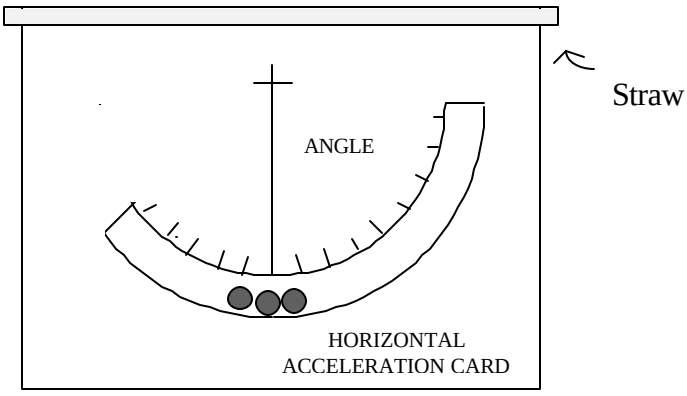
LAB A8 & A9: Instructions for the Use of the Horizontal Accelerometer

10/10/01

The horizontal accelerometer consists of an inverted protractor whose rim is surrounded by transparent plastic tubing inside of which 3 metal Bbs have been placed.

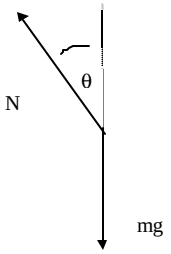
BBs are pictured for constant velocity situation



The accelerometer should be held so that the base of the protractor is pointing along the horizontal acceleration to be measured. For example, suppose the acceleration is directed to the left. If the accelerometer is held as shown in the picture above, the leftward acceleration will result in the BB's moving to the right-side of the accelerometer. If the acceleration is circular, the base of the protractor should be pointed toward the center of the circle; the BB's will be on the opposite side of the protractor.

The force diagram for the BB's is shown at the right.

mg = weight of the BB's
and N = the normal force of the plastic tubing bottom on the BB's



The net force in the vertical direction is zero (since there is no acceleration in the vertical direction: Newton's second law); therefore,

$$F_{net,V} = N\cos\theta - mg = ma_v = 0$$

therefore, $N\cos\theta = mg$

The net force in the horizontal direction is equal to ma (where **a** is the acceleration, which we previously agreed was to the left). This follows from Newton's second law.

$$F_{net,H} = N\sin\theta = ma$$

Dividing the previous two equations gives **$a = g\tan\theta$**