Experiment 2

This laboratory provides a bit of fun for the student; the student will use the experiment in the locker to solve a puzzle. Each will be given unknowns of various kinds and asked to find out the identities by taking suitable measurements. Thus, using precision, accuracy, and significant figures in their measurements, each unknown can be identified. (Eureka!)

In the use of balances, again remind students not to weigh directly on the pan, but to use a container or weighing paper. In the case of the unknown metal, provide suitable containers for their recovery. For the other unknowns, waste containers should be provided. Nothing should be discarded into the sink.

Reading the volume in a graduated cylinder requires lining up of the eye with the meniscus. Demonstrate the proper technique for doing this. It may be the student's first encounter with the Spectroline pipet filler. It would be best to go through the way it works, particularly in the suction phase of its use. If the tip of the pipet is not immersed far enough into the liquid to be pipetted, the force of the suction might cause the liquid to be drawn up into the Spectroline pipet filler's body; these liquids will cause the inside to deteriorate. In addition, the liquids in the pipet filler will contaminate the next liquid to be pipetted, and so this situation should be avoided.

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partner | grade

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EXPERIMENT 2

Pre-Lab Questions

1. How does an intensive property differ from an extensive property? Give an example of an intensive property and of an extensive property.

   The intensive property does not depend on the quantity of the substance: density.

   An extensive properly depends on the quantity of the substance: mass.

2. In order to calculate the density of a solid or liquid sample, what measurements are needed?

   You need a mass measurement and a volume measurement.

3. The volume of a fixed mass of a liquid sample increases as the temperature rises from 20 to 408C. Does the density increase, decrease, or stay the same? Explain your answer.

   As the temperature rises, there is a change in the volume, the volume gets larger. As a result, the density will decrease. (mass/volume= density) Remember, there is no change in the mass; the only factor changing is the volume (you are dividing by a bigger number as the volume increases with increasing temperature).

4.A solid block of exactly 100.0 cm^3 has a mass of 153.6 g. Determine its density. Will the block sink or float on water?

153.6g/100.0 cc = 1.53 g/cc. This density is greater than the density of water, so it will sink.

5. A salvage operator recovered coins believed to be gold. A sample had a mass of 129.6 g and had a volume of 15.3 cm^3. Were the coins gold (d = 19.3 g/cm^3) or just yellow brass (d = 8.47 g/cm^3)? Show your work.

129.6 g/15.3 cc = 8.47 g/cc *Too bad, the metal is brass.*

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2 EXPERIMENT 2

Report Sheet

Report all measurements and calculations to the correct number of significant figures.

Density of a regular-shaped object	Trial 1	Trial 2
Unknown code number 1 (wood block)		
1. Length	20.8 cm	20.8 cm
Width	5.3 cm	5.3 cm
Height	4.4 cm	4.4 cm
2. Volume (L W H)	485 cm^3	485 cm^3
3. Mass	287.57 g	287.62 g
4. Density: (3)/(2)	0.593 g/cm^3	0.593 g/cm^3
Average density of block		0.593 g/cm^3

Density of an irregular-shaped object	Trial 1	Trial 2
Unknown code number 2 (Al shot)		
5. Mass of metal sample	5.232 g	6.702 g
6. Initial volume of water	14.90 mL	16.80 mL
7. Final volume of water	16.80 mL	19.30 mL
8. Volume of metal: (7) (6)	1.90 mL	2.50 mL
9. Density of metal: (5)/(8)	2.75 g/mL	2.68 g/mL
Average density of metal		2.72 g/mL

10. Identity of unknown metal Aluminum

Density of water	Trial 1	Trial 2
11. Temperature of water	22.0 8C	22.0 8C
12. Mass of 50-mL beaker	26.264 g	26.257 g
Volume of water	10.00 mL	10.00 mL
13. Mass of beaker and water	36.143 g	36.176 g
14. Mass of water: (13) (12)	9.879 g	9.919 g
15. Density of water: (14)/10.00 mL	0.9879 g/mL	0.9919 g/mL
16. Average density of water		0.998 g/mL
Density found in literature		0.998 g/mL

Unknown code number 3 (ethyl alcohol)

Density of an unknown liquid	Trial 1	Trial 2
17. Temperature of unknown liquid	22.0 8C	22.0 8C
18. Mass of 50-mL beaker	26.810 g	26.960 g
Volume of liquid	10.00 mL	10.00 mL
19. Mass of beaker and liquid	34.671 g	34.842 g
20. Mass of liquid: (19) (18)	7.861 g	7.882 g
21. Density of liquid: (20)/10.00 mL	0.7861 g/mL	0.7882 g/mL
Average density of unknown liquid		0.7872 g/mL

22. Identity of unknown liquid Ethyl alcohol

Post-Lab Questions

1. In determining the density of olive oil (see Table 2.2), one student took exactly 25.00 mL and found the mass to be 22.95 g. A second student took exactly 50.00 mL and found the mass to be 45.90 g. Will each student arrive at the same value for the density? Do each calculation and explain the result.

   22.95 g/25.00 mL = 0.918 g/mL 45.90 g/50.00 mL = 0.918 g.mL

   Each student will arrive at the same value for the density because density is an intrinsic property; the ratio of mass to volume is the same.

2. Hexane has a density of 0.659 g/mL. How many milliliters (mL) would a student need to pour in order to get 49.5 g of hexane? Show your work.

   If density = mass/volume then volume = mass/density or mL = g/g/mL = g x mL/g

   49.5 g/0.659 g/mL = 75.1 mL

3. In the density determination of a liquid, it was necessary to use the volumetric pipet properly. A student needed to deliver exactly 50.0 mL of a liquid. How will the quantity of liquid be affected by the situations described below, and how will the density determination be affected?

   a. A dirty pipet is used and droplets of liquid adhered to the inner walls of the pipet.
   Density determined decreases. The measured mass of the liquid delivered would be less than it should be (droplets remain in the piper), but the volume is still assumed to be 50.0 mL.

   b. The student did not allow sufficient time for all the liquid to empty from the pipet.
   Density determined decreases. The mass measured would be less (not everything has been transferred) but the volume is still assumed to be 50.0 mL.

   c. The student allowed all the liquid to drain and then blew out the small amount from the tip.
   Density determined increases. The mass measured would be greater since more liquid has been delivered than allowed for by calibration, but the volume is still assumed to be 50.0 mL.

   d. Air bubbles were not removed from the pipet before delivering the liquid.
   Density determined decreases. The mass measure would be less (air took up space of the liquid), but the volume is still assumed to be 50.0 mL

   e. At the mark on the pipet, the student read the upper edge of the meniscus and not the lowest point on the curve.
   Density determined decreases. The mass measured would be less since less than 50.0 mL would be delivered, but the volume is still assumed to be 50.0 mL.