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

7

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 $3.5 \times 10^3$ N.

C $7.2 \times 10^2$ N.

D $2.8 \times 10^3$ 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.
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  0.4\pi m  
D  1.6\pi m

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

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

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. $24 \text{rad s}^{-1}$
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 $7.3 \times 10^{-5}$ rad s$^{-1}$  
B $4.2 \times 10^{-3}$ rad s$^{-1}$  
C $2.6 \times 10^{-1}$ 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?  

**Jun 2005**

A $\frac{m f^2 r^2}{4\pi^2}$  
B $\frac{m f^2 r}{2}$  
C $2\pi^2 m f^2 r^2$  
D $4\pi^2 m f^2 r^2$

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 $1.2 \times 10^{-5}$ rad s$^{-1}$  
B $7.3 \times 10^{-5}$ rad s$^{-1}$  
C $2.6 \times 10^{-1}$ rad s$^{-1}$  
D $4.6 \times 10^2$ rad s$^{-1}$
9 For a particle moving in a circle with uniform speed, which one of the following statements is correct?  

<table>
<thead>
<tr>
<th>Option</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The displacement of the particle is in the direction of the force.</td>
</tr>
<tr>
<td>B</td>
<td>The force on the particle is in the same direction as the direction of motion of the particle.</td>
</tr>
<tr>
<td>C</td>
<td>The momentum of the particle is constant.</td>
</tr>
<tr>
<td>D</td>
<td>The kinetic energy of the particle is constant.</td>
</tr>
</tbody>
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**Jun 2006**

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

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</tr>
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<td>D</td>
<td>The kinetic energy of the particle is constant.</td>
</tr>
</tbody>
</table>

**Jan 2007**

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$^{-1}$?  

<table>
<thead>
<tr>
<th>Option</th>
<th>Angular Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>75 rad s$^{-1}$</td>
</tr>
<tr>
<td>B</td>
<td>150 rad s$^{-1}$</td>
</tr>
<tr>
<td>C</td>
<td>270 rad s$^{-1}$</td>
</tr>
<tr>
<td>D</td>
<td>540 rad s$^{-1}$</td>
</tr>
</tbody>
</table>

**Jan 2008**

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?  

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<th>Angular Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$\sqrt{\frac{gr}{2}}$</td>
</tr>
<tr>
<td>B</td>
<td>$\frac{g}{r}$</td>
</tr>
<tr>
<td>C</td>
<td>$\frac{1}{2} \sqrt{\frac{g}{r}}$</td>
</tr>
<tr>
<td>D</td>
<td>$\sqrt{\frac{g}{2r}}$</td>
</tr>
</tbody>
</table>

**Jan 2008**

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?  

<table>
<thead>
<tr>
<th>Option</th>
<th>Acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$1.2 \times 10^{-4}$ m s$^{-2}$</td>
</tr>
<tr>
<td>B</td>
<td>$2.5 \times 10^{-4}$ m s$^{-2}$</td>
</tr>
<tr>
<td>C</td>
<td>$3.9 \times 10^{-4}$ m s$^{-2}$</td>
</tr>
<tr>
<td>D</td>
<td>$7.9 \times 10^{-4}$ m s$^{-2}$</td>
</tr>
</tbody>
</table>

**Jun 2008**
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 \( \pi \) m

D 1.6 \( \pi \) 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

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