CHAPTER

03 Circular Motion

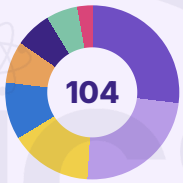
MHT CET · JEE Physics

PHYSICS CIRCLE

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EXAM WEIGHTAGE



MHT CET
2019–2026



JEE Main
2002–2026

	CET	JEE
Centripetal Acceleration & Force	28 (27%)	24 (31%)
Angular Variables	25 (24%)	10 (13%)
Non-Uniform Circular Motion	16 (15%)	5 (6%)
Vertical Circle: Speed & Tension	11 (11%)	5 (6%)
Conical Pendulum & Funnel	8 (8%)	8 (10%)
Level Road & Rotating Platform	3 (3%)	12 (16%)
Banking of Roads & Bridges	7 (7%)	6 (8%)
Critical Speed & Looping	6 (6%)	7 (9%)

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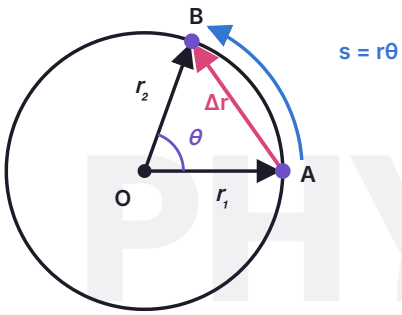
01 CONCEPT Angular Variables

IN ONE LINE

On a circle the radius stays fixed, so we follow the **angle turned**. v = rω links the angle to the speed.

3.1.1 Displacement and distance

- The position vector keeps its size r but turns as the body moves.
- Displacement is the chord AB. Distance is the arc AB.



Body moves from A to B through angle θ

$$\Delta r = 2r \sin \frac{\theta}{2}$$

$$s = r\theta$$

- Half a turn: displacement 2r, distance πr. Full turn: displacement 0, distance 2πr.
- Distance ÷ displacement = $\frac{\theta}{2}$ cosec $\frac{\theta}{2}$.
- A wheel rolling through θ also moves forward by rθ.

3.1.2 Angular displacement

- The angle turned from a reference line. Unit: radian. 2π rad = 360° = 1 revolution.
- Dimension: $[M^0L^0T^0]$.
- Its direction is along the axis, given by the right-hand rule.

3.1.3 Angular velocity, period and frequency

$$\omega = \frac{d\theta}{dt}$$

$$\omega = \frac{2\pi}{T} = 2\pi n$$

$$T = \frac{1}{n}$$

- Unit rad s^{-1}, dimension $[T^{-1}]$. ω points along the axis.
- Same period ⇒ same ω, whatever the mass or radius.
- Given θ(t): differentiate once for ω, twice for α.

3.1.4 Hands of a clock

Hand	Period	ω (rad s^{-1})
second	60 s	$\frac{\pi}{30}$
minute	3600 s	$\frac{\pi}{1800}$
hour	12 h = 43200 s	$\frac{\pi}{21600}$
earth (spin)	24 h	$\frac{\pi}{43200}$

$$\omega_{rel} = \omega_1 - \omega_2,\ T_{rel} = \frac{T_1 T_2}{T_2 - T_1}$$

- Minute and hour hands meet every $\frac{12}{11}$ h.
- Equal ω (geostationary satellite and earth): no relative motion.

3.1.5 Linear speed: v = rω

$$v = r\omega = 2\pi r n = \frac{2\pi r}{T}$$

- As vectors $v = \omega \times r$, so $v \perp r$ at every point.
- All points of a rotating body have the same ω, so $v \propto r$.
- At latitude λ on the earth: r = R cos λ, so v = V cos λ.

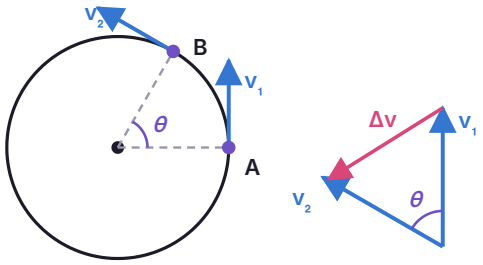
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3.1.6 Angular acceleration

$$\alpha = \frac{d\omega}{dt} = \frac{d^2\theta}{dt^2}$$

- Linear (tangential) acceleration $a = \alpha r$.
- Uniform circular motion: $\alpha = 0$.

3.1.7 Change in velocity



v_1 and v_2 have the same size; Δv joins their tips

$$\Delta v = 2v \sin\frac{\theta}{2}$$

$$\text{angle between } \Delta v \text{ and } v_2 = 90° - \frac{\theta}{2}$$

- Half a turn: $\Delta v = 2v$. Quarter turn: $\Delta v = v\sqrt{2}$. 60°: $\Delta v = v$.
- Average acceleration $= \frac{\Delta v}{t}$. Average velocity $= \frac{\Delta r}{t}$.
- As $\theta \to 0$, Δv turns towards the centre: this is the centripetal acceleration.

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Solved Examples 01 Angular Variables

SOLVED 1 MHT CET 2026 · 20 Apr · Shift 2

A particle completes 2 revolutions in a circular path of radius 3 cm. The angular displacement of the particle will be (in radian)

(a) π (b) 2π
(c) 3π (d) 4π

STEP 1 One revolution = 2π rad
STEP 2 2 revolutions = 2 × 2π
STEP 3 θ = **4π rad**

Answer: **(d)**

SOLVED 2 MHT CET 2026 · 19 Apr · Shift 2

A particle is performing U.C.M. along a circle of radius R. In half the period of revolution, its displacement and distance covered are respectively

(a) √2 R, 2πR (b) 2R, πR
(c) 2R, 2πR (d) R, πR

STEP 1 In half a period it reaches the other end of a diameter
STEP 2 Displacement = diameter = 2R
STEP 3 Distance = half the circumference = πR
⇒ **2R, πR**

Answer: **(b)**

SOLVED 3 MHT CET 2024 · 3 May · Shift 2

A wheel of radius 1 m rolls through 180° over a plane surface. The magnitude of the displacement of the point of the wheel initially in contact with the surface is

(a) 2π (b) π
(c) $\sqrt{\pi^2 + 4}$ (d) 3π

STEP 1 The wheel moves forward by half its circumference: πr = π m
STEP 2 The point goes from the bottom to the top: rise = 2r = 2 m
STEP 3 Displacement = $\sqrt{\pi^2 + 2^2}$ = $\sqrt{\pi^2 + 4}$ **m**

Answer: **(c)**

SOLVED 4 MHT CET 2024 · 4 May · Shift 2

A body moves along a circular path of radius 15 cm. It starts from a point on the circular path and reaches the end of diameter in 3 seconds. The angular speed of the body in rad/s is

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$
(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{5}$

STEP 1 From one end of a diameter to the other: θ = π rad
STEP 2 $\omega = \frac{\theta}{t} = \frac{\pi}{3}$
STEP 3 $\omega = \frac{\pi}{3}$ **rad/s**

