**ACCURACY**

**% error = | Actual - Measured | x 100**

**Actual**

Example: The accepted density of water at 25oC is **0.99704 g/mL.**  Using the best tools available, you calculated the density of your sample of water to be **0.999 g/mL.** Here is how we calculate % error.

**% error = | 0.99704 - 0.999 | x 100**

**0.99704**

**0.00196 x 100 = 0.201978565%**

**0.99704**

However, when we subtracted 0.99704 – 0.999, we were only allowed one significant figure

0.99704

- 0.999

- 0.00196 Even though we should use the entire value of 0.00196 in our calculation, we must adhere to the rules of significant figures when reporting our final answer. Therefore, our % error can only have one significant figure!

So our % error **=**  **0.2%**

**Now you try a problem:**

The accepted value for the heat of fusion of ice is 333.55 J/g. In lab, you determined your heat of fusion of ice to be 344 J/g. What is your % error to the correct number of significant figures?

**% error = | 333.55 - 344 | x 100**

**333.55**

**10.45 x 100 = 3.132963574% = 3.1%**

**333.55**

**PRECISION**

Precision is a measure of the extent to which consecutive determinations of the same value agree with one another. In order to evaluate the precision of your work, you will calculate the **Relative Average Deviation (RAD)** for each piece of glassware. The following is an explanation of how to calculate an RAD and an example of a sample RAD calculation:

Calculation of RAD:

1. Calculate the mean (average). (Let’s assume we measures our sample **x** times)

2. Calculate the deviation () for each value.

 = | mean - individual value | (Note this is an absolute value)

3. Calculate the Standard Average Deviation.

Standard Average  = | 1 | + | 2 | + | 3 | +…+ | x |

x where **x**  is the # of times we measured

4. Calculate the Relative Average Deviation.

RAD (in %) = Standard Average Deviation x 100

mean

*(Note make sure to round to the correct number of significant figures)*

EXAMPLE:

Sample Density Values: 3.02 g/mL 3.08 g/mL 3.05 g/mL

Mean: (3.02 + 3.08 + 3.05)/3 = 3.05

1| 3.05 - 3.02 | = 0.03

2| 3.05 - 3.08 | = 0.03

3| 3.05 - 3.05 | = 0.00

Standard Average  = (0.03 + 0.03 + 0.00)/3 = 0.02

RAD (in %) = 0.02/3.05 x 100 = 0.6557% rounded to **0**.**7%**

*(Note the answer has only one significant figure because the deviation values had only one significant figure)*

**Now you try a problem:**

Here are the values that each student was able to calculate from experimental calculations to determine the heat of fusion of methane:

Group 1: 60.2 J/g

Grouip2: 56.9 J/g

Group 3: 56.8 J/g

Group 4: 59.7 J/g

Calculate the RAD of the groups.

Mean: (60.2 + 56.9 + 56.8 + 59.7)/4 = 58.4

1| 58.4 – 60.2 | = 1.8

2| 58.4 – 56.9 | = 1.5

3| 58.4 – 56.8 | = 1.6

4| 58.4 – 59.7 | = 1.3

Standard Average  = (1.8 + 1.5 + 1.6 + 1.3) = (**6.2**)/4 = 1.55

*(Note that* ***6.2*** *has only two sig figs. So even though we will use 1.55 in our calculation, we must round the final answer to only 2 sig figs).*

RAD (in %) = 1.55/58.4 x 100 = 2.654109589% rounded to **2.7%**