

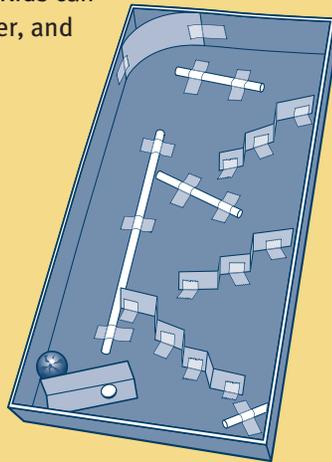
# Pinball Wizard

Two simple machines—a lever and an inclined plane—are the key to constructing a pinball machine out of a shoe box.

## Activity 7

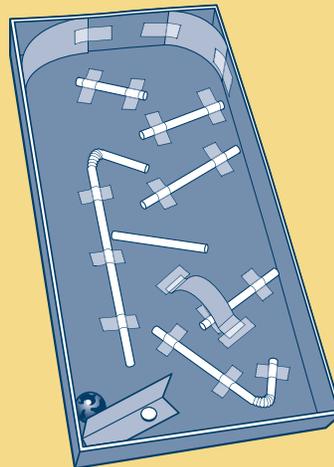
### Prepare Ahead

- Try the activity yourself so you can anticipate where kids may get stuck or need guidance. Attaching the lever and positioning it so it works may be challenging for the youngest kids in your group.
- Collect shoe box tops and boxes. Cut the sides of the shoe boxes down to about two inches, so they look like the shoe box tops.
- Collect egg cartons.
- On the day of the activity, set up work spaces so each kid has scissors, pencil, shoe box top (or bottom with the sides trimmed), two egg carton cups, brass fastener, and a marble. Kids can share straws, cardboard, paper, and index cards.



### Lead the Activity

- 1 Introduce Ruff's challenge.** (5 minutes)  
Hand out activity sheets. Tell kids that today's challenge is to make a pinball machine that shoots a marble to the top of the box and then leads it down again along an obstacle course. They'll build it using a lever and several inclined planes.
- **Review levers.** If you did the previous activity, *Action Figure*, kids will be familiar with levers. If not, briefly discuss what they are, using the information in the Action Figure Leader Notes on p. 29.
- **Introduce inclined planes.** Tell kids that an inclined plane is a slanted surface. Ask them for examples (*slides, wheelchair ramps, staircases, ladder, slanted roof*). Ask why an inclined plane might be useful (*it makes it easier to raise or lower things*).



### Materials

- activity sheet for each kid
- shoe box tops or boxes—see “Prepare Ahead” (1 per kid)
- utility knife (to cut boxes)
- clear tape (1 roll per 2 kids)
- scissors (1 per kid)
- egg cartons (2 cups per kid)
- straws (several per kid)
- brass fasteners (1/2" or 3/4")
- thin cardboard
- construction paper or index cards
- marbles (1 or 2 per kid)
- pencil (1 per kid)
- optional: paper cups, bottle caps, pipe cleaners, markers, aluminum foil, or other odds and ends.

### National Science Education Standards

#### Grades K–4

Physical Science: properties of objects and materials; position and motion of objects

Science and Technology: abilities of technological design

#### Grades 5–8

Physical Science: properties and changes of properties in matter; motions and forces

Science and Technology: abilities of technological design

**2 Build the basics.** (15 minutes) Hand out the activity sheets and have kids follow steps 1–5. Emphasize that they should test after every step, making sure their marble does what they want it to do. Kids may need help with:

- Making holes in the cardboard lever and through the bottom of the box.
- Positioning the lever so it shoots the marble easily, and doesn't hit the side of the box. If the lever doesn't move easily, kids can try loosening the brass fastener a little.
- You may need to demonstrate how to flick the lever. Have kids practice shooting the marble.

**3 Get creative.** (15 minutes) Steps 6 and 7 on the activity sheet are open-ended steps that encourage kids to be inventive. Supply paper cups, pipe cleaners, bottle caps, markers, and other items to stimulate their ideas.

**4 Discuss what happened.** (5 minutes) Gather as a group, and have kids display their pinball machines and try out other kids' models. Ask them to point out any unusual or especially creative features.

**5 Award Points.** (5 minutes). Time to rack up some points! Review the activity's key ideas by asking the following questions, worth 50 points each.

1. What makes your pinball machine work? (*Inclined planes and a lever; gravity*)
2. What would happen if your pinball machine wasn't propped up on the egg carton cups? (*The marble might wander in any direction.*)
3. How many inclined planes are on this pinball machine? Choose one of the kids' models as an example. (*Be sure kids count the pinball machine itself as an inclined plane.*)
4. Name some examples of inclined planes. (*Answers may vary.*)
5. What kinds of changes would you make to your design if you had more time, a bigger box top, or different materials? (*Answers may vary.*)

