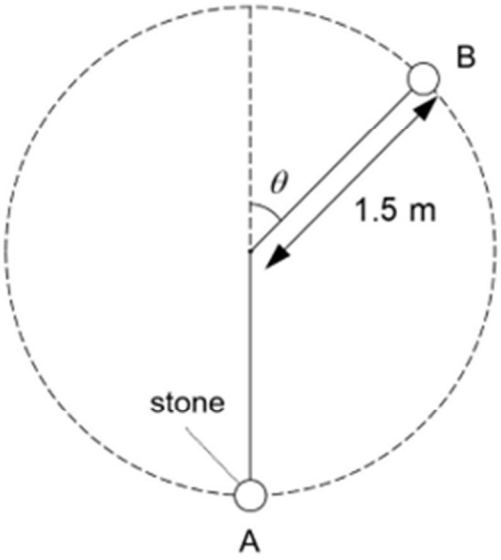
H2 Physics Revision Topic : Motion in a Circle

Multiple Choice Questions Name: _____

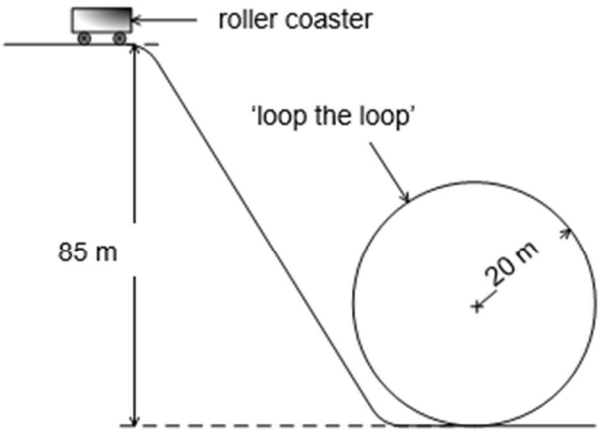
1 A stone attached to a light inextensible string at position A is given an initial push to the right. It subsequently moves in a vertical circle of radius 1.5 m and the string just slackens at position B when it makes an angle of θ to the vertical.



Given that the velocity of the stone at position B is 2.2 m s^{-1}, what is θ?

A 9° **B** 19° **C** 71° **D** 81°

2 A roller coaster starts from rest on a hill-top. It accelerates along a frictionless track before entering a loop-the-loop of radius 20 m as shown below.



What is the minimum normal contact force that the roller coaster seat exerts on a passenger with weight *W*, as it passes through the 'loop the loop'?

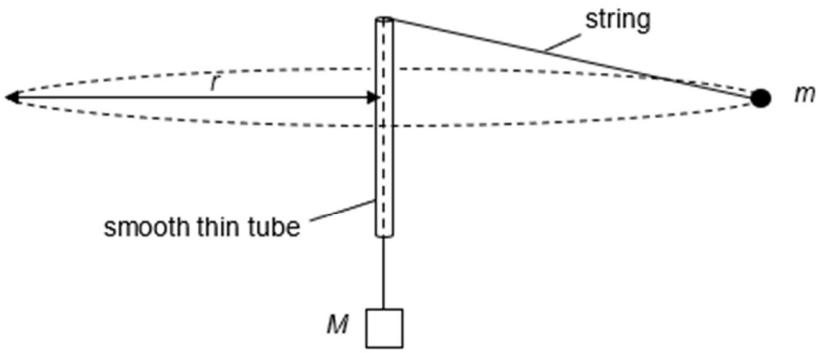
A 0 **B** 3.5 *W* **C** 4.5 *W* **D** 5.5 *W*

3 A pail containing 500 g of water is rotated in a vertical circle of radius 1.20 m.
What is the minimum speed of the pail such that no water spills out when it is upside down at the top of the circle?

A 3.43 m s^{-1} **B** 4.91 m s^{-1}

C 11.8 m s^{-1} **D** 24.1 m s^{-1}

4 A string passes through a smooth thin tube, with objects of masses m and M attached to its ends. The tube is swung so that the object with mass m travels in a horizontal circle of constant radius r at constant speed v as shown.



Which of the following expressions is equal to M?

