



# Grow U

*Grades 6-8*

## Exhibit Guide

Presented by:



[imaginationstationtoledo.org](http://imaginationstationtoledo.org)

Dear Educator,

Welcome to 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.

**Your Grow U Exhibit Guide contains:**

- Introduction- suggestions for using the guide including key concepts
- Alignment to the state standards for Ohio and Michigan
- Chaperone Pages with tips for facilitating exhibit explorations with students
- Student Data Recording Pages to guide your students through exhibit-based explorations
- Extension Activities to do back in the classroom

**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 Data Recording Pages for each student.
- Print off copies of the Chaperone Pages for each of the chaperones. Divide your class into groups of 5-7 students and assign a chaperone to each group.
- Review the guide and your expectations with your students and prepare for a day of fun science learning at Imagination Station!
- **Science Suggestion:** Use this guide in combination with a science notebook so students can record observations and data throughout the day.
- **Teacher Tip:** 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.

## Ohio's New Learning Standards

### GRADE 6 ESS:

#### Topic: Rocks, Minerals and Soil

**Igneous, metamorphic and sedimentary rocks form in different ways.**

**Soil is unconsolidated material that contains nutrient matter and weathered rock.**

Soil formation occurs at different rates and is based on environmental conditions, types of existing bedrock and rates of weathering. Soil forms in layers known as horizons. Soil horizons can be distinguished from one another based on properties that can be measured.

**Rocks, minerals and soils have common and practical uses.**

Nearly all manufactured material requires some kind of geologic resource. Most geologic resources are considered nonrenewable. Rocks, minerals and soil are examples of geologic resources that are nonrenewable.

### GRADE 7 LS:

#### Topic: Cycles of Matter and Flow of Energy

**In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors.**

Ecosystems are dynamic in nature; the number and types of species fluctuate over time. Disruptions, deliberate or inadvertent, to the physical (abiotic) or biological (biotic) components of an ecosystem impact the composition of an ecosystem.

### GRADE 8 LS:

#### Topic: Species and Reproduction

**Reproduction is necessary for the continuation of every species.**

Every organism alive today comes from a long line of ancestors who reproduced successfully every generation. Reproduction is the transfer of genetic information from one generation to the next. It can occur with the mixing of genes from two individuals (sexual reproduction). It can occur with the transfer of genes from one individual to the next generation (asexual reproduction). The ability to reproduce defines living things.

**The characteristics of an organism are a result of inherited traits received from parent(s).**

Expression of all traits is determined by genes and environmental factors to varying degrees. Many genes influence more than one trait, and many traits are influenced by more than one gene.

### INQUIRY 5 - 8

- *Identify questions that can be answered through scientific investigations.*
- *Design and conduct a scientific investigation.*
- *Use appropriate mathematics, tools and techniques to gather data and information.*
- *Analyze and interpret data.*
- *Develop descriptions, models, explanations and predictions.*
- *Think critically and logically to connect evidence and explanations.*
- *Recognize and analyze alternative explanations and predictions.*
- *Communicate scientific procedures and explanations.*

Michigan Grade Level Content Expectations

Science Processes:

- S.IP.M.1** Inquiry involves generating questions, conducting investigations and developing solutions to problems through reasoning and observation.
- S.IA.M.1** Inquiry includes an analysis and presentation of findings that lead to future questions, research and investigations.

Life Science:

- L.EC.M.3** Biotic and Abiotic Factors: The number of organisms and populations an ecosystem can support depends on the biotic (living) resources available and abiotic (nonliving) factors, such as quality of light and water, range of temperatures and soil composition.
- L.EC.M.4** Environmental Impact of Organisms: All organisms (including humans) cause change in the environment where they live. Some of the changes are harmful to the organism or other organisms, whereas others are helpful.

Earth Science:

- E.SE.M.1** Soil: Soils consist of weathered rocks and decomposed organic materials from dead plants, animals and bacteria. Soils are often found in layers with each having a different chemical composition and texture.
- E.SE.M.4** Rock Formation: Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions and forces that created them.
- E.ST.M.4** Geologic Time: Earth processes seen today (erosion, mountain building and glacier movement) make possible the measurement of geologic time through methods such as observing rock sequences and using fossils to correlate the sequences at various locations.

