Name of the Student:_____

Max. Marks : 24 Marks **Time : 24 Minutes**

Q1.

The alpha particle scattering experiment led to a number of observations and conclusions.

Which row in the table gives a correct observation and corresponding conclusion from the alpha particle scattering experiment?

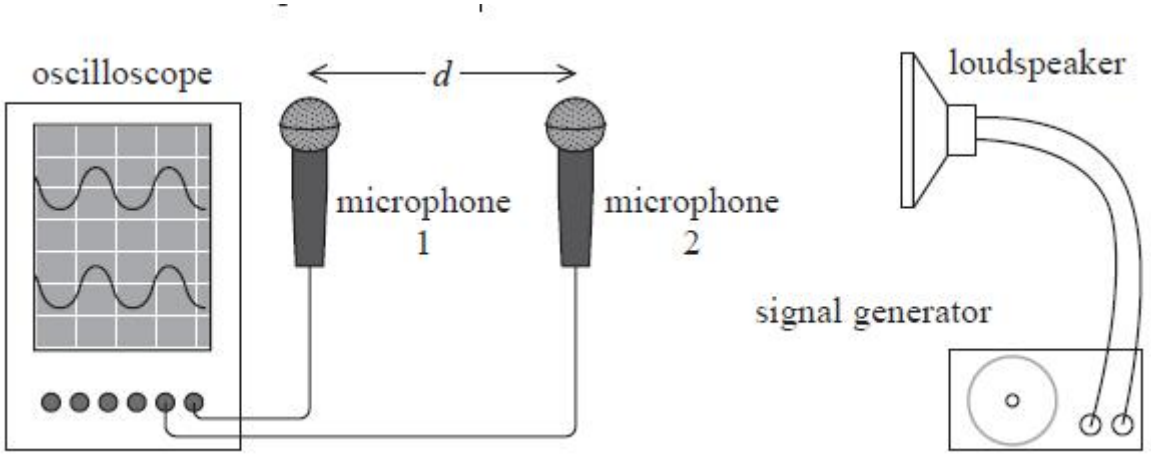
(1)

	Observation	Conclusion
☐ A	Most alpha particles come straight back.	The nucleus is charged.
☐ B	Most alpha particles come straight back.	The atom is mainly empty space.
☐ C	Most alpha particles go straight through.	The atom is mainly empty space.
☐ D	Most alpha particles go straight through.	The nucleus is charged.

(Total for question = 1 mark)

Q2.

In an experiment to determine the speed of sound in air a student connected two microphones to an oscilloscope, as shown.



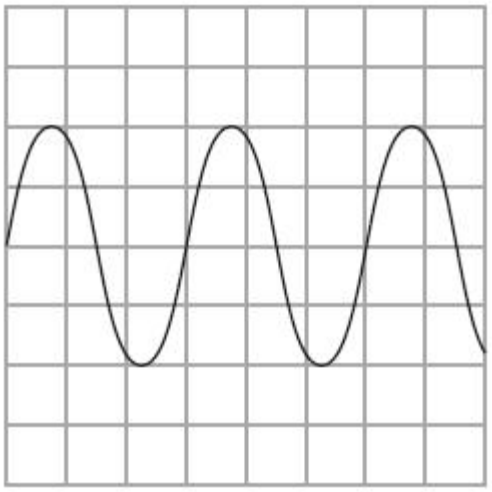
The microphones detect sound from the loudspeaker, converting it to an electrical signal. The signal is displayed on the oscilloscope screen.

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Both microphones were initially positioned the same distance from the loudspeaker. The two signals were in phase on the oscilloscope screen. The student slowly moved microphone 2 towards the loudspeaker, until the two signals on the oscilloscope were in phase again. He then measured the distance *d* between the microphones to determine the wavelength λ of the sound waves.

d = 20.5cm

The oscilloscope trace for the signal from microphone 1 is shown below.



The time base of the oscilloscope was set to 0.20 ms div^{-1}.

Determine a value for the speed of sound in air.

(5)

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Speed of sound = ...

