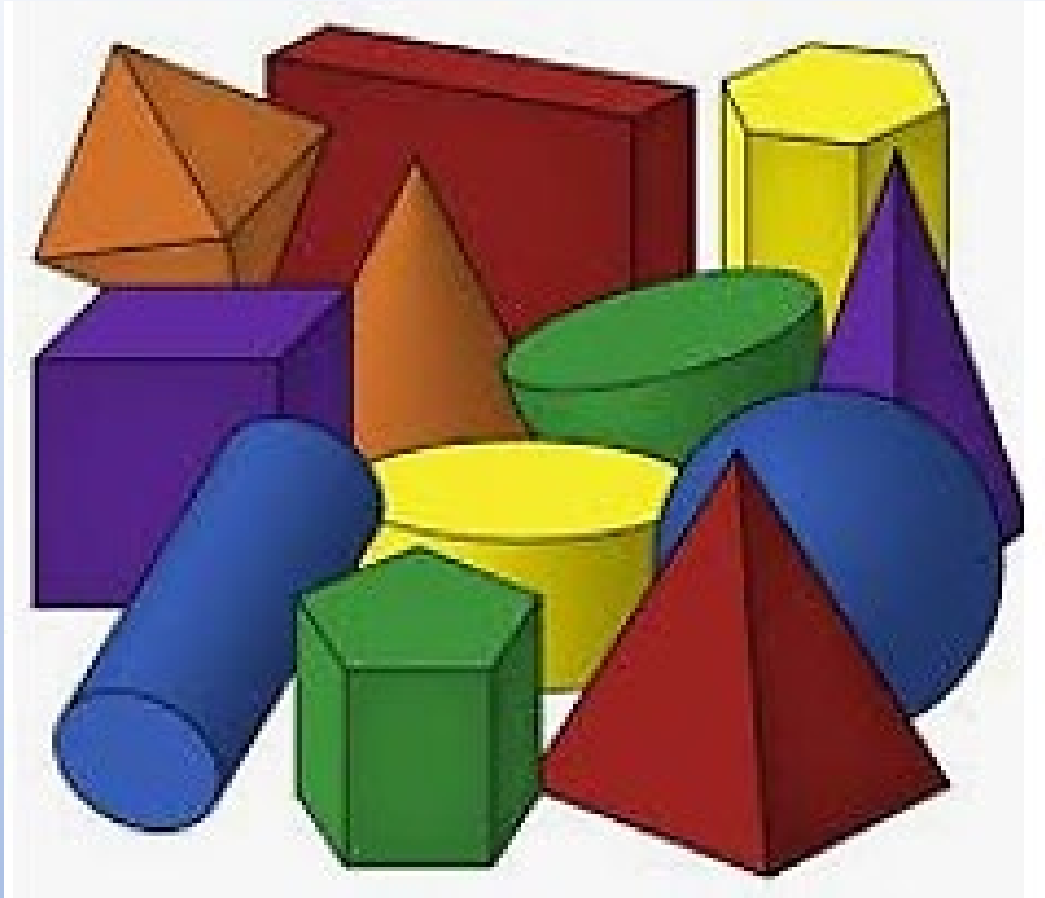


**WEST VIRGINIA  
DEPARTMENT OF EDUCATION**

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# MATHEMATICS

**GRADE 1**

## ***3-D Shape Sort***

# Table of Contents

<b>Rationale for Lesson and Associated Tasks</b>	<b>Page 1</b>
<b>Lesson and Associated Tasks Overview</b>	<b>Pages 1 - 2</b>
<b>West Virginia College-and Career-Readiness Standards</b>	<b>Page 2</b>
<b>Mathematical Habits of Mind (MHM)</b>	<b>Page 2</b>
<b>Mathematics Teaching Practices to Support Student Growth</b>	<b>Page 2</b>
<b>Essential Understandings</b>	<b>Page 3</b>
<b>Set-up Phase</b>	<b>Page 3</b>
<b>Establish Small Groups</b>	<b>Page 3</b>
<b>Develop Open-Ended Questions</b>	<b>Page 3</b>
<b>Gather Materials</b>	<b>Pages 3 - 4</b>
<b>Anticipated Common Student Misconceptions</b>	<b>Page 4</b>
<b>Explore Phase</b>	<b>Pages 4 - 5</b>
<b>Prior Instruction/Knowledge</b>	<b>Page 5</b>
<b>Implementation Phase</b>	<b>Pages 5 - 7</b>
<b>Share, Discuss and Analyze Phase</b>	<b>Page 8</b>
<b>Task in Action</b>	<b>Page 8</b>



