

# Ups & Downs

## Overview

Ups & Downs is a versatile class that is designed to introduce students to basic physics terms and calculations. Using a hands-on approach, students will design and build their own rollercoasters and understand the practical applications of physics calculations.

## Objectives

Students will be able to:

- Verbally explain centripetal acceleration
- Verbally explain displacement
- Calculate the average speed of their rollercoaster
- Calculate the average velocity of their rollercoaster
- Calculate the acceleration of their rollercoaster

## Materials

- 3 foot or 6 foot half inch foam insulation tubing
- Masking tape
- Marbles

## Procedures

Ask the students what kinds of jobs require science.

Have students describe engineers in their own words.

Tell the students that they will be engineers today because they're going to create their own rollercoasters.

Show the students the rollercoaster car (marble) and track (foam insulation tubing) and how to connect the pieces together using masking tape.

Explain centripetal acceleration: The marble is moving with such great acceleration that the force of the marble toward the track is greater than the force of gravity.

Separate students into groups of 3-5 children.

Send students off to create their own rollercoasters.

As the facilitator, travel between groups, helping when needed.

About a half hour before the end of class, hand out the included worksheet and explain the calculations to each group.

- Rollercoaster name: As a group, come up with a name for their project
- Total distance: Count how many pieces of track were used and multiple that by the length of the tubing.
- Time: Facilitator will time each coaster and discuss constant variable.
- Displacement: The distance between start and ending points. For example:
  - If you walk 10 miles to the store, your distance is 10 miles and your displacement is 10 miles.
  - If you walk 10 miles to the store and 4 miles back, your distance is 14 miles and your displacement is 6 miles.
  - If you walk 10 miles to the store and 10 miles back, your distance is 20 miles and your displacement is 0 miles.
- Acceleration: Change in velocity divided by time.
  - The beginning velocity is ZERO.

Have the students complete the name, distance, time, and displacement portion of the worksheet.

About 15 minutes before the end of class, calculate the rest of the worksheet as a large group.

Now take your class on a rollercoaster tour by having each group present their projects.

Review the concepts taught during the lesson.

