

The Geometry of Chuckwagons

Grade Level: 8

Sessions: 1

Session Time: 45-60 minutes

Standards:

- **WY 8.G.I.9** *Given the formulas, solve real-world and mathematical problems involving volume and surface area of cylinders.*
- **CCSS.8.G.C.9** *Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.*

Overview:

Students will practice applying volume to real-world problems relating to chuckwagons. This lesson will also introduce students to the idea of semicylindrical volume.

Objectives:

1. Practice using the formulas for volume of cylinders, triangular prisms, rectangular prisms, and spheres.
2. Interpret word problems and apply mathematical concepts to real-world problems and scenarios.

Guiding questions:

1. How do you find the volume of a cylinder, sphere, rectangular prism, and triangular prism?
2. How would you approach finding the volume of half of a cylinder?
3. How might you find the volume of a shape made up of two different shapes?

Vocab:

- **Volume:** the amount of space inside a 3-D shape
- **Sphere:** a 3-D circle
- **Rectangular Prism:** a 3-Dimensional shape made of rectangular sides
- **Triangular Prism:** a 3-dimensional shape made of rectangular and triangular sides
- **Cylinder:** a 3-dimensional shape that has circular ends
- **Semicylinder:** a shape that is half of a cylinder
- **Chuckwagon:** the wagon used by cooks on cattle drives and roundups to prepare and transport food
- **Chuckwagon bed:** the rectangular portion of the wagon usually made of wood

- **Wagon cover:** the semi-cylindrical cloth covering over the top of the wagon

Sources/ Reading:

- https://youtu.be/0bTCVp12mtU?si=mGb_cUZvavSaCzxA
- <https://nationalcowboymuseum.org/blog/5-things-you-didnt-know-about-chuck-wagons/>
- <https://ranchingheritage.org/the-chuck-wagons-role-in-the-old-west/>
- <https://oregontrailcenter.org/blog/what-is-the-difference-between-a-conestoga-wagon-and-a-prairie-schooner/>
- <https://www.khanacademy.org/math/cc-eighth-grade-math/cc-8th-geometry/cc-8th-volume/v/volume-of-a-sphere>
- <https://centerofthewest.org/2015/02/01/points-west-feeding-cowboys-days-open-range/>
- <https://centerofthewest.org/2014/02/28/biscuits-anyone-time-chow-trail/>
- <https://oregontrailcenter.org/the-wagon>

Activity:

Students will learn about the volume of a variety of shapes and will then complete an activity related to the volume of a chuckwagon and its related components.

Materials:

1. Formula sheet (see page 4)
2. Geometry worksheet (see pages 5-7)
3. Pencils
4. Calculator

Procedure:

1. Review 3-D shapes with students, going over cylinders, spheres, rectangular prisms, and triangular prisms.
2. Ask students to think about how they might find the volume of a shape that is comprised of multiple shapes or is half of another shape.
 - a. Ex: How might you find the area of a semicircle or an object that is comprised of both a rectangular and triangular prism.
3. Discuss with students what a chuckwagon is so that they gain context for the activity
4. Review formulas for volume with students and pass out formula sheets (see page 4)
5. Hand out or ask students to take out calculators
6. Pass out worksheets (see pages 5-7) and have students complete them individually or in groups depending on the level of the class

Extension Activity:

If students finish the problem questions early, ask them to write their own volume-related problem questions. Then, students swap questions and answer each other's questions.

Outcomes:

Students will be able to apply the concept of volume to word problems and real-life scenarios.

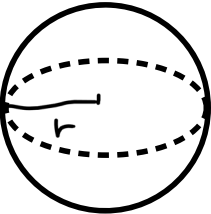
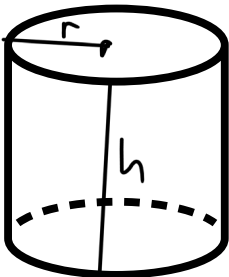
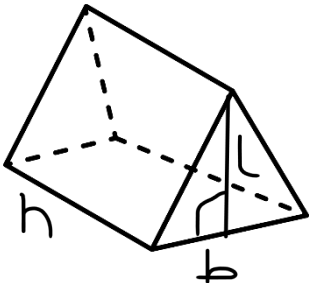
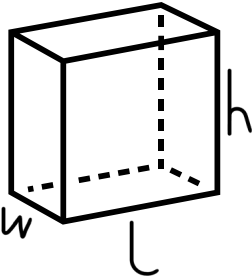


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Formula Sheet

Sphere		$V = \frac{4}{3}\pi r^3$ R = Radius
Cylinder		$V = \pi r^2 h$ R= Radius H= Height
Triangular Prism		$V = \frac{1}{2}bhl$ B= Base L = Length H= Height
Rectangular Prism		$V = lwh$ L = Length W = Width H = Height

Chuckwagon Geometry

Name: _____

Date: _____

Use the following dimensions to answer the questions below. Assume that canned tomatoes, Dutch ovens, coffee pots, and water jugs are cylindrical, pieces of firewood are triangular prisms, onions are spheres, and first aid kits are rectangular prisms.

