2.2 Volume and Surface Area Calculations with Potatoes

# Instructions

**Materials Needed:**

* Potatoes (whole or cut into simple shapes)
* Knife (for adult supervision)
* Ruler or measuring tape
* Water (for estimating volume by displacement)
* Container (to hold water for displacement)
* Paper and pencil (for recording measurements)
* Calculator (optional for calculations)

**Setup:**

1. **Prepare the Potatoes:**
   * Wash the potatoes and cut them into different shapes (e.g., cubes, spheres, or irregular shapes). If you're working with whole potatoes, students can observe the irregular shape and compare it with the shapes they cut.
2. **Set Up Measuring Stations:**
   * Provide rulers or measuring tapes to measure the dimensions of the shapes, along with containers of water for volume estimation using displacement.
3. **Prepare Data Sheets:**
   * Provide students with paper or a template for recording measurements and calculations.

**Activity Instructions:**

1. **Measuring Surface Area (for Regular Shapes):**
   * **Cube or Rectangular Prism:** Measure the length, width, and height of the potato shape. Use the formula for surface area:   
       
     Surface Area = 2(lw+lh+wh)
   * **Sphere (if shaped as a ball):** Measure the diameter or radius of the potato and use the formula for surface area:   
       
     Surface Area of Sphere = 4πr2
   * For irregular shapes, estimate the surface area by breaking the shape into smaller, measurable faces (this can be approximated using small, flat planes).
2. **Measuring Volume (for Regular and Irregular Shapes):**
   * **Regular Shapes (Cube, Rectangular Prism, or Sphere):** Use the following formulas to calculate volume:
     + **Cube or Rectangular Prism:**   
         
       Volume = l × w × h
     + **Sphere:**

Volume of Sphere = πr3

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* + **Irregular Shapes:**
    - **Displacement Method:**
      1. Fill a container with water and record the water level.
      2. Carefully submerge the potato shape in the water and measure the rise in water level.
      3. The volume of the potato is the change in water level, which corresponds to the volume of displaced water.

1. **Estimate and Compare:**
   * After calculating the volume and surface area for regular shapes, students can estimate the volume of irregular shapes and compare their estimations with actual measurements using water displacement.
   * Have students calculate the volume of the potato before and after it’s been cut to see how much was removed and discuss how cutting affects surface area and volume.
2. **Recording Data and Drawing Conclusions:**
   * Have students record their calculations on their data sheets. Encourage them to reflect on the results and discuss the relationship between surface area, volume, and shape.

**Safety Note:**

* Adult supervision is necessary when using sharp knives to cut the potatoes.
* Ensure that students handle water containers carefully to avoid spills and slips.

**Learning Outcomes:**

1. **Understanding Surface Area and Volume:** Students will learn how to calculate surface area and volume for both regular and irregular shapes.
2. **Hands-On Math Application:** Students will apply mathematical formulas in a tangible way, using potatoes to better understand abstract concepts like volume and surface area.
3. **Estimation and Measurement Skills:** Students will practice estimating and measuring physical properties, reinforcing skills in data collection and mathematical reasoning.
4. **Exploration of Shape and Size:** Students will gain insight into how changes in shape and size affect surface area and volume, building problem-solving skills.

This activity provides a hands-on approach to learning geometry, helping students understand the relationship between 3D shapes and their physical properties while also developing their measurement and calculation skills.