

PHYSICS · JEE MAIN

Circular Motion

Chapter-wise previous year questions, with answer key

35

PYQS

2020–2025

PAPERS

4

TOPICS

Centripetal Acceleration and Force

Vertical Circular Motion

Banking of Roads

Centrifugal Force

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

Stuck on a question?

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Centripetal Acceleration and Force · 27 PYQs

Q1 JEE Main 2025 · 4 Apr · Shift 1

If $\vec{L}$ and $\vec{P}$ represent the angular momentum and linear momentum respectively of a particle of mass ' m ' having position vector as $\vec{r} = a(\hat{i} \cos \omega t + \hat{j} \sin \omega t)$. The direction of force is

- (A) Opposite to the direction of $\vec{L}$
- (B) Opposite to the direction of $\vec{L} \times \vec{P}$
- (C) Opposite to the direction of $\vec{r}$
- (D) Opposite to the direction of $\vec{P}$

Step-by-step solution ► [prepwisser.in/questions/KjmkivW5Rf](https://www.prepwisser.in/questions/KjmkivW5Rf)

Q2 JEE Main 2024 · 8 Apr · Shift 1

A clock has 75cm, 60cm long second hand and minute hand respectively. In 30 minutes duration the tip of second hand will travel x distance more than the tip of minute hand. The value of x in meter is nearly (Take $\pi = 3.14$) :

- (A) 118.9
- (B) 140.5
- (C) 139.4
- (D) 220.0

Step-by-step solution ► [prepwisser.in/questions/5vOND3awu8](https://www.prepwisser.in/questions/5vOND3awu8)

Q3 JEE Main 2024 · 5 Apr · Shift 2

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

- (A) $4\pi^2 \text{ms}^{-2}$
- (B) $16\pi^2 \text{ms}^{-2}$
- (C) $57600\pi^2 \text{ms}^{-2}$
- (D) Zero

Step-by-step solution ► [prepwisser.in/questions/FFsyluhqid](https://www.prepwisser.in/questions/FFsyluhqid)

Q4 JEE Main 2024 · 1 Feb · Shift 1

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

- (A) 1600
- (B) 20
- (C) 40
- (D) 1000

Step-by-step solution ► [prepwisser.in/questions/F4836-QOyG](https://www.prepwisser.in/questions/F4836-QOyG)

Q5 JEE Main 2024 · 31 Jan · Shift 1

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 :

- (A) $\sqrt{\frac{r}{\mu g}}$
- (B) $\sqrt{\frac{\mu g}{r}}$
- (C) $\frac{\mu g}{r}$
- (D) $\frac{\mu}{\sqrt{r g}}$

Step-by-step solution ► [prepwisser.in/questions/uYs3aYiSoy](https://www.prepwisser.in/questions/uYs3aYiSoy)

Q6 JEE Main 2024 · 29 Jan · Shift 1

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 :

(A) $1 : \sqrt{3}$

(B) $2 : \sqrt{3}$

(C) $\sqrt{3} : 2$

(D) $\sqrt{3} : 1$

Step-by-step solution ► [prepwiser.in/questions/6LiaRONoXC](https://www.prepwiser.in/questions/6LiaRONoXC)

Q7 JEE Main 2024 · 29 Jan · Shift 2

A particle is moving in a circle of radius 50cm in such a way that at any instant the normal and tangential components of its acceleration are equal. If its speed at $t = 0$ is 4m/s, the time taken to complete the first revolution will be $\frac{1}{\alpha} [1 - e^{-2\pi}]$ s, where $\alpha = \underline{\hspace{2cm}}$.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/-iqbKFdWLP](https://www.prepwiser.in/questions/-iqbKFdWLP)

Q8 JEE Main 2023 · 13 Apr · Shift 2

A vehicle of mass 200kg is moving along a levelled curved road of radius 70m with angular velocity of 0.2rad/s. The centripetal force acting on the vehicle is:

