CUBLES STEM

1. Lesson Plan Information	
Subject/Course: MATH & SCIENCE	**Name:**
Grade Level: 5th	**Date:** **Time:**
Topic: Measuring, Calculating Volume and Engineering	**Length of Period:**

2. Expectation(s)

Standard(s):
MATH

CCSS.MATH.CONTENT.5.MD.A.1
Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

CCSS.MATH.CONTENT.5.MD.C.3
Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

CCSS.MATH.CONTENT.5.MD.C.3.A
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.

CCSS.MATH.CONTENT.5.MD.C.3.B
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.

CCSS.MATH.CONTENT.5.MD.C.4
Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

CCSS.MATH.CONTENT.5.MD.C.5
Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

CCSS.MATH.CONTENT.5.MD.C.5.A
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.

CCSS.MATH.CONTENT.5.MD.C.5.B
Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.

CCSS.MATH.CONTENT.5.MD.C.5.C
Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping

right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.

SCIENCE

5-PS1-3. Make observations and measurements to identify materials based on their properties.

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.

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.

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.

3. Content

What do I want the learners to know and/or be able to do?

- **Use a ruler to measure objects.**
- **Convert units.**
- **Calculate volume.**
- **Make observations.**
- **Generate multiple solutions.**
- **Test a solution.**

Today learners will:

- **Identify 2D and 3D shapes**
- **Measure objects using a ruler.**
- **Convert in to cm, and cm to m.**
- **Construct a figure from a foldout.**
- **Calculate volume.**
- **Make observations about the function of a tool.**
- **Ask questions and generate a solution.**
- **Carry out an investigation.**

4. Assessment (collect data) / Evaluation (interpret data)
(Recording Devices (where applicable): anecdotal record, checklist, rating scale, rubric)

Based on the application, how will I know students have learned what I intended?

You can check the answers provided from your students throughout the handout. Questions 9-13 are to end the lesson and have students thinking more critically about measurement. You can take it one step further by using the extension question.

5. Learning Context

C. Resources/Materials
1.) CUBLE Packet
2.) Calculator
3.) Ruler
4.) Paper
5.) Other materials possible depending upon student generated solutions.

LESSON

ACTIVATE PRIOR KNOWLEDGE

TEACHER NOTES: Use questions related to shapes, measurement, and the function of tools.

Sample Student Questions (these questions are not on the attached handout).
1.) What is the difference between a square and a cube?
2.) What is volume?
3.) How can a measuring cup and a ruler both measure volume?
4.) How can a measurement be more accurate than another?

LESSON INTRODUCTION

TEACHER NOTES:
Pending on the CUBLE(s) your class is using this can be changed to reflect a more engaging hook.

Today, you are going to get a CUBLE, which you will assemble and measure the volume. After measuring the volume of the CUBLE you must use an alternate method to measure them and think about which method is more accurate.

MIDDLE:
TEACHER NOTES: This lesson develops from kids identifying 3D shapes, measuring volume using a ruler, and thinking about other methods to measure volume to compare accuracy. Students will answer questions 1-13 on the handout.

<u>Differentiation</u>:

(Scaffold Lower):
(A) **Provide a word bank for 3D shapes.**
(B) **Demonstrate how to assemble the CUBLE.**
(C) **Demonstrate how to read a ruler.**
(D) **Provide several methods for determining volume and allow the student to choose their second method.**

(Scaffold Higher):
(A) **Ask the student(s) to test multiple methods of for determining volume.**
(B) **Ask the student(s) to design their own method of connecting the CUBLE head and body that will allow them to securely fit together as well as turn.**

CONCLUSION:
TEACHER NOTES: The final product for this lesson is question 9-13.

What can you do to determine your volume, and how can you ensure your measurement is accurate?

EXTENTION QUESTION:

These basic 3D shapes can be easy to determine their volume, but you are made up of a lot of irregular shapes. What can you do to determine your volume, and how can you ensure your measurement is accurate?

Grade Level: 5

Class:_____ Student Name:_____

GOALS for you:

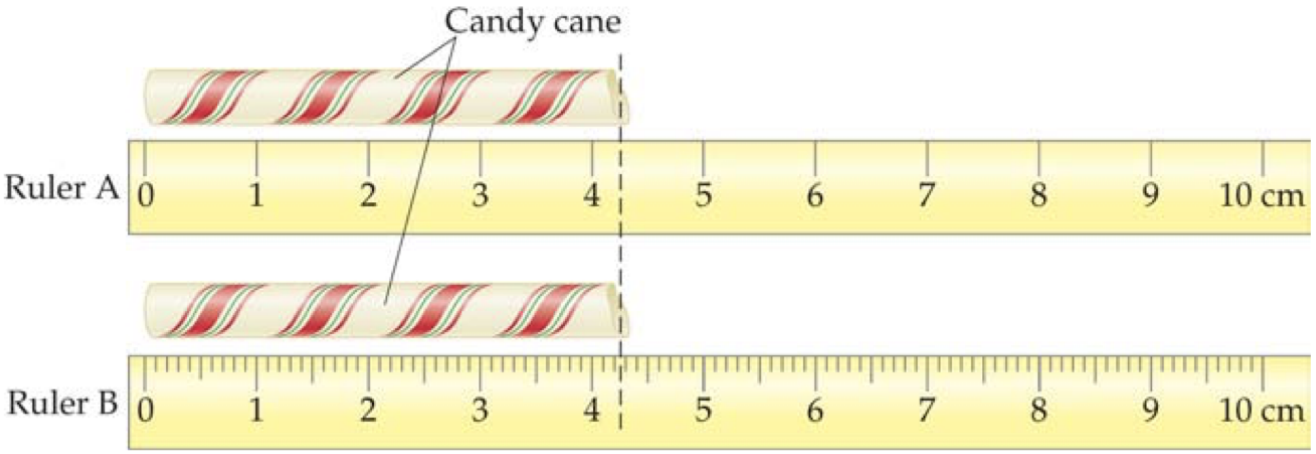
- Measure using a ruler.
- Convert inches (in) to centimeters (cm), and centimeters (cm) to meters (m).
- Describe and calculate volume.
- Make observations.
- Generate solutions to a problem.