Answer: **(b)**

SOLVED 5 MHT CET 2026 · 19 Apr · Shift 1

Two particles having mass M and m are moving in a circular path with radius R and r respectively. The time period for both the particles is same. The ratio of angular velocity of the first particle to that of the second particle will be

(a) 1 : 1 (b) 1 : 2
(c) 2 : 3 (d) 3 : 4

STEP 1 $\omega = \frac{2\pi}{T}$ depends only on the period
STEP 2 Mass and radius do not matter
STEP 3 Same T ⇒ $\omega_1 : \omega_2$ = **1 : 1**

Answer: **(a)**

SOLVED 6 MHT CET 2021 · 22 Sep · Shift 1

The angular displacement of a body performing circular motion is given by $\theta = 5\sin(\frac{\pi t}{6})$. The angular velocity of the body at t = 3 second will be

(a) 5 rad/s (b) 1 rad/s
(c) 2.5 rad/s (d) zero

STEP 1 $\omega = \frac{d\theta}{dt} = \frac{5\pi}{6}\cos(\frac{\pi t}{6})$
STEP 2 At t = 3 s: $\cos(\frac{\pi}{2}) = 0$
STEP 3 ω = **zero**

Answer: **(d)**

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Solved Examples 01 Angular Variables (contd.)

SOLVED 7 MHT CET 2026 · 12 May · Shift 1

Two particles A and B are moving in uniform circular motion in concentric circles of radii r_A and r_B with speeds v_A and v_B respectively. T_A and T_B are the time periods of rotation of the particles respectively and their relation is $T_A = 3T_B$. The ratio of angular speed of B to that of A will be

(a) $r_B : 3r_A$ (b) $3r_B : r_A$

(c) $1 : 3$ (d) $3 : 1$

STEP 1 $\omega = \frac{2\pi}{T}$, so $\omega \propto \frac{1}{T}$

STEP 2 $\frac{\omega_B}{\omega_A} = \frac{T_A}{T_B} = 3$

STEP 3 $\omega_B : \omega_A = \mathbf{3 : 1}$

Answer: **(d)**

SOLVED 8 MHT CET 2026 · 15 May · Shift 1

Angular velocity of hour hand of a watch is (in rad/s)

(a) $\frac{\pi}{43200}$ (b) $\frac{\pi}{30}$

(c) $\frac{\pi}{21600}$ (d) $\frac{\pi}{1800}$

STEP 1 Hour hand: T = 12 h = 43200 s

STEP 2 $\omega = \frac{2\pi}{43200}$

STEP 3 $\omega = \mathbf{\frac{\pi}{21600}}$ **rad/s**

Answer: **(c)**

SOLVED 9 MHT CET 2026 · 13 May · Shift 2

The difference between angular speed of minute hand and second hand of a clock is (in rad/s)

(a) $\frac{59\pi}{900}$ (b) $\frac{59\pi}{1800}$

(c) $\frac{59\pi}{2400}$ (d) $\frac{59\pi}{3600}$

STEP 1 Second hand: $\omega = \frac{2\pi}{60} = \frac{60\pi}{1800}$

STEP 2 Minute hand: $\omega = \frac{2\pi}{3600} = \frac{\pi}{1800}$

STEP 3 Difference = $\mathbf{\frac{59\pi}{1800}}$ **rad/s**

Answer: **(b)**

SOLVED 10 MHT CET 2026 · 13 Apr · Shift 1

The relative angular speed of hour hand and minute hand of clock is

(a) $\frac{2\pi}{60}$ (b) $\frac{11\pi}{360}$

(c) $\frac{11\pi}{21600}$ (d) $\frac{2\pi}{3600}$

STEP 1 Minute hand: $\omega = \frac{\pi}{1800} = \frac{12\pi}{21600}$

STEP 2 Hour hand: $\omega = \frac{\pi}{21600}$

STEP 3 $\omega_{rel} = \mathbf{\frac{11\pi}{21600}}$ **rad/s**

Answer: **(c)**

SOLVED 11 MHT CET 2026 · 15 Apr · Shift 1

A particle performing U.C.M. of radius $\frac{\pi}{2}$ m makes x revolutions in time t. Its tangential velocity is

(a) $\frac{\pi x}{t}$ (b) $\frac{\pi^2 x}{t}$

(c) $\frac{\pi}{xt}$ (d) $\frac{xt}{\pi}$

STEP 1 Frequency $n = \frac{x}{t}$

STEP 2 $v = 2\pi rn = 2\pi \times \frac{\pi}{2} \times \frac{x}{t}$

STEP 3 $v = \mathbf{\frac{\pi^2 x}{t}}$

Answer: **(b)**

SOLVED 12 MHT CET 2024 · 16 May · Shift 2

Two objects of masses m_1 and m_2 are moving in the circles of radii r_1 and r_2 respectively. Their respective angular speeds ω_1 and ω_2 are such that they both complete one revolution in the same time t. The ratio of linear speed of m_2 to that of m_1 is

(a) $\omega_1 : \omega_2$ (b) $T_2 : T_1$

(c) $m_1 : m_2$ (d) $r_2 : r_1$

STEP 1 Same time for one revolution ⇒ same ω

STEP 2 $v = r\omega$, so $v \propto r$

STEP 3 $v_2 : v_1 = \mathbf{r_2 : r_1}$

Answer: **(d)**

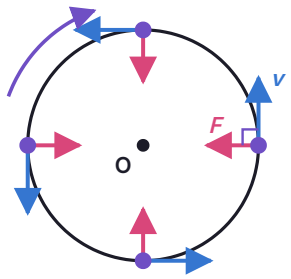
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02 CONCEPT Centripetal Acceleration & Force

IN ONE LINE

Motion on a circle needs a **force towards the centre**. It only turns the velocity, so it does no work.

3.2.1 Centripetal acceleration



v is along the tangent; F and a point to the centre

$$a = \frac{v^2}{r} = \omega^2 r = v\omega$$

$$a = 4\pi^2 n^2 r = \frac{4\pi^2 r}{T^2}$$

- It points along the radius, to the centre. Its direction keeps turning.
- Same ω: $a \propto r$. Same v: $a \propto \frac{1}{r}$.
- At P(R, θ): $a = -\frac{v^2}{R}(\cos\theta\,\hat{i} + \sin\theta\,\hat{j})$.

3.2.2 What stays constant in UCM

Quantity	In UCM
speed, KE, ω, size of a, angular momentum	constant
velocity, momentum, acceleration (as vectors)	change: their direction turns

- $v \perp r$, $a \perp v$, and a is opposite to r.

