Box of accessories, including gliders, index markers, etc.

Stopclocks: M-1 S-1
All else: Back of M cases

Linear air track with blower

Set the air track on the lecture table with its feet on the 3" square plates provided, and with the scale on the lecturer's side. Level the track carefully, using first the two levels mounted thereon and then making the final critical adjustment of the longitudinal level by adjusting the height of the single foot until a glider on the track remains essentially stationary.

Uniform Motion on Level: Place on the level track one of the small gliders. Give this glider a small velocity (SEE WARNING) and let it move back and forth along the track. To the extent that friction has been eliminated and all collisions are perfectly elastic, the glider should move with constant speed. Simply by observing the motion one sees that these ideal conditions are approached rather closely. Should one desire, two coordinated electric stopclocks can be used to compare the speeds on two successive excursions along the track. Both clocks can be started simultaneously as the glider leaves one end of the track. One clock can be stopped as the glider completes one excursion; the second can be stopped at the end of the subsequent excursion. (See Note 1.)

Uniformly Accelerated Motion on Incline: With the track carefully leveled, place under the single foot one of the 1.5" squares provided, preferably the one 2.00 cm thick.

Acceleration Down Incline Independent of Mass: Place at the top of the incline both a small and a medium-sized glider, one against the other, with the thumb nail against the front glider and the rear glider not quite touching the spring at the top of the incline. Note that, when released (see Note 2), the two gliders have equal accelerations even though one has twice the mass of the other. To show that the rear glider was not being held back by the front glider, interchange the positions of the two gliders and repeat.

(over)
Acceleration Down Incline is Uniform: Place an index marker at the center of the track (188.4). Simultaneously release a medium-sized glider from the top of the incline and start both stopclocks. Stop No.1 clock as the center of gravity of the glider passes the index marker, and No. 2 clock as the glider strikes the stop at the lower end of the incline. If the acceleration has been uniform the time required for the entire distance should be the square root of 2 time that required for half the distance. Knowing that the entire distance a medium-sized glider travels on the incline is 347.4 cm (376.8 - 29.4), one can, if he prefers, calculate and compare the actual accelerations for travel down the first half of the incline and for travel down the entire incline.

Determination of g: The distance between feet of the track, measured parallel to the inclined track, is 279.4 cm. Using a 2.00-cm block, \[\sin \phi = 2.00/279.4 = 0.00716\], where \(\phi\) is the angle of elevation of the inclined track. Knowing that in traveling the entire length of the track a medium-sized glider actually travels 347.4 cm, and having measured the time required to travel this distance, the acceleration of gravity, \(g\), can be calculated. (See Note 3.)

Note 1: With the "both" switch in the "off" position and the "No. 1" and "No. 2" switches in the "on" position, reset each clock to zero. Closing the "both" switch starts both clocks simultaneously. Opening the "No. 1" or "No. 2" switch stops the corresponding clock. In case the left hand is being used to release a glider, the clocks can be started with the right hand alone by setting the control box on the table. The box can then be picked up and carried to any desired point at which it is desired to stop a clock.

Note 2: In releasing a glider from rest at the top of the incline, it is advisable to place the thumb nail of the left hand against the lower part of the glider, then jerk the hand away in a direction starting parallel to the track.

Note 3: Do not expect great accuracy. As one would expect, there remains a small frictional force. If this were the only force other than that of gravity there are ways in which a proper correction could be determined. As the glider moves down the plane, however, there appears to be another force, opposite to friction, which depends somewhat on both the mass of the glider and the angle of the incline. Accuracy of about 5 to 10% is all one can expect.

WARNING: Experience has shown that some instructors use such poor judgment in their choice of glider velocities that the springs on the ends of the gliders have all too frequently been permanently bent out of shape. Bumpers have therefore been mounted within the springs to avoid this damage. In order that a collision be perfectly elastic, it is of course necessary to use velocities sufficiently low that the springs never strike the bumpers. The maximum allowable velocity for one of the smaller gliders is that for which the glider requires about 4 seconds to travel the entire length of the track. Heavier gliders must be limited to somewhat lower velocities.