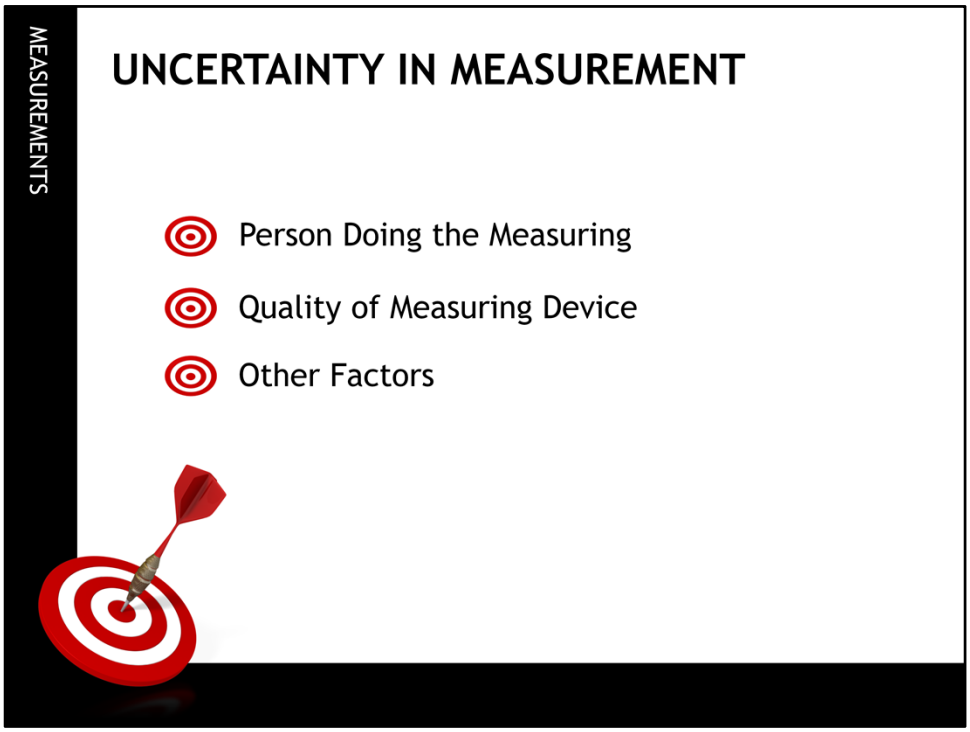
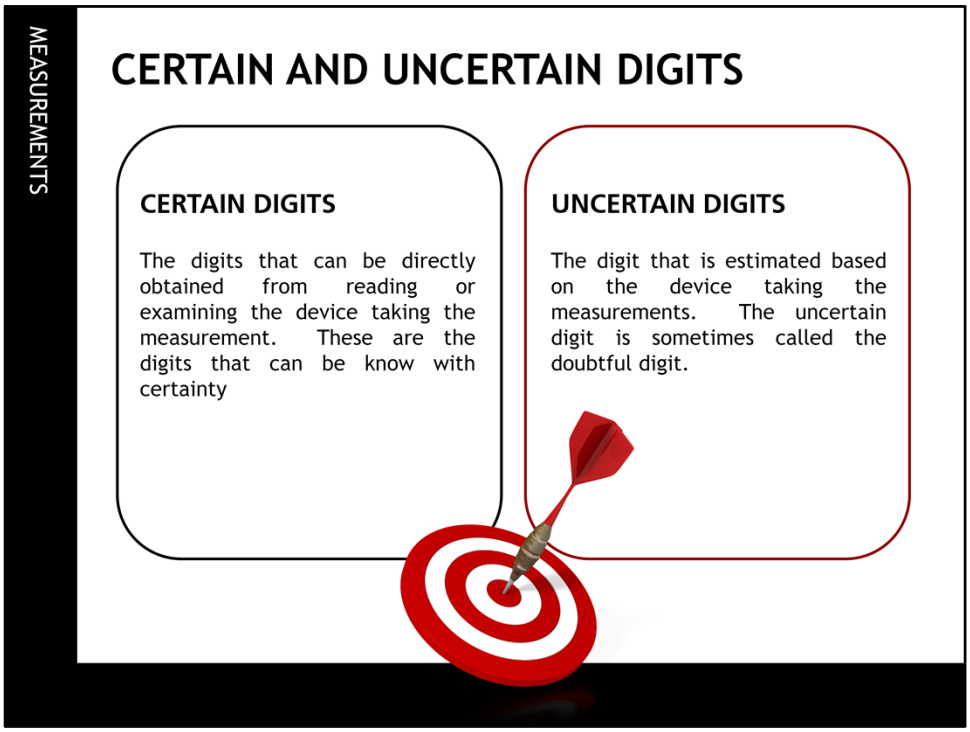
Introductory Module: Fundamentals of Science

