**Lab Activity: Introduction to Measurement**

**Objective:** To develop the student's measuring skills, and to learn how to maximize the instruments we have in the lab.

**Materials:** thermometer, water, graduated cylinders, beaker, electronic balance, meter stick, sulfuric acid, hydrochloric acid, sodium hydroxide, demineralized water, beakers, stirring rods

**Method and Observations: The items below will be supported with video clips of each set of measurements**. *For example* #1-3 will be one video clip. I will use ruler A for number 1 which has a scale that goes up by 100 centimeters, ruler B for number 2 which has a scale that goes up by 10 centimeters, and ruler C which has a scale that goes up by .1 centimeters. **Reminder-to use a measuring device correctly, you have to determine the scale (the smallest increment marked) and then estimate one more place than the scale and add units.** *Example: Ruler A measures by 100 centimeters so I have to go one more place and measured to the 10’s every time I use Ruler A.*

Once I write the measurement, I will use sig. fig. rules to tell the number of sig figs (measured digits) in the measurement that I took. *Ex: 120 cm = 2 sig. figs (ruler A)*

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|  | **Activity** | **Measure-ment** | **Sig. Figs.** |
| **1.** | Height of your locker-A |  |  |
| **2.** | Width of your locker-B |  |  |
| **3.** | Depth of your locker-C |  |  |
| **4.** | Length of your head (chin to the top)-A |  |  |
| **5.** | Length of your foot-B |  |  |
| **6.** | Length of your arm span (finger tips on left hand to finger tips on right hand-C |  |  |
| **7.** | Length of your body (your height)-C |  |  |
| **8.** | Height from floor to top of orange safety shower-B |  |  |
| **9.** | Temperature of demineralized water (from bottle) |  |  |
| **10.** | Mass as close to 5 g of sodium hydroxide as possible. Record the **exact** value. |  |  |
| **11.** | Put the sodium hydroxide in a clean, empty 250 *ml* beaker. Add the demineralized water until you reach 125 *ml*. Stir until dissolved. Record the highest temperature. |  |  |
| **12.** | Measure the volume of the beaker from #11**.(use the scale on the beaker and estimate to the ones please)** |  |  |
| **13.** | Using a 50 *ml* graduated cylinder, measure the volume of the liquid from #12. *(Do not pour any liquid down the sink.)* |  |  |
| **14.** | Pour the liquid from #13 into a 1000 *ml* graduated cylinder. Record the volume. |  |  |
| **15.** | • Go under the fume hood and measure 16.8 *ml* of hydrochloric acid. Pour 50 *ml* of demineralized water into a 400 *ml* beaker, then add the acid. Add more demineralized water until you reach 100 *ml* and stir. Record the highest temperature. |  |  |
| **16.** | Measure the temperature of the sodium hydroxide (#14) and the acid (#15). Mix 25 *ml* of each into a clean, empty beaker, and measure the final temperature. |  |  |

*When you are finished, please pour extra sodium hydroxide and acid into the labeled containers in the back of the room.***Calculations and Results: Check your answers to page 1 before doing the calculations. *You must show work, show the whole answer, and finally show the rounded answer for numbers 1a, 3, 5, 6.***

**1.** **a. Calculate the following ratios: show work, show the whole answer, and finally show the rounded answer for numbers**

 •head length / length of your body (#4/#7 from data)=

 •foot length / length of your body

 •arm span / length of your body

 **b.** Comment on these results. Did you find anything interesting relationships here?

**2.** If you had exactly 5 grams in #10, how should you have recorded your answer, and **why**?

**3.** What is the change in temperature from #11? **show work, show the whole answer, and finally show the rounded answer for numbers**

 What does this tell you about dissolving a base (like sodium hydroxide) in water?

**4.** Why do #12, #13 and #14 have different answers, if they have the same amount of liquid?

**5.** What is the change in temperature from #15? **show work, show the whole answer, and finally show the rounded answer for numbers**

 What does this tell you about dissolving an acid in water?

**6.** What is the change in temperature from #16? **show work, show the whole answer, and finally show the rounded answer for numbers**

 What does this tell you about some chemical reactions?

**Conclusion: Using the following article, pick a measured number, discuss the number of significant figures it has, and why you think the author choose to use this number of significant digits.**

Poland’s 19-year-old Irena Kirszenstein – later known as Irena Szewinska – set her first world record in 1965, running the 200 in 22.7 seconds. She lowered the mark to 22.5 in the 1968 Olympic final. Taiwan’s Chi Cheng dropped the record to 22.4 seconds in 1970. Florence Griffith-Joyner enjoyed one of the greatest sprinting performances in Olympic history in Seoul, South Korea in 1988. She earned the 100-meter gold medal in a wind-aided 10.54 seconds. Flo-Jo shattered the world 200-meter record twice in one day, running 21.56 seconds in the semifinal round, then taking the gold medal in a time of 21.34 seconds. Between 1988 and 2013, the fastest 200-meter times belong to Marion Jones, who ran 21.62 at altitude in 1998, and Merlene Ottey, who posted a 21.64-second time in 1991.