

## Unit 7: Surface Area and Volume

### Geometry

10 Class Meetings

Revised May 2023

#### Essential Questions

- How can you determine the surface area and volume of three dimensional figures?
- How can you find and compare the areas and volumes of similar solids?

#### Enduring Understandings with Unit Goals

**EU 1:** To find the surface area of a three-dimensional figure, find the sum of the areas of all the surfaces of the figure.

- Explain how to find the surface area of various figures.

**EU 2:** You can find the volume of a prism, cylinder, pyramid, and cone when you know the area of the base and the height of the figure, and spheres when you know the radius.

- Explain how to find the volume of various figures.

**EU 3:** You can use ratios to compare the areas and volumes of similar solids.

- Use the proportional relationship between area and volume to find missing values.

#### Standards

##### Common Core State Standards:

- **HSG.MG.A.1:** Use geometric shapes, their measures, and their properties to describe objects.
- **HSG.MG.A.2:** Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
- **HSG.GMD.A.1:** Give an informal argument for the formulas for the volume of a cylinder, pyramid, and cone.
- **HSG.GMD.A.2:** Give an informal argument for the formulas for the volume of a sphere and other solid figures.
- **HSG.GMD.A.3:** Use formulas for cylinders, pyramids, cones, and spheres to solve problems.

#### ISAAC Vision of the Graduate Competencies

**Competency 1:** Write effectively for a variety of purposes.

**Competency 2:** Speak to diverse audiences in an accountable manner.

**Competency 3:** Develop the behaviors needed to interact and contribute with others on a team.

**Competency 4:** Analyze and solve problems independently and collaboratively.

**Competency 5:** Be responsible, creative, and empathetic members of the community.

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#### Unit Content Overview

##### 1. Euler's Formula

- Using Euler's Formula
- Classify polyhedrons

##### 2. Surface Area and Volume of Prisms and Cylinders

- Surface area and volume of a prism
- Surface area and volume of a cylinder

##### 3. Surface Area and Volume of Pyramids and Cones

- Surface area and volume of a pyramid
- Surface area and volume of a cone

##### 4. Surface Area and Volume of Spheres

- Surface area of a sphere
- Volume of a sphere

##### 5. Areas and Volumes of Similar Solids

- Identifying Similar Solids
- Ratios of areas and volumes of similar solids
- Finding and using the scale factor

##### Interdisciplinary Connection:

- Language Arts - Word Problems
- Science – Word Problems

#### Daily Learning Objectives with *TWPS Activities*

##### Students will be able to...

- Compute the number of faces, edges, and vertices using Euler's Formula
- Calculate the surface area and volume of a prism and a cylinder
- Find the surface area and volume of a pyramid and a cone
- Calculate the surface area and volume of a sphere
- Compare and calculate the areas and volumes of similar solids
  - *Why do we need to use ratios when calculating areas and volumes?* Identify polygons in the coordinate plane
- Evaluate the area of a regular polygon
- Evaluate the area of composite figures
  - *When finding a composite area, what strategy do you use to divide the shape?*
- Solve proportions to determine perimeters and areas of similar polygons
  - *Why do we need proportions to solve for unknown perimeters and areas?*

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#### Instructional Strategies/Differentiated Instruction

- **HLP:** Academically Productive Talk
- **HLP:** Writing to Learn (TWPS)
- **HLP:** Effective Feedback
- Whole-group instruction
- Creating authentic connections for students
- Rephrasing and restatement of information and concepts
- Guided notes
- Student-led instruction
- Independent problem-solving
- Collaborative problem-solving
- Cross-curricular problem solving (independent and collaborative)
- Accountable Talk
- Manipulatives
- Cumulative Homework
- Visuals to support instruction
- Small group instruction
- Pre-teaching and reteaching

#### EL DIFFERENTIATED INSTRUCTION:

- Word Walls with visuals
- TWPS (Think, Write, Pair, Share)
- Pre-reading strategies
- Culturally responsive teaching
- Explicit Modeling
- Key Vocabulary
- Graphic Organizers
- Strategic Grouping
- Non-verbal Assessments

#### Assessments

#### FORMATIVE ASSESSMENTS:

- Accountable Talk Discussions
- Daily Think-Write-Pair Share (TWPS)
- Daily Do Now
- Whiteboards
- Mid-class check-ins
- Exit Slips
- Cumulative Homework
- Performance Task – Comparing Aquaculture Tanks
  - Problem Solving Rubric

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#### **SUMMATIVE ASSESSMENTS:**

- Edulastic Quiz 1 – EU 1, EU 2
- Unit 7 Test – EU 1, EU 2, EU 3
- Performance Task – Comparing Aquaculture Tanks

#### **Unit Task**

**Unit Task Name:** Comparing Aquaculture Tanks

**Description:** Students will use information learned in this unit about how to find the surface area of a three-dimensional figure (EU 1), how you can find the volume of a three-dimensional figure when you know the area of the base and the height of the figure (EU 2), and how you can use ratios to compare the areas and volumes of similar solids (EU 3) in order to determine which aquaculture tank can hold the most tilapia before they are harvested. Students will be given 4 different aquaculture tanks in the aquaculture lab. With a partner, they will need to figure out which dimensions they need measure of each tank in order to find the volume. Once they have all the dimensions they need, they will individually calculate the volume for each of the tanks. Students will then determine which tank can hold the most tilapia before harvesting. Students will produce a well-developed paragraph explaining how they arrived at their answers as well as include the calculations they made and sketches with measurements of each tank.

**Evaluation:** Problem Solving Rubric

#### **Unit Resources**

- Worksheets
- Calculator
- Laptops
- SBAC Prep Online
- Edulastic
- Kahn Academy
- Gimkit
- Quizizz
- Individual Whiteboards
- 2 Truths & One Lie
- State Common Core Standards Transition Tasks
- Online resources