



Exploring the World of Science



**Northshore School District
Elementary Science Olympiad
Events Guidelines and Resources
2020-2021**

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Important:

Clarification Point 1:

There are a total of 3 scored events. Please note that **ALL STUDENTS** participate in **ALL EVENTS**. The events are the **SAME** for each student. This document details the events.

Clarification Point 2:

There is **NO** set materials list for any of these events. The challenge is for the students to determine the materials they want to use to make their projects. Please keep in mind that the cost limit is a total of \$15 for items that you have to specially go out and buy. Materials found readily in your home do not come under the \$15 limit.

Onward!

Please reach out to us at wastate.eso@gmail.com with any questions or concerns.

Event 1: Save the Ice

Event Type: Short Build

Description:

Shelter is one of the necessities of human life. For humans, shelter includes the necessity to maintain a sustainable body temperature. Our bodies cannot gain too much heat and neither can they lose too much heat. This event aims to help students understand the various factors that are taken into consideration to create effective tools of heat energy conservation. **Students will construct a container from a variety of materials, of their choosing, that prevents a certain mass of ice cubes from melting.**

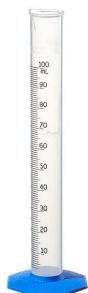
Testing Procedure:

1. When you have built a container that satisfies the rules and conditions below, please follow this testing procedure. Please read through the scoring and submission sections for this event to understand what you must video record before, during, and after testing.
2. Place 50 grams of ice cubes inside your constructed container. If your container has a lid, close and seal the lid.
3. Wait 2 hours.
4. Remove and isolate water discharge (explained in Rule #11).
5. Measure and record water discharge.

Rules:

1. You may use any materials to make your container
2. You may not use a pre-made thermos of any sort
3. The inside of your container (the part that touches the ice cubes) must be completely non-porous.
 - a. You may have a bigger container that contains a smaller non-porous container inside to hold the ice cubes.
 - b. Examples of allowed inside containers are bowls, glasses, beakers.
 - c. Inside containers/materials that will be disqualified are porous: styrofoam, cardboard, wood, leaky plastic bags.
4. The container may not be more than 25 cm on any side (length, width, depth).
5. If the container has a lid, it must be removable
 - a. You must be able to put the ice cubes in the container and isolate the water discharge (explained in detail in Rule #11).
6. The minimum mass of ice cubes used must be 50 grams.
 - a. Note: An average ice cube is 7-15 grams

- b. You may hold a greater mass of ice cubes if you wish to do so (because ice cubes may not be exactly 50 grams together).
 - c. Please use a standard kitchen weighing scale, or something similar to that.
 - i. If you do not have one, please refer to the Measuring Devices section for this event.
- 7. Ice cubes may be of any shape.
- 8. Ice cubes must be made of frozen water. You may not make salt, sugar, flour, etc. solutions and then freeze those so that they look identical to ice cubes.
 - a. Making such mixtures before freezing your cubes is most likely going to be to your disadvantage anyways (due to melting point depression).
- 9. Testing condition: The procedure must be conducted at room temperature (60-78 degrees Fahrenheit).
- 10. You must be able to collect all water discharge from the ice cube.
- 11. You must be able to measure the volume of water discharge.
 - a. Example: You use a bowl as your inside container. You put ice cubes inside the bowl and place that bowl inside your created container. After the 2 hours testing period, you remove the bowl from your container. You separate the solid ice cube with the water (by physically picking up the solid and transferring it to another holder of some sort). Now that you have isolated the water, you pour the water from the bowl into a measuring device to measure its volume.
- 12. Preferable metric measuring devices: kitchen measuring cups with multiple markings (in units of mL), graduated cylinders, teaspoon/tablespoon measuring spoons. Pictures shown below:



- a. The measuring device must have more than one or two markings.
 - b. The measurement device must have a clear/semi-clear interior and exterior.
 - i. Teaspoons/tablespoons of any type are okay
 - c. If you are using teaspoons or tablespoons, you should use multiple spoons to get an accurate volume measurement
 - i. Note that units of tsp or tbs can always be converted to mL. You do not have to worry about this.
- 13. Unacceptable measuring devices: kitchen measuring cups that only have one or two markings on them like $\frac{1}{2}$ cup or $\frac{1}{4}$ cup. Measurements require more precision than this. In general, units of cups are not very precise for this purpose.

