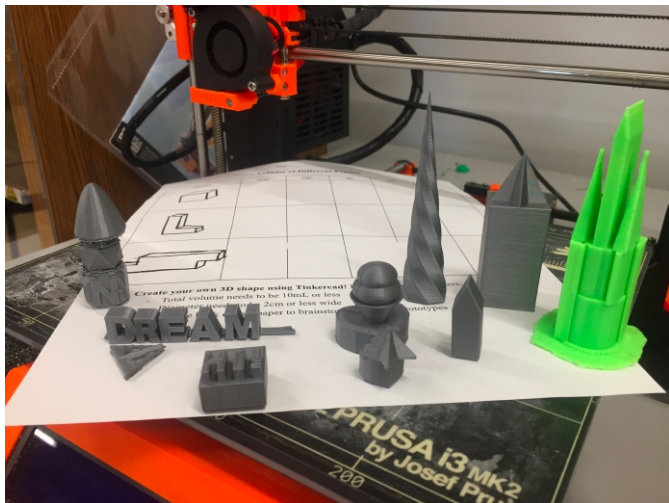


Design Challenge: Make a 3D printed irregular object with a specific volume.



Objective: Participants will practice measuring irregular volumes and make a new 3D object that fits within a specific volume range.

Supplies

- Prepared prisms of known volume (1 cm³, 5 cm³, 10 cm³)
- Graduated Cylinders, rulers
- Water, strainers, pans to catch drips, paper towels
- Access to TinkerCAD.com, a 3D slicer (like Cura) and 3D Printer
- Worksheet, graph paper, pencils, scrap paper

Set Up

Print a set of prisms in the shape and volume shown in the Worksheet for each table group. Have supplies on each table to measure the volume.

Each student will need to log in to TinkerCAD - you can use your teacher account to add students.

ASK [30 min] How can we measure the volume of an irregular object with a ruler? Can we use water?

- Show students how to use the displacement method to measure volume and have them complete the Worksheet.
- Show students how to use the grid on TinkerCAD to measure the length and width of an object.

IMAGINE/PLAN [20 min] Instructor reviews the answers from the worksheet to ensure all groups understand volume. Ask students to start sketching an object they want to make in TinkerCAD that has a volume between 10 cm³ and 20 cm³.

Ask participants to design an object that combines multiple simple shapes. Thinkcrazy! Have a few teams briefly shareout.

CREATE

[45 min] Students use TinkerCAD to make a 3D model of their design. Designs need to fit in the graduated cylinder so the max width will be 2 cm.

NOTE: Walk the room during this time and encourage teams to build. Ask guiding questions like “How will that fit in the graduated cylinder?” or “How are you estimating volume?”

As teams complete their design, export as an .STL and use the 3D printer slicing software to complete a print. Note: this may take until the next class day.

IMPROVE/SHARE

[20 - 40 min] As each team gets their 3D printed design back, have them test the volume using a graduated cylinder and water displacement.

Then each group can share out successes and obstacles while completing the challenge. If time allows have students redesign in TinkerCAD and print to a more accurate volume.

Facilitator Notes

Age Range and Content Connections

5th Grade Math

(5.MD.C.3) Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

(5.MD.C.4) Measure volume by counting unit cubes, using cubic centimeters, cubic inches, cubic feet, and improvised units.

(Fab-Safety.1): I can safely conduct myself in a Fab Lab and observe operations under instructor guidance.

(Fab-Modeling.2): I can construct compound shapes and multi-part components ready for physical production using multiple representations.

(Fab-Design.2): I can participate in design reviews with prepared presentation materials as well as give and receive feedback from peers.

Sustainable Making

The great thing about using 3D printed prisms as examples of volume are that these can be used with all future groups.




Mathematical Practices

Reason abstractly and quantitatively
Model with mathematics
Use appropriate tools strategically
Attend to precision

Additional Resources

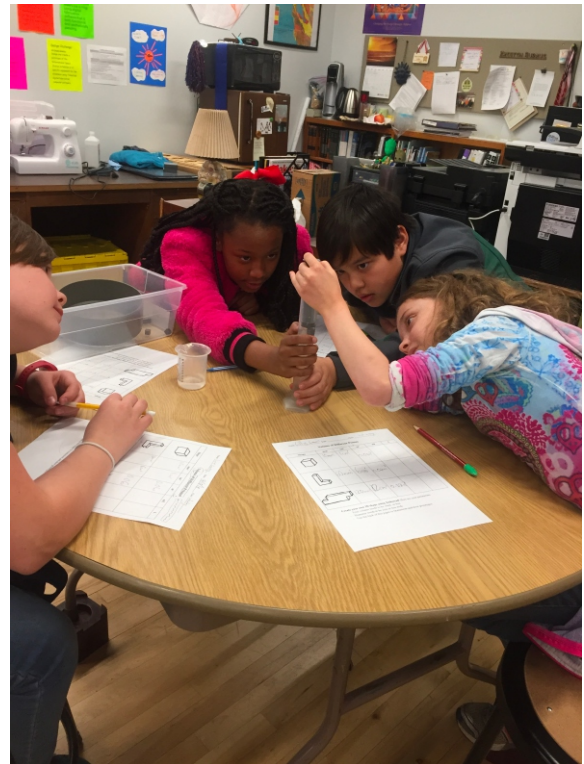
Name: _____ Date: _____ Class: _____

Volume of Different Prisms

Shape	mm ³	cm ³	m ³	mL	L
					
					
					

Create your own 3D shape using Tinkercad! Here are your parameters:

- Diameter needs to be 2cm or less wide
- Use the back of this paper to brainstorm and draw prototypes



Credits:

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