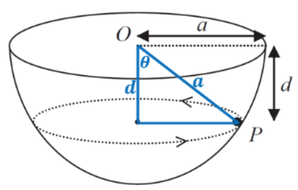
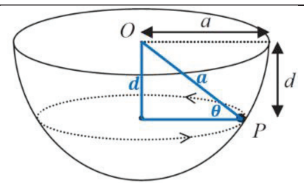
| Question Number | Scheme | Marks |
|---|---|---|
| | $T\cos\alpha = mg$ | M1A1 |
| | $\dfrac{\lambda a}{4a}\times\dfrac{3}{5} = mg \Rightarrow \lambda = \dfrac{20mg}{3}$ * | A1* (4) |
| **1(b)** | $T\sin\alpha = kmg$ | M1A1 |
| | $\dfrac{20mg}{3}\times\dfrac{1}{4}\times\dfrac{4}{5} = kmg$ | M1 |
| | $k = \dfrac{4}{3}$ | A1 (4) |
| | | **(8)** |
| | **Notes for question 1** | |
| | **Mark parts (a) and (b) together** | |
| **1(a)** | | |
| **B1** | Use of Hooke's Law | |
| **M1** | For a relevant equation in $T$. Must be dimensionally correct with the correct number of terms, condone sign errors and sin/cos confusion.<br>Eg<br>• Resolve vertically: $T\cos\alpha = mg$<br>• Parallel to string: $T = kmg\ \sin\alpha + mg\cos\alpha$<br>• Triangle of forces: $T = \sqrt{(mg)^2 + (kmg)^2}$ | |
| **A1** | Correct unsimplified equation | |
| **A1*** | Given answer obtained from complete and correct working. Must include a line of working before reaching the given answer. | |
| **1(b)** | | |
| **M1** | For a relevant equation in $k$ (a second equation). Must be dimensionally correct with the correct number of terms, condone sign errors and sin/cos confusion.<br>Eg<br>• Resolve horiz: $T\sin\alpha = kmg$<br>• Perp to string: $mg\sin\alpha = kmg\cos\alpha$<br>• Triangle of forces: $\tan\alpha = \frac{kmg}{mg} = \frac{4}{3}$ | |
| **A1** | Correct unsimplified equation | |
| **M1** | Complete method to produce an equation in $k$ only (replace $T$ and trig) | |
| **A1** | Any equivalent fraction. Accept 1.3 or better | |
| | Lami: $\frac{T}{\sin 90} = \frac{kmg}{\sin(180-\alpha)} = \frac{mg}{\sin(90+\alpha)}$<br>M0 for an EPE approach | |

| Question Number | Scheme | | Marks |
|---|---|---|---|
| |  $\sin\theta = \frac{\sqrt{a^2-d^2}}{a} = \sqrt{\frac{a^2-d^2}{a^2}} = \sqrt{1-\frac{d^2}{a^2}}$ |  $\cos\theta = \frac{\sqrt{a^2-d^2}}{a} = \sqrt{\frac{a^2-d^2}{a^2}} = \sqrt{1-\frac{d^2}{a^2}}$ | |
| **2(a)** | $R\cos\theta = mg$ | $R\sin\theta = mg$ | M1A1 |
| | $R = \frac{mga}{d}$ | | A1 (3) |
| **2(b)** | $R\sin\theta = \frac{mv^2}{r}$ | $R\cos\theta = \frac{mv^2}{r}$ | M1A1A1 |
| | $\frac{mga}{d} \times \frac{\sqrt{a^2-d^2}}{a} = \frac{mv^2}{\sqrt{a^2-d^2}}$ | | DM1 |
| | $v = \sqrt{\frac{g(a^2-d^2)}{d}}$ | | A1 (5) |
| | | | **(8)** |
| | **Notes for question 2** | | |
| **2(a)** | | | |
| **M1** | Resolve vertically to form an equation with the correct number of terms and the correct structure. Dimensionally correct, condone sign errors and sin/cos confusion | | |
| **A1** | Correct equation | | |
| **A1** | Correct answer. | | |
| **2(b)** | | | |
| **M1** | Form a horizontal equation of motion with the correct number of terms, condone sign errors and sin/cos confusion. Dimensionally correct. Accept $\frac{v^2}{r}$ or $r\omega^2$ for of acceleration. Condone use of *a* for radius at this point but M0 if *a* is used for acceleration. | | |
| **A1** | Equation with at most one error. An error in the acceleration term is one error (incorrect form of acceleration or radius). | | |
| **A1** | Correct equation (must use the correct form of acceleration and correct radius). | | |
| **DM1** | Dependent on previous M. Eliminate *R* and trig to form an equation in *v*, *g*, *a* and *d* | | |
| **A1** | Correct answer ISW | | |

