Question 1

1(a)	calcium oxide	1

1(f)	carbon monoxide	1

Question 2

2(e)	CO_2	1

Question 3

3(a)(i)	hematite	1
3(a)(ii)	1 mark each for any four of: *the production of carbon monoxide* • carbon burns in oxygen / air • to form carbon dioxide • carbon dioxide reduced by carbon / reacts with carbon to form carbon monoxide *the role of carbon monoxide* • iron(III) oxide reduced by carbon monoxide *the role of calcium carbonate, added to the blast furnace* • calcium carbonate decomposes to calcium oxide • calcium oxide reacts with impurities / silicon(IV) oxide (in iron ore) • slag formed / calcium silicate formed	4
3(a)(iii)	arrangement: irregular / no (particular) arrangement (1) motion: sliding over each other	2

Question 4

4(b)	to provide heat / increase temperature (1) to produce carbon dioxide (from the combustion of carbon) (1)	2

Question 5

5(b)(i)	CO_2 loses oxygen	1
5(b)(ii)	redox	1

5(b)(iii)	breakdown of a compound (1) by heating / using heat / high temperature (1)	2

Question 6

6(a)(v)	D	1

Question 7

7(a)(i)	CaO	1

Question 8

8(c)	making cement / making steel / neutralising acidic soils / flue gas desulfurisation / making glass	1

Question 9

9(c)(i)	hematite (1)	1
9(c)(ii)	2 (Fe) (1) 3 (CO_2) (1)	2
9(c)(iii)	breakdown of a compound (1) by heat / when heated / using thermal energy (1)	2
9(c)(iv)	3rd box down ticked (it reacts with impurities in the iron ore to form slag)	1
9(c)(v)	less iron ore mined / conserves iron ore / less energy used to produce iron / conserves fuels	1

Question 10

10(a)	coke	1
10(a)(ii)	provide heat	1
10(b)(i)	**M1** 160 **M2** 112 **AND** 70.(0)(%)	2
10(b)(ii)	hematite	1
10(b)(iii)	by reduction of carbon dioxide	1
10(b)(iv)	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ **M1** species **M2** correct equation	2
10(b)(v)	reduction	1
10(c)	thermal decomposition	1
10(d)(i)	**M1** CaO is basic **M2** SiO_2 is acidic	2
10(d)(ii)	**M1** silicon(IV) oxide **M2** slag	2
10(e)(i)	aluminium is above carbon in the reactivity series **OR** aluminium is more reactive than carbon	1
10(e)(ii)	electrolysis	1
10(f)(i)	2,8	1
10(f)(ii)	**M1** 26 (protons) **M2** 23 (electrons)	2

Question 11

11(c)	iron	1

Question 12

12(b)	aluminium oxide	1

Question 13

13(c)(i)	bauxite	**1**
13(c)(ii)	**M1** cryolite (1) **M2** lowers operating temperature **OR** improves conductivity (1)	**2**
13(c)(iii)	$Al^{3+} + 3e^- \rightarrow Al$ **M1** $Al^{3+} + 3e^-$ on the left-hand side (1) **M2** equation correct (1)	**2**
13(c)(iv)	**M1** (anodes of) carbon react with oxygen (formed at the anode) (1) **M2** (form) carbon dioxide (1)	**2**

Question 14

14(b)(i)	aluminium oxide	**1**
14(b)(ii)	any **two** from: • solvent • lowers the operating temperature • increases conductivity	**2**
14(b)(iii)	carbon reacts with oxygen and forms carbon dioxide	**1**