3.2.3 Centripetal force

$$F = \frac{mv^2}{r} = m\omega^2 r = \frac{4\pi^2 mr}{T^2}$$

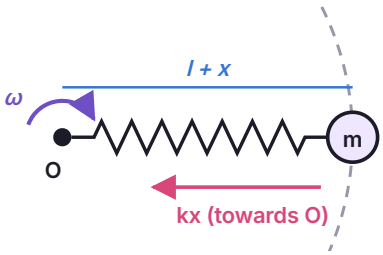
- It is not a new kind of force: tension, friction, gravity, a normal reaction or a magnetic force does this job.
- F ⊥ displacement, so the work done = 0 and KE stays constant.
- With angular momentum L = mvr: $KE = \frac{L^2}{2mr^2}$. Same L, r halved ⇒ v doubles.

Situation	Centripetal force
stone whirled on a string	tension
car turning on a level road	friction on the tyres
vehicle on a speed breaker	weight or its part
earth round the sun	gravity
electron round the nucleus	Coulomb attraction
charge in a magnetic field	magnetic force

3.2.4 Ratios and percentage change

- $F \propto \frac{mv^2}{r}$: change each factor and multiply.
- m, v, r all × 1.2: $F \times \frac{1.2 \times 1.44}{1.2} = 1.44$, a rise of 44%.
- Equal forces on two stones: $\frac{m_1 v_1^2}{r_1} = \frac{m_2 v_2^2}{r_2}$.

3.2.5 Spring or string gives the force



A spring stretched by x pulls the mass to the centre

$$kx = m\omega^2(l + x)$$

$$x = \frac{m\omega^2 l}{k - m\omega^2}$$

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CIRCULAR MOTION

LEVEL 1 · EASY

Topic-wise Previous Year Questions

MHT CET · JEE Main

84	26	8
questions	concepts	topics

CONTENTS

01	Angular Variables	Q 1–20	20 Qs
02	Centripetal Acceleration & Force	Q 21–42	22 Qs
03	Level Road & Rotating Platform	Q 43–48	6 Qs
04	Banking of Roads & Bridges	Q 49–57	9 Qs
05	Non-Uniform Circular Motion	Q 58–63	6 Qs
06	Vertical Circle: Speed & Tension	Q 64–69	6 Qs
07	Critical Speed & Looping	Q 70–74	5 Qs
08	Conical Pendulum & Funnel	Q 75–84	10 Qs
	Answer key		

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TOPIC 01

Angular Variables

20 PYQs · Easy 20 · Medium 0 · Difficult 0 | MHT CET 17 · JEE 3

Concepts covered: Angular displacement & distance (4) · Angular velocity, period & frequency (6) · Clock hands (5) · Linear speed: v = rω (4) · Change in velocity & average acceleration (1)

LEVEL 1 · EASY 20 questions

◆ Angular displacement & distance 4 Qs

1. A particle completes 2 revolutions in a circular path of radius 3 cm. The angular displacement of the particle will be (in radian)

MHT CET 2026 · 20 APR · SHIFT 2

(a) π (b) 2π (c) 3π (d) 4π

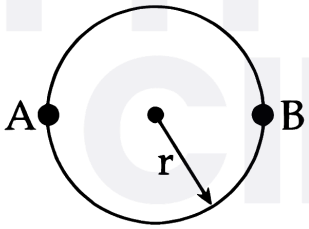
2. A particle is performing U.C.M. along a circle of radius R. In half the period of revolution, its displacement and distance covered are respectively

MHT CET 2026 · 19 APR · SHIFT 2

(a) $\sqrt{2}R, 2\pi R$ (b) $2R, \pi R$
(c) $2R, 2\pi R$ (d) $R, \pi R$

3. A sportsman runs around a circular track of radius r such that he traverses the path $ABAB$. The distance travelled and displacement, respectively, are

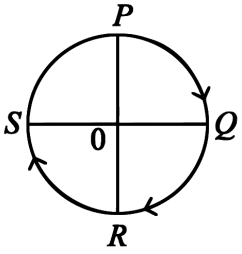
JEE MAIN 2025 · 2 APR · SHIFT 2



(a) $\pi r, 3r$ (b) $2\mathrm{r}, 3\pi\mathrm{r}$ (c) $3\pi\mathrm{r}, 2\mathrm{r}$ (d) $3\pi r, \pi r$

4. A cyclist starts from the point P of a circular ground of radius $2\ \mathrm{km}$ and travels along its circumference to the point S. The displacement of a cyclist is:

JEE MAIN 2024 · 4 APR · SHIFT 2



(a) $\sqrt{8}$ km (b) 4 km (c) 6 km (d) 8 km

◆ Angular velocity, period & frequency 6 Qs

5. A particle moves along a circular path of radius 'r' with uniform speed 'v'. The angle described by the particle in two seconds in radians is

MHT CET 2026 · 19 MAY · SHIFT 1

(a) vr^2 (b) v/r (c) $2v/r$ (d) $r/2v$

6. Two particles having mass 'M' and 'm' are moving in a circular path with radius 'R' and 'r' respectively. The time period for both the particles is same. The ratio of angular velocity of the first particle to that of the second particle will be

MHT CET 2026 · 19 APR · SHIFT 1

(a) 1 : 1 (b) 1 : 2 (c) 2 : 3 (d) 3 : 4

7. A body moves along a circular path of diameter 30 cm. It starts from one end of diameter, moves along the circular path and reaches the other end of diameter in 3 second. The angular speed of the body in radian per second is

MHT CET 2026 · 18 APR · SHIFT 1

(a) $\frac{\pi}{5}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

8. A body moves along a circular path of radius 15 cm. It starts from a point on the circular path and reaches the end of diameter in 3 seconds. The angular speed of the body in $\mathrm{rad/s}$ is

MHT CET 2024 · 4 MAY · SHIFT 2

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{5}$

9. Two particles having mass 'M' and 'm' are moving in a circular path with radius 'R' and 'r' respectively. The time period for both the particles is same. The ratio of angular velocity of the first particle to the second particle will be

MHT CET 2023 · 12 MAY · SHIFT 1

(a) 1: 1 (b) 1: 2 (c) 2: 3 (d) 3: 4

10. The angular displacement of body performing circular motion is given by $\theta = 5\sin\frac{\pi t}{6}$. The angular velocity of the body at $t = 3$ second will be $\left[\sin\frac{\pi}{2} = 1, \cos\frac{\pi}{2} = 0\right]$

MHT CET 2021 · 22 SEP · SHIFT 1

(a) $5\frac{\mathrm{rad}}{\mathrm{s}}$ (b) $1\frac{\mathrm{rad}}{\mathrm{s}}$ (c) $2.5\frac{\mathrm{rad}}{\mathrm{s}}$ (d) zero $\frac{\mathrm{rad}}{\mathrm{s}}$

◆ Clock hands 5 Qs

11. Angular velocity of hour hand of a watch is (in rad/s)

MHT CET 2026 · 15 MAY · SHIFT 1

(a) $\frac{\pi}{43200}$ (b) $\frac{\pi}{30}$ (c) $\frac{\pi}{21600}$ (d) $\frac{\pi}{1800}$