Topic 2 Content: Accuracy and Precision in Measurement Presentation Notes

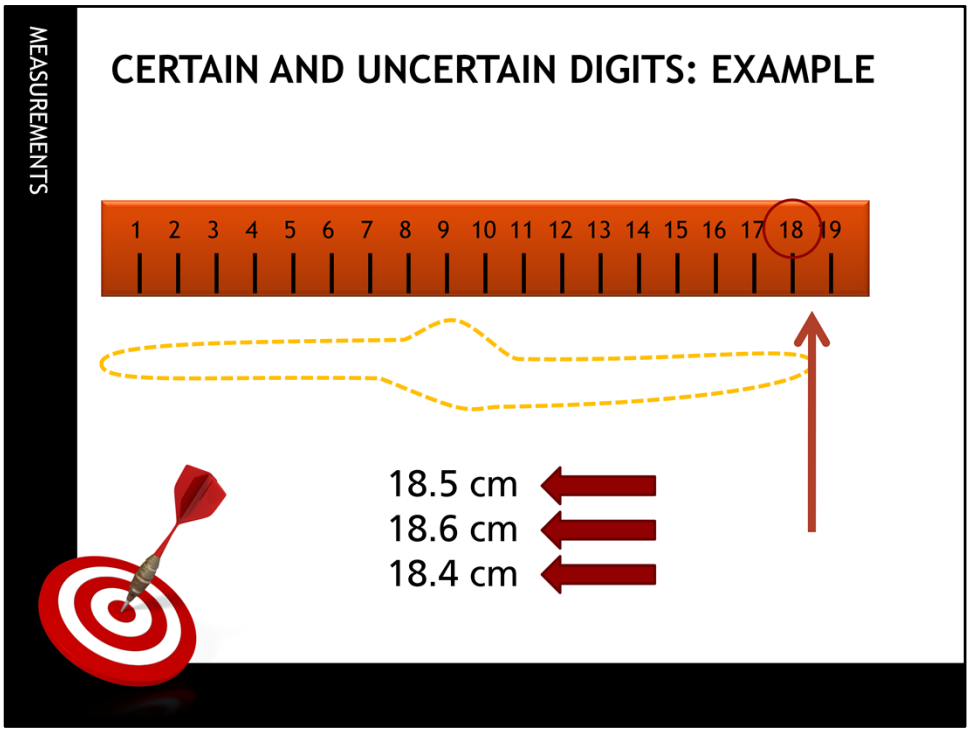
Accuracy and Precision in Measurement



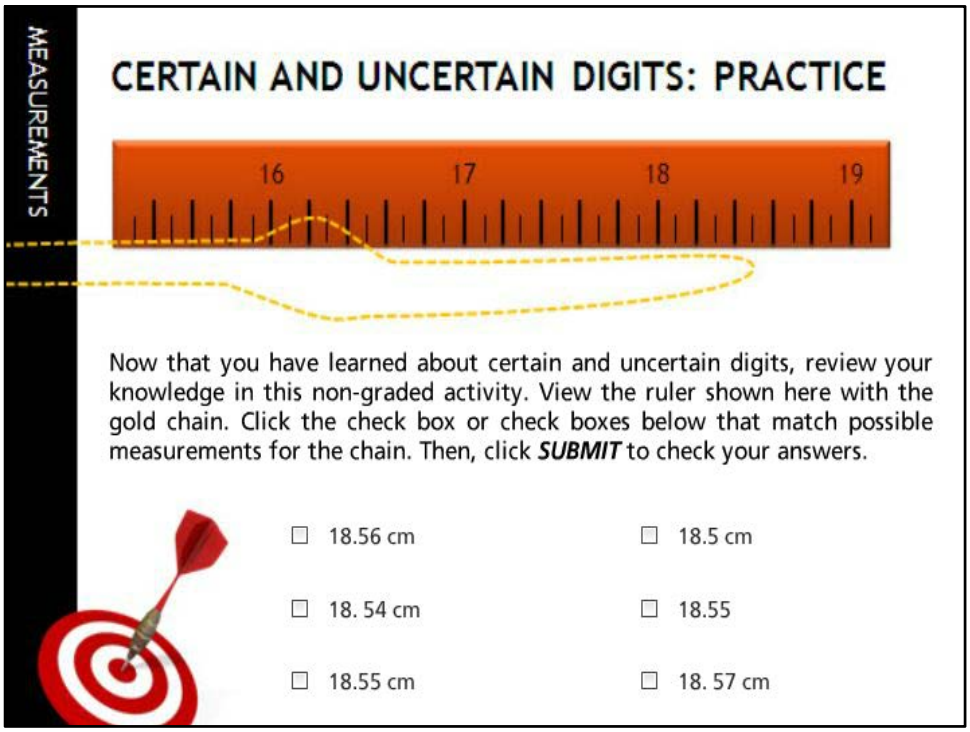
In chemistry, all measurements have a certain degree of uncertainty due to the reliability of the person doing the measuring, the quality of the measuring device, or other factors that may impact measurement.



