

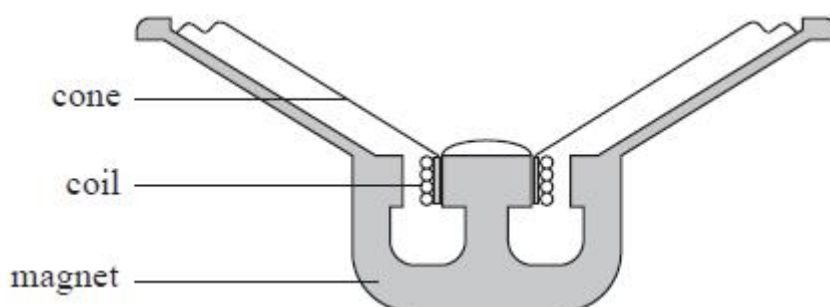
Name of the Student: _____

Max. Marks : 18 Marks

Time : 18 Minutes

Q1.

&A simple loudspeaker consists of a cone, a coil of wire and a magnet. The cone and coil are attached to each other and are free to move. An alternating current in the coil causes the cone to oscillate. The loudspeaker is mounted in a wooden box. A cross-section through the loudspeaker is shown.



A student made the following observations:

- when an alternating potential difference (p.d.) is applied to the coil, the cone oscillates
- the frequency of oscillation is the same as the frequency of the p.d.
- at particular frequencies, the box vibrates with a large amplitude.

Explain these observations.

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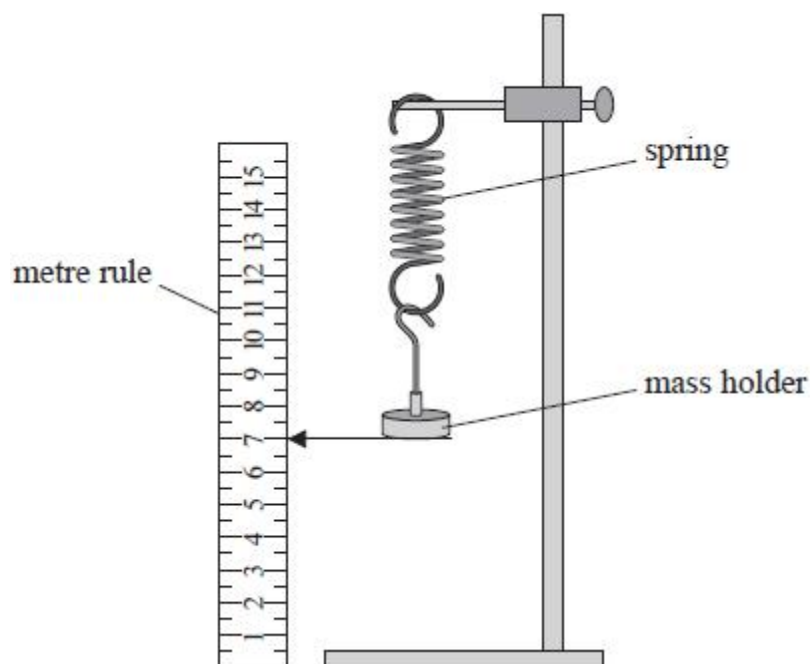
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(Total for question = 6 marks)

Q2.

A student investigated the behaviour of a spring under tension. The spring was hung vertically with a mass holder attached.

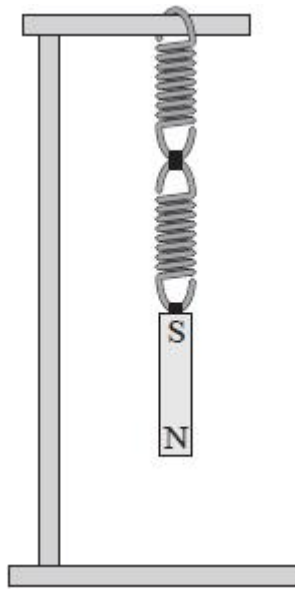


The position of the bottom of the mass holder was recorded. The spring was stretched by adding masses to the mass holder and the new positions were recorded. The extension of the spring each time was calculated.

The student produced the following table.

Mass added / g	Extension / cm	Stretching force / N
50	1.9	0.49
70	3	0.69
90	3.5	0.9
110	4.5	1.08
130	5.3	1.28
150	5.8	1.47

Two identical springs are joined in series and a bar magnet is hung from one end as shown.



