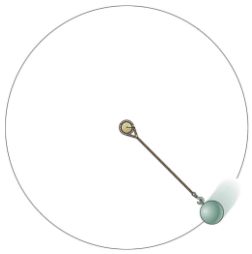
1. An object is spun around in circular motion such that it completes 100 cycles in 25 s.
    a. What is the period of its rotation? [0.25 s]
    b. If the radius is 0.3 m what is the velocity? [7.54 m/s]
    c. Draw an arrow indicating the direction of the velocity on the image.



2. An object completes 2500 cycles in 25 s.
    a. What is the period of its rotation? [0.01 s]
    b. Draw an arrow indicating the direction of the velocity on the image.

3. An object completes 95 cycles in 2.58 minutes.
    a. What is velocity in m/s if the radius is 0.18 m? [0.694 m/s]

4. An object is spun around in circular motion such that its period is 15 s.
    a. How much time will be required to complete 58 rotations? [870 s or 14.5 min]
    b. What is its frequency of rotation? [0.067 Hz]

5. An object is spun around in a circle of radius 1.3 m with a period of 4.5 s.
    a. What is its velocity? [1.81 m/s]
    b. What is its acceleration? [2.53 m/s^2]
    c. Draw an arrow indicating the direction of the velocity and the acceleration on the image.

6. A 5.0 kg object is spun around in a circle of radius 0.85 m with a frequency of 10 Hz.
    a. What is the period of its rotation? [0.1 s]
    b. What is its velocity? [53.4 m/s]
    c. What is its acceleration? [3,355 m/s^2]
    d. What is the net force acting on it? [16,778 N]

7. A 250 kg object is spun around in a circle of radius 20 m with a velocity of 250 m/s.
    a. What is the period of its rotation? [0.503 s]
    b. What is its frequency? [1.99 Hz]
    c. What is its acceleration? [3125 m/s^2]
    d. What is the net force acting on it? [781,250 N]

8. The world's largest wind turbine has blades that are 80 m long (40 ft short of a FB field) it makes 10.5 rev every 1 minute.
    a. Through what distance does the tip move in one revolution? [503 m]
    b. What is the velocity of the tip of one the blades? [88 m/s …that's 197 MPH!]
    c. How long does it take for a blade to go around once? [5.7 s]

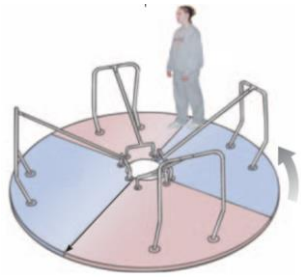
9. What is the velocity of a speck of clay on the edge of a potter's wheel turning at 45 RPM if the wheel's ***diameter*** is 32 cm?

[0.754 m/s]

10. A bike tire is spinning in a circle. The radius of the circle is 0.45 m and it takes 3 seconds to go around once. What is the velocity at the edge of the tire?

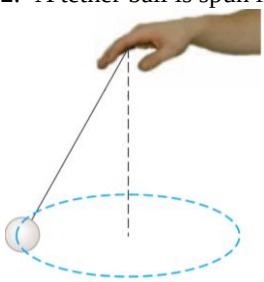
[0.94 m/s]

11. A person standing on the edge of a merry-go-round that has a radius of 2.0 m is traveling at 5 m/s. How long does it take for them to complete one lap?



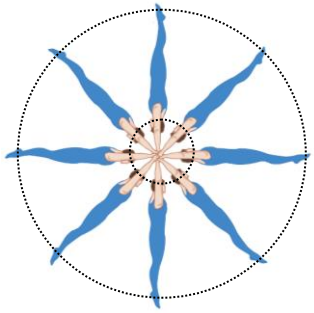
[2.5 s]

12. A tether ball is spun in circle so that its velocity is 2 m/s. What must be the radius of the circle if it takes 3 second to orbit?

