

**LAB A8b: TESTING THE HORIZONTAL ACCELEROMETER  
ON A PLAYGROUND MERRY-GO-ROUND**

10/10/03

Prelab: Read the instructions for use of the horizontal accelerometer (on reverse side) before beginning.

- 1) Assume that the accelerometer is oriented horizontally and is experiencing a constant acceleration to the left. In your lab book, sketch how the accelerometer and BB's will appear in this situation (it is not important at exactly what angle the BB's will be, but it is important what side of the accelerometer the BB's will move to !). Clearly label the direction of acceleration of the BB's and the angle of the protractor at which the BB's sit.
- 2) Do a net force analysis (force diagram, net force equations, etc.) for the BB's. You may ignore frictional effects.
- 3) Use your net force equations to derive an expression for the acceleration experienced by the BB's, in terms of only the gravitational field  $g$  and the angle of the protractor at which the BB's sit.
- 4) Watch the video clip of the Merry-Go-Round and complete the electronic prelab questions. Your instructor will give you the web address where you can do those things.

Procedure:

**IMPORTANT: MAKE SURE THAT YOU READ THIS ENTIRE PAGE BEFORE STARTING!!  
YOU HAVE TO DO SEVERAL THINGS AT ONCE.**

Since the acceleration on a MGR rotating at constant speed is directed toward the center of the MGR, orient the accelerometer so that the plane of the card is radial (i.e., pointing to the center of the MGR). The side of the accelerometer that has markings for the full range of angles (0-90°) should be pointed toward the outside of the MGR. The bottom edge of the card should be flush with the MGR platform; the middle BB should lie directly below the zero-degree mark. (Some accelerometers read different angles on the two sides. What can you do about this?)

While some people in the group keep the MGR rotating at constant speed, others should measure the rotation period accurately (which means timing for at least 5 or 10 periods, right?), while the riders should measure the angle at which the BB's remain. In order to determine the acceleration experienced by the accelerometer BB's, what radial distance should be measured for each rider? Be specific.

**Clearly** record all directly measured data.

Analysis:

- 1) Use your distance and time data above to calculate the horizontal acceleration experienced by the accelerometer BB's. Show work clearly; **do not** start with numbers first.
- 2) Now use your direct angular measurement from above to calculate another value of the acceleration. Compare this with the value from the previous part.
- 3) Predict the position of the BB's if the accelerometer were placed at the center of the ride. Explain.

If you have time, repeat the measurements and calculations described above for a different period of rotation.