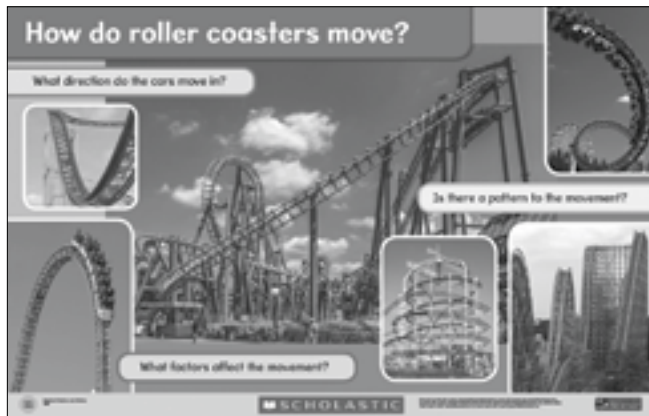


Design Challenge: Building a Roller Coaster



Focus: Students explore materials and tools then use the design process to build their own 'roller coasters.'

Specific Curriculum Outcomes

Students will be expected to:

- 16.0 use appropriate tools [GCO 2]
- 31.0 respond to the ideas and actions of others and acknowledge their ideas and contributions [GCO 2]
- 32.0 compare and evaluate personally constructed objects [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- use appropriate tools and materials to create a roller coaster that meets specified design criteria

NOTES:

Attitude Outcome Statements

Encourage students to:

- show concern for their safety and that of others in carrying out activities and using materials [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- interact with sensitivity and respect, considering the situation, audience, and purpose [GCO 3]
- use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imaginations [GCO 8]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Science Card 11 • <i>What Is the Design Process?</i> poster • Science Card 12 • IWB Activity 9 • BLM <i>Two Stars and a Wish</i>	• selection of commercially produced games such as Mouse Trap, Hot Wheels Racetrack, or a marble maze • large variety of building materials and tools such as cardboard rolls; PVC pipe; pool noodles; Hot Wheels tracks; funnels; craft sticks; paper, aluminum, or Styrofoam plates; socks; duct, packing, or masking tape; glue; staples; string; shoelaces; ribbon; paper clips; paper fasteners; clothespins; Playdough; Sticky Tack; pipe cleaners; plastic, twist, or cable ties; wire • marbles, Ping-Pong balls, or golf balls • students' Science Journals • tablets (optional)	• Find and bookmark online video clips of roller coasters and/or similar amusement park rides. See <i>Additional Resources</i> on page 59 for possible Websites.	• direction • pattern

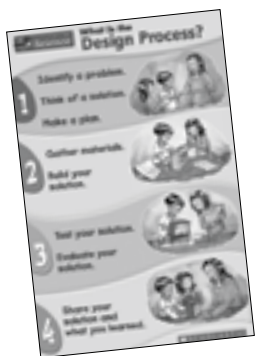
Science Background

- A roller coaster car is pulled to the top of the first hill (the tallest hill in the entire ride) and then it is released. The force of gravity makes the car hurtle downwards and the car continues to roll along the track without any external mechanical assistance for the remainder of the ride. The up and down motions of the ride keep the cars moving (using potential and kinetic energy) but eventually the forces of friction and air resistance ensure the car gradually slows down. A brake on the track brings the car to a complete and safe stop.

Possible Misconceptions

- Students may think roller coasters have an engine, like a car, to keep it racing around the track. Explain to students that it's the up and down motions that keep the roller coaster cars moving.

ACTIVATE



Features of Roller Coasters

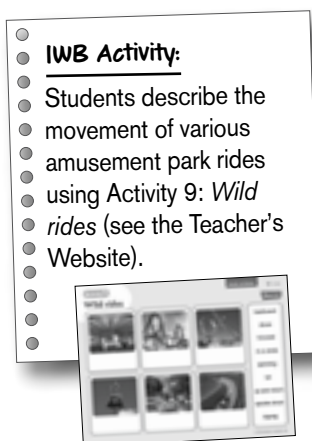
Display Science Card 11 and discuss with students the various features of roller coasters. You might also share online video clips of roller coasters and other similar amusement park rides with the students. Ask:

- How do these rides move?
- What direction do they move in?
- Is there a pattern to the movement?
- What factors affect the movement?

Tell students that they will be working in small groups to design and build their own roller coasters. With the students, establish the specific criteria for their challenge, for example, the roller coaster should move a marble at least 4–6 different ways (up, down, left, right, side-to-side, in a circle, etc.).

Review the *What Is the Design Process?* poster with students and clarify the necessary steps in the process including making a plan, selecting materials and tools, building a prototype, testing it, as well as evaluating and revising their prototype as necessary.

CONNECT



Simple Models

Provide commercially produced games, such as Mouse Trap, Hot Wheels Racetrack, or a marble maze. Encourage students to explore the games and build simple models that can move a marble in different ways. Ask:

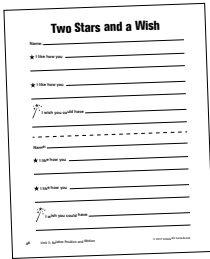
- How are these games similar to the roller coasters shown on Science Card 11?
- What materials could you use to build your own roller coasters?

Exploring Materials and Tools

Share Science Card 12 with the students and discuss the various materials and tools shown. Ask how students think these and/or other materials might be used to create a roller coaster.

Provide a wide variety of materials and tools for students to explore. Invite students to test the materials and tools by conducting trials, and to discuss the pros and cons with their group members to help them choose appropriate tools and materials for building their roller coaster.

CONSOLIDATE



Build It!

Have the groups record their plans and ongoing construction in their Science Journals or by making photo journals on a tablet or other technology. Students may also choose to record their conversations which could help them to communicate their procedure when they present their final roller coaster to the class.

Have students do a Gallery Walk to examine other groups' prototypes. Encourage them to give constructive criticism to other groups using BLM *Two Stars and a Wish*, and to take notes on any ideas they want to incorporate into their own design.

Groups can then finalize their design and test their roller coaster. They should evaluate their design based on the results of their test, and redesign as necessary.

Groups can demonstrate their roller coaster to the class and explain how their prototype meets the established criteria for the design challenge. Encourage students to explain how the roller coaster moves. They might also share some of the challenges they faced in designing and building their roller coasters.

EXPLORE MORE



New Ideas

Students can identify future suggestions or implementations for their roller coasters in their Science Journals. Encourage them to include sketches or diagrams of any proposed changes.

WRAPPING UP THE UNIT



Revisit the questions posted on the I Wonder Wall and have students discuss answers in small groups or with a partner. If there are questions which cannot be answered at the time, these can remain on the I Wonder Wall for students to research independently. Discuss what the students have learned about relative position and motion.

Two Stars and a Wish

Name: _____

★ I like how you _____

★ I like how you _____



I wish you could have _____

Name: _____

★ I like how you _____

★ I like how you _____



I wish you could have _____
