Name: _____

Error Analysis Practice

SPH4U

Multiple Choice

1. An electronic balance gives a reading of 4.0 g. Absent any other information, what would you estimate for the error?

   A. ± 0.05 g B. ± 0.1 g C. ± 0.4 g D. There is no error.

2. How many significant digits are there in the measurement 0.0254 m?

   A. 3 B. 4 C. 5 D. None

3. How would you write 1.25578 ± 0.1247 s, keeping 2 significant digits in the error?

   A. 1.3 ± 0.1 s B. 1.3 ± 0.12 s C. 1.26 ± 0.12 s D. None of the above

4. Which measurement is most precise? *(Hint: compare the relative error.)*

   A. 7.5 ± 0.2 s B. 10.0 ± 0.2 m C. 5.6 cm ± 4% D. The precision is the same.

5. What is 2.0 ± 0.2 m – 1.0 ± 0.1 m?

   A. 1.0 ± 0.1 m B. 1.0 ± 0.2 m C. 1.0 ± 0.3 m D. It cannot be determined.

Mean and Standard Deviation Calculations

Given each of the data sets below, calculate the mean and the standard deviation. (You do not need to show your work. You may use statistics functions on your calculator to calculate each.)

1. 5.3 s, 5.0 s, 4.9 s, 4.7 s, 5.1 s

   Mean: _____ Standard deviation: _____

   Value would be expressed as: _____

2. 125 g, 132 g, 121 g, 123 g, 129 g

   Mean: _____ Standard deviation: _____

   Value would be expressed as: _____

3. 64.2 cm, 63.7 cm, 64.1 cm, 63.6 cm, 64.3 cm

   Mean: _____ Standard deviation: _____

   Value would be expressed as: _____

Error Propagation

Calculate each of the following.

1. $\frac{25 \pm 1\,cm}{8.0 \pm 0.2\,s} =$

2. $5.0 \pm 0.5\frac{m}{s} + (2.0 \pm 0.4\frac{m}{s^2})(2.5 \pm 0.2\,s) =$

3. $\sqrt{\frac{2(450 \pm 18\,J)}{(75 \pm 3\,kg)}} =$

Answers

Multiple Choice: 1. A; 2. A ; 3. C; 4. B; 5. C

Mean and Standard Deviation Calculations:

1. Mean 5.0 s, standard deviation 0.2 s, value would be expressed as 5.0 ± 0.2 s.
2. Mean 126 g, standard deviation 4 g, value would be expressed as 126 ± 4 g.
3. Mean 64.0 cm, standard deviation 0.3 cm, value would be expressed as 64.0 ± 0.3 cm

Error Propagation:

1. 3.1 cm/s ± 6.5% or 3.1 ± 0.2 cm/s

2. $5.0 \pm 0.5\frac{m}{s} + (5.0\frac{m}{s} \pm 28\%) = 5.0 \pm 0.5\frac{m}{s} + (5.0 \pm 1.4\frac{m}{s})$ = 10.0 ± 1.9 m/s

3. $\sqrt{12\frac{m^2}{s^2} \pm 8\%} = 3.46\frac{m}{s} \pm 4\% = 3.46 \pm 0.14\frac{m}{s}$