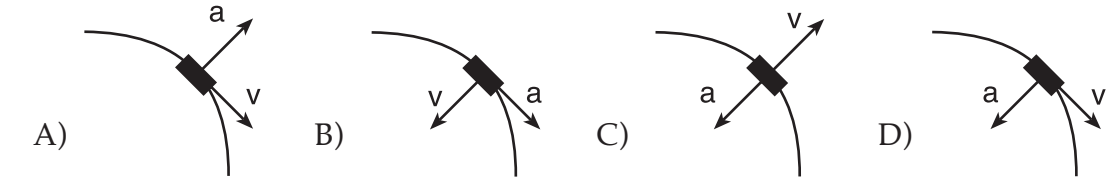
Name _____ Period _____ Date _____

Example Problems

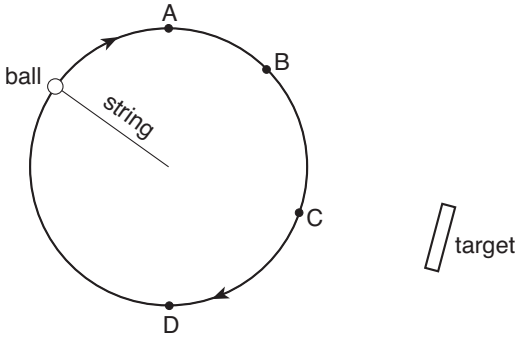
9.2 Centripetal Force

E1. A car rounds a curve of constant radius at a constant speed. Which diagram best represents the directions of both the car's velocity and the car's acceleration?



Explain:

E2. A ball attached to a string is spun in a clockwise circular path as seen from above. Circle the point where the string should be released so that the ball hits the target.



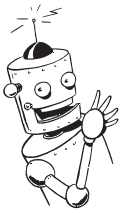
E3. A monkey is driving around a corner that has a radius of 25 meters at a speed of 8.8 m/s. Calculate the car's centripetal acceleration and centripetal force.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$a_c =$

$v =$

$r =$



a) _____ ← units b) _____ ← units

Chapter 9 Centripetal Force

E4. A monkey is chasing his tail and runs in a circle that has a radius of 0.62 meters. The monkey completes 10 full rotations in 7.2 seconds. Calculate the monkey's centripetal acceleration and the centripetal force.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$a_c =$

$v =$

$r =$

a) _____ ⟵ units b) _____ ⟵ units

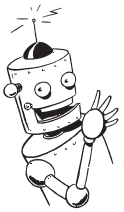
E5. A popular trick is to swing a pail of water in a vertical circle fast enough so that the water does not spill out of the pail when the pail is upsidedown at the top of its swing. The person swinging the pail has an arm length of 0.87 meters and the level of the water is 0.25 meters below the handle of the pail. Calculate the minimum speed with which the pail must be traveling at the top of the swing so that the water doesn't spill out of the bucket.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$a_c =$

$v =$

$r =$



a) _____ ⟵ units

Name _____ Period _____ Date _____

Chapter 9 Centripetal Force

E6. A 40.0 kg stone is whirled around horizontally at the end of a 0.60 meters. If the tangential velocity of the stone is 2.2 m/s, calculate the centripetal acceleration and the tension in the string.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$F_c =$

$m =$

$a_c =$

$v =$

$r =$

a) _____ ← units b) _____ ← units

E7. An athlete spins a 7.00 kg hammer tied to the end of a 1.3 m chain in a horizontal circle. The tension in the chain is 357 N, calculate the tangential speed of the hammer.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

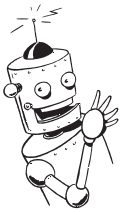
$F_c =$

$m =$

$a_c =$

$v =$

$r =$



a) _____ ← units

Chapter 9 Centripetal Force

E8. A monkey is doing his laundry. A sock is stuck to the inside of the clothes dryer spins around the drum once every 2.0 seconds. The diameter of the drum is 0.50 meters from the center of the drum, calculate the sock's linear speed.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$T =$

$v =$

$r =$

a) _____ ← units b) _____ ← units

E9. A monkey is riding on a merry-go-round and is sitting on a horse that is 8.0 meters from the center of the ride. If the monkey has a mass of 55 kg and the merry-go-round turns around once every 40.0 seconds, calculate the centripetal acceleration and centripetal force.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

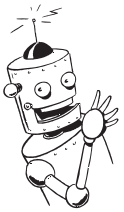
$F_c =$

$m =$

$a_c =$

$v =$

$r =$



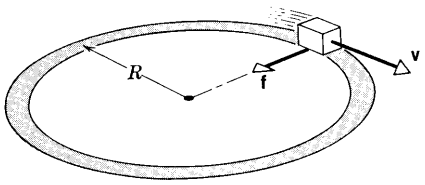
a) _____ ← units b) _____ ← units

Name _____ Period _____ Date _____

Chapter 9 Centripetal Force

E10. Let the block in the figure below represent a monkey-mobile of mass 1610 kg traveling at a constant speed of 20 m/s around an unbanked curved that has a radius of curvature that is 190 meters. Calculate the minimum coefficient of friction between the tires and the roadway so that the car can make the turn.

