Name

Date

THE VAULT
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Uncertainty Calculations

1. Natalie measures the mass and speed of a glider. The percentage uncertainty in her measurement of the mass is 3% and in the measurement of the speed is 10%. If the kinetic energy is calculated by $E_k = \frac{1}{2}mv^2$, her calculated value of the kinetic energy of the glider will have an uncertainty of

   A. 30%
   B. 23%
   C. 13%
   D. 10%

2. 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

3. The power used in a resistor can be calculated by using current, I, and resistance, R, in the formula $P = I^2R$. 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%

4. The radius of a loop is measured to be (10.0 0.5) cm. Which of the following is the best estimate of the uncertainty in the calculated area of the loop?

   A. .25%
   B. 5.0%
   C. 10%
   D. 25%

5. The volume V of a cylinder of height h and radius r is given by the expression:

$$V = \pi r^2 h$$

In a particular experiment, r is to be determined from measurements of V and h. The uncertainties in V and in h are as shown below.

$$V = \pm\ 7\%$$

$$h = \pm\ 3\%$$

The approximate uncertainty in r is:

A. 10%
B. 5%
C. 4%
D. 2%

6. Newton's 2^{nd} Law of Motion states that an external force is equal to the acceleration of that object multiplied by it's mass. When a force F of (10.0 ± 0.2) N is applied to a mass m of (2.0 ± 0.1) kg, the percentage uncertainty attached to the value of the calculated acceleration ($a = \frac{F}{m}$) is:

A. 2%
B. 5%
C. 7%
D. 10%

7. A student measures two lengths as follows:

$$T = 10.0 \pm 0.1 \text{ cm}$$

$$S = 20.0 \pm 0.1 \text{ cm}$$

The student calculates:

F_T, the fractional uncertainty in T
F_S, the fractional uncertainty in S
F_{T-S}, the fractional uncertainty in (T S)
F_{T+S}, the fractional uncertainty in (T + S)

Which of these uncertainties has the largest magnitude?

A. F_T
B. F_S
C. F_{T-S}
D. F_{T+S}