

YEAR 2 | MODULE 5 | PACK 04

Circular motion chapter test

Official past-paper mark scheme

2017-2023 | OCR A H556 | Mixed 5.2.1-5.2.2 with Year 1 mechanics

35 marks | 3 question entries

Suggested time: 50 minutes

Match each extract using its question number and stable CM identifier. Original OCR answers, examiner guidance, alternatives, diagrams and level descriptors are preserved.

The heading gives the maximum marks for the assigned subparts. Alternative methods and "any n from" lists offer routes to those marks; do not add every printed point together.

Click a source reference to open OCR's full official mark scheme. Keep this file closed while attempting the questions.

Reserved: all 2024 and 2025 papers are excluded. These files contain official examination questions only; no sample, specimen or practice papers.

Question index

CM identifiers are stable across the question packs and mark schemes; Q numbers refer to this pack. This core pack has no selected MCQs.

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Q01 | CM08

12 marks

June 2017 | H556/03 | Q6

Question			Answer	Marks	Guidance
6			arrow down through centre of ball labelled weight or W or mg or 1.2 N	B1	zero if any other arrows or forces present
	(b)	(i)	(horizontally) mv^2/r (or $mr\omega^2$) = $T \sin \theta$ and (vertically) W or mg = $T \cos \theta$ ($\tan \theta = v^2/rg$ or $r\omega^2/g$) $\tan \theta = 0.045 \times 4 \times 9.87 \times 2.2/9.81$ or $0.48/1.2$ (= 0.40) $\theta = 22^\circ$	M1 A1 A0	accept figures in place of algebra, $r = 0.045$ m $v = 0.42$ m s ⁻¹ $\omega = 3\pi$ rad s ⁻¹ ; $r\omega^2 = 4.0$ m s ⁻² ; $W = 1.2$ N and $m = 0.12$ kg and $mr\omega^2 = 0.48$ N accept labelled triangle of forces diagram N.B. this is a <i>show that Q</i> ; sufficient calculation must be present to indicate that the candidate has not worked back from the answer
		(ii)	$k = (mg/x_0 = 1.2 / 0.050) = 24$ (N m ⁻¹) ($T = mg / \cos \theta = kx$ giving) $x = 1.2 / 24 \cos 22$ $x = 0.054$ (m)	C1 C1 A1	or solution by ratios
	(c)		($y = \frac{1}{2}gt^2$ =) $0.18 = 0.5 \times 9.81 \times t^2$ giving $t = 0.19$ (s) ($x = vt$ =) $0.42 \times 0.19 = 0.08$ (m) distance = $\sqrt{(r^2 + x^2)} = \sqrt{(0.0020 + 0.0064)} = 0.092$ (m)	C1 C1 C1 A1	alt: projectile motion: $x = vt$, $y = \frac{1}{2}gt^2$ $y = \frac{1}{2}g(x/v)^2$ ecf (b)i for v ; $x^2 = 2yv^2/g = 2 \times 0.18 \times 0.42^2/9.81$
	(d)		T increases or string stretches or angle θ increases to provide/create a larger centripetal force	M1 A1	allow mv^2/r or $mr\omega^2$ in place of <i>centripetal force</i> causality must be implied to gain the A mark

Q02 | CM21

10 marks

November 2021 | H556/03 | Q6

Question			Answer	Marks	Guidance
6	(a)		At $t = 0$ (and $t = 15, 30$) the (magnitude of the) centripetal force equals $R - W$ (as only vertical forces act on the tourist)	B1	Allow at $t = 0$ (or the bottom of the circle) the centripetal force is provided by the resultant/ upwards/vertical force
	(b)	(i)	(For circular motion) there must (always) be a resultant force towards the centre The resultant force is not always vertical/sometimes has a horizontal component This can only be provided by friction/cannot be provided by R and W / R and W are always vertical/only F is horizontal	B1 x 2	any 2 from 3 marking points Allow F provides the horizontal (component of the) centripetal force
		(ii)	Sine wave with period 30 min and amplitude 0.050 (N) Correct phase, i.e. <u>negative</u> sine wave	B1 B1	Must start at the origin
		(iii)	$F = 0.050 \cos 40^\circ$ $F = 0.038$ (N)	C1 A1	Allow alternative methods e.g. triangle of forces Allow ECF from graph if used
	(c)		$m = 650/g$ or $m = 650/9.81$ (= 66.3 kg) ($F = mr\omega^2$ gives) $d = 0.050 / m\omega^2 = 0.050 / 66.3 \times (3.5 \times 10^{-3})^2$ $d = 62$ (m)	C1 C1 A1	Not $m = 650$ kg or $m = 65$ kg or ($F = mv^2/r$ and $v = 2\pi r/T$ gives) $d = 0.050 \times (30 \times 60)^2 / (4\pi^2 \times 66.3)$

Q03 | CM24

13 marks

June 2023 | H556/01 | Q17(a), (b)(i)-(ii)

Question			Answer	Mark	Guidance
17	(a)	(i)	Arrow along the line of the support rod labelled tension or T.	B1	Allow unlabelled single arrow along either rod Allow unlabelled arrows along both rods Allow arrow(s) up, down or both NOT any contradictory arrows
		(ii)	11.1 sin 35 or 11.1 cos 55 seen addition of 3.9 (half the diameter of the support disc) to candidate's horizontal component of rod length Total= 10.3m	M1 M1 A0	NOT use of tan 35 or tan 55 allow 7.8/2 for 3.9 10.27 to 2 dp NB use of 11.1 cos 35 or 11.1 sin 55 arriving at 12.99 scores 1 (wrong trig) NB reject use of radians (scores 0)
		(iii)	$mg = T \cos 35$ $T = mg \div \cos 35$ $= 140 \text{ N}$	C1 C1 A1	Allow use of sin 55 NOT use of tan 35 or tan 55 Answer is 143.7 N to 4 sf

Q03 | CM24 - continued

13 marks

June 2023 | H556/01 | Q17(a), (b)(i)-(ii)

Question			Answer	Mark	Guidance
		(iv)	$T \sin 35 = mr\omega^2$ $\omega = \sqrt{\frac{T \sin 35}{mr}}$ $= 0.8(17) \text{ radian s}^{-1}$	M1 A1 A0	Allow use of $W \tan 35$ or $W \tan 55$ Allow use of $\cos 55$ and/or mv^2/r Allow use of Pythagoras to find centripetal force (82.4...) NOT use of $T \tan 35$ or $T \tan 55$ Allow ω^2 subject. Allow any combination of rearrangement and substitution ECF allowed for T and r . Use of 2 s.f. values for T and r gives 0.84 m

13 marks

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