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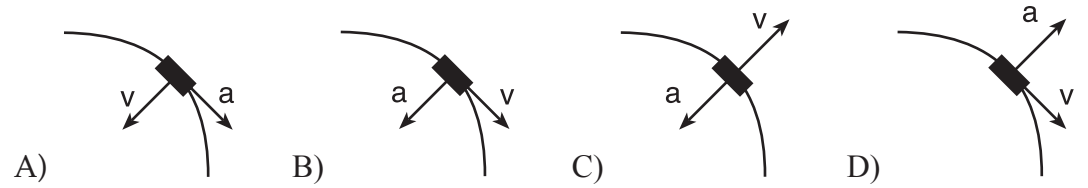
Chapter 9 Centripetal Force

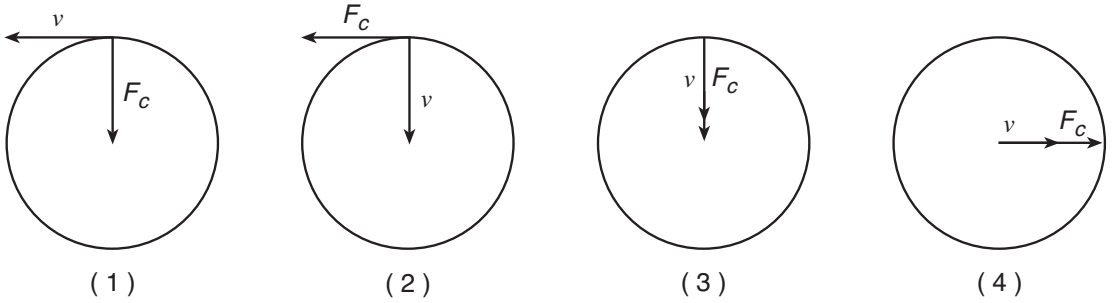
Example Problems

9.1 Centripetal Force

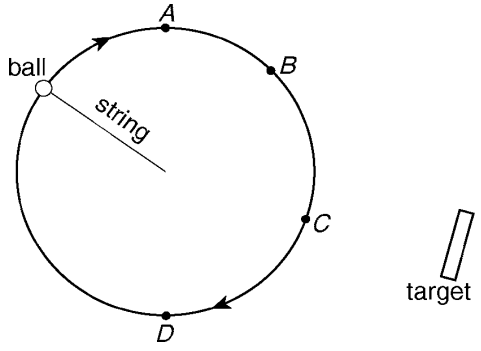
- Example 1:
  - A car rounds a curve of constant radius at a constant speed. Which diagram best represents the directions of both the car's velocity and acceleration?

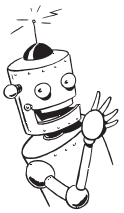


- Example 2:
  - A car travels at a constant speed of 20. meters per second around a horizontal circular track. Which diagram correctly represents the direction of the car's velocity (v) and the direction of the centripetal force (Fc) acting on the car at one particular moment?



- Example 3:
  - A ball attached to a string is moved at constant speed in a horizontal circular path. A target is located near the path of the ball as shown in the diagram below. Circle the point along the ball's path that the string be released, if the ball is to hit the target?





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- Example 4:
  - A monkey moving at a speed of 8.8 m/s rounds a corner with a radius of 25 m. What is the centripetal acceleration of the runner?

What are the givens and unknowns? *Write your formula(s) and show your work*

$a_c =$

$v =$

$r =$

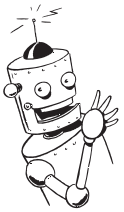
- Example 5:
  - Racing on a flat track, a car (driven by a monkey) going 32 m/s rounds a curve 56 m in radius. What is the car's centripetal acceleration?

What are the givens and unknowns? *Write your formula(s) and show your work*

$a_c =$

$v =$

$r =$



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- Example 6:
  - An athlete whirls a 7.00-kg hammer tied to the end of a 1.3-m chain in a horizontal circle. The hammer has an acceleration of 51 m/s^2. What is the tension in the chain?

What are the givens and unknowns? *Write your formula(s) and show your work*

$F_c =$

$m =$

$v =$

$r =$

- Example 7:
  - If a 40.0-g stone is whirled horizontally on the end of a 0.60-m string at a speed of 2.2 m/s, what is the tension in the string?

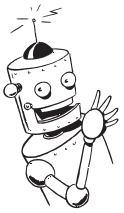
What are the givens and unknowns? *Write your formula(s) and show your work*

$F_c =$

$m =$

$v =$

$r =$



- Example 8:
  - Captain Chip (a monkey), the pilot of a 60,500-kg jet plane, is told that he must remain in a holding pattern over the airport until it is his turn to land. If Captain Chip flies his plane in a circle whose radius is 50.0 km at a velocity of 175 m/s, what centripetal force must the air exert against the wings to keep the plane moving in a circle?

What are the givens and unknowns? *Write your formula(s) and show your work*

$F_c =$

$m =$

$v =$

$r =$

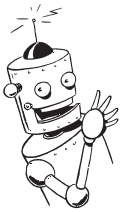
- Example 9:
  - A popular trick of Mr Sharrock and Mr Balmer is to swing a pail of water around in a vertical circle fast enough so that the water doesn't spill out when the pail is upside down. If Mr. Sharrock's arm is 0.87 m long, what is the minimum speed with which he can swing the pail so that the water doesn't spill out at the top of the path?