12. The difference between angular speed of minute hand and second hand of a clock is (in rad/s)

MHT CET 2026 · 13 MAY · SHIFT 2

(a) $\frac{59\pi}{900}$ (b) $\frac{59\pi}{1800}$ (c) $\frac{59\pi}{2400}$ (d) $\frac{59\pi}{3600}$

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13. The relative angular speed of hour hand and minute hand of clock is

MHT CET 2026 · 13 APR · SHIFT 1

(a) $\frac{2\pi}{60}$ (b) $\frac{11\pi}{360}$ (c) $\frac{11\pi}{21600}$ (d) $\frac{2\pi}{3600}$

14. The angular speed of the minute hand of a clock in degrees per second is

MHT CET 2026 · 11 APR · SHIFT 2

(a) 0.6 (b) 0.1 (c) 0.12 (d) 1

15. If ω_1 is angular velocity of hour hand of clock and ω_2 is angular velocity of the earth, then the ratio ω_1: ω_2 is

MHT CET 2021 · 22 SEP · SHIFT 1

(a) 1: 2 (b) 2: 3 (c) 3: 2 (d) 2: 1

◆ Linear speed: v = rω 4 Qs

16. A particle performing U.C.M. of radius $\frac{\pi}{2}$ m makes 'x' revolutions in time t. Its tangential velocity is

MHT CET 2026 · 15 APR · SHIFT 1

(a) $\frac{\pi x}{t}$ (b) $\frac{\pi^2 x}{t}$ (c) $\frac{\pi}{xt}$ (d) $\frac{xt}{\pi}$

17. A particle performing uniform circular motion of radius $\frac{\pi}{2}$ m makes x revolutions in time t. Its tangential velocity is

MHT CET 2025 · 19 APR · SHIFT 2

(a) $\frac{x}{\pi t}$ (b) $\frac{\pi^2}{xt}$ (c) $\frac{\pi^2 x}{t}$ (d) $\frac{\pi x}{t}$

18. Two objects of masses ' m_1 ' and ' m_2 ' are moving in the circles of radii ' r_1 ' and ' r_2 ' respectively. Their respective angular speeds ' ω_1 ' and ' ω_2 ' are such that they both complete one revolution in the same time ' t '. The ratio of linear speed of ' m_2 ' to that of ' m_1 ' is

MHT CET 2024 · 16 MAY · SHIFT 2

(a) $\omega_1 : \omega_2$ (b) $T_2 : T_1$ (c) $m_1 : m_2$ (d) $r_2 : r_1$

19. A particle performing uniform circular motion of radius $\frac{\pi}{2}$ m makes ' x ' revolutions in time ' t '. Its tangential velocity is

MHT CET 2023 · 10 MAY · SHIFT 2

(a) $\frac{\pi x}{t}$ (b) $\frac{\pi x^2}{t}$ (c) $\frac{\pi^2 x^2}{t}$ (d) $\frac{\pi^2 x}{t}$

◆ Change in velocity & average acceleration 1 Q

20. A particle is moving along a circular path with a constant speed of 10 ms^{-1}. What is the magnitude of the change in velocity of the particle, when it moves through an angle of 60° around the centre of the circle?

JEE MAIN 2019 · 11 JAN · SHIFT 1

(a) zero (b) 10 m/s
(c) $10\sqrt{2} m/s$ (d) $10\sqrt{3} m/s$

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TOPIC 02

Centripetal Acceleration & Force

22 PYQs · Easy 22 · Medium 0 · Difficult 0 | MHT CET 12 · JEE 10

Concepts covered: Centripetal acceleration (12) · What stays constant in UCM (6) · Centripetal force & ratios (3) · Spring or string provides the force (1)

LEVEL 1 · EASY 22 questions

◆ Centripetal acceleration 12 Qs

21. Two bodies of mass 10 kg and 5 kg are moving in concentric circular orbits of radii ' R ' and ' r ' respectively such that their periods are same. The ratio between their centripetal acceleration is

MHT CET 2025 · 23 APR · SHIFT 1

(a) R/r (b) r/R (c) R^2/r^2 (d) r^2/R^2

22. A body performing uniform circular motion of radius ' R ' has frequency ' n '. Its centripetal acceleration per unit radius is proportional to $(n)^x$. The value of x is

MHT CET 2024 · 16 MAY · SHIFT 2

(a) 1 (b) 2 (c) -1 (d) -2

23. A particle is performing uniform circular motion along the circumference of the circle of diameter 1 m with frequency 4 Hz. The acceleration of the particle in m/s^2 is

MHT CET 2024 · 2 MAY · SHIFT 1

(a) $8\pi^2$ (b) $16\pi^2$ (c) $24\pi^2$ (d) $32\pi^2$

24. A particle is moving along the circular path with constant speed and centripetal acceleration 'a'. If the speed is doubled, the ratio of its acceleration after and before the change is

MHT CET 2021 · 24 SEP · SHIFT 2

(a) 3 : 1 (b) 1 : 4 (c) 2 : 1 (d) 4 : 1

25. A particle is performing U.C.M. along the circumference of a circle of diameter 50 cm with frequency 2 Hz. The acceleration of the particle in m/s^2 is

MHT CET 2021 · 23 SEP · SHIFT 2

(a) $2\pi^2$ (b) $4\pi^2$ (c) $8\pi^2$ (d) π^2

26. A body performing uniform circular motion of radius 'R' has frequency 'n'. It centripetal acceleration is

MHT CET 2021 · 22 SEP · SHIFT 1

(a) $8\ \pi^2\ nR^2$ (b) $4\ \pi^2 n^2 R$ (c) $4\ \pi^2 n^2 R^2$ (d) $8\ \pi^2 n^2 R$

27. A particle is performing U.C.M. along the circumference of a circle of diameter 50 cm with frequency 2 Hz. The acceleration of the particle in m/s^2 is

MHT CET 2019 · 2 MAY · SHIFT 2

(a) $2\pi^2$ (b) $8\pi^2$ (c) π^2 (d) $4\pi^2$

28. A man carrying a monkey on his shoulder does cycling smoothly on a circular track of radius 9 m and completes 120 revolutions in 3 minutes. The magnitude of centripetal acceleration of monkey is (in m/s^2):

JEE MAIN 2024 · 5 APR · SHIFT 2

(a) $4\pi^2\ ms^{-2}$ (b) $16\pi^2\ ms^{-2}$
(c) $57600\pi^2\ ms^{-2}$ (d) Zero

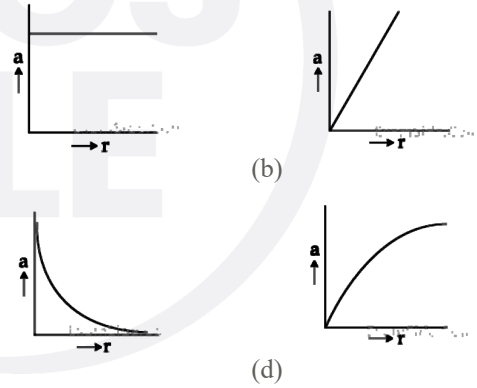
29. A clock has a continuously moving second's hand of 0.1 m length. The average acceleration of the tip of the hand (in units of ms^{-2}) is of the order of:

JEE MAIN 2020 · 6 SEP · SHIFT 1

(a) 10^{-3} (b) 10^{-1} (c) 10^{-2} (d) 10^{-4}

30. If a body moving in a circular path maintains constant speed of $10ms^{-1}$, then which of the following correctly describes relation between acceleration and radius?