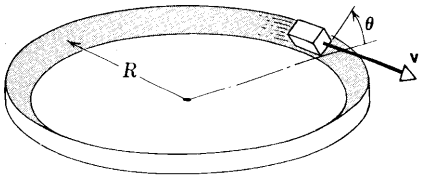
Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

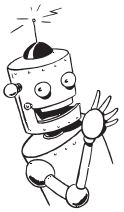


a) _____ ⟵ units

E11. You cannot always count on a sideways frictional force to get your car around a curve if the road is icy or wet so that is why highways are banked. As in the pervious problem, suppose that the monkey-mobile has a mass 1610 kg and is moving at a speed of 20 m/s around a curve that has a radius of curvature that is 190 meters. What angle of banking would make reliance on friction unnecessary?

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve





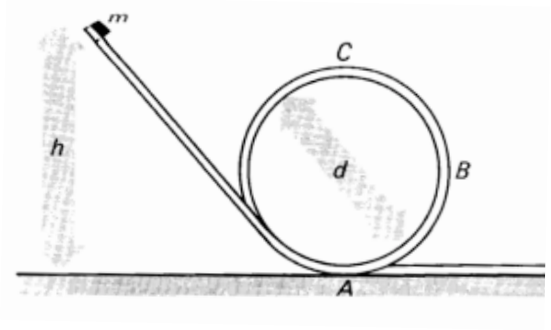
a) _____ ⟵ units

Name _____ Period _____ Date _____

Chapter 9 Centripetal Force

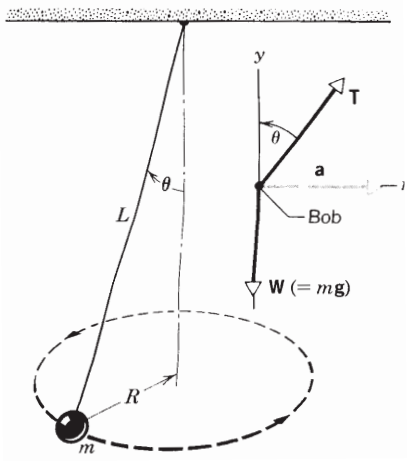
E12. A mass 0.2 kg slides on a frictionless track with a circular loop, as shown. The mass is released from rest from a height of 1 meter and the diameter for the loop is 0.3 meters. Calculate the force the track exerts on ***m*** at points A, B, and C.

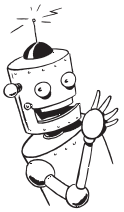
Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve



E13. A conical pendulum's bob has a mass of 1.5 kg. It whirls around in a horizontal circle at constant speed at the end of a cord whose length, measured to the center of the bob, is 1.7 meters. The cord makes an angle of 37° with the vertical. As the bob swings around in a circle, the cord sweeps out the surface of a cone. Find the period of the pendulum, that is, the time for the bob to complete one circle.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve





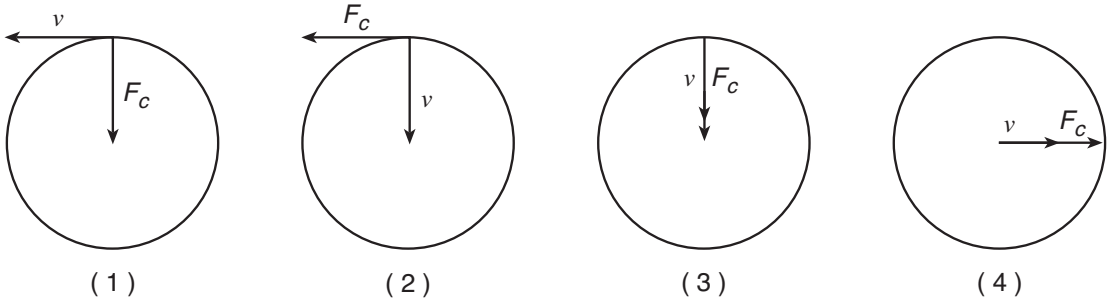
a) _____ ← units

Name _____ Period _____ Date _____

Student Problems

9.2 Centripetal Force

1. A car travels at a constant speed of 20 m/s around a horizontal circular track. Which diagram correctly represents the direction of the car's velocity (v) and the direction of the centripetal force (F_c) acting on the car at one particular moment?