| Question Number | Scheme | Marks |
|---|---|---|
| **3(a)** | $v\frac{\mathrm{d}v}{\mathrm{d}x}=\frac{3\sqrt{x+1}}{4}$ | M1 |
| | $\frac{1}{2}v^2=\frac{1}{2}(x+1)^{\frac{3}{2}}\ \ (+C)$ | M1A1 |
| | $x=15,\ v=8 \Rightarrow C=0$ so $v=(x+1)^{\frac{3}{4}}$ * | A1* (4) |
| **3(b)** | $\frac{\mathrm{d}x}{\mathrm{d}t}=(x+1)^{\frac{3}{4}}$ | M1 |
| | $4(x+1)^{\frac{1}{4}}=t\ (+C)$ | M1A1 |
| | $x=15,\ t=0 \Rightarrow C=8$ so $4v^{\frac{1}{3}}=t+8$ | M1 |
| | $t=4v^{\frac{1}{3}}-8$ | A1 (5) |
| | | |
| | **OR** | |
| | $\frac{\mathrm{d}v}{\mathrm{d}t}=\frac{3}{4}v^{\frac{2}{3}}$ | M1 |
| | $3v^{\frac{1}{3}}=\frac{3}{4}t\ (+C)$ | M1A1 |
| | $t=0,\ v=8 \Rightarrow C=6$ so $3v^{\frac{1}{3}}=\frac{3}{4}t+6$ | M1 |
| | $t=4v^{\frac{1}{3}}-8$ | A1 (5) |
| | | **(9)** |
| | **Notes for question 3** | |
| **3(a)** | | |
| **M1** | Set up a differential equation in $v$ and $x$ only<br>M0 if acceleration is $\frac{dv}{dx}$ or $\frac{dv}{dt}$<br>M0 if there is no differential equation eg starting with $\frac{1}{2}v^2=\int\frac{3\sqrt{x+1}}{4}\,dx$ | |
| **M1** | Clear attempt to separate variables and integrate acceleration in terms of $v$ and $x$. At least one of the powers must increase by 1. | |
| **A1** | Correct integration, condone missing + C | |
| **A1*** | Given answer obtained from complete and correct working. Must include use of the boundary conditions and the initial differential equation. A0 if +C is not dealt with correctly eg If +C is only considered *after* the square root. | |
| **3(b)** | | |
| **M1** | Set up a differential equation in $x$ and $t$ only. Using the given answer in (a). | |
| **M1** | Clear attempt to separate the variables and integrate in terms of $x$ and $t$. At least one of the powers must increase by 1 | |
| **A1** | Correct integration, condone missing + C | |
| **M1** | Use of boundary conditions in an integrated equation and use of (a) to form an equation in $v$ and $t$. M0 if boundary conditions are not used. | |
| **A1** | Correct answer | |
| | **OR** | |
| **M1** | Set up a differential equation in $v$ and $t$ only | |

| Question Number | Scheme | Marks |
|---|---|---|
| **M1** | Clear attempt to separate the variables and integrate in terms of *v* and *t*. At least one of the powers must increase by 1 | |
| **A1** | Correct integration, condone missing + C | |
| **M1** | Use of boundary conditions in an integrated equation to form an equation in *v* and *t*. M0 if boundary conditions are not used. | |
| **A1** | Correct answer | |

