

Welcome to Imagination Station's newest exhibit, Energy Factory!

You are the President of Science Games, a company that makes the most popular video game in the United States, Copernicus's Challenge.

Currently, you have two factories where you manufacture video games; Toledo, Ohio and Phoenix, Arizona.

You are visiting Energy Factory today to learn more about solar energy and energy production and conservation. The questions below will help you learn about these topics.

When you get back to your classroom, you will be asked to make recommendations to determine which factory should get new solar panels. You will also be asked to make suggestions about ways to reduce energy usage at your factories.

Good luck and have fun exploring!

A Voice of the Visitor

1. Listen to the Question of the Day. Write the question below:

2. Listen to three answers from other visitors. Circle whether their answers were mostly fact or opinion.

Visitor #1: Fact or Opinion

Visitor #2: Fact or Opinion

Visitor #3: Fact or Opinion

3. Did you hear more facts or opinions from other visitors?

4. Now it's your turn - record your thoughts!

B Discover Energy Story Wall

1. Looking at the story wall, what are the seven parts of the display? Use the Word Bank to write in your answers.

Word Bank:

Using

Extracting

Creating

Finding

Reducing

Drilling

Refining

1. _____

5. _____

2. _____

6. _____

3. _____

7. _____

4. _____

2. What are three ways to reduce energy usage?

1. _____

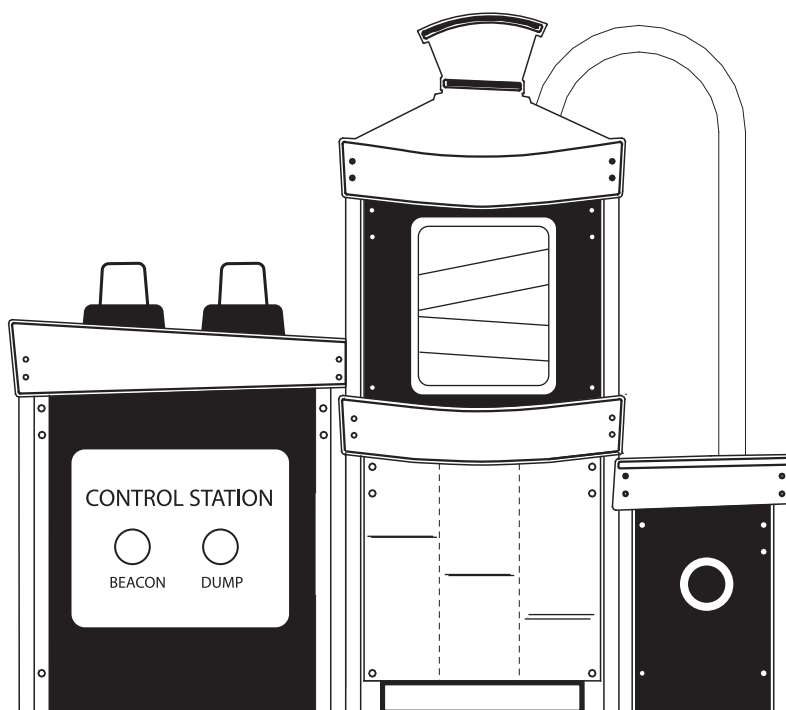
2. _____

3. _____

C Ball Refinery

The ball refinery is a model of the process of refining oil. The balls represent the different types of products that we get from crude oil, the unprocessed oil that comes from the ground.

1. What happens to the balls as they move through the refinery? Draw arrows to indicate how the balls move through the exhibit and label the final three products.



PV Panel Power

1. Color in the area that was lit up before anyone blocked the solar panel.

2. Color in the area that was lit up when you were blocking the solar panel.

3. In the solar panels below, draw in the area you blocked to get the lowest energy output.

PERCENT OUTPUT
☐ 91 - 100%
☐ 81 - 99%
☐ 71 - 89%
☐ 61 - 79%
☐ 51 - 69%
☐ 41 - 59%
☐ 31 - 49%
☐ 21 - 39%
☐ 11 - 29%
☐ 0 - 19%

PERCENT OUTPUT
☐ 91 - 100%
☐ 81 - 99%
☐ 71 - 89%
☐ 61 - 79%
☐ 51 - 69%
☐ 41 - 59%
☐ 31 - 49%
☐ 21 - 39%
☐ 11 - 29%
☐ 0 - 19%

4. Does a solar panel work as well on a cloudy day? Why or why not?

Follow the Sun

The goal at this exhibit is to get a really high number. **Remember to read the sign first!*

1. What is the highest number you can score?_____
2. What do you need to do to get a high number?
3. What is the lowest number you can get?_____
4. What do you need to do to get the lowest possible number?