JEE MAIN 2015 · 10 APR · SHIFT 1



(a) (b) (c) (d)

31. Two cars of masses m_1 and m_2 are moving in circles of radii r_1 and r_2, respectively. Their speeds are such that they make complete circles in the same time t. The ratio of their centripetal acceleration is

AIEEE 2012

(a) $m_1r_1 : m_2r_2$ (b) $m_1 : m_2$
(c) $r_1 : r_2$ (d) 1 : 1

32. A stone tied to 180 cm long string at its end is making 28 revolutions in horizontal circle in every minute. The magnitude of acceleration of stone is $\frac{1936}{x} ms^{-2}$. The value of x _____. (Take $\pi = \frac{22}{7}$)

JEE MAIN 2023 · 30 JAN · SHIFT 2 *(Numerical)*

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◆ What stays constant in UCM 6 Qs

33. For a particle moving in a circle with constant angular speed, which of the following statements is 'false'?
MHT CET 2025 · 20 APR · SHIFT 1
(a) The velocity vector is tangent to the circle.
(b) The acceleration vector is tangent to the circle.
(c) The velocity and acceleration vectors are perpendicular to each other.
(d) The acceleration vector points to the centre of the circle.

34. A particle is moving in a circle with uniform speed. It has constant
MHT CET 2024 · 15 MAY · SHIFT 2
(a) velocity. (b) acceleration.
(c) kinetic energy. (d) displacement.

35. For a particle in uniform circular motion
MHT CET 2024 · 10 MAY · SHIFT 1
(a) linear velocity always radial to the circular path, without change in its magnitude
(b) linear velocity always tangential to the circular path, without change in its magnitude
(c) linear acceleration always tangential to the circular path
(d) linear acceleration always along the axis of the circular path

36. A body moving in a circular path with a constant speed has constant
MHT CET 2022 · 11 AUG · SHIFT 2
(a) momentum (b) velocity
(c) acceleration (d) kinetic energy

37. A body of mass m is performing a UCM in a circle of radius r with speed v. The work done by the centripetal force in moving it through $\left(\frac{2}{3}\right)$rd of the circular path is
MHT CET 2019 · 3 MAY · SHIFT 1
(a) zero (b) $mv^2\pi r$ (c) $\frac{2\pi mv^2 r}{3}$ (d) $\frac{2mv^2\pi}{3}$

38. Which of the following statements is FALSE for a particle moving in a circle with a constant angular speed?
AIEEE 2004
(a) The velocity vector is tangent to the circle.
(b) The acceleration vector is tangent to the circle.
(c) The acceleration vector points to the centre of the circle.
(d) The velocity and acceleration vectors are perpendicular to each other.

◆ Centripetal force & ratios 3 Qs

39. If the radius of curvature of the path of two particles of same mass are in the ratio $3:4$, then in order to have constant centripetal force, their velocities will be in the ratio of:
JEE MAIN 2024 · 29 JAN · SHIFT 1
(a) $1:\sqrt{3}$ (b) $2:\sqrt{3}$ (c) $\sqrt{3}:2$ (d) $\sqrt{3}:1$

40. A vehicle of mass 200 kg is moving along a levelled curved road of radius 70 m with angular velocity of $0.2\ \text{rad/s}$. The centripetal force acting on the vehicle is:
JEE MAIN 2023 · 13 APR · SHIFT 2
(a) 560 N (b) 14 N (c) 2800 N (d) 2240 N

41. A child of mass 5 kg is going round a merry-go-round that makes 1 rotation in 3.14 s. The radius of the merry-go-round is 2 m. The centrifugal force on the child will be
JEE MAIN 2023 · 6 APR · SHIFT 2
(a) 50 N (b) 80 N (c) 100 N (d) 40 N

◆ Spring or string provides the force 1 Q

42. A block of 200 g mass moves with a uniform speed in a horizontal circular groove, with vertical side walls of radius 20 cm. If the block takes 40 s to complete one round, the normal force by the side walls of the groove is:
JEE MAIN 2021 · 16 MAR · SHIFT 1
(a) 9.859×10^{-2} N (b) 0.0314 N
(c) 9.859×10^{-4} N (d) 6.28×10^{-3} N

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TOPIC 03

Level Road & Rotating Platform

6 PYQs · Easy 6 · Medium 0 · Difficult 0 | MHT CET 1 · JEE 5

Concepts covered: Skidding on a level road (3) · Coin on a rotating disc (2) · Drum & wall of death (1)

LEVEL 1 · EASY 6 questions

◆ Skidding on a level road 3 Qs

43. On dry road, the maximum speed of a vehicle along a circular path is 'V'. When the road becomes wet, maximum speed becomes $\frac{V}{2}$. If coefficient of friction of dry road is 'μ' then that of wet road is

MHT CET 2023 · 14 MAY · SHIFT 1

(a) $\frac{2\mu}{3}$ (b) $\frac{\mu}{4}$ (c) $\frac{\mu}{3}$ (d) $\frac{3\mu}{4}$

44. A car is moving on a horizontal curved road with radius 50 m. The approximate maximum speed of car will be, if the coefficient of friction between tyres and road is 0.34. [take g = 10 ms $^{-2}$]

JEE MAIN 2023 · 29 JAN · SHIFT 1

(a) 3.4 ms^{-1} (b) 13 ms^{-1}
(c) 22.4 ms $^{-1}$ (d) 17 ms^{-1}

45. The maximum velocity (in ms^{-1}) with which a car driver must traverse a flat curve of radius 150 m and coefficient of friction 0.6 to avoid skidding is

AIEEE 2002

(a) 60 (b) 30 (c) 15 (d) 25

◆ Coin on a rotating disc 2 Qs

46. A coin is placed on a disc. The coefficient of friction between the coin and the disc is μ. If the distance of the coin from the center of the disc is r, the maximum angular velocity which can be given to the disc, so that the coin does not slip away, is:

JEE MAIN 2024 · 31 JAN · SHIFT 1

(a) $\sqrt{\frac{r}{\mu g}}$ (b) $\sqrt{\frac{\mu g}{r}}$ (c) $\frac{\mu g}{r}$ (d) $\frac{\mu}{\sqrt{rg}}$