Today, there is a CUBLES packet in front of you. You will be using CUBLES to achieve the goals above. Take a moment to open the packet and look at the materials inside.

1.) Did you get excited while looking at the CUBLES packet? Explain.

2.) Get a ruler. Describe how you read a ruler.

3.) Look at ruler A & B in the image below.



A.) What difference do you notice about the 2 rulers?

_____

B.) Measure the candy cane for ruler A. _____

C.) Measure the candy cane for ruler B. _____

D.) Did you record the measurement for the candy cane in ruler A and B the same? Explain why or why not.

E.) You should read ruler A as 4.2 cm or 4.3 cm, and ruler B as 4.25 cm. Why can I add the extra additional number in the hundredths place for ruler B?

F.) Is the following statement **TRUE** or **FALSE**? Explain your reasoning.
When reading a measuring device, like a ruler, we estimate the number 1 place beyond what it is marked for. In ruler A, I estimate the to the tenths place, while I estimated to the hundredths place for ruler B. When we estimate, it is not an exact measurement, but it is the best we can do give the tool we have to measure.

Now you are ready to accurately use your ruler to measure. Let us get back to the awesome CUBLES packet.

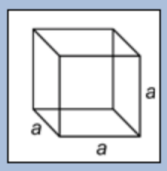
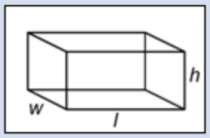
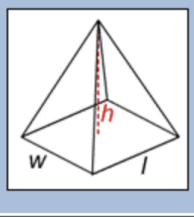
4.) Assemble each piece of your CUBLE. List the pieces, the type of 3D shape, then measure the appropriate sides based on the formulas in the following table.

PIECE	NUMBER OF SIDES	MEASUREMENT OF EACH SIDE
Example *HEAD*	*6*	*side 1:* 2.31 in. *side 2:* 2.30 in. *side 3:* 2.31 in. *side 4:* 2.32 in. *side 5:* 2.30 in. *side 6:* 2.31 in.

5.) Use your measurements in #4 to determine the type of 3D shape of each piece. Explain your reasoning for your label.

PIECE	3D SHAPE	EXPLAIN
Example *HEAD*	*Cube*	*Each side of the shape is nearly the same, which is the definition of a cube.*

6.) Calculate the volume of each piece of your CUBLE.

Name	Transparent Form	Volume Formula
Cube		$V = a \cdot a \cdot a = a^3$ a = the length of one side
Rectangular prism		$V = l \cdot w \cdot h$ l = length w = width h = height
Pyramid		$V = \frac{l \cdot w \cdot h}{3}$ l = length w = width h = height

PIECE	3D SHAPE	FORMULA	CALCULATION
Example			
HEAD	*Cube*	$V = a^3$	$V=2.31^3$ *V=12.33 in*
_____	_____		_____
_____	_____		_____
_____	_____		_____
_____	_____		_____
_____	_____		_____
_____	_____		_____

7.) Use the volumes calculated for each piece to convert the units from in to cm to m. Show your work.

_____

in to cm: cm = in * 2.54 **cm to m: m = cm / 100**

PIECE	Volume (in)	Volume (cm)	Volume (m)
Example			
HEAD	*12.33*	*12.33 cm * 2.54* = 31.32 cm	*31.32 cm / 100* = 0.3132 m
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

8.) What is the total volume of your CUBLE? _____

9.) Assemble your CUBLE. Think of other ways to measure volume now that your CUBLE is assembled and list them below.

1. _____
2. _____
3. _____

10.) Attempt another way to measure the volume of your CUBLE. Write the procedure and your final number below.

a. PRECEDURE:

b. TOTAL VOLUME:

11.) Measuring the CUBLE produced a volume of _____ my second method produced a volume of _____. Which of the two numbers is more accurate? Explain your reasoning.

12.) How can you make measuring volume using a ruler more accurate?

13.) How can you make measuring volume using your second method more accurate?

EXTENTION QUESTION:
These basic 3D shapes can be easy to determine their volume, but you are made up of a lot of irregular shapes. What can you do to determine your volume, and how can you ensure your measurement is accurate?