

GCE

Edexcel GCE

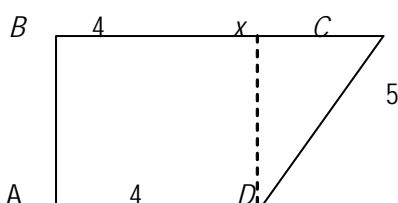
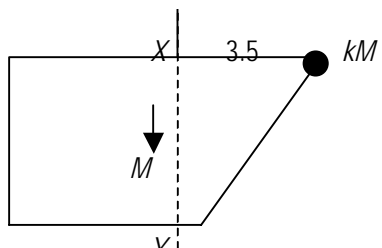
Mechanics M2 (6678)

Summer 2005

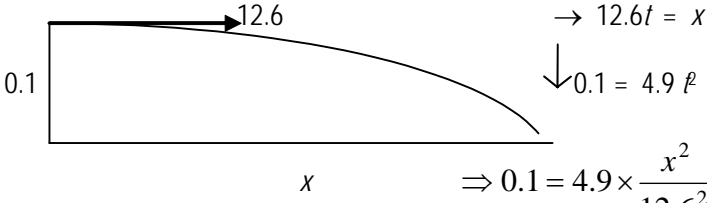
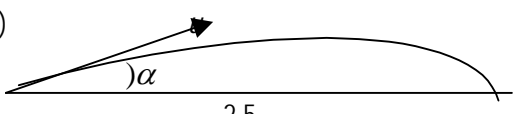
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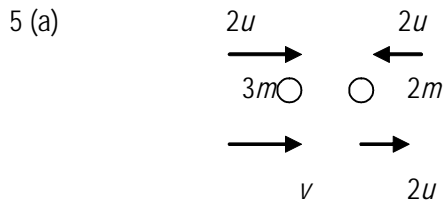
Mark Scheme (Results)

June 2005
6678 Mechanics M2
Mark Scheme

Question Number	Scheme	Marks
1 (a)	<p>Driving force = $\frac{P}{v}$</p> <p>$\frac{21000}{v} = 600 \Rightarrow v = 35 \text{ m s}^{-1}$</p> <p>(b) $\frac{P}{v} = 600 + 1200 \cdot g \cdot \frac{1}{14}$ (= 1440 N)</p> <p>$\frac{21000}{v} = 1440 \Rightarrow v = \frac{21000}{1440} \approx 14.6 \text{ or } 15 \text{ m s}^{-1}$</p>	<p>B1</p> <p>M1 A1</p> <p>(3)</p> <p>M1 A1</p> <p>M1 A1</p> <p>(4)</p>
2 (a)	 <p>$M(AB): 7 \times 3.5 + 5 \times 5.5 + 4 \times 2 = 20 \times \bar{x}$</p> <p>$\Rightarrow 20\bar{x} = 24.5 + 27.5 + 8 = 60 \Rightarrow \bar{x} = 3 \text{ cm}$</p>	<p>(x = 3)</p> <p>M1 A2,1,0</p> <p>dep M1 A1</p> <p>(5)</p>
2 (b)	 <p>$M(XY):$</p> <p>$M \times (3.5 - 3) = kM \times 3.5$</p> <p>$\Rightarrow k = \frac{1}{7}.$</p>	<p>M1 A1 ✓</p> <p>A1</p> <p>(3)</p>

3 (a)	$v = (18 - 12t)\mathbf{i} + 2c\mathbf{j}$	M1 A1 A1
	$t = \frac{3}{2}: v = -9\mathbf{i} + 3c\mathbf{j}$	M1
	$ v = 15 \Rightarrow 9^2 + (3c)^2 = 15^2$	M1
	$\Rightarrow (3c)^2 = 144 \Rightarrow c = 4$	A1
	(6)	
(b)	$a = -24\mathbf{i} + 8\mathbf{j}$	M1
	$t = \frac{3}{2}: a = -36\mathbf{i} + 8\mathbf{j}$	M1
		A1 \checkmark
	(3)	