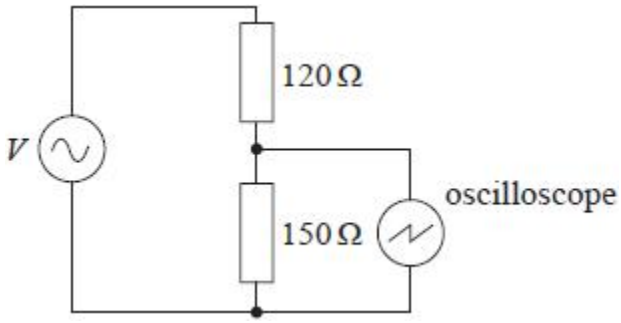
(Total for question = 5 marks)

Q3.

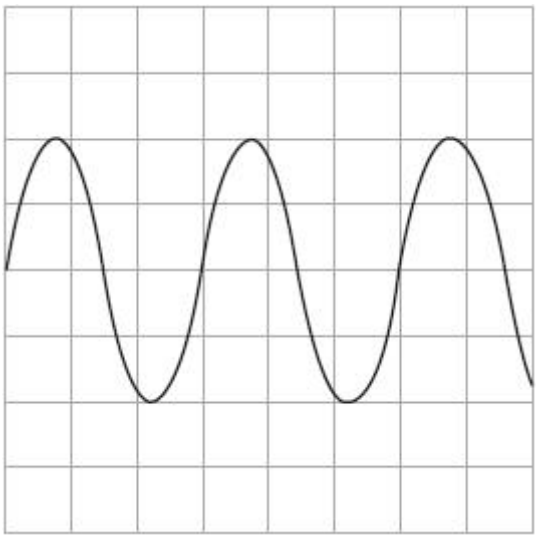
A student connected the output from a source of alternating potential difference (p.d.) to a series resistor combination.

She connected an oscilloscope across the 150 Ω resistor as shown.

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The trace obtained on the oscilloscope is shown below.



(i) Determine the peak p.d. across the 150 Ω resistor.

y-sensitivity of oscilloscope = 2.0 V per division

(2)

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Peak p.d. across 150 Ω resistor = ...

(ii) Calculate the root mean square (r.m.s.) value of the current in the circuit.

(3)

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r.m.s. value of current = ...

(iii) Calculate the power dissipated in the circuit.

(3)

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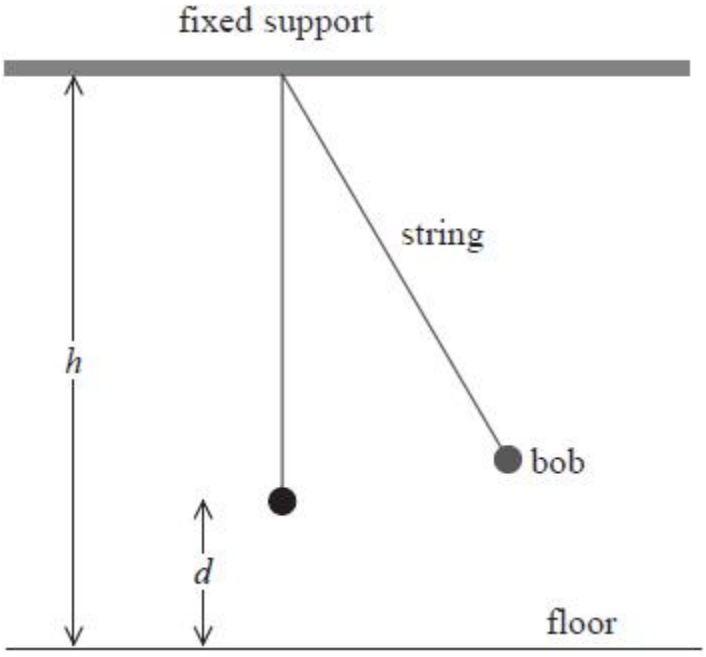
Power dissipated in circuit = ...

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(Total for question = 8 marks)

Q4.

