

Question Number	Acceptable Answer	Additional guidance	Mark
(b)	An answer that makes reference to the following points: • Nitrogen (is reduced) from +5 to 0 (1) • Sodium (is oxidised) from 0 to +1 (1) • Balanced equation (1)	Look for oxidation numbers annotated on the equation Do not award potassium oxidised Penalise omission of "+" sign, once only Example of balanced equation: $10Na + 2KNO_3 \rightarrow K_2O + 5Na_2O + N_2$ Allow multiples	(3)

Question Number	Acceptable Answer	Additional guidance	Mark
(c)	An answer that makes reference to the following points: • Neutralisation reaction / acid base reaction (1) • Sodium and/or potassium oxides are caustic / corrosive (1) • Salts (silicates) formed are inert / unreactive (1)	Allow salt formation Allow "metal oxides" Ignore "harmful" / "alkaline" Allow "not harmful"/ "not caustic" Ignore "neutral"	(3)

Question Number	Acceptable Answer	Mark
(d)	The only correct answer is **A** ***B*** *is incorrect because the peak would shift to the left and be higher* ***C*** *is incorrect because the peak would shift to the left not to the right* ***D*** *is incorrect because the peak would be shift to the left not to the right*	(1)

Q22.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following points: • N changes from (+)5 to (+)4 **(1)** • O changes from −2 to 0 (in O_2) **(1)** • so nitrogen / N is reduced (as the oxidation number has decreased) **and** oxygen / O (in forming O_2) is oxidised (as the oxidation number has increased) **(1)**	These numbers may be written under the formulae in the equation Allow oxidation numbers written as 5+, 4+, 2− Ignore unchanged oxidation numbers of magnesium and oxygen Allow this mark if incorrect / missing oxidation numbers in M1 and M2 Ignore general statement about redox Ignore redox explained in terms of electron gain or loss	**(3)**

Q23.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to the following point: • the oxidation number / state does not change for any element	Accept there is no transfer of electrons	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following points: • (because) sulfur in sulfuric acid is reduced further by hydrogen iodide than hydrogen bromide (and hydrogen chloride) (1) • SO_2 / S(IV) produced in the reaction with HBr (1) • more negative oxidation states of sulfur / S / H_2S / S^{2-} are produced in the reaction with HI (1)	Mark independently Allow potassium salt / halide ion for hydrogen halide May be shown in an equation, but ignore incorrect state symbols and/or balancing May be shown in an equation, but ignore incorrect state symbols and/or balancing	(3)

Q24.

Question Number	Acceptable Answers	Additional Guidance	Mark
	• (a reducing agent) increases in oxidation number **and** loses electron(s)	Allow oxidation number becomes more positive / gets larger Allow donates / gives electrons / number of electrons decreases Ignore a reducing agent decreases the oxidation number of another substance	(1)

Q25.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to • propanal is condensed back (to the pear-shaped flask) **(1)** • so propanal is (further) oxidised (to propanoic acid) or propanal is more readily oxidised than propan-1-ol **(1)**	Allow aldehyde for propanal Allow 'apparatus is reflux' Allow propanal is not being removed /distilled off (from the oxidising agent) Ignore just 'reacts further' Do not award reference to propanal being completely oxidised	**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	• (+)VI	Allow (+) six / (+)6 / six (+) / 6(+)	**(1)**

Question Number	Answer	Additional Guidance	Mark
(iii)	• balanced equation	Example of equation $CH_3CH_2CH_2OH \rightarrow CH_3CH_2CHO + 2H^+ + 2e^-$	**(1)**

Question Number	Answer	Additional Guidance	Mark
(iv)	• provides a surface for bubbles to form / enables smaller bubbles to form / provides nucleation sites for bubbles or to prevent large bubbles forming	Allow distribution of heat more evenly / to prevent superheating Ignore mixing / to stop bumping / spitting / explosion / liquid splashing out / vigorous reaction / loss of reactants Do not award reference to large gas molecules	**(1)**

Question Number	Answer	Additional Guidance	Mark
(v)	• (**M1**) evaluation of number of moles of propan-1-ol **(1)** Method one using masses for percentage calculation • (**M2**) evaluation of maximum mass of propanal **(1)** • (**M3**) percentage yield **(1)** or Method two using moles for percentage calculation • (**M2**) evaluation of actual moles of propanal **(1)** • (**M3**) percentage yield **(1)**	<u>Example of calculation</u> n(propan-1-ol) = (1.50 ÷ 60) = 0.025 (mol) n(propan-1-ol) = n(propanal) max m(propanal) = (0.025 x 58) = 1.45 (g) %Yield = ((0.609 ÷ 1.45) x 100) = 42 % n(propanal) = (0.609 ÷ 58) = 0.0105 (mol) %Yield =((0.0105 ÷ 0.025) x 100) = 42 % Allow TE at each stage Ignore SF except 1SF Penalise incorrect M_r values once only Correct answer without working scores (3)	**(3)**

Q26.

Question Number	Answer	Additional guidance	Mark
(i)	• calculation of moles of VCl_2(aq) **(1)** • calculation of moles of Cl_2(g) **(1)** • deduction of whole number ratio of V^{2+} : Cl_2 **(1)** • deduction of electrons lost per vanadium ion **(1)** • deduction of final oxidation number of V **(1)**	Example of calculation (40/1000) x 0.100 = 4 x 10^{-3} / 0.004 (mol) (144/24000) = 6 x 10^{-3} / 0.006 (mol) $2V^{2+}$: $3Cl_2$ allow V^{2+} : $1.5Cl_2$ 6 electrons lost by $2V^{2+}$, so 3 lost per V^{2+}, (+)5 Allow TE throughout Correct answer with no working scores M5 only	**(5)**

Question Number	Answer	Additional Guidance	Mark
(ii)	• purple / lilac / violet **(1)** • to yellow (solution) **(1)**	Ignore references to blue / green / turquoise or similar, as intermediate colours, regardless of order If no final oxidation state given in (d)(i) do not award M2 Allow lavender / mauve for M1 Mark consequentially from (d)(i) Do not award colourless Use list principle for additional inappropriate intermediate colours e.g. red / pink For consequential marking from (d)(i) V(IV) – blue ; V(III) – green If both colours are given but the wrong way round, allow 1 mark out of 2	**(2)**