

# SU+RVIVAL.

## THE EXHIBITION



**EDUCATOR GUIDE**

produced by  
**imagine**  
exhibitions



# SURVIVAL EDUCATOR GUIDE

INTRODUCTION TO THE EXHIBITION .....	3
EXHIBITION GALLERIES .....	4
NATURAL DISASTERS..... ACTIVITY: EVACUATION PLAN	5
TEMPERATE FOREST..... ACTIVITY: KEEPING WARM	7
HIGH MOUNTAINS .....	9
ACTIVITY: WHAT FIRE NEEDS	
DESERT .....	11
ACTIVITY: PURIFYING	
RAINFOREST.....	13
ACTIVITY: FOOD CHAIN GAME	
EXTREME COLD .....	15
ACTIVITY: SURVIVAL SUNDIAL	
ON THE WATER .....	17
ACTIVITY: MAKING IT FLOAT	
SUBURBAN/URBAN .....	19
ACTIVITY: ASSEMBLING A SURVIVAL KIT	



## INTRODUCTION

What greater thrill is there than to be alive? To stay alive—even thrive—in extreme environments. **SURVIVAL: THE EXHIBITION** offers students a safe, immersive and informative space in which to learn and test newfound survival skills. Simulating a variety of extreme environments, **SURVIVAL: THE EXHIBITION** combines STEM learning with gaming techniques for a challenging, hands-on exploration of the scientific principles behind key survival tactics.

More than a wilderness course or mountaineering experience, **SURVIVAL: THE EXHIBITION** reminds students that in any situation—especially in school—they already have the two most important tools needed: their intelligence and a level head. From On the Water to Temperate Forests, High Mountains and Extreme Cold to the Desert, **SURVIVAL: THE EXHIBITION** empowers visitors by providing them with invaluable skills that could literally save their lives—and others’.

Hands-on learning is key to survival. Tactile, collaborative interactives along with instructional content, inspiring stories and an engaging setting help students develop the physical memory necessary to retain new skills. Working in groups to explore the principles behind those skills also helps students to understand how they work in a variety of environments.

## ABOUT THIS GUIDE

The guide is composed of eight activities designed to help bridge learning from the Exhibition to the classroom, including two design challenges embodying the ideals of STEM and aligned with Next Generation Science Standards.

Activities included cover a variety of 3rd-5th grade performance expectations, so teachers may choose the ones that best align with their curriculum or otherwise fit their students’ needs and interests.

## ACTIVITIES

There is a corresponding 3rd-5th grade activity for each of the Exhibition’s eight main galleries. Some of the activities should be done on-site, but most are follow-up exercises designed to enhance and expand on your students’ experience with **SURVIVAL: THE EXHIBITION**.





**NATURAL DISASTERS**



**RAINFOREST**



**TEMPERATE FOREST**



**EXTREME COLD**



**HIGH MOUNTAINS**



**ON THE WATER**



**DESERT**



**SUBURBAN/URBAN**



**ACTIVITY:**

**EVACUATION PLAN**

Students identify the fastest way out of every K-2nd classroom in their school and create evacuation maps to post in each one.

**GALLERY:**

**NATURAL DISASTERS**

**GRADE LEVEL:**

**3RD-5TH**

**NGSS STANDARD 3-5-ETS1-2:**

Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

**REQUIRED MATERIALS**

- ☒ Pencils
- ☒ Paper

*(Continued on page 6)*





## OUTLINE

-

**ACTIVITY:****KEEPING WARM**

Students build and test a shelter designed to keep a water bottle protected from extreme heat and cold.

