

Vocabulary

COASTER CHALLENGE

Advertisement	advertising is a form of communication intended to persuade an audience (viewers, readers or listeners) to take action.
Amusement Park	an open-air entertainment area consisting of stalls, side shows, etc.
Hypothesis	a tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation.
Invention	a new device, method, or process developed from study and experimentation.
Mass	the size or bulk of an object.
Momentum	the product of a body's mass and linear velocity.
Observation	a detailed examination.
Patent	grants made by a government that confers upon the creator of an invention the sole right to make, use, and sell that invention for a set period of time.
Simple Machines	a simple device for altering the magnitude or direction of a force.
Lever	a rigid bar pivoted on a fixed point and used to transmit force, as in raising or moving a weight at one end by pushing down on the other.
Wheel and Axle	an axle to which a wheel is fastened so that torque applied to the wheel winds a rope or chain onto the axle.
Pulley	a wheel with a grooved rim in which a pulled rope or chain can run to change the direction of the pull and thereby lift a load.
Screw	a device used for fastening materials together, consisting of a threaded and usually tapered shank that has a slotted head by which it may be rotated so as to cut its own thread as it bores through the material.
Wedge	a block of solid material, esp wood or metal, that is shaped like a narrow V in cross section and can be pushed or driven between two objects or parts of an object in order to split or secure them.
Incline Plane	a flat surface set at an angle to the horizontal, used to raise or lower a load by rolling or sliding.
Slogan	a phrase used repeatedly, as in advertising or promotion.
Velocity	the speed of an object in a certain direction.

Activity: Ride Design

Students will use an understanding of force and motion, and simple machines, to draw a track for a roller coaster.

Materials

- Paper
- Markers or crayons
- Pencils

Procedure

1. Discuss with students roller coasters they have ridden. Talk about what makes a roller coaster fun or scary. Make this into a web on the chalk board. List components the students think the ride should have. Are there things a roller coaster must have? Talk about how a roller coaster works. Discuss the fact that most roller coasters start with a big hill. Introduce the students to the following vocabulary words:

Momentum: the product of a body's mass and linear velocity
Mass: the physical volume or bulk of an object
Velocity: the speed of an object in a certain direction
2. Discuss the 6 types of simple machines and how they make work easier. Encourage students to think about how simple machines might have a part in the design of a complex roller coaster.
3. Tell the students that they will be building a roller coaster during their Chicago Children's Museum workshop. When the CCM workshop leader arrives, he/she might like to see what kind of roller coaster they want to build. A good place to start is with a drawing. Just like architects draw plans before a house is built, roller coaster designers start with pictures.
4. Students may now draw a picture illustrating how they envision their roller coaster to appear. They should take into consideration the things that were just discussed. Incorporate a hill early into the ride to build momentum.
5. Encourage students to use one or more simple machines in their design.
6. If time permits, students may share their drawings with the class and indicate where simple machines are included. They may name their ride as well.

Alignment with State Goals

Science State Goal 11

Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.

Science State Goal 11B

Know and apply the concepts, principles and processes of technological design.

Science State Goal 11D

Know and apply concepts that describe force and motion and the principles that explain them.

Activity: Invent on the Spot

COASTER CHALLENGE

During the Coaster Challenge workshop, students will be using a variety of materials to invent a roller coaster. During this activity, students will design a device to solve a problem. They will test, re-test and modify their inventions based on observations while attempting to retrieve the ball. They will hypothesize, conduct experiments, and record what materials work well together and which materials do not.

Materials (one complete set per cooperative group)

- Clear plastic or glass containers that have large enough holes to fit a super ball, but small enough that a student's hand will not fit. This is the "drain pipe."
- Bottles of water (liquid should not fill more than half of container above). This is the "juice."
- Superball
- "Junk": An assortment of pipe cleaners, paper clips, clothespins, popsicle sticks, string, twist ties, and/or other materials as you see fit.
- Paper and pencils for data recording

Procedure

1. Give a container and a bottle of liquid to each group of students.
2. Explain the following scenario to the class:
Your mom sent you to the store to get some juice. Because you were kind enough to do this favor, she gave you some money to buy a toy. You're walking home from the store with the juice and bouncing your brand new superball when it suddenly disappears into a drain pipe! (Drop the balls into the "pipe".) You can see the ball but can't fit your hand through to reach it - what do you do? You look around to see if you can find anything useful to you.
3. Hand out the "junk."
4. Rules: You may use or combine these materials in any way to help you solve your problem. You may not move the drain pipe in any way. You may use anything you happen to have in your pocket. If something falls in the drain pipe, it is stuck there. If someone asks, yes, they may use the "juice" to help retrieve their superball.
5. Have the students record what worked and what didn't.
6. Discuss with the students:
 - Have you been in a situation similar to this one? What did you do?
 - How did you remove the superball? What materials did you use?
 - What materials did you find useless? Did someone else use them?
 - Did you use the materials in a way different from their common use?

Extension Activity

Put together a tub of "junk," similar to that used in the Coaster Challenge workshop, for an activity station. Include tubes, clamps, cardboard, funnels, rope, tools, boxes, pulleys, etc. for your students to invent their own contraptions.

