**Name of the Student**:_____
**Max. Marks : 17 Marks** **Time : 17 Minutes**

Mark Schemes

**Q1.**

| Question Number | Acceptable Answer | Additional Guidance | Mark |
|---|---|---|---|
| | • Use of $a = (-)\omega^2 x$<br>**(1)**<br>• Use of $v = \omega A \sin \omega t$<br>**(1)**<br>• $v_{max} = 0.44$ m s$^{-1}$, so it is safe to oscillate at this amplitude<br>**(1)** | No need to see 0.44 m s$^{-1}$ < 0.5 m s$^{-1}$, as conclusion includes credit for the correct value of $v$.<br><u>Example of calculation</u><br>$\omega = \sqrt{\frac{20.0 \text{ cm s}^{-2}}{5.0 \text{ cm}}} = 2.0 \text{ s}^{-1}$<br>$v_{max} = 2.0 \text{ s}^{-1} \times 0.22 \text{ m} = 0.44 \text{ ms}^{-1}$ | **3** |

**Q2.**

| Question Number | Acceptable Answer | Additional Guidance | Mark |
|---|---|---|---|
| (i) | • Use of $T = 2\pi\sqrt{\frac{\ell}{g}}$ **(1)**<br>• $\ell = 1.55$ m **(1)** | <u>Example of calculation</u><br>$\ell = \frac{(2.50 \text{ s})^2 \times 9.81 \text{ m s}^{-2}}{4\pi^2} = 1.55 \text{ m}$ | **2** |

| Question Number | Acceptable Answer | Additional Guidance | Mark |
|---|---|---|---|
| (ii) | An explanation that makes reference to the following points:<br>• Resistive forces act on the pendulum **Or** The oscillation is damped (1)<br>• Work is done against the resistive/damping forces (1)<br>• So the energy **and** amplitude of the oscillation/pendulum decreases (1) | Accept "energy is transferred from the system" for "energy decreases" | 3 |

**Q3.**

| Question Number | Acceptable Answer | Additional Guidance | Mark |
|---|---|---|---|
| | • Determination of gradient (1)<br>• Re-arrangement of $T = 2\pi\sqrt{\frac{l}{g}}$ (1)<br>• Algebra to show $T^2 = -\frac{4\pi^2}{g}d + \frac{4\pi^2}{g}h$ (1)<br>• Gradient = $(-)\frac{4\pi^2}{g}$ (1)<br>• g = 9.6 m s$^{-2}$ [accept 9.5 → 9.7 m s$^{-2}$] (1) | $T^2 = \frac{4\pi^2}{g}l$<br>$T^2 = \frac{4\pi^2}{g}(h-d)$<br>$T^2 = -\frac{4\pi^2}{g}d + \frac{4\pi^2}{g}h$<br>Example of calculation<br>gradient $= \frac{(12.1-9.2)\ \text{s}^2}{(0.00-0.70)\ \text{m}}$<br>$= -4.1\ \text{s}^2\text{m}^{-1}$<br>$\therefore g = \frac{4\pi^2}{4.1\ \text{s}^2\text{m}^{-1}} = 9.6\ \text{m s}^{-2}$ | 5 |

**Q4.**

| Question Number | Acceptable Answer | Additional Guidance | Mark |
|---|---|---|---|
| (i) | • discards value for $l_3$ (1)<br>• $l_m$=85.7 (cm) (1) | MP2: answer to 1 d.p. only<br><br>Example of calculation<br>$l_m = \frac{85.5+86.0+85.5}{3} = 85.7$ cm | 2 |
| (ii) | • Use of $T = 2\pi\sqrt{\frac{\ell}{g}}$ (1)<br>• $T$=1.86 s (1) | ECF from (i)<br>MP2: accept $T = 1.9$ s<br><br>Example of calculation<br>$T = 2\pi\sqrt{\frac{\ell}{g}}$<br>$= 2\pi \times \sqrt{\frac{0.857\ \text{m}}{9.81\ \text{m s}^{-2}}} = 1.86$ s | 2 |