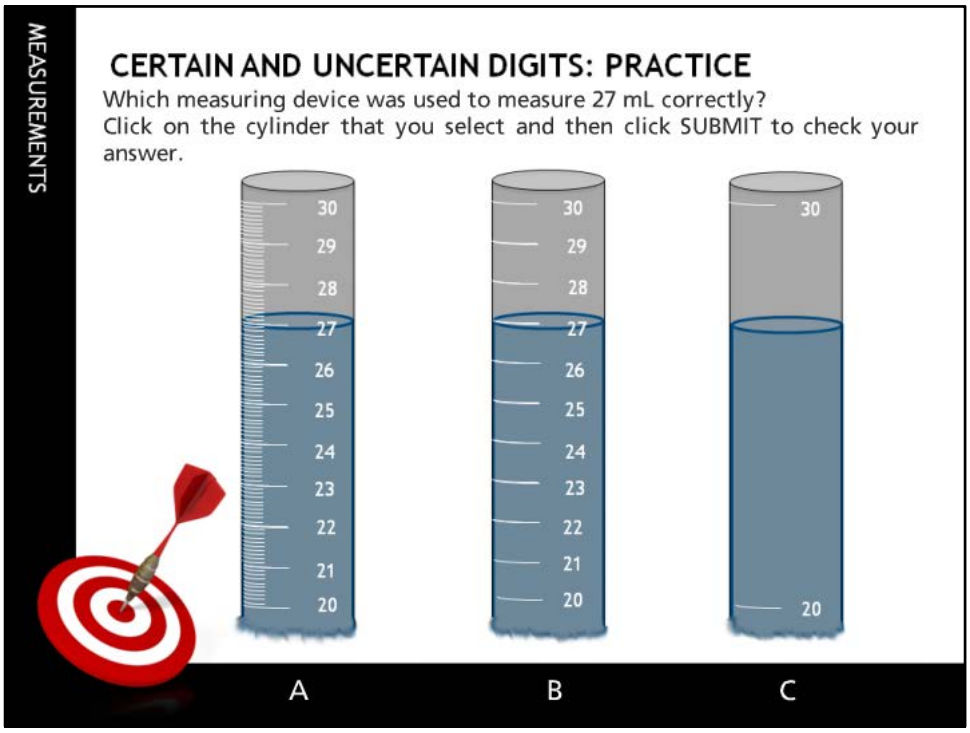
When measuring quantities in chemistry, it is important to record the digits that you can read from the device taking the measurement, known as the certain digits, PLUS one more digit, called the uncertain digit. The uncertain digit is an estimated digit, and because of this, it is sometimes called the "doubtful digit."



Take a moment to view this example using a ruler. Pretend that someone asked you to measure the length of this gold chain. Using the centimeter ruler provided, you would measure the length of the necklace somewhere beyond 18 centimeters. The 18 centimeters is the only certain part of the measurement. Then, you would need to estimate an additional digit. You see that the length of the necklace may be close to .5 centimeters beyond the 18 centimeters, but another person may read this as .6 centimeters. Yet another person may read it as .4 centimeters and so on. All of these measurements would be correct because the last digit is an estimate.

