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January 9, 2002

Centripetal Force

Objective: To understand the nature of centripetal force in relation to Newton's Second Law of Motion and measure the centripetal force required to stretch a spring in a rotating system.

Newton's First Law of Motion states that an object that experiences no external forces will continue to move in a straight line with a constant velocity. Combining this with Newton's Second Law (F = m * a), we see that an object with no force acting on it is not accelerating (a = 0).

Acceleration is a vector which depends on the changing velocity of a system. Since velocity is also a vector, there are two ways in which it can change: we can change its magnitude (strength) or its direction. If either of these changes occur to the velocity vector, the object is accelerating. To move an object in a circular path at a constant velocity, the direction of the velocity vector must be constantly changing. Thus the object must be accelerating, and there is a force (centripetal) which is a vector that always points along the radius of the circle towards the center, described by the equation:

$$F = \frac{mv^2}{r}$$

In this experiment, we will first measure the force required to stretch a spring a certain distance by using the force of gravity. We will then stretch the string the same distance by rotating the system and use the equations for frequency to determine the amount of centripetal force acting on the rotating object.

Hypothesis: The amount of centripetal force required to stretch the spring should be the same as the amount of gravitational force required to stretch the spring.