47. A disc with a flat small bottom beaker placed on it at a distance R from its center is revolving about an axis passing through the center and perpendicular to its plane with an angular velocity ω. The coefficient of static friction between the bottom of the beaker and the surface of the disc is μ. The beaker will revolve with the disc if:

JEE MAIN 2022 · 25 JUN · SHIFT 2

(a) $R \leq \frac{\mu g}{2\omega^2}$ (b) $R \leq \frac{\mu g}{\omega^2}$ (c) $R \geq \frac{\mu g}{2\omega^2}$ (d) $R \geq \frac{\mu g}{\omega^2}$

◆ Drum & wall of death 1 Q

48. A 0.5 kg mass is in contact against the inner wall of a cylindrical drum of radius 4 m rotating about its vertical axis. The minimum rotational speed of the drum to enable the mass to remain stuck to the wall (without falling) is 5 rad/s. The coefficient of friction between the drum's inner wall surface and mass is _____. (Take $g = 10\,\mathrm{m/s^2}$)

JEE MAIN 2026 · 2 APR · SHIFT 2

(a) 0.1 (b) 0.5 (c) 0.7 (d) 0.3

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TOPIC 04

Banking of Roads & Bridges

9 PYQs · Easy 9 · Medium 0 · Difficult 0 | MHT CET 6 · JEE 3

Concepts covered: Bending of a cyclist & bob in a turning vehicle (3) · Banked road without friction (1) · Railway track (3) · Concave & convex bridges (2)

LEVEL 1 · EASY 9 questions

◆ Bending of a cyclist & bob in a turning vehicle 3 Qs

49. A vehicle is moving with a constant speed of $10\ \text{m/s}$ in a circular horizontal track of radius 20 m. A bob is suspended from the roof of a vehicle by a massless string. The angle made by the string with the vertical will be (acceleration due to gravity, $g = 10\ \text{m/s}^2$)

MHT CET 2025 · 22 APR · SHIFT 1

(a) $\tan^{-1}(0.5)$ (b) $\tan^{-1}(0.6)$
(c) $\tan^{-1}(0.7)$ (d) $\tan^{-1}(0.8)$

50. A car moving with a speed of $54\ \text{km/h}$ takes a turn of radius 20 m. A simple pendulum is suspended from the ceiling of the car. Determine the angle made by the string of the pendulum with the vertical during the turning. (Take $g = 10\ \text{m/s}^2$)

JEE MAIN 2026 · 8 APR · SHIFT 2

(a) $\tan^{-1}(0.5)$ (b) $\tan^{-1}(0.75)$
(c) $\tan^{-1}(1.125)$ (d) $\tan^{-1}(0.25)$

51. A car is moving with a constant speed of 20 m/s in a circular horizontal track of radius 40 m. A bob is suspended from the roof of the car by a massless string. The angle made by the string with the vertical will be: (Take $g = 10\ \text{m/s}^2$)

JEE MAIN 2023 · 25 JAN · SHIFT 1

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{3}$

◆ Banked road without friction 1 Q

52. Radius of curved road is 'R', width of road is 'b'. The outer edge of road is raised by 'h' with respect to inner edge so that a car with velocity 'V' can pass safe over it, then value of 'h' is (g = acceleration due to gravity)

MHT CET 2025 · 23 APR · SHIFT 1

(a) $\frac{V^2 b}{Rg}$ (b) $\frac{V}{Rgb}$ (c) $\frac{V^2 R}{g}$ (d) $\frac{V^2 b}{g}$

◆ Railway track 3 Qs

53. A railway track is banked for a speed ',v' by elevating outer rail by a height 'h' above the inner rail. The distance between two rails is 'd' then the radius of curvature of track is (g = gravitational acceleration)

MHT CET 2023 · 12 MAY · SHIFT 1

(a) $\frac{v^2 d}{gh}$ (b) $\frac{2v^2}{gdh}$ (c) $\frac{gd}{2v^2 h}$ (d) $\frac{v^2}{2ghd}$

54. The angle of banking 'θ' for a meter gauge railway line is given by $\theta = \tan^{-1}\left(\frac{1}{20}\right)$. What is the elevation of the outer rail above the inner rail?

MHT CET 2021 · 21 SEP · SHIFT 2

(a) 20 cm (b) 10 cm (c) 0.2 cm (d) 5 cm

55. A train is moving with a speed of $12\ \text{m/s}$ on rails which are $1.5\ \text{m}$ apart. To negotiate a curve of radius $400\ \text{m}$, the height by which the outer rail should be raised with respect to the inner rail is (Given, $g = 10\ \text{m/s}^2$):

JEE MAIN 2024 · 27 JAN · SHIFT 1

(a) 6.0 cm (b) 5.4 cm (c) 4.8 cm (d) 4.2 cm

◆ Concave & convex bridges 2 Qs

56. A car of mass m is crossing the convex bridge of radius of curvature R with speed V. At the highest point the thrust is (g = gravitational acceleration)

MHT CET 2026 · 15 APR · SHIFT 2

(a) mg (b) $\frac{mv^2}{R}$
(c) $mg - \frac{mv^2}{R}$ (d) $mg + \frac{mv^2}{R}$

57. A vehicle is moving with uniform speed along 3 different shaped roads as horizontal, concave and convex. The surface of road on which, the normal reaction on vehicle is maximum is

MHT CET 2025 · 22 APR · SHIFT 1

(a) convex
(b) concave
(c) horizontal
(d) same on all the 3 surface

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TOPIC 05

Non-Uniform Circular Motion

6 PYQs · Easy 6 · Medium 0 · Difficult 0 | MHT CET 5 · JEE 1

Concepts covered: Tangential, radial & net acceleration (4) · Equations of circular motion (2)

LEVEL 1 · EASY 6 questions

◆ Tangential, radial & net acceleration 4 Qs

58. A car is travelling at 40 m/s on a circular path of radius 40 m. It is increasing its speed at the rate of 2 m/s^2. Its net acceleration is (in m/s^2) nearly

MHT CET 2026 · 20 APR · SHIFT 2

(a) 4 m/s^2 (b) 8 m/s^2 (c) 16 m/s^2 (d) 40 m/s^2

59. In non uniform circular motion, the ratio of radial acceleration to tangential acceleration is (V is the velocity, r is the radius and α is the angular acceleration)

MHT CET 2026 · 11 APR · SHIFT 2

(a) $\frac{\alpha r}{V}$ (b) $\frac{V^2}{r^2\alpha}$ (c) $\frac{r^2\alpha}{V^2}$ (d) $\frac{r\alpha^2}{V^2}$

60. A body is moving along a circular track of radius 100 m with velocity 20 m/s. Its tangential acceleration is 3 m/s^2, then its resultant acceleration will be

MHT CET 2020 · 19 OCT · SHIFT 2

(a) 5 m/s^2 (b) 4 m/s^2 (c) 2 m/s^2 (d) 3 m/s^2

61. In non-uniform circular motion, the ratio of tangential to radial acceleration is (r = radius, α = angular acceleration and v = linear velocity)

MHT CET 2020 · 16 OCT · SHIFT 1

(a) $\frac{r\alpha}{v}$ (b) $\frac{v^2}{ra}$ (c) $\frac{r\alpha^2}{v^2}$ (d) $\frac{r^2\alpha}{v^2}$

◆ Equations of circular motion 2 Qs

62. A wheel initially at rest, begins to rotate about its axis with constant angular acceleration. If it rotates through an angle θ_1 in first 2 s and a further angle θ_2 in the next 2 s, the ratio $\theta_1 : \theta_2$ is

MHT CET 2025 · 20 APR · SHIFT 2

(a) 1 : 6 (b) 6 : 1 (c) 3 : 1 (d) 1 : 3

63. A particle is rotating in a circular path and at any instant its motion can be described as $\theta = \frac{5t^4}{40} - \frac{t^3}{3}$.

