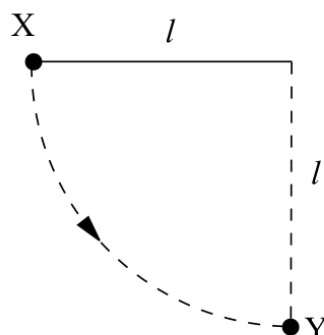


Multiple Choice Circular Motion Paper Questions Jan 2002—Jan 2010 (old spec)

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 v . 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 $T = \frac{mv^2}{l} - mg$

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

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

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

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

A zero.

B 3.5×10^2 N.

C 7.2×10^2 N.

D 2.8×10^4 N.

Jun 2002

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

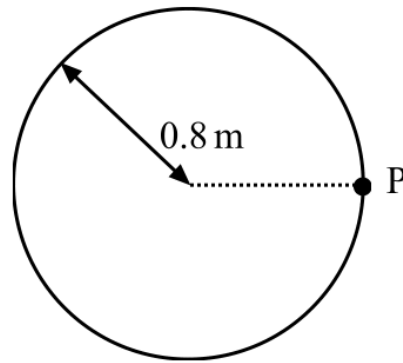
A The velocity of the particle is constant.

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.

9



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?

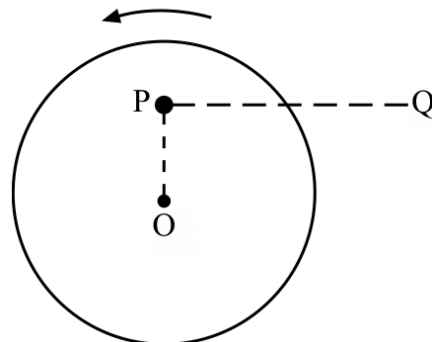
- A zero
- B 1.6 m
- C 0.4π m
- D 1.6π m

- 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

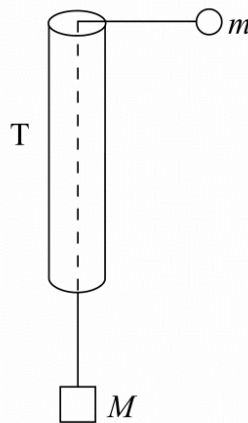


A small mass is placed at P on a horizontal disc which has centre O. The disc rotates anti-clockwise about a vertical axis through O with constant angular speed. Which one of the following describes the force which keeps the mass at rest relative to the disc?

- 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?
- A** $7.3 \times 10^{-5} \text{ rad s}^{-1}$
B $2.6 \times 10^{-1} \text{ rad s}^{-1}$
C 24 rad s^{-1}
D $5.0 \times 10^6 \text{ rad s}^{-1}$
- Jan 2004**
- 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** $\frac{mv^2g}{r}$
- 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 rad s^{-1}

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 $\frac{mf^2 r^2}{4\pi^2}$
- B $\frac{mf^2 r}{2}$
- C $2\pi^2 mf^2 r^2$
- D $4\pi^2 mf^2 r^2$

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 $\frac{\pi^2 m r}{T^2}$
- B $\frac{\pi^2 m r^2}{T^2}$
- C $\frac{2\pi^2 m r^2}{T}$
- D $\frac{2\pi^2 m r^2}{T^2}$

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.

- 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 km h^{-1} ?

- A 75 rad s^{-1}
B 150 rad s^{-1}
C 270 rad s^{-1}
D 540 rad s^{-1}

- 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?

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

Jan 2008

B $\frac{g}{r}$

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

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

- 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

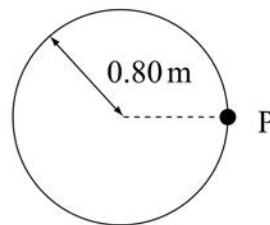
- A $1.2 \times 10^{-4} \text{ m s}^{-2}$
B $2.5 \times 10^{-4} \text{ m s}^{-2}$
C $3.9 \times 10^{-4} \text{ m s}^{-2}$
D $7.9 \times 10^{-4} \text{ m s}^{-2}$

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

9



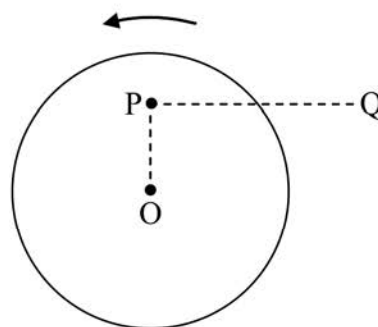
Jun 2009

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 $0.4\pi \text{ m}$
 D $1.6\pi \text{ m}$

9



Jan 2010

A small mass is placed at P on a horizontal disc which has its centre at 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 towards O
 C a frictional force directed away from O
 D a frictional force directed from P to Q