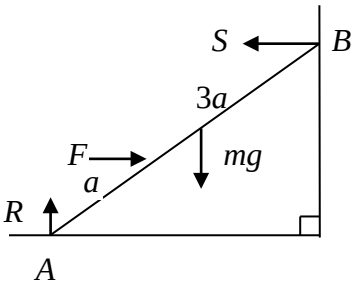
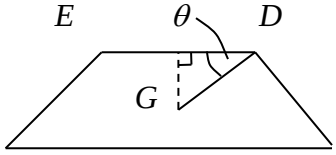
Edexcel
Success through qualifications

**Mock Paper Mark Scheme**

**Advanced Subsidiary/Advanced GCE**
General Certificate of Education

| Question number | Scheme | Marks |
|---|---|---|
| **1.** | $v = \frac{1}{2}u$<br>KE loss $= \frac{1}{2}m(u^2 - (\frac{1}{2}u)^2)$<br>$= \frac{3mu^2}{8}$<br>$\therefore$ fraction of KE lost $= \frac{3mu^2}{8} \div \frac{1}{2}mu^2 = \frac{3}{4}$ | B1<br>M1<br>A1<br>M1 A1 **(5)** |
| **2.** |  <br>$R(\rightarrow)$, $F = S$<br>M ($A$)<br>$mg\ 2a\cos\theta + F\ a\sin\theta = S \times 4a\sin\theta$<br>i.e. $2mg + 2F = 8S$<br>$F = \frac{1}{3}mg$ | B1<br>M1 A2<br>M1 A1 **(6)** |
| **3.** ($a$) | Relative mass: $ABC$ 4, $ADE$ 1, $BCDE$ 3<br>Distance of centre of mass from $BC$: 10, 20, $\bar{y}$<br>$(4 \times 10) - (1 \times 20) = 3\bar{y}$<br>$6\frac{2}{3} = \frac{20}{3} = \bar{y}$ (T) | B3 (–1 each error or omission )<br>M1 A1<br>A1 (6) |
| ($b$) |  <br>$\tan\theta = \frac{15-\bar{y}}{20}$<br>$= \frac{15-\frac{20}{3}}{20} = \frac{5}{12}$<br>$\theta = 22.6°$ (1 d.p.) | M1<br>A1<br>A1 (3) **(9)** |
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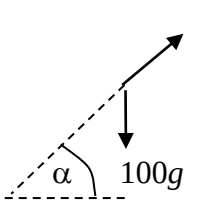
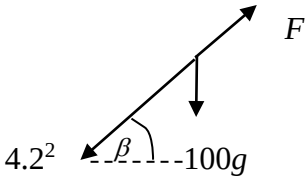
| **4.** (*a*) |  | $R(\swarrow),\ 100g \times \frac{1}{20} = k \times \left(\frac{7}{2}\right)^2$<br>$\Rightarrow\ k = 4$ (T) | M1 A1<br>A1 (3) |
| (*b*) |  | $R(\nearrow),\ F - 100g \times \frac{1}{40} - 16 = 0$<br>$\Rightarrow\ F = 40.5$ N<br>$P = 40.5 \times 2$<br>$= 81$ W | M1 A2<br>A1<br>M1<br>A1 (6) **(9)** |
| **5.** (*a*) | $u \rightarrow$ $\rightarrow \lambda u$<br>*S* (*m*) (*km*) *T*<br>$\rightarrow$ $\rightarrow$<br>0 $v$ | $mu + km\lambda u = kmv$<br>$\frac{u}{k}(1 + k\lambda) = v$<br>$v = e(u - \lambda u) = eu(1 - \lambda)$<br>$\Rightarrow\ \frac{u}{k}(1 + k\lambda) = eu(1 - \lambda)$<br>$\Rightarrow\ \frac{(1+k\lambda)}{k(1-\lambda)} = e$ (T) | M1 A1<br>M1 A1<br>M1<br>A1 (6) |
| (*b*) | $\frac{1+k\lambda}{k(1-\lambda)} \le 1$ | $\Rightarrow\ 1 + k\lambda \le k(1 - \lambda)$<br>$\Rightarrow\ \frac{1}{1-2\lambda} \le k$<br>since $0 < \lambda < \frac{1}{2}$, $k > 1$ (T) | M1<br>A1<br>A1 (3) **(9)** |

