CBC Grade 10 Mathematics Lesson Plan

Volume in Real-Life

Strand	Measurement and Geometry
Sub-Strand	Volume
Specific Learning Outcome	Apply volume formulas to solve real-life problems involving storage, transport, and household needs
Key Inquiry Questions	How do we use volume calculations in everyday life?
Learning Resources	CBC Grade 10 textbooks, containers (jerrycan, drum, box), measuring tape, calculator
Lesson Duration	40 minutes

Lesson Structure Overview

Phase	Activity	Duration
Phase 1	Problem-Solving and Discovery (Anchor Activity)	15 minutes
Phase 2	Structured Instruction (Key Takeaways)	10 minutes
Phase 3	Practice and Application (Worked Examples)	15 minutes
Phase 4	Assessment (Exit Ticket)	5 minutes

Phase 1: Problem-Solving and Discovery (15 minutes)

Anchor Activity: Container Volume Investigation

Work in Groups (2-3 students)

Materials:

- • Various containers (jerrycan, drum, box, jar, barrel)
- • Measuring tape or ruler
- • Calculator
- • Paper and pencil

Context:

Volume tells us how much space an object or container holds. In everyday life we use volume to know how much water fits in a jerrycan, how much grain a sack will carry, or how much fuel a drum can store.

Tasks:

1. (a) Think about different containers you might find in school or at home that you use to carry water or store flour. Examples include jars, barrels, boxes, drums, jerrycans.
2. (b) For each container, determine what kind of shape it is (rectangular box, cylinder, cone, sphere, or other).
3. (c) Estimate or measure its dimensions (length, width, height for boxes; radius and height for cylinders).
4. (d) Try to compute its volume using the appropriate formula.
5. (e) Which of these containers can store the largest amount of water or flour?
6. (f) Discuss: Why is knowing volume important for families and communities?

Teacher Guidance for Anchor Activity

This anchor activity connects volume calculations to practical everyday needs. Students discover that volume is not just an abstract mathematical concept but a useful tool for planning storage, transport, and household needs.

Facilitation Strategy:

- • Bring actual containers to class if possible (jerrycan, small drum, box)
- • Organize students into groups of 2-3
- • Distribute measuring tools and calculators
- • Guide students to identify shape types first
- • Help students recall formulas: box ($V = lwh$), cylinder ($V = \pi r^2 h$)
- • Encourage estimation when exact measurement is difficult
- • Ask probing questions: "How would a farmer use this?" "Why does a jerrycan have that shape?"
- • Connect to real-world uses: water storage, grain storage, fuel transport

Phase 2: Structured Instruction (10 minutes)

Key Takeaways

After students have explored through the anchor activity, formalize their discoveries with these key concepts:

1. Volume in Everyday Life

Volume measures how much a container holds. Knowing how to calculate volume helps families and communities measure and plan for:

- • Storage: How much water fits in a tank?

- • Transport: How much grain can a truck carry?
- • Household needs: How much flour fits in a container?
- • Farming: How much water for irrigation?
- • Construction: How much concrete needed?
- • Cooking: How much liquid in a pot?

2. Common Container Shapes and Formulas

Shape	Formula	Real-Life Example
Rectangular Box	V = l × w × h	Jerrycan, storage box
Cylinder	$V = \pi r^2 h$	Drum, water tank, pipe
Cone	$V = (1/3)\pi r^2 h$	Borehole, funnel, grain pile
Sphere	$V = (4/3)\pi r^3$	Water tank, ball
Triangular Prism	V = (1/2)bh × length	Roof storage, attic
Pyramid	V = (1/3)Bh	Roof, grain storage

3. Unit Conversion: Cubic Metres to Litres

Always use consistent units:

- • Convert centimetres to metres BEFORE computing volume
- • 1 m^3 = 1000 litres
- • To convert m^3 to litres: multiply by 1000
- • To convert litres to m^3: divide by 1000

Example: 0.5 m^3 = 0.5 × 1000 = 500 litres

4. Step-by-Step Process for Volume Problems

7. Step 1: Identify the shape of the container
8. Step 2: Convert all measurements to the same unit (usually metres)
9. Step 3: Apply the appropriate volume formula
10. Step 4: Calculate volume in cubic metres (m^3)
11. Step 5: Convert to litres by multiplying by 1000

5. Composite Solids

Some containers combine multiple shapes:

- • Calculate volume of each part separately
- • Add the volumes together
- • Example: Cylinder with cone top = Volume of cylinder + Volume of cone

Scaffolding Strategies

Address common challenges revealed during the anchor activity:

- • Provide reference chart with formulas for each shape
- • Emphasize unit conversion as a separate step
- • Use dimensional analysis: cm → m (divide by 100)

- • Show that 1 m^3 = 1000 L using a cube diagram
- • Connect formulas to shape properties (why πr^2 for circles)

Phase 3: Practice and Application (15 minutes)

Worked Examples

Example 1: Jerrycan (Rectangular Box)

A metal jerrycan is roughly a rectangular box of dimensions 35 cm by 20 cm by 30 cm. Estimate how many litres of water it can hold.

Solution:

Step 1: Shape is a rectangular box, formula V = lwh

Step 2: Convert cm to m: l = 0.35 m, w = 0.20 m, h = 0.30 m

Step 3: $V = 0.35 \times 0.20 \times 0.30 = 0.021\ m^3$

Step 4: Convert to litres: 0.021 × 1000 = 21 litres

Answer: The jerrycan holds 21 litres.