Roller Coaster Name: \_\_\_\_\_

Formulas

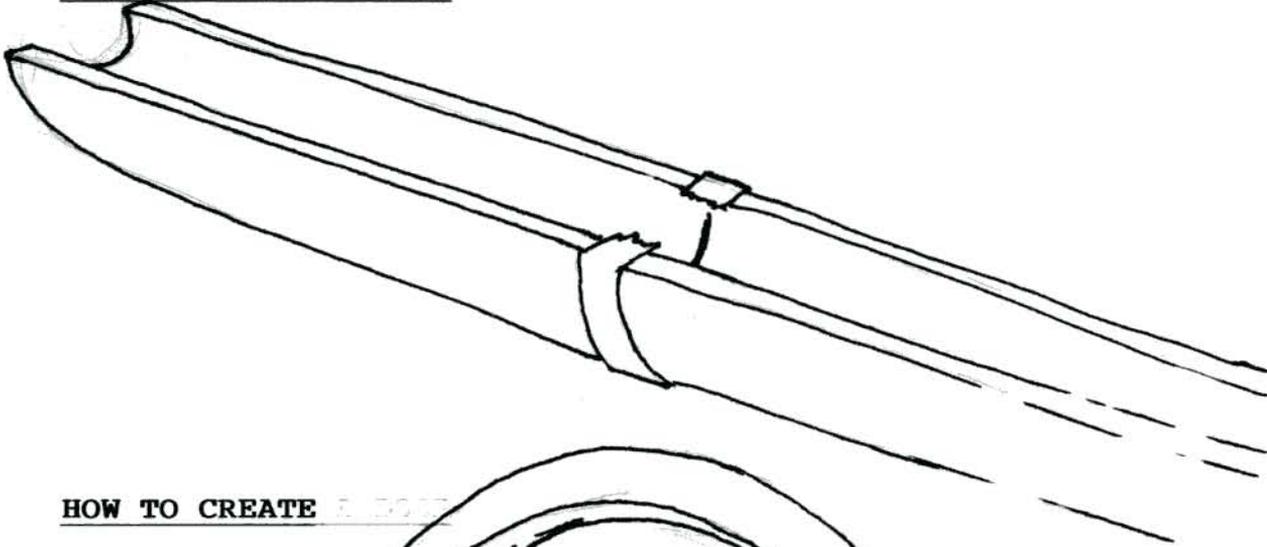
Your Work

**Average Speed =**  $\frac{\text{Total distance}}{\text{Time}}$  ft/ sec  $\rightarrow$  \_\_\_\_\_ ft/ sec

**Average Velocity =**  $\frac{\text{Total displacement}}{\text{Time}}$  ft/ sec  $\rightarrow$  \_\_\_\_\_ ft/ sec

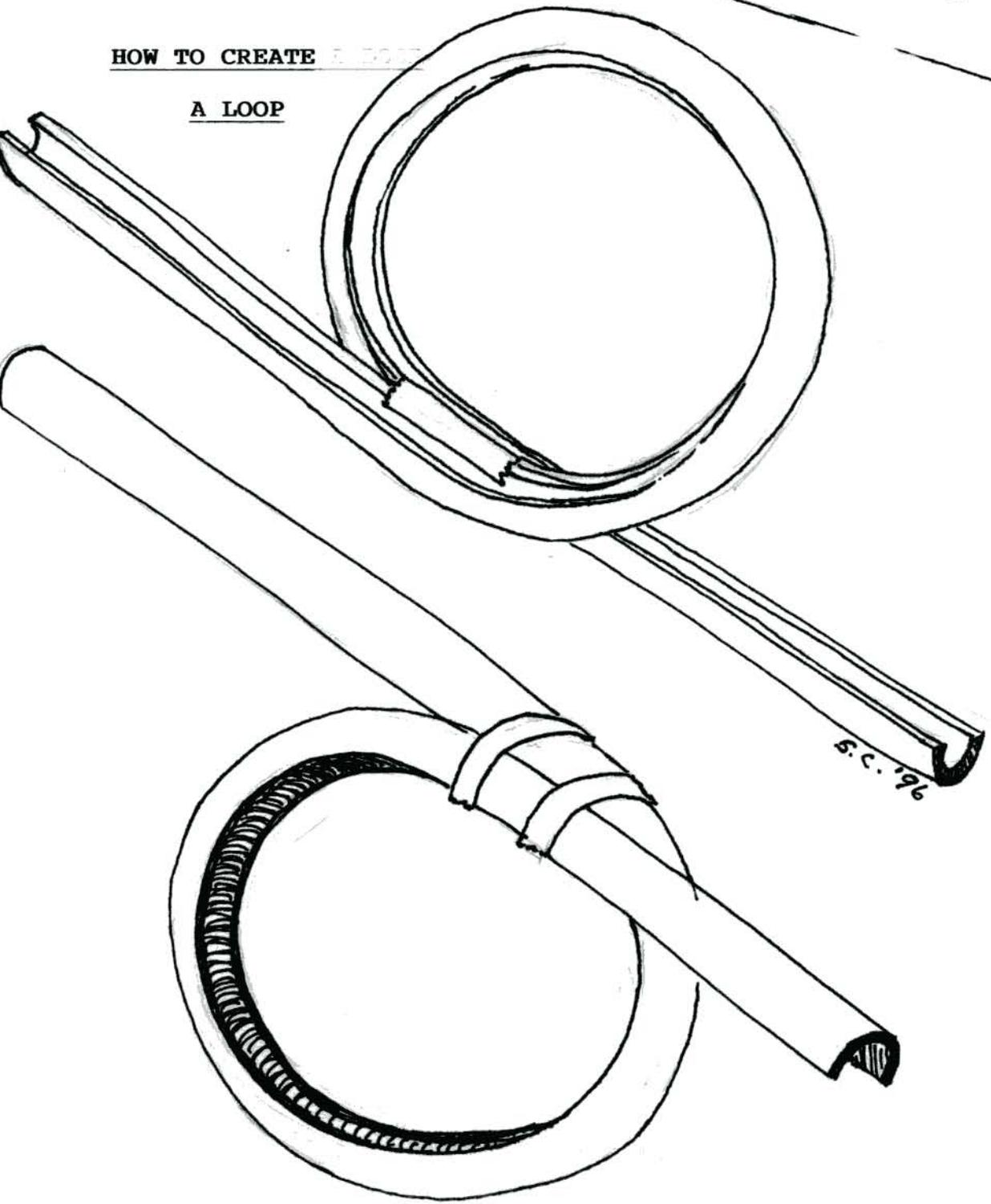
**Acceleration =**  $\frac{\text{Change in velocity}}{\text{Time}}$  ft/ sec  $\rightarrow$  \_\_\_\_\_ ft/ sec

HOW TO CONNECT TRACK



HOW TO CREATE

A LOOP



5. C. 196