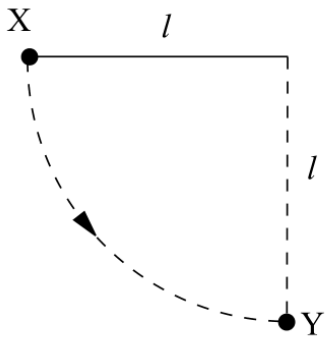
Multiple Choice Circular Motion Paper Questions
Jan 2002—Jan 2010 (old spec)

7



Jan 2002

A ball of mass m, which is fixed to the end of a light string of length l, is released from rest at X. It swings in a circular path, passing through the lowest point Y at speed υ. If the tension in the string at Y is T, which one of the following equations represents a correct application of Newton's laws of motion to the ball at Y?

A $T = \frac{m\upsilon^2}{l} - mg$

B $T - mg = \frac{m\upsilon^2}{l}$

C $mg - T = \frac{m\upsilon^2}{l}$

D $T + \frac{m\upsilon^2}{l} = mg$

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8 A girl of mass 40 kg stands on a roundabout 2.0 m from the vertical axis as the roundabout rotates uniformly with a period of 3.0 s. The horizontal force acting on the girl is approximately

Jun 2002

A zero.

B 3.5×10^2 N.

C 7.2×10^2 N.

D 2.8×10^4 N.

10 For a particle moving in a circle with uniform speed, which one of the following statements is **incorrect**?

A The velocity of the particle is constant.

B The force on the particle is always perpendicular to the velocity of the particle.

C There is no displacement of the particle in the direction of the force.

D The kinetic energy of the particle is constant.

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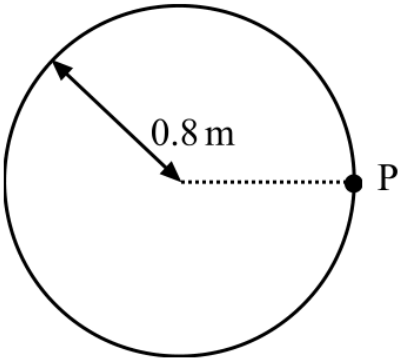


Jan 2003

A model car moves in a circular path of radius 0.8 m at an angular speed of $\frac{\pi}{2}$ rad s^{-1}. What is its displacement from point P, 6 s after passing P?

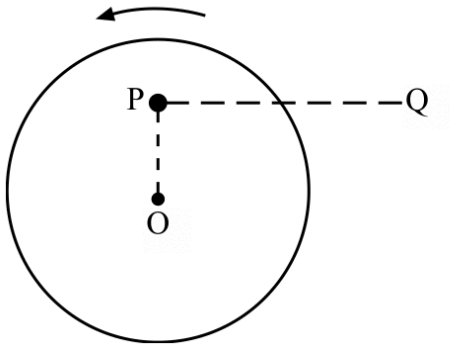
A zero
B 1.6 m
C 0.4π m
D 1.6π m

10 A fairground roundabout makes nine revolutions in one minute. What is the angular speed of the roundabout?

Jun 2003

A 0.15 rad s^{-1}
B 0.34 rad s^{-1}
C 0.94 rad s^{-1}
D 2.1 rad s^{-1}

11



A small mass is placed at P on a horizontal disc which has centre O. The disc rotates anti-clockwise about a vertical axis through O with constant angular speed. Which one of the following describes the force which keeps the mass at rest relative to the disc?

A the weight of the mass
B a frictional force directed away from O
C a frictional force directed towards O
D a frictional force directed from P to Q

6 What is the angular speed of a satellite in a geo-synchronous orbit around the Earth?

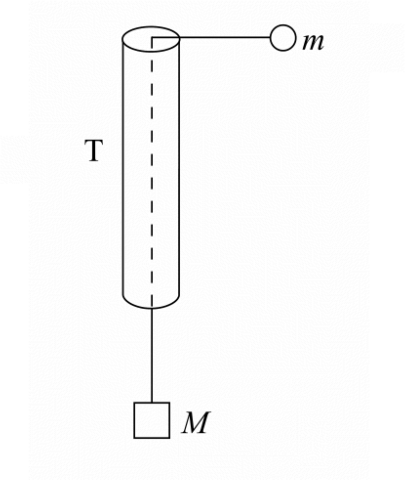
Jan 2004

A $7.3 \times 10^{-5}\,\text{rad s}^{-1}$
B $2.6 \times 10^{-1}\,\text{rad s}^{-1}$
C $24\,\text{rad s}^{-1}$
D $5.0 \times 10^{6}\,\text{rad s}^{-1}$

7 An object moving at constant speed in a circle experiences a force that is

A in the direction of motion.
B outwards and at right angles to the direction of motion.
C inwards and at right angles to the direction of motion.
D opposite to the direction of motion.

8



The figure shows a smooth thin tube T through which passes a string with masses m and M attached to its ends. Initially the tube is moved so that the mass, m, travels in a horizontal circle of constant radius r, at constant speed, v. Which one of the following expressions is equal to M?