Back in the Classroom

Energy Recommendations

Now that you have explored Energy Factory, it is time to make your energy recommendations. Remember you have a factory in both Toledo, OH. and Phoenix, Arizona.

The average number of sunny days in Toledo, Ohio is 180 days.

The average number of sunny days in Phoenix, Arizona is 310 days.

1. If you could only choose one location to place solar panels, would you choose the factory in Toledo, Ohio or Phoenix, Arizona? Why?

2. What recommendations would you make to reduce energy usage in your factories?

3. What changes can you make at school and at home to reduce energy usage?

Dear Chaperone,

We're glad you're here! Thank you for volunteering to be a chaperone on your school's visit to the Imagination Station. This page explains field trip procedures and offer tips on how to facilitate an Imagination Station Exhibit Guide.

The Imagination Station requires students and chaperones to remain together at all times. Group size should be 7 students or less per one adult.

Student Names:

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

Schedule for the day:

Lunch Time:

Demonstration Time(s):

Departure Time:

Imagination Station Exhibit Guides:

- Students should fill out the their Data Recording pages while at the science center. The 'Back in the Classroom' section of the Data Recording pages can be completed when the students return to school. For younger groups, it may be easier for you to be the official recorder and have students dictate their response to you.
- Have fun! Encourage exploration! Students may ask, "What will happen if...?". Encourage them to experiment and find out!
- Ask open-ended questions that will elicit more than 'yes' or 'no' responses. Ask questions that begin "Tell me about...", "What..." or "Why do you think...". You don't have to be the science expert! Tell students to look up information when they return to the classroom or ask an Imagination Station Team Member about a specific exhibit.
- Don't worry about completing the guide in order! You can visit the different exhibits in a manner that is most convenient for your group.
- Check with your head teacher to see if your group needs to complete all of the guide or only a portion.

Visitor Guide

Attractions

High Wire Cycle – This thrill ride hovers over 18 feet above the ground, suspended on a 1-inch cable with a 275 pound counterweight that enables any person to defy gravity.
• *You must be 54" to ride*

BOYO – Using science similar to that of the classic yo-yo, a rider is propelled up to 13 feet in the air using his or her own strength and some basic science principles.
• *You must be 54" to ride*

Simulator Theater – Over The Edge!

Experience every turn, jolt, twist and drop. With HD visuals, surround sound and a responsive platform, you have an adventure without leaving your seat!

- *Imagination Station members ride FREE! You must have a token to ride. Tokens are \$2 and available at Simulator entrance or Visitor Service.*
- *You must be 42" to ride.*
- *Elevator available. Please contact a team member.*

Demonstrations

Extreme Science Theater

Interactive demonstrations with an exciting EXTREME twist! Check monitors located at Visitor Service or at elevators for times.

Learning Worlds

Eat It Up! – This Learning World is focused on nutrition and exercise and tells the story of how the choices you make affect your body. Eat Smart. Play Hard. Have Fun.

Energy Factory – Get a glimpse into the abstract world of oil refining and solar energy.

Flex Space – This ever-changing space features some of the best exhibitions from North America and great experiences that we've created right here at Imagination Station.

