



# University of Delaware

## Interdisciplinary Science Learning Laboratories (ISLL)

### SCEN 101: Lab Overview

### Lab 04. Archimedes' Principle

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Section: 012

Office Hours: 3:00 pm - 5:00 pm (ISE 314)

## A few points:

- Office Hours: 3:00 pm - 5:00 pm (ISE 314)  
Please visit!
- Make sure you participate in the lab!  
Try to contribute in some way :)

## Objective(s):

- Measure the real and apparent weights of a mass block.
- Determine the volume and density of a mass block.
- Verify **Archimedes' Principle!**
- *Explore Archimedes' Principle in everyday life.*
- *Possibilities for R&E.*

# Experimentation setup

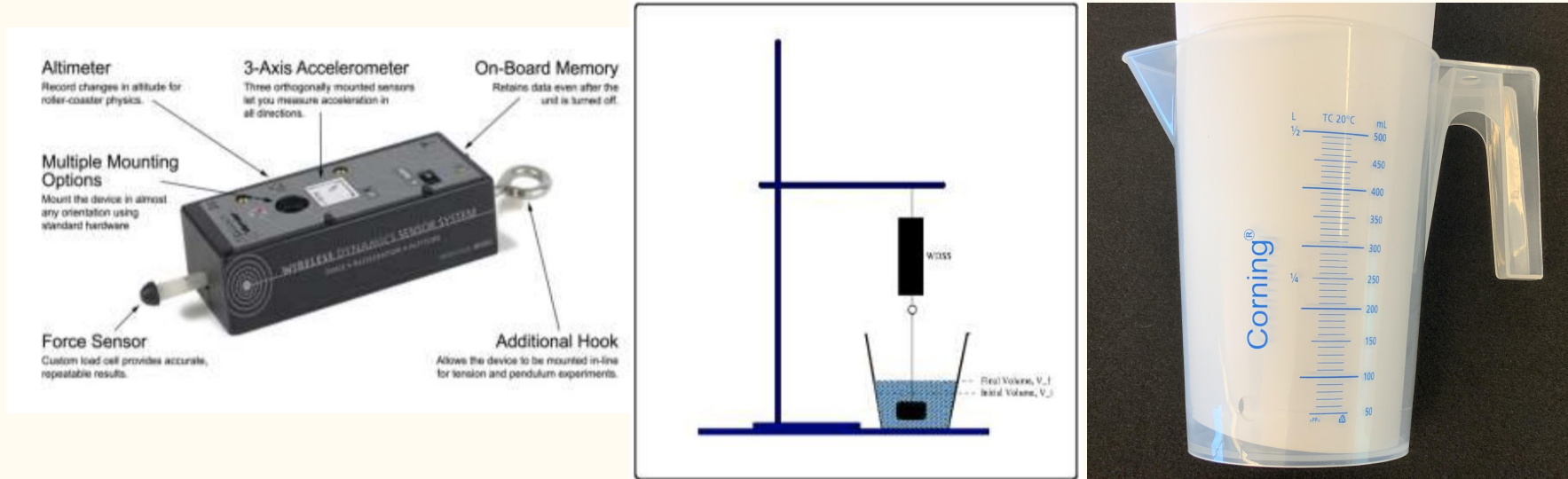


Figure 4.1. Vernier Wireless Dynamic Sensor System (left), Vernier WDSS with attached immersed mass block (*experiment setup*)(middle), and *Sample* of graduated measuring cup (right).

