

Work each of the following problems. SHOW ALL WORK.

1. A 2 kg mass is spun on a string in a horizontal circular path at a constant speed.
 - a. Draw the free-body diagram for the mass.

 - b. If the radius of the path is 0.5 m and the period of revolution is 0.25 s, what is the speed of the mass?

 - c. What force is keeping the mass in a circular path?

 - d. What is the net force acting on the mass in the horizontal direction?

2. A 1000 kg car travels around a circular track at a constant speed.
 - a. Draw the free-body diagram for the car (as viewed from the front of the car).

 - b. If the radius of the path is 200 m and the car is traveling at 25 m/s, how long does it take the car to make a lap around the track?

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c. What is the net force acting on the car in the horizontal direction?

d. What force is keeping the car in a circular path?

e. What is the coefficient of friction between the car's tires and the road?

3. A 60 kg student rides on a roller coaster that makes a vertical loop.

a. Draw a free-body diagram for when the student is at the bottom of the loop.

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b. If the radius of the loop is 30 m, and the roller coaster is traveling at 20 m/s at the bottom of the loop, what is the net force acting on the student in the vertical direction?

c. What force does the seat apply to the student when at the bottom of the loop?

4. The moon orbits the earth with a tangential velocity of 1,022 m/s, and the orbital radius of the moon around the earth is 3.85×10^8 m. The mass of the moon is 7.35×10^{22} kg.
- a. What is the orbital period of the moon around the earth? Convert to days.

Work each of the following problems. SHOW ALL WORK.

b. What is the net force acting on the moon?

c. Using Newton's law of universal gravitation, estimate the mass of the earth using your answer from part (b) above.

5. A 6.25 g quarter sits 25 cm from the axis of rotation on a turntable that has a period of rotation of 1.8 seconds. What must the coefficient of static friction be in order to keep the quarter from sliding outward when the turntable is in motion?

