Experiment 1

This may be a student's first experience in the laboratory. Therefore, the instructor should demonstrate all the techniques used in this laboratory. Show how a Bunsen burner is lit, with a match or a gas striker, and how the flame is adjusted by control of the gas valve and air vents.

This is a relatively simple laboratory for students to work. Most of the common equipment used in the laboratory are introduced here. For many this might be the first time some of the glassware will be encountered. For the instructor, patience is in order since the lack of familiarity of the student with the laboratory ware often creates problems. Take the graduated cylinder, for example. Since it is tall, it is easily knocked over, and although laboratory glassware is reasonably durable, it will shatter and could cause severe cuts. Remind students not to pick up broken glass with the fingers but to use the dustpan and brush. Broken glass should be discarded in a waste container specifically for glass.

While there is little danger in this laboratory of eye damage, nevertheless, it is essential that the rules of the laboratory be followed: **safety glasses are to be worn at all times in the laboratory.**

The thermometers in this laboratory are made of glass and must be handled properly. A thermometer is not a stirring rod and must not be used as such. If a student wants to bring the fluid level in the thermometer down, remind him/her to use cold water from the tap. The laboratory thermometer is not a clinical thermometer and does not require that it be shaken down! Waving the thermometer usually results in it hitting a bench top and breaking. Some of these thermometers contain mercury; the breakage of a thermometer with resultant spillage of mercury must be cleaned up quickly. Mercury is toxic, especially as a vapor. The instructor should be notified immediately for proper clean up. No mercury should be left freely about anywhere. Mercury can be collected with commercial collectors or by a homemade suction apparatus. Connect a side-arm suction filter flask to a water aspirator. The flask is fitted with a one-hole rubber stopper with a small section of glass tubing inserted into the hole. Rubber tubing connects the glass tube to a Pasteur pipet. When the water is turned on, the spheres of mercury will be sucked into the pipet and then into the suction flask. The recovered mercury can be stored under water.

Balances should be handled with care; electronic top-loading balances are sensitive and lose calibration easily. Demonstrate proper use of the balance. Emphasize that no chemical should be weighed directly on the pan; use either weighing paper or a suitable container. Also hot objects should not be put on the pan. Proper care requires that all weights be returned to zero.

The difference between precision and accuracy can be easily demonstrated. Use two balances, one that has been zeroed and calibrated, a second not zeroed and uncalibrated. Repeated weighings of the same object of known weight on the two balances will show high precision (high reproducibility in the clustering of the weights) for each of the two balances but not the same accuracy (agreement with the known weight).

name | section | date

partner | grade

1 EXPERIMENT 1

Pre-Lab Questions

1. In the design of a Bunsen burner, explain the purpose of
   a. the gas control valve
   Manipulation of this valve controls the flow of gas
   b. and the air vents.
   Manipulation of these vents controls the mixing of air with gas; allows the control of flame temperature.

2. Why is a luminous yellow flame often ‘‘smoky’’?
   Lack of sufficient air causes incomplete burning of the gas and produces soot.

3. A student wanted 20.000 g of a salt. Which balance should the student use in order to obtain the most accurate quantity: a platform triple beam balance, a single pan, triple beam balance, or a top-loading balance? Explain your answer.
   The top-loading balance enables you to weigh to the nearest 0.001 g.

4. Explain the difference between precision and accuracy?
   Precision determines the reproducibility of a measurement; accuracy is a measure of how closely the value determined agrees with a known or accepted value.

5. Solve the following problems and record the answers to the proper number of significant figures.
   a. 21.65 - 3.2= 18.5
   b. 4.01 ÷ (4.583 + 2.108)= 0.599
   c. 6.15 ÷ 1.2 = 5.1
   d. 2.26 x 21.43= 48.4

