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## Advanced Volume on the ISEE <br> Middle and Upper Level

LESSON GOAL: Solve multi-step problems that involve the volume of a figure.

## ISEE Middle-Level Volume Question:

The surface area of a cube is 150 centimeters. What is its volume?
A) $5 \mathrm{~cm}^{3}$
B) $25 \mathrm{~cm}^{3}$
C) $100 \mathrm{~cm}^{3}$
D) $125 \mathrm{~cm}^{3}$

## The solution:

Step 1: Work backwards from the surface area to determine the length of each side of your cube. Since the cube has 6 faces, we can divide the surface area by 6 to get the area of each face. Find its square root to get the side length:

$$
150 \div 6=25 ; \sqrt{ } 25=5
$$

Step 2: Find the volume by taking the side length, 5, to the third power. The answer is D.
$5 \times 5 \times 5=125$

## ISEE Upper-Level Volume Question:

The height of the cylinder shown is 5 times its diameter. The formula used to find the volume of a cylinder is $V=$ $\pi r^{2} h$ or $V=r^{2} h \Pi$ where $r$ is the radius of the cylinder and $h$ is the height of the cylinder. If the diameter of the cylinder is 4 in ., what is its volume, in inches ${ }^{3}$ ?
A) 80 п
B) $100 \pi$
C) $160 \pi$
D) $320 \pi$


Helpful tip: Since you don't get a calculator, the ISEE usually provides numbers that are easy to work with, such as perfect squares. If you find yourself doing a complicated calculation, double check your work before continuing.

Helpful tip: Don't stop before you're finished! The test is tricky and often offers partial solutions, like A and B, as answer choices.


Helpful tip: If you see an unfamiliar figure on the test and you don't know the formula, don't panic! The ISEE often gives the formula for a less common figure within the problem. That said, it's important to memorize common formulas, such as the volume of cubes and rectangular prisms.

Step 1: Use the information in the problem to figure out each variable in the formula:
$r=$ half the diameter: $4 \div 2=2 \mathrm{in}$.
$h=5$ times the diameter: $4 \times 5=20 \mathrm{in}$.

Helpful tip: Don't mix up diameter and radius! The test often gives you one of these measures when you need the other one to solve the problem.

Step 2: Plug each variable into the equation and solve: $V=r^{2} h \Pi=2^{2} \times 20 \times \pi=80 \Pi$. The correct answer is A.

