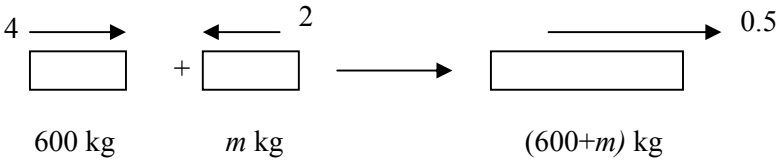
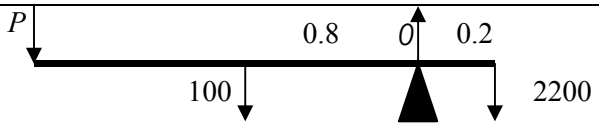
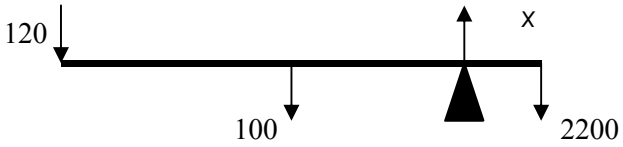
EDEXCEL 6677 MECHANICS M1 JANUARY 2004 PROVISIONAL MARK SCHEME

Question Number		Markscheme	Marks
1			
	(a)	CLM: $600\times 4 - m\times 2 = (600+m)\times 0.5$	M1 A1 ↓
		$\Rightarrow \quad m = \underline{840\text{kg}}$	M1 A1 (4)
	(b)	$I = 600(4-0.5)$	M1 → M1
		$= \underline{2100\text{ Ns}}$	A1 (3)
2	(a)		
		M(C): $P\times 1.8 + 100\times 0.8 = 2200\times 0.2$	M1 A2, 1, 0
		$\Rightarrow \quad P = \underline{200\text{ N}}$	A1 (4)
	(b)		
		M(C): $120(2-x) + 100(1-x) = 2200\,x$	M1 A2, 1, 0 ↓
		$\Rightarrow 340 = 2420x \Rightarrow x \approx \underline{14\text{ cm}}$ (Solve x)	M1 A1 (5)

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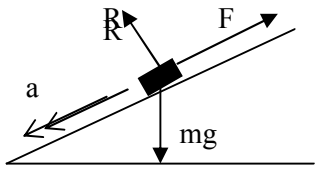
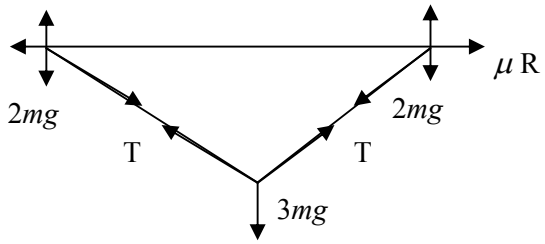
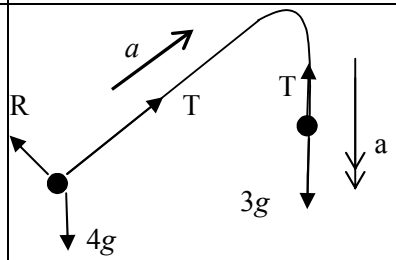
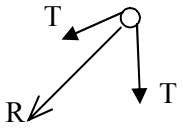
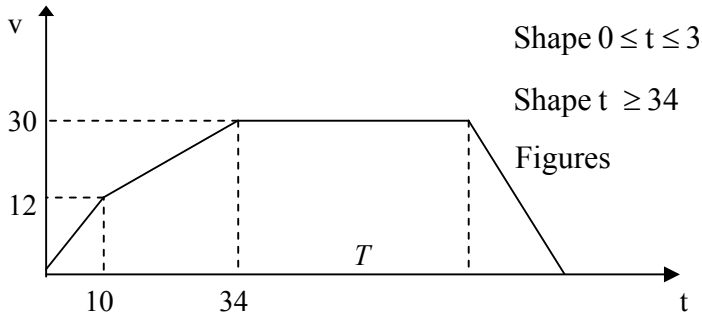
3	(a)	 R	
		R( ): $R = mg\cos 30$	B1
		R( ): $ma = mg\sin 30 - F$	M1 A1
		$F = 0.4\,R$ used	B1
		Eliminate R $ma = mg\sin 30 - 0.4.\,mg\cos 30$	M1
		Solve: $a = 4.9 - 0.4\times 9.8\times\sqrt{3}/2$	M1
		$\approx \underline{1.5 \text{ or } 1.51\ \text{m s}^{-2}}$	A1
			(7)
	(b)	$v^2 = 2\times 1.51\times 3 \Rightarrow v = \underline{3 \text{ or } 3.01\ \text{m s}^{-1}}$	M1 A1
			(2)
	(c)	$1.5/1.51\ \text{m s}^{-2}$ **(same as (a))**	B1
			(1)
4	(a)		
		R ↑ for C: $2T\sin\theta = 3\,mg$	M1 A1
		$\sin\theta = \frac{3}{5} \Rightarrow T = \frac{5}{2}\,mg$ (*)	A1
			(3)
	(b)	R ↑ for A or B: $R = 2mg + T\sin\theta$	M1 A1
		$= 2mg + \frac{5}{2}\,mg.\frac{3}{5} = \frac{7}{2}mg$	M1 A1
		R → for A or B: $T\cos\theta = \mu\,R$	M1
		Solve to get μ as number: $\frac{5}{2}\,mg.\frac{4}{5} = \mu.\frac{7}{2}mg \Rightarrow \mu = \frac{4}{7}$	M1 A1
			(7)

