

Name of the Student: _____

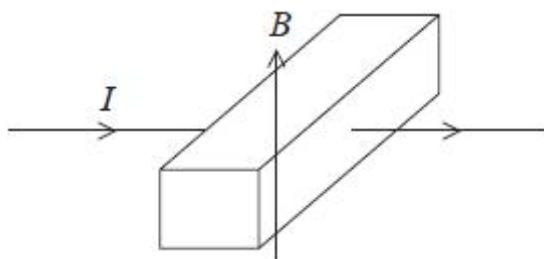
Max. Marks : 17 Marks

Time : 17 Minutes

Q1.

Some liquids conduct electricity. This property can be used to pump these liquids through pipes.

A short section of a rectangular pipe containing a liquid is shown in the diagram. The pipe is placed in a magnetic field of flux density B and a current I is passed through the liquid as shown.



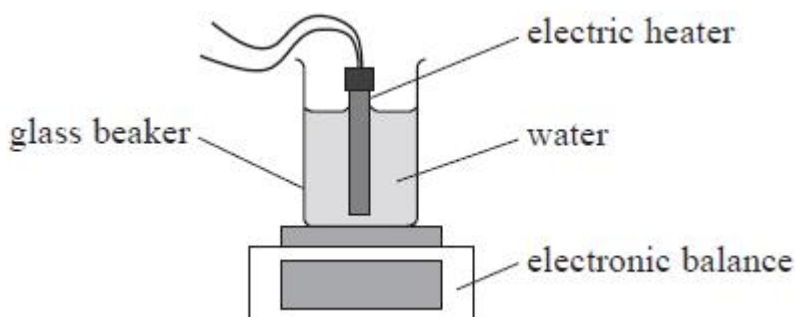
Add an arrow to the diagram above to show the direction in which the liquid will move.

(1)

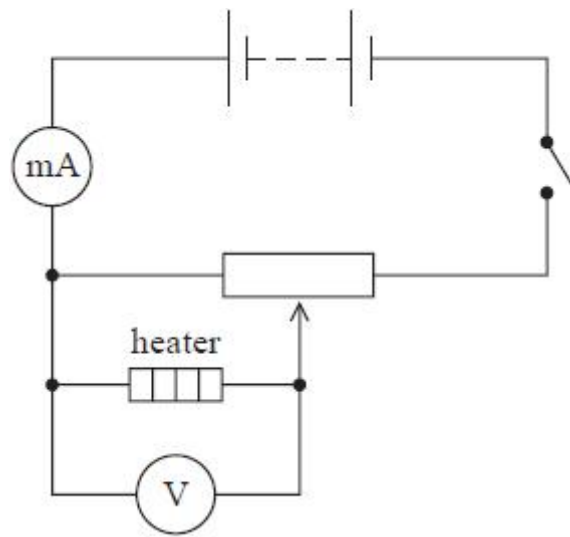
(Total for question = 1 mark)

Q2.

