Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Chemistry

Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Teacher, Class \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Laboratory Record Sheet Use with Section 3.1

**PURPOSE**

To measure the dimensions of an object as accurately and precisely as possible and to apply rules of significant figures to measurements and calculations with measurements.

|  |
| --- |
| **MATERIALS*** 3 inch × 5 inch index card
* metric ruler
 |

**PROCEDURE**

**1.** Use a METRIC ruler to measure in **centimeters** the **length** (*longest side*) and **width** (*opposite length*) of a 3” x 5” index card as accurately and precisely as you can according to the metric ruler. (*The hundredths place in your measurement should be estimated*.)

**2.** Calculate the **perimeter** [2 × (length + width)] and the **area** (length × width) of the index card. Record your results “as is” and then using the proper # of significant figures. SHOW WORK:



**3.** Contact a peer in your class and get their results.

 **Be sure to include units in your measurements.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Your Results****“As is”** | **# of Sig. Figs** | **Your Results****Sig Figs** | **Peer’s Results****“As is”** | **Peer’s Results****Sig Figs** |
| **Length** |  |  |  |  |  |
| **Width** |  |  |  |  |  |
| **Perimeter** |  |  |  |  |  |
| **Area** |  |  |  |  |  |

**CONCLUSIONS (***Write in complete sentences that convey a complete thought***)**

**1.** How did you determine the number of **significant figures** in your measurements of length and of width?

**2.** How do your measurements **compare** with those of your classmates? Were they exactly the same? Do they need to be exactly the same? Why or why not?

**3.** How did you determine the number of **significant figures** in your calculated value for the perimeter?

**4**. How did you determine the number of **significant figures** in your calculated value for the area?

**5.** Assume that the correct (accurate) length and width of the card are 12.80 cm and 7.62 cm, respectively. Calculate the **percent error** for each of your two measurements according to the proper number of significant figures. Show Work:

**6.** What is the major function of using **percent error**?

***You may use these ANSWERS as a guide. However, your measurements will most likely be slightly different and the conclusions should be written in your OWN words.***

**1.** Use a METRIC ruler to measure in **centimeters** the **length** (*longest side*) and **width** (*opposite length*) of a 3” x 5” index card as accurately and precisely as you can according to the metric ruler. (*The hundredths place in your measurement should be estimated*.)

*When measuring length & width, one can see the centimeter graduations and the millimeter graduations on the metric ruler. However, there is a space between each millimeter graduation. This becomes the “estimate” … the measurer (YOU) estimate how much of that 0.1 mm is taken up … from 1 to 9. If it is exactly on the last millimeter line, use “0” for the estimate.*

**2.** Calculate the **perimeter** [2 × (length + width)] and the **area** (length × width) of the index card. Record your results “as is” and then using the proper # of significant figures. SHOW WORK:



 2 x (12.79 cm + 7.60 cm) = 40.78 cm

 12.79 cm X 7.60 cm = 97.204 cm

**3.** Contact a peer in your class and get their results.

 **Be sure to include units in your measurements.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Your Results****“As is”** | **# of Sig. Figs** | **Your Results****Sig Figs** | **Peer’s Results****“As is”** | **Peer’s Results****Sig Figs** |
| **Length** | **12.79 cm** | **4** | **12.79 cm** |  |  |
| **Width** | **7.60 cm** | **3** | **7.60 cm** |  |  |
| **Perimeter** | **40.78 cm** | **4** | **40.78 cm** |  |  |
| **Area** | **97.204 cm** | **3** | **97.2 cm** |  |  |

**CONCLUSIONS (***Write in complete sentences that convey a complete thought***)**

**1.** How did you determine the number of **significant figures** in your measurements of length and of width?

*Significant figures indicate the precision of the measurement, especially of the measuring tool. A standard metric ruler includes centimeters, millimeters, and the space between the millimeters (0.1 mm) as an estimate. Each of these measurements is considered “significant” because one can actually see the graduations on the measuring tool, and one is allowed ONE estimate.*

**2.** How do your measurements **compare** with those of your classmates? Were they exactly the same? Do they need to be exactly the same? Why or why not?

*Measurements will most definitely DIFFER because one is allowed an estimate. Plus, not every index card is exactly the same in dimensions.*

**3**. How did you determine the number of **significant figures** in your calculated value for the perimeter?

*Perimeter involves both addition and multiplication, making it seem a little more complicated to determine sig figs. Since the addition problem is first, we use the LEAST PRECISE measurement between the measurements being added. In this case, both length and width had a precision to the nearest 0.01 cm, meaning that the answer will be to the nearest 0.01 cm. Perimeter involves doubling the sum of the length plus the width so the answer will still be to the nearest 0.01 cm.*

**4.** How did you determine the number of **significant figures** in your calculated value for the area?

*Area is a multiplication problem (as with division), meaning that you use the LOWEST AMOUNT of significant figures between the measurements being multiplied. In this case, the width was 7.60 cm, having only 3 sig figs. Therefore, the answer can only have three sig figs.*

**5.** Assume that the correct (accurate) length and width of the card are 12.80 cm and 7.62 cm, respectively. Calculate the **percent error** for each of your two measurements. Show Work:

$$\% error=\frac{Actual - Observed}{Actual} X 100\%$$

$\% error (length)=\frac{12.80 cm - 12.79 cm}{12.80 cm} X 100\%$ = **8 x 10-2 %** or **0.08 %**

$\% error (Width)=\frac{7.62 cm - 7.60 cm}{7.62 cm} X 100\%$ = **0.3 %**

* *In both cases for % error, the subtraction portion only leaves 1 sig fig. Therefore, the solution for % error can only have 1 sig fig (round up or down).*

**6.** What is the major function of using **percent error**?

*Percent error is a mathematical way to indicate the accuracy (reliability) and/or precision (consistency & measuring tool capability) of a measurement*.