**Save 3 photos from your experimentation!**



Photo 4.1. Measuring  $F_{g, \text{real}}$  (*block in air*)

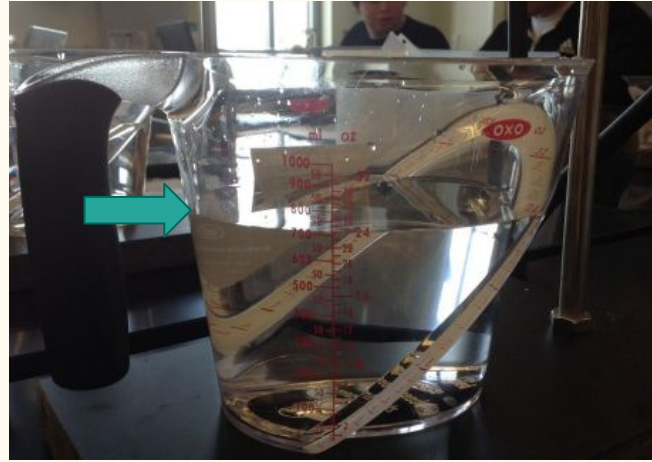


Photo 4.2. Initial volume of graduated measuring cup



Photo 4.3. Measuring  $F_{g, \text{apparent}}$  (*block in water*) + Final volume of graduated measuring cup