**Task Title:** *3-D Shape Sort*

**Grade or Content Area:** 1<sup>st</sup> Grade

**Toolkit Author:** Brenda Buie, JoAnn Nuzum, and Ashley Lawrence

**Original Task Creator:** Illustrative Mathematics

**Quarter:** 1

### **Rationale for Lesson and Associated Tasks**

Students work with a variety of 3-dimensional items or pictures of items as they complete the *3-D Shape Sort* task. The set of objects should include items shaped like spheres, cubes, rectangular prisms, cones, cylinders, and pyramids. The students will be asked to look carefully at the objects, sort them into categories based on shape, and then determine both defining and non-defining characteristics. Working in small groups, students will finally use objects to complete statements based on defining and non-defining characteristics.

The *3-D Shape Sort* task and associated activities provide students with the opportunity to describe and analyze objects and expand their vocabulary to include geometric terms. As students work with the objects and determine the defining and non-defining characteristics, they will develop the ability to see both generalizations and precise details. This ability to differentiate between defining and non-defining characteristics will allow students to develop the ability to think in both broad terms and in more specific terms.

### **Lesson and Associated Tasks Overview**

**Illustrative Mathematics** ([click here](#))

*\*Review all components of the task thoroughly.*

For Grade 1 students, portions of this lesson and associated tasks may best be completed in a small group setting with the teacher asking questions that will develop student thinking, vocabulary, and observation skills.

*Important Note:* After the children are comfortable with the task, it can be set up as an independent discovery/learning station.

*\*\*This lesson is designed to be completed in two mathematics class sessions; however, it can be easily combined into one session.*

### **Day 1**

1. Introduce the *3-D Shape Sort* activity with the whole group. Gather the following geometric solids: sphere, cone, pyramid, cube, cylinder, and rectangular prism. Display the geometric solids one at a time and have all students categorize and discuss the attributes of the geometric solids using a Think-Pair-Share format.
2. Display real object examples or picture examples of the geometric solids. Continue the Think-Pair-Share format and have all students discuss the attributes that make the object a specific 3-dimensional shape. (For instance, a large tissue box is a rectangular prism; it has 6 faces that are all rectangles.) When the students determine the shape of the object, place the object near the corresponding geometric solid.
3. Continue the activity with different shapes and objects. The length of this portion of the lesson is determined by the students' ability to focus on the task.

*\*\*Day 1 ends here if the teacher is completing this task in two mathematics class sessions. Keep the sets of objects on display; they will be used when the lesson continues. For a one-session lesson continue with Day 2 items 4-9.*

## Day 2

1. Review the characteristics of each set of objects. Using the Think-Pair-Share format, have the students determine the defining and non-defining characteristics. (For instance, the tissue box has decorations; the beach ball can bounce.)
2. Introduce the sentence strips portion of the task.
3. Model completing several sets of sentence strips. The number of sentence strips to be completed is based on the students' understanding of the task and their ability to see both defining and non-defining characteristics.
4. Allow students to work in small groups to complete sentence strips for a chosen object.  
Example of defining characteristics:
  - The beach ball is in the shape of a sphere.
  - It is round like all spheres.Example for non-defining characteristics:
  - The beach ball is in the shape of a sphere.
  - It can bounce but some spheres cannot.
5. Ask the individual small groups of students to share their sentence strips with the entire class. Posting their sentence strips will validate the students' group work.
6. In a whole group conversation, encourage students to share some observations that were made during their small group work. Prepare a set of questions to prompt the classroom conversation. If these do not occur naturally in student conversations, consider the following:
  - Was there an object that was difficult to find a defining or non-defining characteristic for? Why?
  - Was it easier to see the defining characteristics or the non-defining characteristics? Why?

