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Chapter 8 Performance Task

**Good Sports Company**
The Okeke family owns and operates a sporting goods company called Good Sports. To create a trustworthy product, they must be precise during the manufacturing process.

Hakeem oversees the making of baseballs. Baseballs have three main parts, as shown. Each part must be made precisely to conform to league standards.

Write your answers on another piece of paper. Show all your work to receive full credit.

**Part A**
The diameter of the spherical core of the baseball measures approximately 1.31 inches. What is the volume of the core of the baseball? Round to the nearest hundredth.

**Part B**
Layers of wool are wound tightly around each core, resulting in a sphere with a radius of approximately 1.41 inches. What is the volume of the wool? Round to the nearest hundredth.

**Part C**
After the cowhide covering is sewn on, each baseball has a total diameter between 2.86 inches and 2.94 inches. What are the possible circumferences of a baseball? What are the possible volumes of a baseball? Write your answers as ranges, and round to the nearest hundredth.
Part D
Baseballs are not the only products made by the company. Good Sports also produces plastic cones with a 3.5-inch diameter and an 8-inch slant height.

Amma is in charge of new product development. She thinks the company should also produce cones with a diameter of 7 inches. She wants to use the same amount of plastic to produce each cone. What is $x$, the slant height of the cone that Amma wants to build? Assume both cones are open on the bottom.

Part E
To conform to tennis standards, each tennis ball the company manufactures must measure between 2.575 inches and 2.70 inches in diameter.

Kahlil is in charge of packaging and distribution. He packages 3 maximum-sized tennis balls in one cylindrical can. He wants to fit the tennis balls snugly so that each ball touches the next one and the sides of the can. What are the diameter $d$ and the height $h$ of each can?

Approximately what percentage of the container will be filled by the tennis balls? Round to the nearest tenth of a percent. Approximately how many cubic inches of empty space remain in the container? Round to the nearest hundredth.
Part A

The balance beam shown below is a translation of the gymnasts. The high beam shown below is a reflection of the gymnasts. As they go around the bars, they perform a rotation of the beam.

Part B

Part C

Part E

Part D

Chapter 8 Performance Task Student Work Sample
Chapter 8 Performance Task Student Work Sample

[Diagram with grid and graph paper]

Part A
- Plot points on the graph:
  - A(2,1)
  - B(3,2)
  - C(4,3)
  - D(5,4)

Part B
- Calculate distances:
  - AB = √[(3-2)² + (2-1)²]
  - BC = √[(4-3)² + (3-2)²]
  - CD = √[(5-4)² + (4-3)²]

Part C
- Determine the area of the triangle ABC:
  - Area = 0.5 × base × height

Part D
- Reflect on your work and discuss any insights or challenges encountered.

Part E
- Complete the following steps:
  1. Reflect across the x-axis.
  2. Reflect across the y-axis.
  3. Enlargement by a factor of 1.5 from the origin.

This is because it was multiplied by a numerator greater than 1.

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Chapter 8  Performance Task Student Work Sample

Part D

Balance Beam: Translation (slide)

High Bar: Rotation

Ice Floor: Reflection (flip)

Part E

- Place and then rotate 180° about the origin.
- Slide by multiplying each point by 1.5 negative.
- Place by multiplying each point by 1.5 and then rotate 180° about the origin.

A1 (0, 5)
B1 (1, 1)
C1 (1.5, 3)
D1 (1.5, 5)
E1 (1, 5)

New Points:
A2 (0, -5)
B2 (1.5, -3)
C2 (1, 3)
D2 (1.5, 3)
E2 (1, 3)

Still II and same length the same distance.

Slides move all points the same distance.
PART A
Balance Beam: Slides
High Bar: Rotates
Pole: Flips

PART B

PART C
F(5,2) G(5,1) H(3,1) J(3,2)
It was a rectangle and stayed the same size

PART D

PART E
Two flips and multiply by 2.
Multiplying by +2 because sides grow from 4 to 8

Enlargement = bigger
### Task Scenario
Students will use formulas and geometric reasoning to find circumference, surface area, and volume related to cones, cylinders, and spheres to solve problems about sporting goods manufacturing.

