

Newton's Laws – Circular Motion

For each of the problems, include a correctly labeled free-body diagram. Identifying all the forces involved in these problems is the key to doing them correctly. Remember that “centripetal force” is just a fast way of saying that the net force is causing a centripetal acceleration.

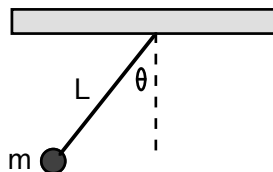
1. A 1750 kg car is traveling around in circles in a flat level parking lot. It is going a constant 7.5 m/s with a constant radius of 22 m.
 - a. What is the magnitude of the net force on the car?

 - b. Where does the centripetal force come from?

2. A 65 kg person is riding the Turkish Twist at Canobie Lake Park. It has a radius of 5 meters and is spinning at a constant 20 rpm when the floor drops, leaving the person stuck to the wall.
 - a. What is the magnitude of the net force on the person?

 - b. Where does the centripetal force come from?

3. A conical pendulum has a length of 1.7 m and a mass of 250 grams. It is spinning such that the tension in the string is 4 N.



- a. What is the net force on the mass?

- b. How fast (m/s) is the mass spinning?
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4. A conical pendulum has a length of 1.3 m and a mass of 0.6 kg. It is spinning around in a circle such that the angle θ (in the diagram above) is 30° . How fast is the mass spinning?

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5. A 75 kg person is riding a Ferris Wheel with a 25 meter radius. It is rotating at constant rate of 2 rpm.
- What is the magnitude of the net force on the person?
 - What is the normal force on the person when at the highest point?
 - What is the normal force on the person when at the lowest point?
6. A stunt rider on a motorcycle (total mass = 325 kg) is going around a loop-the-loop of radius 15 m. Imagine that they are going around the circle at constant speed of 17 m/s (probably not realistic, but hey it's a physics problem.)
- What is the normal force of the track on the motorcycle at the very top of the loop?
 - What is the normal force of the track on the motorcycle at the very bottom of the loop?
 - What is the minimum speed which the motorcycle can go around the loop and stay on the loop?
7. A car is going around a race track with a banked curve. If the car is going 45 m/s, and the radius of the curve is 250 m, what must be the angle of the bank so that friction is not needed to make the curve?

Answers:

- 1 a) 4470 N b) friction between tires and road 2 a) 1430 N b) normal force of wall pushing rider to center.
 3 a) 3.1 N b) 4.1 m/s 4) 1.9 m/s 5 a) 82 N b) 668 N
 c) 832 N 6 a) 3012 N, down! b) 9512 N c) 12.2 m/s 7) 39°