Name of the Student:_____

Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

<table>
<tr><th>Question Number</th><th>Acceptable Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr>
<td>*</td>
<td>
<table>
<tr><th>IC points</th><th>IC mark</th><th>Max linkage mark</th><th>Max final mark</th></tr>
<tr><td>6</td><td>4</td><td>2</td><td>6</td></tr>
<tr><td>5</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td>4</td><td>3</td><td>1</td><td>4</td></tr>
<tr><td>3</td><td>2</td><td>1</td><td>3</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>2</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>
Indicative content:
IC1 Alternating p.d. causes an alternating current in the coil
IC2 Current carrying conductor in a magnetic field experiences a force
IC3 Current is alternating, so force changes direction with current (same frequency)
Or the alternating current drives the cone at the frequency of the p.d.
</td>
<td>
This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully sustained reasoning.

Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.

The table shows how the marks should be awarded for indicative content and structure and lines of reasoning.
<table>
<tr><th>Number of indicative marking points seen in answer</th><th>Number of marks awarded for indicative marking points</th></tr>
<tr><td>6</td><td>4</td></tr>
<tr><td>5–4</td><td>3</td></tr>
<tr><td>3–2</td><td>2</td></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td></tr>
</table>
<table>
<tr><td></td><td>Number of marks awarded for structure of answer and sustained line of reasoning</td></tr>
<tr><td>Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout</td><td>2</td></tr>
<tr><td>Answer is partially structured with some linkages and lines of reasoning</td><td>1</td></tr>
<tr><td>Answer has no linkages between points and is unstructured</td><td>0</td></tr>
</table>
Alternative to first 3 indicative content points:
IC1 Current in coil causes a magnetic field

IC2 Current is alternating so field changes direction with current (same frequency)

IC3 Field interacts with permanent magnet's field so coil experiences oscillating force
</td>
<td></td>
</tr>
</table>

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	IC4 The loudspeaker forces the box into oscillation IC5 (At certain frequencies) the frequency of oscillation equals the natural frequency of oscillation of the air in the box IC6 Maximum energy is transferred and the amplitude of vibration of the box increases	IC6 Resonance occurs and the amplitude of vibration of the box increases	6

Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
	• new spring constant = 11 N m^{-1} **(1)** • Use of $T = 2\pi\sqrt{\frac{m}{k}}$ **(1)** • Use of $f = 1/T$ **(1)** • f = 1.5 Hz **(1)**	Example of calculation: $k = 22/2 = 11\ \text{N m}^{-1}$ $T = 2\pi\sqrt{\frac{0.12\,\text{kg}}{11\,\text{N m}^{-1}}} = 0.66\,\text{s}$ $f = 1/0.66\ \text{s} = 1.5\ \text{Hz}$	4

Q3.

Question Number	Answer	Mark
(b)(i)	Acceleration is: • proportional to displacement from equilibrium position **(1)** • (always) acting towards the equilibrium position **Or** idea that acceleration is in the opposite direction to displacement **(1)** **Or** Force is: • proportional to displacement from equilibrium position **(1)** • (always) acting towards the equilibrium position **Or** idea that force is a restoring force e.g. "in the opposite direction" **(1)** [accept undisplaced point/fixed point/central point for equilibrium position] [An equation with symbols defined correctly is a valid response for both marks. e.g. $a \propto -x$ **or** $F \propto -x$]	2

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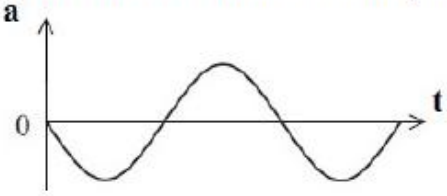
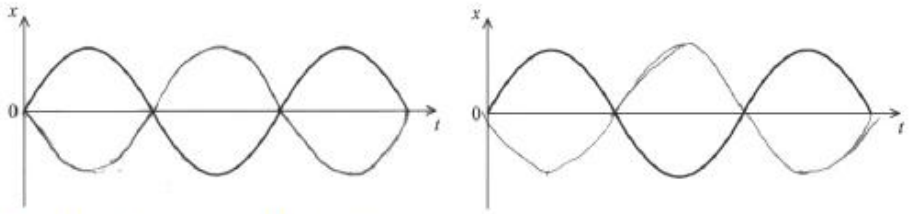
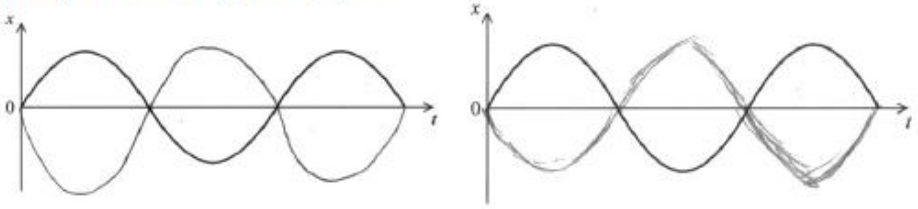
(b)(ii)	Minus sine curve with constant amplitude a  Examples of acceptable graphs:  Examples of unacceptable graphs:  	(1)	1

Q4.

Question Number	Acceptable Answer	Additional Guidance	Mark
	• Maximum value of a read from graph [8 m s^{-2} → 9 m s^{-2}] (1) • Value for period determined from time for at least 3 cycles (1) • Use of $\omega = \frac{2\pi}{T}$ (1) • Use of $a = (-)A\omega^2 \cos \omega t$ (1) • A = 0.33 m, so report is correct (1) [Accept value for A in range 0.25 m → 0.40 m with appropriate conclusion]	Example of calculation $T = \frac{(89.2 - 81.0)\text{ s}}{7} = 1.2\text{ s}$ $\omega = \frac{2\pi}{1.2\text{ s}} = 5.2\text{ rad s}^{-1}$ $x = \frac{a}{\omega^2} = \frac{9\text{ m s}^{-2}}{(5.2\text{ rad s}^{-1})^2} = 0.33\text{ m}$	5

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