

Uncertainty Propagation Worksheet

Name: _____

The following quantities are known: $g = (9.80 \pm 0.01) \text{ m/s}^2$ $r = (8.0 \pm 0.1) \text{ cm}$ $L = (15.0 \pm 0.3) \text{ cm}$

The units of some other symbols used below are: $t \rightarrow$ seconds $y \rightarrow$ meters

1. Find the derivatives indicated. For part d), first solve for a . For parts a) and b), also compute the derivative's value.

Example: $y = A + Ct - Qt^2$ Derivative: $\frac{dy}{dt} = C - 2Qt$

a) $V = \frac{4}{3}\pi r^3 + \pi r^2 L$ Derivative: $\frac{\partial V}{\partial r} =$ Value: _____

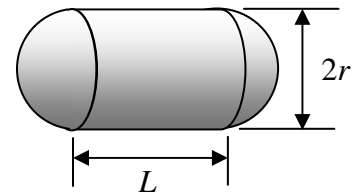
b) $V = \frac{4}{3}\pi r^3 + \pi r^2 L$ Derivative: $\frac{\partial V}{\partial L} =$ Value: _____

c) $a = \frac{(m_2 - \mu_k m_1)}{m_1 + m_2} g$ Derivative: $\frac{\partial a}{\partial \mu_k} =$

d) $L = \frac{1}{2} at^2$ $a =$ Derivative: $\frac{\partial a}{\partial t} =$

2. In the above expressions:

- a) What are the units of C ? _____
- b) What are the units of Q ? _____
- c) What are the units of V ? _____
- d) What are the units of μ_k ? _____
- e) What are the units of $\partial V / \partial r$? _____
- f) What are the units of $\partial V / \partial L$? _____



3. You intend to compute the volume of a cylinder having rounded ends using: $V = \frac{4}{3}\pi r^3 + \pi r^2 L$.

- a) What is \bar{V} ? _____
- b) What is ΔV ? _____
- c) Write the volume of this object using appropriate significant figures: $V =$ _____
- d) To improve the volume uncertainty, should you try to improve your measurement of r or L ? Explain your choice in one sentence.