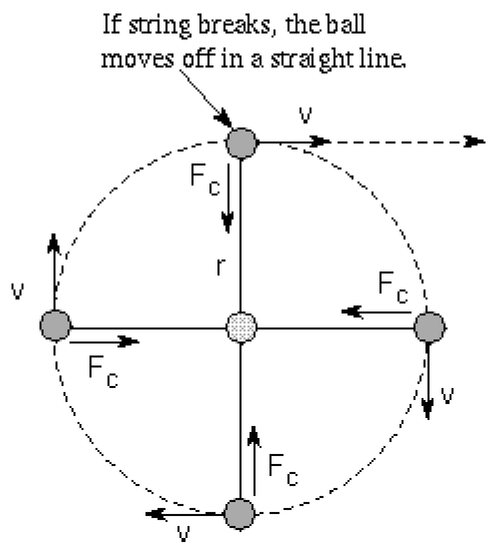
Dynamics of Uniform Circular Motion

1. **Since an object in uniform circular motion is constantly accelerating there must be net force acting on the object.**

$$\Sigma F_r = ma_r = mv^2/r$$

2. **This net force is directed to the centre of the circular path and is known as the centripetal force (centre seeking).**



$F_c = m v^2 / r$

Just enough centripetal force F_c to balance the speed; just enough speed to balance the centripetal force.

3. **There is no centrifugal force. The force you feel on the string is the reaction force of the ball. You pull on the ball to keep it changing direction and the ball pulls on you as a reaction force.**

4. **Forces on a tetherball see overhead.**

Example 5-5 page 118: A 0.150kg ball on the end of a 1.10m long string is swung in a vertical circle. Determine the minimum speed the ball must have in order to continue to move in a circle. Calculate the tension in the string at the bottom of the circle assuming the ball is moving at twice the minimum speed of at the top.

Part 1:

$$\mathbf{\Sigma F_r = mv^2/r}$$

$$\mathbf{\Sigma F_r =}\ F_{ta} + mg = mv_a^2/r$$

For the minimum speed F_{ta} is zero so

$$mg = mv_a^2/r$$

$$v_a = \sqrt{gr}$$

$$9.8\text{m/s}^2 \times 1.10\text{m} = 3.28\text{m/s}$$

Part 2:

$$F_{tb} - mg = mv_b^2/r$$

$$F_{tb} = mv_b^2/r + mg$$

$$\mathbf{F_{tb} = (0.150kg)\frac{(6.56m/s)^2}{(1.10m)} + (0.150kg)(9.80m/s^2) = 7.34N}$$