1. A child moves with a speed of 1.80 m/s when 12.4 m from the center of a merry-go-round. Calculate the centripetal acceleration and the centripetal force if the child has a mass of 25 kg.

2. A plane is travelling 500 m/s and travels in a horizontal loop of diameter 3.00 km, find the centripetal acceleration on the plane. If the plane were to pull out of a dive having the same diameter, how many g's would the pilot pull?

3. If a horizontal force of 26.0 N is applied to a 0.60 kg stone to keep it in a horizontal circle of radius 0.40 m, calculate the speed of the stone.

4. What is the maximum speed with which a 1500 kg car can negotiate a turn of radius 95 m on a flat road if the coefficient of friction is 0.55?

5. If the maximum speed that an 800 kg car can negotiate a turn having a radius of 62 m is 15 m/s, find the coefficient of friction.

6. Tarzan is planning to cross a gorge by swinging in an arc from a hanging vine. If his arms can exert a force not exceeding 1500 N, What is the maximum speed that he can tolerate at the lowest point in his swing? His mass is 85 kg and the vine is 4.0 m long.

7. It is possible to whirl a bucket fast enough so that the water inside, does not fall out. Assuming your arm is 1.0 m long, how fast do you have to swing the bucket so that the water doesn't come out?

8. Because the Earth rotates once per day, the effective acceleration of gravity at the equator is slightly less than at the poles. If the radius of the Earth is 6400 km and the mass of the Earth is $6 \cdot 10^{24} kg$, find the centripetal acceleration and the net acceleration of gravity (9.8 less a_c).

9. What is the minimum speed that a roller coaster must have to do the loop-de-loop if the radius of the loop is 8.0 m?

10. What speed must a satellite have to orbit at a constant altitude of 600 km. (the radius of the Earth is 6400 km)

11. Find the acceleration of gravity at an altitude of 200 km above the Earth.

12. At what altitude would the acceleration of gravity be 7.5 m/s^2?

13. A 50 cm string has a breaking force of 50 N. How fast could a 100 g steel ball tied at one end be spun in a horizontal circle on a frictionless table-- a vertical circle?

14. What is the centripetal force required to keep a 3.0 kg mass moving in a circle of radius 0.5 m at a speed of 8.0 m/s?

15. A space station having a radius of 500 m is spun to simulate gravity. How fast does it have to spin so that the centripetal acceleration is equal to that of Earth?

16. A toy cart is at the end of a 70 cm string and is forced to travel in a circle on a table. The cart has a mass of 300 g and the string has test strength of 40 N. Find the maximum speed the cart can travel before the string breaks.

17. A 1000 kg car is travelling on wet pavement at a speed of 30 m/s. If the coefficient of friction is 0.25, what is the smallest radius turn that the car can make before sliding?

18. A dime, mass 20.0 g is placed 10 cm from the center of a record that is rotating at $33\frac{1}{3}$ rpm. If the coefficient of friction is 0.3 between the dime and the record, will the dime start to slide?

19. A dime is placed on the dashboard of a van that is travelling around a circular turn, radius 40 m, at 15.0 m/s. If this is the maximum speed that it can travel before the dime starts to slide across the dashboard find the coefficient of friction between the dashboard and the dime. Assume that the dime has a mass of 20.0 g.

20. In a famous Bugs Bunny Cartoon, Bugs shows Queen Isabella of Spain that the Earth is round by throwing a baseball westward and waiting for the ball to orbit the Earth, and catching the ball as comes from the East. Assuming that the ball is thrown from sea level (the distance from the center of the Earth would be the radius of the Earth), find the orbital velocity and the time it would take to orbit the Earth at sea level. Assume that the ball does not encounter any hills or mountains on its orbit.

21. A 50.0 g toy plane is attached to a 50.0 cm string. It is swung in a circle such that the string makes an angle with vertical of 30°. Find the orbital velocity. Note that the centripetal force is the resultant of the tension in the string and the weight of the plane. Assume that the string has negligible weight.

22. A 10,000 kg spaceship is on its way to the Moon from the Earth. The distance from the Moon to the Earth is 384,000 km. At some point between the Earth and the Moon, the gravitational force between the Earth and the spaceship would equal the gravitational force between the Moon and the spaceship. At what point between the Earth and the moon would this happen? Would it matter what the mass of the spaceship was?

23. When this spaceship reaches the moon it goes into a circular orbit at an altitude of 200 km above the moon. Find the orbital velocity of the spaceship if the radius of the moon is 1740 km and its mass is $7.0 \cdot 10^{22}$ kg.

24. If an astronaut, mass 80 kg were to set for on the moon, find the acceleration of gravity and his weight.

25. The mass of Jupiter is 318 times that of Earth. It orbits the Sun every 11.86 years. Find the distance from the Sun to Jupiter.

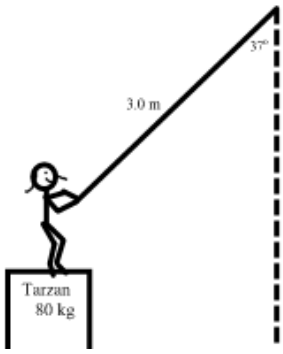
26. A 30 g roulette ball spins around the table having a diameter of 60 cm. How fast does the ball have to travel to stay against the outer edge if the slope of the table is 30°? (Assume that there is no friction and the diameter of the table is the diameter of the ball's orbit)

27. Refer to #21, if the plane was swung with an orbital velocity of 4.50 m/s, what angle would it make with the vertical axis at this speed?

28. Find the correct banking angle of a race track, if the radius of the turn is 50.0 m and the car speed is assumed to be 20.0 m/s. The mass of the car is 1000 kg

29. Find the time, in days, it takes the Moon to orbit the Earth if the distance from the Earth to the Moon is 384,000 Km.

30. Tarzan is getting ready to swing on a vine. Find the speed at the bottom of his swing and the tension in the rope at that point.



31. An electron travelling at $5x10^{4}$ m/s travelling from left to right, passes through a magnetic field that, 0.50 T that is acting into the page. Find the radius of the circle that it will traverse and draw a diagram showing its path. The mass of the electron is $9x10^{-31}$ kg.

32. A mass spectrograph is a device used to separate isotopes of an element. Assuming that a charged beam of hydrogen (charge +1) that contains both isotopes of hydrogen, one having a proton and one having a proton and a neutron. Find the distance that separates them after travelling a full semi-circle if they are passed through a magnetic field having an induction of 2.5 T. Assume that the mass of the a proton and a neutron is the same and is $1.7x10^{-27}$.

33. Using Kepler's 3rd law, determine the period of a satellite around the Earth that was halfway between the Earth and the Moon.

34. A child on a trike and does a loop-de-loop. Will he fall off at the top of the loop? The mass of the boy and the trike are 25.5 kg. (Hint Find W_{PE} and W_{KE})