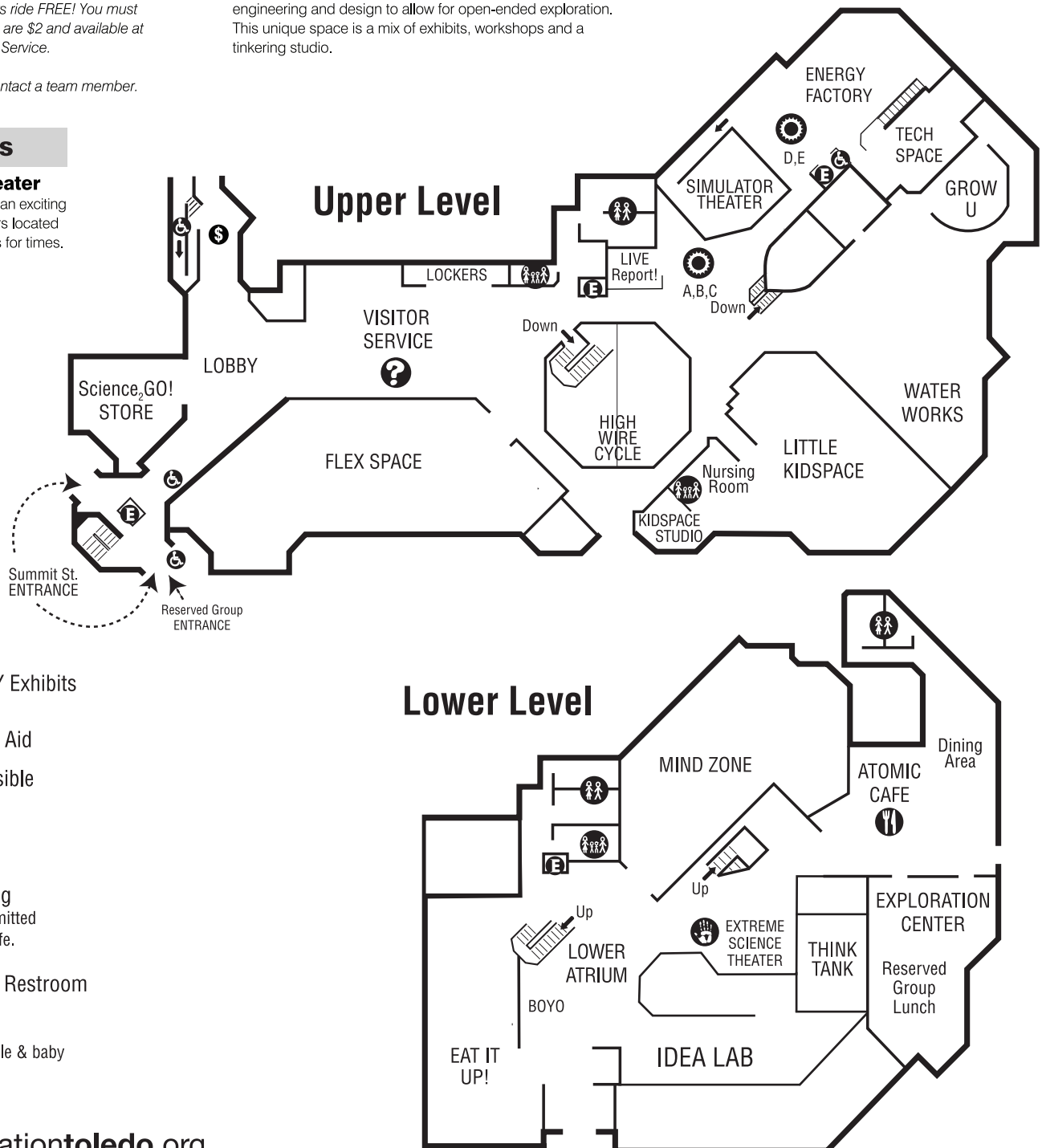
Grow U – Let Mother Nature be your guide as you take on FARM 101: Know It to Grow It.

IDEA Lab – This Learning World combines science, art, engineering and design to allow for open-ended exploration. This unique space is a mix of exhibits, workshops and a tinkering studio.

Little KIDSPACE™ – Our littlest adventurers (kindergarten and under) can hop aboard our fire truck, shop in the grocery store or climb on our favorite tree house while learning science fundamentals.

Mind Zone – Home to the Distorted Gravity Room, discover how the mind processes, interprets and creates illusions and perceptions.

Water Works – Discover the slippery science of water and explore nature's most powerful resource.



