

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

An electric drinks cooler is an appliance consisting of a thermally insulated compartment and a heat pump that transfers heat from the inside of the cooler to the room in which the cooler is placed.

This maintains the temperature of the inside of the cooler below the temperature of the room.



(Source: <http://www.americanas.com.br/produto/110863245/adega-de-vinhos-easycooler-12-garrafas>)

On closing the door of the cooler, warm air at atmospheric pressure and at a temperature of 22.5°C is trapped inside. After a time, the internal temperature stabilises at 3.3°C .

A student notices that the door is difficult to open and concludes that this is because the air inside has cooled down and reduced the pressure.

Carry out a calculation to assess the validity of the student's conclusion.

atmospheric pressure = 102 kPa

area of door = 0.15 m^2

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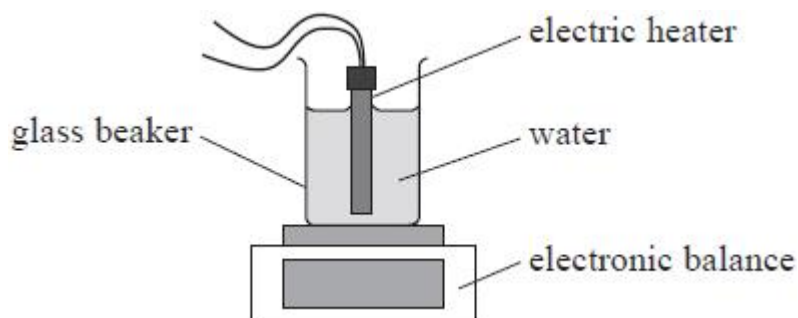
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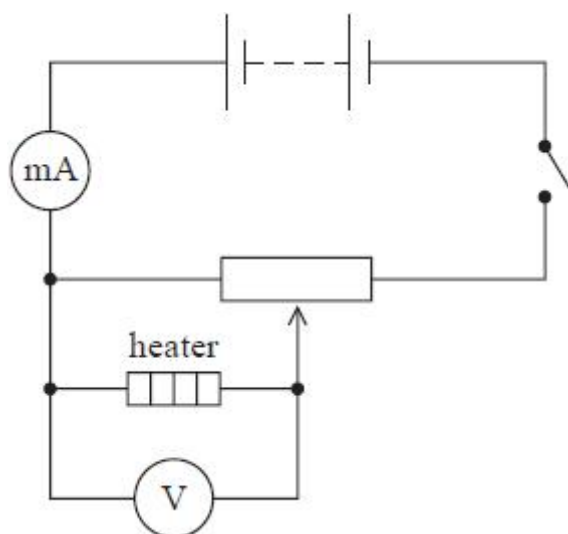
(Total for question = 7 marks)

Q2.

The specific latent heat of vaporisation of water can be determined using the apparatus shown.



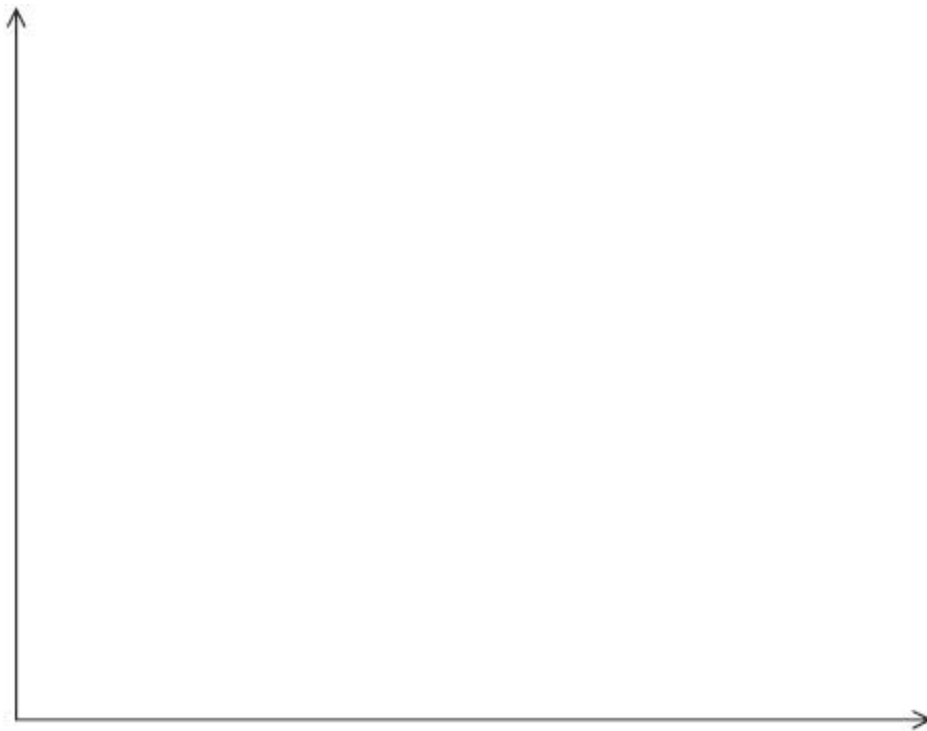
A student planned to vary the current in the heater from 0 A to 5 A. The student connected the following circuit to measure the current in the heater.



(i) The student corrected the circuit and closed the switch. He waited until the water started boiling. He started a stopwatch and recorded the readings on the balance at regular time intervals.

Sketch a graph, on the axes below, of how the readings on the balance would vary with time.

(3)



(ii) The heater was switched on for 6.0 minutes and the change in mass of water in the beaker was 7.5 g.
Calculate the specific latent heat of vaporisation of water, L .
 $V = 12 \text{ V}$
 $I = 4.2 \text{ A}$

(3)

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$L =$

(iii) The errors in the experiment include uncertainty in the mass reading and uncertainty in reading the stopwatch, as the water boils.
Explain how another significant source of error affects the value of L obtained from the experiment.

(2)

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(Total for question = 8 marks)

Q3.

Aldebaran is a red giant star.

For a black body radiator of Aldebaran's surface temperature, the wavelength λ_{max} at which the intensity is maximum is $7.43 \times 10^{-7} \text{ m}$.

Determine the luminosity of Aldebaran.

radius of Aldebaran = 3.14×10^{10} m

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Luminosity =

(Total for question = 4 marks)