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

**Standards addressed by this lesson:**

* 5.MD.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
* 5.MD.3a A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume.
* 5.MD.3b A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.
* 5.MD.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.
* 5.MD.5a Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.

**Materials Needed:**

* Snap Cubes
* Task Page
* Math Notebooks

**Goals:**

* Students will measure volumes by counting unit cubes.
* Students will generalize a rule for finding volumes of rectangular prisms.

**Lesson Day 1:**

1. Give students some snap cubes and pose this problem (Students could work in small groups, in pairs, or individually):
   * Your class made some bracelets for a school fundraiser. Your teacher posted some pictures of the bracelets on Pinterest and the bracelets became very popular. People from all over the United States wanted to buy them. Your class decided to start an afterschool club that would make and ship the bracelets all over the U.S. The latest order is for 144 bracelets. The club decided to ship 12 bracelets in each box.
     + Using 1 snap cube to represent 1 box with 1 bracelet in it, what are all the ways you could package the bracelets?
       - Complete the chart below to show all the ways you could package the bracelets.
     + How many boxes will be needed? Explain how you know.

|  |  |  |  |
| --- | --- | --- | --- |
| **# of cubes in a pack** | **# of cubes long** | **# of cubes wide** | **# of cubes high** |
|  |  |  |  |

1. Once students are working, walk around and observe them and make notes about their thinking. Think about what examples you would like for students to share.
2. Bring students together and have them share their different arrangements. Have them use the cubes to demonstrate their arrangements. Lead a discussion about how they solved the problem and ask them if they have found all the different ways it could be done. Have them share their thinking about how many boxes will be needed. Have students write a reflection in their math notebooks for the day.

**Lesson Day 2:**

1. Pose this new problem to students:
   * + The club did not have 12 boxes to make their shipment, so they decided to ship 18 bracelets in each box instead of 12. Using 1 snap cube to represent 1 box with 1 bracelet in it, what are all the ways you could package the bracelets now?
     + What if the club needed to ship 11 bracelets? How would you package the 11 bracelets?

|  |  |  |  |
| --- | --- | --- | --- |
| **# of cubes in a pack** | **# of cubes long** | **# of cubes wide** | **# of cubes high** |
|  |  |  |  |

1. Give students time to work with the cubes on the next two situations. Make notes about their strategies and how they are solving the problem.
2. Bring students together to share. Ask students:
   * How are the numbers of cubes on each dimension (how long, wide and high) related to the total number of cubes used to make a rectangular package?
     + Have students share their thinking. Ask probing questions and encourage them to question each other. The big thinking here is to show that the volume is the same as would be found by multiplying the edge lengths, (i.e. multiplying the height by the area of the base or by multiplying how long by how wide by how high).
     + Ask them how the 11 boxes changed the situation. Did it make it harder? How many ways could they come up with for packaging them in a rectangular box? How did that differ from the situation with 12 or 18? Why was it different?

1. For an extension or follow up, ask students to solve the same problem for 24 bracelets. Have them sketch each box on [isometric dot paper](http://illuminations.nctm.org/Lessons/Isometric/Isometric-AS-DotPaper.pdf) . Ask students to tell how they know if they have them all?

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

**Task Page Day 1:**

Your class made some bracelets for a school fundraiser. Your teacher posted some pictures of the bracelets on Pinterest and the bracelets became very popular. People from all over the United States wanted to buy them. Your class decided to start an afterschool club that would make and ship the bracelets all over the U.S. The latest order is for 144 bracelets. The club decided to ship 12 bracelets in each box.

* Using 1 snap cube to represent 1 box with 1 bracelet in it, what are all the ways you could package the bracelets?
* Complete the chart below to show all the ways you could package the bracelets.

|  |  |  |  |
| --- | --- | --- | --- |
| **# of cubes in a pack** | **# of cubes long** | **# of cubes wide** | **# of cubes high** |
|  |  |  |  |

How many boxes will be needed? Explain how you know.

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

**Task Page Day 2:**

The club did not have 12 boxes to make their shipment, so they decided to ship 18 bracelets in each box instead of 12. Using 1 snap cube to represent 1 box with 1 bracelet in it, what are all the ways you could package the bracelets now?

|  |  |  |  |
| --- | --- | --- | --- |
| **# of cubes in a pack** | **# of cubes long** | **# of cubes wide** | **# of cubes high** |
|  |  |  |  |

How many boxes will be needed now? Explain how you know.

What if the club needed to ship 11 bracelets? How would you package the 11 bracelets?

|  |  |  |  |
| --- | --- | --- | --- |
| **# of cubes in a pack** | **# of cubes long** | **# of cubes wide** | **# of cubes high** |
|  |  |  |  |

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

**Task Page Extension:**  
What are all the possible packages using 24 cubes? Record all the possible ways on [isometric dot paper](http://illuminations.nctm.org/Lessons/Isometric/Isometric-AS-DotPaper.pdf) and on a chart.

|  |  |  |  |
| --- | --- | --- | --- |
| **# of cubes in a pack** | **# of cubes long** | **# of cubes wide** | **# of cubes high** |
|  |  |  |  |

How do you know you have all of them?