Measurement – ID: 16142

By Texas Instruments
TEACHER GUIDE

Time required
45 minutes

Topic: Measurement

- *Take and record measurements using different measuring devices.*
- *Determine significant digits and estimated values of measurements.*

Activity Overview

In this activity, students will become familiar with a number of scientific measuring devices. They will become familiar with measurement, precision, certain and uncertain values, and significant figures.

Materials

To complete this activity, each student will require the following:

- *10 mL graduated cylinder*
- *100 mL graduated cylinder*
- *1000 mL beaker*
- *meter stick with millimeter marks*
- *caliper*

- *thermometer*
- *wood block*
- *food coloring*
- *copy of student worksheet*
- *pen or pencil*

TI-Nspire Applications

Lists & Spreadsheet, Notes

Teacher Preparation

Students should be familiar with taking basic measurements using the various measuring devices listed on the materials list.

- *The screenshots on pages 2–3 demonstrate expected student results.*
- *Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.*
- ***To download the .tns file, go to education.ti.com/exchange and enter "16142" in the search box.***

Classroom Management

- *This activity is designed to be **student-centered**, with the teacher acting as a facilitator while students work cooperatively. The student worksheet guides students through the main steps of the activity and includes questions to guide their exploration. Students may record their answers to the questions on blank paper or answer in the .tns file using the Notes application.*
- *The ideas contained in the following pages are intended to provide a framework as to how the activity will progress. Suggestions are also provided to help ensure that the objectives for this activity are met.*
- *In some cases, these instructions are specific to those students using TI-Nspire handheld devices, but the activity can easily be done using TI-Nspire computer software.*
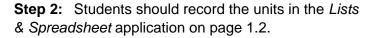
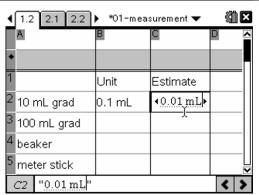The following questions will guide student exploration during this activity:

- How does estimation factor into the process of taking measurements?
- Which parts of a measurement are significant digits?

The goals of this activity for students are a) to determine the units of measurement for different measuring devices, b) take measurements using different measuring devices, and c) determine the estimated values and significant digits for various measurements.

Problem 1 – Units of Measurement

Step 1: Students should open the file **01-Measurement.tns** and then observe the following measuring devices: 10 mL graduated cylinder, 100 mL graduated cylinder, meter stick, micrometer, and thermometer. Then, they should determine the smallest unit of measurement for each device as well as the estimated value for each device. Encourage students to look at the marks on each measuring device to determine the unit of measurement.
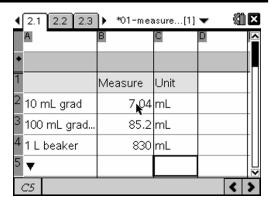
Step 2: Students should record the units in the *Lists & Spreadsheet* application on page 1.2.

	Unit	Estimate	
10 mL grad	0.1 mL	◀0.01 mL▶	
100 mL grad			
beaker			
meter stick			

C2 "0.01 mL"

Problem 2 – Measuring Objects

Step 1: Students should move to page 2.1. Then, they should fill a 10 mL and 100 mL graduated cylinder ¾ full with water. It may help to use colored water so that the meniscus is more easily observed. Students should record their measurements in the table on page 2.1.

Step 2: Students should measure the volume of liquid in a ¾ full 1 L beaker and record their measurements on page 2.1.

Step 3: Students should measure the length, width, and height of a wood block with both a ruler and a micrometer. They should record their measurements on page 2.1. Then, they should answer questions 1–4.

	Measure	Unit	
10 mL grad	7.04	mL	
100 mL grad...	85.2	mL	
1 L beaker	830	mL	

C5

Q1. The 10 mL graduated cylinder has marks every:

A. *0.1 mL*

Q2. The 100 mL graduated cylinder has marks every:
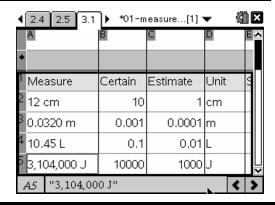
A. *1 mL*

Q3. The 1 L beaker has marks every:

A. *100 mL*

Q4. Which volume-measuring device has the greatest precision?

A. *10 mL graduated cylinder*

Problem 3 – Analyzing Measurements

Step 1: Students should move to page 3.1 and complete the spreadsheet there. Students may need help determining the certain and estimated values for each measurement listed.

	Measure	Certain	Estimate	Unit	
1	Measure	Certain	Estimate	Unit	
2	12 cm	10	1	cm	
3	0.0320 m	0.001	0.0001	m	
4	10.45 L	0.1	0.01	L	
5	3,104,000 J	10000	1000	J	

A5 "3,104,000 J"

TI-Nspire Navigator Opportunity: *Quick Poll*

Quick Poll can be used here to ensure student understanding of the terms presented in the spreadsheet. You may provide students with a sample measurement, such as 42.5 mm, and have students determine the certain and estimated values, the units of measurement, and the significant figures for this measurement. (In this case, the certain value is 42, the estimated value is 0.5, the units of measurement are 1 mm, and the number of significant figures is 3.)

Step 2: Students should answer questions 5–8.

Q5. Determine the number that represents the mark on the device in the following measurement: 25.43 L.

A. *0.4 L*

Q6. How many significant figures are there in 12.20?

A. *4*

Q7. How many significant figures are there in 0.025?

A. *2*

Q8. How many significant figures are there in 65,100?

A. *3*