### West Virginia College-and-Career-Readiness State Standard

(While the entire standard is listed below, the bold format identifies the portion of the standard that is a focus of the task)

**M.1.19 Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, and/or overall size); build and draw shapes to possess defining attributes.**

### Mathematical Habits of Mind (MHM)

\*While the lesson addresses several MHM, the MHM in bold font is the focus of the lesson and associated tasks.

MHM3. Construct viable arguments and critique the reasoning of others.

**MHM6. Attend to precision.**

MHM7. Look for and make use of structure.

### Mathematics Teaching Practices to Support Student Growth

- Implement tasks that promote reasoning and problem solving
- Facilitate meaningful mathematical discourse
- Elicit and use evidence of student thinking.

## Essential Understandings

- Geometric solids have defining and non-defining mathematical attributes.

## Set-up Phase

### 1. Become an Expert Regarding All Lesson and Associated Task Content

It is essential that the teacher becomes very familiar with the geometric solids and associated objects including the correct vocabulary. The level of student engagement will be determined by how thoroughly the teacher is able to promote and extend observations.

### 2. Establish Small Groups

The *3-D Shape Sort* activity promotes both individual and group thinking. Students will make and share observations with both their group and the teacher.

Skill level and personality should both be considered when developing the groups for this activity. Small groups work best when the students have had some time to work together regularly. The ability to think deeply, share ideas, and ask questions will prove helpful in the successful completion of the task. When creating the groups, it is important to eliminate a situation where one student may do all the observations and all the talking while others in the group simply listen. For all students to benefit from the task, they must share equally in the roles of observing and sharing. Prepare responses and comments that students may use as they collaborate to find defining and non-defining characteristics.

### 3. Develop Open-Ended Questions

Teachers should create a list of open-ended questions designed to support and to scaffold the learning for their students. These questions should purposefully direct students toward the learning goals and to assist them with using their previously learned content.

Some questions might include the following:

- What do you notice about the object?
- How are the objects similar?
- How are the objects different?
- Can you explain your thinking?
- Can you tell me more?

### 4. Gather Materials

- Geometric Solids: sphere, cone, pyramid, cube, cylinder and rectangular prism (preferably more than one set made of different materials, different sizes, and different colors)
- 3-dimensional (sphere, cone, cube, cylinder, rectangular prism) “real-world” objects or pictures of objects. Items (be sure the items are the actual shape and not a close approximation of the shape) might include the following:
  - Baseball, orange, globe, stress ball
  - Food can, toilet paper roll
  - Traffic cone, party hat
  - Cereal box, tissue box
  - Dice, Rubik’s cube

- Sentence strips, pencils, markers
  - Two strips for each defining characteristic:
    - The \_\_\_\_\_ is in the shape of a \_\_\_\_\_.
    - It has \_\_\_\_\_, just like all \_\_\_\_\_.
  - Two strips for each non-defining characteristic:
    - The \_\_\_\_\_ is in the shape of a \_\_\_\_\_.
    - It has \_\_\_\_\_, but some \_\_\_\_\_ do not.
- Word cards for the students to use when completing the sentence strips. These cards should have the names of the geometric solids and the name of each real-world object.
- Teacher Observation Form

### 5. Anticipated Common Student Misconceptions

Teachers should be prepared to address possible misconceptions. By spending time prior to the lesson thinking through possible misconceptions, teachers will have responses prepared. While this task/activity is focused on the attributes of the shapes and not the name of the shape, it is important to know and understand both. Most of the misconceptions from this task will arise from the real-world objects. These objects must be exactly the shape and not simply close approximations. (An apple is not a sphere.) Other misconceptions will arise from misunderstanding the vocabulary. (The edge is not the side/face.)

Misconceptions may include the following:

- Misrepresenting an object as a cube when it is a rectangular prism. This will happen if the real-world object is not chosen carefully.
- Inadvertently promoting the misunderstanding that a cube is not a rectangular prism. The teacher must help students understand that the definition of a rectangular prism does not include the dimensions of the faces.
- Misconstruing a defining characteristic. If all the spheres are the same approximate color this could be misconstrued as a defining characteristic. (Using a basketball, an orange, and an orange plastic geometric solid may lead the students to think the color is a defining characteristic)

### Explore Phase

Prior to having the students work in small groups, it is important that they understand the task as well as the life skills of taking turns, listening to each other, and being a full participant in a group. The objects and their attributes should be discussed in a whole group setting prior to having students work independently in small groups.