What are the givens and unknowns? *Write your formula(s) and show your work*

$a_c =$

$v =$

$r =$



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Student Problems

8.1 Momentum

YOU MUST SHOW ALL WORK! (Formulas, plug in numbers, answer boxed, units)

1. During an Olympic bobsled run, a Planet of the Apes team takes a turn of radius 7.62 m at a speed of 26.82 m/s (60 mph). What centripetal acceleration do the team members experience during the turn?

What are the givens and unknowns? *Write your formula(s) and show your work*

$a_c =$

$v =$

$r =$

a) _____ _____ ← units

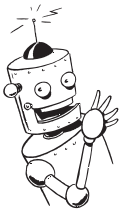
2. A monkey is washing his socks. At the end of the wash cycle, a washing machine uses centripetal force to "spin" the water out of the clothes. The diameter of the basket is 0.35-meters and the maximum velocity of a sock stuck to the wall of the basket is 8.52 m/s. What is the centripetal acceleration acting on the clothes during the spin cycle?

What are the givens and unknowns? *Write your formula(s) and show your work*

$a_c =$

$v =$

$r =$



a) _____ _____ ← units

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3. A 25-kg monkey is enjoying a ride on a merry-go-round. The monkey sits on a hours located 1.2 m from the center and has a tangential speed of 1.35 m/s. What is the centripetal acceleration and force acting on the monkey? Draw a picture of the merry-go-round and use arrows to identify the direction of the monkey's liner velocity and acceleration.

What are the givens and unknowns? *Write your formula(s) and show your work*

$a_c =$

$v =$

$r =$

a) _____ _____ ← units

4. A 2,000-kilogram car is traveling at a constant speed of 12 m/s as it rounds a circular curve of radius 30 m. What is the magnitude of the centripetal force and the centripetal acceleration of the car as it goes around the curve? Draw a picture of the car making the turn and use arrows to identify the direction of the car's liner velocity and the net force acting on the car.

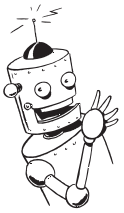
What are the givens and unknowns? *Write your formula(s) and show your work*

$F_c =$

$m =$

$v =$

$r =$



a) _____ _____ ← units

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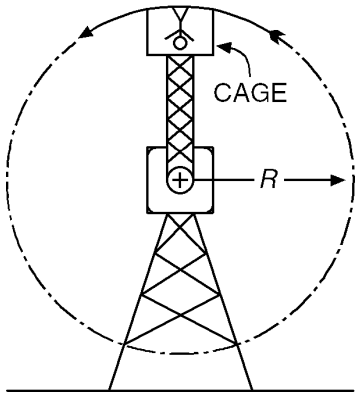
5. At an amusement park, a passenger whose mass is 65 kilograms rides in a cage. The cage has a constant speed of 12 meters per second in a vertical circular path of radius R, equal to 15 meters.



What is the magnitude of the centripetal acceleration and the centripetal force acting on the passenger?

What are the givens and unknowns? *Write your formula(s) and show your work*

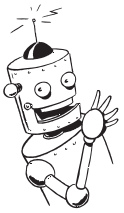
$F_c =$

$a_c =$

$m =$

$v =$

$r =$



a) _____ _____ b) _____ _____

6. A plane is piloted by a monkey and is traveling at 224 m/s. The monkey makes a sharp turn following a circular trajectory, what should 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]

What are the givens and unknowns? *Write your formula(s) and show your work*

$a_c =$

$v =$

$r =$

a) _____ _____ ← units

7. A monkey is driving out of control when he enters into a turn traveling way to fast at a speed of of 35.76 m/s (80 mph). If the total amount of friction (centripetal force) possible between the tires and the road is only 9,790 N, what is the minimum radius possible so that the car does not fly off the road? If the actual radius of the turn is only 120 m from the center does the monkey make it through the turn or does the car fly off the road?

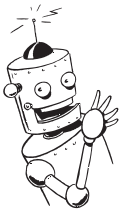
What are the givens and unknowns? *Write your formula(s) and show your work*

$F_c =$

$m =$

$v =$

$r =$



a) _____ _____ ← units

8. A force of 150 N is required to break a 3.0 m nylon cord. A 1.2 kg mass is fixed to one end of the cord and whirled around, determine the maximum speed at which the mass can travel without breaking the cord?

What are the givens and unknowns? *Write your formula(s) and show your work*

$F_c =$

$m =$

$v =$

$r =$

a) _____ _____ ← units

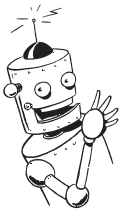
9. A popular trick of many physics teachers is to swing a pail of water around in a vertical circle fast enough so that the water doesn't spill out when the pail is upside down. In order to make sure that water does not fall out of the bucket the minimum centripetal acceleration my be at least the same as gravity. If Mr. Physic's arm is 0.60 m long, what is the minimum speed with which he can swing the pail so that the water does not spill out at the top of the swing? [use 9.8 as gravity]

What are the givens and unknowns? *Write your formula(s) and show your work*

$a_c =$

$v =$

$r =$



a) _____ _____ ← units

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