## Seed Germination

**Supplies:** (amount will vary by class size)

Various types of seeds

Cotton balls

Clear plastic gloves

Water

Permanent marker

### Procedure:

1. Provide each student with a clear plastic glove and have them label the palm of the glove with their name and the fingers of the glove with the names of the seeds.
2. Students should then wet five cotton balls and wring out excess water.
3. Place 3 to 4 seeds on each cotton ball or dip the damp cotton ball in the seeds then place one in each finger of the glove.
4. Finally, have students puff some air into the glove, tie it off and tape their gloves to a window for warmth from the sun or place in a warm area of the room.
5. Check seed packets for germination period. Have students observe seeds for the appropriate time until germination is complete.
6. Once seeds have germinated, students should transplant them into soil and provide them with the things they need to grow into strong plants!
7. Make observations as the plant progresses through its various life cycle phases.

### What's Happening:

**Germination** is when a seed sprouts and begins to grow. It is important for students to know that germination starts right when a bud is present from the seed. Explain to your students that their sprout will need a while to grow and that every plant is different in the amount of time it takes for them to get to maturity. Ask them what their plant will need to grow. Most plants need water, light, proper temperature, time, soil (nutrients), oxygen and ample space to grow to full maturity, which is something you can show your students. A typical plant cycle includes sprout, growth, flower and fruit. The basic parts of the plant to point out are roots, leaves, stem, flower, seeds and fruit. Make sure to point out that not all plants have every part.

### Additional activities:

- Have students keep a journal of the day to day changes with the plants.
- Experiment with different types of gloves.
- Do the seeds germinate at the same rate in the dark as they do in the light?
- Have students review information on the seed packet for growing habits of plants. What zone does Ohio fall in?
- Have students discuss the crops grown in Ohio today. How has transportation changed the variety of foods available to consumers?
- Keep records of the classroom and outdoor temperatures. Is there an optimum temperature for germination?

## Web of Life

This activity will help your students to better understand the interdependence of different organisms in the environment and how the food we eat depends on other organisms in the food web.

**Supplies:** (amount will vary by class size)

Ball of string

### Procedure:

1. Have everyone form a circle. Challenge your class to try to make the food web as long as possible. Encourage them to include organisms such as bacteria, insects and decomposers (cockroaches).
2. Start by having a student be the sun and wrap the end of a string loosely around their hand.
3. Have a second student name a type of plant that will benefit from the sun. The first student (the sun) tosses the the string to this student who then wraps the string loosely around their hand.
4. Have another student name a living organism that may benefit from the plant (ex: a mouse). The second student(the plant) tosses the ball of string to them and the third student wraps the string loosely around their hand.
5. Students continue naming living organisms and passing the string around the circle.

### Questions to Ask:

- How many living organisms did you have in your web? Does the cycle ever get back to plants? How many cycles can you connect together?
- Together everyone makes a stable web. Have one student tug on their string. The tug represents something happening to that organism (ex: a tree is cut down, an animal goes extinct). Everyone that feels the tug would be affected by the absence of that organism. Can you name other ways the web may be affected? (temperature, deforestation, poaching, extinction, etc)

Have students try the activity again (always starting with the sun) and continue your web of life!

This game illustrates how living organisms are connected in a single ecosystem. Each participant represents one member of the cycle. If even one member of the circle is lost, the entire web may be affected. There are many factors that can affect a web of life, such as temperature changes, the illegal hunting of animals (poaching) and deforestation.

## Soil Study

**Supplies:**

Three clear, plastic 12oz bottles  
Potting soil  
Local soil  
Sand (coarse grained)  
Magnifying glasses  
Plastic trays  
Pencils

**Preparation:**

1. Fill three plastic bottles 2/3 full with each of the different types of soil.
2. Label the bottles so that you know what sample is contained in each.
3. Add water to the bottle, fill to near the top and cap. Shake the bottles and allow them to sit for 24 hours. Soils are best observed with as little disruption as possible, so place these bottles at stations a day in advance of your lesson. Students will record their observations in the "Samples in Water" section of their worksheet.
4. In addition, set up stations where students can observe the different soils on a plastic tray or container with a magnifying glass. Students will record their observations in the "Dry Samples" section of their worksheet.

