UNITS IN PHYSICS

PES 1000 – PHYSICS IN EVERYDAY LIFE

WHY ARE UNITS IMPORTANT?

- Units allow us to quantify physical measurements
- Units allow us to compare physical quantities across all branches of science
- We can study physical relationships without units, but we need units to relate the physics to our everyday experiences
- We can check the correctness of formulas by finding if the units properly combine
- Units can be accurately standardized so that many people can compare their results

CONSIDERATIONS WHEN CHOOSING A SET OF UNITS

- Completeness: The units should be able to characterize all measurable physical properties
- Independence: There should be no overlap
  - Two distinct units shouldn't depend on the same physical property
- Measurability: It should be possible to accurately measure something to base a standard unit upon
  - It is better that the something be a property of nature, not an artifact, or man-made object
- Usability: Units should be of a reasonable size relative to typical properties measured
  - Not too big, not too small
- Scalability: Conversion between different scales of objects should be convenient (powers of 10)

THE INTERNATIONAL SYSTEM OF UNITS

- **Called the S.I. units (for Système International** d 'unites)
- Adopted by all of the countries in the world except three
- Conversions involve powers of ten (moving the decimal point): 1000. meters is 1.000 kilo-meters
- Based on physical measurements of nature that can be performed by anyone
  - Not based on physical artifacts (Exception: the kilogram)
    - *This changes on 20-May-2019, when the kilogram will be defined in terms of the Planck constant, the meter, and the second.*

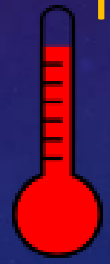
THE INTERNATIONAL SYSTEM OF UNITS

Length – the meter (m)

Intensity – the candela (cd)

Temperature – the Kelvin (K)

Mass – the kilogram (kg)



Time – the second (s)

Amount of substance – mole (mol)

Current – the Ampere (A)

THE U.S. CUSTOMARY UNITS

- Formerly called British or English units
- Only used in the United States of America, Liberia, and Burma
- Originally based on the general size of easily available ‘items’
  - Foot – based on an average foot size
  - Inch – about the size of the first knuckle of a finger
  - Yard – approximately the size of a stride
  - Hand (for measuring horses) – the width of an average hand
  - Fahrenheit – This temperature scale is suited to the comfort levels of people
- Requires memorizing conversion factors: 12 inches is a foot, 5280 feet in a mile, 3 feet in a yard, etc.

CONCLUSION

- This class will be primarily concerned with SI units
- All formulas given (unless otherwise stated) will assume SI units
- I'll also occasionally present US Customary units and their relation to SI units to give those of us raised with our antiquated unit system a sense of their SI system equivalents