|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Measurements** |  |

|  |
| --- |
| **Your Tasks (Mark these off as you go)** |
| * Review significant figures in measurements * Review how to count significant figures * Complete the measurement challenges * Receive credit for the group portion of this lab |

**▢ Review significant figures in measurements**

All measuring devices are subject to error, making it impossible to obtain exact measurements.

When recording a measurement, you should record all the digits of the measurement using the markings that you know exactly, plus one further digit that is estimated or uncertain.

The *uncertain digit* is our best estimate using the smallest unit of measurement given and estimating between two of these values. These digits are collectively referred to as *significant figures*.

|  |  |
| --- | --- |
|  | Here the “ruler” markings are every 0.1-centimeter. The correct reading is 1.67 cm.  The first 2 digits **1.6** are known exactly. The last digit **7** is uncertain. You may have instead estimated this measurement as 1.68 cm.  The recorded measurement has 3 significant figures. 2 certain plus one estimated. |

The *volume* of a liquid can be directly measured with specialized glassware, typically in units of milliliters (mL) or liters (L). Note that when measuring liquid volumes, it is important to read the graduated scale from the lowest point of the curved surface of the liquid, known as the liquid *meniscus*.

|  |  |
| --- | --- |
|  | Here, the graduated cylinder markings are every 1-milliliter. When read from the lowest point of the meniscus, the correct volume reading is 30.0 mL.  The first 2 digits **30** are known exactly. The last digit **0** is uncertain. Even though it is a zero, it is significant and must be recorded.  The recorded measurement has 3 significant figures. 2 certain plus one estimated. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Have each person in your group record each of the measurements below. Don't forget to measure to one place of uncertainty AND include units. For each measurement, indicate the number of significant figures. It is OK if you and your partner estimate the last digit differently. | | | | |
|  | **Partner 1** | | **Partner 2** | |
| **Measurement** | **Significant Figures** | **Measurement** | **Significant Figures** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Be careful! Measure from the top down! |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**▢ Review how to count significant figures**

As you saw above, in any measurement, the number of significant figures in a measurement is the number of digits believed to be correct by the person doing the measuring. It includes all the known digits plus one estimated digit.

If you are the person recording the measurement, the number of significant figures is easy to identify. But, what if you are looking at someone else’s measurement? The rules for determining the number of significant figures in a measurement are as follows,

|  |  |
| --- | --- |
| **Rule** | **Example** |
| Leading zeros are never significant | 000512 has 3 significant figures  0.000512 has 3 significant figures |
| Trapped zeros are always significant | 1001 has 4 significant figures  1.00201 has 6 significant figures |
| Trailing zeros are significant only if the decimal point is specified | 500 has 1 significant figure  10100 has 3 significant figures  100.00 has 5 significant figures |

|  |  |
| --- | --- |
| Discuss with your partner the number of significant figures in each of the measurements below. Record the value you both agreed upon. | |
| **Measurement** | **Number of significant figures** |
| 124501 |  |
| 0.00100 |  |
| 500.00 |  |
| 300.0100 |  |
| 500 |  |

**▢ Complete the measurement challenges**

You have been assigned to a group that represents a diverse set of interests. Within your group,

* Introduce yourself
* Explain the thing you know a lot about
* Teach your group something about it, or tell the group something interesting about it
* Have each person in the group indicate their name and their thing below.

|  |  |
| --- | --- |
| **Name** | **Thing** |
|  |  |
|  |  |
|  |  |
|  |  |

**▢ Brainstorm technological innovations**

People seem to say that technology is all around us, that it affects everything we do. Is that true? Technological innovation is about recognizing a problem that needs to be solved, or recognizing something that needs improving and then building a tool to solve it.

Go around the group, and for each individual's area of interest:

* Identify how technology affects your thing
* Then, make a suggestion for how technology could be applied to improve or solve a problem with your thing

|  |  |  |
| --- | --- | --- |
| **Thing** | **How is technology used with or affects the thing** | **How might technology be used to improve or solve a problem with the thing** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**▢ Nominate an idea**

As a group you have just brainstormed about technology ideas. Now, come together and get excited about one of them. As a group, nominate the idea you’ve discussed that you think would be the most interesting to everyone else in the class. Complete the questions below.

|  |  |
| --- | --- |
| **Innovation:** | |
| **What does the technological innovation enable you to do?** |  |
| **What is the task you want to improve?** |  |
| **How do people currently do the task that you are wanting to improve?** |  |
| **What is a problem or issue with the way this task is done and how does your innovation solve or make it better?** |  |
| **What new problems are created by your innovation?** |  |

**▢ Brainstorm an infographic**

An infographic is a collection of imagery, charts, and minimal text that gives an easy-to-understand overview of a topic. Check out the link below to learn more about infographics,

[https://venngage.com/blog/what-is-an-infographic/#1](https://venngage.com/blog/what-is-an-infographic/" \l "1)

Now that you have explored infographics, you will create an infographic of your idea. The infographic you create must convey the following information,

* The name of your innovation
* The thing your innovation impacts
* How your innovation works to improve your thing

Feel free to jot down ideas or sketches in the space below:

|  |
| --- |
| **Brainstorming and notes** |
|  |

**▢ Create your infographic**

To create your infographic we will be using Jamboard. To get started, navigate to the link below,

<https://jamboard.google.com/d/1O_rndWhVuCSWSLnponSi9POYal3uv2LvqNsTgSEVlpg/edit?usp=sharing>

Locate the frame number that corresponds to your group, then double click on the “Names” sticky and add the names of all group members.

Now you can get creative and create your infographic!

**▢ Receive Credit for the group portion of this lab**

Make sure indicate the names of all group members on this lab, the Project Manager is charge of submitting this lab