Buoyancy Lab

BUOYANCY AND DENSITY In this experiment, we will measure the density of 3 rods using Archimedes' Principle applied to objects weighed by a mass scale in air or completely submerged under water. Your results should be within the error bars discussed below. PROCEDURE:

1. See lecture notes on hydrostatics, Ch. 12, including hints to #27.

2. See model set up and listen carefully to instructor comments.

3. Pay attention to "Add on" notes on this lab in today's posted lecture (8-28-13).

BUOYANCY AND THE DETERMINATION OF DENSITY

USE RODS OF THREE DIFFERENT MATERIALS

Instrument	MASS SCALE				
Reading	Weight OF ROD in air	Weight OF ROD in water	**ROD VOLUME (SHOW WORK BELOW)**	**ROD DENSITY (SHOW WORK BELOW)**	**% ERROR**
ROD 1	m_1	m_1'	$\left(\frac{m-m'}{\rho_w \cdot g}\right)_1$	$\left(\frac{m\rho_w}{m-m'}\right)_1$	X
	m_2	m_2'	⋮	$\left(\frac{m\rho_w}{m-m'}\right)_2$	X
	m_3	m_3'	⋮	$\left(\frac{m\rho_w}{m-m'}\right)_3$	X
	m_4	m_4'	$\left(\frac{m-m'}{\rho_w}\right)_4$	$\left(\frac{m\rho_w}{m-m'}\right)_4$	X

m_{AV} OR m_{AV} = [ ] $\left(\frac{m-m'}{\rho_w}\right)_{AV}$

AVERAGE $\rho_{exp} = \left[\frac{m\rho_w}{(m-m')}\right]_{AV}$

AVERAGE					
ROD 2					
AVERAGE					
ROD 3					
AVERAGE					

P.E. $= \left| \frac{\rho_{exp} - \rho_{acc}}{\rho_{acc}} \right| \times 100\%$

Volume, Density AND % ERROR CALCULATIONS:
(Attached more sheets as needed.)

Rod1 (Show work):
Rod2 (Show work):
Rod3 (Show work):

speed sound Lab (1

Data Sheet

Room temperature = _____ Frequency 2 = 512

	Position of water level (cm)	ΔL
L1	16.60 → 16.70 → 16.60 → 16.50 → Av.	Not Applicable
	Average L1	
	(L1max – L1min)/4 =	
	ΔL inst =	
	ΔL (larger of previous two) =	
L3	51.10 → 50.20 → 49.90 → 50.00 → Av.	Average L3 - L1 =
	Average L3	
	(L3max – L3min)/4 =	
	ΔL inst =	
	ΔL (larger of previous two) =	
L5	83.40 → 83.60 → 82.90 → 84.10 → Av.	Average L5 – L3 =
	Average L5	
	L5max – L5min)/4 =	
	ΔL inst = 0.05cm * ; **	
	ΔL (larger of previous two) =	
Average ΔL =		
Average λ = Average v =		
|average v – accepted v| = Compare |average v – accepted v| with the overall error, which gives the range, as discussed in class. Does the accepted value fall within the range centered at the average value?		

Least count and ERROR ΔL inst.

** best case scenario

ΔL inst = 0.2 cm

* more realistic?

Meter stick

2.0

measurement

3.0cm

2.6 2.7

2.00 2.20

Data Sheet

Room temperature = _____ Frequency 1 = _____

	Position of water level	ΔL
L1		Not Applicable
	Average L1	
	(L1max – L1min)/4 =	
	ΔL inst =	
	ΔL (larger of previous two) = ΔL_1	
L3		Average L3 - L1 =
	Average L3	
	(L3max – L3min)/4 =	
	ΔL inst =	
	ΔL (larger of previous two) = ΔL_3	
L5	L_{5_1}	Average L5 – L3 =
	L_{5_2}	
	L_{5_3}	
	L_{5_4}	
	Average L5	
	L5max – L5min)/4 =	
	ΔL inst =	
	ΔL (larger of previous two) = ΔL_5	

Average ΔL = $\dfrac{(L_5 - L_3) + (L_3 - L_1)}{2}$ Note $L_{5_{AV}} = \dfrac{L_{5_1} + L_{5_2} + L_{5_3} + L_{5_4}}{4}$, ETC

Average λ = $(L_5 - L_3) + (L_3 - L_1)$

Average v = $f\cdot[(L_5 - L_3) + (L_3 - L_1)] = \Delta V = f\cdot\left[\Delta L_5 + 2\Delta L_3 + \Delta L_1\right]$

|average v – accepted v| =

Compare |average v – accepted v| with the overall error, which gives the range, as discussed in class. Does the accepted value fall within the range centered at the average value?

$V_{AV} - \Delta V < V_{Acc} < V_{AV} + \Delta V$