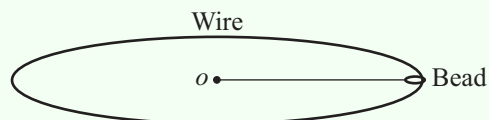
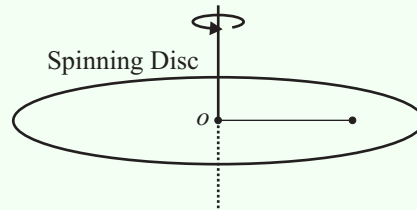


EXERCISE 1. CIRCULAR MOTION 1

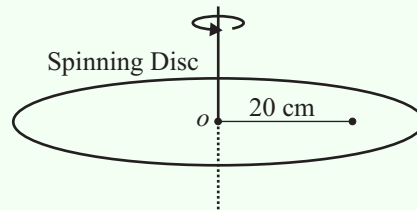
- A particle moves with constant angular speed of 4 rads s^{-1} around a circle of radius 2 m.
Find
 - the speed,
 - the centripetal acceleration,
 - the periodic time,
 - the frequency.
- A particle moves around a circle of radius 50 cm at a speed of 5 m s^{-1} .
Find
 - the angular speed,
 - the centripetal acceleration,
 - the periodic time,
 - the frequency.
- A record is revolving at 60 revs/min on a turntable. Find its angular speed. Find the speed of a point on the rim of the record if its radius is 40 cm.
- A body of mass 2 kg is moving at 3 rads s^{-1} in a circle of radius 60 cm.
Find
 - the speed,
 - the centripetal acceleration,
 - the centripetal force,
 - the periodic time,
 - the frequency.
- A particle of mass 2 kg moves in a circle of radius 30 cm at a frequency of 0.2 Hz on the end of a string.
Find
 - the periodic time,
 - angular speed,
 - speed,
 - the tension in the string.
- A body of mass 4 kg lies on a smooth horizontal surface and is connected to a point o on the surface by a light inextensible string of length 20 cm. With the string taut, the body describes a circle with centre o . If the tension in the string is 20 N find the speed of the body. Draw a picture with all the forces acting on the body. Find the normal reaction of the table.
- A smooth wire in the form of a circle of radius 50 cm and centre o has a bead of mass 0.2 kg threaded on it moving at 4 m s^{-1} .
Find
 - the vertical force of the bead on the wire,
 - vertical force of the wire on the bead,
 - the horizontal force on the wire due to the bead,
 - the horizontal force on the bead due to the wire,
 - the centripetal force on the bead,
 - the centripetal acceleration of the bead.



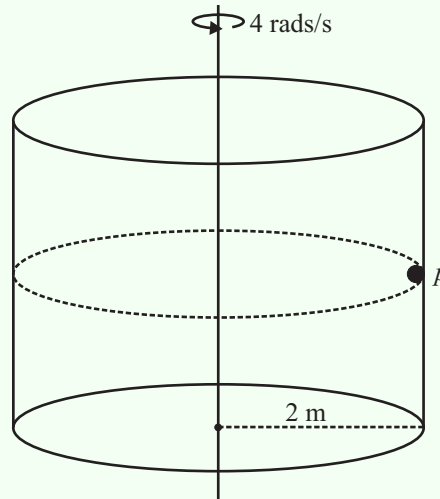
8. A mass rests without slipping on a horizontal disc rotating at 6 rads^{-1} . The coefficient of friction is 0.5. Find the greatest possible distance of the body from the centre of rotation.



9. A disc rotates at 60 revs/min. Find its angular speed. A body is placed 20 cm from the centre of the disc and is on the point of slipping. Find the coefficient of friction between the body and the disc.