Example 2: Water Drum (Cylinder)

A cylindrical water drum has radius 0.25 m and height 1.0 m. Find its volume in litres.

Solution:

Step 1: Shape is a cylinder, formula $V = \pi r^2 h$

Step 2: r = 0.25 m, h = 1.0 m (already in metres)

Step 3: $V = \pi \times (0.25)^2 \times 1.0 = \pi \times 0.0625 \times 1.0 \approx 0.19635\ m^3$

Step 4: Convert to litres: 0.19635 × 1000 ≈ 196 litres

Answer: The drum holds approximately 196 litres.

Example 3: Borehole (Cone)

A small borehole is shaped like a cone with height 1.2 m and base radius 0.15 m. Estimate the volume of water it can hold in litres.

Solution:

Step 1: Shape is a cone, formula $V = (1/3)\pi r^2 h$

Step 2: r = 0.15 m, h = 1.2 m (already in metres)

Step 3: $V = (1/3) \times \pi \times (0.15)^2 \times 1.2 = (1/3) \times \pi \times 0.0225 \times 1.2 \approx 0.0283\ m^3$

Step 4: Convert to litres: 0.0283 × 1000 ≈ 28 litres

Answer: The borehole holds approximately 28 litres.

Example 4: Composite Solid (Cylinder with Cone Top)

A container is made by placing a cone (height 0.5 m, base radius 0.3 m) on top of a cylinder (height 1.0 m, same radius 0.3 m). Find the total volume in litres.

Solution:

Step 1: Calculate cylinder volume: $V_{cylinder} = \pi r^2 h = \pi \times (0.3)^2 \times 1.0 = 0.09\pi \approx 0.283\ m^3$

Step 2: Calculate cone volume: $V_{cone} = (1/3)\pi r^2 h = (1/3) \times \pi \times (0.3)^2 \times 0.5 = 0.015\pi \approx 0.047\ m^3$

Step 3: Total volume = 0.283 + 0.047 = 0.330 m^3

Step 4: Convert to litres: 0.330 × 1000 = 330 litres

Answer: The container holds approximately 330 litres.

Individual Practice (Students work independently)

Provide students with similar problems to solve:

12. 1. A farmer fills a rectangular trough 2.0 m long, 0.5 m wide, and 0.4 m deep. How many litres?
13. 2. A drum has radius 0.30 m and height 0.9 m. Estimate capacity in litres. (Use $\pi \approx 3.14$)
14. 3. A spherical water tank has diameter 1.2 m. How many litres? (Use $\pi \approx 3.14$)

Phase 4: Assessment - Exit Ticket (5 minutes)

Students complete individually to demonstrate understanding:

Question 1: A rectangular water tank is 1.5 m long, 1.0 m wide, and 0.8 m high. Calculate:

- (a) The volume in cubic metres
- (b) The volume in litres

Question 2: A cylindrical storage container has radius 0.4 m and height 1.2 m. Calculate its volume in litres. (Use $\pi \approx 3.14$)

Question 3: Explain why knowing how to calculate volume is important in everyday life. Give two examples.

Exit Ticket Answer Key

Question 1:

(a) $V = 1.5 \times 1.0 \times 0.8 = 1.2 \text{ m}^3$

(b) $1.2 \times 1000 = 1200$ litres

Question 2:

$V = \pi r^2 h = 3.14 \times (0.4)^2 \times 1.2 = 3.14 \times 0.16 \times 1.2 \approx 0.603 \text{ m}^3$

In litres: $0.603 \times 1000 \approx 603$ litres

Question 3:

Volume calculations help us:

• Plan water storage for households and farms

• Determine how much grain or food a container can hold

• Calculate fuel capacity for transport

• Estimate materials needed for construction

(Accept any two reasonable examples)

Differentiation Strategies

For Struggling Learners:

- • Provide formula reference card for each shape
- • Break down unit conversion into separate steps
- • Use simpler numbers (whole numbers, easy decimals)

- • Allow calculator use for all calculations
- • Provide worked example template to follow
- • Focus on rectangular boxes and cylinders only

For Advanced Learners:

- • Introduce frustum and composite solid problems
- • Challenge with cost calculations (price per litre)
- • Explore optimization (which shape holds most for given surface area)
- • Investigate irregular shapes using approximation
- • Connect to density and mass calculations

Extension Activity

Household Water Storage Project

Objective: Apply volume calculations to plan household water storage.

Activity Description:

15. 1. Research: A family of 5 needs 50 litres of water per person per day.
16. 2. Calculate: How many litres needed for one week?
17. 3. Design: Choose container shapes (rectangular tank, cylindrical drum, or combination).
18. 4. Determine: What dimensions would provide enough storage?
19. 5. Compare: Which shape is most efficient (holds most water for least material)?
20. 6. Present: Share your design with the class, explaining your calculations.

Post-Lesson Reflection for Teachers

- • Did students successfully apply volume formulas to real-life problems?
- • Were students able to convert between cubic metres and litres?
- • What misconceptions emerged about units or formulas?
- • How engaged were students with the container investigation?
- • Did students recognize the practical importance of volume?
- • What adjustments are needed for future lessons on this topic?