Mathematics M1 (June 2009)
Final Markscheme

1.(a) Using $v = u + at$ with $u = 14.7$, $a = (-)9.8$, $t = 2$. M1
$v = 14.7 - 9.8 \times 2$ A1
$v = -4.9$
Speed = $\underline{4.9 \text{ms}^{-1}}$ A1

1.(b) Using $v^2 = u^2 + 2as$ with $u = 14.7$, $a = (-)9.8$, $s = (-)70.2$. M1
$v^2 = 14.7^2 + 2\times (-9.8) \times (-70.2)$ A1
$v = \underline{39.9 \text{ ms}^{-1}}$ cao A1

1.(c) Using $s = ut + \frac{1}{2}at^2$ with $u = 14.7$, $a = (-)9.8$, $s = 3.969$. M1
$3.969 = 14.7t - \frac{1}{2}\times 9\cdot 8\times t^2$ A1
$t^2 - 3t + 0.81 = 0$ attempt to solve m1
$(t - 0.3)(t - 2.7) = 0$
$t = 0.3, 2.7$
Therefore required length of time $= 2.7 - 0.3$
$= \underline{2.4 \text{ s}}$ cao A1

2.(a) N2L $5g - T = 5a$ dim. correct M1 A1
$T - 2g = 2a$ dim. correct M1 A1

Adding $3g = 7a$ m1
$a = \underline{3g/7} = \underline{(4.2)\text{ms}^{-2}}$ cao A1
$T = 2 \times 9.8 + 2 \times 4.2$
$= \underline{28 \text{ N}}$ cao A1

2.(b) Magnitude of acceleration of objects A and B are equal. B1

3.(a) N2L applied to lift and person $900g - T = 900a$ dim corr. M1
$900 \times 9.8 - 8550 = 900a$ A1
$a = \underline{0.3 \text{ ms}^{-2}}$ cao A1

3.(b) N2L applied to person $65g - R = 65a$ M1
$R = 65(9.8 - 0.3)$ A1
$R = \underline{617.5 \text{ N}}$ ft c's a A1

4.(a) At $t = 10$, acceleration $= \dfrac{20-5}{30}$ M1

$= \underline{0.5\ \text{ms}^{-2}}$ cao A1

At $t = 420$, acceleration $= \underline{0}$ B1

4.(b) Using $v = u + at$ with $u = 5$ $t = 20$, $a = 0.5$(c). M1

$v = 5 + 0.5 \times 20$

$v = \underline{15\ \text{ms}^{-1}}$ ft acce if > 0 A1

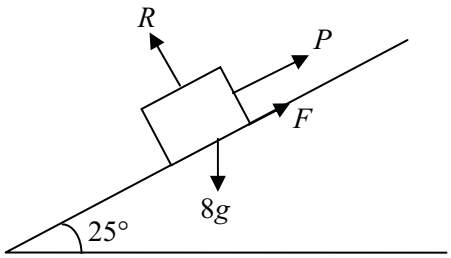
4.(c) Distance $= \dfrac{1}{2}(5+20)\times 30 + 20\times 400 + \dfrac{1}{2}\times 20\times 50$ method for distance M1

any correct area B1

correct expression A1

Distance = $\underline{8875\ \text{m}}$ cao A1

5.



(a) $R = 8g\cos 25°$ (=71.05) si M1 A1

$F = 0.3 \times 8g\cos 25°$ (=21.32) si m1

N2L up slope dim correct, all forces, $a = 0$ M1

$P + F = 8g\sin 25°$ A1

$P = 8 \times 9.8\sin 25° - 2.4 \times 9.8\cos 25°$

$P = \underline{11.82\ \text{N}}$ cao A1

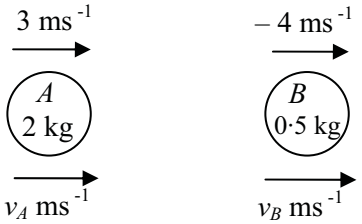
(b) N2Ldown slope dim correct, all forces M1

$P - F - 8g\sin 25° = 8a$ A1 A1

$P = 8g\sin 25° + 2.4g\cos 25° + 8 \times 0.6$

$P = \underline{59.25\ \text{N}}$ cao A1

6.



(a) conservation of Momentum M1

$2 \times 3 - 0.5 \times 4 = 2v_A + 0.5v_B$ A1

$4v_A + v_B = 8$

Restitution M1

$v_B - v_A = -e(-4 - 3)$ A1

$= \frac{2}{7} \times 7$

$v_B - v_A = 2$

Subtracting $5v_A = 6$ dep. on both M's m1

$v_A = \underline{1.2 \text{ms}^{-1}}$ cao A1

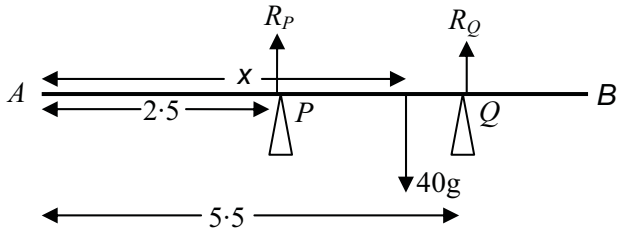
$v_B = \underline{3.2 \text{ms}^{-1}}$ cao A1

(b) Impulse on B = Change in momentum of B. used M1

$I = 0.5(3.2 - (-4))$

$I = \underline{3.6 \text{Ns}}$ ft v_A, v_B A1 B1

7.



(a) Resolve vertically $R_P + R_Q = 40g$ oe M1

$R_P = R_Q = R$ $R + R = 40g$

$R = 20g = (196)\text{N}$ A1

(b) Moments about A moments both sides, dim correct M1

$2.5 R_P + 5.5 R_Q = x \times 40(g)$ A1 B1

$8 \times 20g = 40g \times x$

$x = \underline{4\text{m}}$ cao A1

OR If $R_P = R_Q$, C must be the midpoint of PQ. M1

Therefore $x = 2.5 + 0.5(5.5 - 2.5)$ B1 A1

$= \underline{4 \text{ m}}$ A1

8. Resolve in one direction to obtain component of resultant M1

$X = 7\cos30° - 2\cos60° - 5\cos50°$ A1

$X = 1.8482$

Resolve in perpendicular direction M1

$Y = 5\cos40° + 7\cos60° - 2\cos30°$ A1

$Y = 5.5982$

$\text{Resultant}^2 = 1.8482^2 + 5.5982^2$ m1

Resultant = 5.9 N cao A1

9.(a)

	Area	from *AE*	from *AB*
Square	36	3	3
Triangle	12	3	$6+\frac{4}{3}=\frac{22}{3}$
The sign	48	x	y

B1 B1 B1

Distance of centre of mass from $AE = x = 3$ B1

Moments about *AB* M1

$48y = 12\times\frac{22}{3} + 36\times3$ ft areas, y's A1

$y = \frac{49}{12} = 4.083$ cm cao A1

(b) $\tan\theta = \frac{3}{\frac{49}{12}}$ ft x, y M1 A1

$\theta = 36.3°$ ft x, y A1