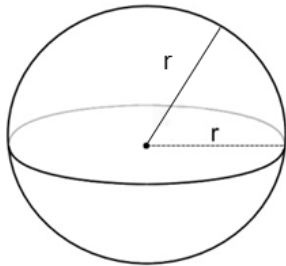


Objective: Solve problems by finding the surface area of a sphere.

Concept

Surface Area of a Sphere is a measure of the area of the curved surface of a sphere.

Since all spheres are similar (same shape but may be different sizes), the formula for the surface area of a sphere is only dependent upon the radius of the sphere. **The radius is measured from the point at the center of the sphere to the surface of the sphere.**



The formula used to calculate the surface area of a sphere is $S = 4\pi r^2$, where r is the radius of the sphere.

Objective: Solve problems by finding the surface area of a sphere.

Ex) Earth's radius is approximately 4000 miles. About two-thirds of the Earth's surface is covered by water. Estimate the land area on Earth to the nearest square mile.



① $\frac{2}{3}$ is water, then $\frac{1}{3}$ is land

② $\frac{1}{3}$ of Earth's surface area

$$S = 4\pi r^2$$

① $r = 4000 \text{ mi}$

② $\frac{1}{3}(4\pi r^2) = \frac{1}{3} \cdot 4 \cdot \pi \cdot (4000 \text{ mi})^2$

$\approx 67,020,643 \text{ mi}^2$

③ The land area on Earth is about 67,020,643 square miles.

Objective: Solve problems by finding the surface area of a sphere.

Practice) A beach ball has a diameter of 15 inches. About 25% of the ball is blue. Estimate the area that is blue to the nearest tenth.

$$S_{blue} = 0.25(4\pi r^2) = 0.25 \cdot 4\pi (7.5 \text{ in})^2 \approx 176.7 \text{ in}^2$$



The area of the ball that is blue is about 176.7 square inches.

Objective: Solve problems by finding the surface area of a sphere.

Ex) The size of a cultured pearl is typically indicated by its diameter in millimeters. How many times as great is the surface area of the 9 mm pearl compared to the surface area of the 6 mm pearl?

$$\text{① } \frac{S_{9\text{mm}}}{S_{6\text{mm}}} = \frac{4\pi(4.5\text{mm})^2}{4\pi(3\text{mm})^2} = \frac{(4.5\text{mm})^2}{(3\text{mm})^2} = 2.25$$

Handwritten notes:
 diam $r = 3\text{mm}$ (for 6mm pearl)
 diam $r = 4.5\text{mm}$ (for 9mm pearl)
 $S = 4\pi r^2$



② The Surface area of the 9mm pearl is 2.25 times greater than the surface area of the 6mm pearl.

Objective: Solve problems by finding the surface area of a sphere.

Ex) A spherical water tank is 21.5 feet in diameter. The corrosion-resistant alloy skin of the tank is $\frac{1}{8}$ in thick. Estimate the amount of alloy used to make the tank, to the nearest cubic inch.

* Surface Area \times thickness

① convert

$$\frac{21.5 \text{ ft}}{1} \times \frac{12 \text{ in}}{1 \text{ ft}} = 258 \text{ in} = \text{diameter}$$

② radius = $\frac{258 \text{ in}}{2} = 129 \text{ in}$

③ 8 times thickness = $4\pi (129 \text{ in})^2 \times \frac{1}{8} \text{ in}$
 $\approx 26,140 \text{ in}^3$

④ The alloy used to make the tank is about $26,140 \text{ in}^3$.



Objective: Solve problems by finding the surface area of a sphere.

Concept

Surface Area of a Hemisphere



Surface Area of a Hemisphere (including the base)

half of the surface area of a sphere + area of the circular base

$$S = \frac{1}{2}(4\pi r^2) + \pi r^2 \rightarrow S = 2\pi r^2 + \pi r^2 \rightarrow S = 3\pi r^2$$

Surface Area of a Hemisphere (not including the base)

half of the surface area of a sphere

$$S = \frac{1}{2}(4\pi r^2) \rightarrow S = 2\pi r^2$$

Objective: Solve problems by finding the surface area of a sphere.

Ex) A dome with a diameter of 73 feet in the shape of a hemisphere is covered with solar panels. Estimate the square feet of solar panels needed to cover the dome. Round to the nearest tenth.

$$S = 2\pi r^2$$

$$r = \frac{73 \text{ ft}}{2} = 36.5 \text{ ft}$$

$$S = 2\pi (36.5 \text{ ft})^2 \approx 8370.8 \text{ ft}^2$$

About 8370.8 ft² of solar panels is needed.



Objective: Solve problems by finding the surface area of a sphere.

Practice) A paperweight made of blown glass is in the shape of a hemisphere with a diameter of 3.7 inches. What is the surface area of the paperweight? Round to the nearest tenth.

1. Find the radius of the paperweight.

$$r = \frac{3.7 \text{ in}}{2} = 1.85 \text{ in}$$



2. Find the surface area of the paperweight (hemisphere with the base).

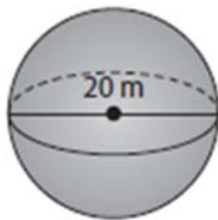
$$S = \frac{1}{2}(4\pi r^2) + \pi r^2 = 3\pi r^2 = 3\pi(1.85 \text{ in})^2 \approx 32.3 \text{ in}^2$$

The surface area of the paperweight is about 32.3 square inches.

Objective: Solve problems by finding the surface area of a sphere.

Closure

Susana solved for the surface area of the sphere. Her work is shown below. Find her error and explain how to fix it.



$$\begin{aligned} S &= \frac{4}{3} \pi r^2 \\ &= \frac{4}{3} \pi (10m)^2 \\ &= \frac{4}{3} \pi (100m^2) \\ &= \boxed{\frac{400}{3} \pi m^2} \end{aligned}$$

Susana used $\frac{4}{3}$, which is part of the volume formula for a sphere, not the surface area formula, which is $S = 4\pi r^2$. To fix the error, change the $\frac{4}{3}$ to a 4.