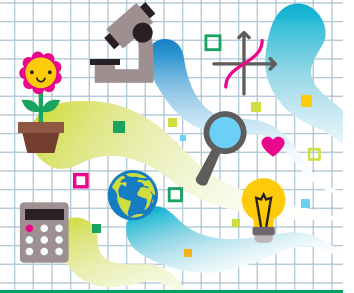




HEADS IN, HEARTS IN

Rockin' Roller Coaster

Instructions for Set-Up



Supplies

- “Guide for Families” handout
- Clear plastic standup display (optional)
- “Engineering Process” handout (1 per participant or family)
- Paper
- Pencils
- Foam pipe insulation at least 1.5 inches in diameter
- Sharp scissors or utility knife (for use by an adult only)
- Painter’s tape
- Marbles or metal ball bearings, small wooden balls or rubber balls
- Cups
- Chair, desk, wall or other stationary item
- Display table

Activity Preparation

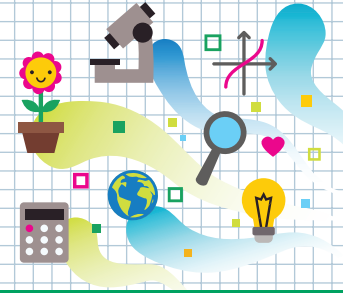
- ▶ Purchase or locate items on supply list.
- ▶ Print one copy of the “Guide for Families” handout. Laminate or place in a clear plastic standup display to allow participants to see it more readily.
- ▶ Print one “Engineering Process” handout per participant or family. Optionally, print and laminate a few to leave on the table.
- ▶ Using the sharp scissors or utility knife, cut the foam pipe insulation in half, lengthwise, to form two U-shaped trenches. Next, cut the U-shaped trenches in lengths of at least 6 feet long.
- ▶ Set up the display table and arrange needed supplies.



HEADS IN, HEARTS IN

Rockin' Roller Coaster

Guide for Families



Learning Objectives

What you need to know:

Engineering is a process used to solve problems by designing, building and testing things. An engineer is a person who uses math and science to create new things, solve problems or make things better.

For the marble to stay on the track, it must have the correct speed and be moving in the correct direction.

Speed is the distance you go in a particular amount of time (such as miles per hour). Engineers use their understanding of speed to design and build machines such as roller coasters to make sure that people are safe.

What you will do and learn:

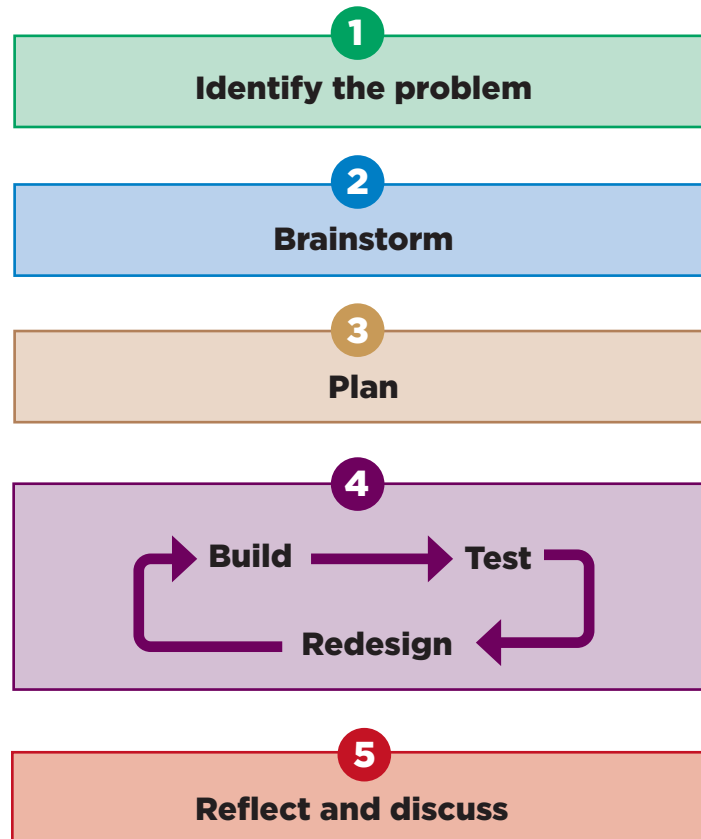
In this activity, you will practice using the engineering process to build a roller coaster that contains at least one upside-down loop, and holds a marble in its track from beginning to end without falling out. For the marble to stay on the track, you must pay attention to its speed.

Instructions

1. Using the “Engineering Process” handout, start to work through building your roller coaster.
2. Identify the problem: Build a roller coaster that will hold a marble that will go through an upside-down loop without it falling out.
3. Brainstorm: What keeps a roller coaster on a track when it goes upside down? Is that the same or different from what would keep a marble in the track? Would a marble be more likely to stay in the track if it was faster or slower? How might you help the marble go faster or slower? Does the weight or size of the marble make a difference?
4. Plan: Make a drawing or sketch of your design. Gather your materials.
5. Build: Build your roller coaster. Remember that it needs to have at least one upside-down loop. Use the cup at the end of your roller coaster to catch your marble.
6. Test: Place a marble at the beginning of the roller coaster. Let it go. Did the marble follow the curves and twists of the roller coaster? Did the marble get to the end of the roller coaster? Was it able to stay inside the track when it went upside down? Did your marble need more speed?
7. Redesign: Make some changes to your design to improve your roller coaster. Try some of the ideas you came up with during your brainstorming.
8. Repeat steps 6 and 7 as many times as needed.
9. Reflect and Discuss: Did your marble stay in the track when it was fast and slow? Why or why not? How is a roller coaster the same and different from a marble on a track? How do you think the speed on a real roller coaster is altered to keep both the coasters on the track and the riders in their seats?

Engineering Process Handout

Engineering Process



- 1. Identify the problem:** Engineering is about identifying problems and designing solutions. As you go through these activities, think of the goal you are trying to achieve.
- 2. Brainstorm:** What are the many different ways I could solve this problem? What are the potential advantages and disadvantages of different ideas? What things do I need to think about to make that solution successful?
- 3. Plan:** What are the different ways I can solve this problem or make the build? What steps can I take to try out my solution? What do I need to do to prepare my build? What might happen if I choose that solution? During your design phase, you might discover new problems that you need to brainstorm.
- 4. Build:** Construct and carry out the design. As you build your design, you might come up with more problems that you need to brainstorm and design new ideas for.
Test: How does my solution work? Does it solve the problem? Is it effective? Are there additional problems?
Redesign: How can I improve my design? What can I try to make my solution work better?
- 5. Reflect and Discuss:** How did the solution turn out? What could I do differently next time? How would my design be different if I had different materials?