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1 EXPERIMENT 1

Report Sheet

Bunsen burner

1. What is the color of the flame when the air vents are closed?
   Yellow

2. Did anything happen to the surface of the Pyrex test tube in this flame?
   Soot collected on the test tube

3. What happens to the flame size when the gas control valve is turned?
   The flame changes in size

4. Describe the effect on the flame as the air vents were opened.
   The flame looses the yellow color and becomes blue

Length

1. Length 27.5 cm

   Width 21.5 cm

2. Length 275 mm 0.275 m

   Width 215 mm 0.215 m

3. Area 591 cm^2 59100 m
   (Show calculations)
   27.5 x 21.5= 591.25= 591

   275 x 215= 59125= 59100

Volume

1. Erlenmeyer flask 49.5 mL 0.0495 L

2. Beaker 42.0 mL 0.0420 L

3. Error in volume:
   Erlenmeyer flask 0.5 mL 1% %

   Beaker 2.0 mL 5.0% %

$$\% \text{ Error} = \frac{\text{Error in volume}}{\text{Total volume}} \times 100 \text{ (Show your calculations)}$$

(0.5/50) x 100=1% (2.0/40) x 100= 5.0%

4. Graduated cylinder

Mass

Object	Balance					
	Platform		Single Pan, Triple Beam		Top Loading	
	g	mg	g	mg	g	mg
Quarter	5.8	5800	5.61	5610	5.613	5613
Test tube (100 13 mm)	8.1	8100	7.92	7920	7.872	7872
125-mL Erlenmeyer flask	77.1	77100	76.95	76950	76.948	76948

Temperature

	8C	8F	K
Room temperature	22.5	72.5	295.7
Ice water	0.5	32.9	273.7
Boiling water	99.5	211.1	372.7

How well do your thermometer readings agree with the accepted values for the freezing point and boiling point of water? Express any discrepancy as a deviation in degrees.

Freezing Point: + 0.5 degrees Celsius Boiling Point: -0.5 degrees Celsius

Post-Lab Questions

1. How does a student need to adjust the Bunsen burner in order to change a luminous yellow flame into a nonluminous blue flame?

Open the air vents at the bottom of the burner barrel; more air assures complete combustion.

2. What causes the luminescence in the cooler, yellow flame?

Unburned small particles of carbon, soot, causes the luminescence.

3. A student needed exactly 45.3 mL of a solution. What piece of glassware should that student use? Justify your choice.

The graduated cylinder has gradations in 0.1 mL and would give the more accurate measure.

3. The diagram below is of a nonluminous Bunsen flame. Indicate the approximate region of the hottest part of the flame.

The tip of the inner blue cone is the hottest part of the flame.

5. Two students weighed a 125-mL beaker that had a mass of 80.562 g on a calibrated top-loading balance. Each student used their own top-loading balance, recorded three mass readings for the beaker, and then determined the average. Below are the results:

	Student A	Student B
	80.560	80.400
	80.555	79.551
	80.565	81.729
Average:	80.560	80.560

a. Find the averages.

b. Which set of results matches the known mass of the beaker?

Both sets agree well with the known weight of the beaker.

c. Which set of results is more precise?

Student A has a balance that gives more precise results; the weights are more reproducible

d. Which student has the more reliable balance?

Student A has a more reliable balance

6. A student measured the dimensions of a table and recorded the length as 103.50 cm and the width as 73.75 cm. According to the student's calculator, the area is 7633.125 cm^2. What should the student report? Explain your answer.

The answer is good to only 4 significant figures. The answer is 7633 cm square.

7. John has a mass of 115 kg. Sally has a mass of 115 lb. Who is the heavier of the two? Show your calculations to justify your answer.

115 kg x 2.20 lb/kg=253lb. *John is heavier*

8. At 20,320 ft., Mount McKinley in Alaska is the highest peak in North America. Express the height in meters (m) and kilometers (km) to the correct number of significant figures. Show your work.

20,320 ft x 30.48 cm/ft x 1 m/100 cm x 1 km/100m = 6.194 km

20,320 ft x 30.48 cm/ft x 1 m/100 cm = 6194 m

9. A 16.95 g sample of sugar was added to a glass with a mass of 8.3 oz. What is the combined mass of the glass and the sample in ounces (oz.), grams (g), and milligrams (mg)? Show your work and express your answers to the correct number of significant figures.

8.3 oz. x 28.35 g/oz. = 235.3 g or 240 g to 2 sig. fig.

16.95 g + 235.3 g= 252.3 g or 16.95g +240 g= 257 g if you follow sig. fig. rules

257 g x 1000 mg/g= 257,000 mg

16.95 g x 1 oz./28.35g= 0.5979 oz.

8.3 oz. + 0.5979 oz. = 8.8979 oz. = 8.9 oz. to 2 sig. fig.