NZQA

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Chemistry and Biology 2024

92023 Demonstrate understanding of how the physical properties of materials inform their use

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of how the physical properties of materials inform their use.	Explain how the physical properties of materials inform their use.	Evaluate how the physical properties of materials inform their use.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Pull out Resource Booklet 92023R from the centre of this booklet.

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 the margins (▨▨▨). This area will be cut off when the booklet is marked.

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

QUESTION ONE: Paper electrical circuits

A pencil containing graphite (carbon), C, has been used to draw an electrical circuit, which is an outline of a car. A 9V battery and light-emitting diode (LED) are also part of the circuit.

Table 1: Physical properties of graphite (carbon), C		
Physical property	**Numerical values**	**Comment**
Melting point	3650°C	Very high
Solubility in water		Insoluble
Electrical conductivity	3×10^5 σ (S/m) at 20°C	Good
Malleability	4.80 GPa	Brittle
Hardness	1 to 2 Moh	Soft

(a)   Describe TWO physical properties of graphite (carbon) and link these two physical properties to their use in drawing and creating an operating electrical circuit.

_____

_____

_____

_____

_____

_____

(b)   Explain these TWO physical properties with reference to the structure and bonding of graphite (carbon).

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(c)   Evaluate how graphite (carbon) will behave when used to draw and create an operating electrical circuit by linking the TWO physical properties to the structure and bonding.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

QUESTION TWO: Electrical fire

Carbon dioxide fire extinguishers can be used safely to put out electrical fires. These extinguishers are filled with non-flammable carbon dioxide, CO_2, gas.

Table 2: Physical properties of carbon dioxide and air		
Physical property	**CO_2**	**Air**
Density at 20°C (kg/m³)	1.98	1.20
Electrical conductivity	Insulator	Insulator

A carbon dioxide fire extinguisher

(a)   Describe TWO physical properties of carbon dioxide and link these two physical properties to the safe use of carbon dioxide to prevent oxygen in the air from fuelling a fire.

(b)   Explain these TWO physical properties, with reference to the structure and bonding of carbon dioxide.

(c) Evaluate how carbon dioxide will behave when used as a fire extinguisher by linking the TWO physical properties to the structure and bonding.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

QUESTION THREE: Harakeke

Harakeke (New Zealand flax) has long upright leaves that can grow up to four metres (4 m) in length. When the green flesh is removed by scraping, a long, white fibre (**polymer**) called **muka** is revealed. This fibre can be spun or plaited.

Muka fibre is a natural polymer material.

The spun muka can be used for many things, including making a kupenga (fishing net). Kupenga could then be weighed down with stones so that the kupenga would sink.
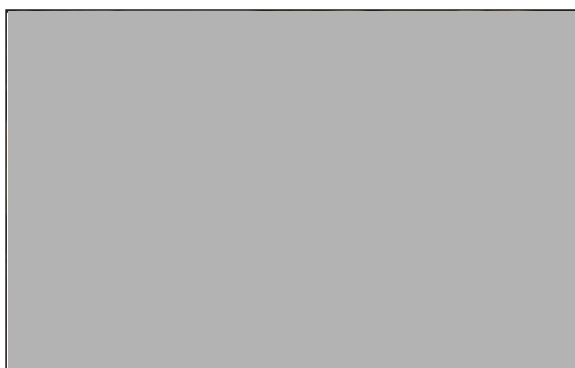
Harakeke leaves (green) and muka fibres (white)

Kupenga made by knotting muka fibres together

Table 3: Young's modulus and solubility of various materials		
Material	**Young's modulus* GPa**	**Solubility in water**
Muka	8.6	Insoluble
Hemp	11.8	Insoluble
Wool	2.3	Insoluble
Glass	70–100	Insoluble

* A high value of Young's modulus means that a material is brittle

(a) Describe TWO physical properties of muka and link these two physical properties to their use in making a working kupenga.

_____

_____

_____

_____

_____

_____

(b) Explain these TWO physical properties, with reference to the structure and bonding of muka.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(c) Evaluate how muka will behave when used as a kupenga by linking the TWO physical properties to the structure and bonding.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

QUESTION
NUMBER

> **Extra space if required.**
> **Write the question number(s) if applicable.**

92023