**GALLERY:****TEMPERATE FOREST**

**Grade Level:**  
**3RD-5TH**

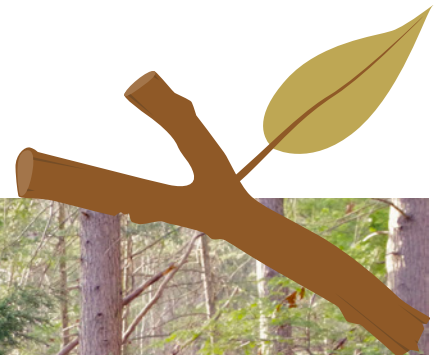
**NGSS STANDARD 3-5-ETS1-3:**

Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

**REQUIRED MATERIALS**

- ☒ Clear 16-ounce water bottle, label removed (one per group)
- ☒ Thermometer
- ☒ Art supplies (styrofoam, colored paper, rubber bands, food coloring, cardboard boxes)
- ☒ Heat lamp or other heat source, if needed

*(Continued on page 8)*





## OUTLINE

- 1 Discuss the Temperate Forest gallery. Ask students why maintaining a healthy body temperature is so important. Review what hypothermia is, its warning signs and how it affects the human body.
- 2 Discuss how critical shelter is to survive in the wilderness, as both a cool place to escape the sun and a warm place to protect you from the cold.
- 3 Challenge students to design and build a model shelter, large enough to cover a 16-ounce water bottle and protect it from extreme hot or cold.
- 4 Talk to students about coolers, thermal mugs and other items commonly used to keep liquids hot or cold. Brainstorm ways students might construct their shelters to include similar features.
- 5 Break students into small groups to discuss and sketch their shelters. Once you have seen their ideas, give each group their bottle, building materials and a set amount of time to complete their structures.
- 6 Have each group record the initial temperature of the water in their bottle and place it in their shelter. Place the bottle in the freezer for one hour. Remove the bottle, take and record the water temperature and have each group calculate the change from its initial temperature.
- 7 Have students share their results and discuss why some models worked better than others. What were some of the common design features?
- 8 Assuming it is hot enough outside, have students place their bottles in the sun for an hour and record the change in temperature. (If it is not warm and sunny outside, apply a heat lamp or other safe, strong heat source.)
- 9 Discuss how and why some shelters are more resistant to heat or cold.
- 10 Ask students what changes they would make to better protect their water bottles. To conclude, ask them how what they've learned might impact how they build a shelter in the wilderness.





**ACTIVITY:****WHAT FIRE NEEDS**

Students discuss fire and fire safety, including a demonstration of the three elements a fire needs to burn.

**GALLERY:****HIGH MOUNTAINS****GRADE LEVEL:****3RD-5TH****NGSS STANDARD 3-5-ETS1-2:**

Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

**REQUIRED MATERIALS**

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Candles                 | <input checked="" type="checkbox"/> Water             |
| <input checked="" type="checkbox"/> Glass jar               | <input checked="" type="checkbox"/> Metal baking tray |
| <input checked="" type="checkbox"/> Clay                    | <input checked="" type="checkbox"/> Poster paper      |
| <input checked="" type="checkbox"/> Refillable spray bottle |   |

**OUTLINE**

- 1 Ask students what they recall about the High Mountains gallery. Remind them that much of the Exhibit focused on fire and fire safety.
- 2 Ask students “What is fire?” and if they have seen fire in daily life—for example: while camping, in a fireplace or on the stove. Ask them to identify any similarities or differences between fires they have seen. Focus on how fires look similar or different, what other objects and materials may be around a fire and how they start.
- 3 Discuss why the High Mountains gallery is so focused on fire and ask what fires need to burn. Why are fires more dangerous in dry, forested places?

*(Continued on page 10)*



## OUTLINE CONT.

- 4 Explain that fires need three things to burn and ask students to share their ideas about what those three things might be. Write the responses on the board.
- 5 Tell students that you are going to do a demonstration, to help the class come to a consensus about the three things fire needs to burn. After the demonstration, ask students to pinpoint those materials.
- 6 Place a ball of clay on the baking sheet and put a candle in it. Light the candle. Ask students to suggest different ways to extinguish the candle. Test any of their safe ideas. As students' ideas are tested, ensure that the following are suggested and tested:
  - ➔ Spray the candle with water
  - ➔ Place the glass jar over the candle
  - ➔ Let the candle burn down until there is no more wick or wax
- 7 Revisit the list you made of things fire needs to burn and decide as a class on the three most important. These can be from the list you created or new ideas—though the official answers are oxygen, heat and fuel. Discuss how:
  - ➔ Placing the jar over the candle eliminated available oxygen
  - ➔ Spraying the flame with water took away the heat from the fire
  - ➔ Letting the wax burn away exhausted the fuel, so the fire could no longer burn
- 8 On the board, draw a triangle and write either HEAT, OXYGEN, or FUEL on each point. Pass out the poster paper and tell students that they're going to make their own Fire Triangle— only instead of labeling the three points, they need to describe what happens in each. Give students time to create their posters and put them up around the room. Do a gallery walk so students can take notes on each other's posters.
- 9 As a class, discuss what students noticed about the posters and how understanding the Fire Triangle can help them stay safe around fires. Ask students what they would do if they encountered a fire.



