



eClassroom

INTERNATIONAL A LEVEL MATHEMATICS • MECHANICS 1

Mechanics 1

Exam Questions by Topic: Mark Scheme

Pearson Edexcel International Advanced Level (WME01/01) • Calculator allowed • Take $g = 9.8 \text{ m s}^{-2}$

Every question in the booklet, marked line by line the way an examiner marks it

Chapters (tap a chapter to jump to it)	Qs	Marks	Page	My score
1 Mathematical Models in Mechanics Not examined on its own: modelling ideas are tested within Chapters 2 to 8	—	—	Not applicable	
2 Constant Acceleration Motion graphs, the suvat formulae, vertical motion under gravity	10	82	own PDF	
3 Vectors in Mechanics Resultants, velocity and position vectors, $\mathbf{r} = \mathbf{r}_0 + \mathbf{v}t$	10	81	own PDF	
4 Dynamics of a Particle Moving in a Straight Line $F = ma$, connected particles, pulleys, lifts	10	82	3	
5 Forces and Friction Resolving forces, friction, inclined planes	10	86	own PDF	
6 Momentum and Impulse Conservation of momentum, impulse	10	81	own PDF	
7 Statics of a Particle Equilibrium, limiting friction	10	82	own PDF	
8 Moments Beams and rods, tilting, non-uniform rods	10	82	own PDF	

[Question booklet](#)

[Free courses](#)

[More worksheets](#)



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

How to use this mark scheme

The same marking rules Pearson examiners use for WME01.

Mark every line, not just the answer. Method marks are given for a correct method even when the final answer is wrong. If you lost marks, find the *first* line where your working differs from the scheme. That is the thing to fix.

Code	Meaning
M1	Method mark: for knowing a correct method and attempting to apply it. Small slips in the working do not lose this mark.
dM1	Dependent method mark: can only be given if the method mark before it has been given.
A1	Accuracy mark: for a correct answer or line of working. It can only be given if the method mark it depends on has been given.
B1	Independent mark: for a correct result or statement, whatever method was used.
*	The answer is given in the question. Every step must be shown, and the answer must follow from correct working (cso).
cao	Correct answer only.
cso	Correct solution only: no errors anywhere in the working.
ft	Follow through: the mark can be given for correct work using your own earlier (wrong) answer.
oe	Or equivalent: any correct equivalent form is accepted.

Accuracy after using $g = 9.8$. When $g = 9.8 \text{ ms}^{-2}$ has been substituted, the final answer must be given to 2 or 3 significant figures: more accurate answers (and fractions) lose the final A mark. Exact multiples of g are usually accepted. Using $g = 9.81$ loses accuracy marks.

Marking a sketch. Graph marks are given for the correct shape (straight lines for constant acceleration, no solid vertical lines) and for the key values marked on the axes. An equation of motion or a suvat equation must have the correct number of terms and be dimensionally correct to earn its method mark.



4

Chapter 4: Dynamics of a Particle Moving in a Straight Line

Mark scheme. Marks are shown on the right of each line.

Question 1

6 marks

Part	Scheme	Marks
(a)	Resultant = $(2 + p)\mathbf{i} + (3 + q)\mathbf{j}$ and $\mathbf{F} = m\mathbf{a} = 0.5(8\mathbf{i} - 6\mathbf{j})$ $2 + p = 4, 3 + q = -3$ $p = 2, q = -6$	M1 A1 A1 (3)
(b)	$\sqrt{8^2 + 6^2} = 10\text{ms}^{-2}$ Jan 2025 report: leaving the acceleration as a vector loses this mark.	B1 (1)
(c)	$\tan^{-1} \frac{6}{8}$ 36.9° (below $\mathbf{i}$)	M1 A1 (2)
Total for Question 1: 6 marks		

