Lesson Plan: Capacity and Rainfall

Level: Stage 4

Syllabus link: MA4-14MG **"**uses formulas to calculate the volumes of prisms and cylinders, and converts between units of volume"

LESSON OUTLINE

This activity is designed to supplement a lesson in which students are taught how to calculate the volumes of simple right-prisms, specifically rectangular prisms, triangular prisms, and cylinders. Once students have been introduced to the formulae for calculating the volumes of each prism and provided with some example calculations, they can complete the worksheet to practice and consolidate their new skills in the context of rainfall collection. In addition to practicing using formulas, the aim is for students to make the link between the amount of rainfall collected and the area of the cross-section at the top of the container.

Resources/Materials:

- Worksheet (included)
- Calculator (optional)

Description of activity:

Before doing this lesson, students should be familiar with rectangular prisms, triangular prisms, and cylinders. They should be able to identify each shape and know how to use the formula for calculating the volume of each prism. It is recommended that you spend some time doing worked examples with your class before giving them the worksheet.

The worksheet is designed to give students an opportunity to practice using volume formulae in the context of collecting rainfall. Students will begin by calculating the capacity of a range of prism-shaped containers and then they will solve problems involving rainfall.

In addition to practicing using formulas, the aim of this lesson is for students to make the link between the amount of rainfall collected and the area of the cross-section at the top of the container. They will hopefully realise that even if a container has a greater overall capacity, if it has a small cross-sectional area it will not collect as much rain as a container with a large cross-sectional area.

The final question on the worksheet shows a picture of a rainfall collection device that uses a large tarp to collect and funnel rainwater into the storage container below. The idea behind this is that the tarp is able to provide a greater cross-sectional collection area than the container itself, so it increases the amount of rain that can be collected. This can lead into discussions about how rainfall is collected and why having a large collection area is so important (such as using the roof of a house rather than the container on its own).

Key Questions to Ask

What is the formula for the volume of a rectangular prism?

What is the formula for the volume of a triangular prism?

What is the formula for the volume of a cylinder?

Do the units of measurement matter when using a formula?

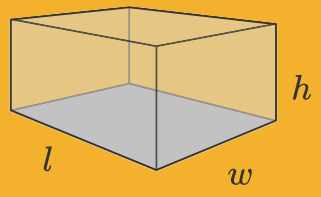
Why do we measure rainfall as a length (in mm)?

What property of the container determines how much rain it will collect?

How much rain can each container hold?

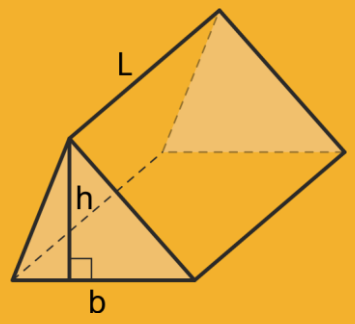
FORMULAE

Rectangular Prism



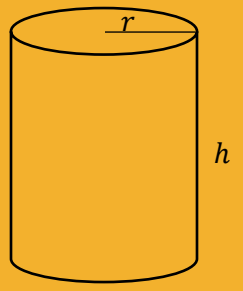
$V = l \times w \times h$

Triangular Prism



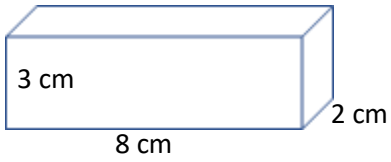
$V = \frac{1}{2} \times b \times h \times L$

Cylinder

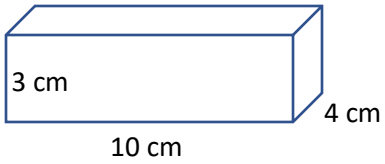
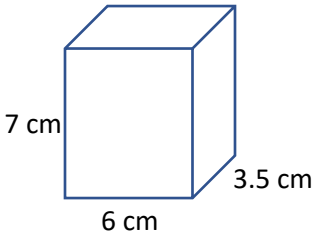
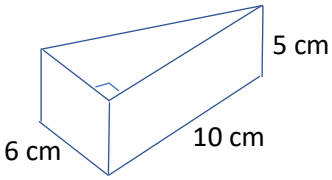


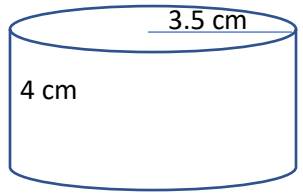
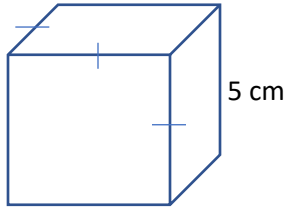
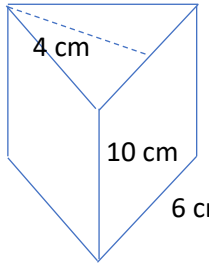
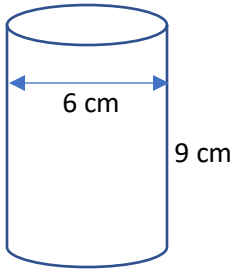
$V = \frac{1}{2} \times \pi \times r^2 \times h$

EXAMPLE

Container	Type and formula	Capacity (Volume when full)	Volume with 5 mm rain
	Rectangular Prism $V = l \times w \times h$	$C = 8 \times 2 \times 3$ $C = 48\ cm^3$	$V = 8 \times 2 \times 0.5$ $V = 8\ cm^3$ Make sure you convert from mm to cm

1. The weather is forecast to rain about 5 mm tomorrow and Sandra wants to collect as much of the rain as she can. She has the following containers to use. Complete the table to determine which container will collect the most rain.

Container	Type and formula	Capacity (Volume when full)	Volume with 5 mm rain
			
			
			

 3.5 cm 4 cm			
 5 cm			
 4 cm 10 cm 6 cm			
 6 cm 9 cm			

2. Circle the container that collects the most rain. Why does this container collect more rain than the other containers?

3. Last week the total rainfall was 52 mm. If Sandra had left all her containers out, which one would have collected the most rain?

4. Explain the purpose of the blue tarp in the following rainwater collection set up. Why not just collect the rain directly into the container?