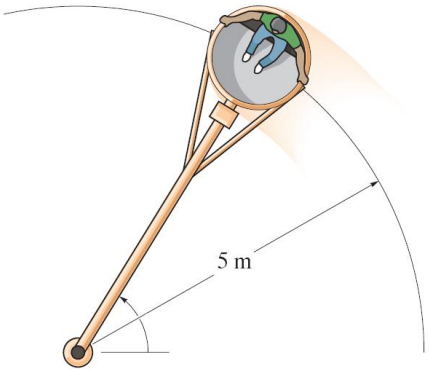


[0.95 m]

13. A gymnast is swinging around a bar. He makes 10 revolutions in 4 seconds.
    a. How long does it take for him to go around once? [0.4 s]
    b. What is the velocity of his feet (radius = 2.5 m)? [39 m/s]
    c. What is the velocity of his head (radius = 0.25 m)? [3.9 m/s]



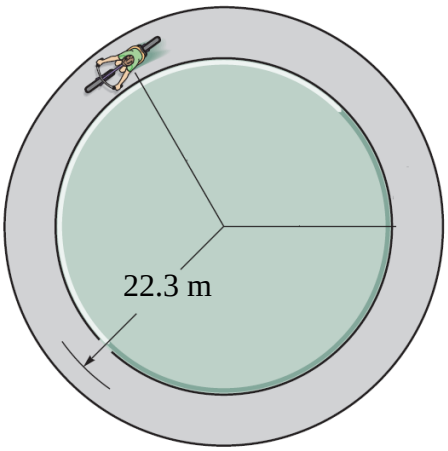
14. A person is on a ride at an amusement park. The ride makes 4 revolutions in 30 seconds.



A. What is the period? [7.5 s]
B. What is the frequency? [0.13 Hz]
C. What is the velocity? [4.2 m/s]
D. What is the acceleration? [3.5 m/s^2]
E. If the students mass is 75 kg. What must be the force? [263 N]

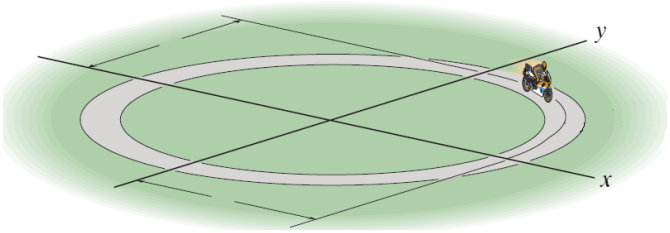
15. A 65 kg person is out riding their bike in a circle with a radius of 22.3 m. In order to stay on the road they need a centripetal force of 186.5 N.

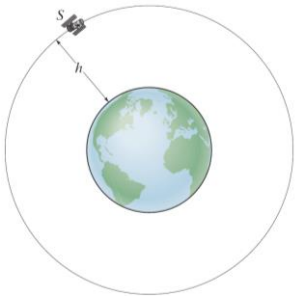
A. What must be their acceleration? [2.87 m/s^2]
B. How fast must they be traveling? [8.0 m/s]
C. What is their period? [17.5 s]
D. How many laps will they make in 10 minutes? [34.25 laps]

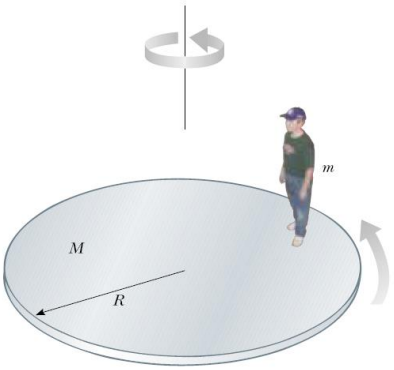


[22.3 m]