(A) 560N

(B) 14N

(C) 2800N

(D) 2240N

Step-by-step solution ► [prepwiser.in/questions/q1vx4VWvEh](https://www.prepwiser.in/questions/q1vx4VWvEh)

Q9 JEE Main 2023 · 11 Apr · Shift 1

A coin placed on a rotating table just slips when it is placed at a distance of 1cm from the center. If the angular velocity of the table is halved, it will just slip when placed at a distance of _____ from the centre :

(A) 1 cm

(B) 8 cm

(C) 4 cm

(D) 2 cm

Step-by-step solution ► [prepwiser.in/questions/69MWxv5cHS](https://www.prepwiser.in/questions/69MWxv5cHS)

Q10 JEE Main 2023 · 6 Apr · Shift 1

A small block of mass 100g is tied to a spring of spring constant 7.5N/m and length 20cm. The other end of spring is fixed at a particular point A. If the block moves in a circular path on a smooth horizontal surface with constant angular velocity 5rad/s about point A, then tension in the spring is -

(A) 0.50 N

(B) 1.5 N

(C) 0.75 N

(D) 0.25 N

Step-by-step solution ► [prepwiser.in/questions/f4xutS2FEB](https://www.prepwiser.in/questions/f4xutS2FEB)

Q11 JEE Main 2023 · 30 Jan · Shift 2

A stone tied to 180cm 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 $\pi = \frac{22}{7}$)

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/iRhYl2X1Wl](https://www.prepwiser.in/questions/iRhYl2X1Wl)

Q12 JEE Main 2023 · 29 Jan · Shift 2

A car is moving on a circular path of radius 600 m such that the magnitudes of the tangential acceleration and centripetal acceleration are equal. The time taken by the car to complete first quarter of revolution, if it is moving with an initial speed of 54 km/hr is $t(1 - e^{-\pi/2})$ s. The value of t is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/G7zGseB0XC](https://www.prepwiser.in/questions/G7zGseB0XC)

Q13 JEE Main 2023 · 29 Jan · Shift 1

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

(A) 3.4 ms^{-1}

(B) 13 ms^{-1}

(C) 22.4 ms^{-1}

(D) 17 ms^{-1}

[Step-by-step solution ► prepwiser.in/questions/M3gakpCdnZ](https://www.prepwiser.in/questions/M3gakpCdnZ)

Q14 JEE Main 2023 · 25 Jan · Shift 1

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 $g = 10 \text{ m/s}^2$)

(A) $\frac{\pi}{2}$

(B) $\frac{\pi}{6}$

(C) $\frac{\pi}{4}$

(D) $\frac{\pi}{3}$

[Step-by-step solution ► prepwiser.in/questions/11mj77I-xz](https://www.prepwiser.in/questions/11mj77I-xz)

Q15 JEE Main 2023 · 24 Jan · Shift 2

A body of mass 200g is tied to a spring of spring constant 12.5 N/m, while the other end of spring is fixed at point O. If the body moves about O in a circular path on a smooth horizontal surface with constant angular speed 5 rad/s. Then the ratio of extension in the spring to its natural length will be :

(A) 1 : 2

(B) 2 : 3

(C) 2 : 5

(D) 1 : 1

[Step-by-step solution ► prepwiser.in/questions/Z5zxK9wScm](https://www.prepwiser.in/questions/Z5zxK9wScm)

Q16 JEE Main 2022 · 29 Jul · Shift 2

A metal wire of length 0.5m and cross-sectional area 10^{-4} m^2 has breaking stress $5 \times 10^8 \text{ Nm}^{-2}$. A block of 10kg is attached at one end of the string and is rotating in a horizontal circle. The maximum linear velocity of block will be _____ ms^{-1} .