**Discussion:**

Begin with a discussion. Ask your students:

- What do you find in soil?  
*Write all responses for students to view. Possible responses include water, air, worms, rocks, clay, sand, bacteria, nutrients and insects.*
- How would you categorize the different components of soil?  
*This is a more difficult question. Guide your students to create two categories: inorganic and organic. Inorganic items include clay, silt and sand. These items will all be non-living. Organic materials can include both living and non-living items- bacteria, insects and wood chips.*
- How does soil help plants grow?  
*Responses could include supports root systems, provides nutrients for plants, holds water and controls temperature.*

## Soil Study page 2

### Procedure:

Divide students into groups and ask them to observe the different soil samples at different stations. Have them record their observations on the worksheet provided.

### What you should expect to see:

The **potting soil** will show a thick layer of dark material on the bottom, a thick layer of cloudy water and a thinner layer of organic material on the top.

The **local soil** will depend on the location it was extracted from. Typically, the layering will be similar to potting soil, but will likely have less organic material on the top.

The **sand** will form a thick layer on the bottom. There should be a thick layer of clear water and a very thin layer of organic material on the surface. The local soil and potting soil will have cloudier water because the clay present in these soil will remain suspended in the water. This is because clay has a finer grain than sand.

All soil is different depending on where it comes from. Some soils contain lots of rocks, sand and clay, although all soils will contain some organic material, known as **humus**. Humus is the remains of dead and decayed plant and animal material found in tiny and fragments. Humus is usually located near to the surface of the soil. When you shake up your mixture of soil and water the ingredients separate. Because the organic material (humus) doesn't weigh as much as the inorganic materials (rocks, sand, clay) the humus floats.

### Conclusion:

Ask students: What properties of soil are important to support plant growth?

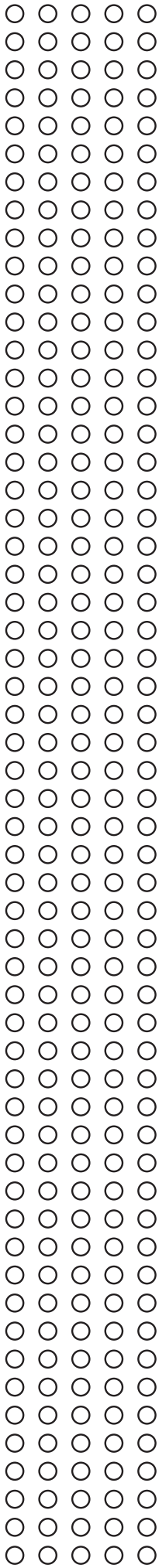
*Soil must be firm enough to support plant growth*

*Soil must contain essential plant nutrients*

*Soil must contain both organic and inorganic materials*

*Soil allows water to percolate through it*

*Soil contains space between the particles for air*



Name: \_\_\_\_\_ Date: \_\_\_\_\_

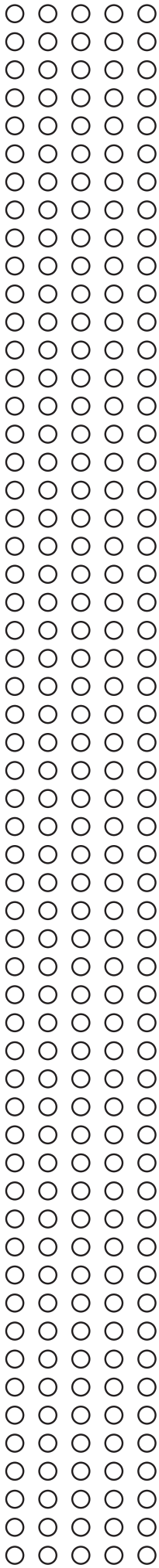
# Properties of Soil

**Samples in Water:** Observe the different types of soil. What differences do you observe between them?

Type of Soil	Observations
Potting Soil	
Local Soil	
Sand	

**Dry Samples:** Observe the different types of soil. What differences do you observe between them?  
List the organic and inorganic materials you observe in the different types of soils.