## ACTIVITY:

### PURIFYING

Students learn how pollutants get into our water and the effects they can have on the body if ingested. Students design and test several techniques to remove pollutants from the water.

## GALLERY:

### DESERT

## GRADE LEVEL:

### 3RD-5TH

## NGSS STANDARD 3-5-ETS1-2:

Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

## REQUIRED MATERIALS

### Filtration materials

- ☒ Two-liter soda bottles, one for each group
- ☒ Cups, one for each pair of students
- ☒ Napkins
- ☒ Coffee filters
- ☒ Gravel
- ☒ Sand
- ☒ Cotton balls
- ☒ Clay



### Pollution materials

- ☒ Dirt
- ☒ Bits of plastic
- ☒ Paperclips
- ☒ Food scraps
- ☒ Leaves or grass
- ☒ Food coloring
- ☒ Cooking oil
- ☒ Glitter
- ☒ Salt or other spices

*(Continued on page 12)*



## OUTLINE

- 1 Discuss the importance of clean water. Ask students to reflect on all of the ways they use water and how they would behave differently if they did not have access to clean water.
- 2 Ask students to guess how much drinking water there is on Earth. Explain that, though 70% of the Earth is covered with water, only about 2.5% of that water is drinkable—and only about 1% of Earth’s freshwater is even accessible. The rest is trapped in glaciers and snowfields. As the population continues to grow, so does the demand for fresh water. Increasing population and industrialization causes more pollution, making the limited water to which we have access less drinkable.
- 3 Ask students to speculate about possible sources of water pollution and list them on the board. Discuss what happens when you drink polluted water.
- 4 Put students in pairs and tell them they are going to design and test a water purification system to help provide more clean drinking water for the world.
- 5 Give each pair of students a cup and an empty two-liter soda bottle, split horizontally about 2/3 of the way down. Turn the top part of the bottle upside down and place it inside the other (lower) half. The top will serve as the filter and the bottom will store the filtered water.
- 6 Have student pairs draw a table with five of the filtration materials listed on its side and five pollutants along the top.
- 7 Have student pairs select a filtration material and add it to the top (inverted) half of the bottle. In a cup, mix one of the pollutants with water and pour over the filter. Students should record in their tables how well the filter succeeded at removing the pollutant. They should also note the color of the water, if there are any particles in it and any other relevant observations. Have students repeat the process for each type of filter and each of their five pollutants. For example, if one pair sets up a napkin filter, they should test what happens when they put water mixed with dirt through it. Next, students test a new napkin filter with water mixed with food scraps and then repeat this process with a new napkin filter for the other three pollutants they choose.
- 8 After testing all 25 variations, have students review their data and design a final filtration system based on their results. This can be a combination of any of the materials they have tested—a napkin with gravel and sand layered on top of it, for example.
- 9 In a large pitcher, mix several pollutants together and pour equal amounts over each pair’s final filtration system. Observe and discuss the results as a class. Did any of the systems work perfectly? Do students have other ideas for potential filters? Would they drink water filtered by this process? Discuss how different filters did a better or worse job of filtering out different pollutants and the implications that has in the real world. Should the same filters be used around the world or should they be designed especially for local pollutants?

**ACTIVITY:****FOOD CHAIN GAME**

Students play a game that demonstrates how energy is lost as it moves through the trophic levels of a food chain. Students pretend to be producers, herbivores and carnivores, who must compete over a finite amount of available energy.

