

Physics 122
Chapter 11 – Projectile and Circular Motion
Problems – Circular Motion

1. An electric train moving at constant speed on a circular track of radius 1.0 m goes around the track every 10 s. What is the centripetal acceleration of the train?
2. A plane flying at a constant speed in a circular path of radius 5500 m completes one revolution every 485 s.
 - a) What is the speed of the plane?
 - b) What is the acceleration of the plane?
3. A stone attached to a string 2.0 m long is whirled in a horizontal circle. At what speed must the stone move for its centripetal acceleration to equal to g ?
4. The blade of a fan is 0.20 m long and makes 20 revolutions per second. What acceleration is experienced by a particle at the end of the blade?
5. An electron moves in a circular path of radius 0.20 m at a constant speed of 2.0×10^6 m/s.
 - a) What is the period of its motion?
 - b) What is its centripetal acceleration?
6. An object moving along a circular path at a constant speed of 8.0 m/s completes one trip around the circle in 5.0 s.
 - a) What is the radius of the circle?
 - b) What is the acceleration of the object?
7. A student attaches a mass of 0.5 kg to one end of a rope. The student then swings the mass in a horizontal circle having a radius of 1 m so that the tangential speed is 4 m/s. What centripetal force must be exerted on the mass to keep it moving in a circle?
8. An artificial satellite has a period of 5.6×10^3 s and an orbital radius of 6.8×10^6 m. If its mass is 2.0×10^3 kg, what is the centripetal force keeping it in orbit?
9. If a 620 kg racecar takes 15.2 s to travel at constant speed once around a circular race track of 50.0 m radius, what are the centripetal acceleration of the car and centripetal force exerted by the track on the car's tires?
10. A knight holds a 1.6 m chain attached to 10.0 kg mace. He whirls the mace in a circle. If the mace has a frequency of 0.20 Hz, what is the centripetal acceleration of the mace and the tension in the chain?

Answers

1. The centripetal acceleration of the train is 0.39 m/s^2 .
2. a) The speed of the plane is 71.2 m/s .
b) The acceleration of the plane is 0.922 m/s^2 .
3. Its speed must be 4.4 m/s .
4. The particle experiences an acceleration of $3.2 \times 10^3 \text{ m/s}^2$.
5. a) The period is $6.3 \times 10^{-7} \text{ s}$.
b) The centripetal acceleration is $2.0 \times 10^{13} \text{ m/s}^2$.
6. a) The radius of the circle was 6.4 m .
b) The acceleration of the object is 10 m/s^2 .
7. The centripetal force is 8 N .
8. The centripetal force is $1.7 \times 10^4 \text{ N}$.
9. The centripetal acceleration and centripetal force are 8.53 m/s^2 and $5.29 \times 10^3 \text{ N}$.
10. The centripetal acceleration is 2.5 m/s^2 and the tension in the chain is 25 N .