32290 Economy Coriolis Apparatus

Purpose:

This apparatus is designed to demonstrate that the Earth's rotation causes linear motion to be perceived as curvilinear motion, and is different in the northern and southern hemispheres.

Background:

The rotation of the earth has an influence on objects moving independently of the surface. This influence, called the Coriolis effect is named after the French physicist who first described it mathematically in 1835. An understanding of this behavior will be helpful when students are examining weather phenomena brought about by moving air and currents of water.

The revolving turntable simulates the motion of the earth looking down on the northern hemisphere by turning the disk counterclockwise, or in the opposite direction for the southern hemisphere. With this apparatus, the steel sphere represents any unattached object moving across the earth's surface, including projectiles, winds, and water currents.

Procedure:

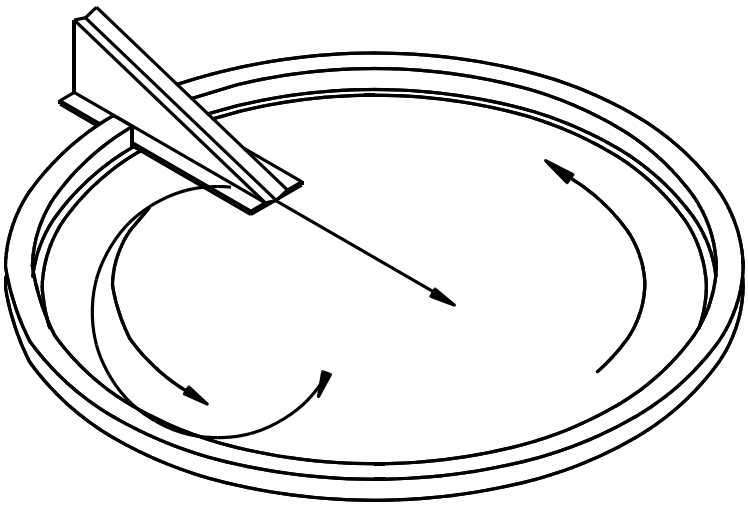
Using cut pieces of the hook and loop material, arrange to mount the ramp within the slot at the edge of the turntable so that the slope of the ramp is towards the center of the turntable. Hook and Loop fastenings are provided to hold the launch ramp for this and subsequent trials. Simply cut the material into appropriate sized pieces, peel off the paper backing, and stick the material on the surface of the turntable and the bottom of the ramp. Care must be exercised to only use the "hook" material on the ramp, for instance, and then only the "loop" on the turntable. In this way, the ball can be launched towards or away from the "pole" about which rotation is being considered. Then, place the special carbon paper (a soft formulation carbon paper for pen and pencil) over a piece of white paper on the turntable. This yields a clear and unmistakable trace as the ball rolls over the back of the carbon paper, forcing it to mark the white paper. Next, without rotating the turntable, release the ball on the ramp, and notice the track left on the white paper. Repeat this several times, and notice the results.

To see the effects of surface motion on the rolling ball, begin by attaching the launch ramp with the slope towards the center, but most of the ramp extended through the slot and well beyond the edge of the turntable, but not so far that if falls off during use. Start a counterclockwise rotation by gently holding onto the ramp, and at the same time, release the steel ball from the top of the ramp. Again, repeat this for several different rates of rotation and positions of the ramp.

The relationship between direction of rotation, rate of rotation and the actual pathway on the white paper can be thoroughly investigated.

The launch ramp can now be moved in and positioned so that the ball is crossing the axis of rotation as it leaves the ramp, and is rolling towards the perimeter of the turntable. Again, both directions of rotation can be tried. In this view, an object such as a missile, wind, or current of water is seen to be moving from the pole towards the equator. This differs from the first demonstration in which the ball was launched towards the pole, past it, and on towards the equator.

In all cases, the turntable should be rotated gently, somewhat slowly, and the ball should be allowed to make its curved path on the white paper as it presses down on the carbon paper. At the same time, an effort should be made to notice the path of the ball with respect to the room itself which is not moving, of course.



Evaluation Questions:

Given sketches of plausible tracks, students should be able to distinguish those belonging to the northern hemisphere from those belonging to the southern hemisphere and be able to tell which were produced by slow rotation and which by more rapid rotation of the turntable.

1. When the turntable was turning counterclockwise, simulating the motion of the northern hemisphere, how did the ball appear to curve in relation to its directed path of motion? (It always appears to curve to the right of its directed path of motion.)

2. Why does this apparent motion occur? (Because this turntable is turning at different rates at different distances from the center as it passes beneath the rolling ball.)

3. Did the path of the ball actually curve as it rolled across the table? (No. The curved path on the paper resulted from the rate at which the surface moved beneath the ball. The steel ball actually took a straight line path in relation to the observer and the classroom which were not moving.)

Time Allocation:

Very little assembly is required for this product when it is first unpacked. Once the hook and loop material is properly mounted, a process that takes less than 10 minutes, the apparatus can be readied in less than five minutes thereafter. Individual experiment times will vary depending on choice of methods of instruction, but normally a full exploration will not exceed one class period.

Feedback:

If you have a question, a comment, or a suggestion that would improve this product, you may call our toll free number.