

APOLLO

Forces and momentum

HL

Physics

First assessment 2025

21 questions | mark schemes

Mark-scheme answers

Physics HL | Paper 1A | May 2025 TZ1 | Q3 | 1 marks

3. A

Physics HL | Paper 1A | May 2025 TZ1 | Q4 | 1 marks

4. C

Physics HL | Paper 1A | May 2025 TZ1 | Q6 | 1 marks

6. A

Physics HL | Paper 1A | May 2025 TZ2 | Q4 | 1 marks

4. D

Physics HL | Paper 1A | May 2025 TZ2 | Q5 | 1 marks

5. D

Physics HL | Paper 1A | May 2025 TZ3 | Q3 | 1 marks

3. C

Physics HL | Paper 1A | May 2025 TZ3 | Q4 | 1 marks

4. D

Physics HL | Paper 1A | May 2025 TZ3 | Q5 | 1 marks

5. D

Physics HL | Paper 1A | May 2025 TZ3 | Q6 | 1 marks

6. D

1.	a		ALT 1 KE before is $\frac{1}{2} \times 3.0 \times 6.0^2 = 54 \text{ J} \checkmark$ KE after is $\frac{1}{2} \times 3.0 \times 2.0^2 + \frac{1}{2} \times 6.0 \times 4.0^2 = 54 \text{ J} \checkmark$ ALT 2 In elastic collisions relative velocity remains constant in magnitude $\checkmark$ $6 - 0 = -2 - 4 \checkmark$	Ignore references to conservation of momentum	[2]
	b	i	$F = \frac{6.0 \times 4.0}{40 \times 10^{-3}} \text{ OR } F = \frac{3.0 \times (6.0 - (-2.0))}{40 \times 10^{-3}} \checkmark$ $F = 6.0 \times 10^2 \text{ N} \checkmark$	Allow ECF from a wrong time interval. If the final answer is incorrect, award MP1 for [1max] for any attempt to use rate of change of momentum or mass x acceleration with wrong data values for masses and velocities.	[2]
	b	ii	Alternative 1 $\Delta E_K = \frac{1}{2} \cdot 6.0 \cdot 4.0^2 \text{ OR } 48 \text{ J} \checkmark$ $P = \ll \frac{\Delta E_K}{\Delta t} = \gg \frac{48}{40 \times 10^{-3}} = 1200 \text{ W} \checkmark$ Alternative 2 $\bar{P} = F \frac{u+v}{2} \checkmark$ $\bar{P} = 600 \times \frac{0+4.0}{2} = 1200 \text{ W} \checkmark$	Award [2] if 1200 <<W>> is seen as the answer without working Award [1] for 2400 W. Allow ECF from bi) in ALT 2.	[2]

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2225 – 6715M

	b	iii	KE is $\frac{1}{2} \times (3.0 + 6.0) \times 2.0^2 = 18 \text{ J} \checkmark$ PE is $54 - 18 = 36 \text{ J} \checkmark$	Allow ECF from MP1	[2]
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2225 – 6715M

Question	Answers	Notes	Total
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1.	a	It is a ratio between two forces therefore units cancel out. OR $\mu = F_f/N$, therefore units cancel out. ✓		1
1.	b	uses the static coefficient ✓ $F = 0.36 \times 1.2 \times 9.8 = 0.36 \times 11.76$ OR $F = 4.2 \text{ «N»}$ ✓	Must see full substitution OR answer to 2 (or more) significant figures for MP2.	2

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2225 – 6721M

1.	c	ALT 1 $F_f = 0.28 \times 1.2 \times 9.8 = 3.29 \text{ «N»}$ ✓ $W \text{ done over } 0.35 \text{ m} = (14 - 3.29) \times 0.35 = 3.75 \text{ «J»}$ ✓ $d = \langle 3.75 \text{ J} / 3.29 \text{ N} \rangle = \langle 1.14 \text{ «m»} \rangle$ ✓ ALT 2 $a = (14 - 0.28 \times 1.2 \times 9.8) / 1.2 = 8.92 \text{ «m s}^{-2}\text{»}$ ✓ $v = \sqrt{(2)(8.92)(0.35)} = 2.50 \text{ «m s}^{-1}\text{»}$ ✓ $d = \langle 2.5^2 / (2 \times 0.28 \times 9.8) \rangle = \langle 1.14 \text{ «m»} \rangle$ ✓	Allow ECF from MP1. Only award marks from one ALT.	3
1.	d	ALT 1 $\tau \text{ of } F = F \times 0.15$ OR $\tau \text{ of weight} = 1.2 \times 9.8 \times 0.03$ ✓ equals both to get $F = 2.4 \text{ «N»}$ ✓ ALT 2 $\tau \text{ of } F = F(.162)(\sin 68)$ OR $\tau \text{ of weight} = (1.2)(9.8)(.162/2)(\sin 22)$ ✓ equals both to get $F = 2.4 \text{ «N»}$ ✓		2

