To measure the volume of an object, two lengths $l_1$ and $l_2$ are measured.

$l_1 = 10.25 \pm 0.05$ cm → $\Delta a$

$l_2 = 15.45 \pm 0.05$ cm

Calculate:

**(a)** the % uncertainty in $l_1$

**(b)** the % uncertainty in $l_2$

**(c)** the area of the object

**(d)** the % uncertainty in the area.

$$\% \text{ uncertainty } (l_1) = \frac{\Delta a}{a} = \frac{0.05\text{ cm}}{10.25\text{ cm}} * 100 =$$

$$= .4878\ \%$$

$$= .5\%\ (1\text{ SF})\ (a)$$

To measure the volume of an object, two lengths $l_1$ and $l_2$ are measured.

$l_1 = 10.25 \pm 0.05$ cm

$l_2 = 15.45 \pm 0.05$ cm ⇒ $\Delta a$

Calculate:

**(a)** the % uncertainty in $l_1$

**(b)** the % uncertainty in $l_2$

**(c)** the area of the object

**(d)** the % uncertainty in the area.

$$\% \text{ uncertainty } (l_2) = \frac{\Delta a}{a} * 100 = \frac{0.05\text{cm}}{15.45\text{cm}} * 100$$

$$= .3236\%$$

$$= .3\% \text{ (1SF)}$$

To measure the volume of an object, two lengths $l_1$ and $l_2$ are measured.

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Calculate:

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$158.4 \pm 1.3\ cm^2$

(A) $Area = l * w$

$A = l_1 * l_2$

$A = (10.25cm)(15.45cm)$

$A = 158.4\ cm^2$

$A_{max} = l_{1\,max} * l_{2\,max}$

$A_{max} = (10.3cm)(15.5cm) = 159.65cm^2$

$A_{min} = l_{1\,min} * l_{2\,min}$

$(10.2cm)(15.4cm) = 157.08\ cm^2$

$$\Delta A = \frac{A_{max} - A_{min}}{2} = \frac{159.65 - 157.08}{2} = 1.285\ cm^2$$

$= 1.3cm^2$

To measure the volume of an object, two lengths $l_1$ and $l_2$ are measured.

$l_1 = 10.25 \pm 0.05$ cm

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Calculate:

**(a)** the % uncertainty in $l_1$

**(b)** the % uncertainty in $l_2$

**(c)** the area of the object

**(d)** the % uncertainty in the area.

% uncertainty (product) = % uncert $l_1$ + % uncert $l_2$

$= .5\% + .3\%$

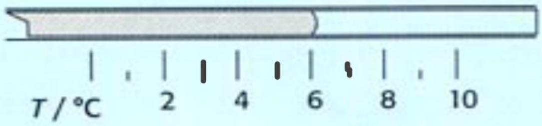
$= .8\%$

$158.4 \pm 1.3 \text{ cm}^2$

$$\% \text{ uncertainty} = \frac{\Delta A}{A} * 100 = \frac{1.3}{158.4} * 100 = .8207\%$$

$= .82\%$

1 The diagram below shows the position of the meniscus of the mercury in a mercury-in-glass thermometer.




Which of the following best expresses the indicated temperature with its uncertainty?

**A** (6.0 ± 0.5)°C

**B** (6.1 ± 0.1)°C

**C** (6.2 ± 0.2)°C

**D** (6.2 ± 0.5)°C [1]

**3** An ammeter has a zero offset error. This fault will affect

**A** neither the precision nor the accuracy of the readings.

**B** only the precision of the readings.

**C** only the accuracy of the readings.

**D** both the precision and the accuracy of the readings. [1]

A student measures a distance several times. The readings lie between 49.8 cm and 50.2 cm. This measurement is best recorded as

A 49.8 ± 0.2 cm.

B 49.8 ± 0.4 cm.

C 50.0 ± 0.2 cm.

D 50.0 ± 0.4 cm. (1)

The power dissipated in a resistor of resistance *R* carrying a current *I* is equal to $I^2R$. The value of *I* has an uncertainty of ±2% and the value of *R* has an uncertainty of ±10%. The value of the uncertainty in the calculated power dissipation is

A ±8%.

B ±12%.

C ±14%.

D ±20%. (1)

$I^2R$

$2\ \%I + \%R$

$2(2\%) + 10\%$

$14\%$

When a force $F$ of $(10.0 \pm 0.2)$ N is applied to a mass $m$ of $(2.0 \pm 0.1)$ kg, the percentage uncertainty attached to the value of the calculated acceleration $\frac{F}{m}$ is

A 2%.

B 5%.

C 7%.

D 10%.

$$\% \text{ uncert. } F = \frac{.2}{10.0} * 100 = 2\%$$

$$\% \text{ uncert. } m = \frac{.1}{2.0} * 100 = 5\%$$

$$\% \text{ uncert. } a = \%F + \%m = 7\%$$

The length of each side of a sugar cube is measured as 10 mm with an uncertainty of ± 2 mm. Which of the following is the absolute uncertainty in the volume of the sugar cube?

A. ± 6 $mm^3$

B. ± 8 $mm^3$

C. ± 400 $mm^3$

D. ± 600 $mm^3$

$10\,mm \pm 2\,mm$

$l \pm \Delta l$

$V = l^3 \pm 3\ \%\text{uncert}_l$

$\% l = \frac{2\,mm}{10\,mm} * 100 = 20\%$

$\frac{\Delta a}{a} * 100 = \%\text{uncert}$

$\Delta V\% = 60\%$

$V = 1000\,mm^3$

absolute uncertainty of volume $= 60\% * 1000\,mm$

The current in a resistor is measured as 2.00A ±0.02A. Which of the following correctly identifies the absolute uncertainty and the percentage uncertainty in the current?

| | Absolute uncertainty | Percentage uncertainty |
|---|---|---|
| A. | ±0.02A | ±1% |
| B. | ±0.01A | ±0.5% |
| C. | ±0.02A | ±0.01% |
| D. | ±0.01A | ±0.005% |

2.00A ± 0.02A

$\Delta a$ ⇒ absolute uncertainty

$$\% \text{ uncert} = \frac{\Delta a}{a} * 100 = \frac{.02}{2.00} * 100 = 1\%$$