Pennsylvania Adult Education Resources

Lesson Plan Template for Math, English Language Arts (ELA) or English as a Second Language (ESL)

Lesson Overview

Lesson Title: Popcorn Geometry	**Lesson Timeframe:** 2.5 hours. You can complete the lesson in one class or over a period of two classes, if necessary.
Lesson Author: Gayle Willits, Lori Forlizzi, Kim Roush, Ruth Love-Schooley – PSU Career Pathways	**Date Created:** 10/4/2020
Content Area(s): Math- Geometry	**General Topics/Skills Covered:** Estimation Volume Formulas Calculation
NRS Level(s): 4	**Prerequisite Skills:** This lesson is part of final lessons of our Geometry section. Students will be familiar with cylinders as objects and shapes. They will know the formulas for finding the radius of a circle, the area of a circle, and the diameter of a circle. They will be able to perform calculations using this formula.

Standards and Skills Addressed

College and Career Readiness Standards (CCRS): G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. 2.NBT.2 Count within 1000; skip count by 5s, 10s, and 100s. 2.NBT.4 Compare two, three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons. 6.EE.2 Write, read, and evaluate expressions in which letters stand for numbers.

Standards and Skills Addressed

A.SSE.1 Interpret expressions that represent a quantity in terms of its context.
K.G.4 Analyze and compare two- and three- dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners"), and other attributes (e.g., having sides of equal length).

English Language Proficiency Standards (ELPS) (if applicable):	**Target Grammar/Language Forms (for ESL):**

Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Look for and make use of structure.

Foundation Skills Framework (Workforce Skills):

- Applies mathematical operations, concepts, and reasoning

Digital Literacy Skills:
Students will utilize a Zoom environment, including breakout rooms and the chat function, to communicate during the lesson. A video is included for the students to view. Students are also asked to access the Quizizz website and input a code to work on a quiz.

Objectives, Materials, and Vocabulary

Lesson Objective(s):	**Lesson Objective Tips:**
At the end of this lesson, students will be able to: • Use known measurements to find the volume of different cylinders;	• Check it with SMART. (Is it Specific, Measurable, Achievable, Relevant, and Timely?)

Objectives, Materials, and Vocabulary

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- Compare volumes of objects;
- Analyze a real-world problem and construct a plan for solving it;
- Test the proposed plan and revise if needed; and
- Justify their reasoning using data from their formulas/solution plan.

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Texts, Materials, Resources:

- Pencils
- 2-4 sheets of 8 and ½ by 11-inch paper
- Tape
- Popped popcorn (12 – 14 oz.)
- 4 paper or other plates of similar size
- Volume + formula + chart blank formula sheet (copies in person, can share PDF if remote)
- Volume of cylinder worksheet practice (copies in person, can share PDF if remote, or send attached to an email for students to print or copy before class)
- Printouts of worksheets (if students have access to a printer at home) or notebook paper/pencil to write formulas and any practice exercises
- Calculator to use for practice

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Lesson Vocabulary:
Cylinder; volume; circumference; radius; height; two-dimensional shape; three-dimensional shape; sphere; cone; prism; rectangular prism; triangular prism. Have the students get out their notebook or paper to record any vocabulary they are not familiar with. In my class, I have the students keep a notebook, and I encourage keeping a separate section for vocabulary.

We will use a video to review 2D vs 3D shapes. Students can use attached formula sheets (in person) or copy the template on their own sheet of paper (remote) to copy and keep for future reference. I will also review the concept of LxWxH vs BxWxH and how GED® and HiSET® formula sheets use different words for the same measurements, and we need to be flexible as the video mentions. Here is the link to the video. The blank formula sheets are attached. I would stop the video at 9:30 and save the remaining part for the next lesson.

https://youtu.be/qJwecTgce6c

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Instructional Activities

Lesson Introduction (45 minutes): Introduce the lesson objectives and describe how workers in many fields may need to be able to estimate volume and choose containers for liquid or solid matter. For example, laboratory technicians may need to choose a container for experimental materials; chefs may need to plan kitchen equipment to use in preparing recipes for small and large numbers of people; and cleaning and maintenance professionals may need to choose containers to hold liquids or solids needed to complete specific jobs. Note that we have previously discussed area and surface area of two- dimensional shapes. At the end of the previous lesson, we talked about what would happen if we added another dimension. How does that change things? We discussed a basic rectangular box and how we can find how much it holds. Use the above YouTube video to review these concepts and give students a chance to write or rewrite formulas/vocabulary. In this lesson, we have a specific application problem to solve. You need to look at two cylinders and determine which will hold a larger quantity. You have spent the day volunteering to put up flyers for a local park's "drive-in movie night." Since you have helped put up the flyers, you get free admission to the movie and one free container of popcorn. You are very excited because this park is known to sell the best popcorn in town. However, when you get in line at the concession stand, you learn that the vendor is all out of popcorn bags but does have some paper plates. No worries; you have some flyers and tape left. You can use your	**Lesson Introduction Tips:** • Explain how the lesson objectives will be shared with learners. • Make connections to learners' goals and prior and future lessons. • After the video, reiterate the differences between 2D and 3D figures; the units in how they are measured; the differences in labeling figures and being flexible; and GED® vs HiSET® formula sheets.

