Question	Marking Guidance	Mark	Comments
4(a)(i)	white flame / white light	1	Mark flame independent of other observations
	solid / powder / smoke / ash / white fumes	1	penalise precipitate penalise wrong colour if more than one observation for M2 apply list principle. (If an observation is incorrect, the incorrect observation negates a correct one)
	$2Mg + O_2 \rightarrow 2MgO$	1	ignore state symbols allow multiples
	ionic	1	do not allow reference to covalent character
4(a)(ii)	blue flame	1	do not allow any other colour Mark flame independent of other observations
	fumes or misty or pungent/choking/smelly gas	1	do not allow incorrect smell (e.g. bad eggs) apply list principle as in (a) (i) do not allow just 'gas' or 'colourless gas'
	$S + O_2 \rightarrow SO_2$	1	ignore state symbols allow multiples and S_8
	covalent	1	penalise giant covalent

4(b)	ionic O^{2-} / oxide ion reacts with water / accepts a proton forming OH^- ions/ NaOH / sodium hydroxide (can show in equation from Na_2O even if incorrect)	1 1 1	If covalent, can only score M3 M2 requires reference to O^{2-} / oxide ion allow $O^{2-} + H_2O \rightarrow 2OH^-$ or $O^{2-} + H^+ \rightarrow OH^-$ to score M2 & M3 also allow equations with spectator Na^+ ions on both sides.
4(c)	(heat until) molten conducts electricity / can be electrolysed / electrolyse and identify Al / O_2 at an electrode	1 1	or dissolve in <u>molten</u> cryolite do not allow solution in water M2 can only be gained if M1 scored
4(d)	insoluble (in water)	1	allow oxide impermeable to air / water or oxide is unreactive / inert
4(e)(i)	$Al_2O_3 + 6H^+ \rightarrow 2Al^{3+} + 3H_2O$	1	allow $O^{2-} + 2H^+ \rightarrow H_2O$ and formation of aquated Al^{3+} species allow spectator Cl^- ions penalise HCl (not ionic!)
4(e)(ii)	$Al_2O_3 + 2OH^- + 3H_2O \rightarrow 2Al(OH)_4^-$ or $Al_2O_3 + 6OH^- + 3H_2O \rightarrow 2Al(OH)_6^{3-}$	1	allow formation of $Al(H_2O)_2(OH)_4^-$ allow Na^+ spectator ions penalise NaOH (not ionic!)