14. If you do not have an acceptable measuring device, please refer to the Measuring Devices section for this event.
15. Volume Measurements must be taken to 3 significant figures. Use this link to understand what significant figures are:
 - a. <http://chemclass-ol.org/significant-figures/>

Measuring Devices

This event requires that students have a **kitchen weighing scale** and an **acceptable volume measuring device**. We understand that some students may not have this available in their homes.

In order to solve this there are two options:

1. You may purchase the measuring devices if you are able to do so. This cost would NOT come under the \$15 limit.
2. If you would require financial assistance to purchase the measuring devices, please email us at wastate.eso@gmail.com and we will try our best to provide you with these materials.

Submission:

For some of the rules specified above, your project will not be directly checked and verified. It is expected that participants will adhere to the honor code and follow all rules. This event will be submitted completely through TWO pre recorded videos. These will be submitted as TWO different videos on Flipgrid around competition time. There are no live testing components (through Zoom) for this event.

Video 1:

Participants must create a 1-2 minute video that includes the following components:

- Student's full name and school.
- Verbal statement of dimensions of container
- Verbal statement of the approximate temperature of the testing room
 - Saying "this room is at room temperature" is acceptable
- Explanation of the shape of ice cubes used
- Picture (or video clip) visually showing the mass of ice cubes used.
 - Example: Take a picture of the ice cubes on the weighing scale so that the reading on the scale is visible.
- Verbal statement of the mass of ice cubes used
- Pictures (or video clip) showing the top view and side view(s) of your container.

This video may be edited to put together pictures/video clips.

Video 2:

Participants must submit an 2-4 minute UNEDITED video of steps 4-5 of Testing Procedure (above) for ONE trial that includes the following components:

- Visually showing steps 4-5 of Testing Procedure:
 - Remove and isolate water discharge
 - Measure and record water discharge
- Verbal statement of the water discharge collection method
 - Highly suggested: As you are doing Step 4 of Testing Procedure, talk about this.
- Verbal statement of volume measurement method for water discharge
 - Highly suggested: As you are doing Step 5 of Testing Procedure, talk about this.
- Show the volume of water discharge (as shown by the volume measuring device)
 - Show the markings on your clear-colored measuring device.

This video may not be edited (no cuts or breaks anywhere). If this section of the video is edited, the submission will be disqualified.

Scoring:

This event has a simple scoring method. Students will be scored on the volume of water discharge. The smaller the volume of water discharge, the higher the score.

Ties: A volume difference of ± 2 mL will be considered a tie.

Ties will be broken by examining testing setup (through your UNEDITED video (Video 2)) and other components of your submission videos.

Resources:

Below is a suggested set of **steps to follow** in order to understand the science concepts behind this project as well as apply them to building this project. Youtube videos and google searches are very efficient and helpful sources of information to learn the concepts/topics described below. This is suggested NOT required. Please feel free to tweak or change this process.

- The core science concept of this project is heat conservation, and hence you must understand how heat is transferred.
 - Conduction
 - Convection
 - Radiation
- Next, distinguish between materials that can absorb heat vs materials that conduct heat.
- Conduct research about the materials and design used in popular heat conserving methods like a thermos flasks, sleeping bags, jackets etc.
- Understand the differences and similarities between materials that prevent heat loss vs heat gain.
- Now that you have a good idea of the science behind this project, start comparing materials in order to determine which ones are the best for your purpose.
 - Tip: Interpret and analyze the results of this experiment:
<https://sciencefaircentral.com/sites/default/files/downloads/sfcp2-keepitcool.pdf>

- Please note that this experiment just serves to show you how you can conduct your experiments at home to determine which materials are the most effective
 - (Advanced) Tip: From the research you have done previously, pick 4-5 materials to conduct your own experiment using the process demonstrated in this experiment.
 - Clarification: Doing the experiment is NOT what this event is directly about. The experiment solely helps you determine what materials to construct your container with, which is what this event is about.
- Now that you have identified your materials, construct your container. Use the engineering design process to ensure that you are constructing the best possible container.
- Testing Tips and Hints:
 - Note that the rules say you can use any shape of ice cubes
 - Determine which shape of ice cubes would melt the fastest
 - Hint: Search up “surface area to volume ratio of human cells”. Apply this concept to determining your ice cube shape.
 - When you are testing out your completed container, you should do more than multiple trials and you should video record steps 4-5 of Testing Procedure (this is what is included in your video submission for this event) for EACH trial. Then you can choose the trial with the best results and submit that one as part of your video submission.
 - NOTE: This does not mean that you submit the video recording for each trial. By keeping a video recording of each trial, you will be able to choose the best one to submit.

