Units, Dimension, and Scale

Professors David Ruth and David Puelz

The University of Austin

Units, Dimension, and Scale

Goals:

- Review notions of unit, dimension, and scale
- Explore arsenic case study
- Program in Python

Zaslow Appendix 5 (review/learn)

- 5.1: Units
- 5.2: Scientific notation
- 5.3: Scientific notation under operations

Some practical instances (estimate value with appropriate unit)

- US Gross Domestic Product
- Avagadro's number
- number of calculations a supercomputer performs in a day
- chance of winning this week's Powerball jackpot
- charge on an electron
- number of cells in a liver

Intensive vs. extensive properties

The physical properties of a system can be classified into two categories:

- **Extensive properties** depend on the mass of a system.
- **Intensive properties** are independent of the mass of a system.

Examples of each?

Intensive vs. extensive properties

The physical properties of a system can be classified into two categories:

- **Extensive properties** depend on the mass of a system.
- **Intensive properties** are independent of the mass of a system.

Examples of each?

See https://sciencenotes.org/intensive-extensive-properties/ for more on this.

Zaslow Ch. 4 - Should I worry about arsenic (As) in rice?

Zaslow Ch. 4 - Should I worry about arsenic (As) in rice?

Do you you have a prior opinion?

Zaslow Ch. 4 - Should I worry about arsenic (As) in rice?

Do you you have a prior opinion?

What are the possible responses?

Zaslow Ch. 4 - Should I worry about arsenic (As) in rice?

Do you you have a prior opinion?

What are the possible responses?

What would it take for you to favor a particular respone?

Zaslow Ch. 4 - Should I worry about arsenic (As) in rice?

Do you you have a prior opinion?

What are the possible responses?

What would it take for you to favor a particular respone?

What are the key subquestions to answer?

Zaslow Ch. 4 - Should I worry about arsenic (As) in rice?

Do you you have a prior opinion?

What are the possible responses?

What would it take for you to favor a particular respone?

What are the key subquestions to answer?

- How much As do I ingest associated with rice consumption?

Zaslow Ch. 4 - Should I worry about arsenic (As) in rice?

Do you you have a prior opinion?

What are the possible responses?

What would it take for you to favor a particular respone?

What are the key subquestions to answer?

- How much As do I ingest associated with rice consumption?
- Is that quantity of As enough to worry about?

Example: ppm

Quantities of As in water are are measured in parts per million, or ppm.

Example: ppm

Quantities of As in water are are measured in parts per million, or ppm.

$$\text{ppm} = (\text{mass of solute})/(\text{mass of solution})$$

Example: ppm

Quantities of As in water are are measured in parts per million, or ppm.

$$\text{ppm} = (\text{mass of solute})/(\text{mass of solution})$$

Note: "ppm" is technically unitless; i.e.,

$$1 \text{ ppm} = 1 \text{ mg/kg}$$

Example: ppm

Quantities of As in water are are measured in parts per million, or ppm.

$$\text{ppm} = (\text{mass of solute})/(\text{mass of solution})$$

Note: "ppm" is technically unitless; i.e.,

$$1 \text{ ppm} = 1 \text{ mg/kg}$$

For water solution with neglible solute mass,

$$\text{ppm} = 1 \text{ mg/L}$$

Zaslow Ch. 4 - Should I worry about arsenic (As) in rice?

SHIFT TO WHITEBOARD

Python programming

Two programs today:

- Simple program that triples and input and generates formatted output.

- Documented program that performs conversion similar to assigned problem.