A $m\sqrt{1+\left(\frac{v^2}{rg}\right)^2}$ **B** $\frac{mv^2r}{g}$ **C** $\frac{mv^2g}{r}$ **D** $\frac{mv^2}{rg}$

5 A small mass is tied to a light inextensible string. The mass is hung onto a fixed spring balance. The spring balance reads 50 g. (Fig. 8.1)

The mass is then displaced from the vertical at an angle 30° and released from rest. (Fig. 8.2)

Fig. 8.1

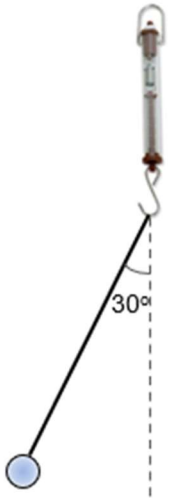


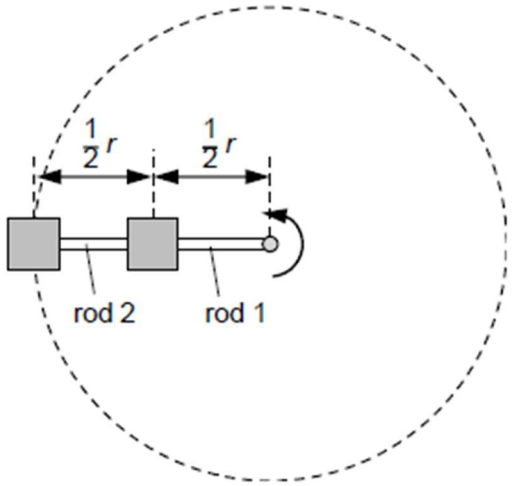
Fig. 8.2

Fig. 8.3

The reading on the balance when the mass is at the lowest point of its motion (Fig. 8.3) is

A = 50 g **B** < 50 g **C** > 50 g **D** = 0 g

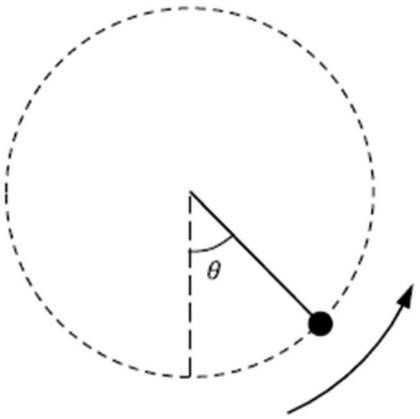
6 Two identical blocks connected by light rigid rods are pivoted at one end to move in a circular path at uniform angular velocity on a smooth horizontal surface, as shown.



What is the ratio of $\frac{\text{tension in rod 1}}{\text{tension in rod 2}}$?

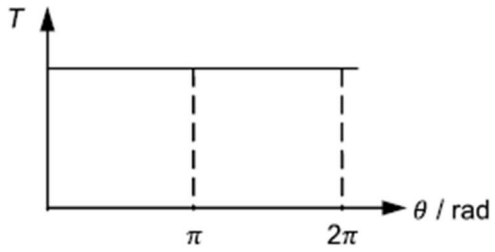
A 0.50 **B** 1.0 **C** 1.5 **D** 2.0

7 An object is fixed to one end of an inextensible light string which rotates in a vertical circle at constant speed.

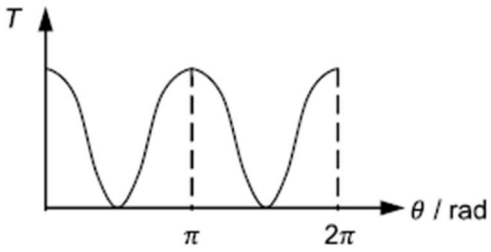


Which graph could represent the variation with angle θ of the tension T in the string?

A



B



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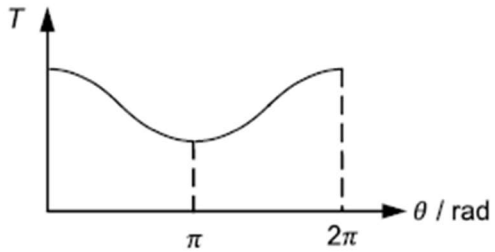
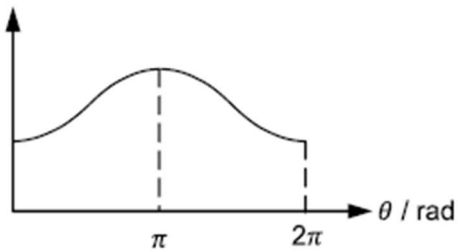
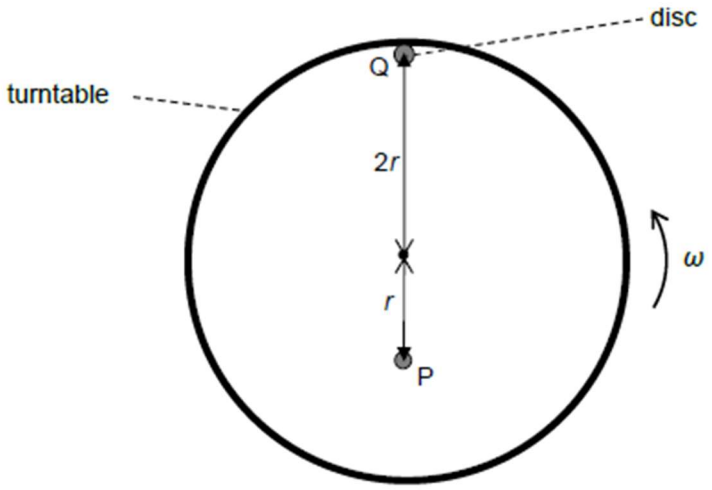


D



8 Two discs P and Q of mass m and $2m$ respectively are placed on a rough, horizontal and level turntable as shown in the diagram. P and Q are at a distance of r and $2r$ from the centre of the turntable respectively. The turntable starts rotating from rest with gradually increasing angular velocity ω.