A Voice of the Visitor:

Student Data Recording Page Questions:

1. Listen to the Question of the Day. Write the question below:
2. Listen to three answers from other visitors. Circle whether their answers were mostly fact or opinion.
3. Did you hear more facts or opinions from other visitors?
4. Now it's your turn - record your thoughts!

IN THE KNOW

Students, especially at this age, often have a difficult time distinguishing between fact and fiction. Help them look for keywords in an opinion response, such as 'I think' or 'In my opinion'.

B Discover Energy Story Wall:

Student Data Recording Page Questions:

1. Looking at the story wall, what are the seven parts of the display?
Use the Word Bank to write in your answers.
2. What are three ways to reduce energy usage?

IN THE KNOW

The three ways to reduce energy usage are listed in the final step of the story wall. Talk about the three ways to reduce energy usage and how students think that they could implement these behaviors at home.

© Ball Refinery

Student Data Recording Page Questions:

The ball refinery is a model of the process of refining oil. The balls represent the different types of products that we get from crude oil, the unprocessed oil that comes from the ground.

1. What happens to the balls as they move through the refinery?

Draw arrows to indicate how the balls move through the exhibit and label the final three products.

IN THE KNOW

The refining process can be complicated- even for adults! Talk with the students about how fossil fuels are processed to form different types of products- heavy, medium and light.

Quick Review- Oil Refining

Fossil fuels are used to produce petroleum products. Fossil fuels were formed millions of years ago from animal and plant remains. Today, unprocessed oil known as crude oil is extracted from the earth and sent to refineries by pipeline or ships to be processed into different products. Crude oil is composed of hydrocarbons, which provide the incredible stored energy that makes oil such a valuable resource to humans. From crude oil, the refining process will extract petroleum gas, gasoline, oil, tar and asphalt.

In the refinery, crude oil is heated until it evaporates. At this point, it enters the fractioning tower as a vapor. The fractioning tower is a huge vessel which is hot at the bottom and cooler at the top. The result is that larger hydrocarbons, which have higher boiling points, turn back into liquids nearer the bottom of the tower. In this part of the tower, where the temperatures are very hot, the smaller hydrocarbons remain as gases. These gases move up the tower and condense at different points depending upon their length and the temperature in the tower.

Ⓢ PV Panel Power

Student Data Recording Page Questions:

1. Color in the area that was lit up before anyone tried to block the solar panel.
2. Color in the area that was lit up when you were blocking the solar panel.
3. In the solar panels below, color in the amount of area you blocked to get the lowest energy output.
4. Does a solar panel work as well on a cloudy day? Why or why not?

IN THE KNOW

Students may want to work in teams and mark the area of the solar panel that they cover for each other (as it may be difficult for students at this age to determine the area they are covering without seeing themselves in a mirror).

Quick Review- Solar Energy

Solar energy can be converted directly or indirectly into other forms of energy, such as heat and electricity. The major issues to overcome when utilizing solar energy are: (1) the intermittent and variable manner in which it arrives at the earth's surface and, (2) the large area required to collect it at a useful rate.

The simplest photovoltaic systems power many of the small calculators and wristwatches used everyday. More complicated systems provide electricity to pump water, power communications equipment, and even provide electricity to our homes.

Solar cells are also known as photovoltaic cells. Photovoltaic cells can turn the energy of the sun into electrical energy, which can be stored in batteries. When light strikes the cell, electrons are excited and travel along wires in the cell. The electrons flow through the wire and power whatever is connected and needs electricity to work, for example a motor. The flow of electrons is called electricity. Photovoltaic systems are quiet, clean, and non-polluting, but they are currently relatively expensive.

Ⓢ Follow the Sun

Student Data Recording Page Questions:

1. What is the highest number you can score?
2. What do you need to do to get a high number?
3. What is the lowest number you can get?
4. What do you need to do to get the lowest possible number?

IN THE KNOW

When the solar panel is facing a light source directly, it is able to capture more energy than when the light source is hitting the panel at an angle. If students are having trouble understanding this concept, encourage them to think about how bright the sun is when it is directly overhead in the afternoon versus when it is rising or setting in the sky.

When students return to the classroom, they will be asked to make decisions based on what they learned in Energy Factory. Encourage your group to discuss ways they can help to reduce energy usage.