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

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**Name of the Student**:_____
**Max. Marks : 21 Marks** **Time : 21 Minutes**

Mark Schemes
**Q1.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| | □ because the (resultant) force is (directly) proportional to displacement from equilibrium position (1)<br>□ force is in the opposite direction to displacement or force is (always) acting towards the equilibrium position (1) | | 2 |

**Q2.**

| Question Number | Acceptable Answer | Additional Guidance | Mark |
|---|---|---|---|
| **(a)(i)** | • no net force on bridge (1)<br>• no net moment of force about any point (1) | Alternative wording that implies these 2 points will be accepted | **(2)** |
| **(a)(ii)** | • use of $W = mg$ to find the weight of the bridge (1)<br>• use of moment = $F x$ (1)<br>• applies principle of moments (1)<br>• $F_A$ = 43610 N (1)<br>• applies equilibrium of forces or applies principle of moments about a different point to obtain $F_B$ = 45990 N (1) | <u>Example of calculation:</u><br>W = mg = 8500 kg × 9.8 N kg$^{-1}$= 83300 N<br><br>Taking moments about A,<br>Clockwise moments<br>= (1500 N × 4 m)<br>+ (4800 N × 6.5 m)<br>+ (83300 N × 9.5 m)<br>Anticlockwise moments<br>= $F_A$ × 19 m<br>19 N × $F_A$<br>= 828550 Nm<br><br>$F_A$ = 828550 Nm/19 m<br>= 43610 N<br><br>$F_A + F_B$ = 1500 N + 4800 N + 83300 N<br><br>$F_B$ = 89600 N − 43610 N<br>= 45990 N | **(5)** |

| Question Number | Acceptable Answer | | Additional Guidance | Mark |
|---|---|---|---|---|
| **(b)(i)** | • resonance occurs when the bridge is forced into oscillation at its natural frequency | (1) | | **(2)** |
| | • this results in an increasing amplitude of oscillation of the bridge, which may damage the bridge | (1) | | |
| **(b)(ii)** | • energy was transferred from the oscillating bridge to the dampers | (1) | | **(3)** |
| | • this energy was dissipated in the dampers (and not returned to the bridge) | (1) | | |
| | • hence the <u>amplitude</u> of oscillation was kept small | (1) | | |
| **(b)(iii)** | • as the viscosity of the fluid increased the fluid would offer greater resistance to movement [accept reverse argument] | (1) | | **(2)** |
| | • a greater resistance to movement would result in a greater energy dissipation | (1) | | |

**Q3.**

| Question Number | Acceptable answers | | Additional guidance | Mark |
|---|---|---|---|---|
| | • use of graph to find gradient = $k$ ($= F/x$) | **(1)** | <u>Example of calculation</u> | **5** |
| | • use of $T = 1/f$ | **(1)** | $k = 0.55\text{ N} / 0.07\text{ m}$<br>$= 7.86\text{ N m}^{-1}$ | |
| | • use of $T = 2\pi\sqrt{\frac{m}{k}}$ | **(1)** | $T = ½ = 0.5\text{ s}$ | |
| | • $m = 0.05$ (kg)<br>**or** $k$ using 50 g and 2 Hz = 7.9 (N m$^{-1}$)<br>**or** $f$ using 50 g and $k$ from graph = 2.0 (Hz)<br>**or** $T$ using 50 g and $k$ from graph = 0.50 (s) | **(1)** | $0.5\text{ s} = 2\pi\sqrt{\frac{m}{7.86\text{ N m}^{-1}}}$<br>$m = 0.050$ kg (0.0498 kg)<br>A smaller mass means a shorter period, so smaller than 0.05 kg would be a higher frequency than 2 Hz, so 50 g is smallest mass. | |
| | • Comparison and correct conclusion (dependent on MP4) | **(1)** | | |