### CCSS Content Standard(s)
- 8.G.9

### Mathematical Practices
- MP1, MP2, MP3, MP4, MP5, MP6

### Depth of Knowledge
- DOK2, DOK3, DOK4

<table>
<thead>
<tr>
<th>Part</th>
<th>Maximum Points</th>
<th>Scoring Rubric</th>
</tr>
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</table>
| A    | 1              | **Full Credit:**
|      |                | \( d = 1.31 \text{ in.}, \text{ so } r = 0.655 \text{ in.} \)  
|      |                | \( V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi (0.655)^3 \approx 0.375 \pi \approx 1.18 \text{ in}^3 \)  
|      |                | No credit will be given for an incorrect or incomplete answer. |
| B    | 2              | **Full Credit:**
|      |                | Total volume of the ball after the wool layers are added:  
|      |                | \( V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi (1.41)^3 \approx 3.738 \pi \approx 11.74 \text{ in}^3 \)  
|      |                | Volume of wool layers alone:  
|      |                | 11.74 – 1.18 = 10.56 \text{ in}^3  
|      |                | Partial Credit (1 point) will be given for the correct volume of the core and wool combined OR the correct volume of only the wool.  
|      |                | No credit will be given for an incorrect or incomplete answer. |
| C    | 2              | **Full Credit:**
|      |                | Smallest baseball: \( C = \pi d = 2.86 \pi \approx 8.98 \text{ in.} \)  
|      |                | Largest baseball: \( C = \pi d = 2.94 \pi \approx 9.24 \text{ in.} \)  
|      |                | The circumference of a baseball is between 8.98 and 9.24 inches.  
|      |                | Smallest baseball: \( d = 2.86, r = 1.43 \)  
|      |                | \( V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi (1.43)^3 \approx 12.25 \text{ in}^3 \)  
|      |                | Largest baseball: \( d = 2.94, r = 1.47 \)  
|      |                | \( V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi (1.47)^3 \approx 13.31 \text{ in}^3 \)  
|      |                | The volume of a baseball is between 12.25 and 13.31 cubic inches.  
|      |                | Partial credit (1 point) will be given for the correct range of circumferences OR the correct range of volumes.  
|      |                | No credit will be given for an incorrect answer. |
### Part D

**Maximum Points:** 2

**Scoring Rubric:**

Full Credit:

Because both cones are open at the bottom, the amount of plastic used is equal to the lateral area.

- **Current cone:**
  - $d = 3.5$, $r = 1.75$
  - $L.A. = \pi r \ell = \pi (1.75)(8) = 14\pi \approx 43.98 \text{ in}^2$

- **New cone:**
  - $d = 7$, $r = 3.5$
  - Lateral area is equal to the current cone’s lateral area.

  $L.A. = \pi r \ell$
  
  $14\pi = \pi (3.5)(x)$
  
  $14 = 3.5x$
  
  $4 = x$, so the slant height of the new cone is 4 in.

Partial credit (1 point) will be given for the correct lateral area OR the correct slant height.

No credit will be given for an incorrect or incomplete answer.

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### Part E

**Maximum Points:** 4

**Scoring Rubric:**

Full Credit:

- **Maximum diameter of a tennis ball = 2.7 in.**
- **Diameter of can = diameter of ball = 2.7 in.**
- **Height of can = height of 3 tennis balls = 3(2.7) = 8.1 in.**
- **Radius of can or tennis ball: 2.7 \div 2 = 1.35 in.**

- **Can:**
  
  $V = \pi r^2h = \pi (1.35)^2(8.1) \approx 46.377 \text{ in}^3$

- **1 tennis ball:**
  
  $V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi (1.35)^3 \approx 10.306 \text{ in}^3$

- **3 tennis balls:**
  
  $V = 3(10.306) = 30.918 \text{ in}^3$

- **Percentage of the can filled by tennis balls:**
  
  $\frac{30.918}{46.377} \approx 0.667, \text{ or } 66.7\%$

- **Empty space in can:**
  
  $46.377 - 30.918 \approx 15.46 \text{ in}^3$

Partial Credit (1 point) will be given for each of 4 answers: the correct can dimensions OR the correct percentage of can filled by tennis balls OR the correct mathematical reasoning and process for finding the percentage but based on incorrect calculations OR the correct amount of empty space in the can.

No credit will be given for an incorrect and incomplete answer.

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**TOTAL:** 11
Chapter 8 Performance Task Student Work Sample

Part A

Vol. = \frac{1}{3} \pi r^2 h

\begin{align*}
\text{Vol.} & = \frac{1}{3} \pi \times 0.045^2 \times 1.14 = 0.021 \text{ m}^3 \\
\text{Vol.} & = \frac{1}{3} \pi \times 0.045^2 \times 1.49 = 0.026 \text{ m}^3 \\
\text{Vol.} & = \frac{1}{3} \pi \times 0.045^2 \times 1.81 = 0.030 \text{ m}^3
\end{align*}

Part B

Vol. = \frac{1}{3} \pi r^2 h

\begin{align*}
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 1.49 = 0.105 \text{ m}^3 \\
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 1.81 = 0.124 \text{ m}^3 \\
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 2.19 = 0.155 \text{ m}^3
\end{align*}