Alignment with State Goals

Science State Goal 12C

Compare physical properties of matter.

Fine Arts State

Goal 26A

Identify media and tools and how to use them in a safe way.

Fine Arts State

Goal 26B

Create visual artworks using manipulation, eye-hand coordination, building and imagination.

Physical Development

State Goal 19A

Demonstrate control when performing manipulative skills

Activity: Invention Investigation

Research the history of the roller coaster, Ferris wheel, or another amusement park ride.

Materials

- access to a computer or library for research
- paper and pencil

Procedure

1. Brainstorm with students a list of amusement park attractions.
Discuss the fact that all rides and attractions are different and unique. Ask if they have ever considered who thought up the ideas for all of those amusement park rides.
2. Divide the students in to small groups, or ask them to work individually. Each student (or group of students) should pick a ride from the list. Using the school or public library, or internet resources, each group should research the history and background of that ride.

Ask each group to investigate:

- When was it first built?
 - Who invented it?
 - What improvements have been made?
3. Students may find that their research leads to other discoveries, aside from this list of questions.
 4. Invite each student, or group of students, to present their findings to the class.

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Alignment with State Goals

Language Arts State Goal 1

Read with understanding and fluency.

Language Arts State Goal 5

Acquire, assess and communicate information.

Activity: Come to Pier's Point and Ride the...

COASTER CHALLENGE

Students will reflect on the experience of creating a roller coaster during the Chicago Children's Museum workshop. Then, they will market and advertise their roller coaster to the visitors to Pier's Point Amusement Park.

Materials

- Poster board or paper
- Markers, crayons or paint

Procedure

1. With your students, reflect on the roller coaster you designed and built with the CCM educator who visited your classroom. If you took photographs, review those together.
2. Ask students, how do you think you could convince and encourage your friends to try riding such a roller coaster? Tell your students that people who own and operate amusement parks are faced with the task of marketing their rides, and encouraging visitors to try the new rides.
3. Ask your students to come up with a marketing plan and advertisement for the roller coaster you built during the Coaster Challenge workshop.
4. Think of an advertisement slogan, or a catchy phrase, to make your ride sound fun.
5. Design a poster to advertise the ride. Use drawings and your slogan on the poster.
6. Write a 30 second radio commercial to advertise the coaster. Deliver your speech to the class.

Extension Activity

Working in groups, students can create television commercials advertising their roller coaster ride.

Encourage students to research the process of patenting an invention. Ask them to find out what steps need to be taken to obtain a patent for a new creation. What would they need to do in order to get a patent for their new roller coaster design?

Alignment with State Goals

Language Arts State Goal 3

Write to communicate for a variety of purposes.

Language Arts State Goal 4

Listen and speak effectively in a variety of situations.

COASTER CHALLENGE

Activity: Dear Mr. Pier...

Students will write a letter to Peter Pier explaining the ride your class has created.

Materials

- Paper
- Pencils

Procedure

1. Remind students of the letter Peter Pier wrote to them asking for help in creating a new amusement park ride.
2. Discuss the format for a letter.
3. Ask students to return a letter to Mr. Pier describing the roller coaster they built. The letter should:
 - Include their favorite feature of the coaster.
 - List which simple machines were used in the creation of the coaster.
4. Explain how the marble moved around the track. Did it include:
 - Using force and motion?
 - Explain why it will bring visitors back to Pier's Point.
5. Encourage students to use descriptive words which accurately describe the experience of riding the coaster. You may choose to create a list of descriptive words as a class before students write the letter.
6. Invite students to read their letters in front of the class.

Mail the letter to:

Peter Pier, Care of Student Visit Program
Chicago Children's Museum
700 E. Grand Ave.
Chicago, IL 60611

Alignment with State Goals

Language Arts

State Goal 3

Write to communicate for a variety of purposes.

Language Arts

State Goal 5

Acquire, assess and communicate information.

Resource List

Books

- *The New Way Things Work* by David Macaulay and Neil Ardley
- *Simple Machines* by Deborah Hodge and Ray Bourdreau
- *The Kids' Invention Book* by Arlene Erlbach
- *The Book of Think* by Marilyn Burns
- *Brainstorm! The Stories of Twenty American Kid Inventors* by Tom Tucker
- *Roller Coaster Science* by Jim Wiese
- *Roller Coaster* by Marla Frazee
- *Roller Coasters: or I Had So Much Fun, I Almost Puked* by Nick Cook
- *Physics for Every Kid: 101 Easy Experiments in Motion, Heat, Light, Machines, and Sound* by Janice Van Cleave
- *Work and Simple Machines* by Jan Richards

Helpful Websites

www.inventionatplay.org

www.scienceforfamilies.allinfo-about.com/features/rollercoaster.html

www.learner.org/exhibits/parkphysics/coaster

www.funderstanding.com/k12/coaster

www.science.howstuffworks.com/roller-coaster1.htm

www.glencoe.com/sec/science/webquest/content/rollercoast.shtml

www.coasterquest.com

www.edheads.org/activities/simple-machines

www.galaxy.net/~k12/machines/index.shtml

www.teacher.scholastic.com/dirtrep/simple