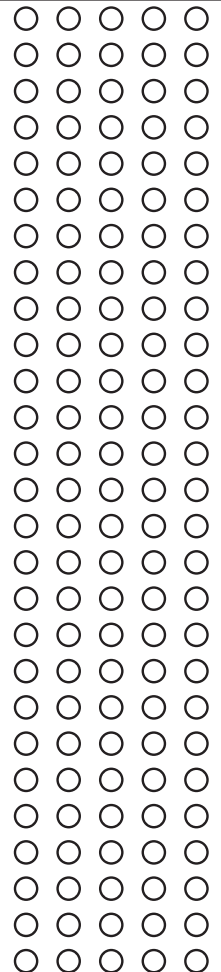
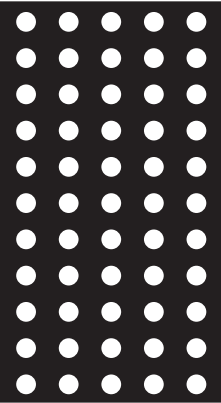
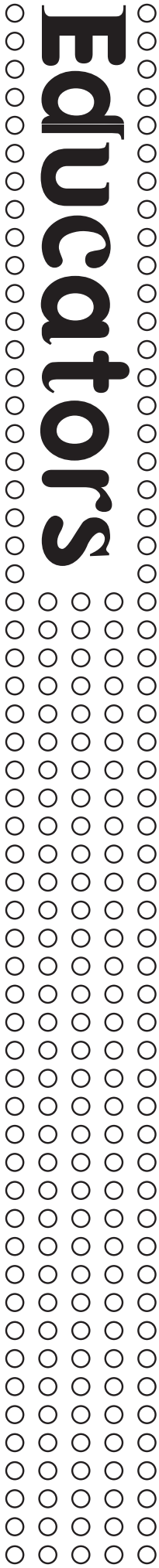


Engineer It!

Grades 6-8 Exhibit Guide





Educators

Engineer It

Grades 6-8

Dear Educator,

Welcome to the Imagination Station's field trip resource! With the assistance of area K-12 educators, Imagination Station has created learning guides to help structure a field trip that aligns directly to the concepts you are teaching in the classroom.

Students will explore the engineering design process in our Learning World, Engineer It!

Your Engineer It! Exhibit Guide contains:

- Introduction- suggestions for using the guide, with key concepts included.
- State Standards Alignment for both Ohio and Michigan.
- Tips for facilitating exhibit explorations with students.
- An Engineer's Notebook that will guide your class through exhibit-based explorations.
- Extension Activities to do before and after your visit to the science center.

How to Use This Guide:

- Review the guide
- Customize the guide for your needs. You can have your students complete the entire guide or just a particular component, depending on your field trip objectives.
- Print off sufficient copies of the Student Pages for each student.
- Print off copies of the Chaperone Page for each of the chaperones. Divide your class into groups of 5-7 students and assign a chaperone to each group.
- Divide the guide into sections and have different groups complete different components. Each group can then report their findings to the class back at school.

Schedule for the day:

Lunch Time:

Demonstration Time(s):

Departure Time:

Ohio Academic Content Standards

Grade 6

Physical Sciences, Nature of Energy

7. Describe how electric energy can be produced from a variety of sources.

Science and Technology, Abilities To Do Technological Design

5. Design and build a product or create a solution to a problem given one constraint (e.g., limits of cost and time for design and production, supply of materials and environmental effects).

Scientific Inquiry, Doing Scientific Inquiry

1. Explain that there are not fixed procedures for guiding scientific investigations; however, the nature of an investigation determines the procedures needed.

Grade 7

Physical Sciences, Nature of Energy

3. Identify different forms of energy (e.g., electrical, mechanical, chemical, thermal, nuclear, radiant and acoustic).

Science and Technology, Abilities To Do Technological Design

4. Design and build a product or create a solution to a problem given more than two constraints (e.g., limits of cost and time for design and production or supply of materials and environmental effects).

Scientific Inquiry, Doing Scientific Inquiry

1. Explain that variables and controls can affect the results of an investigation and that ideally one variable should be tested at a time; however it is not always possible to control all variables.

Grade 8

Science and Technology, Abilities To Do Technological Design

3. Design and build a product or create a solution to a problem given more than two constraints (e.g., limits of cost and time for design and production, supply of materials and environmental effects).

