Faster Than G Hinged Board Lesson Plan

Amount of time Demo takes: 1-3 mins.
Don’t try this at home!

Materials
- 1” Metallic sphere
- Green hinged board setup

Set-up Instructions
1. Make sure the apparatus is about level before beginning and do a test run to observe that the setup is sufficient.

SAFETY!
- Have people stand back so their fingers or other parts of the body are clear of the pinch-point near the hinge and, in general, are not going to be crushed when the green bar falls.

Lesson’s Big Idea
- The hinged arm is the center of mass of the board that must fall with the acceleration due to gravity and this point is lower than that of the sphere on the board. As the center of mass falls, it forces the rest of the rigid board to move with it. Since the point at which the sphere starts is further away, it must “fall” faster.

Background Information
- Center of Mass: Focus on the averaging of masses in correlation with the distance from the objects.
- Having an object at its’ center of mass, there is no net torque so there will be no movement. The second the the center of mass is not applied, the equilibrium of the object is disturbed and thus motion with a shift of the center of mass.
- “Falling Waters”, balancing toys, and the Leaning Tower of Pisa are examples of the center of mass concept.
- Newton’s Laws are applicable too.
  - An object will be in motion till an external force is applied.
  - Mass times acceleration is equal to the force.
For every action there is an equal and opposite reaction.

**Instructional Procedure**

1. Place ball in groove on upper green board.
2. Slowly remove pin that holds board up, watch as ball falls into cup. The cup will need to get replaced occasionally. Putting a clay-covered magnet in the cup will help keep the ball from bouncing out.

**Assessment/sample questions you could ask**

- If all objects are subject to the same gravitational acceleration, why does it appear as though the board falls faster than the sphere?

**References**

- Torque
- Center of Mass
- [http://hyperphysics.phy-astr.gsu.edu/hbase/cm.html](http://hyperphysics.phy-astr.gsu.edu/hbase/cm.html)

**Next Generation Science Standards**

- K-5
  - 3-PS2-2
  - 5-PS2-1
- 9-12
  - HS-PS2-4