**GALLERY:****RAINFOREST****GRADE LEVEL:****5TH****NGSS STANDARD 5-LS2-1:**

Develop a model to describe the movement of matter among plants, animals, decomposers and the environment.

**REQUIRED MATERIALS**

- ☒ Large bag of popcorn
- ☒ Small, medium and large cups (one each per student)

**OUTLINE**

- 1 Ask students what they noticed in the Rainforest gallery. What were their main takeaways?
- 2 Discuss the importance of rainforests to our environment and how they are being destroyed at an alarming rate. Ask students how cutting down the trees in a rainforest affects the animals that live there.
- 3 Ask students if they know what a food chain is and how producers, primary consumers and secondary consumers interact—clover, rabbits and foxes, for example. Take the students backwards through the food chain by discussing where the fox gets its energy (from the rabbit), where the rabbit gets its energy (from the clover) and where the clover gets its energy (from the sun via photosynthesis). Ask what happens if one link in the food chain becomes more or less populous.

*(Continued on page 14)*



**OUTLINE CONT.**

- 4 Take students to a large, safe outdoor area and tell them they will play a game that demonstrates how energy is gained or lost as it moves through a food chain.
- 5 Place a number of the smallest cups, about one for every other student, around the play area at random and fill them with popcorn. Explain that these cups represent clover, and the popcorn inside the cups represents energy the clover expended to produce food. Tell students that plants are only able to use about 3% of the solar energy they receive to make food.
- 6 Give half of the class medium size cups and tell them that they are to pretend to be the primary consumers: rabbits. To survive, the rabbits must get energy (popcorn) from the producers (clover) and fill up their cups. Give the remaining half of the students the large cups and tell them to pretend to be the secondary consumers: foxes. To survive, the foxes must fill their cups with energy from the primary consumers (rabbits). Ask the class why foxes need larger cups than rabbits.
- 7 Explain that the game will be played in two 90-second rounds, including a 30-second head start for the rabbits to collect as much energy as they can from the clover before the foxes are released. The foxes will then try to get energy from the rabbits by tagging them (when a rabbit is tagged by a fox, they must pour all of their popcorn into the fox's cup and are finished for that round). The other rabbits may continue to try to get energy from clover while attempting to avoid the foxes.
- 8 Ask students to predict what they think will happen when the game begins. Begin the game with one round, giving the rabbits their 30-second head start before setting the foxes loose for one minute. (Shout "Freeze!" to end the round.) Count and record how many primary and secondary consumers are left. Refill the small cups and play one more round, then tally the results again.
- 9 As a class, debrief the results. What happened? Where did the energy end up? Did you spill any popcorn as you ran? If so, that represents energy lost to heat and other normal activities. Ask students to notice that they need more producers than primary consumers—and more primary consumers than secondary consumers—because of the amount of energy each requires to survive.
- 10 Ask students to play the game again, but only after deciding as a class how many producers and consumers ought to be in play, in order to make the food chain more sustainable. Play the game with these new parameters and discuss the results. Ask students to think about how the game might apply to the Rainforest. When one link of the food chain is depleted, how does that affect the other parts? What are some ways humans can mitigate such impact?

**ACTIVITY:****SURVIVAL SUNDIAL**

Students construct a sundial to observe the movement of the sun across the sky over the course of a day. Students use data from the sundial to determine high noon and record how the Sun's position changes over the course of a year.

**GALLERY:****EXTREME COLD****GRADE LEVEL:****5TH****NGSS STANDARD 5-ESS1-2.L:**

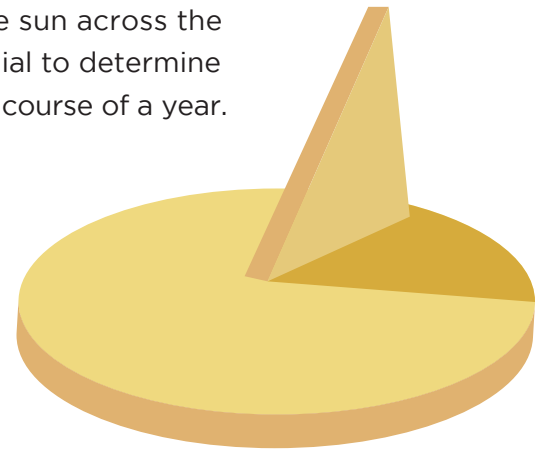
Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night and the seasonal appearance of some stars in the night sky.

