| Question Number | Scheme | Marks |
|---|---|---|
| **7(a)** | $\frac{1}{2}m(8ag)+mg(8a)=\frac{1}{2}mv^2+mg(8a\cos\theta)$ | M1A1A1 |
| | $\left(v^2=24ga-16ga\cos\theta\right)$ | |
| | $T+mg\cos\theta=\frac{mv^2}{8a}$ | M1A1 |
| | $T+mg\cos\theta=\frac{m\left(24ga-16ga\cos\theta\right)}{8a}$ | DM1 |
| | $T+mg\cos\theta=3mg-2mg\cos\theta$ | |
| | $T=3mg-3mg\cos\theta=3mg(1-\cos\theta)$ * | A1* |
| | | (7) |
| **(b)** | At $B$ $v_B{}^2=24ga$ | B1 |
| | $T_1=\frac{m(24ag)}{8a}=3mg$ or $T_2=\frac{m(24ag)}{3a}=8mg$ | B1 |
| | | |
| | $\Delta T=5mg$ | B1 |
| | | (3) |
| **(c)** | $\frac{1}{2}mv_1{}^2=\frac{1}{2}m(8ag)+mg(11a)$ | M1 |
| | $v_1{}^2=30ag$ | |
| | After impact $v_2{}^2=20ag$ | A1 |
| | | |
| | $\frac{1}{2}m(20ag)-mg(3a)=\frac{1}{2}mv_2{}^2+mg(8a\cos\alpha)$ | M1A1 |
| | $\left(v_2{}^2=14ga-16ga\cos\alpha\right)$ | |
| | $mg\cos\alpha=\frac{m\left(14ga-16ga\cos\alpha\right)}{8a}$ | M1A1 |
| | $mg\cos\alpha=\frac{7mg}{4}-2mg\cos\alpha$ | |
| | $\cos\alpha=\frac{7}{12}$ * | A1* |

| Question Number | Scheme | Marks |
|---|---|---|
| | | (7) |
| | | [17] |

**(a)**

**M1** Attempt at energy equation at a general point. Must be dimensionally correct and contain two KE terms and a change in GPE.

**A1, A1** Correct unsimplified equation. -1 each error.

**M1** Attempt to resolve radially. Acceleration can be in either circular form.

**A1** Correct equation. Must be $\frac{mv^2}{r}$

**DM1** Eliminate $v$ to produce equation in $T$, $m$, $g$, $\theta$. Dependent of the previous 2 M marks.

**A1*** Reach given result with no errors seen.

**(b)**

**B1** $v_B^{\,2} = 24ga$ . Correct expression for speed (or speed squared) at $B$. This mark will **not** be implied by a correct tension if they simply use the final result in (a).

**B1** Correct expression for Tension at $B$, for either radius. Can be found using the result from (a).

**B1** Correct expression for change in tension.

**(c)**

**M1** Attempt at energy equation at wall. Must include 2 KE terms and a change in GPE.

**A1** Correct speed (or speed squared, or KE) after impact.

**M1** Attempt at Energy equation to $\alpha$. Must include 2 KE terms and a change in GPE.

**A1** Correct energy equation.

**M1** Attempt at radial equation. If $T$ included, it must be set to zero before this mark is awarded. Condone use of $3a$ for this mark?

**A1** Correct equation in $\cos\alpha$ only oe.

**A1*** Solve to reach given result.

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