Top View

Given that the maximum frictional force acting on P is half of that on Q, which of the following is correct?

A P will slip first.

B Q will slip first.

C P and Q will slip at the same time.

D Neither P nor Q will slip.

9 The capsules in the Singapore Flyer move in a circle of radius 75 m with an average period of 30 minutes.

What is the centripetal acceleration of the capsules?

A 9.1×10^{-4} m s^{-2} **B** 0.26 m s^{-2} **C** 3.3 m s^{-2} **D** 9.8 m s^{-2}

10 A body of mass m moves in uniform circular motion with radius r, linear speed v and angular speed ω.

Which change does **not** affect the value of the centripetal force on the body?

A Mass of body is decreased to $\frac{m}{2}$.

B Radius is increased to $2r$ and angular speed is decreased to $\frac{\omega}{2}$.

C Radius is decreased to $\frac{r}{2}$ and linear speed is decreased to $\frac{v}{2}$.

D Linear speed is decreased to $\frac{v}{2}$, angular speed is increased to 2ω and radius is decreased to $\frac{r}{4}$.

11 A pendulum bob of mass 1.27 kg is supported by a string so that the radius of its path is 0.600 m. It is moving with velocity 0.575 m s^{-1} horizontally at the centre of its motion when the string is vertical.

What is the tension in the string at this instant?

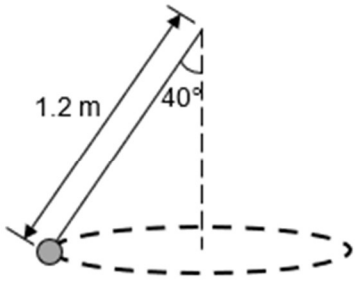
A 11.8 N

B 12.5 N

C 13.2 N

D 13.7 N

12 A simple pendulum of length 1.2 m is swung such that the mass goes round in a uniform circular motion in the horizontal plane. The string makes an angle of 40° with the vertical.



What is the speed of the mass in its circular path?

A 2.5 m s^{-1} **B** 2.8 m s^{-1} **C** 3.0 m s^{-1} **D** 3.3 m s^{-1}

13 Two wooden cubes of masses 100 g and 25 g are placed at different positions from the centre of a turntable. When the turntable rotates at a constant rate, both cubes remain at the same positions on the turntable. The frictional force acting on each cube is proportional to its weight.

What is the ratio of the distance from the centre of the turntable of the 100 g cube to that of the 25 g cube?

A 0.25 **B** 1.0

C 2.0 **D** 4.0

14 A simple pendulum is released from rest at A.

What is the tension in the string when the pendulum is at position B where the string is vertical, given that the mass of the bob is *m* and the length of the pendulum is *L*?

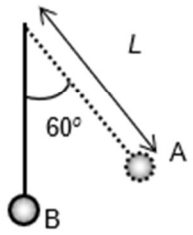
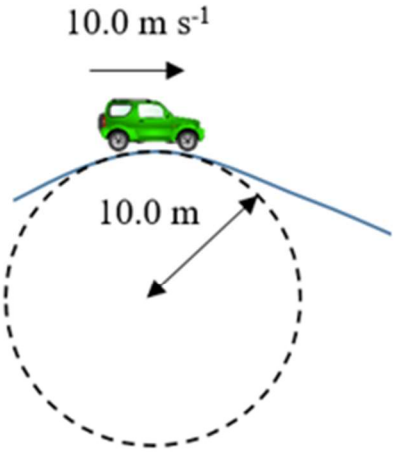


Diagram not to scale

A 0.87 mg **B** mg **C** 1.27 mg **D** 2 mg

15 A car drives over a hump with a circular radius of 10.0 m at a speed of 10.0 m s^{-1}.



A 250 g mass is suspended vertically from the ceiling of the car by a spring of force constant 25.0 N m^{-1}.

What happens to the spring as the car passes over the hump?

	While passing over hump
A	Shortens by 10 cm
B	Shortens by 20 cm
C	Lengthens by 10 cm
D	Lengthens by 20 cm