

Name of the Student: _____

Max. Marks : 23 Marks

Time : 23 Minutes

Q1.

The photograph shows a small plastic container, its lid and some pellets of frozen carbon dioxide, known as dry ice. When at room temperature the dry ice gradually changes state directly from solid to gas.



Dry ice is placed in the container and the lid is put on. The container is turned upside down and placed on the floor. After a few minutes the pressure of the gas causes the container to fly into the air, leaving the lid and some dry ice behind.

A student investigated the motion of the container.

(a) The student obtained measurements of the maximum height reached by the container for a particular initial mass of dry ice. The student determined that the maximum height was 2.5 m.

Calculate the initial speed of the container.

(2)

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Initial speed =

(b) The student investigated how the maximum horizontal distance travelled by the container varies with launch angle.

Calculate the maximum horizontal distance the container would travel if launched at an initial speed of 6.5 m s^{-1} at an angle of 20° to the horizontal.

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Maximum horizontal distance =

(c) The student added dry ice to the container again and placed it on its side on the floor. When the lid was forced off, the container moved forward at a speed of 5.5 m s^{-1} and the lid moved backwards. The pellets of dry ice remained in their original position.

mass of container = 4.3 g

mass of lid = 1.6 g

(i) Calculate the initial speed of the lid.

(3)

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Initial speed of lid =

(ii) Explain why the dry ice remained at the original position.

(2)

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(Total for question = 12 marks)

Q2.

Read the following passage and then answer the questions that follow.

Cool Heads Come Out On Top

The school team are celebrating their win at the regional STEM Club competition for their fan cooled hat.

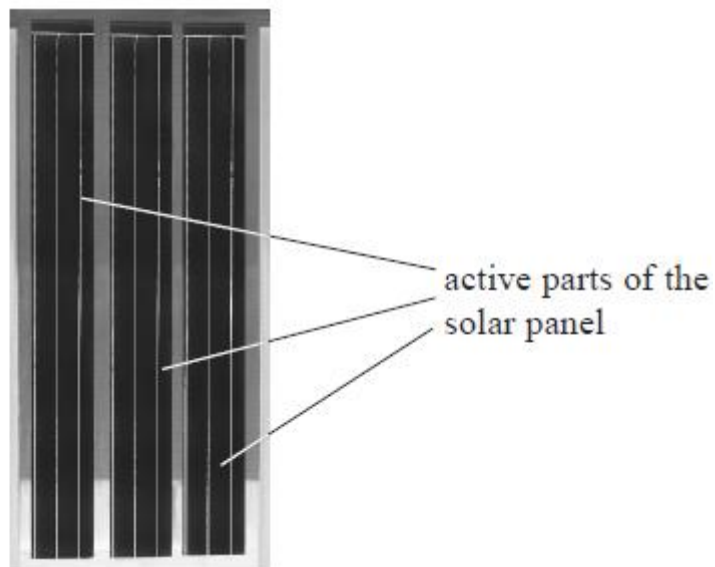
The photograph shows an early prototype.



The solar panel on top of the hat powers the fan which is at the front of the hat. This cools the wearer of the hat.

A team member said, “Our cell generates 1.5 V and has a solar to electrical efficiency of about 10%. This doesn’t sound like much, but our hat could make a significant contribution to energy conservation and protecting the environment.”

(a) The photograph shows the active parts of the solar panel at full size.



(i) By taking measurements from the full size photograph, show that the total area of the active parts of the solar panel is about 10^{-3} m^2 . Include the uncertainty in your answer.

(4)

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(ii) The following results were recorded when the team tested the hat in the laboratory.
intensity of incident light = 1240 W m^{-2}
output current = 102 mA
output potential difference = 1.52 V
Determine whether the team member's statement about the efficiency is correct.

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(b) Criticise the comment, "our hat could make a significant contribution to energy conservation and protecting the environment".

(2)

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(Total for question = 11 marks)