

To be completed by candidate

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This assessment is based on a now-expired version of the achievement standard and may not accurately reflect the content and practice of external assessments developed for 2024 onwards.

92023

Draw a cross through the box (☒) if you have NOT written in this booklet

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Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Chemistry and Biology RAS 2023

92023 Demonstrate understanding of how the properties of chemicals inform their use in a specific context

Credits: Four

PILOT ASSESSMENT

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of how the properties of chemicals inform their use in a specific context	Explain how the properties of chemicals inform their use in a specific context	Evaluate how the properties of chemicals inform their use in a specific context

Enter your National Student Number (NSN) and School Code into the space above.

You should attempt ALL parts of the task in this booklet.

Make sure you have Resource Booklet 92023R.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

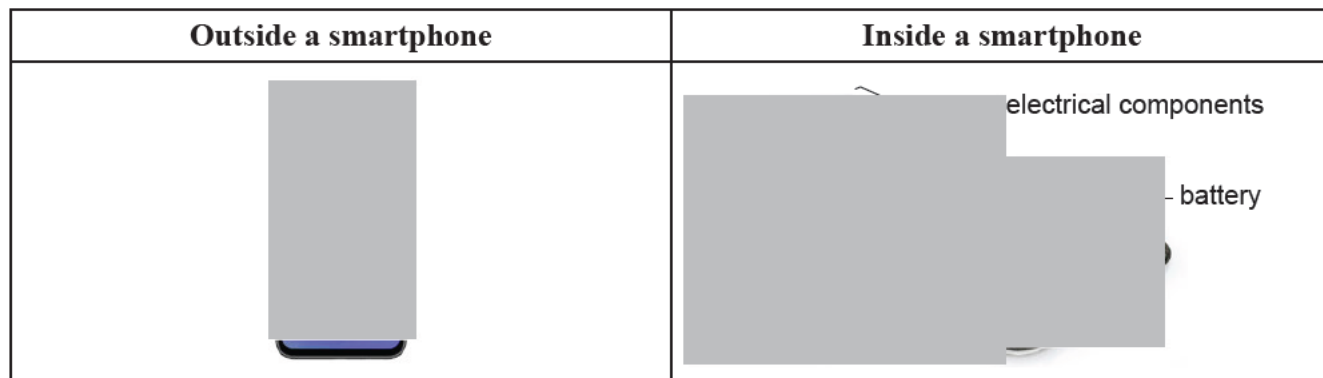
Do not write in any cross-hatched area (☒). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TASK

Elements in a smartphone

A smartphone is an electronic device that contains a lot of circuitry (electrical components). The smartphone shown contains the elements copper (Cu), gold (Au), and tin (Sn).



- (a) Use your knowledge of the physical properties of chemicals to explain why ALL of the three elements are suitable for use as electrical components in a smartphone.

In your answer:

- Identify the ONE type of chemical structure from the list below that copper (Cu), gold (Au), and tin (Sn) all share.
- Identify TWO key physical properties from the list below needed for copper (Cu), gold (Au), and tin (Sn) to be used for electrical components.
- Discuss the structure of the elements and the two physical properties you have chosen, and link these to their use as an electrical component in a smartphone.

Type of chemical structure (choose ONE): covalent network, ionic, metallic, molecular

Type of chemical structure: _____

Key physical properties (choose TWO): boiling point, density, electrical conduction, heat conduction, malleability, melting point, solubility in water

Two key physical properties: _____

Discussion: _____

- (b) One of the electrical components in a smartphone is a **heat sink**. The heat sink draws heat away from the electrical components in the smartphone to prevent the phone overheating.

Substance	Melting point °C	Electrical conductivity, σ (1/ohms m)	Thermal (heat) conductivity, k (W/mK)
Copper	1084	5.96×10^7	413
Gold	1063	4.52×10^7	319

Note: $10^7 = 10\,000\,000$

Use **Table A** to discuss which of the two elements above (copper or gold) would be the most suitable as a **heat sink**.

Most suitable element (copper or gold): _____

Discussion: _____

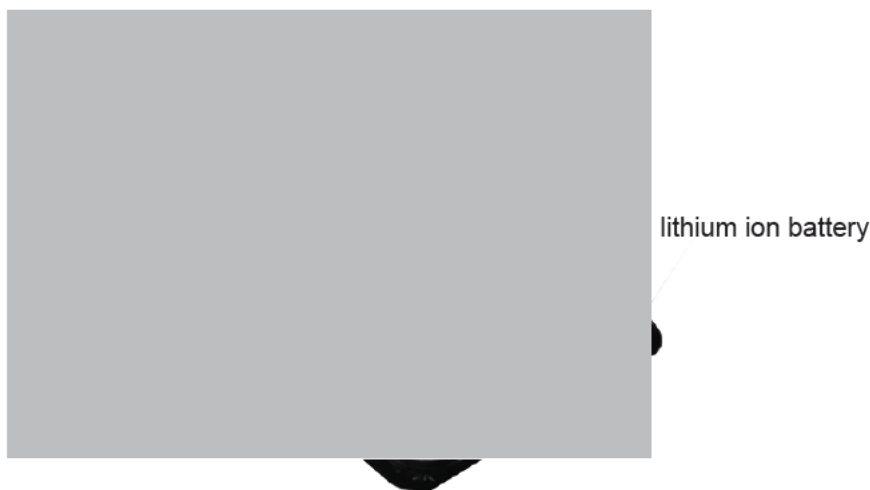
- (c) Solder is a combination of metals, mainly tin (Sn). Solder is used to join the electrical components of the smartphone together. Solder does this by **melting** then **cooling**, forming a **solid** join connecting the electrical components together.

Table B: Properties of chemicals		
Substance	Melting point °C	Electrical conductivity, σ (1 / ohms m)
Copper	1084	5.96×10^7
Gold	1063	4.52×10^7
Tin	232	9.17×10^6

Note: $10^7 = 10\,000\,000$ and $10^6 = 1\,000\,000$

Use your analysis of the information in **Table B** to discuss why solder is mainly made of tin.

The battery of a smartphone



Interior view of smartphone showing the lithium ion battery

For electricity to flow, substances need charged particles, either electrons or ions. The electrons or ions require two terminals (+ and –) for the battery to work.

(d) Both graphite and diamond are forms of carbon (allotropes).

Discuss why graphite is used as part of a smartphone battery (terminal) to conduct electricity rather than diamond.

In your answer refer to the:

- type of chemicals graphite and diamond are
- structure of the graphite and diamond
- relevant physical properties of graphite and diamond.
