Rolling Race

Amount of time Demo takes: **3-4 minutes**

Try this at home!

Lesson's Big Ideas

- The moment of inertia of a rolling object determines how quickly it is accelerated by a gravitational force.

Materials

- Spheres, shells, discs, and rings
- Long board for them to roll down
- Lead bricks to prop up the board and catch the rolling objects

SAFETY!

- Take care that students don't pinch their fingers between rolling objects and the bricks.

Background Information

- The objects with differing moments of inertia accelerate linearly at different rates. This can be examined with the conservation of energy.
- Starting at the top of the ramp (some height *h* above the ground), the rolling objects have no kinetic energy but some non-zero potential. Hence, their total initial energy (before rolling) is $E_i = mgh$.
- When released, the rolling objects will begin to gain kinetic energy and lose potential conserving the total amount of both added together. At the bottom of the ramp, their total energy will be only kinetic, written as $E_f = \frac{1}{2} I \left(\frac{v}{r}\right)^2$ where *v* is the linear velocity of the rolling object, *I* is the object's moment of inertia, and *r* is the radius.
- Since energy is conserved, we can set the initial and final energies equal to each other. After rearranging to find velocity, $v = r\sqrt{\frac{2mgh}{I}}$. This readily implies that the larger the moment of inertia is of the object in

question, the slower it will be moving when it reaches the bottom of the ramp.

Setup Information

- Coming soon!

Instructional Procedure

- Coming soon!

Tips & Tricks

- Coming soon!

Assessment Questions

- Coming soon!

Careers & Real-World Applications

- Coming soon!

Clean Up

- Clean up between demos if needed. When completely finished gather all materials listed for this demo and make sure everything is accounted for. If something was used up, broken, or damaged. Let someone know so it can get replaced or fixed.

References

- http://www.physicsclassroom.com/class/newtlaws/u2l1b.cfm

Related Next Generation Science Standards

- K-5
    - K-PS2 Motion and Stability: Forces and Interactions
    - 3-PS2 Motion and Stability: Forces and Interactions
    - 4-PS3 Energy
- 6-8
    - MS-PS2 Motion and Stability: Forces and Interactions
    - MS-PS3 Energy
- 9-12

- HS-PS2 Motion and Stability: Forces and Interactions
- HS-PS3 Energy