| Question Number | Scheme | Marks |
|---|---|---|
| **4(a)** | $a = 3$ (m) | B1 |
| | $\frac{38}{3} = \frac{2\pi}{\omega} \Rightarrow \omega = \frac{3\pi}{19}$ | M1A1 |
| | $x = -a\cos\omega t \Rightarrow v = a\omega\sin\omega t$ or similar | M1 |
| | $v = 3\times\frac{3\pi}{19}\sin\left(\frac{3\pi}{19}\times\frac{95}{60}\right)$ | M1 |
| | $=\frac{9\pi\sqrt{2}}{38}$, 1.1, 1.05,1.052,… ($\text{m h}^{-1}$) | A1 (6) |
| **4(b)** | $-1.5 = 3\cos\frac{3\pi t}{19}$ | M1A1ft |
| | $t = \frac{38}{9}$ (h) | A1 |
| | Time is 16:13 or 16:14 | A1 (4) |
| | | **(10)** |
| | **Notes for question 4** | |
| **4(a)** | | |
| **B1** | $a = 3$ seen or implied | |
| **M1** | For use of $T = \frac{2\pi}{\omega}$ to give an equation in $\omega$ where $T = 2\times\frac{19}{3}$ (double the time between 12:00 and 18:20). Condone use of $T = 760$ min or 45600 seconds. | |
| **A1** | A correct equation using hrs, min or seconds. | |
| **M1** | Form a relevant equation in $v$ and $t$ using their $a$ and $\omega$<br>Eg<br>• $x = -a\cos(\omega t) \Rightarrow v = a\omega\sin(\omega t)$<br>• $x = a\cos(\omega t) \Rightarrow v = -a\omega\sin(\omega t)$<br>• $x = a\cos(\omega t) = (2.12\ldots) \Rightarrow v^2 = \omega^2(a^2 - x^2)$ | |
| **M1** | Use correct equation with an appropriate value of $t$ | |
| **A1** | Correct answer, must be positve and must be in metres per hour. | |
| **4(b)** | | |
| **M1** | A complete method to find the required time eg<br>• Use of $-1.5 = a\cos\omega t$ to find required time is $\frac{1}{\omega}\cos^{-1}\left(\frac{x}{a}\right)$<br>• Use of $1.5 = a\sin\omega t$ to find required time is $\frac{1}{4}\text{Period} + \frac{1}{\omega}\sin^{-1}\left(\frac{x}{a}\right)$<br>• Use of $1.5 = a\cos\omega t$ to find required time is $\frac{1}{\omega}\cos^{-1}\left(\frac{x}{a}\right)$ subtracted from 18:20 | |
| **A1ft** | A correct equation, ft on their $a$ and $\omega$ $\frac{1}{4}\left(\frac{38}{3}\right) + \frac{1}{\omega}\sin^{-1}\left(\frac{x}{a}\right)$ | |
| **A1** | A correct $t$ value in hours or minutes or seconds<br>$t = \frac{38}{9}$ (h) , $t = \frac{760}{3}$ (min) $t = 15200$ (s) | |
| **A1** | For the correct time . Accept 4.13pm or 4.14 pm or 16:13 or 16:14 | |

| Question Number | Scheme | Marks |
|---|---|---|
| **5(a)** | $\bar{x} = \dfrac{\pi\int_0^{4r} x\left(\frac{1}{4}x\right)^2 \mathrm{d}x}{\frac{4\pi r^3}{3}}$ or $\bar{x} = \dfrac{\pi\int_0^{4r} x\left(r-\frac{1}{4}x\right)^2 \mathrm{d}x}{\frac{4\pi r^3}{3}}$ | M1A1 |
| | $= \dfrac{3}{256r^3}\left[x^4\right]_0^{4r}$ | A1 |
| | $= 3r$* | A1* |
| | | (4) |
| **5(b)** | (table below) | B1 B1 |
| | $\left(\dfrac{4\pi r^3}{3}\times 3r\right) - \left(\pi\left(\dfrac{1}{2}r\right)^2 \times r\right)\left(4r-\dfrac{1}{2}r\right) = \left(\dfrac{4\pi r^3}{3} - \pi\left(\dfrac{1}{2}r\right)^2 \times r\right)\bar{y}$ | M1A1 |
| | $\bar{y} = \dfrac{75}{26}r$ * | A1* |
| | | (5) |
| **5(c)** | $\tan\alpha = \dfrac{r}{4r - \frac{75}{26}r}$ | M1A1 |
| | $\tan\alpha = \dfrac{26}{29}$ | A1 |
| | | (3) |
| | | **(12)** |
| | **Notes for question 5** | |
| **5(a)** | | |
| **M1** | Correct method to find the distance of the centre of mass from vertex or plane face, using $\bar{x} = \dfrac{\pi\int_0^{4r} xy^2 \mathrm{d}x}{\frac{4\pi r^3}{3}}$. The formula must be correct but allow a constant multiple if it appears in both numerator and denominator or cancelled $\pi$. The $y$ | |

