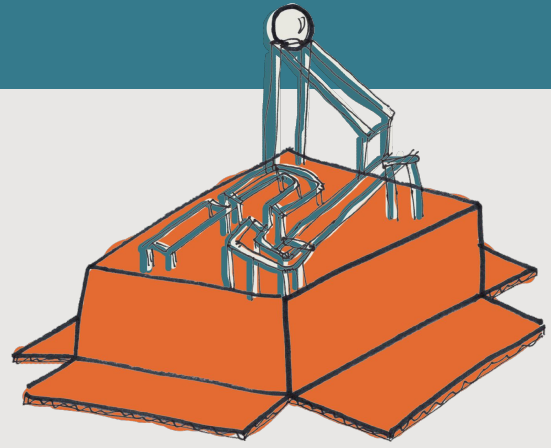


STRAW ROLLERCOASTER

ELEMENTARY SCHOOL LEVEL 3



The world's oldest roller coaster dates back to 1912 and still stands today in Luna Park, Melbourne. With some simple materials and a hot glue gun, students will engineer a roller coaster track for a ping pong ball. What creates the motion? What will make this roller coaster go?

EDUCATIONAL STANDARDS:

NGSS CONNECTION:

4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*

COMMON CORE CONNECTION: ELA/Literacy

RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Mathematics

4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

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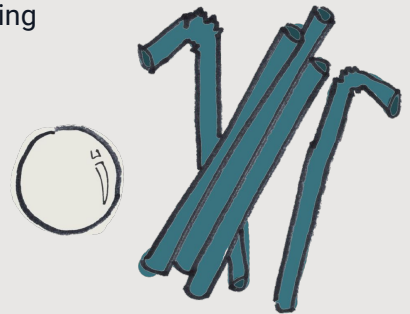
Level 2: Concept

Level 3: Strategic Thinking

Level 4: Extended Thinking

MATERIALS NEEDED:

- ☐ Straws
- ☐ Ping pong ball
- ☐ Cardboard box



DIRECTIONS:

1. Place a cardboard box upside down, the bottom of the box will provide a base to plant your straws in.
2. Build up from the box to your drop point, the highest part of the track.

3. Use straws for the legs and track of the roller coaster; build in turns, drops, and twists.
4. Drop your ball at the top of the track and let it run. Adjust and rebuild when needed to keep the ball from running off.

NEXT LEVEL:

- What tricks and techniques did students develop to improve their track?
- What new materials and designs did they come up with?
- There are no wrong answers and so many ways to make a better build.

OBJECTIVE:

Students will be able to design simple roller coasters as means of converting one form of energy to another and its relationship to the speed of an object.

ESSENTIAL QUESTION:

- How does an object's energy affect its speed?

ENGAGE / EXPLORE:

1. Students conduct investigations of objects rolling down ramps to observe the effects on speed.
 - a. Students may change the height
 - b. Students may change the mass of the object
 - c. But not at the same time!
2. Students record observations from experimenting
3. Make claims from evidence on the effect of energy on speed of an object
 - a. Where does the energy come from?
 - b. How does that energy convert to speed?

4. Students create an explanation of their findings
5. Evaluate
 - a. Misconceptions
 - b. Students' explanations

EXPLAIN:

1. Use PhET simulation skate park
 - a. [Skate Park](#)
 - b. Allow students to explore the simulator
 - i. First in basic mode
 - ii. Then allow the playground mode
 - c. Ask students to record observations on what affects the speed and energy of an object
 - i. Changing mass
 - ii. Changing height of the ramp
 - iii. Effects on speed
2. Discuss students findings as a class
3. Clear up student misconceptions
 - a. Use simulator graphs/charts to support your discussion
4. Evaluate
 - a. Check student understanding by changing simulation
 - i. Students make predictions on how those changes effect
 1. Energy
 2. Motion

ELABORATE:

1. Students design and create their own roller coasters
 - a. Incorporate their learning from the above activities to be successful
2. Students produce a detailed drawing of their rollercoaster
 - a. Identify energy conversions and speed at critical points
 - b. Identifying constraints in their designs.
3. Evaluate
 - a. Explanation of energy and speed in their roller coaster
 - b. Constraints and engineering design