

## **Laboratory 1 – Physical Instrumentation**

### **Purpose**

The purpose of this experiment is to understand the different fundamental units of the metric system and to be able to visualize and convert units within the metric system easily. Also, this experiment recognizes the relative alkalinity or acidity of a solution given its pH. Lastly, to understand the functions of different chemical and physical determinations such as indicators, input transducers, electrodes, amplifiers, and output transducers.

### **Procedures**

In every experiment there are specific procedures that need to be followed. In the first part of the experiment, a black box was observed and made an effort to understand how the black box works. On the second part of the experiment, the basic metric units of measure are given and analyzed these measurements to learn the basic unit of each measurement. The basic metric units of measure were used to calculate the specific conversion for a problem. For the linear measurements, the lecture text was measured including its length, width, and the depth of the material. For the volume measurements, water was poured into the beaker and weighed to get the volume. After that, the water from the beaker was poured into a graduated cylinder and gathered the volume of the water. On the mass measurement, a phone was weighed to gather the mass of the object. Next, water was poured into the beaker and weighed to get the volume of the water.

On the pH measurements, the different liquids were poured into their own test tubes and labeled them A, B, and C. A test strips were given to determine the pH of each liquid. For the last part of the experiment which is the time measurement, pulse was gathered for 15 seconds and 60 seconds. Converting of measurements were needed in each part of the experiment.

## **Results**

### **I-A *Blackbox***

The black box itself just looks like a regular black box. It has wires that connects to your finger to determine your pulse rate from the middle finger.

### **I-B *Units of measure***

#### *Linear Measurements*

1. State the length of your lecture text: **27.9 mm      2.79 cm**
2. State the width of your lecture text: **21.6 mm      2.16 cm**
3. State the depth of your lecture text: **10 mm      1 cm**

#### *Volume Measurements*

1. Pour some water in the beaker and state the volume: **15.0 ml              0.15 liters(l)**
2. Pour the water from the beaker into a graduated cylinder and state the volume:

**90 ml              0.09 liters(l)**

#### *Mass Measurements*

1. State the mass (apple phone) of the weight: **0.28459 mg              284.59 g**

2. Pour some water into the beaker and state the mass of the liquid in the beaker:

**0.08748 mg**

**87.48 g**

### *pH Measurements*

1. State the pH of the liquid in container "A": **6**

2. State the pH of the liquid in container "B": **7**

3. State the pH of the liquid in container "C": **9**

### *Time Measurements*

1. Determine your pulse rate after 15 seconds: **75 beats/second**      **1.25 beats/minute**

2. Determine your pulse rate after 60 seconds: **1.30 beats/minute**

**78 beats/second**

**78 beats/millisecond**

### **Discussion**

In the first part of the experiment, after observing the black box for a while, it looked like a plain black box until someone operated it. This black box can tell the pulse rate of a person by putting the middle finger into this machine. While looking at the pulse rate monitor, it gave a not steady pulse rate which is normal and gathered the acceptable number for the pulse rate. After analyzing this occurrence, the black box depends on the feelings or heart rate of the user. If the user is standing up, it gives bigger numbers but when the user is sitting still, it gives lower numbers. Some possible errors occurred in this part of the experiment was the placement of the

black box or the placement of the middle finger in the equipment that caused unacceptable numbers.

The second part of the experiment focuses on how to measure things properly, to be familiar with the fundamental units of the metric system and learn how to convert. In this part of the experiment, different things were measured such as the laboratory manual using a ruler. In each experiment errors are expected. One of the errors encountered is the ruler. The ruler might be inaccurate in order to tell the exact length, width, and depth of the laboratory manual. Another error encountered was the weighing scale. The weighing scale might not be calibrated properly in order to cause inaccurate results. For the pH measurements, three liquids were analyzed and gathered their pH using the test strips. After smelling the three liquids, each liquid has its own unique smell. One of them has a slightly acidic smell to it but the other two do not have smell at all. The error encountered in this part of the experiment is the test tubes. Putting the liquids in the test tubes might alter the pH of the liquids due to the particles from the test tubes that were not thoroughly cleaned before starting the experiment.

## **Conclusions**

In conclusion, the black box that was observed can determine the pulse rate. It operates with a machine that if the middle finger was put into, it will give the pulse rate of a person. Although sometimes it will not give a stable result it is still usable. After that experiment, any emotions, feelings, or even the position of the user can affect their pulse rate results in a way where it may show high numbers or low numbers. For the measurements, the length of the lecture text is 27.9 mm and 2.79 in centimeter. The width of the lecture text is 21.6 mm and 2.16 in centimeter.

Lastly, the depth of the lecture text is 10 mm and 1 in centimeter. For the volume measurements, after pouring some water in the beaker the volume is 15.0 ml and 0.15 in liters(l). Also, after pouring the water from the beaker into a graduated cylinder, the volume is 90 ml and 0.09 in liters(l). For the mass measurements, the mass of the phone is 0.28459 mg and 284.59 in grams. After pouring some water into the beaker, the mass of the liquid in the beaker is 0.08748 m and 87.48 in grams. For the pH measurements, the first liquid has a pH of 6, the second liquid has a pH of 7, and the third liquid has a pH of 9 which makes all our liquid bases and not that acidic. For the last part, the pulse rate gathered after 15 seconds is 75 beats/second and 1.25 in beats/minute while for 60 seconds is 1.30 beats/minute, 78 in beats/second, and 78 in beats/millisecond. Conversions were made throughout the experiment. It is important to know that the basic metric units of measure were given in the lab manual. In conclusion, it is very important to know the basic metric units of measure and how to use these units of measure in proper calculations and conversions.