1.	d	ii	Because «static» friction has a «maximum» value greater than F ✓	<i>Must see a comparison between F and friction (e.g. frictional force is larger than F).</i>	1
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Question	Answers	Notes	Total
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Mark-scheme answers

Physics HL | Paper 1A | Nov 2025 TZ1 | Q3 | 1 marks

3. A

Physics HL | Paper 1A | Nov 2025 TZ1 | Q4 | 1 marks

4. A

Physics HL | Paper 1A | Nov 2025 TZ3 | Q3 | 1 marks

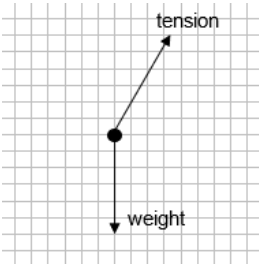
3. B

Physics HL | Paper 1A | Nov 2025 TZ3 | Q4 | 1 marks

4. C

Physics HL | Paper 1A | Nov 2025 TZ3 | Q5 | 1 marks

5. B

2.	a	i	 Labelled vertical weight / W / mg / F_g and tension / T / F_T in approximately correct direction ✓ With vertical T component equal to weight ✓	Ignore other forces drawn for MP1	[2]
2.	a	ii	$T \sin 30^\circ = ma$ OR $T \cos 30^\circ = mg$ ✓ $a = g \tan 30^\circ = 5.66 \approx 5.7 \text{ m s}^{-2}$ ✓	Accept reversed trig functions if 60° used. Award [2] for CNA	[2]
2.	b		The ball is in equilibrium / forces are balanced / net force is zero / no acceleration / the vertical weight must be balanced by a vertical tension ✓ The angle is zero ✓	For MP2, accept an answer of 10° if from the students' answer it can be understood that they interpreted the vertical as the perpendicular line to the ceiling of the truck, so that their answer of 10° implies that the string is vertically downwards.	[2]

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8825–6721M

Question		Answers	Notes	Total
2.	c	$\mu mg = m \frac{v^2}{R}$ ✓ $v = \sqrt{0.6 \times 9.8 \times 75}$ 21 ms ⁻¹ ✓	Award [2] for a CNA.	[2]
2.	d	ALTERNATIVE 1 KE $\frac{1}{2} \times 1400 \times 15^2$ OR $1.6 \times 10^5 \text{ J}$ ✓ Work done by drag force $520 \times \pi \times 75$ OR $1.2 \times 10^5 \text{ J}$ ✓ This is less than the KE so the truck will make it ✓ ALTERNATIVE 2 Truck decelerates at $\frac{520}{1400}$ OR 0.371 ms^{-2} ✓ Speed at gas station is $\sqrt{15^2 - 2 \times 0.371 \times \pi \times 75}$ OR 7.0 ms^{-1} OR truck stops after a distance $\ll \frac{15^2}{2 \times 0.371} = \gg 303 \text{ m}$ ✓ Speed is not zero OR $303 \text{ m} > 75 \pi$ OR $303 \text{ m} > 236 \text{ m}$ ✓	Allow MP3 for a consistent conclusion if any previous calculation is wrong.	[3]

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8825–6721M

Question	Answers	Notes	Total
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Mark-scheme answers

Physics HL | Paper 1A | Specimen 2025 | Q2 | 1 marks

2. C

Physics HL | Paper 1A | Specimen 2025 | Q5 | 1 marks

5. D

Physics HL | Paper 1A | Specimen 2025 | Q8 | 1 marks

8. D

1.	a		static friction force «between blocks» AND directed to the right✓		1
1.	b		$F = 60a$ ✓ $F_f = 0.6 \times 15 \times 9.8$ «= 88.2N» ✓ $88.2 = 15 \times \frac{F}{60} \Rightarrow F = 350$ «N» ✓	Allow use of $a = 0.6g$ leading to 353 N.	3

Question	Answers	Notes	Total
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