A $\frac{mv^2}{2r}$

B mv^2rg

C $\frac{mv^2 g}{r}$

D $\frac{mv^2}{rg}$

7 What is the angular speed of a point on the Earth's equator?

Jun 2004

A $7.3 \times 10^{-5}\,\text{rad s}^{-1}$
B $4.2 \times 10^{-3}\,\text{rad s}^{-1}$
C $2.6 \times 10^{-1}\,\text{rad s}^{-1}$
D $15\,\text{rad s}^{-1}$

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8 A mass on the end of a string is whirled round in a horizontal circle at increasing speed until the string breaks. The subsequent path taken by the mass is

Jan 2005

A a straight line along a radius of the circle.
B a horizontal circle.
C a parabola in a horizontal plane.
D a parabola in a vertical plane.

9 A particle of mass m moves in a circle of radius r at a uniform speed with frequency f. What is the kinetic energy of the particle?

A $\dfrac{mf^2r^2}{4\pi^2}$

B $\dfrac{mf^2r}{2}$

C $2\pi^2mf^2r^2$

D $4\pi^2mf^2r^2$

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8 A particle of mass m moves in a circle of radius r at uniform speed, taking time T for each revolution. What is the kinetic energy of the particle?

Jun 2005

A $\dfrac{\pi^2mr}{T^2}$

B $\dfrac{\pi^2mr^2}{T^2}$

C $\dfrac{2\pi^2mr^2}{T}$

D $\dfrac{2\pi^2mr^2}{T^2}$

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7 What is the value of the angular velocity of a point on the surface of the Earth?

Jan 2006

A $1.2 \times 10^{-5}\ \text{rad s}^{-1}$
B $7.3 \times 10^{-5}\ \text{rad s}^{-1}$
C $2.6 \times 10^{-1}\ \text{rad s}^{-1}$
D $4.6 \times 10^{2}\ \text{rad s}^{-1}$

9 For a particle moving in a circle with uniform speed, which **one** of the following statements is correct?

Jun 2006

A The displacement of the particle is in the direction of the force.
B The force on the particle is in the same direction as the direction of motion of the particle.
C The momentum of the particle is constant.
D The kinetic energy of the particle is constant.

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9 For a particle moving in a circle with uniform speed, which one of the following statements is **incorrect**?

Jan 2007

A The velocity of the particle is constant.
B The force on the particle is always perpendicular to the velocity of the particle.
C There is no displacement of the particle in the direction of the force.
D The kinetic energy of the particle is constant.

10 What is the angular speed of a car wheel of diameter 0.400 m when the speed of the car is $108\,\text{km}\,\text{h}^{-1}$?

A $75\,\text{rad}\,\text{s}^{-1}$
B $150\,\text{rad}\,\text{s}^{-1}$
C $270\,\text{rad}\,\text{s}^{-1}$
D $540\,\text{rad}\,\text{s}^{-1}$

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9 A small body of mass m rests on a horizontal turntable at a distance r from the centre. If the maximum frictional force between the body and the turntable is $\frac{mg}{2}$, what is the angular speed at which the body starts to slip?

Jan 2008

A $\sqrt{\frac{gr}{2}}$

B $\frac{g}{r}$

C $\frac{1}{2}\sqrt{\frac{g}{r}}$

D $\sqrt{\frac{g}{2r}}$

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8 The wheel of the London Eye has a diameter of 130 m and can rotate at a steady speed, completing one rotation every 30 minutes. What is the centripetal acceleration of a person in a capsule at the rim?

Jun 2008

A $1.2 \times 10^{-4}\,\text{m}\,\text{s}^{-2}$
B $2.5 \times 10^{-4}\,\text{m}\,\text{s}^{-2}$
C $3.9 \times 10^{-4}\,\text{m}\,\text{s}^{-2}$
D $7.9 \times 10^{-4}\,\text{m}\,\text{s}^{-2}$

7 A revolving mountain top restaurant turns slowly, completing a full rotation in 50 minutes.
A man sits in the restaurant 15 m from the axis of rotation.
What is the speed of the man?

Jan 2009

A $\frac{\pi}{100}\,\text{m s}^{-1}$

B $\frac{3\pi}{5}\,\text{m s}^{-1}$

C $\frac{\pi}{200}\,\text{m s}^{-1}$

D $\frac{\pi}{1500}\,\text{m s}^{-1}$

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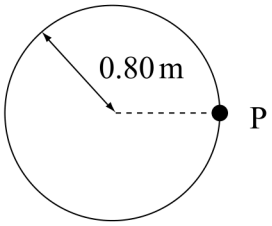
Jun 2009



A model car moves in a circular path of radius 0.80 m at an angular speed of $\frac{\pi}{2}\,\text{rad s}^{-1}$.

What is its displacement from point P, 6.0 s after passing P?

A zero
B 1.6 m
C 0.4π m
D 1.6π m

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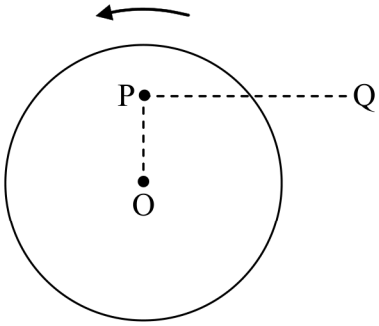
Jan 2010



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C a frictional force directed away from O
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