Name: _____ Section: _____ Date: _____

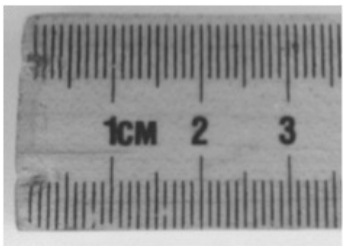
Worksheet - Exp 1: Measurement and Analysis

Theory: Any instrument has a limited resolution (smallest degree of measure). This brings an inherent degree of uncertainty to all scientific measurements.

The uncertainty is: Equal to the resolution for digital instruments
Equal to $\frac{1}{2}$ the resolution for analog instruments

Measurements made on a vernier caliper and measurements of time are considered digital.

1. Find the resolution and uncertainty in these measurements: (12 pts)



Resolution: _____ Resolution: _____ Resolution: _____

Uncertainty: _____ Uncertainty: _____ Uncertainty: _____

Procedure:

Part 1: Measuring Density

2. Zero the triple beam balance.

3. Measure the mass of the metal cylinder provided (4 pts). What is the resolution of the balance? _____ (2 pts) Use this to determine the measurement uncertainty (2 pts).

4. Measure the height and diameter of the metal cylinder using the digital caliper, be sure to include the uncertainty of the caliper (4 pts).

5. Calculate the volume of the cylinder (4 pts). This is equal to the area of the base times the height. Show work below.

6. What is the density, ρ, of the metal cylinder? (2 pts)

7. Identify the metal in the cylinder using the density chart provided (and hopefully, a little common sense). Compare your value of density to the accepted value. What is your percent error? (6 pts)

Metal: _____

% Error = _____ %

Metal Cylinder Measurements

Mass:	(_____ ± _____) _____
Height:	(_____ ± _____) _____
Diameter:	(_____ ± _____) _____
Volume:	(_____ ± __X__) _____
Density:	(_____ ± __X__) g/cm^3

Part 2: Graphing

Linear graphs show the relationship between two directly proportional quantities y and x, or in this case C and D. The slope of the graph tells us something about their ratio: $y/x = m$

#	Diameter	Circumference
1		
2		
3		
4		
5		

8. Measure diameter and circumference of 5 cylinders. To measure the circumference, wrap a piece of string around the cylinder, and measure the length of the string.

9. Graph C *vs.* D using graphical analysis, placing the circumference values on the y-axis, and the diamter values on the x-axis. Instructions for graphing with graphical analysis can be found on the lab webpage.

10. Apply a linear trendline to your data.

11. Determine the slope of the best-fit line from the information box provided on-screen.

12. What is the slope, m, of the circumference vs. diameter graph? Insert it in the equation below. (4 pts)

    y = m * x

    C = _____ * D

13. The circumference of a circle is equal to 2π times the radius ($C = 2\pi r$). Based on this knowledge;
    a) Theoretically, what number should we **expect** to be filled in the equation above? _____ (4 pts)
    b) Calculate your percent error in measuring this quantity. Show your work. (4 pts)

    Percent Error: _____ %

14. Print your graph file and staple it to your worksheet.
    Be sure to include axes labels and a descriptive title.
    (10 pts)