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/ijZ8mzQ38g](https://www.prepwiser.in/questions/ijZ8mzQ38g)

Q17 JEE Main 2022 · 27 Jun · Shift 2

One end of a massless spring of spring constant k and natural length l_0 is fixed while the other end is connected to a small object of mass m lying on a frictionless table. The spring remains horizontal on the table. If the object is made to rotate at an angular velocity ω about an axis passing through fixed end, then the elongation of the spring will be :

- (A) $\frac{k-m\omega^2 l_0}{m\omega^2}$
(B) $\frac{m\omega^2 l_0}{k+m\omega^2}$
(C) $\frac{m\omega^2 l_0}{k-m\omega^2}$
(D) $\frac{k+m\omega^2 l_0}{m\omega^2}$

[Step-by-step solution ► prepwisser.in/questions/0Euzg5873z](https://www.prepwisser.in/questions/0Euzg5873z)

Q18 JEE Main 2022 · 25 Jun · Shift 2

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 :

- (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) $R \geq \frac{\mu g}{\omega^2}$

[Step-by-step solution ► prepwisser.in/questions/OqBD-Jaohb](https://www.prepwisser.in/questions/OqBD-Jaohb)

Q19 JEE Main 2022 · 24 Jun · Shift 1

A boy ties a stone of mass 100 g to the end of a 2 m long string and whirls it around in a horizontal plane. The string can withstand the maximum tension of 80 N. If the maximum speed with which the stone can revolve is $\frac{K}{\pi}$ rev./min. The value of K is :

(Assume the string is massless and unstretchable)

- (A) 400 (B) 300
(C) 600 (D) 800

[Step-by-step solution ► prepwisser.in/questions/KWNcXx3TVu](https://www.prepwisser.in/questions/KWNcXx3TVu)

Q20 JEE Main 2021 · 18 Mar · Shift 2

If the angular velocity of earth's spin is increased such that the bodies at the equator start floating, the duration of the day would be approximately : [Take $g = 10 \text{ ms}^{-2}$, the radius of earth, $R = 6400 \times 10^3 \text{ m}$, Take $\pi = 3.14$]

- (A) 84 minutes (B) 1200 minutes
(C) 60 minutes (D) does not change

[Step-by-step solution ► prepwisser.in/questions/28dzKmTyIk](https://www.prepwisser.in/questions/28dzKmTyIk)

Q21 JEE Main 2021 · 16 Mar · Shift 1

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 :

- (A) 9.859×10^{-2} N
- (B) 0.0314 N
- (C) 9.859×10^{-4} N
- (D) 6.28×10^{-3} N

[Step-by-step solution ► prepwisser.in/questions/xwUpn0qUY](https://www.prepwisser.in/questions/xwUpn0qUY)

Q22 JEE Main 2021 · 26 Feb · Shift 1

A particle is moving with uniform speed along the circumference of a circle of radius R under the action of a central fictitious force F which is inversely proportional to R^3 . Its time period of revolution will be given by :

- (A) $T \propto R^{\frac{4}{3}}$
- (B) $T \propto R^{\frac{5}{2}}$
- (C) $T \propto R^{\frac{3}{2}}$
- (D) $T \propto R^2$

[Step-by-step solution ► prepwisser.in/questions/MBpD-WYZUy](https://www.prepwisser.in/questions/MBpD-WYZUy)

Q23 JEE Main 2021

A particle moves along a circle of radius 10 m with constant speed. It completes one revolution in 4 s. What is the magnitude of centripetal acceleration in m/s^2 ? (Take $\pi^2 = 10$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/JgRc5HMkgn](https://www.prepwisser.in/questions/JgRc5HMkgn)

Q24 JEE Main 2020 · 6 Sep · Shift 1

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 :

- (A) 10^{-3}
- (B) 10^{-1}
- (C) 10^{-2}
- (D) 10^{-4}

[Step-by-step solution ► prepwisser.in/questions/ZDd4ap34jB](https://www.prepwisser.in/questions/ZDd4ap34jB)

Q25 JEE Main 2020 · 9 Jan · Shift 1

A body of mass $m = 10$ kg is attached to one end of a wire of length 0.3 m. The maximum angular speed (in rad s^{-1}) with which it can be rotated about its other end in space station is :

