raft RESOURCE AREA FOR TEACHING

STEAM SCIENCE TECHNOLOGY ENGINEERING ARTS MATHEMATICS

LEARNING ACTIVITY

# Tubular Racers

**Cardboard Rolls and Soup Cans of Speed-Rock and Roll!**

Keep used soup cans and a few paper towel rolls to make tubular racers. Add other round, cylindrical objects that can roll down a slope, to be used as tubular racers as well.

**Activity Challenge**

Design, draw, and modify, the fastest tubular racer. Use soup cans, paper rolls, plastic cups, etc. What will make the fastest racer?

**Preparation**

1. Define workspace and collect materials.
2. Smooth any sharp edges if using soup cans.
3. If possible, use at least two different size tubular racers (tubes or other cylindrical objects).
4. Designate, or make a ramp, for the racers to roll down. (Cardboard, wood, and/or sidewalks can be used).
5. Optional: Use a scale to weigh each tube. Measure the ramp height with a ruler.

**To Do**

1. Roll the tubular racers down a ramp. Track the time from start to finish (when the racer stops moving).
2. Add weights to the inside of the racers. Weights can be added near the center or edges. Use tape, or something similar, to hold the weights in place.
3. If more than two different size racers are being used, add the same amount of weight to each.
4. Roll the racers down the ramp again to see which one completes the course first. Again, time the racers.
5. Continue to modify the racers by adding weights and/or changing the placement of the weights inside the racer.
6. Test modifications to see what makes it roll the fastest.

**Observations**

- Note the time it takes for the initial racer to roll down the course.
- Compare the initial roll time to the weighted racer roll time.
- If possible, weigh and measure each racer before and after modifications.

**Materials Needed**

- Empty soup cans
- Cardboard rolls
- Pebbles, rocks, paperclips, washers, magnets, etc. (weights)
- String, tape, glue (fastening medium)
- Optional: Stopwatch or timer, scale, ruler

**Grade Range**

3-5
6-8

**Topics/Skills**

Math: Proportion
Science: Displacement; Motion; Forces: Kinetic & Potential Energy

**Learning Standards**

NGSS: Motion and Stability: Forces and Interactions

**Duration**

15-20 minutes

**Prep Time**

10-15 minutes

**Extensions**

- Measure and tape a blank piece of paper around the can. Remove the paper and decorate it with a name, artistic designs, symbols and colors.
- Test different sized cans, tubes, etc. with weights in different positions.

**The Content Behind the Activity**

Potential energy is defined mathematically as the mass of an object (m), times the gravitational field (g), times its height (h) above the ground [mgh]. Students can calculate the potential energy of their tubular racer by identifying those three values and multiplying them together. If each tubular racer has the same mass, and the same starting point on the course, then each tubular racer will have the same amount of potential energy. The racers will offer a shared physical example of kinetic energy and how rotational energy can increase speed at different rates. Each tubular racer will have translational and rotational energy moving the racer down the slope. Those two values, added together, will give the total kinetic energy. Visit https://bit.ly/2UF29of for a short video on potential energy and kinetic energy.

The formulas below allow more advanced learners to make more calculated predictions.

- Kinetic Energy is half of the object's mass (m) times its velocity (v) squared. Kinetic Energy=$[1/2mv^2]$.
- Rotational energy can be calculated by multiplying one-half by the inertia (I) of the object by the angular speed (ω) squared. Rotational Energy= $[1/2I\omega^2]$.