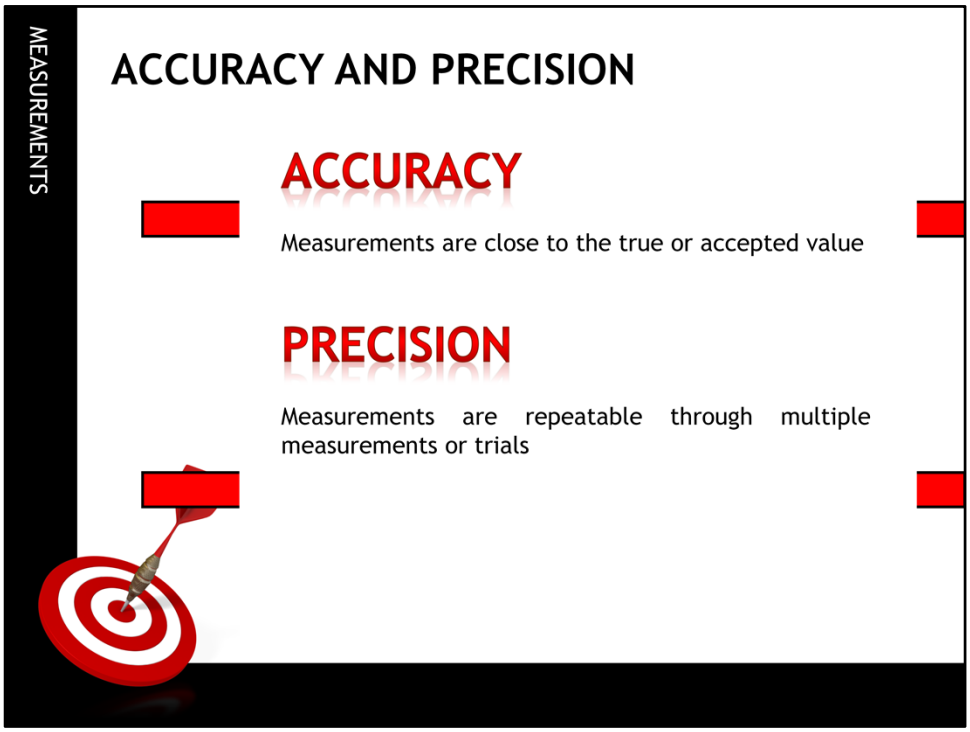


Now that you have learned about certain and uncertain digits, review your knowledge in this non-graded activity. Read the directions associated with each question and select the correct response, or responses. Then, click ***SUBMIT*** to check your answers.

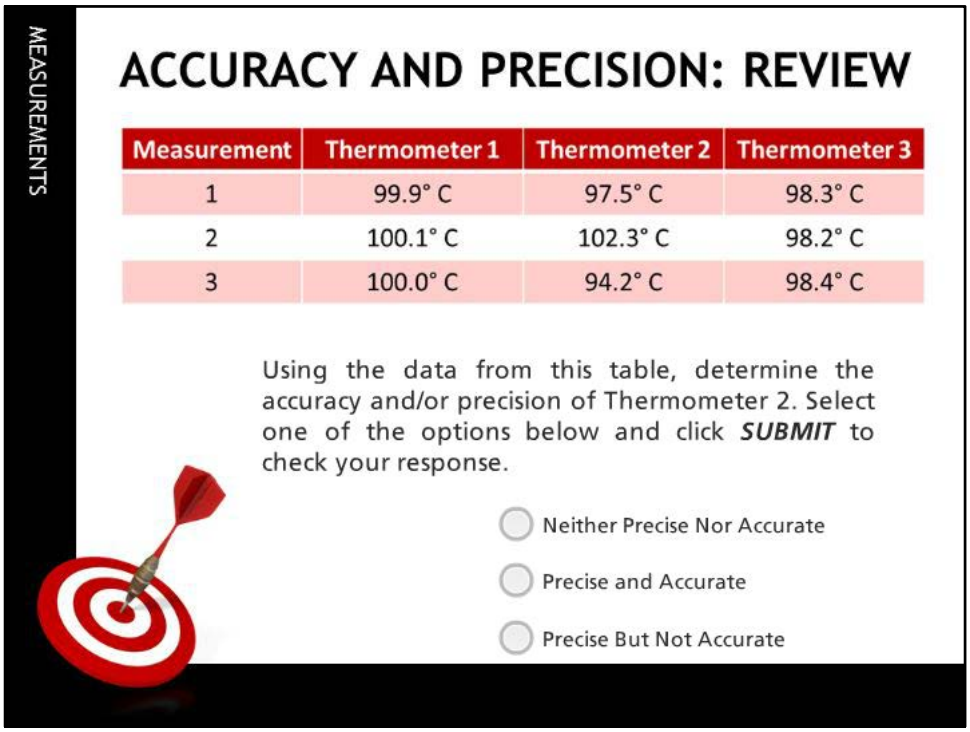

MEASUREMENTS
CERTAIN AND UNCERTAIN DIGITS: PRACTICE
Which measuring device was used to measure 27 mL correctly?
Click on the cylinder that you select and then click SUBMIT to check your answer.
30
29
28
27
26
25
24
23
22
21
20
A
B
C