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



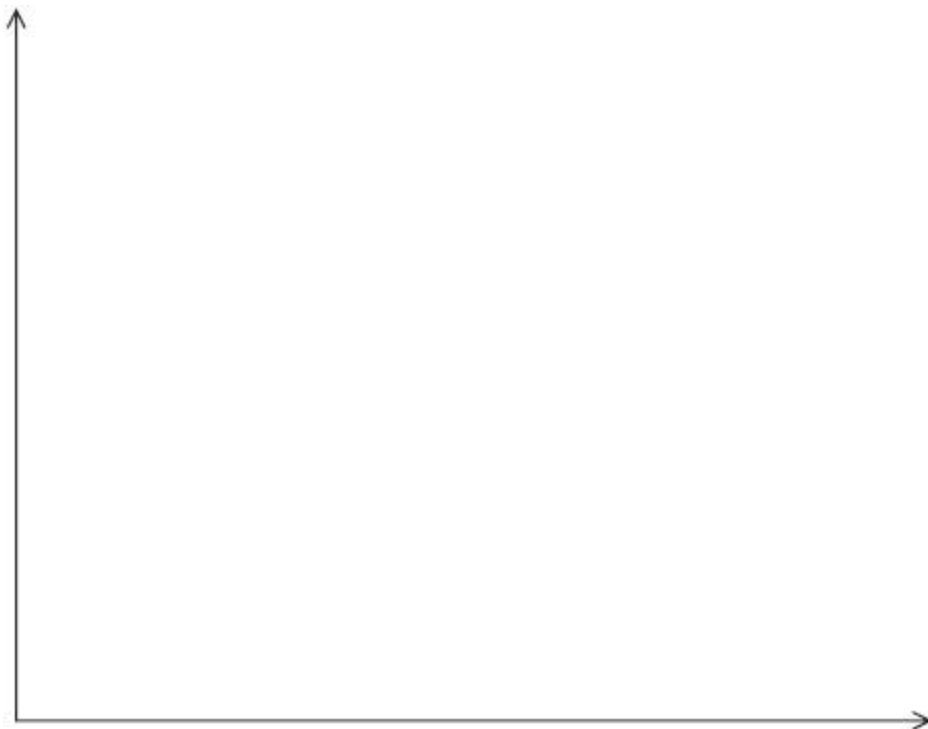
A student planned to vary the current in the heater from 0 A to 5 A. The student connected the following circuit to measure the current in the heater.



(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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$$L = \text{.....}$$

(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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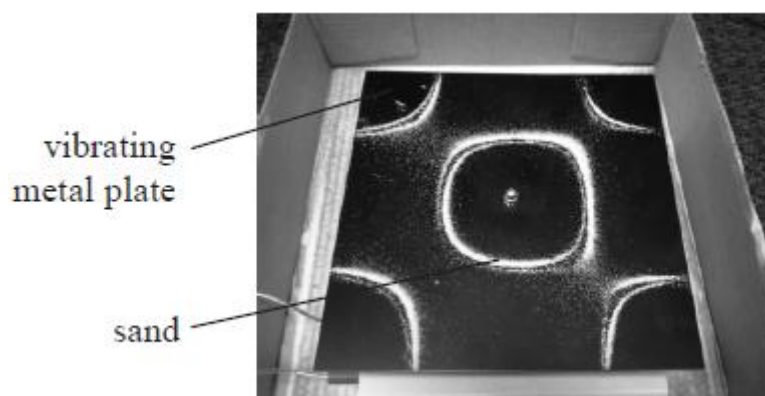
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(Total for question = 8 marks)

Q3.

Rosslyn Chapel is a 15th century chapel in Scotland. Inside the chapel, small sandstone cubes protrude from a number of arches. It has been suggested that carvings on these cubes bear a resemblance to standing wave patterns that can be produced on a vibrating metal plate.

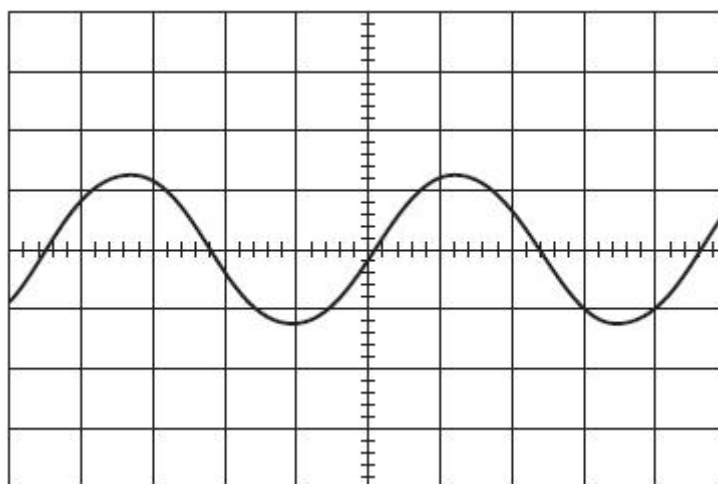
A metal plate is made to vibrate and sand is scattered evenly across its surface. At a certain frequency the sand moves to produce the standing wave pattern shown below.