The angular acceleration of the particle after 10 seconds is _____ rad/s^2.

JEE MAIN 2026 · 2 APR · SHIFT 1

(a) 150 (b) 120 (c) 130 (d) 170

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TOPIC 06

Vertical Circle: Speed & Tension

6 PYQs · Easy 6 · Medium 0 · Difficult 0 | MHT CET 4 · JEE 2

Concepts covered: Tension at the lowest point (4) · Maximum & minimum tension (1) · Speed at any angle (1)

LEVEL 1 · EASY 6 questions

◆ Tension at the lowest point 4 Qs

64. A stone of mass m is tied to a string and is moved in a vertical circle of radius r making 'n' r.p.m. The total tension in the string when the stone is at the lowest point is (g = acceleration due to gravity)

MHT CET 2026 · 14 MAY · SHIFT 2

(a) mg (b) $m(g+\pi nr^2)$
(c) $m(g+nr)$ (d) $m\left[g+\frac{\pi^2n^2r}{900}\right]$

65. A stone of mass 40 g is tied to a light inextensible string of length 50 cm and whirled in a vertical circle at the rate of 30 revolutions per minute. The tension in the string when it is at the lowest point of the circle is (Take gravitational acceleration, $g = 10$ m/s^2 and $\pi^2 = 10$)

MHT CET 2026 · 19 APR · SHIFT 2

(a) 0.4 N (b) 0.5 N (c) 0.6 N (d) 0.7 N

66. A stone of mass ' m ' kg is tied to a string of length ' L ' m and moved in a vertical circle of radius 49 cm in a vertical plane. If it completes 30 revolutions per minute, the tension in the string when it is at the lowermost point is nearly [Take $\pi^2 = 10$ and acceleration due to gravity, g $= 10$ m/s^2]

MHT CET 2025 · 5 MAY · SHIFT 2

(a) (90 m)N (b) (60 m)N (c) $(45m)$N (d) $(15m)$N

67. A stone of mass 900 g is tied to a string and moved in a vertical circle of radius 1 m making 10 rpm. The tension in the string, when the stone is at the lowest point is (if $\pi^2 = 9.8$ and $g = 9.8$ m/s^2):

JEE MAIN 2024 · 29 JAN · SHIFT 2

(a) 17.8 N (b) 97 N (c) 9.8 N (d) 8.82 N

◆ Maximum & minimum tension 1 Q

68. A stone of mass m, tied to a string is being whirled in a vertical circle with a uniform speed. The tension in the string is

JEE MAIN 2022 · 24 JUN · SHIFT 2

(a) the same throughout the motion.
(b) minimum at the highest position of the circular path.
(c) minimum at the lowest position of the circular path.
(d) minimum when the rope is in the horizontal position.

◆ Speed at any angle 1 Q

69. A pendulum bob has a speed 4 m/s at its lowest position. The pendulum is 1 m long. When the length of the string makes an angle of 60° with the vertical, the speed of the bob at that position is (acceleration due to gravity, g $= 10$ m/s^2, $\cos 60° = 0.5$)

MHT CET 2025 · 21 APR · SHIFT 2

(a) 6 m/s (b) $\sqrt{3}$ m/s (c) $\sqrt{6}$ m/s (d) 3 m/s

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TOPIC 07

Critical Speed & Looping

5 PYQs · Easy 5 · Medium 0 · Difficult 0 | MHT CET 5 · JEE 0

Concepts covered: Just completing the circle (3) · Bucket of water (2)

LEVEL 1 · EASY 5 questions

◆ Just completing the circle 3 Qs

70. A body of mass 'm' attached at the end of a string is just completing the loop in a vertical circle. The apparent weight of the body at the lowest point in its path is
(g = gravitational acceleration)
MHT CET 2026 · 19 APR · SHIFT 2
(a) $6\,mg$ (b) $3\,mg$ (c) $1\,mg$ (d) zero

71. A body of mass 'm' attached at the end of a string is just completing the loop in a vertical circle. The apparent weight of the body at the lowest point in its path is (g = gravitational acceleration)
MHT CET 2023 · 12 MAY · SHIFT 2
(a) zero (b) mg (c) 3 mg (d) 6 mg

72. A body attached to one end of a string performs motion along a vertical circle. Its centripetal acceleration, when the string is horizontal, will be [g = acceleration due to gravity]
MHT CET 2021 · 24 SEP · SHIFT 1
(a) zero (b) 5g (c) 3g (d) g

◆ Bucket of water 2 Qs

73. A bucket containing water is revolved in vertical circle of radius r. To prevent the water from falling down, the period of revolution required is (g = gravitational acceleration)
MHT CET 2026 · 15 APR · SHIFT 2
(a) $2\pi\sqrt{\frac{g}{r}}$ (b) $2\pi\sqrt{\frac{r}{g}}$ (c) $2\pi\sqrt{rg}$ (d) $\frac{\sqrt{rg}}{2\pi}$

74. A bucket containing water is revolved in a vertical circle of radius r. To prevent the water from falling down, the minimum frequency of revolution required is
(g = acceleration due to gravity)
MHT CET 2022 · 11 AUG · SHIFT 2
(a) $2\pi\sqrt{\frac{r}{g}}$ (b) $\frac{1}{2\pi}\sqrt{\frac{r}{g}}$ (c) $\frac{1}{2\pi}\sqrt{\frac{g}{r}}$ (d) $2\pi\sqrt{\frac{g}{r}}$

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TOPIC 08

Conical Pendulum & Funnel

10 PYQs · Easy 10 · Medium 0 · Difficult 0 | MHT CET 7 · JEE 3

Concepts covered: Conical pendulum (5) · Stone whirled in a horizontal circle (2) · Particle in a funnel (3)

LEVEL 1 · EASY 10 questions

◆ Conical pendulum 5 Qs

75. A string of length 'L' fixed at one end carries a mass 'm' at the other end. The string makes $\frac{3}{\pi}$ r.p.s. around the vertical axis through fixed end. The tension in the string is

