

Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 13_Oscillations

Name of the Student: _____

Max. Marks : 25 Marks

Time : 25 Minutes

Mark Schemes

Q1.

| Question Number | Answer | Mark |
|-----------------|--|----------|
| * | (QWC – Work must be clear and organised in a logical manner using technical wording where appropriate) | |
| | Current carrying conductor in a magnetic field | (1) |
| | Coil experiences a force | (1) |
| | Current is alternating, so force changes direction with current (same frequency) | (1) |
| | Or | |
| | Current in coil causes a magnetic field | (1) |
| | Current is alternating so field changes direction with current (same frequency) | (1) |
| | Field interacts with permanent magnet's field so coil experiences oscillating force | (1) |
| | | 3 |

Q2.

| Question Number | Acceptable Answer | Additional Guidance | Mark | | | | | | | | | | | | | | | | | | | | |
|---|---|--|---|---|---|-----|---|-----|---|---|---|---|---|---|--|--|---|---|--|---|--|---|---|
| * | <p>This question assesses a student's ability to show a coherent and logical structured answer with linkage and fully-sustained reasoning. Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.</p> <p>The following table shows how the marks should be awarded for indicative content.</p> <table border="1"> <thead> <tr> <th>Number of indicative points seen in answer</th> <th>Number of marks awarded for indicative points</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>Indicative content:</p> <ul style="list-style-type: none"> As magnet A moves, its coil experiences a change of magnetic <u>flux</u> (linkage) The change in magnetic flux linkage <u>induces an emf</u> in the coil The (induced) emf causes a current in both coils The current in the second coil causes a force to act on magnet B, driving magnet B into oscillation Because both mass-spring systems have the same period/frequency Resonance occurs (and magnet B oscillates with increasing amplitude) | Number of indicative points seen in answer | Number of marks awarded for indicative points | 6 | 4 | 5-4 | 3 | 3-2 | 2 | 1 | 1 | 0 | 0 | <p>The following table shows how the marks should be awarded for structure and lines of reasoning</p> <table border="1"> <thead> <tr> <th></th> <th>Number of marks awarded for structure and lines of reasoning</th> </tr> </thead> <tbody> <tr> <td>Answer shows a coherent and logical structure with linkage 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 linkage between points and is unstructured</td> <td>0</td> </tr> </tbody> </table> <p>Linkage Marks</p> <p>IC points 1 – 4 Three of these points could score one linkage mark</p> <p>IC points 5 & 6 could score one linkage mark</p> | | Number of marks awarded for structure and lines of reasoning | Answer shows a coherent and logical structure with linkage and fully sustained lines of reasoning demonstrated throughout | 2 | Answer is partially structured with some linkages and lines of reasoning | 1 | Answer has no linkage between points and is unstructured | 0 | 6 |
| Number of indicative points seen in answer | Number of marks awarded for indicative points | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 4 | | | | | | | | | | | | | | | | | | | | | | |
| 5-4 | 3 | | | | | | | | | | | | | | | | | | | | | | |
| 3-2 | 2 | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | | | | | | | | | | | | | | | | | | | | | | |
| | Number of marks awarded for structure and lines of reasoning | | | | | | | | | | | | | | | | | | | | | | |
| Answer shows a coherent and logical structure with linkage and fully sustained lines of reasoning demonstrated throughout | 2 | | | | | | | | | | | | | | | | | | | | | | |
| Answer is partially structured with some linkages and lines of reasoning | 1 | | | | | | | | | | | | | | | | | | | | | | |
| Answer has no linkage between points and is unstructured | 0 | | | | | | | | | | | | | | | | | | | | | | |

Q3.

| Question Number | Acceptable answers | Additional guidance | Mark |
|-----------------|--|---|------|
| | <ul style="list-style-type: none"> Use of $T = 2\pi\sqrt{l/g}$ (1) Apply factor of 2 correctly for 2 half cycles (1) Use of $f = 1/T$ (1) $f = 0.68$ Hz (1) | <p><u>Example of calculation</u></p> $T = 2\pi\sqrt{l/g}$ $T = 2\pi\sqrt{(0.43 / 9.81)}$ $= 1.32 \text{ s}$ $T = 2\pi\sqrt{(0.67 / 9.81)}$ $= 1.64 \text{ s}$ $T = (1.32 \text{ s} + 1.64 \text{ s}) / 2 = 1.48 \text{ s}$ $f = 1 / 1.48 \text{ s} = 0.68 \text{ Hz}$ | 4 |

Q4.

| Question Number | Answer | Mark |
|-----------------|---|---|
| (a) | <p>(QWC – Work must be clear and organised in a logical manner using technical wording where appropriate)</p> <p>(Hooke’s Law:) for a spring, force is proportional to extension Or $F = k \Delta x$</p> <p>An extension of the spring causes a force towards the equilibrium position Or (resultant force towards the equilibrium position, so) $ma = -k \Delta x$</p> <p>Condition for shm is restoring force [acceleration] is proportional to displacement (from equilibrium position)</p> <p>[QWC question, so max 2 if equations given with no further explanation]</p> | <p>(1)</p> <p>(1)</p> <p>(1)</p> <p>3</p> |
| (b) | <p>Use of $a = -\omega^2 x$</p> <p>Use of $T = \frac{2\pi}{\omega}$</p> <p>$T = 1.55$ (s)</p> <p>[Credit use of $F = k \Delta x$ and use of $T = 2\pi \sqrt{\frac{m}{k}}$ for first two marking points]</p> <p><u>Example of calculation:</u></p> $\omega = \sqrt{\frac{0.49 \text{ m s}^{-2}}{3.0 \times 10^{-2} \text{ m}}} = 4.04 \text{ s}^{-1}$ $T = \frac{2\pi}{4.04 \text{ s}^{-1}} = 1.55 \text{ s}$ | <p>(1)</p> <p>(1)</p> <p>(1)</p> <p>3</p> |
| (c)(i) | Damped / damping [Do not accept critical/heavy damping] | (1) 1 |
| (c)(ii) | Forced / driven | (1) 1 |
| (c)(iii) | <p>Resonance</p> <p>$f = 0.65 \text{ Hz}$ [accept s^{-1}] [0.625 Hz if show that value is used, 0.64 Hz if unrounded value used]</p> <p><u>Example of calculation:</u> $f = 1/1.55 \text{ s} = 0.645 \text{ Hz}$</p> <p>[allow 2nd mark if they use either their value from (b) or 1.6 s]</p> | <p>(1)</p> <p>(1)</p> <p>2</p> |
| (d) | <p>(With a smaller mass baby) the natural frequency of oscillation would increase</p> <p>Or</p> <p>The natural frequency of the system would increase</p> | |

| | | | |
|--|--|------------|-----------|
| | Or The periodic time of the system would decrease | (1) | |
| | Smaller mass baby would have to kick at a higher frequency (to force system into resonance) [accept larger mass baby would have to kick at a lower frequency] | (1) | 2 |
| | Total for question | | 12 |