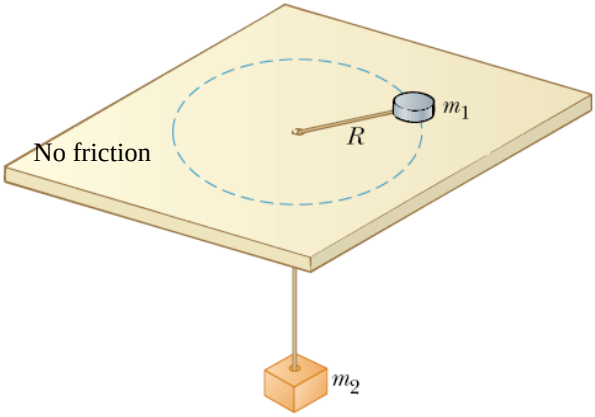
FBD's

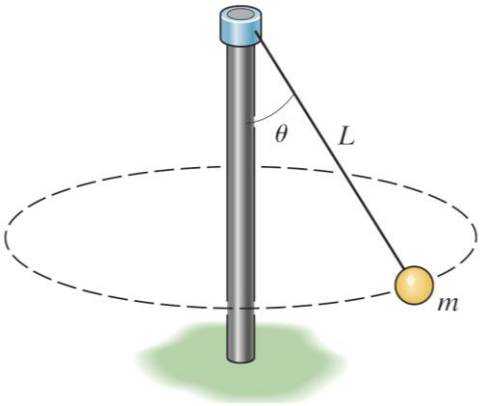


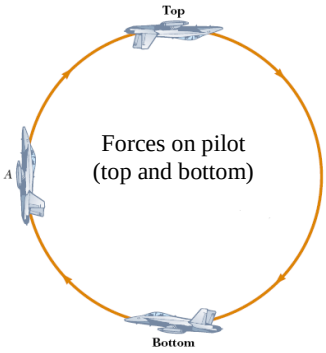




No friction

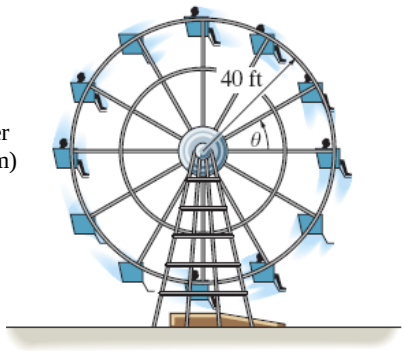




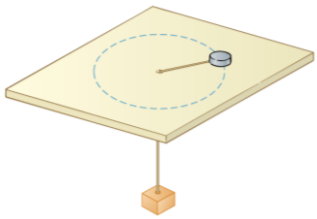


Forces on pilot
(top and bottom)

Forces on rider
(top and bottom)



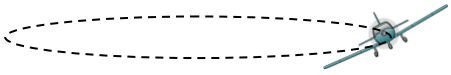
16. A puck on the end of string rotates at 16 RPM. The radius is 0.85 m and the mass of the puck is 1.5 kg.



    A. What is the velocity of the puck in m/s? [1.42 m/s]
    B. What will be the tension in the string? [3.58 N]
    C. How long will it take for the puck the complete 1 revolution? [3.8 s]
    D. What must be the mass of the block hanging in the center? [0.365 kg]
    E. What happens to the force if the radius is decreased by ½? (same velocity) [7.1 N]

17. A coin is placed on a rotating record player. The coin is observed to rotate at 3.5 m/s at a radius of 1.5 m.
    A. What force provides the centripetal force? [friction]
    B. What must the coefficient of friction be? [0.83]
    C. How many revolutions will the coin make in 4 minutes? [89.1 rev]

18. A plane traveling in a circle experiences an acceleration of 20 m/s^2. What is the velocity of the plane if the radius is 4 m?

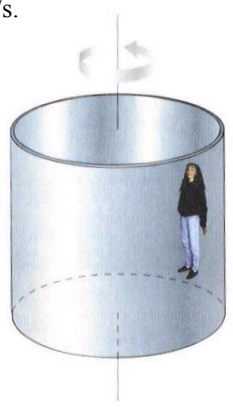


[8.9 m/s]

19. The coefficient of friction between a rider and the merry go round is 0.45 and the person is measured to be traveling at 20.0 RPM. At what radius must the person be standing? [1.00 m]

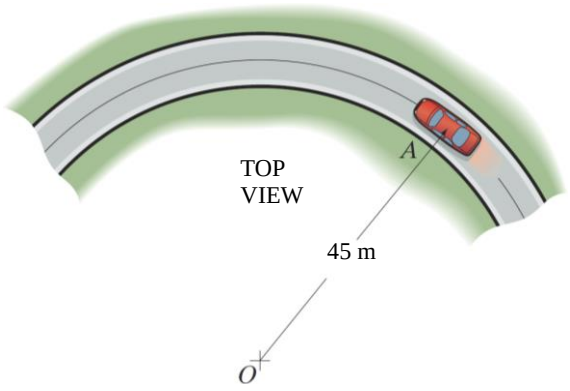
20. A car traveling at 26.4 m/s is rounding a curve with a radius of 75 m. What must the coefficient of friction be between the tires and the road? [0.95]

21. A 75 kg person is on a "gravitron ride" where the radius is 3.0 m and it spins with a velocity of 6.5 m/s.
    A. What is the force of gravity on the person? [735 N]
    B. What is the normal force on the person? Where is it directed? [1056 N , inward]
    C. What force is canceling out the force of gravity? [friction]
    D. What must the μ be so the person does not slip down the wall? [0.696]