MHT CET 2026 · 13 APR · SHIFT 1

(a) $72mL$ (b) $36mL$ (c) $18mL$ (d) $9mL$

76. An inextensible string of length 'l' fixed at one end, carries a mass 'm' at the other end. If the string makes $\frac{1}{\pi}$ revolutions per second around the vertical axis through the fixed end, the tension in the string is [The string makes an angle θ with the vertical]

MHT CET 2025 · 23 APR · SHIFT 2

(a) 16 ml (b) 8 ml (c) 4 ml (d) 2 ml

77. In a conical pendulum the bob of mass 'm' moves in a horizontal circle of radius 'r' with uniform speed 'V'. The string of length 'L' describes a cone of semi vertical angle 'θ'. The centripetal force acting on the bob is (g = acceleration due to gravity)

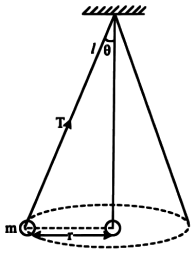
MHT CET 2023 · 11 MAY · SHIFT 2

(a) $\frac{mgr}{\sqrt{L^2-r^2}}$ (b) $\frac{mgr}{(L^2-r^2)}$ (c) $\frac{\sqrt{L^2-r^2}}{mgL}$ (d) $\frac{mgL}{\sqrt{L^2-r^2}}$

78. A ball of mass 'm' is attached to the free end of a string of length 'l'. The ball is moving in horizontal circular path about the vertical axis as shown in the diagram.

The angular velocity 'ω' of the ball will be [T = Tension in the string.]

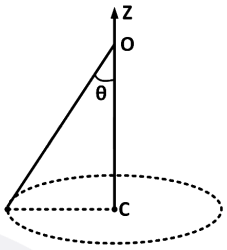
MHT CET 2023 · 11 MAY · SHIFT 1



(a) $\sqrt{\frac{Tl}{m}}$ (b) $\sqrt{\frac{Tm}{l}}$ (c) $\sqrt{\frac{ml}{T}}$ (d) $\sqrt{\frac{T}{ml}}$

79. A conical pendulum of length 1 m makes an angle $\theta = 45^\circ$ w.r.t. Z-axis and moves in a circle in the XY plane. The radius of the circle is 0.4 m and its center is vertically below O. The speed of the pendulum, in its circular path, will be: (Take g = 10 ms^{-2})

JEE MAIN 2017 · 9 APR · SHIFT 1



(a) 0.4 m/s (b) 4 m/s (c) 0.2 m/s (d) 2 m/s

◆ Stone whirled in a horizontal circle 2 Qs

80. A ball of mass 0.5 kg is attached to a string of length 50 cm. The ball is rotated on a horizontal circular path about its vertical axis. The maximum tension that the string can bear is 400 N. The maximum possible value of angular velocity of the ball in rad/s is:

JEE MAIN 2024 · 1 FEB · SHIFT 1

(a) 1600 (b) 20 (c) 40 (d) 1000

81. A stone of mass 1 kg is tied to end of a massless string of length 1 m. If the breaking tension of the string is 400 N, then maximum linear velocity, the stone can have without breaking the string, while rotating in horizontal plane, is:

JEE MAIN 2023 · 31 JAN · SHIFT 2

(a) 20 ms^{-1} (b) 40 ms^{-1}
(c) 400 ms^{-1} (d) 10 ms^{-1}

◆ Particle in a funnel 3 Qs

82. A particle describes a horizontal circle of radius 'r' in conical funnel with smooth inner surface with a speed of 0.5 m/s. The height of the plane of the circle from the vertex of the funnel is (acceleration due to gravity, $g = 10\ m/s^2$)

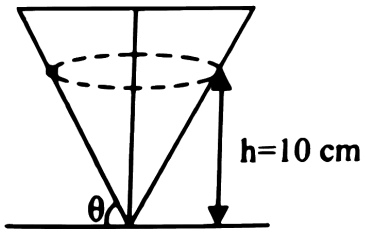
MHT CET 2026 · 16 APR · SHIFT 1

(a) 1.5 cm (b) 2.5 cm (c) 3.5 cm (d) 0.5 cm

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83. A particle describes a horizontal circle on smooth inner surface of a cone as shown in figure. If the height of the circle above the vertex is 10 cm. The speed of the particle is (g, acceleration due to gravity $= 10\ \mathrm{m/s^2}$)

MHT CET 2025 · 23 APR · SHIFT 2



(a) $2\ \mathrm{m/s}$ (b) $1.5\ \mathrm{m/s}$ (c) $1\ \mathrm{m/s}$ (d) $0.5\ \mathrm{m/s}$

84. A particle rotates in a horizontal circle of radius 'R' in a conical funnel with constant speed 'V'. The inner surface of the funnel is smooth. The height of the plane of the circle from the vertex of the funnel is (g-acceleration due to gravity)

MHT CET 2024 · 10 MAY · SHIFT 2

(a) $\frac{V}{g}$ (b) $\frac{V}{2g}$ (c) $\frac{V^2}{2g}$ (d) $\frac{V^2}{g}$

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ANSWER KEY

Shaded by level: **Easy**

01 Angular Variables

1. (d)	2. (b)	3. (c)	4. (a)	5. (c)	6. (a)	7. (c)	8. (b)	9. (a)	10. (d)
11. (c)	12. (b)	13. (c)	14. (b)	15. (d)	16. (b)	17. (c)	18. (d)	19. (d)	20. (b)

02 Centripetal Acceleration & Force

21. (a)	22. (b)	23. (d)	24. (d)	25. (b)	26. (b)	27. (d)	28. (b)	29. (a)	30. (c)
31. (c)	32. 125	33. (b)	34. (c)	35. (b)	36. (d)	37. (a)	38. (b)	39. (c)	40. (a)
41. (d)	42. (c)								

03 Level Road & Rotating Platform

43. (b)	44. (b)	45. (b)	46. (b)	47. (b)	48. (a)				

04 Banking of Roads & Bridges

49. (a)	50. (c)	51. (c)	52. (a)	53. (a)	54. (d)	55. (b)	56. (c)	57. (b)	

05 Non-Uniform Circular Motion

58. (d)	59. (b)	60. (a)	61. (d)	62. (d)	63. (c)				

06 Vertical Circle: Speed & Tension

64. (d)	65. (c)	66. (d)	67. (c)	68. (b)	69. (c)				

07 Critical Speed & Looping

70. (a)	71. (d)	72. (c)	73. (b)	74. (c)					

08 Conical Pendulum & Funnel

75. (b)	76. (c)	77. (a)	78. (d)	79. (d)	80. (c)	81. (a)	82. (b)	83. (c)	84. (d)

Note: *"Bonus" = no option is correct as the question is printed (dropped in the official key). Numerical questions show the numerical answer.*

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