Question number				Answer	Notes	Marks
1	a	i	M1	(A) reduced AND (B) oxidised	If first column blank, M1 can be scored from words in second column: eg reduction is gain of electrons in 2nd column for A scores M2 oxidation is gain of oxygen in 2nd column for B scores M3 Both above statements would score M1 as well If M1 wrong way round, then 0/3 If 1st column has oxidation ×2 or reduction × 2, then no M1, but it will sometimes be possible to award either M2 or M3 for a correct matching statement.	1
			M2	(A) gain of electrons	If species identified, must be correct, eg not aluminium gains electrons Ignore reference to loss of oxygen	1
			M3	(B) gain of oxygen	Ignore reference to loss of electrons	1
		ii	M1	$2O^{2-} \rightarrow O_2 + 4e^{(-)}$	Both formulae correct and on correct sides of equation	1
			M2		Balancing including electrons	1
					Accept electrons lost on LHS Accept $O^{2-} \rightarrow O + 2e^{(-)}$ followed by $2O \rightarrow O_2$	
		iii		electrodes burn /get smaller / decrease (in mass) / have to be replaced	Ignore erode / corrode / wear / damage	1

Question number				Answer	Notes	Marks
1	a	iv	M1	coke	Ignore coal / carbon Reject other raw materials such as limestone/haematite	1
			M2	produces heat / exothermic (reaction)	M2 independent Accept makes carbon dioxide which then produces CO/reducing agent	1
	b	i		carbonating drinks / in drinks		1
			M2	soluble (in water) / reacts with water	M2 dependent on M1 Accept just solubility, ignoring qualifying statements such as only slightly soluble, or only dissolves under pressure	1
			M3	fire extinguishers / putting out fires		1
			M4	denser than air / does not support combustion	Accept denser than oxygen Ignore does not burn M4 dependent on M3 Ignore references to covering / sitting on fire	1
					Accept M1+M2, and M3+M4 reversed	

Question number				Answer	Notes	Marks
1	b	ii	M1	$SO_2 + H_2O \rightarrow H_2SO_3$	Accept $SO_2 + H_2O + ½O_2 \rightarrow H_2SO_4$ Do not accept unconventional formulae such as SO_3H_2	1
			M2	adverse effect on plants/trees/crops/vegetation OR adverse effect on fish / water animals / aquatic life OR adverse effect on iron/steel/metal OR adverse effect on stonework/limestone/marble	eg kills / harms / damages / destroys / stunts growth eg kills / harms / damages / destroys /reduces fish population eg damages / causes rusting/corrosion eg causes corrosion / damages Not just buildings/structures/statues Ignore changes in pH Ignore effects on animals/birds Ignore just habitats Do not accept burning/weathering/erosion as adverse effects Not just affects plants/fish/etc	1
					Do not apply list principle	

Question number				Answer	Notes	Marks
1	c		M1	$M_r(PbCO_3)$ = 267 / A_r (Pb) = 207	Accept 414 for Pb	1
			M2	n($PbCO_3$) / n(Pb) = 1.87 mol	Accept 1.9	1
			M3	m(Pb) = 387 – 388 g		1
				OR		
			M1	$M_r(PbCO_3)$ = 267 / A_r (Pb) = 207		1
			M2	m(Pb) = $\frac{207 \times 500}{267}$		1
			M3	m(Pb) = 387 - 388 g		1
				OR		
			M1	$M_r(PbCO_3)$ = 267 / A_r (Pb) = 207		1
			M2	% Pb = $\frac{207 \times 100}{267}$ = 77.5 %		1
			M3	m(Pb) = 500 × 0.775 = 387.5 g		1
					Correct final answer with or without working scores 3 Accept answer in kg Apply ECF throughout	
					Accept other valid methods 774-776 scores 2	
					Total	17

Question number	Answer	Notes	Marks
2 (a)	**M1** coke **M2** limestone accept answers in either order	ignore 'carbon' / 'charcoal' ignore 'calcium carbonate' ignore formulae	2
(b) (i)	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ **M1** all formulae correct **M2** balanced	 **M2** dep on **M1**	2
(ii)	**M1** iron / Fe **M2** (it has) lost oxygen	 **M2** dep on **M1**or near miss eg Fe_2O_3 accept 'iron (III) ions / Fe^{3+} has gained electrons' accept 'oxidation number of iron decreases / oxidation number of iron changes from +3 to 0'	2
(c) (i)	$C + O_2 \rightarrow CO_2$		1
(ii)	C (neutralisation)		1

(d) (i)	**M1** oxygen **M2** water	accept 'air' accept 'moisture' / 'water vapour' ignore 'steam' accept answers in either order	2
(ii)	prevents oxygen/water from coming into contact with the iron	accept refs to acting as a barrier	1
(e) (i)	galvanising	ignore 'sacrificial protection'	1
(ii)	**M1** zinc is more reactive than iron / loses electrons more readily **M2** (and therefore) corrodes in preference (to the iron)	ignore 'sacrificial protection' accept 'reacts (with oxygen/water) in preference (to the iron)' accept refs to zinc converting iron(II) ions to iron (atoms) reject 'zinc rusts' for **M2**	2
(f) (i)	(aluminium/it) is too reactive / more reactive than carbon / <u>above</u> carbon in the reactivity series	accept 'carbon is less reactive than aluminium' accept 'the temperature required is too high' ignore refs to carbon monoxide	1
(ii)	energy costs are too great / electricity is expensive	allow 'it is cheaper to use the blast furnace' ignore refs to iron being below carbon in the reactivity series	1

Question number	Answer	Notes	Marks
3 a	mix / add / react (the two) solutions / salts together	Ignore references to volumes	
	stir	Accept swirl	4
	filter	Accept description of filtration	
	wash (with water)		
	suitable method of drying	eg warm / heat / place in oven / leave on window ledge / leave to dry / dry with filter paper or kitchen towel Not just dry Any four above for 1 mark each If M3 not scored then M4 and M5 cannot be awarded If description of evaporation of solution, then M4 and M5 cannot be awarded	
	identifying two suitable pieces of apparatus	Any two of • beaker / flask / test tube (for mixing) • (glass) rod (for stirring) • (filter) funnel/paper (for separation) Reference to filter paper or filter funnel scores M3 and counts as one of M6 If any other substance added, then MAX 4	1

Question number	Answer	Notes	Marks
3 b i	B (the products are both elements)		1
ii	electrons on wrong side / should be on right /should be $-2e^-$	Accept + in front of electrons (should be —)	1
	2Br should be Br_2	Accept product is shown as a bromine atom / should be shown as a bromine molecule Equation correctly rewritten scores both marks	1
iii	ions stop moving / ions not free to move OR electrons stop moving (through wires)	Ignore liquid becomes solid / no free ions Accept electric current in place of electrons Reject implication that electrons stop flowing through liquid	1
			Total 9 marks