(Breaking stress of wire = $4.8 \times 10^7 \text{ Nm}^{-2}$ and area of cross-section of the wire = 10^{-2} cm^2) is:

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/08PpU8XDxP](https://www.prepwisser.in/questions/08PpU8XDxP)

Q26 JEE Main 2020 · 9 Jan · Shift 2

A spring mass system (mass m , spring constant k and natural length l) rest in equilibrium on a horizontal disc. The free end of the spring is fixed at the centre of the disc. If the disc together with spring mass system, rotates about it's axis with an angular velocity ω , ($k \gg m\omega^2$) the relative change in the length of the spring is best given by the option :

- (A) $\frac{m\omega^2}{3k}$
- (B) $\frac{m\omega^2}{k}$
- (C) $\frac{2m\omega^2}{k}$
- (D) $\sqrt{\frac{2}{3}} \left(\frac{m\omega^2}{k} \right)$

[Step-by-step solution ► prepwisser.in/questions/Qv8_81WWHD](https://www.prepwisser.in/questions/Qv8_81WWHD)

Q27 JEE Main 2020 · 8 Jan · Shift 2

A particle moves such that its position vector

$$\vec{r}(t) = \cos \omega t \hat{i} + \sin \omega t \hat{j}$$

where ω is a constant and t is time. Then which of the following statements is true for the velocity $\vec{v}(t)$ and acceleration $\vec{a}(t)$ of the particle :

- (A) $\vec{v}$ and $\vec{a}$ both are perpendicular to $\vec{r}$
- (B) $\vec{v}$ and $\vec{a}$ both are parallel to $\vec{r}$
- (C) $\vec{v}$ is perpendicular to $\vec{r}$ and $\vec{a}$ is directed towards the origin
- (D) $\vec{v}$ is perpendicular to $\vec{r}$ and $\vec{a}$ is directed away from the origin

[Step-by-step solution ► prepwisser.in/questions/z4edL69Ltx](https://www.prepwisser.in/questions/z4edL69Ltx)

Vertical Circular Motion · 3 PYQs

Q28 JEE Main 2025 · 29 Jan · Shift 1

A body of mass 'm' connected to a massless and unstretchable string goes in vertical circle of radius 'R' under gravity g . The other end of the string is fixed at the center of circle. If velocity at top of circular path is $n\sqrt{gR}$, where, $n \geq 1$, then ratio of kinetic energy of the body at bottom to that at top of the circle is :

- (A) $\frac{n^2+4}{n^2}$
- (B) $\frac{n+4}{n}$
- (C) $\frac{n^2}{n^2+4}$
- (D) $\frac{n}{n+4}$

[Step-by-step solution ► prepwisser.in/questions/gDm1NH0HeG](https://www.prepwisser.in/questions/gDm1NH0HeG)

Q29 JEE Main 2023 · 6 Apr · Shift 1

A particle is moving with constant speed in a circular path. When the particle turns by an angle 90° , the ratio of instantaneous velocity to its average velocity is $\pi : x\sqrt{2}$. The value of x will be -

- (A) 1
- (B) 7
- (C) 5
- (D) 2

[Step-by-step solution ► prepwisser.in/questions/F8aQ6_YK_I](https://www.prepwisser.in/questions/F8aQ6_YK_I)

Q30 JEE Main 2021 · 25 Feb · Shift 1

A small bob tied at one end of a thin string of length 1 m is describing a vertical circle so that the maximum and minimum tension in the string are in the ratio 5 : 1. The velocity of the bob at the highest position is _____ m/s. (Take $g = 10 \text{ m/s}^2$)

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwiser.in/questions/KdOJmq5Y8) ► [prepwiser.in/questions/KdOJmq5Y8](https://www.prepwiser.in/questions/KdOJmq5Y8)

Banking of Roads · 4 PYQs

Q31 JEE Main 2025 · 24 Jan · Shift 1

A car of mass ' m ' moves on a banked road having radius ' r ' and banking angle θ . To avoid slipping from banked road, the maximum permissible speed of the car is v_0 . The coefficient of friction μ between the wheels of the car and the banked road is