**REQUIRED MATERIALS:**

- ☒ Weatherproof rod or pole, one meter or longer
- ☒ Masking tape
- ☒ Rocks or other durable, weatherproof shadow markers
- ☒ Meter stick or measuring tape

**OUTLINE**

- 1** Ask students what they know about how the Sun travels across the sky. Ask if the Sun or the Earth is moving and how we know this. Ask students if the Sun travels across the sky the same way all the time or if it follows different patterns during different seasons.
- 2** Ask students how they would tell the time of day if they were lost in the wilderness. How did people tell time before mechanical or digital clocks were invented?
- 3** Ask students if they have ever heard of a sundial and explain what they are. Ask students how they could make a sundial at their school. Have students do a think/pair/share to discuss ideas for constructing a sundial. Be sure to ask where their sundial should be located, how to collect data from it and how to test its accuracy.



*(Continued on page 16)*

**OUTLINE CONT.**

- 4 As a class, create a plan to build an outdoor sundial. The next sunny morning, take them outside to identify a flat space, unobstructed by trees or other structures that might block the Sun yet secluded enough to remain undisturbed for six months. Plant the pole—called a “gnomon” when used as a sundial—securely and perpendicular to the ground.
- 5 Have a student place a rock on the ground at the end of the pole’s shadow. Write the time on a strip of masking tape and put it on the rock.
- 6 Measure the distance from the pole to rock and have students make a data table to record both the time of day and the length of the shadow.
- 7 Every hour or so for the remainder of the day, have a pair of students go outside and place a rock marked with the time at the end of the gnomon’s shadow, then measure and record the shadow’s length to share with the rest of the class.
- 8 On the next sunny day, explain that solar noon is when the Sun is at its highest in the sky. Ask students to use their data tables to predict when they think solar noon will be. Have them go outside and measure the length of the gnomon’s shadow at their predicted solar noon times to identify when the shadow is shortest. Compare their predictions to the actual solar noon for your area, which can be found with a simple internet search. Discuss why students’ predictions were or were not accurate.
- 9 Using their data tables, have students predict the length of the gnomon’s shadow at the top of each hour. For example, if the shadow was 50 cm at 11:30 a.m. and 30 cm at 12:30 p.m., students could predict that the shadow would be around 40 cm at 12:00 p.m. Have pairs of students go to the sundial at the top of each hour and record the length of the shadow. Have them place another rock at the new shadow point and label it with the date and time.
- 10 Ask students to explain why the gnomon’s shadow changes throughout the day. Ask them if they think it will change throughout the year and if so, why?
- 11 Approximately six months after creating the sundial, choose a sunny day to take the class back to visit it. Observe where the shadows fall, compared to the same times six months earlier. Discuss what causes these fluctuations. (This is a great way to introduce astronomy to students.) Sometimes sundials have different scales for different seasons. If time allows, have students place different colored rocks around the sundial to indicate where the shadows fall during different seasons.

**ACTIVITY:****MAKE IT FLOAT**

Students use creativity, understanding of buoyancy and the principles of economics to design a functioning boat—economical in design and able to carry a heavy load—from standard art materials.

**GALLERY:****ON THE WATER****GRADE LEVEL:****3RD - 5TH****NGSS STANDARD 3-5-ETS1-1:**

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time or cost.

