

**Assessment Schedule – 2011****Chemistry: Demonstrate understanding of aspects of selected elements (90933)****Evidence Statement**

Q	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
ONE (a)(i) (ii) (iii)  (b)  (c)	<p>Sodium: 2,8,1 Nitrogen: 2,5</p> <p>Sodium has only one electron in its outer shell. This electron is lost so as to achieve a stable octet, forming <math>\text{Na}^+</math>. Nitrogen has 5 electrons in its outer shell. It gains 3 electrons to achieve a stable octet / arrangement, forming <math>\text{N}^{3-}</math>.</p> <p>Lithium has one less shell but still has one electron in its outer / valence shell. Sodium has one more full inner shell but still has one electron in its outer / valence shell</p> <p>Lithium floats on water and gently fizzes, giving off hydrogen gas until it disappears. There is not as much heat produced, so Li does not melt. A colourless solution of LiOH is formed. <math>2\text{Li}(s) + 2\text{H}_2\text{O}(\ell) \rightarrow 2\text{LiOH}(aq) + \text{H}_2(g)</math></p> <p>Sodium also floats on the surface, but enough heat is given off to melt the sodium (sodium has a lower melting point than lithium and the reaction produces heat faster) and it melts almost at once to form a small silvery ball that dashes around the surface, being pushed by the hydrogen being formed. A colourless solution of sodium hydroxide is formed. Sometimes the hydrogen may catch fire to burn with an orange flame. The colour is due to contamination of the normally blue hydrogen flame with sodium compounds. <math>2\text{Na}(s) + 2\text{H}_2\text{O}(\ell) \rightarrow 2\text{NaOH}(aq) + \text{H}_2(g)</math></p> <p>Sodium is more reactive than lithium. This is because there is only 1 electron in the valence shell that is easily lost and the elements get more reactive as that valence electron is further away from the nucleus in the bigger atoms.</p> <p>(Candidates are not required to write states in equations.)</p>	<p>States correct electron arrangements for sodium and nitrogen.</p> <p>Describes sodium losing one electron AND Nitrogen gaining 3 electrons</p> <p>Identifies that Li and Na both have one valence electron</p> <p>States ONE observation of Li or Na reacting in water.</p> <p>Identifies hydrogen as the gas formed</p> <p>NØ no response or no relevant evidence. N1 one–two correct. N2 three correct. A3 four correct. A4 all correct.</p>	<p>Links stable octet arrangement to sodium losing an electron and nitrogen gaining electrons.</p> <p>Recognises that Na and Li are different sizes even though they have the same valence electrons</p> <p>Links observations of BOTH metals in water to formation of hydrogen gas (named or formula) and an alkaline solution (named or formula).</p> <p>Explains that Na is more reactive</p> <p>M5 three links. M6 four links.</p>	<p>Explanation of the chemistry of Group 1 metals linking electron arrangement, size and reactivity (including observations), and an explanation of why Na is more reactive.</p> <p>ONE balanced equation.</p> <p>E7 both criteria. E8 both criteria but with no minor errors.</p>

