Question	Answer	Marks	AO Element	Notes	Guidance
1	ammonium nitrate	1			
2	1 mark each for any two of: (alloy is) harder / more durable / more resistant to wear ORA for copper (1)	2			
	(alloy is) stronger ORA for copper (1)				
	(alloy is ) more resistant to corrosion ORA for copper (1)				
3	fluorine is more reactive than chlorine / chlorine is less reactive than fluorine	1			
4	copper < iron < samarium < sodium (1)	2			
	if 2 marks not scored allow 1 mark for 1 consecutive pair reversed				
5	<i>any three of:</i> - conducts electricity / conducts heat - malleable - ductile - shiny / lustrous	3			
6	sodium hydroxide (1) hydrogen (1)	2			

Question	Answer	Marks	AO Element	Notes	Guidance
7	1 mark each for any two of:	2			
	$\infty$ high density ORA for Mg				
	$\infty$ forms coloured compounds ORA for Mg				
	∞ forms ions with different charges / has variable oxidation number ORA for Mg				
	$\infty$ forms complex ions ORA for Mg				
	$\infty$ copper is catalyst ORA for Mg				
	∞ reference to difference in chemical properties e.g. magnesium reacts with dilute acid / copper does not react with dilute acid				
8(a)	has complete <b>outer</b> (electron) shell/has full <b>outer</b> (electron) shell/ <b>outer</b> shell cannot gain or lose electron(s)	1			
8(b)	lamps/inert atmosphere (in metal extraction)	1			
9	(D), F, A, C, E, B (2) if 2 marks not scored: 1 mark for 1 consecutive pair of letters reversed	2			

Question	Answer	Marks	AO Element	Notes	Guidance
10(a)	thermal decomposition	1			
10(b)	M1 basic (oxide )	2			
	M2 calcium is a metal (oxide)				
11(a)(i)	cobalt carbonate	1			
11(a)(ii)	lead iodide	1			
11(b)	$2 \text{ AgNO}_3 + \text{Na}_2\text{CO}_3 \rightarrow \\ \text{Ag}_2\text{CO}_3 + 2 \text{ NaNO}_3$	2			
	formula of silver carbonate correct (1)				
	fully correct equation (1)				
11(c)	$Pb^{2+} + 2I^- \rightarrow PbI_2$	2			
	Pb <sup>2+</sup> and I $^-$ on left of equation (1)				
	fully correct equation (1)				
12(a)	loss of oxygen / decrease in oxidation number / gain of electrons / addition of hydrogen	1			
12(b)	oxidation	1			

Question	Answer	Marks	AO Element	Notes	Guidance
13	fewer <b>OR</b> less molecules <b>OR</b> moles + on right <b>OR</b> in product (1) <b>ORA</b>	2			
	equilibrium shifts to the right (1)				
14(a)	burning fossil fuels/volcanoes/heating (sulfide) ores	1			
14(b)	substance which speeds up a reaction/substance which increases the rate of reaction	1			
14(c)	рН 4	1			
14(d)	erodes buildings (made of carbonate rocks)/wears away buildings (made of carbonate rocks)/reacts with mortar/corrodes iron work/corrodes metal	1			
15	endothermic	1			
16(a)	4728	1			
16(b)	6004	1			
16(c)	-1276	1			ecf (a) – (b)

Question	Answer	Marks	AO Element	Notes	Guidance
17(a)	hydrogen	1			
17(b)	$2H_2 + O_2 \rightarrow 2H_2O$ water as product from reaction of hydrogen and oxygen (1) balanced (1)	2			
18(a)	positive electrode: chlorine / $Cl_2$ (1) negative electrode: hydrogen / $H_2$ (1)	2			
18(b)	bubbles (of gas)	1			
19	graphite (1) conducts electricity / inert (1)	2			
20	positive electrode: chlorine (1) negative electrode: magnesium (1)	2			
21	sodium carbonate + calcium hydroxide → sodium hydroxide + calcium carbonate if 2 marks not scored 1 mark for a correct name of one of the carbonates or calcium hydroxide	2			

Question	Answer	Marks	AO Element	Notes	Guidance
22	magnesium sulfate (1) hydrogen (1)	2			
23	147 (2)	2			
	If 2 marks not scored: 1 mark for 4 × 1 <b>OR</b> 4 (for H) <b>OR</b> 2 × 35.5 <b>OR</b> 71 for C <i>l</i>				
24	1 pair of bonding electrons between each H and the C atom (1)	2			
	no additional outer shell electrons on the H or C atoms (1)				
25	electron	1			
26	electron in outer shell (1) electrons in first shell <b>AND</b> eight electrons in the second shell (1)	2			
27	melting point decreases (1) boiling point increases (1)	2			
28	goes from solid to gas (1) directly / without liquid (being formed) (1)	2			

Question	Answer	Marks	AO Element	Notes	Guidance
29	anhydrous copper(II) sulfate turns blue (2) IF: 2 marks not scored 1 mark for anhydrous copper sulfate <b>or</b> copper sulfate turns blue <b>OR</b> anhydrous cobalt(II) chloride turns pink / red (2) IF: 2 marks not scored 1 mark for anhydrous cobalt chloride <b>or</b> cobalt chloride turns pink	2			
30	2 (CH <sub>4</sub> ) (1) 4 (H <sub>2</sub> ) (1)	2			
31	2 (O <sub>2</sub> ) (1) 2 (H <sub>2</sub> O) (1)	2			
32	heat given out / heat evolved	1			
33(a)	4 (NO)	1			
33(b)	heat released / heat given out	1			
33(c)	oxygen added (to NO)	1			
33(d)	acidic oxide AND nitrogen is a non-metal	1			

Question	Answer	Marks	AO Element	Notes	Guidance	
34(a)	22 s	1				
34(b)	P (1) the gradient / slope of the graph is steep(est) (1)	2				
34(c)	0.9 (g)	1				
34(d)(i)	(increasing temperature) increases / faster (1)	1				
34(d)(ii)	(larger pieces of carbonate) decreases / slower (1)	1				
	[Total: 80]					