Introductory Module: Fundamentals of Science

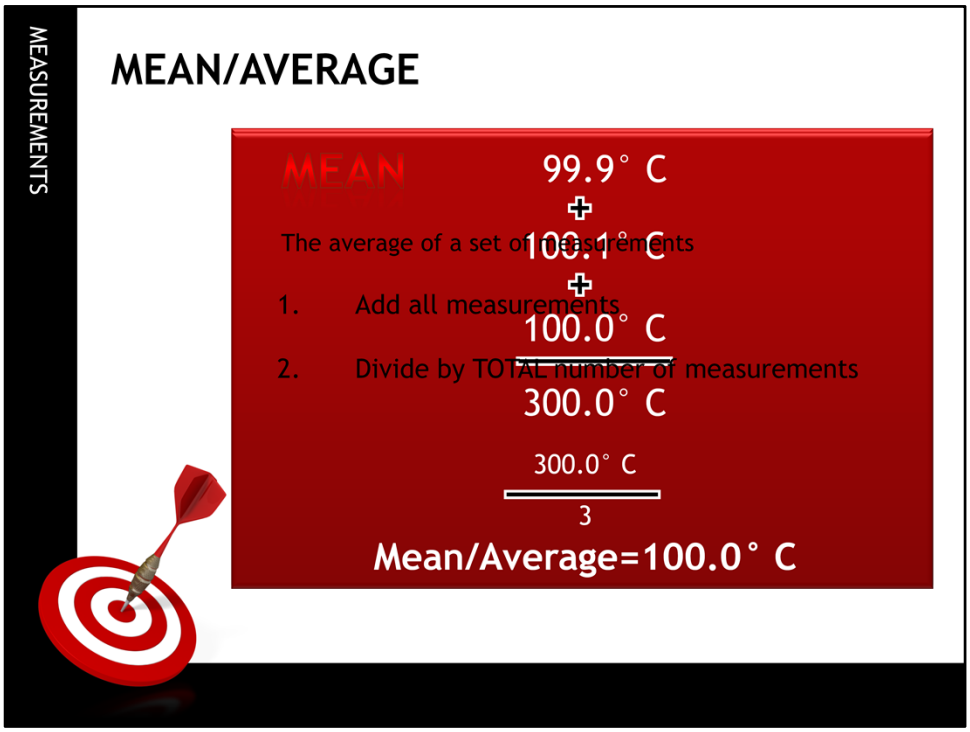
Topic 2 Content: Accuracy and Precision in Measurement Presentation Notes



When you take measurements, it is important to be accurate as well as precise. An accurate measurement is one which is close to the true or accepted value. Precise measurements are those which are repeatable through multiple measurements or trials. In other words, precision means getting the same measurement each time, regardless of the accuracy. If the images shown here were targets in a game of darts, the first dart board would be neither accurate nor precise because the measurements were not close to the accepted value of the bull's-eye, nor were they repeatable over multiple throws. In the second dart board, the measurements would be precise because they had a similar value over repeated throws, but they were not close to the accepted value of the bull's-eye. In the third dart board, the measurements would be accurate but not precise because they were all close to the accepted value of the bull's-eye, but they were not repeated over multiple throws. In the final image, the measurements would be accurate and precise because they were all similar to one another, and they were close to the accepted value.



Now, take a look at an example of accuracy and precision with data from an actual experiment. A student used three different thermometers to record the temperature of boiling water three different times. You know that the actual temperature of boiling water is 100° Celsius. In this non-graded activity, determine the accuracy and precision of each thermometer. Review the data and select the correct response. Then, click ***SUBMIT*** to check your responses.



Sometimes, it may be necessary to take a measurement several different times and determine the mean, or average, of those measurements. In order to determine the mean of a set of measurements, simply add all the measurements together and then divide by the total number of measurements. This example will use the data from the thermometer practice to explore determining the mean boiling temperature recorded for the first thermometer.

For thermometer number one, the first measurement was 99.9° Celsius, the second measurement was 100.1° Celsius, and the third measurement was 100.0° Celsius. When added, the total of these three measurements is 300.0° Celsius. Now, you will need to divide by three, because that is the total number of measurements you added together. The mean, or average, of the three readings for thermometer number one is 100.0° Celsius.