Question 2

6 marks

Part	Scheme	Marks
(a)	$25^2 = 10^2 + 2a \times 150$ 1.75ms^{-2}	M1 A1 (2)
(b)	$D - 450 = 900 \times 1.75$ 2025 N (2030 N)	M1 A1 (2)
(c)	Deceleration $\frac{450}{900} = 0.5\text{ms}^{-2}$ and $0 = 25 - 0.5t$ 50 s	M1 A1 (2)
Total for Question 2: 6 marks		



Question 3

6 marks

Part	Scheme	Marks
(a)	Whole system: $3000 + 300 + 100 = 1600a$ 2.125 ms^{-2} (2.13)	M1 A1 (2)
(b)	Trailer only: $100 + F = 400 \times 2.125$ (towbar force F acting backwards on the trailer) $F = 750$ 750 N, a thrust <i>Summer 2019 report: assuming the coupling is in tension. A negative tension (-750) must be interpreted as a thrust for the last mark.</i>	M1 A1 A1 (3)
(c)	$0 = 20^2 - 2 \times 2.125s$: 94.1 m	B1 (1)
Total for Question 3: 6 marks		

Question 4

6 marks

Part	Scheme	Marks
(a)	Whole system: $2800 - 250g = 250a$ 1.4 ms^{-2}	M1 A1 (2)
(b)	B only: $T - 50g = 50 \times 1.4$ 560 N <i>Oct 2019 report: forces acting on the wrong part of the system. The rope tension acts on B; the cable tension does not.</i>	M1 A1 (2)
(c)	$a = 0$: $250g = 2450 \text{ N}$	B1 (1)
(d)	Moving down and slowing: acceleration 0.6 ms^{-2} upwards; $T - 50g = 50 \times 0.6$: 520 N	B1 (1)
Total for Question 4: 6 marks		



Question 5

6 marks

Part	Scheme	Marks
(a)	Upwards motion: $-(0.5g + 1.1) = 0.5a$ Deceleration 12ms^{-2}	M1 A1 (2)
(b)	$0 = 18^2 - 2 \times 12 \times h$ 13.5m	M1 A1 (2)
(c)	Downwards: $0.5g - 1.1 = 0.5a$, $a = 7.6\text{ms}^{-2}$ (resistance now acts upwards) $v^2 = 2 \times 7.6 \times 13.5$: 14.3ms^{-1} <i>Using the same acceleration for both directions gives 18ms^{-1}: M0. The resistance opposes the motion, so it changes direction.</i>	M1 A1 (2)
Total for Question 5: 6 marks		



Question 6

10 marks

Part	Scheme	Marks
(a)	$B: 3g - T = 3a$ Correct $A: T - 2g = 2a$ $a = \frac{g}{5} = 1.96 \text{ ms}^{-2}$ $T = 2(g + 1.96) = 23.5 \text{ N} \left(\frac{12g}{5} \right)$ <i>Jan 2025 report: m instead of 2m or 3m; g omitted from a weight or included in ma; $T - 2mg = 3mg - T$.</i>	M1 A1 M1 A1 A1 (5)
(b)	$v^2 = 2 \times 1.96 \times 1.5$ 2.42 ms^{-1} <i>Using $a = g$ (as if B falls freely) is M0.</i>	M1 A1 (2)
(c)	After B lands, A moves freely under gravity: $0 = 5.88 - 2 \times 9.8 \times h$, $h = 0.3$ Greatest height $1.5 + 0.3 = 1.8 \text{ m}$	M1 A1 (2)
(d)	The accelerations of A and B have the same magnitude (and A rises 1.5 m while B falls 1.5 m)	B1 (1)
Total for Question 6: 10 marks		



Question 7

10 marks

Part	Scheme	Marks
(a)	Whole system: $3850 - 350g = 350a$ $3850 - 3430 = 350a$ $a = 1.2 \text{ ms}^{-2}$ *	M1 A1 A1* (3)
(b)	$B: R_B - 10g = 10 \times 1.2$ 110 N	M1 A1 (2)
(c)	$A: R - 40g - 110 = 40 \times 1.2$ (the 110 N of B on A acts downwards, Newton's third law) or A and B together: $R - 50g = 50 \times 1.2$ 550 N	M1 A1 (2)
(d)	A and B together: $50g - 440 = 50d$ Deceleration 1 ms^{-2} $350g - T = 350 \times 1$: 3080 N	M1 A1 A1 (3)
Total for Question 7: 10 marks		