Answer:

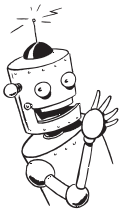
2. During an Olympic bobsled run, the Gorilla bobsled team takes a turn of radius 7.62 meters at a speed of 60 mph (26.82 m/s). Calculate the centripetal acceleration acting on the Gorilla team members during the turn.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

a_c =

v =

r =



a) _____ ← units

Name _____ Period _____ Date _____

Chapter 9 Centripetal Force

3. A 2,000 kilogram monkey-mobile is traveling at a constant speed of 12 m/s as it goes rounds a curve of radius 30 meters. Calculate the centripetal force and the centripetal acceleration acting on the monkey-mobile as it goes around the curve.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$F_c =$

$m =$

$a_c =$

$v =$

$r =$

a) _____ ⟵ units b) _____ ⟵ units

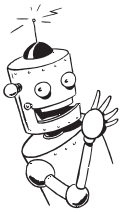
4. A plane that is piloted by a monkey is traveling at 224 m/s. The monkey makes a sharp turn following a circular trajectory. Calculate the radius of the trajectory be so that the acceleration acting on the monkey does not exceed 4 times the acceleration of gravity? [use 9.8 as gravity]

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$a_c =$

$v =$

$r =$



a) _____ ⟵ units

Name _____ Period _____ Date _____

Chapter 9 Centripetal Force

5. A monkey is driving out of control as he enters into a turn traveling way to fast. The monkey-mobile has a mass of 2,000 kg and is traveling at a speed of 80 mph (35.76 m/s). If the total amount of friction possible between the tires and the roadway is only 9,790 N, calculate the minimum radius possible so that the monkey-mobile can make the turn without flying off the road. If the actual radius of the turn is only 120 meters does the monkey make it through the turn?

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$F_c =$

$m =$

$v =$

$r =$

a) _____ ← units b) _____ ← units

6. A force of 150 N is required to break string. A 1.2 kg mass is fixed to one end of the cord and whirled around horizontally at a 3 meter radius by a monkey. Calculate the maximum linear velocity of the mass so that the string does not beak.

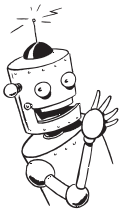
Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$F_c =$

$m =$

$v =$

$r =$



a) _____ ← units b) _____ ← units

Chapter 9 Centripetal Force

7. A monkey's favorite ride at the fair is the Ferris wheel. The Farris wheel has a radius of 7.0 meters. If the monkey has a mass of 50 kg, how fast must the Ferris wheel be turning so that the monkey feels weightless at the top? (To feel weightless the acceleration must be equal to gravity)

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$a_c =$

$v =$

$r =$

a) _____ ⟵ units

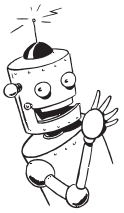
8. In a 1901 circus performance, Allo "Dare Devil" Diavolo introduced the stunt of riding a bicycle in a loop-the-loop. Assuming the loop is a circle with radius 2.7 meters, what is the least linear velocity he could have at the top of the loop if he is to remain in contact with the track at the top? (For this to work, the acceleration must be at a minimum equal to gravity)

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$a_c =$

$v =$

$r =$



a) _____ ⟵ units

Name _____ Period _____ Date _____

Chapter 9 Centripetal Force

9. A front loading clothes washer has a horizontal drum that is thoroughly perforated with small holes. A monkey is washing his 4.5 kg Teddy bear. Assuming the washer spin at 1 rotation per second and has a radius of 0.40 meters, calculate the linear velocity and the centripetal force exerted on the Teddy bear as it spins in the drum.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$F_c =$

$m =$

$v =$

$r =$

a) _____ ← units b) _____ ← units

10. Captain Chip, a monkey, pilots a 60,500 kg jet plane. Chip is told that he must remain in a holding pattern over the airport until it is his turn to land. Chip flies his plane in a circular path whose radius is 500,000 meters once every 30.0 minutes, calculate the linear velocity and the centripetal force acting on the plane.

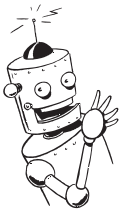
Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$F_c =$

$m =$

$v =$

$r =$

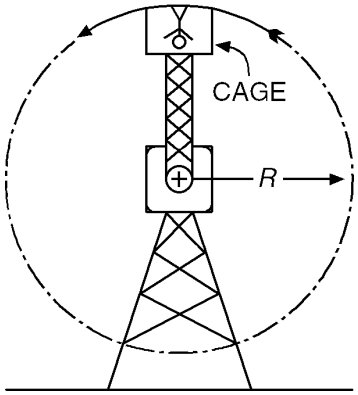


a) _____ ← units b) _____ ← units

Name _____ Period _____ Date _____

Chapter 9 Centripetal Force

11. At an amusement park, a monkey whose mass is 65 kilograms rides in a cage that completes one rotation every 8 seconds. The cage travels in a vertical circular path of radius 15 meters.



Calculate the magnitude of the centripetal acceleration and the centripetal force acting on the monkey.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

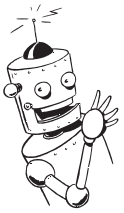
$F_c =$

$m =$

$a_c =$

$v =$

$r =$



a) _____ ← units b) _____ ← units