Pilot Assessment Schedule – 2023

Chemistry and Biology: Demonstrate understanding of how the properties of chemicals inform their use in a specific context (92023)

Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of how the properties of chemicals inform their use in a specific context involves: • describing the properties of each chemical used, in a specific context • describing a relevant physical condition for each chemical used, in the specified context.	*Explain how the properties of chemicals inform their use in a specific context* involves: • linking the properties of each chemical used to the relevant physical condition in the specified context.	*Evaluate how the properties of chemicals inform their use in a specific context* involves: • analyse reasons for using chemicals in the specified context, based on properties and relevant physical condition.

Evidence

Task	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	Copper (Cu), gold (Au), and tin (Sn) are metals / metallic substances. In order to be useful as an electronic component in a smartphone, all metals must contain charged particles that are free to move. All these metals contain delocalised electrons / valence electrons that are free to move, and therefore conduct electricity. *AND* All these metals are malleable / ductile. The bonding in metals is non-directional, so the metal atoms / cations / positive ions will slide over each other when a force is applied, allowing them to be shaped into different electronic components. *OR* All these metals have a high melting point. A lot of heat energy is required to break the forces of attraction between the metal atoms / cations / positive ions, so they are solid at room temperature and suitable for making electronic components. *OR* All these metals are insoluble in water, so the electronic components will not dissolve when in contact with moisture from the air. The forces of attraction between the metal atoms / cations / positive ions and water molecules are weaker than the forces of attraction between the metal atoms (and their valence electrons).	• Substance identified as metallic. *AND* • Recognise metals have free moving / delocalised electrons.	• One relevant physical property explained.	• Two relevant physical properties linked to their use as an electronic component. Must include electrical conductivity.

(b)	The metal most suitable to be used as a heat sink is copper. An electrical component being used as a heat sink needs to conduct electricity, have a high melting point, and a high thermal conductivity. Both copper and gold have relatively high melting points. A lot of heat energy is required to break the forces of attraction between the metal atoms / cations / positive ions so they can absorb heat energy without melting / changing state. *(Can explain copper has a higher melting point.)* Both copper and gold conduct electricity, as they have electrons that are free to move, enabling them to be used as an electrical component. *(Can explain copper has a higher electrical conductivity.)* Copper has a higher thermal conductivity (413 W / m) than gold (319 W / m), so will be more efficient at drawing heat away, preventing the phone overheating.	• Recognises copper is the most suitable element for a heat sink.	• Explains a physical property of copper that makes it suitable as a heat sink.	• Discusses why copper is more suitable than gold as a heat sink. Must include thermal conductivity. Minor error – not using values from table.
(c)	The solder needs to melt at a lower temperature than the metal components it is joining, and also conduct electricity. Tin has the lowest melting point of the three solids, so tin could be heated to form a join between the components without the metal components melting or damaging the electrical components. Its conductivity is lower than other metals, but it can still conduct electricity between the electrical components.	• Tin has the lowest melting point.	• Explains that tin has a lower melting point than the other metals so is suitable as a solder to join components. • Ability to conduct electricity between components.	• Complete discussion of the use of tin in solder.
(d)	The battery terminal needs to be a solid at room temperature and conduct electricity. Diamond is a covalent network structure with four (strong covalent) bonds holding each carbon atom in a regular array / structure. Diamond does not contain any charged particles / electrons that are free to move for electrical conduction (as its electrons are shared in covalent bonds between the atoms.) It is not suitable as a battery terminal / anode or cathode, as it does not conduct electricity. Graphite is also a covalent network substance. Each carbon atom is covalently bonded to three other carbon atoms (in regular array hexagonal rings). The free electrons / delocalised electrons present allow the graphite to conduct electricity, making it suitable as a battery terminal / anode or cathode.	• Covalent network substances.	• Links structure of diamond to non-conductivity. *OR* • Links structure of graphite to conductivity.	• Compares structure of graphite and diamond, linking physical properties to suitability as an anode / cathode.

(e)	To conduct electricity, the source of charged particles (lithium ions) needs to be able to move freely between the battery terminals. A solid lithium salt is an ionic substance where the lithium ions are held together in fixed positions by a strong attractive force. The ions are not free to move and conduct electricity. In solution or as an electrolyte, the attractive forces between the ions have been broken, and the lithium ions are free to move between the battery terminals to conduct electricity.	• Recognises lithium salt is an ionic substance.	• Links movement of lithium ions to electricity conductivity in solution *OR* • Links no free lithium ions to non-conduction in solid.	• Discusses electrical conductivity of lithium ions in both the electrolyte and solid ionic compound, and links to use in a battery.
(f)	An alloy is a mixture of chemical elements of which at least one is a metal. *AND* Any sensible suggestions linked to use as a battery in a smartphone, for example: Alloy 2 has a higher melting point so is less likely to melt as the battery heats up. Its density is less than Alloy 1, so will help reduce the weight of the smartphone, making it easier to carry. The malleability of Alloy 2 is lower, so the casing could be made out of thinner sheets, making the smartphone slimmer and easier to fit into a pocket.	• Defines an alloy. *OR* • Suggests Alloy 2 using data, no linking of physical properties to use.	• Suggests an alloy linking ONE physical property to use.	• Suggests an alloy linking TWO physical properties to use.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response	2A	3A	4A	5A	3M	4M	3E	4E

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 2	3 – 4	5 – 6	7 – 8