

Uncertainty Calculations

IB PHYSICS | SCIENCE SKILLS



Uncertainty Review



Absolute Uncertainty	
Fractional Uncertainty	
Percentage Uncertainty	

Uncertainty in Calculations

Adding or Subtracting

If $y = a \pm b$ then $\Delta y = \Delta a + \Delta b$

To find the **uncertainty in a sum or difference** you just add the uncertainties of all the ingredients.

Try This

A 5.0 ± 0.7 meter ladder propped vertically next to a 8.5 ± 0.3 meter wall. How far between the top of the ladder and the top of the wall?



Uncertainty in Calculations

Multiplying or Dividing

If $y = a \times b \div c$ then $\Delta y/y = \Delta a/a + \Delta b/b + \Delta c/c$

To find the **uncertainty in a product or quotient** you just add the percentage or fractional uncertainties of all the ingredients.

Try This

A car travels 64.7 ± 0.5 meters in 8.65 ± 0.05 seconds.
What is its speed?



This is in the Data Booklet ☺

Uncertainties

lf: $y = a \pm b$	then: $\Delta y = \Delta a + \Delta b$
lf: $y = \frac{ab}{c}$	then: $\frac{\Delta y}{y} = \frac{\Delta a}{a} + \frac{\Delta b}{b} + \frac{\Delta c}{c}$
lf: $y = a^n$	then: $\frac{\Delta y}{y} = \left n \frac{\Delta a}{a} \right $

Example IB Question

2. The current I through a resistor is measured with a digital ammeter to be 0.10A. The uncertainty in the calculated value of I^2 will be
- A. 1%.
 - B. 2%.
 - C. 5%.
 - D. 20%.

Example IB Questions

1. The radius of a sphere is measured with an uncertainty of 2%. What is the uncertainty in the volume of the sphere?
 - A. 2%
 - B. 4%
 - C. 6%
 - D. 8%

1. The length of the side of a cube is 10.0 ± 0.3 cm. What is the uncertainty in the volume of the cube?
 - A. ± 0.027 cm³
 - B. ± 2.7 cm³
 - C. ± 9.0 cm³
 - D. ± 90 cm³

Lesson Takeaways

- I can calculate uncertainty from added or subtracted values
- I can calculate uncertainty from multiplied or divided values