TWO	<p><b>Diamond</b></p> <ul style="list-style-type: none"> <li>is very hard due to a 3D tetrahedral arrangement of C atoms covalently bonded to each other. Used as an abrasive, often in cutting instruments.</li> <li>has high lustre and dispersion of light so used as a gemstone in jewellery. Lustre quality is due to the strong covalent bonds of diamond*.</li> </ul> <p>(* This is beyond the scope of the standard but if the use is used, the property must be relevant.)</p> <p><b>Graphite</b></p> <ul style="list-style-type: none"> <li>has a soft, slippery feel because sheets of graphite can move over each other due to weak forces holding the sheets together. These are easily broken. Graphite can be used in pencils and as a dry lubricant, eg for locks.</li> <li>conducts electricity because the C atoms only bond to 3 other C atoms which allows for a delocalised electron that is able to carry charge. Can be used as a material in batteries, as electrodes.</li> <li>hard substance due to the sheets of graphite which are C atoms that are covalently bonded to each other. Used in fishing rods, bike frames, golf clubs.</li> </ul> <p><b>Buckyballs</b></p> <ul style="list-style-type: none"> <li>The C<sub>60</sub> molecule is extremely stable, being able to withstand high temperatures and pressures.</li> <li>Low melting point, soft and slippery because buckyballs are discrete molecules with a small number of atoms.</li> <li>Hollow structure allows for any element to be housed within it. This has many potential uses.</li> <li>By doping fullerenes, they can be electrically insulating, conducting, semiconducting or even superconducting.</li> </ul> <p>Some potential applications for fullerenes include:</p> <ul style="list-style-type: none"> <li>superconductors</li> <li>lubricants</li> <li>catalysts</li> <li>applications in fuel cells</li> <li>antioxidants.</li> </ul>	<p>Describes a property OR aspect of bonding of diamond.</p> <p>Describes a property OR aspect of bonding of graphite.</p> <p>Describes a property of C<sub>60</sub>.</p> <p>Names a use for ONE allotrope.</p> <p>NØ no response or no relevant evidence. N1 one descriptor. N2 two descriptors. A3 three descriptors. A4 All 4 descriptors.</p>	<p>Links ONE relevant property with an aspect of bonding to a named use for TWO allotropes.</p> <p>M5 makes links for TWO allotropes. M6 makes links for THREE allotropes.</p>	<p>Explains with comprehensive understanding how a relevant property (and its bonding) relates to a named use or predicted use for TWO allotropes.</p> <p>E7 meets criteria for two allotropes. E8 meets criteria for three allotropes.</p>
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<p>THREE</p> <p>(a)</p> <p>(b)</p> <p>(c)(i)</p> <p>(ii)</p>	<p>Pungent, colourless gas that is choking</p> <p><math>S(s) + O_2(g) \rightarrow SO_2(g)</math></p> <p>Observations: Lead – small bubbles of gas appear on the surface of the metal. (It is unlikely that any heat will be detectable or that any of the metal will be able to be seen to disappear, unless over a long period.) Zinc – bubbles of gas are released. Metal disappears (may detect heat being released).</p> <p>Equations: <math>Pb(s) + H_2SO_4(aq) \rightarrow PbSO_4(aq) + H_2(g)</math> <math>Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)</math></p> <p>To conduct electricity, a solution must contain charged particles. Water molecules are electrically neutral, so cannot conduct electricity. When sulfuric acid forms a solution with water, ions are formed. Ions are charged particles and therefore can conduct electricity.</p> <p><math>H_2SO_4(l) + 2H_2O(l) \rightarrow 2H_3O^+(aq) + SO_4^{2-}(aq)</math></p> <p>OR</p> <p><math>H_2SO_4(l) + H_2O(l) \rightarrow H_3O^+(aq) + HSO_4^-(aq)</math></p> <p>OR</p> <p><math>H_2SO_4(l) \rightarrow 2H^+(aq) + SO_4^{2-}(aq)</math></p>	<p>Describes an observation that identifies <math>SO_2</math> or identifies <math>SO_2</math> in the equation.</p> <p>Describes ONE observation of lead in acid.</p> <p>Describes ONE observation of zinc in acid.</p> <p>Identifies that <math>H_2</math> is the gas formed.</p> <p>Recognises that charged particles conduct electricity.</p> <p>NØ no response or no relevant evidence. N1 one description correct. N2 two descriptions correct. A3 three descriptions correct. A4 four descriptions correct.</p>	<p>Links observations to formation of <math>SO_2</math>.</p> <p>Links observations to formation of products (this may be shown in equations).</p> <p>Links sulfuric acid to forming ions in solution.</p> <p>M5 two criteria. M6 three criteria.</p>	<p>Writes THREE balanced equations.</p> <p>Explains ALL observations linked to products that show clearly the difference in reactivity of the metals.</p> <p>Explanation shows comprehensive understanding of nature of conductivity in solution with regards to the ions of a sulfuric acid solution.</p> <p>E7 two criteria. E8 all three criteria.</p>
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FOUR	<p><b>Aluminium</b></p> <ul style="list-style-type: none"> <li>• Its low density makes it the first choice for long distance powerlines because it is cheaper to build structures to hold up powerlines despite:</li> <li>• Less (63% of) electrical conductivity of copper which means it will not be as efficient in its energy transfer.</li> <li>• Aluminium is corrosion-resistant due to oxide layer that is formed because of aluminium's reactivity with oxygen in the air so it will withstand the conditions of the outside.</li> <li>• Aluminium is more ductile than copper, so easier to draw into wires which is more efficient and useful for long distance wires.</li> </ul> <p><b>Copper</b></p> <ul style="list-style-type: none"> <li>• Excellent electrical conductor so cheaper alternative because little wasted electrical energy.</li> <li>• Is denser (and thus expensive support structures needed to be used in comparison to aluminium).</li> <li>• Also corrosion resistant so will not react with household substances and cause any problems.</li> <li>• Has higher melting point than aluminium, so is less likely to melt and cause damage in household wiring.</li> </ul>	<p>Identifies TWO relevant properties of Copper to its role in the household.</p> <p>Identifies TWO relevant properties of Aluminium to its role outdoors.</p> <p>NØ no response or no relevant evidence. N1 identifies ONE relevant property of ONE metal. N2 identifies ONE relevant property of BOTH metals. A3 both descriptors. A4 identifies more than TWO relevant properties for ONE metal.</p>	<p>Links TWO named and relevant properties to an advantage/ disadvantage for EACH metal</p> <p>M5 meets criteria. M6 links more than TWO named properties to an advantage / disadvantage for ONE metal.</p>	<p>Comprehensively compares and contrasts TWO relevant properties of EACH metal in their respective roles</p> <p>E7 meets criteria. E8 evaluates with THREE properties for ONE of the metals.</p>
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### Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 10	11 – 17	18 – 24	25 – 32