

Worksheet 5.1 Circular Motion: Centripetal Acceleration

1) Calculate the net force acting on a 925 kg car as it rounds an unbanked curve with a radius of 75 m at a speed of 22 m/s.

$$(6.0 \times 10^3 \text{ N})$$

2) A small plane makes a complete circle with a radius of 3282 m in 2.0 min. What is the centripetal acceleration of the plane?

$$(9.0 \text{ m/s}^2)$$

3) A car with a mass of 833 kg rounds an unbanked curve in the road at a speed of 28.0 m/s. If the radius of the curve is 105 m, what is the average net force exerted on the car?

$$(6.2 \times 10^3 \text{ N})$$

4) An amusement park ride has a radius of 2.8 m. If the time of one revolution of a rider is 0.98 s, what is the speed of the rider? (18 m/s)

5) An electron ($m = 9.11 \times 10^{-31} \text{ kg}$) moves in a circle whose radius is $2.00 \times 10^{-2} \text{ m}$. If the force acting on the electron is $4.60 \times 10^{-14} \text{ N}$, what is its speed?

$$(3.18 \times 10^7 \text{ m/s})$$

6) A 925 kg car rounds an unbanked curve at a speed of 25 m/s. If the radius of the curve is 72 m, what is the minimum coefficient of friction between the car and the road required so that the car does not skid?

$$(0.89)$$

7) A $2.7 \times 10^3 \text{ kg}$ satellite orbits the Earth at a distance of $1.8 \times 10^7 \text{ m}$ from the Earth's centre at a speed of $4.7 \times 10^3 \text{ m/s}$. What force does the Earth exert on the satellite?

$$(3.3 \times 10^3 \text{ N})$$

8) A string can withstand a force of 135 N before breaking. A 2.0 kg mass is tied to the string and whirled in a horizontal circle with a radius of 1.10 m. What is the maximum speed that the mass can be whirled at before the string breaks?

$$(8.62 \text{ m/s})$$

9) A 932 kg car is traveling around an unbanked turn with a radius of 82 m. What is the maximum speed that this car can round this curve before skidding:

a) if the coefficient of friction is 0.95? (28 m/s)

b) if the coefficient of friction is 0.40? (18 m/s)