

8.1 UNIFORM CIRCULAR MOTION

1. When you take your 1200-kg car out for a spin, you go around a corner of radius 57 m with a speed of 15 m/s. The coefficient of static friction between the car and the road is 0.88. Assuming your car doesn't skid, what is the force exerted on it by static friction?
2. To test the effects of high acceleration on the human body, the National Aeronautics and Space Administration (NASA) has constructed a large centrifuge at the Manned Spacecraft Center in Houston. In this device, astronauts are placed in a capsule that moves in a circular path with a radius of 15 m. If the astronauts in this centrifuge experience a centripetal acceleration 9.0 times that of gravity, what is the linear speed of the capsule?
3. A car goes around a curve on a road that is banked at an angle of 31.5° . Even though the road is slick, the car will stay on the road without any friction between its tires and the road when its speed is 227 m/s. What is the radius of the curve?
4. Jill of the Jungle swings on a vine 6.5 m long. What is the tension in the vine if Jill, whose mass is 61 kg, is moving at 2.4 m/s when the vine is vertical?
5. You swing a 4.5-kg bucket of water in a vertical circle of radius 1.1 m. **(a)** What speed must the bucket have if it is to complete the circle without spilling any water? **(b)** How does your answer depend on the mass of the bucket?

8.2 NEWTON'S LAW OF UNIVERSAL GRAVITATION

6. In each hand you hold a 0.26-kg apple. What is the gravitational force exerted by each apple on the other when their separation is **(a)** 0.25 m and **(b)** 0.50 m?
7. A 6.1-kg bowling ball and a 7.2-kg bowling ball rest on a rack 0.75 m apart. **(a)** What is the force of gravity exerted on each of the balls by the other ball? **(b)** At what separation is the force of gravity between the balls equal to 2.0×10^{-9} N?
8. A communications satellite with a mass of 450 kg is in a circular orbit about the Earth. The radius of the orbit is 35,000 km as measured from the center of the Earth. Calculate **(a)** the weight of the satellite on the surface of the Earth and **(b)** the gravitational force exerted on the satellite by the Earth when it is in orbit.
9. At new moon, the Earth, Moon, and Sun are in a line, as indicated in the figure below. Find the direction and magnitude of the net gravitational force exerted on **(a)** the Earth, **(b)** the Moon, and **(c)** the Sun.



NAME _____

PERIOD _____

UNIT 8 PRACTICE PROBLEMS

AP PHYSICS

8.3 KEPLER'S LAWS AND SATELLITE MOTION

10. On Apollo missions to the Moon, the command module orbited at an altitude of 110 km above the lunar surface. How long did it take for the command module to complete one orbit?
11. Find the orbital speed of a satellite in a geosynchronous circular orbit $3.58 \times 10^7 \text{ m}$ above the surface of the Earth.
12. Phobos, one of the moons of Mars, orbits at a distance of 9378 km from the center of the red planet. What is the orbital period of Phobos?
13. GPS (Global Positioning System) satellites orbit at an altitude of $2.0 \times 10^7 \text{ m}$. Find **(a)** the orbital period, and **(b)** the orbital speed of such a satellite.
14. An asteroid revolves around the Sun with a mean orbital radius twice that of Earth's. Predict the period of the asteroid in Earth years.
15. A planet's mean distance from the sun is $2.0 \times 10^{11} \text{ m}$. What is its orbital period?
16. Jupiter is 5.2 times farther from the Sun than Earth is. Find Jupiter's orbital period in Earth years.