Event 2: Mission Possible!

Event Type: Long Build

Description: A Rube Goldberg machine, named after American cartoonist Rube Goldberg, is a machine intentionally designed to perform a simple task in an indirect and overly complicated way, often through multiple other tasks. Students will design, build, and test a Rube Goldberg-like device, which incorporates up to at least 5 different tasks(specified below).

Mandatory Tasks:

1. Create a domino-effect
2. Make a round object roll
3. Have a change in elevation
4. Create a pendulum action
5. Make a loud sound

Rules:

1. The device will be started by some action of the participant such as switching a switch, pushing a button, dropping an object, etc. Once the device has started, it should be able to run on its own to complete the tasks without any additional help from the student.
2. The device has no size restrictions. It can be as large (running through an entire room) as needed or as small (in a box) as needed.
3. Students are encouraged to use readily available materials in your homes.
4. The device may have components attached to the floor or walls of the house.
5. The time limit (on how long the device takes to complete the 5 tasks) is 2 minutes. This should be more than sufficient for participants.
6. Students are free to incorporate more than the above listed 5 tasks, although they will not be scored on them.
 - a. Note: Please ensure that adding more tasks does not compromise the consistency of your device.
 - b. Please refer to Scoring to see what students will be scored on.
7. Have fun and be creative!

Submission:

This event will have two submission components - 1) TWO pre recorded videos of a student's device, and 2) testing their device in a live Zoom meeting. The two videos will be submitted as TWO different videos on Flipgrid around competition time.

1) TWO pre recorded videos

Video 1:

Participants must create a 2-4 minute video that includes the following components:

- Student's full name and school.
- Photo/picture/video clip of a draft/design that you made on paper before building the device.
- Explanation of the draft/design.
- Picture (or video clip) showing the entire device from a fixed camera.
- Picture (or video clip) showing each of the 5 mandatory tasks in the device.
 - The device shouldn't be started at this time. We just want to get a closer look at how you have made each section of your device.
 - These pictures (or video clips) should show a closer look into your device.
 - Explain each section/task that your device does as you show them

This video may be edited to put together pictures/video clips.

Video 2:

Participants must submit an 1-2 minute UNEDITED video, from a fixed camera position, with your device in action for ONE trial. The video should have the following components:

- Video must show the participant doing the first action to start the device and then the series of actions that follow until the device has completed all tasks
- Only submit a video for ONE trial (your best one)

This video may not be edited (no cuts or breaks anywhere). If this section of the video is edited, the submission will be disqualified.

2) Live testing on Zoom

Participants will do multiple tests on competition day (virtually in a Zoom meeting) where the judge tests the consistency of the device. Details about how this testing will happen is explained below in Testing Procedure.

Testing Procedure:

This is the procedure that we will follow to test the consistency of the device in a Zoom meeting on competition day:

1. Students will be sent to breakout rooms to test their device with a judge
2. Students should set up their computer camera so that the entire device is visible.
3. Now testing will begin.
4. As the judge says "start", the student will do the first action to start the device.
5. The judge will record how many of the 5 tasks have been completed by the device after it has stopped.
6. Steps 4-5 will be repeated 2 more times (for a total of 3 trials).
7. Students will be given time to re-setup their device after each trial.