Question Number		Markscheme	Marks
5	(a)		
		A: $T - 4g\sin 30 = 4a$	M1 A1
		B: $3g - T = 3a$	M1 A1
		$\Rightarrow T = \frac{18g}{7} = \underline{25.2\text{ N}}$	M1 A1
			(6)
	(b)		
		$R = 2T\cos 30$	M1 A1
		$\approx \underline{44 \text{ or } 43.6\text{ N}}$	A1
			(3)
	(c)	(i) String has no weight/mass	B1
		(ii) Tension in string constant, i.e. same at A and B	B1
			(2)
6	(a)	After 10 s, speed $= 1.2\times 10 = 12\text{ m s}^{-1}$	B1
		After next 24 s, $v = \text{"u + at"} = 12 + 0.75\times 24 = 30\text{ m s}^{-1}$ (*)	M1 A1
			(3)
	(b)		
		Shape $0 \le t \le 34$	B1
		Shape $t \ge 34$	B1
		Figures	B1
	(c)	Distance $= \frac{1}{2}\times 10\times 12, + \frac{1}{2}(30+12)24$	B1, M1 A1
		$= 60 + 504 = \underline{564\text{ m}}$	A1
			(4)
	(d)	Distance travelled decelerating $= \frac{1}{2}\times 30\times 10$	B1
		$564 + 30T + \frac{1}{2}\times 30\times 10 = 3000$	M1 A1 √
		$\Rightarrow T = \underline{76.2\text{ s}}$	A1
			(4)

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7	(a)	$\tan\theta = \frac{3}{5} \Rightarrow \theta = 031$	M1 A1
			(2)
	(b)	$\mathbf{a} = 9t\,\mathbf{j}$	B1
		$\mathbf{b} = (-10 + 3t)\mathbf{i} + 5t\,\mathbf{j}$	M1 A1
			(3)
	(c)	B south of A $\Rightarrow -10 + 3t = 0$	M1
		$t = 3\frac{1}{3} \Rightarrow \underline{1520 \text{ hours}}$	A1
			(2)
	(d)	$AB = \mathbf{b} - \mathbf{a} = (3t - 10)\mathbf{i} - 4t\,\mathbf{j}$	M1 A1
		$d^2 = \lvert\mathbf{b} - \mathbf{a}\rvert^2 = (3t-10)^2 + 16t^2$ ↓	M1
		$= 25t^2 - 60t + 100 \quad (*)$	A1
			(4)
	(e)	$d = 10 \Rightarrow d^2 = 100 \Rightarrow 25t^2 - 60t = 0$	M1
		$\Rightarrow t = (0 \text{ or}) 2.4$	A1
		$\Rightarrow \text{time } \underline{1424 \text{ hours}}$	A1
			(3)