PHY131H1F Centre-screen notes
Monday Sep. 17, 2012

Convert $14\ in^2$ to SI Units.

A: Knowns: Use conversions to create fractions equal to one.

$$1 = \left(\frac{1\ in}{2.54\ cm}\right) \longrightarrow \left(\frac{2.54\ cm}{1\ in}\right)$$

$$1 = \left(\frac{100\ cm}{1\ m}\right) \longrightarrow \left(\frac{1\ m}{100\ cm}\right)$$

Quantity: $14\ in^2$ (2 sig figs) ← multiply by 1, try to put m^2 on top, and cancel in^2

$$14\ in^2 \left(\frac{2.54\ cm}{1\ in}\right)^2 \left(\frac{1\ m}{100\ cm}\right)^2$$

$$= 14\ \cancel{in^2}\left(\frac{6.4516\ \cancel{cm^2}}{1\ \cancel{in^2}}\right)\left(\frac{1\ m^2}{10{,}000\ \cancel{cm^2}}\right)$$

$$= \frac{14 \times 6.4516\ m^2}{10{,}000} = 0.009032\ m^2$$

Final answer: $\boxed{9.0 \times 10^{-3}\ m^2}$

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t_5 measurements:

7.53 s.

7.38 s

⋮

Error in the mean.

N numbers: $x_1, x_2, \ldots, x_N$ } all have same error, Δx

To find the average: $\bar{X} = \dfrac{X_1 + X_2 + \cdots + X_N}{N}$

To find the error in the average, 2 steps:

(1) Use Rule #1 to find error in $X_{sum} = X_1 + X_2 + \cdots X_N$

$$\Delta X_{sum} = \underbrace{\sqrt{\Delta x^2 + \Delta x^2 + \cdots + \Delta x^2}}_{N \text{ of these}} = \sqrt{N(\Delta x^2)}$$

$$\Delta X_{sum} = \sqrt{N}\,\Delta x$$

(2) Use Rule #2.1, multiply by exact constant $\left(\frac{1}{N}\right)$

$$\Delta \bar{X} = \Delta X_{sum} \left|\frac{1}{N}\right|$$

$$= \sqrt{N}\,\Delta x \left(\frac{1}{N}\right) = \frac{\sqrt{N}}{\sqrt{N}\sqrt{N}}\,\Delta x$$

$$\boxed{\Delta \bar{X} = \frac{\Delta x}{\sqrt{N}}}$$