



## Design It, Build It, Launch It!

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Adapted from “Kicking Machine,” Design Squad Educators guide. 2007. WGBH Educational Foundation. Developed with funding from the American Council of Engineering Companies of Virginia and the MathScience Innovation Center.

### Question

Can you design a machine that is able to launch a Ping-Pong ball into a cup, lying on its side, 12 inches away?

### Grade/Subject

Grade Six Science, Life Science, Physical Science, Earth Science.  
Virginia Standards of Learning: (2010) 6.1, 6.2, LS.1, PS.1, PS.6, ES.1.

### Background

Many machines turn potential energy, stored energy, into kinetic energy, energy of motion. Your job is to build a machine that can successfully change potential into kinetic energy that can be used to accurately launch a ball.

### Safety

Remember to observe your regular classroom rules for lab safety.

### Materials

A set of the following materials are required for each student group:

1 Ping-Pong ball	1 Ruler
1 Scissors	4 Tacks or thumbtacks
4 Paper clips	1 length of string
1 Paper cup	Tape (masking or duct)
4 Popsicle sticks	1 length thin metal wire (optional)
6 small & large rubber bands	5 Wooden skewers
1 Wooden spoon (pendulum)	1 Corrugated cardboard (12”x12”)

### Procedure

#### Design your machine:

1. Before beginning building your machine, brainstorm answers to the following questions.

- Should the machine use a pendulum or a rubber band or a combination of both to send the ball into the cup?
- How will you stop the machine from launching the ball before you are ready to release it?
- How will the machine be triggered when you are ready to launch the ball?

- How will you make the pendulum or rubber band or combination of the two launch the ball straight enough and with the right amount of force so that it goes into the cup?
2. Think about how to create different release points for the pendulum or rubber band so that you have more control over **the** launched ball. Also consider how to determine the right amount of energy to store up before making your shot.

### **Build and Test Your Design:**

1. Build your machine using your design.
2. Lay a cup 12 inches away and test your machine to see if you can get the ball into the cup.
3. Fix problems with your machine if unsuccessful.
4. Re-test your machine to launch the ball into the cup.
5. Re-evaluate and re-test your machine once again!

### **Data Analysis/ Results**

**Contest** between lab teams to see which machine can successfully get the ball into the cup 3 out of 5 tries.

### **Conclusion / Questions**

Conduct a class discussion with your students and emphasize the following points:

What made the winning designs successful?

What modifications can be made to your design to make it more successful?

Give examples of potential and kinetic energy during the launching of the balls.

How did you measure the success or effectiveness of your machine?

### **For Further Challenges:**

- Move the cup so it is 24 inches from the kicking machine
- Build a ramp and see if you can shoot the ball up and over the ramp.
- Build a machine that can launch two balls at once or that can launch balls at different speeds.

### **References**

Lesson activity adapted from “Kicking Machine,” Design Squad Educators guide. 2007. WGBH Educational Foundation.

<http://pbskids.org/designsquad/engineers>

### **MathScience Innovation Center**

Information on educational programs available to students, teachers and school divisions and procedures for registering for programs.

<http://msinnovation.info>