Laboratory techniques and measurements analysis

Measurement: Length, Mass, Volume, Density, and Time Peter Jeschofnig, Ph. D. Version 42-0267-00-01 Lab RepoRt assistant This document is not meant to be a substitute for a formal laboratory report. The Lab Report Assistant is simply a summary of the experiment's questions, diagrams if needed, and data tables that should be addressed in a formal lab report. The intent is to facilitate students' writing of lab reports by providing this information in an editable file which can be sent to an instructor. Data Table 1: Estimation of various measurements| Measurement| Estimated| Actual| % Error| Length (m)| | | | Time (s)| | | |

Mass (g)| | | | Data Table 2: Measurement of an object using various instruments| | Length(cm)| Width(cm)| Height(cm)| Volume(cm3)| Object Being Measured:| | | | | Hand (hand units)| | | | | Hand (cm)| | | | | Ruler| | | | | Meter tape| | | | | Data Table 3: Measurement of an object using various instruments| | Length(cm)| Width(cm)| Height(cm)| Volume(cm3)| Object Being Measured:| | | | | Hand (hand units)| | | | | Hand (cm)| | | | | Ruler| | | | | Meter tape| | | | | Data Table 4: Measurement of an object using various instruments| | Length(cm)| Width(cm)| Height(cm)| Volume(cm3)| Object Being Measured:| | | | |

Hand (hand units)| | | | | Hand (cm)| | | | | Ruler| | | | | Meter tape| | | | | Data Table 5: Determination of ? | Object| DiameterD(cm)| CircumferenceC(cm)| Slope| % Error| | | | | | | | | | | | | | | | | | | | | | | | | | | Data Table 6: Density measurements| Method| Volume of water in graduated cylinder (mL)| Volume of water+ bolt(mL)| Volume of bolt (mL)| Mass of bolt in air (g)| Mass of bolt in water (g)| Mass of bolt " lost" in water (g)| Density orS. G. ofbolt(g/mL)S. G. = unitless| Water- displacement method| | | | | | | | Archimedes' principle

method| | | | | | | Data Table 7: Time measurements using visual cues| Drop time (s)| Trial 1| | Trial 2| | Trial 3| | Average| | Data Table 8: Time measurements using auditory cues| | Drop time (s)| Trial 1| | Trial 2| | Trial 3| | Average| | Questions Exercise 1: Estimation of Various Measurements A. Why is it important to correctly estimate length, time, and mass? Exercise 2: Measuring Using Instruments of Varying Degrees of Precision A. Can you think of an occasion when it would be adequate to use your " hand" measurement? B. What would happen to your volume calculations if the length, width and height measurements were off a little? Exercise 3: Graphing data and the determination of ?

Object Description| Diameter (cm)| Circumference (cm)| Measuring Device| Penny| 1. 90 ± 0. 01| 5. 93 ± 0. 03| Vernier caliper, paper| " D" cell battery| 3. 30 ± 0. 02| 10. 45 ± 0. 05| Vernier caliper, paper| PVC cylinder A| 4. 23 ± 0. 02| 13. 30 ± 0. 03| Vernier caliper, paper| PVC cylinder B| 6. 04 ± 0. 02| 18. 45 ± 0. 05| Plastic ruler, paper| Tomato soup can| 6. 6 ± 0. 1| 21. 2 ± 0. 1| Plastic ruler, paper| 5. Graph C vs. d using a computer spreadsheet program. 7. What is the slope of the line? What does it represent? 8. Calculate the percent error of your value from the true value of pi.

Exercise 4: Density Measurements A. Which of the two volume determinations will be more accurate? Why? B. Research the Archimedes' principle method. Write one paragraph explaining why it is called Archimedes' principle Exercise 5: Time Measurements A. Which is more accurate, the individual times or the average? Explain. B. Sometimes many trials are run and recorded. Then the highest and lowest data points are disregarded when taking the average. Could this technique help in this

experiment? How? C. Explain any differences that occurred between recording the data visually and aurally.