Part C

Vol. = \frac{1}{3} \pi r^2 h

\begin{align*}
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 1.49 = 0.105 \text{ m}^3 \\
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 1.81 = 0.124 \text{ m}^3 \\
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 2.19 = 0.155 \text{ m}^3
\end{align*}

Part D

Vol. = \frac{1}{3} \pi r^2 h

\begin{align*}
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 1.14 = 0.021 \text{ m}^3 \\
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 1.49 = 0.026 \text{ m}^3 \\
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 1.81 = 0.030 \text{ m}^3
\end{align*}

Part E

Vol. = \frac{1}{3} \pi r^2 h

\begin{align*}
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 1.14 = 0.021 \text{ m}^3 \\
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 1.49 = 0.026 \text{ m}^3 \\
\text{Vol.} & = \frac{1}{3} \pi \times 0.186^2 \times 1.81 = 0.030 \text{ m}^3
\end{align*}
Chapter 8 Performance Task Student Work Sample

Part A

V = \frac{1}{3} \pi r^2 \cdot h

V = \frac{1}{3} \pi (1.4)^2 \cdot 6

V \approx 10.56 \text{ in}^3

Circumference: between 8.98 in and 9.24 inches

Volume: between 12.25 \text{ in}^3 and 13.31 \text{ in}^3

Part B

V = \frac{1}{2} \pi (1.4)^3

V \approx 11.8 \text{ in}^3

Part D

LA = \pi \frac{(3.5)^2}{2}

LA = 87.9 \text{ in}^2

\frac{87.9}{\pi} = x

3.99 \text{ in} = x

Part E

Can t \div \text{in}

\frac{4}{3} \pi \text{in}^3

\frac{4}{3} \pi \left(\frac{(1.35)^3}{3}\right)

V = \frac{9}{2} \pi \text{in}^3

V = 3.092 \text{ in}^3

Left over space = 46.38 - 30.92 = 15.46 \text{ in}^3
Chapter 8 Performance Task

**Part A**

\[ V = \frac{4}{3} \pi r^3 \]
\[ V = \frac{4}{3} \pi \cdot 1.31^2 \]
\[ V = \frac{4}{3} \pi \cdot 2.1488691 \]
\[ V = 9.42 \text{ cubic inches} \]

**Part B**

\[ V = \frac{2}{3} \pi r^3 \]
\[ V = \frac{2}{3} \pi \cdot 1.41^3 \]
\[ V = \frac{2}{3} \pi \cdot 2.803221 \]
\[ V = 11.74 \text{ in}^3 \]

\[ 11.74 \text{ in}^3 - 9.42 \text{ in}^3 = 2.32 \text{ in}^3 \]

is the volume of wood alone.

**Part C**

\[ C = \pi d \]
\[ C = \pi (2.94) \]
\[ C = \pi \cdot 8.98 \text{ in} \to C = 9.23 \text{ in} \]
\[ V = \frac{2}{3} \pi r^3 \]
\[ V = \frac{2}{3} \pi \cdot 1.43^3 \]
\[ V = \frac{2}{3} \pi \cdot 2.924207 \]
\[ V = 12.25 \text{ in}^3 \to V = 13.31 \text{ in}^3 \]

**Part D**

\[ V = \frac{2}{3} \pi r^2 \cdot h \]
\[ V = \frac{2}{3} \pi (1.78)^2 \cdot 8 \]
\[ V = \frac{2}{3} \pi \cdot 3.0425 \cdot 8 \]
\[ V = 25.65634 \]
\[ 25.65634 = \frac{1}{2} \pi (3.5)^2 \cdot h \]
\[ 25.65634 = \frac{12.28817}{12.28817} \cdot h \]
\[ 2 \text{ in} \cdot h \]

The height is 2 inches.

**Part E**

Maximum = 2.70
The height is 8.1 inches (2.7 \times 3) and the diameter is 2.7 inches.

\[ \text{BALL} \]
\[ V = \frac{2}{3} \pi r^3 \]
\[ V = \frac{2}{3} \pi (1.45)^3 \]
\[ V = \frac{2}{3} \pi \cdot 3.018625 \]
\[ V = 12.77 \text{ in}^3 \]
\[ 12.77 \times 3 = 38.31 \]
\[ 38.31 \div 53.50 = 71.6\% \text{ of the can is filled.} \]

53.50 - 38.31 = 15.19 cubic inches remain.

\[ \text{CAN} \]
\[ V = \pi r^2 h \]
\[ V = \pi (1.45)^2 \cdot 8.1 \]
\[ V = 53.50 \text{ in}^3 \]
Chapter 8 Performance Task Student Work Sample

**PART A**
Core: 9.H

**PART B**
No. 1: 11.7

**PART C**
Av. Circumference: 9.1
Av. Volume: 13.7

**PART D**
\[ H: 4 \]

[The rest of the document is not visible.]