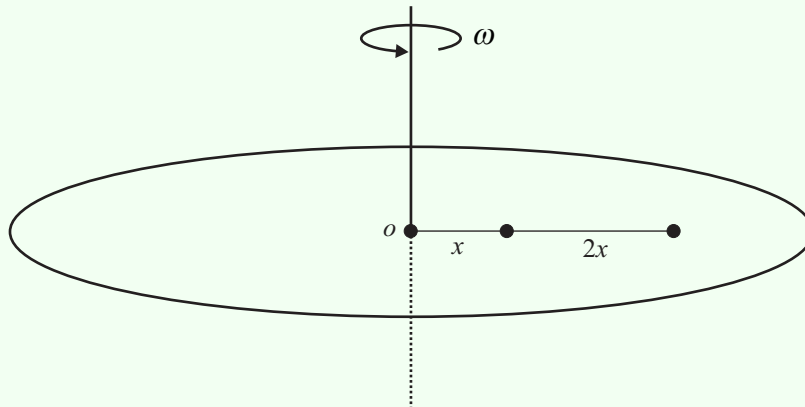


10. A car travels round a bend on a level road at 12 m s^{-1} . The radius of the bend is 60 m. If the car does not slip find the coefficient of friction between the car and the road.
11. A bend in a level road forms a circular arc of radius 55 m. Find the greatest speed at which a car can travel around the bend without slipping if the coefficient of friction between the tyres and the road surface is 0.45.
12. A hollow cylinder rotates about its axis of symmetry at 4 rads^{-1} . A particle p rotates with the cylinder and is on the point of slipping down. Find the coefficient of friction between the particle and the cylinder.



13. A level railway track is in the form of a circular arc of radius 180 m. Find the horizontal force on the rails when a train of 20,000 kg travels around the bend at a speed of 18 m s^{-1} .
14. A turntable rotates at 20 revs/min. Find the minimum distance from the centre at which a particle can be placed without slipping if the coefficient of friction for the particle and the turntable is $\frac{1}{3}$.

15. A particle is placed on a rough horizontal rotating platform. If the particle is a distance r from the centre of rotation and the coefficient of friction is μ find the maximum speed that can be given to the platform without the particle slipping.
16. Two particles of equal mass are attached by a light inelastic string of length $2x$ which is taut. The particles are distances x and $3x$ from the centre of a horizontal circular table so that the centre o of the table and the particles are collinear. The table rotates about its centre o with angular speed ω . The coefficient of friction of each particle and the table is $\frac{1}{2}$. If both particles are on the point of slipping find ω .



EXERCISE 1.

ANSWERS

1. (i) 8 m s^{-1} (ii) 32 m s^{-2} (iii) $\frac{1}{2}\pi \text{ s}$ (iv) $\frac{2}{\pi} \text{ s}^{-1}$
2. (i) 10 rads s^{-1} (ii) 50 m s^{-2} (iii) $\frac{1}{5}\pi \text{ s}$ (iv) $\frac{5}{\pi} \text{ s}^{-1}$
3. $2\pi \text{ rad s}^{-1}, 2.512 \text{ m s}^{-1}$
4. (i) 1.8 m s^{-1} (ii) 5.4 m s^{-2} (iii) 10.8 N (vi) $\frac{2\pi}{3} \text{ s}$
 (v) $\frac{3}{2\pi} \text{ s}^{-1}$
5. (i) 5 s (ii) $\frac{2}{5}\pi \text{ rad s}^{-1}$ (iii) 0.38 m s^{-1} (vi) 0.95 N
6. $1 \text{ m s}^{-1}, 4g \text{ N}$
7. (i) $\frac{1}{5}g \text{ N}$ (ii) $\frac{1}{5}g \text{ N}$ (iii) 6.4 N (iv) 6.4 N
 (v) 6.4 N (vi) 32 m s^{-2}
8. 0.136 m
9. $2\pi \text{ rad s}^{-1}, 0.8$
10. 0.245
11. 15.6 m s^{-1}
12. 0.306
13. $36,000 \text{ N}$
14. 0.745 m
15. $\sqrt{\mu gr}$
16. $\frac{1}{2}\sqrt{g}$