8. A maximum of 5 minutes will be given for re-setup between each trial.

Scoring:

Points will be awarded as follows:

- **Video 1:** 10 points for successful submission containing all components
- **Video 2:** 40 points awarded for successful completion of the device
- For each trial (there are 3) during live testing:
 - 4 points awarded for each successful task completed (there are 5)
 - 5 additional points awarded for the successful completion of the entire device
 - Therefore there is a maximum of 25 points for each trial
- For the event there is a maximum of $10 + 40 + 3 \times 25 = 125$ points possible

Event 3: Elements, Compounds, and Mixtures

Event Type: Objective Test

Description: Chemistry is the study of matter, which is, simply, everything in this world. Developing understanding of chemistry helps you better understand the world we live in. For example, have you ever wondered, “where does all the food I eat go?” Does the stomach magically digest it? The answer to that is that a series of chemical reactions in your stomach. Although this event will not teach you what those chemical reactions are, it will hopefully develop your basic understanding of chemistry and get you excited about learning more. The objective of this event is to test the ability of students to classify materials into one of three categories: elements, compounds, and mixtures, as well as test basic concepts in chemistry.

Topics:

- Classification (40% of test)
 - Understanding the difference between the following: atoms, elements, molecules, compounds, homogeneous mixtures, heterogeneous mixtures
 - Classification of daily materials or nature into one of the three categories: elements, compounds, or mixtures
 - Eg: air is a mixture
 - Eg: glass is a compound
- Basic Concepts in Chemistry (60% of test)
 - Matter
 - States of Matter
 - Protons, neutrons, and electrons
 - The Bohr Model of the Atom
 - Periodic Table (atomic number, atomic mass, identity)
 - What are chemical reactions? What are examples of chemical reactions in daily life? What are examples of chemical reactions in our body?
 - Acids and bases (pH, litmus paper)
 - Density
 - Finding Volume (the water displacement method)

Testing Procedure:

1. The objective test will be proctored.

2. Students will take the test on a zoom meeting on competition day. Cameras must be on unless you notify us of inability to do so (preferably prior to competition day).
3. Students will be given a link to open and start their test.
4. The test will be 45 minutes long and will have 40 questions.

Rules:

1. Students cannot take the objective test unless they are in the zoom meeting.
 - a. Exception: Special arrangements made after emailing us at wastate.eso@gmail.com
2. Students may use the periodic table and one cheat sheet. The cheat sheet must be a two sided 8x11 piece of paper (or smaller).
3. Students may not leave the testing browser at any time during the test. We may have measures in place to prevent such cheating.

Scoring:

There are 40 total questions on the test. There may be 2-4 optional bonus questions as well. 4 points will be rewarded for every correct answer. 2 points will be awarded for every correct answer that is a bonus question. 1 point will be deducted for every incorrect answer. No points will be deducted for omitted questions.

Resources:

Classification:

You must understand the difference between the following: atoms, elements, molecules, compounds, homogeneous mixtures, heterogeneous mixtures

- Any library books (from county or school) on these vocabulary terms are a VERY good resource!
 - Library books (for kids) for such topics are 15-30 pages long. Please don't read a whole textbook. That may not be beneficial for your understanding.
- There are some very good chemistry content creators on Youtube. Please watch basic chemistry videos and do not feel overwhelmed with the difficult and advanced topic videos on the channels.
- Excellent Youtube Channels:
 - Professor Dave Explains
 - ChemJungle
- Khan Academy Chemistry Library: <https://www.khanacademy.org/science/chemistry>
 - Recommended Videos from Khan Academy:
 - Introduction to the atom
 - Ions and compounds
 - Pure substances
 - Mixtures

■ Mixtures and Solutions

- Please note that some of these videos start with basic information and then present more advanced information which is not needed. Do not be scared by these videos!

Basic Concepts in Chemistry:

- The readings and videos for the classification category of the test will also help for this category of the test.
- This category has a wider range of topics to study. These topics may sound scary and vocabulary heavy at first, but taking your time to understand them will help you realize that they are fun and interesting!
- Library books and Youtube videos are also the best resource for this category.
- Recommended Khan Academy videos from the Chemistry Library:
 - States of matter
 - Introduction to the atom
 - Introduction to the Periodic Table
 - Balancing chemical equations (you do not have to know how to balance chemical equations but hopefully this helps you better understand what chemical reactions are)
 - Acids, bases, and pH
- Please note that some of these videos start with basic information and then present more advanced information which is not needed. Do not be scared by these videos!

Fun (Non-scored) Event: Picture This

This event will take place on zoom on competition day. This event is not scored. We will put students in temporary teams. This event can be thought of as a Science Pictionary. Students will attempt to draw and guess scientific terms. Each round will be followed by an explanation of these terms by the moderator.