Table for 5(b):

| | Cone | Cylinder | S |
|---|---|---|---|
| Mass ratio | $\dfrac{4\pi r^3}{3}$ | $\pi\left(\dfrac{1}{2}r\right)^2 \times r$ | $\left(\dfrac{4\pi r^3}{3} - \pi\left(\dfrac{1}{2}r\right)^2 \times r\right)$ |
| | $\dfrac{4}{3}$ | $\dfrac{1}{4}$ | $\dfrac{13}{12}$ |
| Distance from vertex | $3r$ | $\left(4r - \dfrac{1}{2}r\right)$ | $\bar{y}$ |
| Distance from plane face | $r$ | $\dfrac{1}{2}r$ | $\bar{y}$ |

| Question Number | Scheme | Marks |
|---|---|---|
| | must be replaced with $y=\frac{1}{4}x$ or $y=r-\frac{1}{4}x$. Condone a gradient of $\pm\frac{r}{h}$ if $h$ is later replaced with $4r$. There must be an attempt to integrate the numerator i.e. the power of $x$ must increase by 1. The denominator of $\frac{4\pi r^3}{3}$ is given in the question. Condone sight of vol $=\pi\int_0^{4r}\left(\frac{1}{4}x\right)^2 \mathrm{d}x$ as denominator. Ignore limits for the method mark. | |
| **A1** | Correct equation for the distance of the centre of mass from vertex or plane face. $\bar{x}=\dfrac{\pi\int_0^{4r} x\left(\frac{1}{4}x\right)^2 \mathrm{d}x}{\frac{4\pi r^3}{3}}$ or $\bar{x}=\dfrac{\pi\int_0^{4r} x\left(r-\frac{1}{4}x\right)^2 \mathrm{d}x}{\frac{4\pi r^3}{3}}$ Ignore limits. | |
| **A1** | A correct expression for the distance of the centre of mass from vertex or plane face following integration and division by $\frac{4\pi r^3}{3}$. Limits must be correct at this point. $\frac{3}{256r^3}\left[x^4\right]_0^{4r}$ or $\frac{3}{4r^3}\left[\frac{r^2x^2}{2}-\frac{rx^3}{6}+\frac{x^4}{64}\right]_0^{4r}$ | |
| **A1*** | Given answer obtained from complete and correct working. If distance is found from plane face this must be subtracted to find required distance. | |
| **5(b)** | | |
| **B1** | Correct mass ratios | |
| **B1** | Correct distances (for their parallel axis) Ignore signs. | |
| **M1** | Form a moments equation with correct number of terms (allow about a parallel axis). Equation must be dimensionally correct (mass ratio × distance). | |
| **A1** | Correct unsimplified equation | |
| **A1*** | Given answer obtained from complete and correct working. Working should include a line of simplification. The simplification could occur between the moments equation and the given answer or in the initial stage eg in a table. | |
| **5(c)** | | |
| **M1** | Use of tan to obtain an equation for a relevant angle, allow reciprocal $\dfrac{r}{4r-\frac{75}{26}r}$ | |
| **A1** | For a correct equation, condone reciprocal. | |
| **A1** | Correct answer, $\tan\alpha=\frac{26}{29}$ o.e. Must be an exact value for $\tan\alpha$. A0 if they got straight to $\alpha$. | |

| Question Number | Scheme | Marks |
|---|---|---|
| **6(a)** | $\frac{1}{2}mv^2 - \frac{1}{2}mu^2 = mgr(1-\cos\theta)$ | M1A2 |
| | $mg\cos\theta = \frac{mv^2}{r}$ | M1A1 |
| | Eliminate $v^2$ and solve for $\cos\theta$ | M1 |
| | $\cos\theta = \frac{2gr+u^2}{3gr}$ * | A1* |
| | | (7) |
| **6(b)** | $\cos\theta = \frac{4}{5}$ | B1 |
| | $v^2 = rg\cos\theta$ $\quad \left(v = \sqrt{\frac{4rg}{5}}\right)$ | M1 |
| | Horiz cpt at $C$: $H = v\cos\theta$ <br> $\left(H = \frac{4}{5}\sqrt{\frac{4rg}{5}} = \sqrt{\frac{64rg}{125}}\right)$ | |
| | Vert cpt at $C$: $V = \sqrt{(v\sin\theta)^2 + 2gr\cos\theta}$ <br> $\left(V = \sqrt{\frac{236rg}{125}}\right)$ | |
| | Speed at $C$: $W$ where <br> $A$ to $C$: $\frac{1}{2}m\left(W^2 - \frac{2gr}{5}\right) = mgr$ <br> **OR** <br> $B$ to $C$: $\frac{1}{2}m\left(W^2 - v^2\right) = mgr\cos\theta$ <br> $\left(W = \sqrt{\frac{12rg}{5}}\right)$ | M1<br>M1 |
| | $\tan\alpha = \frac{V}{H} = \frac{\sqrt{W^2-H^2}}{H} = \frac{V}{\sqrt{W^2-V^2}}$ | DM1 |
| | $= \frac{\sqrt{59}}{4}$ | A1 |
| | | (6) |
| | | **(13)** |
| | **Notes for question 6** | |
| **6(a)** | | |
| **M1** | Use conservation of energy to form a dimensionally correct equation. All terms present and no extras. Condone sign errors and sin/cos confusion. Anything that should be resolved has been resolved. | |
| **A1** | An unsimplified equation with at most one error. | |
| **A1** | A correct unsimplified equation. | |
| **M1** | Use N2L to form an equation of motion towards $O$. Equation must be dimensionally correct. All terms present and no extras. Condone sign errors and sin/cos confusion. Anything that should be resolved has been resolved <br> Allow this mark with or without $R$. | |