Question 8

10 marks

Part	Scheme	Marks
(a)	$30\,000 - 5000 - 2500 = 30\,000a$ 0.75 ms^{-2}	M1 A1 (2)
(b)	Carriage: $T - 2500 = 10\,000 \times 0.75$ $10\,000\text{ N}$	M1 A1 (2)
(c)	$0.75 \times 40 = 30\text{ ms}^{-1}$	B1 (1)
(d)	Carriage: $2500 = 10\,000a$, deceleration 0.25 ms^{-2} $0 = 30^2 - 2 \times 0.25 \times s$ 1800 m	M1 M1 A1 (3)
(e)	Carriage stops after 120 s; engine: $a = \frac{25\,000}{20\,000} = 1.25$, $s = 30 \times 120 + \frac{1}{2} \times 1.25 \times 120^2 = 12\,600$ $12\,600 - 1800 = 10\,800\text{ m}$ <i>Using the old acceleration 0.75 for the engine is the Summer 2019 error: the acceleration changes when the coupling breaks.</i>	M1 A1 (2)
Total for Question 8: 10 marks		



Question 9

10 marks

Part	Scheme	Marks
(a)	Resultant $(4 + p)\mathbf{i} + 4\mathbf{j}$ Parallel to $\mathbf{i} + 2\mathbf{j}$: $\frac{4+p}{1} = \frac{4}{2}$ $p = -2$	B1 M1 A1 (3)
(b)	$(2\mathbf{i} + 4\mathbf{j}) = 2\mathbf{a}$, $\mathbf{a} = \mathbf{i} + 2\mathbf{j}$ 2.24 ms^{-2} ($\sqrt{5}$)	M1 A1 (2)
(c)	$\mathbf{v} = (3\mathbf{i} - 4\mathbf{j}) + t(\mathbf{i} + 2\mathbf{j})$ Due east: $-4 + 2t = 0$, $t = 2$ $\mathbf{v} = 5\mathbf{i}$: speed 5 ms^{-1}	M1 A1 A1 (3)
(d)	$\mathbf{s} = \mathbf{u}t + \frac{1}{2}\mathbf{a}t^2 = (6\mathbf{i} - 8\mathbf{j}) + (2\mathbf{i} + 4\mathbf{j}) = 8\mathbf{i} - 4\mathbf{j}$ 8.94 m ($\sqrt{80}$) <i>The path is a straight line only if $\mathbf{u}$ is parallel to $\mathbf{a}$; here the magnitude of the displacement is what is asked for.</i>	M1 A1 (2)
Total for Question 9: 10 marks		



Question 10

12 marks

Part	Scheme	Marks
(a)	$P: T_1 = 5a$; Q and R together: $5g - T_1 = 5a$ Both correct $a = 4.9 \text{ ms}^{-2}$ $T_1 = 24.5 \text{ N}$	M1 A1 A1 A1 (4)
(b)	$R: 3g - T_2 = 3 \times 4.9$ 14.7 N	M1 A1 (2)
(c)	$T_1 \sqrt{2}$ (the two parts of the string are perpendicular) 34.6 N	M1 A1 (2)
(d)	P and Q only: $2g = 7a$ 2.8 ms^{-2} <i>Summer 2019 report: continuing with the old acceleration after a particle separates is M0.</i>	M1 A1 (2)
(e)	Speed at the break $4.9 \times 0.5 = 2.45 \text{ ms}^{-1}$; $s = 2.45 \times 0.5 + \frac{1}{2} \times 2.8 \times 0.5^2$ 1.58 m	M1 A1 (2)
Total for Question 10: 12 marks		