Chuckwagon bed dimensions – L: 128 in x W: 46 in x H: 27 in

Chuckwagon cover dimensions – R: 23 in x H: 128 in

Dutch oven dimensions – R: 7 in x H: 12 in

Canned tomatoes dimensions – H: 7 in x R: 2 in

Coffee pot dimensions – H: 15 in x R: 4 in

Onion dimensions – R: 3 in

Firewood dimensions – B: 6 in x H: 5 in x L: 20 in

Water jug dimensions – H: 24 in x R: 7 in

First aid kit dimensions – L: 15 in x W: 5 in x H: 12 in

The Basics:

1. Find the volume of the chuckwagon
 - a.
2. Find the volume of each of the seven items
 - a.
3. How many of each item could you fit in the chuckwagon if the chuckwagon only held one type of item?
 - a.

Word Problems:

4. In order to cook for the month of June, Izzy needs 1 jug of water per day in her chuckwagon. How many cans of tomatoes could she fit in the remaining space?
 - a.

5. Luke only wants to fill the bed of his chuckwagon. How many pieces of firewood could he fit in that section of his wagon?
 - a.

6. Alexis wants to fill half of her chuckwagon with Dutch ovens and the other half with coffee pots. How many of each item can she fit?
 - a.

7. Ella wants to fill each of her Dutch ovens with onions. How many onions can she fit in each Dutch oven? If she fills her chuckwagon halfway with onion-filled Dutch ovens, how many onions will be on her chuckwagon?
 - a.

8. Alex wants to bring 50 first aid kits, 10 water jugs, 300 pieces of firewood, and 500 cans of tomatoes. How many Dutch ovens can she fit in the remaining space?
- a.
9. Heather decides that she wants larger Dutch ovens which measure D: 16 in x H: 12 in. What is the new volume of her Dutch ovens? How many of these Dutch ovens can she fit in the chuckwagon?
- a.
10. George decides to make changes to his chuckwagon so that it is now 140 inches long, but the bed is only 22 inches high. Does his new chuckwagon have a volume which is greater than or less than the original chuckwagon?
- a.

Chuckwagon Geometry

Name: ANSWER KEY

Date: _____

Use the following dimensions to answer the questions below. Assume that canned tomatoes, Dutch ovens, coffee pots, and water jugs are cylindrical, and pieces of firewood are triangular prisms.

Chuckwagon bed dimensions – L: 128 in x W: 46 in x H: 27 in

Chuckwagon cover dimensions – R: 23 in x H: 128 in

Dutch oven dimensions – R: 7 in x H: 12 in

Canned tomatoes dimensions – H: 7 in x R: 2 in

Coffee pot dimensions – H: 15 in x R: 4 in

Onion dimensions – R: 3 in

Firewood dimensions – B: 6 in x H: 5 in x L: 20 in

Water jug dimensions – H: 24 in x R: 7 in

First aid kit dimensions – L: 15 in x W: 5 in x H: 12 in

The Basics:

- Find the volume of the chuckwagon
 - $265,500 \text{ in}^3$
- Find the volume of each of the seven items
 - Dutch oven – 1847.26 in^3
canned tomatoes – 87.96 in^3
coffee pot – 753.98 in^3
onion – 113.1 in^3
firewood – 300 in^3
water jug – 3694.51 in^3
first aid kit – 900 in^3
- How many of each item could you fit in the chuckwagon if the chuckwagon only held one type of item?
 - Dutch ovens $\rightarrow 143.73$ (or 143)
canned tomatoes $\rightarrow 3018.42$ (or 3018)
coffee pots $\rightarrow 352.13$ (or 352)
onions $\rightarrow 2,347.48$ (or 2,347)
firewood $\rightarrow 885$
water jugs $\rightarrow 71.87$ (or 71)
first aid kits $\rightarrow 295$

Word Problems:

4. In order to cook for the month of June, Izzy needs 1 jug of water per day in her chuckwagon. How many cans of tomatoes could she fit in the remaining space?
a. 1758.35 (or 1758) cans of tomatoes

5. Luke only wants to fill the bed of his chuckwagon. How many pieces of firewood could he fit in that section of his wagon?
a. 530 pieces of firewood

6. Alexis wants to fill half of her chuckwagon with Dutch ovens and the other half with coffee pots. How many of each item can she fit?
a. 71.86 (or 71) dutch ovens
176.07 (or 176) coffee pots

7. Ella wants to fill each of her Dutch ovens with onions. How many onions can she fit in each Dutch oven? If she fills her chuckwagon halfway with onion-filled Dutch ovens, how many onions will be on her chuckwagon?
a. 16.33 (or 16) onions per dutch oven
1173.53 (or 1173) onions in the chuckwagon

8. Alex wants to bring 50 first aid kits, 10 water jugs, 300 pieces of firewood, and 500 cans of tomatoes. How many Dutch ovens can she fit in the remaining space?

a. 10.6 (or 10) Dutch ovens

9. Heather decides that she wants larger Dutch ovens which measure D: 16 in x H: 12 in. What is the new volume of her Dutch ovens? How many of these Dutch ovens can she fit in the chuckwagon?

a. 2412.74 in^3

110.04 (or 110) Dutch ovens will fit in the chuckwagon

10. George decides to make changes to his chuckwagon so that it is now 140 inches long, but the bed is only 22 inches high. Does his new chuckwagon have a volume which is greater than or less than the original chuckwagon?

a. The new chuckwagon ~~has~~ has a volume greater than the original chuckwagon.