Type of Soil	Observations	Organic Material	Inorganic Material
Potting Soil			
Local Soil			
Sand			



# Grow U

Which of the samples appears to be the best environment to grow plants? Why?

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What properties of soil are important for plant growth?

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## Farm 101: know it to grow it

One thing I knew about agriculture and plants before playing the game show:

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One thing I learned from playing the game show:

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One thing that I would like to learn more about after playing the game show:

## Be A Bee Scientist

Observe the bees in the hive. Where do you see most of the bees? Select a bee in the hive to observe. This can be tough work as they are moving around quickly! What do you see this bee doing?

Bees are diurnal which means they are awake during the day and asleep at night. Since Imagination Station is open during the day, you are seeing the bees when they are most active. You may notice a bee doing the waggle or round dance, worker bees feeding drones, bees cleaning the hive, bees with pollen on their legs from a recent trip to a flower or other bees tending to the queen.

Record your observations below.

Date:	Time:	Approximate temperature:
What do you see?		

On the wall, you will find information about the roles of different types of bees in the colony. Based what you learned, what type of bee do you think you are observing?

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Do you think that the temperature and time of day have any effect on the bees? Why or why not?

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What role do bees play in pollination? Look at the signs for help!

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## Water Drainage

Turn the wheel and observe how water passes through the different types of soil.

When the water passes through the clay soil, I notice....

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When the water passes through the silty soil, I notice...

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When the water passes through the sandy soil, I notice...

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A farmer has three different crops that she needs to plant. Over many acres of land, different types of soil conditions exist. Based on your observations, make recommendations about where the farmer should plant the crops.

### Crops to plant:

**Cabbage** - heartier plant; does well in variable soils; needs moist environment

**Carrots** - most root vegetables do well with soil that drains quickly; these plants can tolerate a drier soil

**Tomatoes** - needs a soft soil to support their root system; soil needs to retain moisture

### Area of Farm:



primarily clay soil

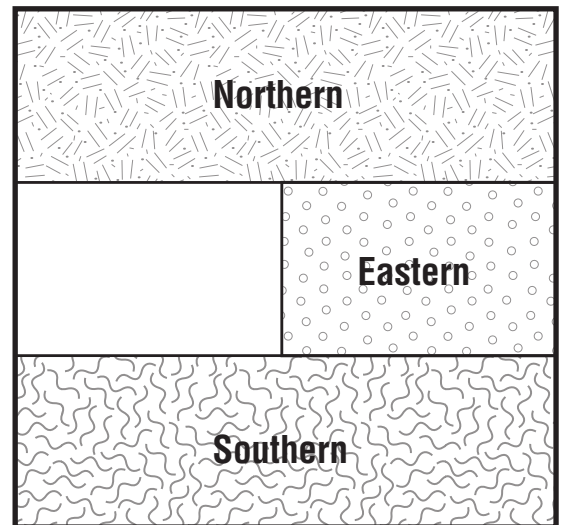


very sandy



mixture of sand, silt and clay (also known as loamy soil)

### Soil types on the Farm

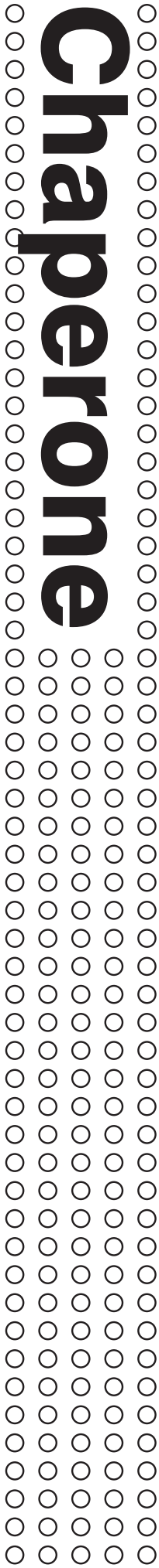


### Area of Farm      Type of Crop to Plant

Northern \_\_\_\_\_

Southern \_\_\_\_\_

Eastern \_\_\_\_\_



# Chaperone

Dear Chaperone,

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

Imagination Station requires students and chaperones to remain together at all times. Group size should be seven 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. It should take about one hour to complete the activities.
- Have fun! A field trip is a great chance to interact with young people and see the wonder of science through their eyes.
- 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...".
- Encourage exploration! Students may ask "What will happen if....". Encourage them to experiment and find out!
- 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.

