NO. 1

Date 2012 · 9' · 14.

1. Title: The Densities of Liquids and Solids [redacted] 2012. Sept. 14th

2. Objective: We are performing this experiment because we want to find a density of an unknown liquid by using the density of water. We also want to find the simple way to measure an unknow solid's density by using some related mass and volume.

3. Chemical reaction: No.

4. Equipment:

1) Materials: 1 empty flask, 1 stopper, 1 thermometer, 1 balance.

2) Chemicals: water, unknown liquid, metal.

5. Safety Considerations:

1) Wear your protective equipments, like lab coats, shoes, goggles, and tie your hair into pony tail. Because we don't know anything about the unknown liquid, maybe the liquid is toxic or can hurt your eyes.

2) ~~You should~~ I should be careful when I pour the unknown liquids to the flask, the reason is same as the last one.

3) When I wash the flask, I am supposed to be careful when I am using the chemical to dry the flask.

4) When I finish this the first experiment, which is about the density of unknown liquid, I may recycle this liquid as much as possible, because I don't pollute it so maybe we can use this to do other experiments next time.

5) ~~You~~ I should clean our table or, otherwise, the unknown liquid would pollute the table.

6. Procedure:

First, please prepare all the stuff you need in the experiment. And, then you can start measuring the weight of empty flask plus stopper by balance, record the data m1. Next, put water in the flask, and, also measure the mass of stoppered flask plus water, m2. Pour all the water out, and put

unknown liquid into the flask until it is full. Furthermore, use the same method to measure the mass of stoppered flask plus liquid, which is m3. Put all the data in a data table and clean the flask.

Add some metals to the flask when it's dry. In addition, find the mass of stoppered flask plus metal by balance, m4. After that, we add water in the flask again until it's full. Then, we can measure the mass of stoppered flask plus metal plus water, which is m5. Eventually, we clean the lab table and all of the chemicals and do some analysis with our data.

7. Data/ Observations/ Results:

Density of unknown liquid:

Mass of empty flask + ~~water~~ (m1/g)	73.76
Mass of stoppered flask + water (m2/g)	155.16
Mass of flask + liquid (m3/g)	139.38
Temperature int the lab (t/°C)	25.00

Density of unknown metal:

Mass of stoppered flask + metal (m4/g)	82.48
Mass of stoppered flask + metal + water (m5/g)	162.34

8. Calculations/ Results.

1) Density of unknown liquid:

Mass of Water (m/g): Mass of stoppered flask + water − mass of stoppered flask = 155.16g − 73.76g = 81.40g.

Volume of flask (V/cm³): $\frac{\text{mass of water}}{\text{density of water}} = \frac{81.4g}{0.9970749g/cm^3} = 81.64\ cm^3$.

Mass of liquid (m/g): Mass of flask + metal − mass of metal = 139.38g − 73.76g = 65.62g

Density of liquid (ρ/g/cm³) = $\frac{\text{Mass of liquid}}{\text{Volume of liquid}} = \frac{65.62g}{81.64cm^3} = 0.804\ g/cm^3$.

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2) Density of unknown metal:

Mass of $^{water}_{metal}$ = Mass of flask + metal + water − Mass of flask + metal

= 162.34g − 82.48g = 79.86g.

Mass of metal = Mass of flask + metal − Mass of flask

= 82.48g − 73.76g = 8.72g

Volume of water = $\frac{\text{Mass of water}}{\text{Density water}} = \frac{79.86g}{0.997044g/cm^3} = 80.09cm^3$.

Volume of metal = Volume of flask − Volume of water

= $81.64cm^3 - 80.09cm^3 = 1.55cm^3$

Density of metal = $\frac{\text{Mass of metal}}{\text{Volume of metal}} = \frac{8.72g}{1.55cm^3} = 5.63g/cm^3$.

3) Percent Error:

We don't have to calculate the parcent error, in this experiment, because we don't have the uniformed answer.

9. Data Analysis:

1) Density of unknown liquid: data table

Mass of empty flask + stopper	(m1/g)	73.76
Mass of flask + water	(m2/g)	155.16
Mass of flask + liquid	(m3/g)	139.38
Mass of water	(mw/g)	81.40
Temperature in the lab	(t/℃)	25.00
Volume of flask	(V_1/cm^3)	81.64
Mass of liquid	(m4/g)	65.62
Density of liquid	(ρ_1/g/cm^3)	0.803

In this experiment, we used the balance to figure out mass of empty flask, flask with water and flask with liquid. Then, we can get the mass of water by the different mass between empty flask and flask with water, for the, which is, 81.40g, With the same way, we find the mass of liquid, which is

65.62g. We also get the value of volume of liquid, which is equalt to the volume of flask and volume of water. Finally, we could use the equation $\rho = \frac{m}{V}$ to figure out the density of this unknown liquid. In addition, we don't have a graph for this experiment.

2) Density of unknown metal : data table

Mass of empty flask	m/g	73.76
Mass of flask + metal	m/g	82.48
Mass of flask + metal + water	m/g	162.34
Mass of metal	m/g	8.72
Mass of water	m/g	79.86
Volume of water	V/cm³	80.09
Volume of metal	V/cm³	1.55
Density of metal	ρ/g/cm³	5.64

In this experiment, we need to figure out the mass of metal first. We measure the mass of empty flask, flask + metal and flask + metal + water seperately so we can calculate the mass of metal by subtracting the first and second data. Moreover, we also should find the mass of water by subtracting in order to figure out the volume of water. And we use the equation $\rho_w V_w = \frac{m_w}{\rho_w}$, We've already know the volume of flask, so we can easily get the volume of metal by finding the differences between volume of flask and volume of water. Finally, we can use the equation $\rho_m = \frac{m_m}{V_m}$ to calculate the density of this unknown metal.

In addition, we don't have a graph for these datas.

10. Conclusion.

In this lab, we want to find an easy way to figure out the density of an unknown liquid and the density of a unknown metal that just use a flask, a balance and some water. We have actually finished figuring out the density by using very few materials. In the first experiment, we find the mass of liquid by measuring the mass of water and flask, and we find the volume of

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liquid by using water and flask. And our final result is 0.803 g/cm³. In the second experiment, we do almost the same thing but just add some metals, and our calculation for the density of this metal is 3.64 g/cm³.

As for errors, we do make some little mistakes in our experiments. Firstly, despite the precise electronic balance, we still cannot get the accurate mass of flask, because the balance is always changes the number. For example, the data will change if a very slight wind blow the stuff. More importantly, we cannot use the significant figure as much as we want, so it limits our observations and calculations that we do not get a very accurate result. Eventually, during the process of pouring liquid or water into the flask, although we try our best to make it full, it still has some small empty space without water or liquid.

For our next lab, we need to use more suitable significant figures in our data and during observations. And to improve the accuracy of the mass, we could find a quiet and closed place without any other disturbances.