Question Number	Answer	Acceptable answers	Mark
1(a)(i)	<table><tr><th>particle</th><th>number</th></tr><tr><td>proton</td><td>29</td></tr><tr><td>neutron</td><td>34</td></tr><tr><td>electron</td><td>29</td></tr></table> all 3 correct **(2)** any 1 or 2 correct **(1)**		**(2)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	(copper atom has) 4 (shells of electrons)	Do not allow 4 electrons on the outer shell Do not allow 4 outer shells	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	An explanation linking • atoms of the (same) element/ atoms with the same {number of protons/atomic number} **(1)** • (but) different {numbers of neutrons/mass numbers} **(1)**	Maximum **(1)** if no mention of atom(s)/atomic Allow the marks if a specific example is given e.g. all chlorine atoms have 17 protons **(1)** but some have 18 neutrons and others have 20 neutrons **(1)** Ignore any reference to numbers of electrons Ignore different forms of an element Allow {more/less} neutrons than the {usual/original} atom **(1)** Do not allow more neutrons than protons Do not allow different (relative) atomic masses	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iv)	• (in 100 atoms) mass of copper-63 atoms = 63 x 70 / 63 x 0.7 / 63 x 7 **(1)** (= 4410 / 44.1 / 441) • mass of copper-65 atoms = 65 x 30 / 65 x 0.3 / 65 x 3 **(1)** (= 1950 / 19.5 / 195) • relative atomic mass = $\frac{(63 \times 70 + (65 \times 30)}{100}$ / $\frac{4410 + 1950}{100}$ 44.1 + 19.5/ $\frac{441+ 195}{10}$ **(1)** (= 63.6)	63.6 with no working **(3)** 63.5/64 with no working **(0)** Allow correct working shown to calculate 63.6 then final answer is rounded to 64 **(3)** Note: correct working shown to calculate 63.6 then final answer is incorrectly rounded to 63.5/63 **(2)** Ignore any unit e.g. g Allow TE for third mark e.g if percentages used the wrong way round 64.4 scores **(1)**	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	• two electrons/ $2e^{(-)}$ **(1)** • {loses/gives away} electrons **(1)**	Reject any reference to a covalent bond or sharing electrons (0) $Cu \rightarrow Cu^{2+} + 2e^{(-)}$ **or** $Cu - 2e^{(-)} \rightarrow Cu^{2+}$ **(2)** Allow +2 for charge Allow transfers electrons to another atom **(1)** Allow electrons taken away **(1)** Ignore electrons are missing Ignore references to the nitrate ion/other non-metals Ignore references to full outer shell	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	$Cu(NO_3)_2$	Formula must be totally correct including subscripts, letter case and brackets Allow $Cu^{2+}(NO_3^-)_2$ Ignore any balancing numbers in front of formula Ignore any working/attempted equation to find the formula	**(1)**

Question Number	Answers	Acceptable Answers	Mark
2 (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
2 (b)	D equal numbers of protons and electrons		**(1)**

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

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

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

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

Question Number	Answers	Acceptable Answers	Mark
3 (a)(i)	<table><tr><td></td><td>chlorine-35</td><td>chlorine-37</td></tr><tr><td>number of protons</td><td>**17**</td><td>**17**</td></tr><tr><td>number of neutrons</td><td>**18**</td><td>**20**</td></tr><tr><td>number of electrons</td><td>**17**</td><td>**17**</td></tr></table> the four 17s (1) the 18 and 20 (1)		**(2)**

Question Number	Answers	Acceptable Answers	Mark
3 (a)(ii)	An explanation linking M1 average (mass of atoms/isotopes present) (1) M2 more chlorine-35 than chlorine-37 / higher {percentage / abundance} of Cl-35 / lower {percentage / abundance} of Cl-37 / (1)	mean ignore weight 75% chlorine-35 / 25% chlorine-37/ chlorine-35 and chlorine-37 in ratio 3:1 / correct calculation to obtain 35.5 (2) eg[(75x35) + (25x37)]/100	**(2)**

Question Number	Answers	Acceptable Answers	Mark
3 (b)	Diagram showing one carbon and four chlorines four pairs of electrons shared between the carbon and chlorine atoms (1) fully correct (1)	use of dots or crosses or mixture of both ignore inner shells even if incorrect ignore symbols	**(2)**

Question Number		Indicative Content	Mark
QWC	**3(c)**	A response including some of the following points Note: (carbon to carbon) strong bonds is given in question Diamond: Uses and Properties • in cutting tools/engraving • drill bit • jewellery • diamond very hard/strong • attractive/lustrous • high melting point Explanations • giant molecular/covalent • each carbon atom bonded to four other carbon atoms • three dimensional structure • to break it lots of bonds would need to be broken • would need lot of energy/force Graphite: Uses and Properties • to make electrodes • a lubricant • sporting equipment • in pencils/drawing • graphite conducts electricity • soft Explanations • giant molecular/covalent • each carbon atom bonded to three other carbon atoms • each carbon atom has a free electron • delocalised electrons • (delocalised) electrons move to carry current • layers of carbon atoms • weak forces/bonds between layers/sheets • so layers/sheets can slide/rub off or over each other	**(6)**

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

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

Question Number	Answer	Acceptable answers	Mark
4(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
4(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
4(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
4(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)**