Archimedes' Principle

Purpose: In this lab you will verify *Archimedes' Principle* by measuring the buoyancy force, apparent weight, and weight of the displaced water of several submerged objects. You will also calculate the density and volume of the displaced water.

Equipment: spring scale
graduated cylinder
Two containers (overflow cup and handled cup)
Specific Gravity masses
Tray

Part 1:

Procedure: A) Measure the weight of the metal cube with a spring scale and record it as F_o in the data table. Measure the weight of the handled cup and record it as F_c.

B) Fill up the overflow cup until water comes out (make sure you have a beaker under the spout). After it stops dripping have your partner hold the handled cup under the spout and then lower the metal cube (attached to spring scale) slowly into the water and collect the displaced water. Record the weight of the cube in water as F_{app}. Record the weight of the water and cup as F_{cw}. Calculate the buoyancy force (F_b) by: $F_b = F_o - F_{app}$ Calculate the weight of the water (F_w) by: $F_{cw} – F_c$, and record it.

C) Calculate the S.G. of the metal by dividing F_o by F_b and record it. [$S.G. = F_o/(F_o - F_{app})$]

D) Pour the water from the handled cup into the graduated cylinder and record its volume in table two (V_w)

Table One

	F_o	F_c	F_{cw}	F_w	F_{app}	F_b	S.G.
Brass							
Aluminum							
Steel							
Lead							

Part 2:

Error Analysis:

Table Two

	V_w	m_w	$F_{w2} = m_w g$	$E_a = \lvert F_w – F_{w2} \rvert$	$E_a = \lvert F_{w2} – F_b \rvert$	$E_a = \lvert S.G. - \rho_t \rvert$	$E_r = E_a/\rho_t \times 100$
Brass							
Aluminum							
Steel							
Lead							

A) Determine and record the mass of the water (m_w). remember 1 ml = 1 g of water.

B) Calculate the weight of the water (F_{w2}) by multiplying the mass by "g".

C) Compare the weight of the water F_{w2} (from table Two) to the F_w from Table One using Absolute Error (E_a).

D) Compare the S.G. from Table One to the accepted value in the density table (ρ_t)

ρ_t

	density	S.G.
Brass	8700 kg/m^3	8.70
Aluminum	2700 kg/m^3	2.70
Steel	7900 kg/m^3	7.90
Lead	11300 kg/m^3	11.30