4 (a)		$\rightarrow 12.6t = x$ $\downarrow 0.1 = 4.9t^2$	B1
	$\Rightarrow 0.1 = 4.9 \times \frac{x^2}{12.6^2}$		B1
	$\Rightarrow x = 1.8 \text{ m}$	M1	M1
	(4)		A1
(b)		$\rightarrow u \cos \alpha t = 2.5$ $\uparrow u \sin \alpha t = \frac{1}{2}gt^2$	M1 A1
	$u \cdot \frac{24}{25}t = 2.5$		M1 A1
	$u \cdot \frac{7}{25} = 4.9 \cdot \frac{2.5 \cdot 25}{24u}$		
	$u^2 = \frac{4.9 \times 2.5 \times 25^2}{7 \times 24}$		
	$\Rightarrow u \approx 6.75 \text{ or } 6.8 \text{ m s}^{-1}$	M1 A1	(6)



CLM: $6mu - 4mu = 3mv + 4mu$ M1 A1
 $\Rightarrow v = -\frac{2}{3}u$ A1
 NLI: $2u - v = e.4u$ M1 A1
 $\Rightarrow 4eu = \frac{8}{3}u \Rightarrow e = \frac{2}{3}$. M1 A1

(7)

(b)

$5my + 2mx = 4mu$ M1 A1
 $y - x = \frac{3}{5}.2u = \frac{6}{5}u$ A1

Solve: $x = -\frac{2}{7}u$ M1 A1
 $\frac{2}{7}u < \frac{2}{3}u$ so B does not overtake A M1
 So no more collisions A1 cso

(7)

6 (a)

M(A): $P \times 0.5 \sin 60 = 30g \times 1.5$ M1 A2
 $P = 90g \cdot \frac{2}{\sqrt{3}} \approx 1020 \text{ N (1000N)}$ A1

(4)

(b) $\rightarrow X = P \cos 60 = \frac{1}{2}P$ M1 A1
 $(\approx 509 \text{ N (510N)})$

$\uparrow Y + P \cos 30 = 30g$ M1 A1
 $(\Rightarrow Y = -588 \text{ N})$

resultant = $\sqrt{(X^2 + Y^2)} = \sqrt{(509^2 + 588^2)} \approx 778 \text{ N}$ M1 A1
 or 780N

(6)

(c) In equilibrium all forces act through a point M1
 P and weight meet at mid-point;
 hence reaction also acts through mid-point so reaction horizontal A1 cso

(2)

OR M(mid-point): $Y \times 1.5 = 0 \Rightarrow Y = 0$ M1
 Hence reaction is horizontal A1

	<p>7 (a) PE lost = $3 \times g \times 8 \sin 30 = 3 \times g \times 8 \times 0.5 = 117.6 \text{ J} \approx 118 \text{ J}$ or 120J</p>	<p>M1 A1 (2)</p>	
	<p>(b) KE gained = $\frac{1}{2} \times 3 \times 5^2 = 37.5 \text{ J}$ Work-energy: $F \times 8 = 117.6 - 37.5 = 80.1$ $\Rightarrow F = 10.0125 \approx 10 \text{ N}$</p>	<p>M1 A1 M1 A1√ A1 (5)</p>	
	<p>(c) $R = 3g \cos 30 (= 25.46 \text{ N})$ $F = \mu R \Rightarrow \mu = \frac{10}{25.46} \approx 0.393 \text{ or } 0.39$</p>	<p>B1 M1 A1 (3)</p>	
	<p>(d) Work done by friction = 80.1 as before Work-energy: $\frac{1}{2} \times 3 \times v^2 = \frac{1}{2} \times 3 \times 2^2 + 117.6 - 80.1$ $\Rightarrow v \approx 5.39 \text{ or } 5.4 \text{ m s}^{-1}$</p>	<p>M1 M1 A2,1,0√ A1 (5)</p>	

