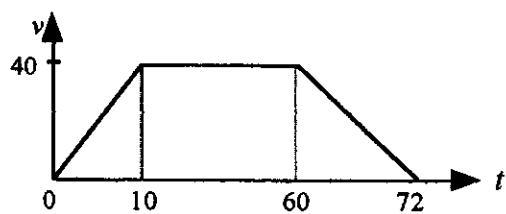


MECHANICS 1 (A) TEST PAPER 2 : ANSWERS AND MARK SCHEME

1.	(a) Moments about P : $4g + 8g = 2kg$	$k = 6$	M1 A1 A1	
	(b) Resolve vertically: $R = 9g + kg$	$R = 15g = 147 \text{ N}$	M1 A1	5
2.	(a) Cos. rule on force Δ : $R^2 = 16 + 36 - 48 \cos 140^\circ$	$R = 9.42 \text{ N}$	M1 A1 M1 A1	
	(b) $\sin \theta / 6 = \sin 140^\circ / R$	$\sin \theta = 0.409$	$\theta = 24.2^\circ$	M1 A1
3.	(a) $7 = \frac{1}{2}gt^2$	$t^2 = 14 \div 9.8$	$t = 1.20 \text{ s}$	M1 A1
	(b) $v = gt = 11.7 \text{ ms}^{-1}$	(c) $0 - 5.8566^2 = -2gh$	$h = 1.75 \text{ m}$	M1 A1; M1 A1 A1
	Modelled stone as particle, ignored air resistance, etc.			B1 B1
4.	(a) P has p.v. $40\mathbf{i} + 80\mathbf{j}$, so $OP = \sqrt{8000} = 89.4 \text{ m}$		B1 M1 A1	
	(b) Speed from P to Q is 3 ms^{-1} , so time = 25 s		M1 A1	
	(c) $OQ = 40\mathbf{i} + 80\mathbf{j} + 25(2.4\mathbf{i} - 1.8\mathbf{j}) = 100\mathbf{i} + 35\mathbf{j}$		M1 A1 A1	
	(d) $65(a\mathbf{i} + b\mathbf{j}) = 100\mathbf{i} + 35\mathbf{j}$	$a = \frac{20}{13}, b = \frac{7}{13}$	M1 M1 A1 A1	12
5.	(a) $10000(u_A - 10) = 84000$	$u_A = 18.4 \text{ ms}^{-1}$	M1 A1 A1	
	$7000(u_B + 10) = 84000$	$u_B = 2 \text{ ms}^{-1}$	M1 A1 A1	
	(b) Resisting force = $\mu R = 0.15 \times 17000g = 24990 \text{ N}$		M1 A1 A1	
	(c) $v = u + at$: $0 = 10 - 0.15gt$	$t = 6.80 \text{ s}$	M1 A1 A1	12
6.	(a) $T - 0.2g = 0.4(1)$	$T = 0.4 + 0.2g = 2.36 \text{ N}$	M1 A1 A1	
	(b) $Mg - T = 0.4M$	$9.4M = 2.36$	$M = 0.251$	M1 A1 A1
	(c) $0.5 = \frac{1}{2} \times 0.4t^2$	$t = 1.58 \text{ s}$	M1 A1 A1	
	(d) P has moved 0.5 m and has speed 0.632 ms^{-1} and acceleration $-0.2g$, so $0^2 - 0.632^2 = 2(-0.2g)s$	$s = 0.102$	B1 M1 A1	
	Comes to rest $0.75 - (0.5 + 0.102) = 0.148 \text{ m}$ from pulley			M1 A1
7.	(a) 		B3	
	(b) Time for last section = $240 \div \frac{1}{2}(40) = 12 \text{ s}$, so total time = 72 s		M1 A1	
	Total distance = $\frac{1}{2}(50 + 72) \times 40 = 2440 \text{ m}$		M1 A1	
	Average speed = $2440 \div 72 = 33.9 \text{ ms}^{-1}$		M1 A1	
	(c) Put $t = 5$: $k(5m - 25) = 4$	Put $t = 10$: $k(10m - 100) = 0$	B1 B1	
	$k = \frac{4}{25}, m = 10$		M1 A1 A1	
	(d) When $t = 2$, $a = \frac{4}{25} \times 16 = 2.56 \text{ ms}^{-2}$		M1 A1	16