# 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

### 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.

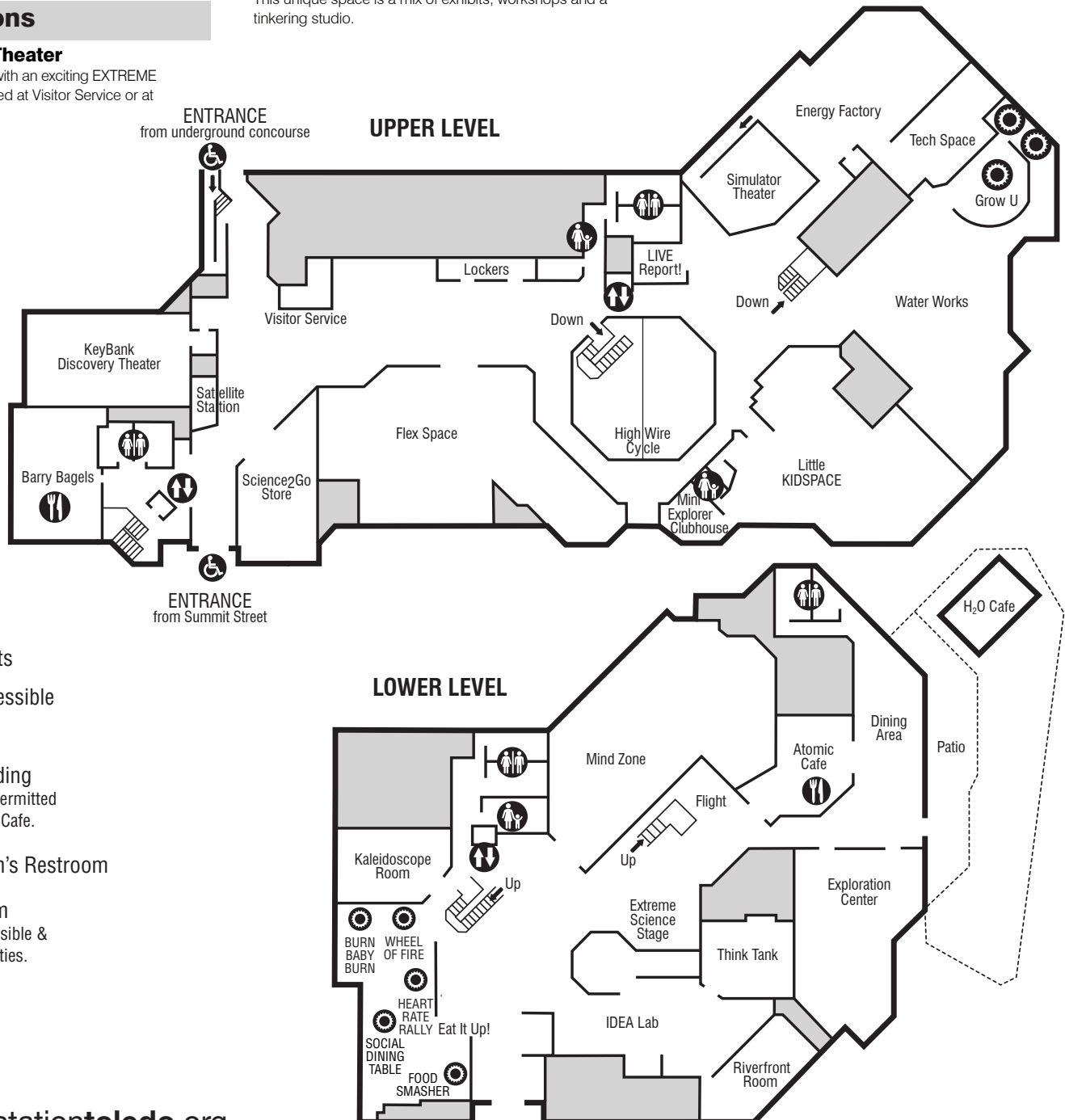
**Grow U** – Let Mother Nature be your guide as you take on FARM 101: Know It to Grow It.

