

PhysicsLab-008	Buoyancy	Class I	Date 10/24	Name Shubei Morita
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Hypothesis	An object completely immersed in a fluid experiences an upward buoyant force equal to the weight of fluid displaced by the object. (Archimedes' Principle)
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### Experiment-A - A weight in a cup

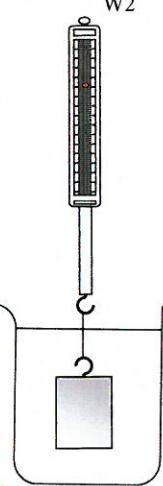
1	Experience the buoyant force	<p>A hand holds a small cylindrical weight above a plastic cup filled with water. The cup has dimensions: width 5.2 cm, depth 5.6 cm, and base width 3.8 cm.</p>	
2	Measurement of the buoyant force A weight in a plastic cup on water	<p>A weight of 50 g is placed in a plastic cup resting on a scale. The scale shows a reading of 3.6 cm. The cup has a diameter of 5.2 cm and a base diameter of 3.8 cm. The water level is marked at 5.6 cm. The volume of water displaced is labeled V.</p>	Measurement of x $x = 3.6 \text{ cm}$
	Calculation of d	<p>A right-angled triangle is shown with a vertical leg of 5.6 cm and a horizontal leg of 3.8 cm. The hypotenuse is labeled d. The angle between the vertical leg and the hypotenuse is labeled x.</p> $d = x \times \frac{5.2 - 3.8}{5.6} + 3.8$	$d = 4.05$
	Calculation of V <i>(V: The volume of water that the object displaces)</i>	$V = \frac{1}{2} \times (\text{Upper Area} + \text{Lower Area}) \times x$ $\frac{1}{2} \times \left(\frac{4.05}{2}\right)^2 \pi + \left(\frac{3.8}{2}\right)^2 \pi \times 3.6$	$V = 43.6 \text{ cm}^3$
	Buoyant force	$f = \rho_{\text{water}} V g$ $1000 \times 43.6 \times 10^{-4} \times 9.8$	$f = 0.43 \text{ N}$
3	Gravity on the weight (and the cup)	$W = mg$ $0.05267 \text{ kg} \times 9.8$	$W = 0.52 \text{ N}$ <span style="color:red">OK</span>

### Discussion

I calculated Buoyant force and Gravity on the weight. These two result should be equal. But there is error that these two are not equal. I think the first measurement is little different from actual number.

Very good

## Experiment-B - Weight

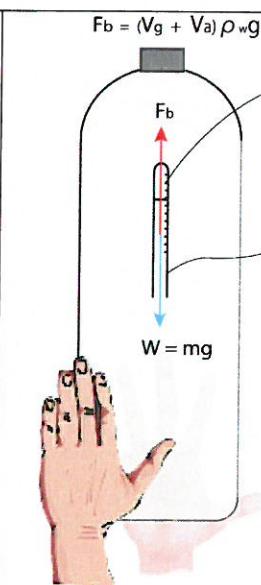
	Measurement	W1  W2 	Measurement  W1 = 0.6 N  W2 = 0.4 N  Buoyant force $f = W_1 - W_2 = 0.2$
1	Measurement  (Zero adjustment of a spring scale)		
2	Calculation	$\alpha \times g \delta = 0.6$ Mass of the weight (m)	0.061 kg
		Volume of the weight (V)	$0.00002040 \text{ m}^3$ $\rightarrow 2.04 \text{ m}^3 \times 10.5$
		Density of the weight ( $\rho$ )	$2989 \text{ kg/m}^3$ $\rightarrow \approx 3000 \text{ kg/m}^3$

OK

## Discussion

when I put the weight into water, Buoyant force occurred. It works upper direction for weight. So power which works down direction increased.

## Experiment-C - Cartesian Diver

		$F_b = (V_g + V_a) \rho_w g$ 	Measurement
1	Set up and measurement		The <u>volume of air</u> inside the test tube ( $V_a$ ) when it is in the intermediate position of the bottle.
2	Data	Mass of the test tube ( $m$ ) = 14.77g Density of glass ( $\rho_{\text{glass}}$ ) = 2500 kg/m <sup>3</sup> Volume of the test tube ( $V_g$ ) = $0.00000591$ $= 5.91 \times 10^{-6} \text{ m}^3$	$1.477 \times 10^{-2} \text{ kg}$ $5.91 \times 10^{-6} \text{ m}^3$
3	Calculation	Buoyant Force $f.0 \times 10^{-6} \text{ N}$ $F_b = (V_g + V_a) \rho_w g$ $= 0.136 \times 5.91 \times 10^{-6} \text{ m}^3$	0.136 N (0.14N)
		Gravity = mg $= 0.1447$	0.1467 N (0.14N)

OK

## Discussion and opinions

When I push the bottle inside, glass goes down because

Volume of air decreases and also Buoyant force decreases.

I was very excited. this experiment because look like little world

When I stopped the glass, Buoyant force and Gravity should be the same.