# Circular Motion

1. A space shuttle is placed in a circular orbit at an altitude of 3.00 x 105m above Earth’s surface.

 original orbit

 new orbit

 a) What is the shuttle’s orbital speed in original orbit?

 b) The space shuttle is then moved to a higher new orbit in order to

 capture a satellite. The shuttle’s speed in this new higher orbit

 will have to be:

 EARTH a. greater than in the lower orbit.

 b. less than in the lower orbit.

 c. the same as in the lower orbit.

 c) Using principles of physics, explain your answer to (b).

2. A satellite movies in a circular path at a constant speed. Which vector in the diagram below best represents the satellite’s acceleration?

 I

A. I

B. II

C. III IV II

D. IV III

3. A 2.5 kg object moves at a constant speed of 8.0 m/s in a 5.0 m radius circle. What is the object’s acceleration?

4. What is the magnitude of Earth’s centripetal acceleration as it orbits the Sun?

5. A 35 kg child rides a ferris wheel of radius 12 m. The child moves in a vertical circle at a **constant speed** and completes one rotation every 9.0s.

a) As the child travels over the top, what is the magnitude of the force that the seat exerts on the child?

b) How does the magnitude of the child’s acceleration at the top of the ride compare to him acceleration at the bottom?

c) The child’s acceleration at the top is: (circle one)

 i) less than at the bottom.

 ii) greater than at the bottom

 iii) the same as at the bottom

Explain your choice using principles of physics.

6. **Need Work/Energy!!!!**

 A student on a distant planet performs a “loop-the-loop” experiment. He releases a frictionless 1.3kg cart from a height of 4.50m. It is observed that the track exerts a downward, normal reaction force of 21N on the cart at the top of the circle. Calculate the gravitational field strength on the distant planet.

 4.50m

 1.40m

7. A physics student swings a 5.0 kg pail of water in a vertical circle of radius 1.3m.

 *v*

What is the minimum speed, *v*, at the top of the circle if the water is not to spill from the pail?

8. A satellite orbits Earth at a velocity of 3.1 x 103 m/s. What is the radius of this orbit?

9. A satellite orbits a planet with a speed of 8000.0m/s. If this satellite were to orbit the same planet with twice the previous orbital radius what would its speed be?

10. A 1289kg car travels around a reverse banked turn (i.e. the inner edge of the corner is higher than the outer edge). The angle of banking is 14.0o and the radius is 88m. If the coefficient of static friction between the tires and the road is 0.790, find the maximum speed.

11. A mass is suspended by a 1.2m long string, and swings in a horizontal circular path, as shown in the diagram. The tension in the string is 16.0N.

 28o

Find the period of rotation.

12. A 75kg skier passes over the top of a hill, which can be considered a section of a vertical circle, at 12.0m/s. At the top of the hill the normal force on the skier is 600.0N. Find the radius of the hill.

13. A cylindrical space station rotates so that a point on its outer surface travels at 115m/s. If the artificial gravity in the space station is 7.5m/s2, find the radius of the space station.

14. A car travels around an unbanked circular corner, r=45.3m. The coefficient of static friction between the tires and the road is 0.888. Find the maximum speed.

15. A car travels around a banked turn at a speed above the ideal speed. The force of friction on the 1543kg car is 5608N. The angle of banking is 22o and the radius of the turn is 28.6m. Find the speed of the car.

16. A car travels over a hill that can be approximated as a section of a circle with a radius r. As the 1200kg crests the hill the normal force on the car is 9760N.





Find the normal force acting on the car as it passes the bottom of a hill that is a section of circle of the same radius, at the same speed.