NZQA

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Physics, Earth and Space Science 2025

92047 Demonstrate understanding of a physical system using energy concepts

Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of a physical system using energy concepts.	Explain a physical system using energy concepts.	Analyse a physical system using energy concepts.

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 92047R from the centre of this booklet.

Show ALL working.

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 2–12 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: LIFTING A PAINT POT

A paint pot is attached to a very light rope. A painter uses a 250 Watt electric motor to lift a 40 kilogram paint pot up the side of a 20 metre building from the ground. It takes 35 seconds to lift the pot from the ground to the top of the building.

250 W

m

40 kg
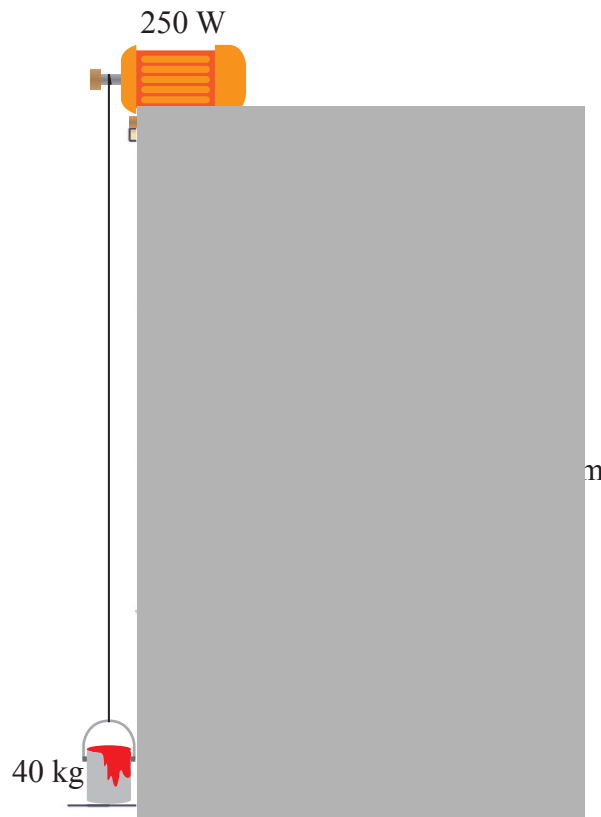
Adapted from: https://img.pikbest.com/png-images/qiantu/city-cartoon-vector-building-mbe-style-apartment-house_2583356.png!sw800

(a)   Describe the energy changes as the motor lifts the paint pot up the side of the building.

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(b)   Compare the amount of energy provided by the motor with the gain in gravitational potential energy of the paint pot when it is at the top of the building.

In your answer, you should:

  •   consider the amount of electrical energy provided by the motor

  •   consider the amount of gravitational potential energy gained by the paint pot from the ground to a height of 20 m

  •   explain why there is a difference between these two numbers.

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(c)   The paint pot is at the top of the building and the rope breaks.

Discuss the energy transfer of the paint pot from the top of the building to when it is halfway down.

You may use diagrams or words (or both) for your answer.

Diagrams:

(d) The paint pot falls from 20 m.

Discuss the speed of the paint pot just before it hits the ground.

In your answer, you will need to:

• calculate the maximum speed at which the paint pot hits the ground

• include any assumptions you have made in this calculation

• explain why the paint pot will not reach this speed.

QUESTION TWO: KEEPING WARM

Loa is in the lounge and feeling cold. She connects a convection heater to the power supply and switches it on. Loa places the heater in the room and notices the temperature of the air begin to rise.

(a)   Compare the concepts of temperature and heat energy.

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(b)   Loa notices the maximum power rating for the heater is 2000 W.

The voltage supply in her house is 240 V.

She sets the dial to **50% maximum**.

Calculate the current in the heater circuit.
Include the correct units.

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(c) Loa turns the dial on the heater, which increases the current in the heater.

Discuss how an increase in current in the circuit affects the amount of thermal energy released by the heater.

Use relevant formulae to support your answer; calculations are not required.

(d)   In the space below, draw a labelled diagram showing how the air particles move as a result of the heater heating the air.

Discuss particle movement in various parts of your diagram, and how this results in the pattern you have drawn in your diagram.

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QUESTION THREE: HEATING WATER

Cecelia uses the equipment shown to measure the specific heat capacity (c) of water.

She puts 0.5 kg of water in a beaker on a hotplate to heat the water. The voltage of the hotplate is 24 V, and the current provided to the hotplate is 5.0 A.

thermometer
beaker
hotplate
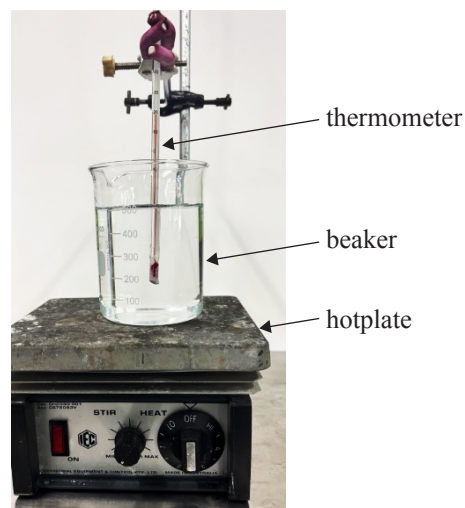
(a)   Define the term **specific heat capacity**.

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(b)   Show that the electrical energy used by the hotplate over 10 minutes (600 seconds) is 72 000 J.

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(c)   Cecelia graphs the increase in water temperature over time, and obtains the following result.

Heating water against time
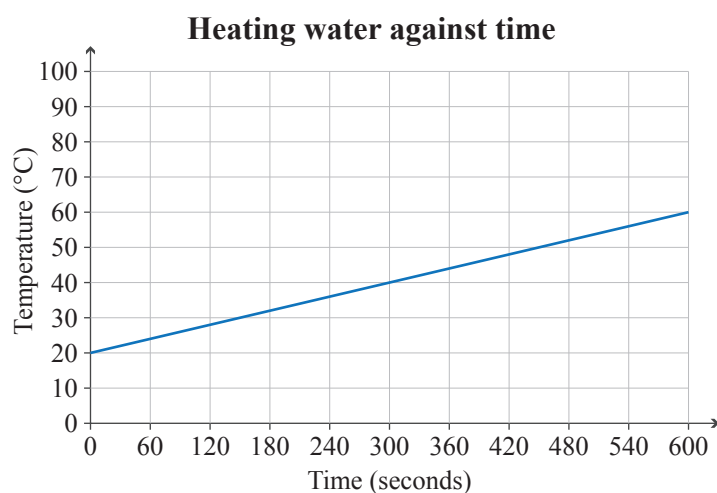
(i)   Calculate Cecelia's value for the specific heat capacity gained from her results over 10 minutes.

In your answer, you should:

- consider the electrical energy is 72 000 J
- use the graph to find the change in temperature over 10 minutes
- then calculate Cecelia's value for the specific heat capacity of water.

Include the correct unit in your final answer.

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(ii) Cecelia then compares her value with the one in the textbook.

Discuss why her value and the textbook value are different.

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(d) Cecelia's value for the specific heat capacity of water is different from the value given in a textbook.

Discuss how she could improve this experiment to get a more accurate result.

In your answer, you will need to:

- draw a labelled diagram showing an experimental setup with ONE suggested improvement
- explain why this change would give you a more accurate answer
- discuss the idea of heat transfer linked to this improvement.

Space for drawing

QUESTION NUMBER	Extra space if required. Write the question number(s) if applicable.

QUESTION
NUMBER

92047