Physics Exploration Homework Supplement **P110-3.pdf**

Measurement of “g” on an Inclined Air Track

Go to the Physics Exploration Center. Enter through the resource room 311/312 Thaw Hall.

Before you start this exploration assignment answer the following questions:

(1) Consider the following statement by a student: "When a baseball soars in the sky after being hit by a bat, the "force of the hit" still acts on the ball after it has left contact with the bat." Do you agree or disagree with the student? Explain.

(2) If an object is released from the top of an inclined frictionless surface with an angle of inclination θ with the horizontal, the magnitude of ACCELERATION of the object down the plane

(a) depends on whether the object started from rest or was given an initial push at the top of the incline plane
(b) is always g sin (θ) where g is the magnitude of the acceleration due to gravity
(c) continuously increases
(d) is zero
(e) none of the above

This week you will play with an air track demonstration. When the air is turned on, objects can slide with negligible friction on the track. Such instruments are useful for understanding Newton's laws. You can change the incline from horizontal to tilted by placing the 2 centimeter disk under the front leg of the air track. Attached to the air track is a sonar displacement sensor. The sensor is attached to a computer. When triggered, the computer will track the velocity and acceleration of the slider.

(a) Predict whether the velocity and acceleration of the slider will change if you push the slider (and then let go) with different initial force on a "horizontal" surface. Explain your reasoning. Now try pushing the slider with different initial force on a horizontal air track. Measure the velocity and acceleration for each case. Does the acceleration of the slider depend upon the initial force (push) that you apply to get the slider moving? Justify your answer.

(b) What is the magnitude of the acceleration for the slider moving on the horizontal friction-less track in part (a) for all initial pushes that you apply? What does it tell you about the net force on the slider along the track while it is moving? Does it make sense? Justify your answer using Newton's laws of motion.

(c) What was the purpose of the initial force that you applied to get the slider moving? Does this force still act on the slider after you let go of it?

(d) Perform the same measurements when the air track is inclined. Try giving different initial pushes and measure the acceleration of the slider along the track when it is let go from rest at the top of the track. Does the acceleration of the slider depend upon the initial force (push) that you apply to get the slider moving? Justify your answer. Attach graphs showing velocity vs. time and acceleration vs. time for two different initial pushes.

(e) Measure the angle of inclination θ of the track (you can do this by measuring tangent of θ). Does the magnitude of the acceleration from the graph in part (d) equal the component of acceleration due to gravity $g\sin(\theta)$ along the direction of motion ($g = 9.8 m/s^2$ is the magnitude of the acceleration due to gravity)? Why does the normal force not cause any acceleration in that direction? Justify your answer.

(f) If you agreed with the statement about the baseball at the beginning of this assignment, have you changed your mind after doing this assignment? Justify your answer.