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| **Set 0. Bits and Bytes** |

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| **Skill 0.01: Describe how computers represent data**  **Skill 0.02: Be able to correctly record a measurement**  **Skill 0.03: Understand the relationship between equipment accuracy and reported measurements.** |

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| **Skill 0.01: Describe how computers represent data** |

**Skill 0.01 Concepts**

When we look at a computer, we see text and images and shapes. To a computer, all of that is just binary data, or 1s and 0s. The following 1s and 0s for example represent a tiny GIF.



This next string of 1s and 0s represents a command to add a number:



You might be scratching your head at this point. Why do computers represent information in such a hard to read way? And how can 1s and 0s represent so many different things? That's what we'll explore in this lesson.

To start off, check out the next video from Code.org where engineers from Microsoft and Adafruit introduce the basics of bits and binary data.

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| <https://youtu.be/ewokFOSxabs> |

Computers store information using bits. A **bit** (short for "binary digit") stores either the value 0 or 1.

A single bit can only represent two different values. That's not very much, but that's still enough to represent any two-valued state. The following represent information that could be stored in a single bit,

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**Skill 0.01 Example 1**

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| Identify the measuring device. Then identify the quantity (length, mass, volume, etc) and corresponding unit that could be used to describe measurements taken with the following instruments: |
| |  |  |  |  | | --- | --- | --- | --- | | Object | Device | Quantity | Unit | |  |  |  |  | |  |  |  |  | |  |  |  |  | |

[**Skill 0.01 Exercise 1**](https://hpluska.github.io/Chemistry/ticketOutTheDoor/Set0TicketOutTheDoorChemistry.pdf)

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| **Skill 0.02: Be able to correctly record a measurement** |

**Skill 0.02 Concepts**

A measurement must always reflect the accuracy of the measuring instrument.

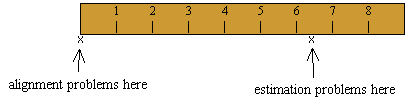
Sample 1:



cm

You can see that the measurement is somewhere in between 3 and 4 cm. It appears to be *about* half-way and so you might record the measurement as 3.5 cm or 3.4 cm. Notice the last digit is estimated, but is still included.

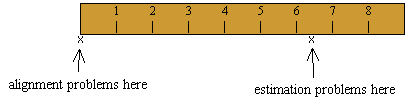
Sample 2:



cm

This measurement is between the 0 and 1 and so you might record the measurement as 0.3 cm or 0.4 cm. Notice that in both measurements the only digit recorded is estimated.

Sample 3:



cm

This measurement appears to be exactly on the 3. However it should be reported as 3.0 cm NOT simply 3. This is because every measurement taken with this device can be recorded to the tenths. 3.0 cm reflects the accuracy of the instrument whereas 3 does not.

**Skill 0.02 Example 1**

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| Record the measurement for each of the following (INCLUDE UNITS!) | | |
| (a) | (b) | (c) |

[**Skill 0.02 Exercise 1**](https://hpluska.github.io/Chemistry/ticketOutTheDoor/Set0TicketOutTheDoorChemistry.pdf)

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| **Skill 0.03: Understand the relationship between equipment accuracy and reported measurements.** |

**Skill 0.03 Concepts**

The number of digits in a measurement can be used to communicate information about the measuring device used to take the measurement.

Consider the two rulers shows.

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| A | cm  5.0 5.1 5.2 5.3 | A measurement taken with ruler A should be reported as 5.00 cm. |
| B | cm  5 6 7 8 | A measurement taken with ruler B should be reported as 5.0 cm. |

Evaluation of the measurements indicate that ruler A provides the most accuracy. Had the 2 zeros beyond the five not been recorded on the other hand, it would have appeared that ruler B was the more accurate measuring device.

Measurement A = 5.00 cm

Measurement B = 5.0 cm

**Skill 0.03 Example 1**

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| For each data set, identify the measurement taken from the most accurate measuring device. | | |
| (a) 1.0 g, 1.00 g, 1.000 g | (b) 12 cm, 123 cm, 1234 cm | (c) 1 g, 0.1 g, 0.01 g, 0.001 g |

[**Skill 0.03 Exercise 1**](https://hpluska.github.io/Chemistry/ticketOutTheDoor/Set0TicketOutTheDoorChemistry.pdf)