

Lab 1 - Introduction to Measurement and Error Analysis, Part 2

Name _____

I. Introduction

You should have completed part 1 of this lab and started to investigate experimental uncertainties. The objective of this part of the lab is to work on the mathematical/statistical aspects of scientific analysis. You will not receive a grade for this part of the lab, only a pass/fail mark. If you fail you must repeat this part of the lab until you pass it. If you do not pass this part of the lab by the end of the term, you will not pass the course regardless of other conditions.

II. Equipment

Computer with Internet access

III. Procedure

1. Verify/read chapter two of the laboratory manual at the URLs below. After you have read these sections initial them off in the area below.

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Chap 2 section 1 http://itech.fgcu.edu/faculty/bbowman/Lab_Manual/2-1/sect2-1.html

Chap 2 section 2 http://itech.fgcu.edu/faculty/bbowman/Lab_Manual/2-2/sect2-2.html

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Chap 2 section 1 _____

Chap 2 section 2 _____

Chap 2 section 3 _____

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Chap 2 section 6 _____

IV. Analysis

1. In each of the following cases, guess reasonable limits of uncertainty of the measurement process. In each case, is the limitation due primarily to a systematic or a random error? In each case, what would you do to improve the precision? The accuracy?

(a) You measure the distance from New York, NY to Los Angeles, CA on your car's odometer.

(b) You measure your pulse rate by counting heartbeats for 15 seconds.

(c) You estimate an object's weight (its mass is something like a kilogram or two) by comparing its apparent weight, in your hand, to that of a "known" mass.

2. A student measures a quantity 8 times, with the results: 6.5, 6.7, 6.9, 6.7, 6.8, 6.4, 6.8, and 6.7. Calculate the mean, the standard deviation, and the standard error of these data. (If the calculation is wired into your calculator use it, but algebraically outline the work.).

3. The diameter of a sphere has been measured as 0.89 ± 0.02 cm. Calculate the corresponding value, and its standard deviation, of
- (a) the circumference,

(b) the surface area, and

(c) the volume of the sphere.

4. A land speed trial is conducted on a track whose length is 1.0000 ± 0.0002 miles. The time required to traverse the track is 13.591 ± 0.002 seconds. What is the speed of the car? How precisely has it been measured? If you wanted to improve the measurement, would you concentrate on the timing equipment, or on the track length measurement?

V. Conclusions and Comments (Not required in this part of this lab!)