Circular Motion Equations Worksheet

Level: A-Level / AP Physics 1 / IB HL | Difficulty: Advanced | Topic: Mechanics

Practice uniform circular motion with 10 problems covering centripetal acceleration, centripetal force, angular velocity, and period. Full solutions included.

Equations you will need

a = v^2/r	Centripetal acceleration
F = mv^2/r	Centripetal force
? = v/r	Angular velocity
T = 2pi/?	Period
v = 2pir/T	Linear speed from radius and period

Symbol key

Symbol	Quantity	Unit
a	centripetal acceleration	m/s^2
v	linear speed	m/s
r	radius	m
F	centripetal force	N
?	angular velocity	rad/s
T	period	s
m	mass	kg

Practice problems

1. A car travels at 10 m/s on a circular track of radius 20 m. Find centripetal acceleration.

2. Find the centripetal force on a 1500 kg car going 25 m/s around a 50 m radius curve.

3. A point on a 0.3 m diameter wheel rotates at 4 rev/s. Find linear speed.

4. Find the period of a satellite in a 7000 km orbit moving at 7500 m/s.

5. A 0.5 kg ball on a 1 m string is whirled at 3 rev/s. Find the tension.

6. A 800 kg car rounds a flat curve of radius 40 m at 15 m/s. Find required friction force.

7. Find ? for an object completing one revolution every 4 seconds.

8. A 2 kg mass swings in a horizontal circle of radius 0.8 m at angular velocity 5 rad/s. Find centripetal force.

9. A car at 20 m/s rounds a curve where max friction force = 8000 N. Min radius if car mass is 1200 kg?

10. The Moon orbits Earth in 27.3 days at radius 3.84x108 m. Find its orbital speed.

Answer key

Full worked solutions for each problem.

1. a = v^2/r = 100/20 = 5 m/s^2
2. F = mv^2/r = 1500(625)/50 = 18,750 N
3. v = 2pir x f = 2pi(0.15)(4) = 3.77 m/s
4. T = 2pir/v = 2pi(7x106)/7500 = 5864 s ? 98 min
5. ? = 6pi rad/s; v = 6pi m/s; F = mv^2/r = 0.5(6pi)^2/1 = 177.6 N
6. F = 800(225)/40 = 4500 N
7. ? = 2pi/T = 2pi/4 = 1.57 rad/s
8. v = ?r = 4 m/s; F = mv^2/r = 2(16)/0.8 = 40 N
9. 8000 = 1200(400)/r -> r = 60 m
10. T = 27.3 x 86400 = 2.36x106 s; v = 2pir/T = 1023 m/s