

Percent Error

Students often assume that each measurement that they make in the laboratory is true and accurate. Likewise, they often assume that the values that they derive through experimentation are very accurate. However, sources of error often prevent students from being as accurate as they would like. Percent error calculations are used to determine how close to the true values, or how accurate, their experimental values really are.

The value that the student comes up with is usually called the **observed value**, or the experimental value. A value that can be found in reference tables is usually called the **accepted value**, or the accepted value. The **percent error** can be determined when the **accepted value** is compared to the **observed value** according to the equation below:

$$\text{Percent Error} = \frac{(\text{Observed Value} - \text{Accepted Value})}{\text{Accepted Value}} \times 100\%$$

Let's look at an example of how the formula would be used in a real-life situation.

Ex. 1 A student measures the mass and volume of a piece of copper in the laboratory and uses his data to calculate the density of the metal. According to his results, the copper has a density of 8.37 g/cm^3 . Curious about the accuracy of his results, the student consults a reference table and finds that the accepted value for the density of copper is 8.92 g/cm^3 . What would be the student's percent error?

Solution - Step 1. Determine which values are known.

The student's result, or the observed value = 8.37 g/cm^3 .

The accepted, or true value = 8.92 g/cm^3 .

Step 2. Substitute these values in the percent error calculation, as shown below:

$$\text{Percent Error} = \frac{(\text{Observed Value} - \text{Accepted Value})}{\text{Accepted Value}} \times 100\%$$

$$\text{Percent Error} = \frac{(8.37 \text{ g/cm}^3 - 8.92 \text{ g/cm}^3)}{8.92 \text{ g/cm}^3} \times 100\%$$

Step 3. Solve for the unknown, and round to correct significant digits.

$$\text{Percent Error} = -6.17\%$$

Please note that the negative sign does not mean that the error was less than zero, which would be impossible. It shows that the student's calculated value was actually too low.

Use your knowledge of math and science, along with your ESRT to answer the questions below. Round all answers to the nearest tenth and show all work!

Write out the formula for Percent Error below.

Percent error =

Answer the following questions

1. Working in the laboratory, a student finds the density of a piece of pure aluminum to be 2.85 g/cm^3 . The accepted value for the density of aluminum is 2.699 g/cm^3 . What is the student's percent error?

2. A student experimentally determines the specific heat of water to be $4.29 \text{ J/g} \times \text{C}^\circ$. He then looks up the specific heat of water on a reference table and finds that it is $4.18 \text{ J/g} \times \text{C}^\circ$. What is his percent error?

3. A student takes an object with an accepted mass of 200.00 grams and masses it on his own balance. He records the mass of the object as 196.5 g. What is his percent error?

4. A student measured the mass of a rock to be 19.8 grams; the actual mass was 18.6 grams. What was the student's percent deviation?

5. A student measured the volume of water to be 18.5 ml; the actual volume was 17.5 ml. What was the % deviation?

6. A 75 ml solid is estimated by a student to be 81 ml. Calculate the percent error.

7. Calculate percent deviation: Actual value = 21 mm, Student measured 24 mm.