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| **6.** (*a*) | $\mathbf{v} = \int 2\mathbf{i} + 6t\mathbf{j}\ \mathrm{d}t = 2t\mathbf{i} + 3t^2\mathbf{j}$ (+ **c**) | M1 A1 |
| | $\mathbf{c} = 2\mathbf{i} - 4\mathbf{j}$ | A1 (3) |
| | $\mathbf{v} = (2t + 2)\mathbf{i} + (3t^2 - 4)\mathbf{j}$ | |
| (*b*) | $t = 2$: $\mathbf{v} = 6\mathbf{i} + 8\mathbf{j}$ | B1 |
| | $3\mathbf{i} - 1.5\mathbf{j} = 0.5(\mathbf{v} - (6\mathbf{i} + 8\mathbf{j}))$ | M1 A1 |
| | $\Rightarrow \mathbf{v} = 12\mathbf{i} + 5\mathbf{j}$ | A1 |
| | $\Rightarrow \lvert\mathbf{v}\rvert = \sqrt{(12^2 + 5^2)} = 13$ m s$^{-1}$ | M1 A1 (6) **(9)** |
| **7.** (*a*) | ($\uparrow$): $-52.5 = 14t - \frac{1}{2} \times 9.8t^2$ | M1 A2 |
| | $7t^2 - 20t - 75 = 0$ | |
| | $(7t + 15)(t - 5) = 0$ | M1 A1 A1 |
| | $t = 5$ (or $t = -\frac{15}{7}$) | M1 |
| | ($\rightarrow$): $S = 28 \cos 30° \times 5$ | A1 (8) |
| | $= 70\sqrt{3} = 121$ m (3 s.f.) | |
| (*b*) | $v_{\text{horizontal}}$ : $28 \cos 30° = 14\sqrt{3}$ | B1 |
| | $v_{\text{vertical}}$: $28 \sin 30° - 5g = -35$ | M1 A1 |
| | $\therefore$ speed $= \sqrt{((14\sqrt{3})^2 + 35^2)} = \sqrt{1813} = 42.6$ m s$^{-1}$ | M1 A1 (5) **(13)** |
| OR | KE gain = PE loss | M1 A2 |
| | $\frac{1}{2} m (v^2 - 28^2) = mg \times 52.5$ | M1 A1 (5) |
| | $\Rightarrow v = \sqrt{1813} = 42.6$ m s$^{-1}$ | |

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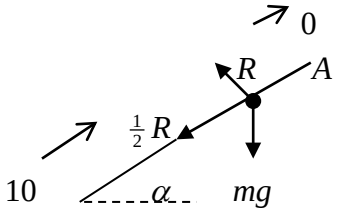
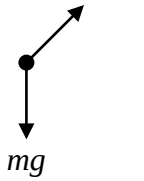
| **8.** (*a*) |  $R$ (↖), $R = mg\cos\alpha = \frac{4}{5}mg$ | M1 A1 |
| | $\frac{2}{5}mgd = \frac{1}{2}m \times 10^2 - mgd\sin\alpha$ | M1 A3 |
| | $OA = d = \frac{50}{g} = 5.10$ m (3 s.f.) | A1 (7) |
| (*b*) | At $A$,  component of weight down plane = $mg\sin\alpha = \frac{3mg}{5}$ | B1 |
| | limiting friction up = $\frac{2mg}{5}$ | B1 |
| | $\therefore$ slides down as $\frac{3mg}{5} > \frac{2mg}{5}$ | M1 (3) |
| | Work done against friction = KE loss | |
| | $2 \times \frac{2mg}{5} \times \frac{50}{g} = \frac{1}{2}m(10^2 - v^2)$ | M1 A3 |
| | $v = \sqrt{20} = 4.47$ m s$^{-1}$ | A1 (5) **(15)** |