Instructional Activities

flyers, tape, and a paper plate to create a container for your popcorn. Show students how two containers for popcorn can be created; in one case using an 8 and ½ by 11 sheet to wrap and join at the 8 and ½-inch sides and using a second sheet to wrap and join at the 11-inch sides. Cylinders can be taped to plates to finish the popcorn containers. Show students each container. Ask students to discuss and predict (with partners in breakout room) which cylinder will hold more popcorn – short or tall. Everyone should justify their answer. Release students to breakout rooms. Return students to main room; ask each student to state and justify their prediction. Record predictions and justifications. Discuss why they made their choices; try to spark a discussion on the whys, encouraging students to come to a possible conclusion.	
Lesson Body: **Direct Instruction (15 minutes)** Assist students in creating both cylinders on their own at home. Once the cylinders are completed, ask them to fill both containers with popcorn. Then, have them dump out the contents of each cylinder onto two fresh paper plates, keeping the piles separate. Students count and record the number of kernels from each of their containers. Students see that the "short" container holds more kernels. **Guided Practice (15 minutes):**	**Lesson Body Tips:** • Provide enough detail that another instructor could teach this lesson based on the information in this lesson plan. • Include how you will group students; approximate timeframes for each activity; and how you will integrate technology. • Describe where in the lesson sequence, and how, the instructor will model the target skills and/or tasks for the learners.

Instructional Activities

Ask students to discuss the factors that might determine volume and why the volume of the "short" container was larger. Ensure that all students recognize that the radius drives the size of the volume. Have students calculate the volume of the two cylinders using the formula. Students will write about what changes they could make to the cylinder dimensions to increase the amount of popcorn it could hold. They should prove their prediction by drawing a model and completing a calculation. **Independent Practice (30 minutes):** Have students practice calculating volume of cylinders, specifically with different heights, radii and diameter with the attached worksheet. Remind students that they must convert diameter to radius, in the questions that only provided the diameter, by dividing it by 2 because the formula calls for the radius. Allow the students about 10-15 minutes to work on individually. I use the chat feature when teaching remotely. Have students share answers privately or ask questions and then go over each question individually or only ones that students answered in correctly or had difficulties with. If in- person, I may have students volunteer to share questions on the board or have the answers available for students to check and go over only the ones they answered incorrectly or they had difficulties with. After we are done with this practice, we again may discuss any observations they have about the volume of a cylinder.	
Assessment (20 minutes): Have students do the following Quizizz to assess their knowledge. I prefer to do the guided quiz in class, but you can also assign it for homework if you run out of time. You could also create your	**Assessment Tips:** • Describe the ongoing assessments that you will use to check learners' progress toward the lesson objectives.

Instructional Activities

own quiz, if you prefer to do that, and use it here to assess the students' knowledge. I like the Quizizz website because it allows me to be more flexible with students while working remotely, and it is easy to use. https://quizizz.com/admin/quiz/5e9e23a6aa0448001c5a7b81/volume-of-a-cylinder-practice	• Describe the cumulative assessments that will measure the extent to which learners met the lesson objectives.
Lesson Conclusion (20 minutes): Instructor closes the lesson by reviewing the objectives, again discussing the different dimensions of the cylinder and how that affects how much the cylinder can hold. How does this connect to other three-dimensional shapes like a sphere or cone? Do you have any predictions on what the volume formulas for those shapes would be? Could they be related to any of the formulas we learned about today? Have the students share any ideas about those shapes in the chat.	**Lesson Conclusion Tips:** • Review lesson objectives. • Provide an opportunity for student reflection. • Connect to prior and future learning.
Lesson Extension: **Homework:** Provide a sheet of problems in three workplace contexts where a worker must make a decision between two containers to obtain a container with the correct volume to solve a problem, find the surface area and volume of three-dimensional shapes and the cost of making specific three-dimensional objects with real life applications. This assignment is attached in a separate document. **Additional enrichment/practice opportunities:** Option 1: **Find** two, gallon-size containers that are different shapes/sizes, but hold the same volume. Option 2: **Draw** two shapes that are different sizes with the same volume. Label the figure with realistic dimensions. Option 3: **Trace** a circle using an object with a round base, like a jar. Cut string the length of the circumference of the circle. Straighten the string out and measure it. Measure the diameter of the circle and do the calculation (divide the circumference by the diameter) to see how close to π you get.	

Instructional Activities

Check to ensure that your lesson addresses the Key Shifts in the CCRS:	
ELA Key Shifts: ☐ Text Complexity ☐ Evidence ☐ Building Knowledge	**Math Key Shifts:** ☒ Focus ☒ Coherence ☒ Rigor

Instructor Reflection After the Lesson

Instructor Reflection Questions (to be completed after teaching the lesson):

- What went well in the lesson?
- What did not go well in the lesson?
- Did the learners meet the lesson objectives? If not, why?
- What changes will you make for the next time you teach the lesson?