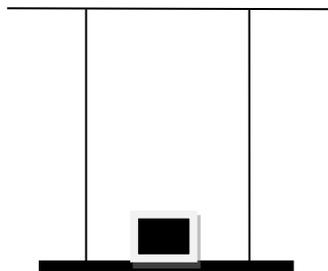


1. A light string can support a stationary load of 25.0 kg before breaking. A 3.00 kg object rotates on a horizontal frictionless table in a circle of radius 0.800 m and the other end of the string is held fixed. What range of speed can the object have before the string breaks?
a) any speed up to 8.08m/s
2. In the Bohr model of the hydrogen atom, the speed of the electron is approximately 2.20E6m/s. Find (a) the force acting on the electron as it revolves in a circular orbit of radius 0.530E-10 m and b) the centripetal acceleration of the electron.
a) 8.32E-8 N towards nucleus, b) 9.13E22m/s² inwards.
3. A coin placed 30.0 cm from the center of a horizontal turntable slips when its speed is 50.0 cm/s. a) What force causes the centripetal acceleration when the coin is stationary relative to the turntable. b) What is the coefficient of static friction between the coin and the turntable?
a) static friction b) 0.085
4. Consider a conical pendulum with an 80.0 kg bob on a 10.0 m wire making an angle of $\theta=5.00^\circ$ with the vertical. a) Determine the horizontal and vertical components of the force exerted by the wire on the pendulum and b) the radial acceleration of the bob. a) 68.6N b) 784N c) 0.857m/s²
5. A 40.0 kg child swings in a swing supported by two chains, each 3.00 m long. The tension in each chain at the lowest point is 350N. Find a) the child's speed at the lowest point and b) the force exerted by the seat on the child at the lowest point. Ignore the mass of the seat. a) 4.81m/s b) 700 N up.



6. A pail of water is rotated in a vertical circle of radius 1.00 m. a) What is the pail's minimum speed at the top of the circle if no water is to spill out? If the mass of the water is 5.00kg what is the normal force of the bottom of the pail on the water at the lowest vertical position, assuming twice speed at the top. a) 3.13m/s; b) 5mg=238N

7. An object of mass 5.00 kg, attached to a spring scale, rests on a frictionless, horizontal surface inside of a boxcar. The spring scale is attached to the front of the boxcar, and shows a constant reading of 18.0 N when the car is moving. a) The spring scale reads 0.00 when the car is at rest. Determine the acceleration of the car. b) What constant reading will the spring scale show if the car moves with constant velocity. c) Describe the forces on the object as observed by someone (boy) in the car, and someone at rest outside the car (girl). a) 3.60m/s^2 . b) 0 c)
8. A person stands on a scale in an elevator. As the elevator starts, the scale has a constant reading of 591 N. Later as the elevator stops, the scale reading is 391 N. Assume the magnitude of the acceleration is the same during starting and stopping. Determine a) the weight of the person, b) the person's mass, c) the acceleration of the elevator. a) 491N b) 50.1 kg c) 2.00 m/s
9. A small piece of Styrofoam packing material is dropped from a height of 2.00 m above the ground. Until it reaches terminal speed, the magnitude of its acceleration is given by $a=g-bv$. After falling 0.500 m, the Styrofoam effectively reaches terminal speed and then takes 5.00 s more to reach the ground. a) What is the value of the constant b? b) What is the acceleration at $t=0$? c) What is the acceleration when the speed is 0.150 m/s? a) $32.7/\text{s}$ b) g; c) $g/2$
10. An amusement park ride consists of a large rotating cylinder that spins around its central axis fast enough that any person inside is held up against the wall when the floor drops away. The coefficient between person and wall is μ_s and the radius of the cylinder is R. a) Show that the maximum period of revolution necessary to keep the person from falling is $T = 2\pi \sqrt{\frac{R\mu_s}{g}}$
- b) Obtain a numerical value for T, taking $R=4.00\text{m}$ and $\mu_s=0.400$. How many revolutions per minute (rpm) does the cylinder make, what is the value for ω ?
- c) Show that $\mu_s=gR/v^2$
- b) $T=2.54\text{s}$, 23.6rpm, $\omega=2.47/\text{s}$
11. Let us imagine a large circular disk rotating (in outer space with no gravitational pull) around a perpendicular axis with an angular velocity of 10 revolutions per day ($7.27\text{E}-4/\text{s}$). A sniper standing in the center of the disk has no way of telling that she is in a rotating, i.e. accelerating system. She takes aim at a target point A along the radius which is one mile away, and fires at the target with a bullet velocity of 1000m/s. Where will the bullet hit a target as compared to the original point A. Show that the bullet is deflected to the right by an apparent force

$$\vec{F}_{cor} = -m\vec{a} = -2m\omega v_{object} \vec{u}_\theta. 1.89\text{m}$$