| 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><br>all 3 correct **(2)**<br>any 1 or 2 correct **(1)** | | **(2)** |

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

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **1(a)(iii)** | An explanation linking<br><br>• atoms of the (same) element/ atoms with the same {number of protons/atomic number} **(1)**<br><br>• (but) different {numbers of neutrons/mass numbers} **(1)** | Maximum **(1)** if no mention of atom(s)/atomic<br><br>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)**<br><br>Ignore any reference to numbers of electrons<br>Ignore different forms of an element<br><br>Allow {more/less} neutrons than the {usual/original} atom **(1)**<br>Do not allow more neutrons than protons<br>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)<br><br>• mass of copper-65 atoms = 65 x 30 / 65 x 0.3 / 65 x 3 **(1)** (= 1950 / 19.5 / 195)<br><br>• 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)**<br><br>63.5/64 with no working **(0)**<br><br>Allow correct working shown to calculate 63.6 then final answer is rounded to 64 **(3)**<br><br>Note: correct working shown to calculate 63.6 then final answer is incorrectly rounded to 63.5/63 **(2)**<br><br>Ignore any unit e.g. g<br><br>Allow TE for third mark<br>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)**<br><br>• {loses/gives away} electrons **(1)** | Reject any reference to a covalent bond or sharing electrons (0)<br><br>$Cu \rightarrow Cu^{2+} + 2e^{(-)}$<br>**or**<br>$Cu - 2e^{(-)} \rightarrow Cu^{2+}$ **(2)**<br>Allow +2 for charge<br><br>Allow transfers electrons to another atom **(1)**<br>Allow electrons taken away **(1)**<br>Ignore electrons are missing<br>Ignore references to the nitrate ion/other non-metals<br>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<br>Allow $Cu^{2+}(NO_3^-)_2$<br>Ignore any balancing numbers in front of formula<br>Ignore any working/attempted equation to find the formula | **(1)** |

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

| Question Number | Answers | Acceptable Answers | Mark |
|---|---|---|---|
| **2 (c)(ii)** | O | ignore any negative charge on the O<br>ignore oxygen<br>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><br>the four 17s (1)<br><br>the 18 and 20 (1) | | **(2)** |

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

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

| Question Number | | Indicative Content | Mark |
|---|---|---|---|
| **QWC** | **3(c)** | A response including some of the following points<br><br>Note: (carbon to carbon) strong bonds is given in question<br><br>Diamond:<br><br>Uses and Properties<br><br>• in cutting tools/engraving<br>• drill bit<br>• jewellery<br>• diamond very hard/strong<br>• attractive/lustrous<br>• high melting point<br><br>Explanations<br><br>• giant molecular/covalent<br>• each carbon atom bonded to four other carbon atoms<br>• three dimensional structure<br>• to break it lots of bonds would need to be broken<br>• would need lot of energy/force<br><br>Graphite:<br><br>Uses and Properties<br><br>• to make electrodes<br>• a lubricant<br>• sporting equipment<br>• in pencils/drawing<br>• graphite conducts electricity<br>• soft<br><br>Explanations<br><br>• giant molecular/covalent<br>• each carbon atom bonded to three other carbon atoms<br>• each carbon atom has a free electron<br>• delocalised electrons<br>• (delocalised) electrons move to carry current<br>• layers of carbon atoms<br>• weak forces/bonds between layers/sheets<br>• 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<br>eg number of protons and electrons worth (1) | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **4(b)(ii)** | An explanation including<br><br>• (atoms of) both contain 5 /same number of protons/same atomic number (1)<br><br>• boron-10 atoms contain 5 neutrons but boron-11 atoms contain 6 neutrons / different numbers of neutrons/ different mass number (1) | <br><br>ignore electrons<br><br><br><br>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<br><br>• M1 {average/mean} mass (of atoms of an element) (1)<br><br>• M2 compared to {1/12 mass carbon-12 (atom)/ (mass of) carbon-12 (atom) taken as 12} (1) | <br><br>For M1<br>reject weight<br>reject if mass of molecule<br>reject if mass of neutrons and protons<br><br>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)<br><br>[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)** |