(A) $\mu = \frac{v_0^2 + rg \tan \theta}{rg + v_0^2 \tan \theta}$

(B) $\mu = \frac{v_0^2 - rg \tan \theta}{rg - v_0^2 \tan \theta}$

(C) $\mu = \frac{v_0^2 - rg \tan \theta}{rg + v_0^2 \tan \theta}$

(D) $\mu = \frac{v_0^2 + rg \tan \theta}{rg - v_0^2 \tan \theta}$

[Step-by-step solution](https://www.prepwiser.in/questions/Alm7cQEZGd) ► [prepwiser.in/questions/Alm7cQEZGd](https://www.prepwiser.in/questions/Alm7cQEZGd)

Q32 JEE Main 2024 · 6 Apr · Shift 2

A car of 800kg is taking turn on a banked road of radius 300m and angle of banking 30° . If coefficient of static friction is 0.2 then the maximum speed with which car can negotiate the turn safely: ($g = 10 \text{ m/s}^2$, $\sqrt{3} = 1.73$)

(A) 51.4 m/s

(B) 102.8 m/s

(C) 70.4 m/s

(D) 264 m/s

[Step-by-step solution](https://www.prepwiser.in/questions/qQVqdW0wCD) ► [prepwiser.in/questions/qQVqdW0wCD](https://www.prepwiser.in/questions/qQVqdW0wCD)

Q33 JEE Main 2022 · 25 Jun · Shift 2

A curved in a level road has a radius 75 m. The maximum speed of a car turning this curved road can be 30 m/s without skidding. If radius of curved road is changed to 48 m and the coefficient of friction between the tyres and the road remains same, then maximum allowed speed would be _____ m/s.

Numerical answer — enter the value.

[Step-by-step solution](https://www.prepwiser.in/questions/0tUyI-URcM) ► [prepwiser.in/questions/0tUyI-URcM](https://www.prepwiser.in/questions/0tUyI-URcM)

Q34 JEE Main 2021 · 16 Mar · Shift 2

Statement I : A cyclist is moving on an unbanked road with a speed of 7 kmh^{-1} and takes a sharp circular turn along a path of radius of 2m without reducing the speed. The static friction coefficient is 0.2. The cyclist will not slip and pass the curve. ($g = 9.8 \text{ m/s}^2$)

Statement II : If the road is banked at an angle of 45° , cyclist can cross the curve of 2m radius with the speed of 18.5 kmh^{-1} without slipping.

In the light of the above statements, choose the correct answer from the options given below.

- (A) Statement I is incorrect and statement II is correct
- (B) Both statement I and statement II are true
- (C) Statement I is correct and statement II is incorrect
- (D) Both statement I and statement II are false

[Step-by-step solution ► prepwisser.in/questions/6hRFWEo-b3](https://www.prepwisser.in/questions/6hRFWEo-b3)

Centrifugal Force · 1 PYQs

Q35 JEE Main 2023 · 6 Apr · Shift 2

A child of mass 5kg is going round a merry-go-round that makes 1 rotation in 3.14s. The radius of the merry-go-round is 2m. The centrifugal force on the child will be

- | | |
|-----------|----------|
| (A) 50 N | (B) 80 N |
| (C) 100 N | (D) 40 N |

[Step-by-step solution ► prepwisser.in/questions/_6OB2mHEI5](https://www.prepwisser.in/questions/_6OB2mHEI5)

Answer key — Circular Motion

Numbers match the question numbers above. For full working, open the solution link under each question.

1	C	2	C	3	B	4	C	5	B	6	C	7	8	8	A
9	C	10	C	11	125	12	40	13	B	14	C	15	B	16	50
17	C	18	B	19	C	20	A	21	C	22	D	23	25	24	A
25	4	26	B	27	C	28	A	29	D	30	5	31	C	32	A
33	24	34	B	35	D										

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