**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.



## Farm 101: know it to grow it

*Responses will vary for students. Encourage your group to try to answer their questions using the other exhibits in Grow U or researching the question when they return to school or at home.*

One thing I knew about agriculture and plants before playing the game show: \_\_\_\_\_

One thing I learned from playing the game show: \_\_\_\_\_

One thing that I would like to learn more about after playing the game show: \_\_\_\_\_

## Be A Bee Scientist

Observe the bees in the hive. Where do you see most of the bees? Select a bee in the hive to observe. This can be tough work as they are moving around quickly! What do you see this bee doing?

Bees are diurnal which means they are awake during the day and asleep at night. Since Imagination Station is open during the day, you are seeing the bees when they are most active. You may notice a bee doing the waggle or round dance, worker bees feeding drones, bees cleaning the hive, bees with pollen on their legs from a recent trip to a flower or other bees tending to the queen.

Record your observations below.

Date:	Time:	Approximate temperature:
<p>What do you see?</p> <p><i>Students will observe a variety of different things. Some may notice a bee doing the waggle or round dance, worker bees will feed drones, some bees will clean the hive, others will have pollen on their legs from a recent trip to a flower, while others will tend to the queen. It is unlikely that you will be able to view the queen as her hive keeps her well protected, however, she is larger than the other bees.</i></p>		

On the wall, you will find information about the roles of different types of bees in the colony. Based what you learned, what type of bee do you think you are observing?

**Workers:** *These small female bees do it all- make honey, clean the hive, feed the larvae (baby bees) and build the wax cells where the bees live. There are 10,000 to 60,000 worker bees per colony.*

**Drones:** *These male bees usually number around 100 per colony. Their primary job is to mate with the queen. Drones can be so lazy that worker bees oftentimes have to feed them!*

**The Queen:** *Only one queen can rule a colony and her main responsibility is to lay eggs...lots of eggs! During the summer months, a queen will lay up to 1,500 eggs per day. Queens usually live around 4 years and can produce over one million eggs in that time.*

Do you think the temperature and time of day have any effect on the bees? Why or why not?  
*Bees prefer temperatures above 54°F. During the winter months, worker bees stay in the hive and huddle around the queen. The bees vibrate against each other for warmth. Once temperatures are above 54°F, worker bees will leave the hive in search of food. Bees are typically diurnal which means they are awake during the day and asleep at night. Most likely students are observing the bees at their most active time of day.*

What role do bees play in pollination? Look at the signs in the exhibit for help!  
*Some estimates indicate that without honeybees, farmers would produce a third less produce than they do! Pollen sticks to bees as they move from one plant blossom to another. As a bee travels from plant to plant, so does the pollen resulting in cross-pollination.*

## Water Drainage

Turn the wheel and observe how water passes through the different types of soil.

When the water passes through the clay soil, I notice....

*Clay drains the slowest because it has the smallest particles and they are packed tightly together.*

When the water passes through the silty soil, I notice...

*Silt drains faster than clay, but slower than sand. This prevents the soil from drying out but also allows air to circulate through the soil.*

When the water passes through the sandy soil, I notice...

*Sand drains the faster than silt and clay because the particles are large and loosely packed. This type of soil dries out easily.*

A farmer has three different crops that she needs to plant. Over her many acres of land, different types of soil conditions exist. Based on your observations, make recommendations about where the farmer should plant the crops.

### Crops to plant:

Cabbage- heartier plant; does well in variable soils; needs moist environment

Carrots- most root vegetables do well with soil that drains quickly; these plants can tolerate a drier soil

Tomatoes- needs a soft soil to support their root system; soil needs to retain moisture

### Area of Farm:



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very sandy



mixture of sand, silt and clay (also known as loamy soil)

Area of Farm	Type of Crop to Plant
Northern	___Cabbage___
Southern	___Tomatoes___
Eastern	___Carrots___