**NOTE:** fill graduated measuring cup to 400 mL

**Save 1 graph from Graphical!**



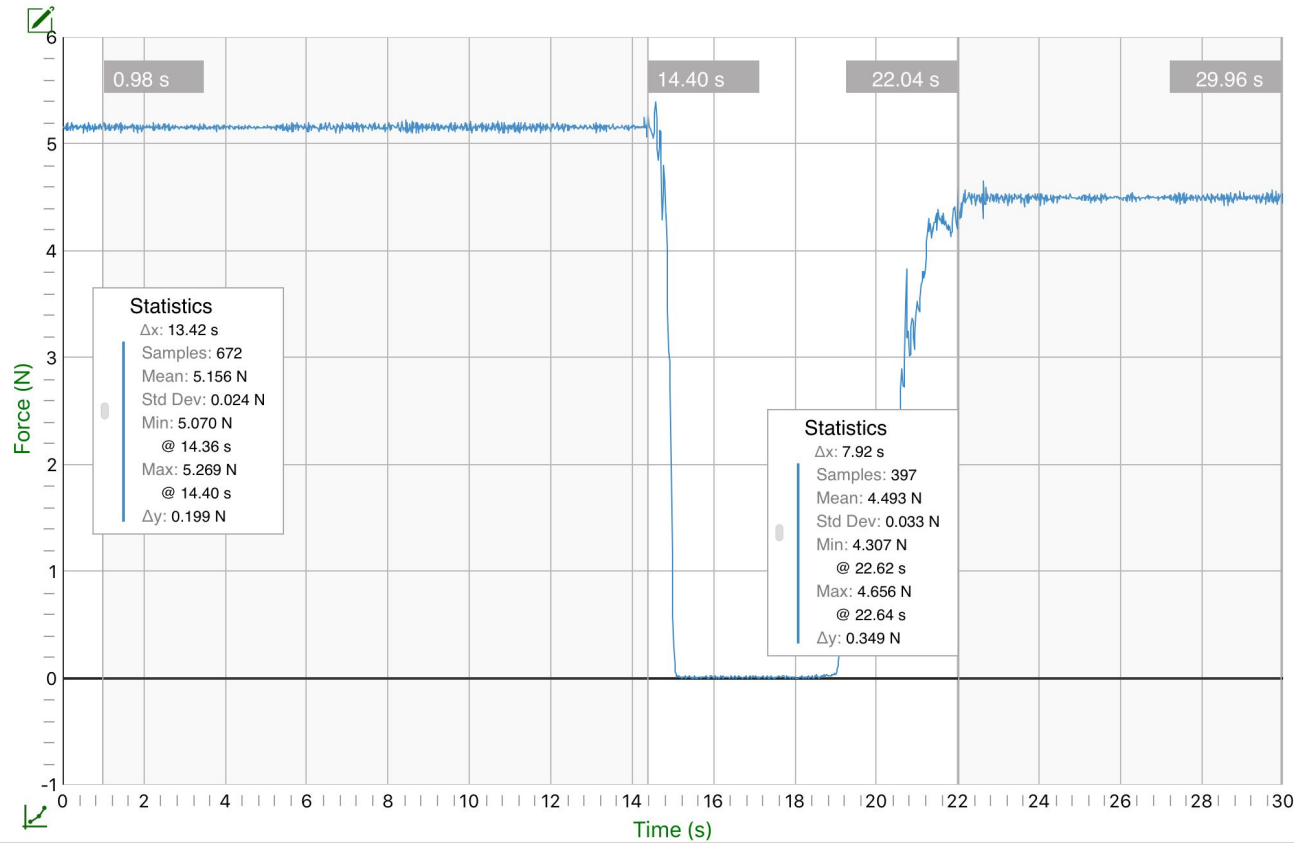


Figure 4.2. Force vs. Time of mass block in air and water

Measurements	Block	Dimensions of block			Mass ( $m_e$ )
		Width	Length	Height	

p <sub>water</sub> =	Kg/m <sup>3</sup>	g =	m/s <sup>2</sup>
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Mass	<b>m</b> Show conversion along with your other calculations				<b>m<sub>g</sub></b> Show calculations outside of the table		
		grams		kg			Newtons
Force (From Graphical Analysis of data)	Real Weight (F <sub>g,real</sub> )		Apparent Weight (F <sub>g,apparent</sub> )		Buoyant Force (F <sub>B</sub> ) Show calculations outside of the table		
	5.156	Newtons	4.493	Newtons			Newtons
Volume	Vestimate Show conversion along with your other calculations				Density of the mass block (ρ <sub>block</sub> ) Show calculations outside of the table		
	0	cm <sup>3</sup>	0	m <sup>3</sup>		#DIV/0!	kg/m <sup>3</sup>
	Initial Volume (V <sub>i</sub> )		Final Volume (V <sub>f</sub> )		Volume of water displaced (ΔV) Show conversion along with your other calculations		ρ <sub>water</sub> (ΔV)g (N) Show calculations outside of the table
		mL		mL		mL	
						m <sup>3</sup>	
					1 mL = 1 cm <sup>3</sup> = 10 <sup>-6</sup> m <sup>3</sup>		
Error	WEIGHT: % difference between m <sub>g</sub> and F <sub>g, real</sub>				BUOYANT FORCE: % difference between F <sub>B</sub> and ρ <sub>water</sub> (ΔV)g		

**USE THE PROVIDED DATA SPREADSHEET!**

$$F_B = F_{g, \text{real}} - F_{g, \text{apparent}}$$

$$\rho_{\text{Block}} = \frac{m_e}{V_{\text{estimate}}}$$

$$\Delta V = V_f - V_i$$

$$\% \text{ Difference} = \left| \frac{\text{Value}_1 - \text{Value}_2}{\frac{\text{Value}_1 + \text{Value}_2}{2}} \right| \times 100\%$$

# Name that Variable

$m_e$

mass of block (scale!)

$V_{est}$

volume of mass block:  $l*w*h$  (ruler!)

$V_i$

initial volume (from cup)

$V_f$

final volume (from cup)

$F_{g, real}$

weight of block in air

$F_{g, apparent}$

weight of block in water

# Lab 04. Archimedes' Principle

## Deliverables

1. Photo 1. Measuring  $F_{g, \text{real}}$  (*block in air*)
2. Photo 2. Initial volume of graduated measuring cup
3. Photo 3. Measuring  $F_{g, \text{apparent}}$  (*block in water*) + Final volume of graduated measuring cup (TWO ASPECTS IN ONE PHOTO)
4. Figure 1. Force (N) vs. Time (s) of mass block in air and water
5. Completed Tables 4.1 and 4.2
6. Calculations, showing formulas used, all work, and **3 conversions**

**\*The labels for visuals are examples, be sure to be more descriptive AND include appropriate selections within each graph.**

ANY QUESTIONS?