4. Evaluate the overall effectiveness of a product design or solution.

Scientific Inquiry, Doing Scientific Inquiry

3. Read, construct and interpret data in various forms produced by self and others in both written and oral form (e.g., tables, charts, maps, graphs, diagrams and symbols).

Michigan Curriculum Framework

Middle School

Strand I. Constructing New Scientific Knowledge

2. Design and conduct scientific investigations.

6. Write and follow procedures in the form of step-by step instructions, formulas, flow diagrams, and sketches.

Strand II.I Reflecting on Scientific Knowledge

1. Evaluate the strengths and weaknesses of claims, arguments or data.

3. Show how common themes of science, mathematics and technology apply in real-world contexts.

Strand IV.III Motion of Objects

1. Qualitatively describe and compare motion in two dimensions.

2. Relate motion of objects to unbalanced forces in two dimensions.

5. Design strategies for moving objects by application of forces, including the use of simple machines.

Engineer It!

The engineering design process is an iterative (repetitive) process that helps engineers solve problems. To get your students in an engineering mindset, try the activity below before you visit Imagination Station.

Points of discussion:

- What ideas come to mind when you hear the word engineer?
- Picture an engineer. What do they look like?
- What does an engineer's job involve?

Ask:

Can you build an 18-inch tall tower with the materials provided that can support a tennis ball and withstand the wind from a fan? Remember, you can only use materials supplied.

Materials:

Electric fan Paper
Straws String
Tape Tennis ball
Popsicle sticks

THINK and Plan:

- Working in groups, students first brainstorm different types of solutions. Encourage them to think creatively. They can work independently and then bring ideas to the group or the brainstorming can be done entirely as a group.
- Next, students select an idea and each team member creates a rough drawing of their structure. The drawing should include important notes about the design and a list of materials.

BUILD:

- Give students sufficient time to build their structures. Remind them that they need to adhere as closely as possible to their work plan- just as builders would follow the blueprints provided by an engineer.

TEST and Improve:

- Have students place the tower one foot away from the fan when they are ready to test. Did the tower support the tennis ball and not fall over? If not, have students go back to the drawing board.

Remember:

- Engineering is a repetitive process and it is fine to try several designs before you are successful. Engineers often construct models before they spend the time and money to create the real thing!

The Engineering Design Process

ASK

Identify a problem.
Ask a meaningful question.
What do you already know about this topic?

IMAGINE

Brainstorm possible solutions.
Think outside the box.
Choose your best solution.

PLAN

How will you implement your solution?
Identify what needs to be done to test your idea.

CREATE

Implement your plan.
Test it for success

IMPROVE

What can you do to improve your design?
What changes do you need to make?
If needed, begin the process again to further refine your creation.



Tower Challenge

THINK:

Can you build an 18-inches tall structure to support the water tower that can withstand an earthquake and cost the least amount of money? Each block is valued at \$100.

BUILD:

You will be creating two different designs to test on the shake table. Build your first design.

TEST:

Press the start button to shake your tower and then fill in the table below.

Repeat the process by building your second design. Press the start button to shake your tower and then fill in the table below.

	18" tall?	Withstand the earthquake?	Number of bricks	Cost for Design (# of bricks x \$100)
Design 1	Yes or No	Yes or No		
Design 2	Yes or No	Yes or No		

Based on the test results, which design would you recommend to your client? Why?

An engineer's design must meet the specifications of the client and stay within budget. Factors such as the look, function, cost of materials and safety of design are all carefully considered.

Chaperones

Engineer It

Grades 6-8

Chaperone Tip: Students will test several exhibits inside Engineer It! and make recommendations for the best designs. Remember, good engineers test multiple designs before they begin construction. We've included in this guide suggestions and helpful hints. Ask open-ended questions. You don't have to be the science expert! If a student is struggling, ask questions like "What have you done so far?" or "What were you thinking about doing next?" These types of questions can help students work through challenges and find their own solutions.

- Students should fill out the their Data Recording pages while at the science center. It should take about 1 hour to complete.
- Have fun! A field trip is a great chance to interact with young people and see the wonder of science through their eyes.

Student Names:

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

Schedule for the day:

Lunch Time:
 Demonstration Time(s):
 Departure Time:



