

Name of the Student: \_\_\_\_\_

Max. Marks : 19 Marks

Time : 19 Minutes

**Q1.**

The figure below shows some bumper cars.

Bumper cars are designed to withstand collisions at low speeds.



- (a) During a collision between a bumper car and the barrier, the bumper car and barrier act as a closed system.

What is meant by a 'closed system'?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(1)

- (b) How does Newton's Third Law of motion apply to the collision between the bumper car and the barrier?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(1)

- (c) During the collision, the change in momentum of the bumper car is 700 kg m/s.

The time taken for the collision is 0.28 s.

Calculate the force on the bumper car during the collision.

Use the Physics Equations Sheet.

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Force = \_\_\_\_\_ N

(2)

(d) The bumper car has a flexible bumper.

Explain how the flexible bumper reduces the risk of injury to the people in the bumper car during the collision.

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(3)

(e) A bumper car moved with an initial constant velocity and then accelerated at  $2.0 \text{ m/s}^2$ .

While accelerating, the bumper car travelled a distance of 1.5 m.

The final velocity of the bumper car was 2.5 m/s.

Calculate the initial constant velocity of the bumper car.

Use the Physics Equations Sheet.

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Initial constant velocity = \_\_\_\_\_ m/s

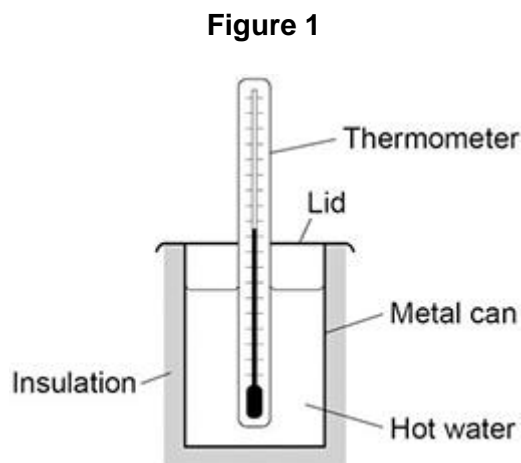
(3)

(Total 10 marks)

## Q2.

A student investigated the insulating properties of different materials.

**Figure 1** shows some of the equipment used by the student.



This is the method used:

1. Wrap insulating material around the can.
2. Put a fixed volume of boiling water in the can.
3. Place the lid on the top of the can.
4. Measure the time taken for the temperature of the water to decrease by a fixed amount.
5. Repeat steps 1 – 4 using the same thickness of different insulating materials.

(a) Identify the independent variable and the dependent variable in this investigation.

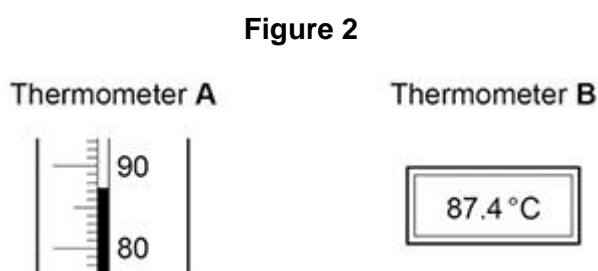
Independent variable \_\_\_\_\_

Dependent variable \_\_\_\_\_

(2)

The student used two different types of thermometer to measure the temperature changes.

**Figure 2** shows a reading on each thermometer.



(b) What is the resolution of thermometer **B**?

Resolution = \_\_\_\_\_ °C

(1)

(c) Thermometer **A** is more likely to be misread.

Give **one** reason why.

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(1)

- (d) For one type of insulating material, the temperature of the water decreased from 85.0 °C to 65.0 °C.

The energy transferred from the water was 10.5 kJ.

specific heat capacity of water = 4200 J/kg °C

Calculate the mass of water in the can.

Use the Physics Equations Sheet.

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Mass = \_\_\_\_\_ kg

(3)

- (e) The table below shows the results for two insulating materials.

Material	Time for temperature to decrease by 20 °C in seconds
X	450
Y	745

Explain how the results in above table can be used to compare the thermal conductivity of the two materials.

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(2)  
(Total 9 marks)