During whole group time, the objects can be projected on a whiteboard or displayed in such a way that every child can see. Begin by showing one geometric solid and discussing the attributes. Once students understand the attributes of geometric solids then begin introducing real-world objects. These are 3-dimensional objects so it is important to discuss what they can do. For instance, a cylinder can roll or stand on its end, a sphere rolls, and prisms can be stacked.

Math centers/stations during this exploration phase should also allow for the students to spend time exploring attributes of objects.

Suggestions for stations include, but are not limited to the following:

- Building 3-dimensional objects with various materials such as pipe cleaners, craft sticks, clay, magnetic tiles
- Finding a specific 3-dimensional shape in the classroom or a picture of an object in a magazine or book
- Using geometric solids to create a 3-dimensional picture

### Prior Instruction/Knowledge

Kindergarten students work with identifying and classifying simple shapes to help them compare and manipulate two or more shapes. Students describe both similarities and differences of shapes using informal language. They begin to understand that 3-D shapes are composed of 2-D shapes.

Grade 1 students describe and classify shapes based on defining and non-defining attributes.

**Please review the following:** The information below provides valuable insights into Kindergarten prerequisite skills and First Grade student understandings specific to the analysis, comparison, and composing of 3-D objects.

Educators Guide for Mathematics Grade K: pages 27 – 32, pdf 29-34 ([click here](#))

Educators Guide for Mathematics Grade 1: pages 33 – 34, pdf 35-36 ([click here](#))

### Prerequisite Skills

- Identify, draw, and name basic shapes such as triangles, squares, rectangles, hexagons, and circles.

### Supporting Skills

- Identify and name spheres and cubes.
- Use models to determine properties of basic solid figures (slide, stack, and roll).

### Impending Skills

- Recognize the 2-dimensional elements of 3-dimensional figures.
- Use manipulatives, pictorial representations, and appropriate vocabulary (e.g., polygon, side, angle, vertex, diameter) to identify and compare properties of plan figures.

**Source:** *The Quantile Framework for Mathematics*

<https://metametricsinc.com/educators/quantile-for-educators/>

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### Implementation Phase

#### Teacher Notes Overview

**\*\*This lesson is designed to be completed in two mathematics class sessions; however, it can be easily combined into one session.**

Prior to the first day\*\* of the task, review the attributes of geometric solids and real-world objects in the shape of geometric solids several times.

With First Grade students, it is always wise to review content and model expectations prior to the actual task. Before assigning small groups and allowing the students to begin working, it will be important to

spend some time as a whole group reviewing the attributes of a few of the geometric solids. Choices for this review should be based on observations from the responses given in the previous days.

Depending on the number of adults in the room, the teacher may wish to have all the students working on this task at the same time or may wish to have some at other math centers working independently while the teacher monitors one small group of students.

The small group work can be set up in multiple ways if the entire class is doing this task at the same time:

- The first is to have the groups of objects in a central location. The students are assigned to groups and work locations. One child from each group selects an object and takes it to the work location. This arrangement will require that the teacher monitor materials for each group ensuring they have the word cards needed to complete the sentence strips.
- The second is to have the objects in groups around the room. The students are assigned to groups and to a set of objects. This arrangement requires enough groups of objects for the groups of students. It minimizes the need for the teacher to monitor materials.

*Important Note: When the students can articulate and record defining and non-defining characteristics without teacher support this task can be moved to an independent workstation. A recording sheet with the sentence structure provided can be used to add accountability to the task.*

Other extensions of this task might include the following:

- Room walk: Use one geometric solid as a guide, walk students around the room to identify real-world items of the same shape.
- Picture walk: like a room walk, but students use magazines or books to find items of the same shape.
- Finding real-world items in the room or in pictures comprised of two or more geometric solids. (For instance, most pictures of ice cream cones are a sphere and a cone.)

