Question number	Answer	Additional guidance	Mark
1(a)	An answer that combines the following points of understanding to provide a logical description: • (hydrogen produced as a gas so) there would be {effervescence/fizzing/ bubbles} (1) • and (calcium hydroxide produced as a solid so) the water would go {cloudy/a white precipitate would form} (1)	Allow: calcium moves (around) (1) calcium decreases in size/disappears/dissolves (1)	**(2)**

Question number	Answer	Mark
1(b)	$Mg + H_2O \rightarrow MgO + H_2$ • LHS (1) • RHS (1)	**(2)**

Question number	Answer	Additional guidance	Mark
1(c)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • In calcium the outermost electron(s) {are further away from nucleus /experience(s) greater shielding} (from the nucleus) (as shown by the electronic configuration) (1) • Therefore less attraction between nucleus and electron(s)/ the electron(s) is/are easier to remove (1)	Allow answers in terms of why reactivity of magnesium is less than that of calcium	**(2)**

Question number	Answer	Additional guidance	Mark
1(d)	• divides mass by relative atomic mass (1) • calculates simplest ratio (1) • expresses ratio correctly as empirical formula (1)	Example of calculation Ca : Br $\frac{0.2}{40}$: $\frac{0.8}{80}$ 0.005 : 0.01 1 : 2 empirical formula $CaBr_2$ Formula alone scores max 1	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	A, B and C	Mg Ca Au (any order) magnesium calcium gold (any order)	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	A and B	Mg Ca (any order) magnesium calcium (any order)	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	8 (protons)		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	A : 10		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	(in 100 atoms) mass of mass number 20 atoms = 20 x 90 (1) mass of mass number 22 atoms = 22 x 10 (1) relative atomic mass = {(22 x 10) + (20 x 90)}/100 (=20.2) (1) OR 20 contributes = 90/100 x20(1) 22 contributes = 10/100 x22(1) relative atomic mass 90/100 x 20 + 10/100 x 22 (= 20.2) (1)	20.2 = 3 marks 21.8 = 2 marks (only 1 error made)	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(d)	An explanation linking any two of (the element is) group 0 / noble gas /unreactive / inert / does not react (1) {(has) 8 electrons / full} outer shell (1) prevents filament from reacting (1)	 ignore 'not very reactive' does not {gain / lose / share} electrons	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	An explanation including the following points • metal (1) • because {on left of / below} the line dividing metals and non-metals/because boron only non-metal in group 3 (1)	 correct statement relating to neighbouring metallic elements surrounded by metals	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)	2.8.3	283	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	A five protons		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	An explanation including the following points • atoms of same element / same {number of protons / atomic number} (1) • different {numbers of neutrons / mass numbers} (1)	 ignore electrons	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(iii)	more atoms have mass 11 (than 10) / ORA	boron 11 isotope more abundant OWTE	**(1)**

Question Number	Answers	Acceptable Answers	Mark
4 (a)	<table><tr><th></th><th>relative mass</th><th>relative charge</th><th>position in atom</th></tr><tr><td>proton</td><td>1</td><td>(+1)</td><td>in nucleus</td></tr><tr><td>neutron</td><td>(1)</td><td>0</td><td>(in nucleus)</td></tr><tr><td>electron</td><td>1/1837</td><td>-1</td><td>in shells</td></tr></table> all 6 correct (3) 4 or 5 correct (2) 2 or 3 correct (1)	ignore units reject relative mass of proton: +1/1+ for relative mass of electron: anything smaller than 1/1500/0.00067 (almost) 0/negligible/very small for relative charge on neutron: none/no charge/neutral for position of electron in an atom: in orbits / orbitals / energy levels / around the nucleus /outside the nucleus ignore rings ignore inner/outer	**(3)**

Question Number	Answers	Acceptable Answers	Mark
4 (b)	D equal numbers of protons and electrons		**(1)**

Question Number	Answers	Acceptable Answers	Mark
4 (c)(i)	Ca	Reject CA / ca /cA ignore calcium	**(1)**

Question Number	Answers	Acceptable Answers	Mark
4 (c)(ii)	O	ignore any negative charge on the O ignore oxygen reject: oxide/O_2	**(1)**

Question Number	Answers	Acceptable Answers	Mark
4 (d)(i)	13	Allow correct working even if wrong answer	**(1)**

Question Number	Answers	Acceptable Answers	Mark
4 (d)(ii)	**D** AlN		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	C T		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	C Q and S		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	number of protons (in nucleus of atom)	ignore number of electrons eg number of protons and electrons worth (1)	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	An explanation including • (atoms of) both contain 5 /same number of protons/same atomic number (1) • boron-10 atoms contain 5 neutrons but boron-11 atoms contain 6 neutrons / different numbers of neutrons/ different mass number (1)	ignore electrons boron-11 atoms contain 1 more neutron / boron-10 atoms contain 1 less neutron	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(c)(i)	An explanation including the following • M1 {average/mean} mass (of atoms of an element) (1) • M2 compared to {1/12 mass carbon-12 (atom)/ (mass of) carbon-12 (atom) taken as 12} (1)	For M1 reject weight reject if mass of molecule reject if mass of neutrons and protons any reference to carbon-12 scores mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(c)(ii)	[19.7 x 10] (1) +[80.3 x 11] (1) /100 (1) (=10.8) [0.197 x10] (1) + [0.803 x11] (1) = [1.97 + 8.83] (1) (=10.8)	If no working shown 10.8(03) worth 3 marks	**(3)**