Wednesday, September 23, 2020

Example 1: Density of the Earth

$$\rho_{Earth} = \text{density} = \frac{\text{Mass}}{\text{Volume}} = 5.50 \times 10^{12}\ \text{kg/km}^3$$

Conversion to g/cm^3

$1\ \text{kg} = 1000\ \text{g}$

$$5.50 \times 10^{12}\ \frac{\text{kg}}{\text{km}^3} = 5.50 \times 10^{12} \times \frac{1000\ \text{g}}{(1000\ \text{m})^3} = \frac{5.50 \times 10^{12} \times 1000}{1000^3}\ \frac{\text{g}}{\text{m}^3}$$

$1\ \text{km} = 1000\ \text{m}$

$$1000^3 = (10^3)^3 = 10^9$$

$$= \frac{5.50 \times 10^{12} \times 10^3}{10^9}\ \text{g/m}^3 = 5.50 \times 10^6\ \text{g/m}^3$$

$$10^{12+3-9} = 10^6$$

$$5.50 \times 10^6\ \frac{\text{g}}{\text{m}^3} = 5.50 \times 10^6 \times \frac{\text{g}}{(100\ \text{cm})^3} = \frac{5.50 \times 10^6}{(10^2)^3}\ \frac{\text{g}}{\text{cm}^3} = 5.50\ \text{g/cm}^3$$

$1\ \text{m} = 100\ \text{cm}$

$(10^2)^3 = 10^6$

$\Rightarrow$ the average density of the Earth is $\boxed{\rho_{Earth} = 5.50\ \text{g/cm}^3}$

Example 2: Conversion of $100\ cm^2$ to m^2

$100\ cm^2 = 100 \times (0.01\ m)^2 = 100 \times (10^{-2})^2\ m^2$

$= 100 \times 10^{-4}\ m^2$

$= 10^2 \times 10^{-4}\ m^2$

$= 10^{2-4}\ m^2$

$= 10^{-2}\ m^2$

$= 0.01\ m^2$

$1\ cm = 0.01\ m$

$= 10^{-2}\ m$

$\Rightarrow$ $100\ cm^2 = 0.01\ m^2$

Area of a sphere $= 4\pi R^2$