| Question Number | Scheme | Marks |
|---|---|---|
| | Condone $\pm R + mg\cos\theta = \dfrac{mv^2}{r}$ | |
| **A1** | Correct equation ($R = 0$ must be used now at some point)<br>A0 if $R$ never becomes 0 | |
| **M1** | Solve to find an expression for $\cos\theta$ in terms $g$, $r$ and $u$ | |
| **A1*** | Given answer obtained from correct and complete working. Working should include a line with $v^2$ eliminated before reaching the given answer. | |
| **6(b)** | | |
| **B1** | For $\cos\theta = \dfrac{4}{5}$ seen or implied | |
| **M1** | Solve to find $v$ in terms of $g$, $r$ and $\theta$ | |
| **M1** | Correct method to find at least **one** of $H$, $V$ or $W$ in terms of $g$, $r$ and $\theta$<br>Condone finding $H^2$, $V^2$ or $W^2$<br>Equation must be dimensionally correct. All terms present and no extras.<br>Condone sign errors and sin/cos confusion. Anything that should be resolved has been resolved.<br>M0: If they use the speed from (a) instead of $v$ | |
| **M1** | Correct method to find any **two** of $H$, $V$ or $W$ in terms of $g$, $r$ and $\theta$<br>Condone finding $H^2$, $V^2$ or $W^2$<br>Equation must be dimensionally correct. All terms present and no extras.<br>Condone sign errors and sin/cos confusion. Anything that should be resolved has been resolved.<br>M0: If they use the speed from (a) instead of $v$ | |
| **DM1** | Dependent on previous two M's. Complete method to find $\tan\alpha$<br>Condone if they go straight to $\alpha = \tan^{-1}(\ldots)$ and never state $\tan\alpha = \ldots$ | |
| **A1** | A correct value for $\tan\alpha$ $\dfrac{\sqrt{59}}{4}$ Accept any equivalent surd, eg $\sqrt{\dfrac{59}{16}}$ but must be exact.<br>A0 if they go straight to $\alpha$ and never find $\tan\alpha$ | |