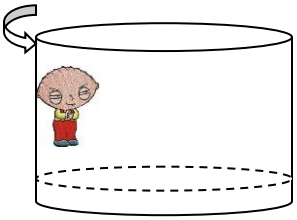


22. A gravitron ride has a μ=0.95 and a radius of 5.0 m. What must be the period of the ride so that the floor can drop out and the passengers remain in the air? [4.38 s]

23. A 1200 kg car rounds a flat corner with a radius of 45 m and that has a μ equal to 0.82.
    a. What force keeps the car on the road?
    b. How fast can the car go without skidding? [19 m/s]
    c. What will be the centripetal acceleration of the car? [8.02 m/s^2]
    d. What will be the centripetal force on the car? [9630 N]



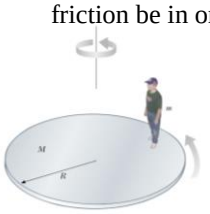
24. Stewie is on the Taz Twister at great adventure. He is spinning at 9 m/s. The walls of the ride have a $\mu = 0.75$. What must be the radius of the ride? What force provides the centripetal force?



[6.2 m]

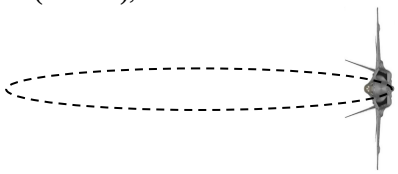
25. A 0.56 kg plane attached to a 2.00 m string is rotated so that is makes 8.50 revolutions in one second.
    A. What must be the tension in the string? [3200 N]
    B. If the string's length is halved what does the tension become (same velocity as A)? [6400 N]
    C. If the plane rotates at 17 rev/sec (twice as fast) what is the tension (same radius as A)? [13,000 N]

26. A 50.0 kg student stands 2.50 meters from the center on a merry-go-round rotating at 3.50 m/s. What must the coefficient of friction be in order for the student to keep from sliding?



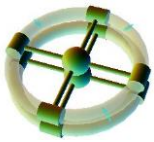
[0.500]

27. Most humans, with aid of a flight suit, pass out if they are submitted to an acceleration of 9.0 g's. If a jet is traveling at 344 m/s (mach 1), what is the minimum horizontal turn radius a person can survive?



[1340 m]

28. In order to simulate gravity in space it has been conceived that a rotating space station would do the job. If the space station has a radius of 1200. m, how many revolutions per minute are needed to accelerate at person on the edge at 9.80 m/s^2?



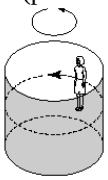
[0.863 rev/min]

29. A car is traveling at 29.1 m/s (65 mph) on a flat (unbanked) highway. It enters a turn with a radius of 250. m. What is minimum coefficient of friction needed to keep the car from sliding?

TOP
VIEW

[0.345]

30. While in the Gravitron (r = 2.50 m), a person observes the floor to drop out and they see that they are still suspended in the air (pinned against the wall). If μ=0.78 what must be the velocity of the Gravitron in m/s? Rev/min?



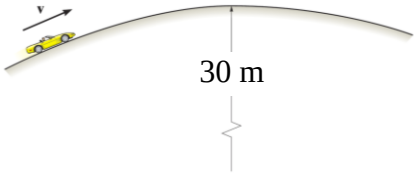
[5.60 m/s]
[21.4 rev/min]

31. A physics student makes a bet that if they can run fast enough they could "run on the walls" in a circular building with a radius of 3.00 m. If the μ=0.81, how fast must they run in order to do so

[6.02 m/s]
F.Y.I. :[13.5 mph]

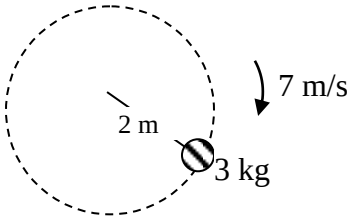
VERTICAL CIRCLES

32. A car is going over a hill that has a radius of 30 m. The driver's mass is 85 kg.
    A. What is the normal force exerted by the seat on the driver at the top if v = 15 m/s? [196 N]
    B. What speed should the car be traveling if the driver is to be weightless at the top? [17.1 m/s]

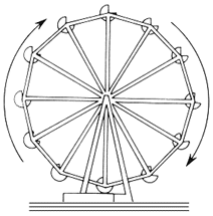


33. A rollercoaster is traveling at 20. m/s at the top of a vertical loop. What must be the radius of the loop so the passenger will not fall out at the highest part? [41 m]