A student carried out an experiment with a pendulum hung from a fixed support. The fixed support was a distance *h* above floor level as shown.



As the student was unable to measure the length of the pendulum directly, she measured the distance *d* from the bob to the floor.

To determine the period *T* of the pendulum, the student used the following method:

- release the bob from its highest position and start a stopwatch
- stop the stopwatch when the bob reaches the same position again.

Criticise the student's method for measuring the period.

(2)

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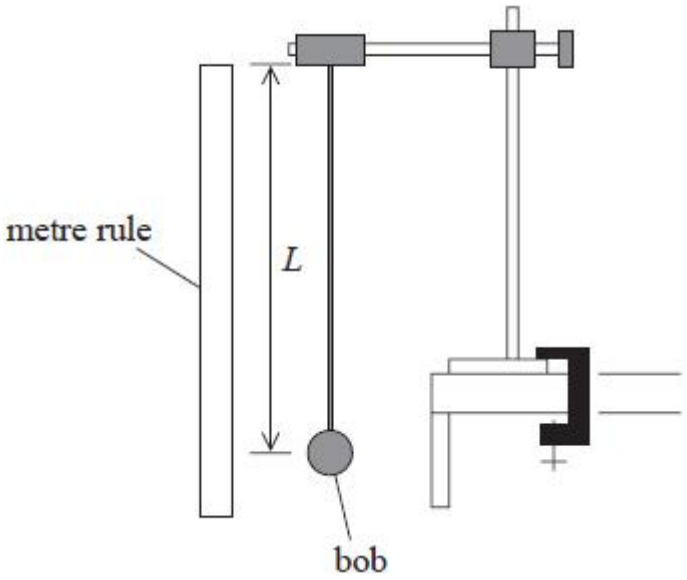
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(Total for question = 2 marks)

Q5.

A student set up a "seconds pendulum". This is a simple pendulum for which the time taken to move from the bob's highest position on one side to its highest position on the opposite side is 1.00 s.

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(a) Calculate the length *L* required for the pendulum to be a "seconds pendulum".

(2)

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L = ...

(b) The student set the pendulum into oscillation. She used a stopwatch to check the accuracy of the pendulum's period *T*.

Describe the procedure the student should have used to obtain an accurate value for *T*.

(2)

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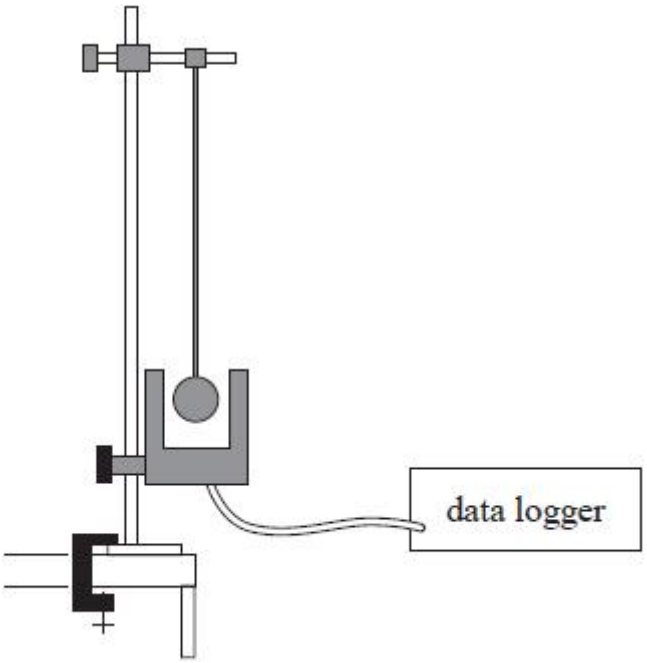
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(c) Another student suggested that the uncertainty in the measurement of the time period of the pendulum could be reduced by using a light gate and a data logger. The data logger would record the time between successive interruptions of the light beam. Both the data logger and the stopwatch have a resolution of 0.01 s.

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Comment on the student's suggestion of using a data logger rather than a stopwatch.

(4)

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(Total for question = 8 marks)

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