| Question Number | Scheme | Marks |
|---|---|---|
| **7(a)** | $\frac{1}{2}mU^2 - \frac{1}{2}mv^2 = \frac{2mgx^2}{2l}$ | M1 A1A1 |
| | $v^2 = U^2 - \frac{2gx^2}{l}$ * | A1* (4) |
| **7(b)** | $2v\frac{\mathrm{d}v}{\mathrm{d}x} = -\frac{4gx}{l}$ | M1A1 |
| | $\ddot{x} = -\frac{2g}{l}x$, SHM ($\omega = \sqrt{\frac{2g}{l}}$) | A1 |
| | Period $= \frac{2\pi}{\omega} = \pi\sqrt{\frac{2l}{g}}$ * | DM1A1* (5) |
| **7(c)** | $\sqrt{\frac{gl}{2}} = a\sqrt{\frac{2g}{l}}$ **OR** $0 = \frac{gl}{2} - \frac{2ga^2}{l}$ | M1 |
| | $a = \frac{1}{2}l$ | A1 |
| | time from $x = a$ to $x = \frac{1}{4}l$, $t$ given by: $\frac{1}{4}l = \frac{1}{2}l\cos\sqrt{\frac{2g}{l}}t$ | M1 |
| | $t = \frac{\pi}{3}\sqrt{\frac{l}{2g}}$ | A1 |
| | Time $= \frac{1}{4}$period + time from $x = a$ to $x = \frac{1}{4}l$ | M1 |
| | $= \frac{5\pi}{6}\sqrt{\frac{l}{2g}}$ | A1 (6) |
| | | **(15)** |
| | **Notes for question 7** | |
| **7(a)** | | |
| **M1** | Use conservation of energy equation with 2KE terms and 1EPE term. Note there are rearrangements. Dimensionally correct, terms of the correct structure, condone sign errors. EPE of the form $\frac{1}{2}k\,x^2$ | |
| **A1** | For an unsimplified equation with at most one error | |
| **A1** | For a correct unsimplified equation | |
| **A1*** | Given answer obtained from complete and correct working. Must include a line of working before reaching the given answer. | |
| **7(b)** | Note: In (b) it is possible to score M1A1A0 DM1A1* | |
| **M1** | For differentiating wrt $x$. Powers of $v$ and $x$ to reduce by 1 and $\frac{dv}{dx}$ seen.<br>M0 for an approach that does not involve differentiating with respect to $x$ eg N2L | |
| **A1** | A correct differentiated equation | |
| **A1** | Correct SHM equation. Must use $\ddot{x}$ for acceleration **and** conclude SHM. | |
| **DM1** | Dependent on previous M. Correct use of period $= \frac{2\pi}{\omega}$ | |

| Question Number | Scheme | Marks |
|---|---|---|
| **A1*** | Given answer correctly obtained. Must include a line of working between $\ddot{x} = -\omega^2 x$ and the given answer. Eg<br>$\text{period} = \frac{2\pi}{\omega} = \frac{2\pi}{\sqrt{\frac{2g}{l}}} = \pi\sqrt{\frac{2l}{g}}$<br>Or<br>$\omega = \sqrt{\frac{2g}{l}}$ , $\text{period} = 2\pi\sqrt{\frac{l}{2g}} = \pi\sqrt{\frac{2l}{g}}$ | |
| **7(c)** | | |
| **M1** | For use of $U = a\omega$ OR energy equation with $v = 0$ and $x = a$ to find the amplitude. | |
| **A1** | For correct amplitude, $\frac{l}{2}$ | |
| **M1** | For a complete method to find the partial time with their calculated $a$ and their $\omega$<br>• Use of $x = a\cos(\omega t)$ where $\frac{1}{4}l = \frac{1}{2}l\cos\sqrt{\frac{2g}{l}}t$ to give a partial time.<br>• Use of $x = a\sin(\omega t)$ where $\frac{1}{4}l = \frac{1}{2}l\sin\sqrt{\frac{2g}{l}}t$ to give a partial time. | |
| **A1** | For a correct partial time<br>• Use of $x = a\cos(\omega t) \Rightarrow t = \frac{1}{\omega}\frac{\pi}{3}$<br>• Use of $x = a\sin(\omega t) \Rightarrow t = \frac{1}{\omega}\frac{\pi}{6}$ or $\frac{1}{\omega}\frac{5\pi}{6}$ | |
| **M1** | For a complete method to find the total time<br>• Using $x = a\cos(\omega t)$<br>Total time $= \frac{1}{4}\text{period} + \text{time from } x = a \text{ to } x = \frac{1}{4}l$<br>$= \frac{1}{4}\pi\sqrt{\frac{2l}{g}} + \frac{\pi}{3}\sqrt{\frac{l}{2g}}$<br>• Using $x = a\sin(\omega t)$ with $\frac{1}{\omega}\frac{5\pi}{6}$<br>Total time $= \frac{1}{\omega}\frac{5\pi}{6}$<br>• Using $x = a\sin(\omega t)$ with $\frac{1}{\omega}\frac{\pi}{6}$<br>Total time $= \frac{1}{2}\text{period} - \text{time from } x = 0 \text{ to } x = \frac{1}{4}l$<br>Total time $= \frac{1}{2}\pi\sqrt{\frac{2l}{g}} - \frac{\pi}{6}\sqrt{\frac{l}{2g}}$ | |
| **A1** | Correct answer of $\frac{5\pi}{6}\sqrt{\frac{l}{2g}} = \frac{5\pi}{3}\sqrt{\frac{l}{8g}} = \pi\sqrt{\frac{25l}{72g}}$ o.e | |