The bar magnet is displaced a small distance vertically from its equilibrium position and released.
Calculate the frequency at which the system oscillates.

mass of magnet = 120 g
spring constant of each spring = 22 N m⁻¹

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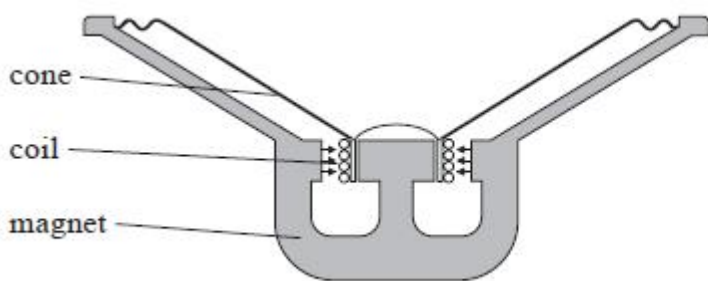
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Frequency =

(Total for question = 4 marks)

Q3.

A simple loudspeaker consists of a cone, a coil of wire and a magnet. The cone and coil are attached to each other and are free to move. An alternating current in the coil causes the cone to oscillate.



The loudspeaker cone undergoes simple harmonic motion.

(i) State what is meant by simple harmonic motion.

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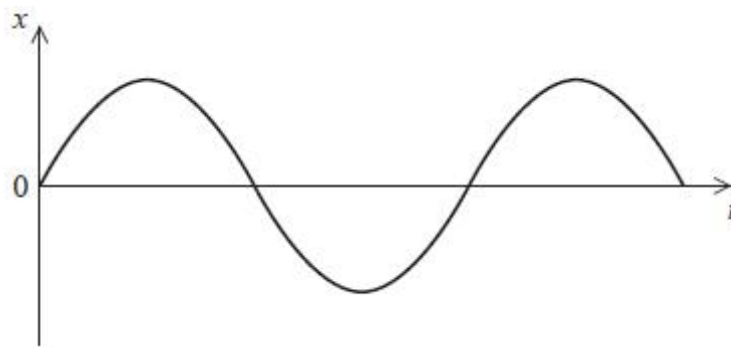
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(ii) The graph below shows how the displacement x of the cone varies with time t .

Add another line to the graph to show how the acceleration of the cone varies over the same time interval.

(1)

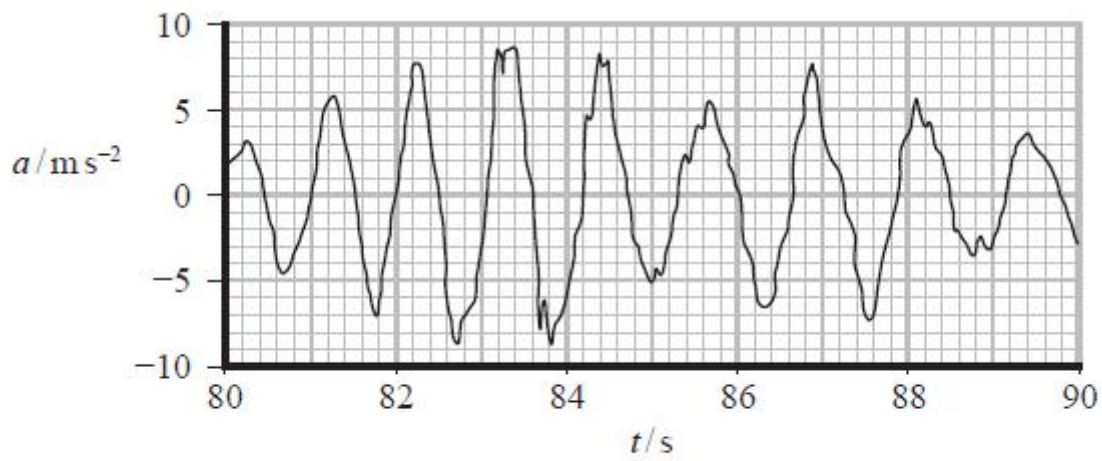


Q4.

In 2011, a tsunami was caused by a massive earthquake centred some distance off the coast of Japan. The tsunami caused a cooling system failure at the Fukushima Nuclear Power Plant. This resulted in a nuclear meltdown and radioactive materials were released into the surroundings.

Buildings in nearby Tohoku University suffered structural damage during the 2011 earthquake.

The graph shows how the acceleration of one of the buildings, measured on the 9th floor, varied with time during the earthquake.



(Source: <https://www.sciencedirect.com/science/article/pii/S0038080612001035>)

At the time it was reported that during the earthquake the 9th floor of the building displaced by more than 30 cm from its normal position.

Assess the accuracy of this report.

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(Total for question = 5 marks)