

4.2.1 Without looking up anything, using only numbers you know and your calculator, what is your best estimate for the mass of the earth?

Assume density of the earth is $5 \times 10^4 \text{ kg m}^{-3}$.

Assume earth is a sphere with radius $6 \times 10^6 \text{ m}$

$$\text{Volume of earth} = 2 \times \int_0^{6 \times 10^6} \pi r^2 dr$$

$$= 2 \times \pi \times \frac{r^3}{3} \bigg|_0^{6 \times 10^6}$$

$$= 2 \times \pi \times \frac{(6 \times 10^6)^3}{3} \text{ m}^3$$

$$= 4.524 \times 10^{20} \text{ m}^3$$

$$\text{Mass of Earth} = \text{Volume of Earth} \times \text{Density of Earth}$$

$$= 4.524 \times 10^{20} \text{ m}^3 \times 5 \times 10^4 \text{ kg m}^{-3}$$

$$= 2.262 \times 10^{25} \text{ kg}$$