**REQUIRED MATERIALS:**

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Large clear, watertight bin | <input checked="" type="checkbox"/> Plastic straws               |
| <input checked="" type="checkbox"/> Popsicle sticks             | <input checked="" type="checkbox"/> Corks                        |
| <input checked="" type="checkbox"/> Aluminum foil               | <input checked="" type="checkbox"/> Masking tape                 |
| <input checked="" type="checkbox"/> Paper                       | <input checked="" type="checkbox"/> Multiple small metal washers |
| <input checked="" type="checkbox"/> Glue                        |  |

*(Continued on page 18)*





## OUTLINE

- 1 Ask students what they learned about water safety in the On the Water gallery. Review the key aspects of water safety and list them on the board.
- 2 Tell students that one fundamental of staying safe while on the water is having a boat that floats! Show students a flat piece of paper and ask them if it will float in water. Place the unfolded paper in the bin of water and have students share their observations. Take out a second piece of paper and ask them how to make it sink. Crumple the paper and place it in the water. Ask students to discuss why this paper sank and the other did not. (Be sure to discuss surface area.) Ask them how they might fold the paper to make it float and then test their ideas.
- 3 Divide students into groups and challenge them to design a boat that can carry a heavy load without costing too much to build. Each group must then “buy” the materials they need to build their boat—which when complete, must be strong enough to float at least 10 washers. (The goal is to make a boat that holds the most materials and costs the least.)
- 4 Describe the types of materials students can use to build their boats and list the costs of each on the board:
  - ➔ Lumber (popsicle sticks) = \$50/per
  - ➔ Reinforcements (plastic straws) = \$25/per
  - ➔ Wood (printer paper) = \$15/sheet
  - ➔ Buoys (corks) = \$50/per
  - ➔ Sheet metal (aluminum foil) = \$25/sheet
  - ➔ Cable (masking tape) = \$10/inch
  - ➔ Welding materials (glue) = \$50/bottle
- 5 Have the groups discuss and draw their designs, then list the materials needed to calculate the cost of building their boats. Regardless of whether or not they were used, each group must include all of the materials they’ve purchased to determine their total cost.
- 6 Give the groups time to build their boats and then call them to the front, one at a time, to test how many washers each boat can hold and remain afloat. Before placing the boats in the water, have each group explain their design to the class and reveal how much their boat cost to build. After testing each boat, list the cost of the boat and how many washers it held before sinking on the board.
- 7 Discuss the results with the class. Ask which designs worked best. Ask if there was a correlation between building cost and the number of washers a boat could hold.
- 8 Allow the groups a chance to redesign their boats and test them again. As a class, discuss what changes were made and what they learned about how and why boats float.





### **ACTIVITY:**

#### **ASSEMBLING A SURVIVAL KIT**

Students research the necessary components for a survival kit and use a budget to design one specifically for their family.

### **GALLERY:**

#### **SUBURBAN/URBAN**

### **GRADE LEVEL:**

#### **3RD-5TH**

### **NGSS STANDARD 3-5-ETS1-1:**

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time or cost.

### **REQUIRED MATERIALS**

- ☒ Internet access

*(Continued on page 20)*





## OUTLINE

- 1 After visiting **SURVIVAL: THE EXHIBITION**, review the importance of being prepared with students. Discuss the types of natural disasters that can occur in your area and other emergencies that might affect them. Ask students to share what types of things they need to prepare for disasters and other ways they can prepare their families for an emergency.
- 2 Tell students that they are each going to design a home survival kit specifically for their family.
- 3 Discuss the five main categories of items a survival kit should provide and list them on the board:
  - ➔ **Shelter and warmth**
  - ➔ **Health and first aid**
  - ➔ **Food and water**
  - ➔ **Signaling and navigation**
  - ➔ **Multipurpose tools and materials**
- 4 Divide students into five groups and assign one category to each group. Have each group research their category, create a list of recommended items and record the costs of each one. For example, the Food and Water group should determine the best types of foods to include in their kits and list the prices of each individual item. Have students start their research by visiting [www.ready.gov/build-a-kit](http://www.ready.gov/build-a-kit), which is a government website designed to help Americans prepare for emergencies.
- 5 Have each group share their list with the class. Tell students to decide which items from each group's list they want in their kit, assuming they have a total budget of \$100. Challenge students to personalize their kits. Meaning: If they live in a cold place, they need to focus on how to keep warm—or if they have a large family, their kit should include more food than that of someone with a smaller family.
- 6 Give students time to design their kits and then have each one present what they chose to include in theirs to the class. Encourage students to take their designs home and have their families actually assemble their survival kits.