### **Day 1**

- Introduce the activity
- Identify and sort geometric solids and real-world objects or pictures of objects into groups
- Describe both defining and non-defining characteristics of each group of objects

### **Day 1 Teacher Notes**

Students will sort a collection of 3-dimensional objects into categories by shape. There should at least one set of geometric solids and at least 2 real-world objects for each geometric solid. This will provide a minimum of 3 objects in each group. This portion of the lesson can be done in a whole group or small group setting. This decision is based on how best the students can focus on the task.

During this portion of the task, the teacher should ask questions in order to deepen the students' understanding of the attributes of geometric solids and real-world objects of those shapes. It is important to create a list of higher-order questions (see notes in the Set-up Phase section of this guide). Targeted extensions to the conversation may include questions that ask students to compare defining and non-defining characteristics of two real-world objects. E.g., "Yes, they both have circles at the ends (base). But do they both have the same label?" (Keep the groups of objects on display for use on Day 2.)



The list of defining and non-defining characteristics should be recorded. This provides validation to the students that their thoughts are important and provides reminders for the next portion of the task. (This chart will be used on Day 2)

## Day 2

- Review defining and non-defining characteristics of each group of objects
- Introduce the sentence strips
- Complete several sets of sentence strips with the whole group
- Have small groups complete a set of sentence strips
- Review the sentence strips with the whole group

### Day 2 Teacher Notes

Review the groups of objects developed on Day 1. Refer to the defining and non-defining characteristics that were recorded. (If this lesson is completed in one day, this step may be skipped)

The teacher will introduce the activity by stating in complete sentences some of the defining and non-defining characteristics using the same wording as the sentence strips.

e.g., “The soup can is in the shape of a cylinder.

It has circles at the ends (base), just like all cylinders.”

“The tissue box is in the shape of a rectangular prism.

It has pictures on the sides, but some rectangular prisms do not.”

With first grade students, it is best to start with the sentence structure that shows the similarities. The teacher should provide several examples: the number of which will depend on the ability of the students to grasp the understanding.

Allow several students to share understandings using the same sentence structure. When selecting students to demonstrate at this stage of the lesson consider the student’s skill at noticing defining and non-defining characteristics and his/her ability to articulate that knowledge using the sentence structure.

The teacher will post the sets of sentence strips. These can be projected on the whiteboard or clipped on a chart holder. The teacher will complete a set of sentence strips using the example provided by one of the students. This will validate the students thinking and confirm their ability to successfully complete the task. The number of sets completed with teacher support is dependent upon the students’ ability to grasp the nature of the task.

One person from each small group will select an object. The group will work together to determine a defining or non-defining characteristic and complete the corresponding set of sentence strips.

After the small groups have completed their sentence strips return to a whole group setting. Allow each group to present the sentence strips developed during the task. These sentence strips should be displayed providing validation for the students’ work.

## Share, Discuss, and Analyze Phase

### Essential Understanding:

Geometric solids have defining and non-defining mathematical attributes.

**Share:** This lesson opens with the students sorting geometric solids and real-world shapes into groups based on defining characteristics. This format allows the teacher to monitor understanding as the students share their observations about the objects.

**Discuss:** Working in small groups, students determine defining and non-defining attributes of real-world shapes and complete sentence strips to record their observations. The teacher poses higher-order questions that will allow the students to think more deeply about defining and non-defining characteristics. At this stage, it is critical that the teacher address any misconceptions, and not to inadvertently promote misunderstandings.

**Analyze:** Students return to a whole group format to share the observations made during the small group task by sharing their sentence strips and by responding to open-ended questions:

- What do you notice about the object?
- How are the objects similar?
- How are the objects different?

### Task In Action

The video clips below provide a demonstration of the task being implemented in a classroom as it aligns with the Effective Mathematics Teaching Practice indicated. These clips should be used by the teacher to model the implementation of the task in his or her classroom.

- Implement tasks that promote reasoning and problem solving:
  - [Video Clip #1](#)
  - [Video Clip #2](#)
- Facilitate meaningful mathematical discourse:
  - [Video Clip #3](#)
  - [Video Clip #4](#)
- Elicit and use of evidence of student thinking:
  - [Video Clip #5](#)