(Source: <https://skullsinthestars.com/2013/05/02/physics-demonstrations-chladni-patterns/#jpcarousel-7353>)

The plate is set into movement by a vibration generator. The wavelength of the waves produced in the plate was estimated to be 0.32 m.

The signal applied to the vibration generator is shown on the oscilloscope trace below. The time base of the oscilloscope was set to 0.50 ms div^{-1} .



The waves produced in the plate travel at a speed much less than the speed of sound in air.

Evaluate whether the data supports a value for the speed of waves in the plate that is much less than the speed of sound in air.

speed of sound in air = 340 m s^{-1}

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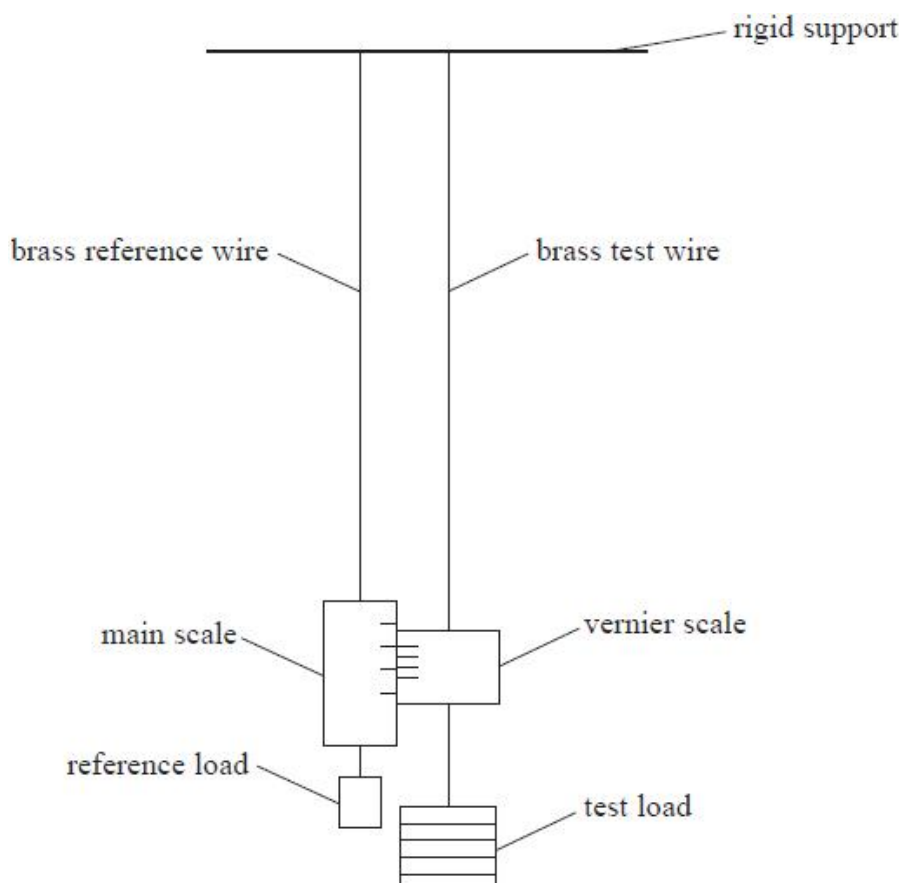
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(Total for question = 5 marks)

Q4.

A student used the apparatus shown to determine the Young modulus of brass. Loads were added to the test wire and corresponding readings taken from the vernier scale. The test wire and the reference wire were identical.



Explain why the test wire should be both long and thin.

(3)

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(Total for question = 3 marks)