8MA0/02: AS Paper 2 Part B Mechanics Mark scheme

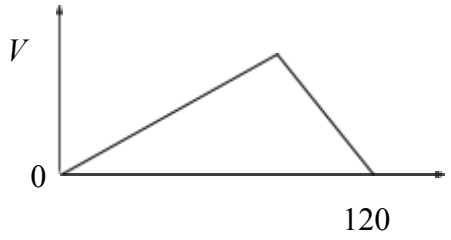
Question	Scheme	Marks	AOs
1(a)	Use of $s = vt - \frac{1}{2}at^2$	M1	2.1
	$19.6 = 4v - \frac{1}{2} \times 9.8 \times 4^2$	A1	1.1b
	$v = 24.5$ or 25 (m s^{-1})	A1	1.1b
		(3)	
(b)	$0 = 14.7^2 - 2 \times 9.8h$	M1	2.1
	$h = 11.0$ or 11 (m)	A1	1.1b
		(2)	
(c)	New value of speed would be lower.	B1	3.5a
		(1)	
			(6 marks)

Notes:

(a)
M1: Complete method to give equation in v only (could involve 2 or more *suvat* equations and then elimination) with usual rules
A1: Correct equation
A1: Correct answer

(b)
M1: Complete method to find h
A1: 11.0 or 11 (m)

(c)
B1: New value of speed will be lower

Question	Scheme	Marks	AOs
2(a)	 Shape	B1	1.1b
	V, 120	B1	1.1b
		(2)	
(b)	$\frac{1}{2} \times 120V = 1500$	M1	3.1b
	$V = 25$	A1	1.1b
		(2)	
(c)	Area of triangle = Distance travelled = $(\frac{1}{2} \times 120V) = 1500$	B1	2.4
	This does not depend on T so T can take any value where $0 < T < 120$	B1	2.4
		(2)	
(d)	Include a constant speed phase in the motion	B1	3.5c
		(1)	
			(7 marks)

Notes:

(a)
B1: Triangle, starting at the origin with base on axis and apex between $t = 0$ and $t = 120$
B1: V and 120 correctly marked (allow a delineator)

(b)
M1: Identifying correct strategy to solve problem to give equation in V only
A1: $V = 25$

(c)
B1: Area of triangle only depends on base and height
B1: So T can take any value $0 < T < 120$

(d)
B1: e.g. Include a *smooth* change from acceleration phase to deceleration phase.
e.g. Have a variable acceleration and/or deceleration phase

Question	Scheme	Marks	AOs
3(a)(i)	Equation of motion for P with usual rules	M1	3.3
	$T - 1.5 = 0.4 \times 2.5$	A1	1.1b
	$T = 2.5$ (N)	A1	1.1b
(ii)	Equation of motion for Q with usual rules	M1	3.3
	$10M - T = 2.5M$	A1	1.1b
	$M = 0.33$	A1	1.1b
		(6)	
(b)	$2 = \frac{1}{2} \times 2.5t^2$	M1	3.4
	$t = 1.3$ (s)	A1	1.1b
		(2)	
(c)	e.g. the mass of the rope	B1	3.5b
		(1)	
			(9 marks)

Notes:

(a) (i)
M1: Resolve horizontally for P
A1: Correct equation
A1: Correct answer. Ignore units

(a)(ii)
M1: Resolve vertically for Q
A1: Correct equation
A1: Correct answer

(b)
M1: Use $s = ut + \frac{1}{2}at^2$
A1: 1.3. Ignore units

(c)
B1: e.g. the pulley may not be smooth,
air resistance

Question	Scheme	Marks	AOs
4(a)	$s = \int_0^1 16 - 3t^2 \, \mathrm{d}t$	M1	1.1a
	$= \left[16t - t^3\right]_0^1$	A1	1.1b
	$= 15$ (m)	A1	1.1b
		(3)	
(b)	$16 - 3t^2 = 0$	M1	3.1b
	$t = \sqrt{\frac{16}{3}}$ oe	A1	1.1b
		(2)	
(c)	$16t - t^3 = 0$	M1	3.1b
	$t(16 - t^2) = 0$	M1	1.1b
	$t = 4$	A1	1.1b
		(3)	
			(8 marks)

Notes:

(a)

M1: Attempt to integrate, one power going up

A1: Correct integral and limits or indefinite integral with $C = 0$ and $t = 1$.

A1: 15 (m)

(b)

M1: Identifying correct strategy to solve problem of finding direction change by equating v to 0 and solving for t

A1: correct answer – any surd or decimal equivalent to at least 2 sf

(c)

M1: Identifying correct strategy to solve problem by using use $s = 0$ and equating their integral to 0

M1: Attempt to solve

A1: $t = 4$