



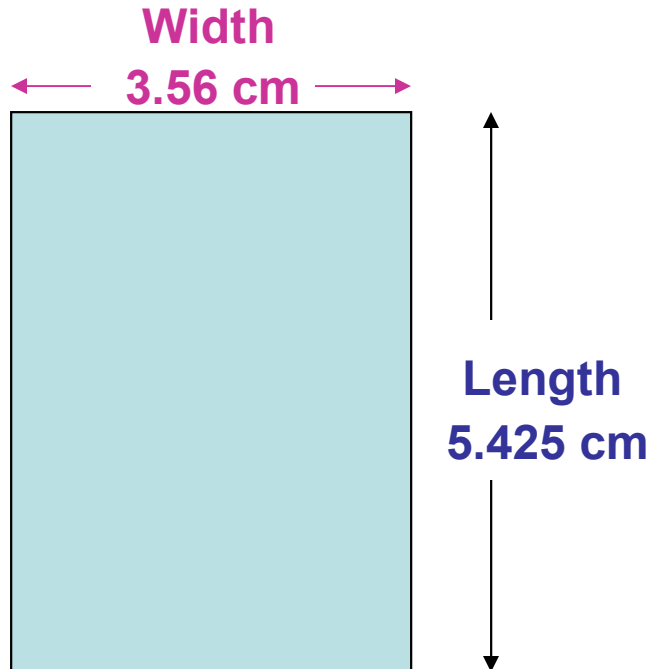
Significant Figures in Calculations

Determining the
Density of Graphite



Multiplication & Division Significant Figures

The calculation result has the same number of **significant figures** as the measurement with the fewest significant figures.



$$\text{Area} = \text{Length} \times \text{Width}$$

$$\text{Area} = \overset{4 \text{ Sig. Figs.}}{5.425 \text{ cm}} \times \overset{3 \text{ Sig. Figs.}}{3.56 \text{ cm}}$$

$$\text{Area} = \underline{19.313 \text{ cm}^2}$$

$$\text{Area} = 19.3 \text{ cm}^2 \quad (3 \text{ Sig. Figs.})$$



Addition & Subtraction Decimal Digits

The calculation result has the same number of **decimal digits** as the measurement with the fewest decimal digits.

$$\begin{array}{r} 98.\underline{67} \text{ cm} \quad 2 \text{ decimal digits} \\ - 45.\underline{149} \text{ cm} \quad 3 \text{ decimal digits} \\ \hline 53.\underline{521} \text{ cm} \quad 2 \text{ decimal digits} \end{array}$$

Answer: 53.52cm



Density

- Density: Measure of the amount of mass contained in a specific volume.
 - High Density: Large mass in small volume.
 - Low Density: Small mass in Large volume.
- Low density materials float on high density materials.



Density: Calculated

Graphite: One of three solid forms of pure carbon.



$$\text{Density (D)} = \frac{\text{Mass}}{\text{Volume}}$$



Graphite: Mass Measurement



$$\text{Mass}_{\text{graphite}} = 23.01 \text{ g}$$

4 Sig. Figs.



Graphite: Volume Measurement



**Water
Displacement**

Graduated Cylinder: After



Graduated Cylinder: Before

1 Decimal
Digit
↓
112.2 mL

- 103.0 mL

9.2 mL

↑
1 Decimal
Digit

Volume_{graphite} = 9.2 mL



Density Calculation

$$\text{Mass}_{\text{graphite}} = 23.01 \text{ g}$$

$$\text{Volume}_{\text{graphite}} = 9.2 \text{ mL}$$

$$\text{Density (D)} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Density (D)} = \frac{\overset{4 \text{ Sig. Figs.}}{23.01 \text{ g}}}{\underset{2 \text{ Sig. Figs.}}{9.2 \text{ mL}}} = \underline{2.501086957} \underset{2 \text{ Sig. Figs.}}{\quad}$$

$$\text{Density (D)} = 2.5 \text{ g/mL}$$



Better Measurements?

$$\text{Volume}_{\text{graphite}} = 9.2 \text{ mL}$$

$$\text{Mass}_{\text{graphite}} = 22.9991 \text{ g}$$

$$\text{Density (D)} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Density (D)} = \frac{22.9991 \text{ g}}{9.2 \text{ mL}} = \underline{2.499902} \text{ g/mL}$$

6 Sig. Figs. 2 Sig. Figs. 2 Sig. Figs.

$$\text{Density (D)} = 2.5 \text{ g/mL}$$

No improvement since the volume measurement limits the answer's significant figures.