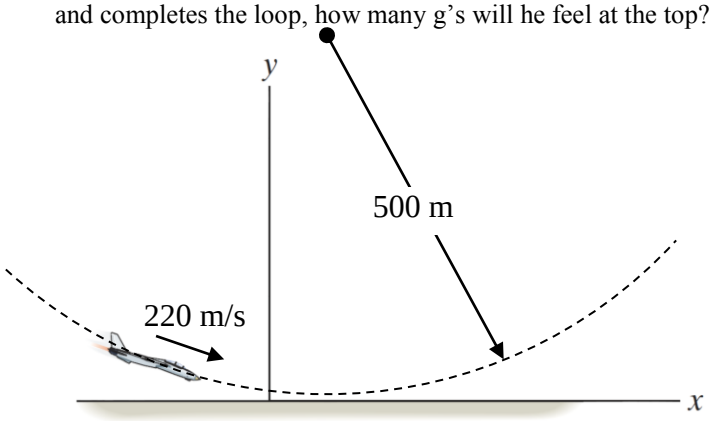
34. The following is a VERTICAL circle:
    a. What will be the tension in the cord at the top? [44.1 N]The bottom? [103 N]
    b. How fast must the object be swung in order for the cord to remain taught when the object is at the top? [greater than 4.4 m/s]



35. A 84.0 kg person is sitting on a scale in a Ferris Wheel with a radius is 9.00 m and turns once on its axis every 28.0 seconds.
    A. What does the scale read at the bottom of the loop? [861 N]
    B. What does the scale read at the top of the loop? [785 N]

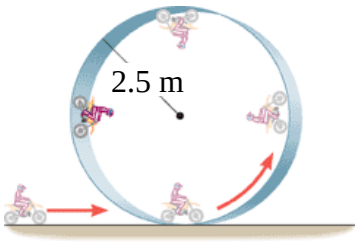


36. How many g's (that is how many times his normal weight) will the pilot pull at the bottom of this loop? If he maintains his speed and completes the loop, how many g's will he feel at the top? [11 g's bottom, 8.9 g's top]

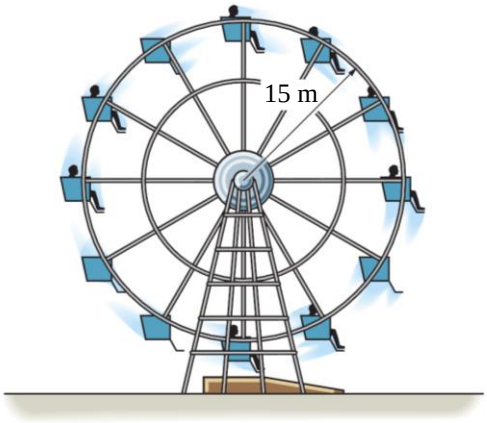


37. A stuntman is attempting to make a loop-de-loop with a radius of 2.5 m.
    A. What must be his a_C at the top of the loop to not fall out? [9.8 m/s^2]
    B. How fast (minimum) must he be traveling at the top of the loop to not fall? [4.95 m/s]
    C. What must be his velocity (minimum) at the bottom of the loop? [11.1 m/s]

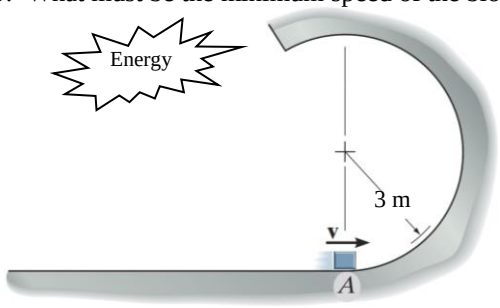
Energy



38. A rider on a Ferris Wheel (R = 15 m) notices that they weigh 25% less on the top of the ride than when they are off the ride.
    a. What is the velocity of the ride? [6.1 m/s]



39. What must be the minimum speed of the block at A in for it to make the circle and not fall?



[12.1 m/s]

40. A bullet is fired at 357 m/s into (inelastic collision) a 5.0 kg mass hanging on the end of string that is 1.0 m long.
    A. What must be the mass of the bullet so the string remains taught at the top? [0.10 kg]
    B. If an identical bullet is fired into the mass at twice the speed, what will be the tension in the string at the top? [750 N]