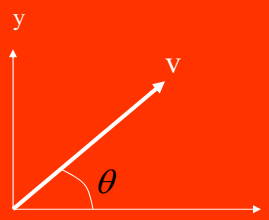
# PHYS 210 - General Physics I

30 Aug 2019




## GP I – 30 Aug 2019

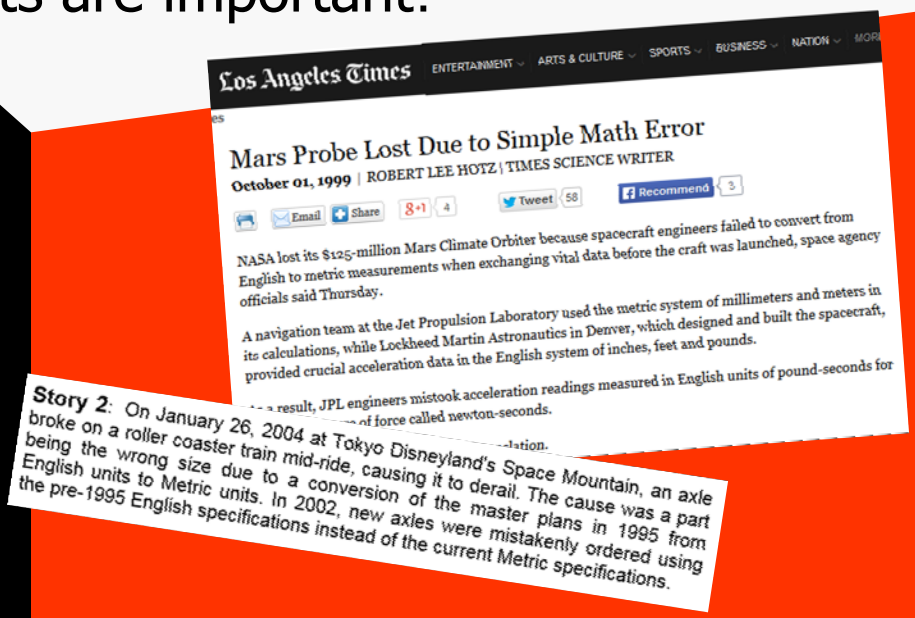
- *Business:* student info sheets, PreLab quiz + Pre-Post Assessment on Canbvas
- Syllabus questions?
- Syllabus quiz
- Unit conversion - "chain link conversion"
- Motion diagrams
- Vectors – a first look
- Speed vs. Velocity

# HW 02

***Due Monday, 6 PM***
***– what if I'm not in my office?***

- **See Website after Class!!**
- **Ex Cr:** One litre of red dye molecules is dumped in the ocean from a bottle. The ocean is given a really good stir and one litre of the well-mixed seawater is scooped up in the bottle. About how many dye molecules will now be in the bottle?

# Units are important!



Los Angeles Times ENTERTAINMENT ARTS & CULTURE SPORTS BUSINESS NATION

Mars Probe Lost Due to Simple Math Error

October 01, 1999 | ROBERT LEE HOTZ | TIMES SCIENCE WRITER

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NASA lost its $125-million Mars Climate Orbiter because spacecraft engineers failed to convert from English to metric measurements when exchanging vital data before the craft was launched, space agency officials said Thursday.

A navigation team at the Jet Propulsion Laboratory used the metric system of millimeters and meters in its calculations, while Lockheed Martin Astronautics in Denver, which designed and built the spacecraft, provided crucial acceleration data in the English system of inches, feet and pounds.

a result, JPL engineers mistook acceleration readings measured in English units of pound-seconds for of force called newton-seconds.

lation.

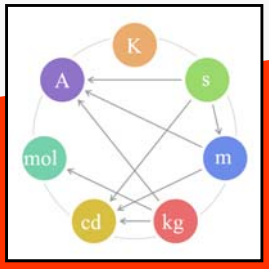
**Story 2**: On January 26, 2004 at Tokyo Disneyland's Space Mountain, an axle broke on a roller coaster train mid-ride, causing it to derail. The cause was a part being the wrong size due to a conversion of the master plans in 1995 from English units to Metric units. In 2002, new axles were mistakenly ordered using the pre-1995 English specifications instead of the current Metric specifications.

# Metric Prefixes

"short scale" vs. "long scale"
[$10^9$ = billion vs. $10^{12}$ = million]

| | | | |
|---|---|---|---|
| exa | E | 1 000 000 000 000 000 000 | $10^{18}$ |
| peta | P | 1 000 000 000 000 000 | $10^{15}$ |
| tera | T | 1 000 000 000 000 | $10^{12}$ |
| giga | G | 1 000 000 000 | $10^{9}$ |
| mega | M | 1 000 000 | $10^{6}$ |
| kilo | k | 1 000 | $10^{3}$ |
| hecto | h | 100 | $10^{2}$ |
| deca | da | 10 | $10^{1}$ |
| (none) | (none) | 1 | $10^{0}$ |
| deci | d | 0.1 | $10^{-1}$ |
| centi | c | 0.01 | $10^{-2}$ |
| milli | m | 0.001 | $10^{-3}$ |
| micro | μ | 0.000 001 | $10^{-6}$ |
| nano | n | 0.000 000 001 | $10^{-9}$ |
| pico | p | 0.000 000 000 001 | $10^{-12}$ |
| femto | f | 0.000 000 000 000 001 | $10^{-15}$ |
| atto | a | 0.000 000 000 000 000 001 | $10^{-18}$ |

# SI Base Units




| Physical Quantity | Name of Unit | Symbol |
|---|---|---|
| Length | Meter | m |
| Mass | Kilogram | kg |
| Time | Second | s |
| Temperature | Kelvin | K |
| Electric Current | Ampere | A |
| Luminous Intensity | Candela | cd |
| Amt. of substance | mole | mol |

## Derived Units

- Derived units are combinations of Base Units for other physical quantities
- Examples:
  - Speed: m/s, Acceleration: $m/s^2$
  - Force: 1 N = 1 Newton = kg $m/s^2$
  - Energy: 1 J = 1 Joule = 1 kg $m^2/s^2$
  - Electric Field: 1 N/C= 1 (kg m)/(A $s^3$)

See inside front cover of the text!

## Unit Conversion


- How many seconds are in a year?
- 80 miles is how many meters? Kilometers?

Note use of scientific notation!!

# Dimensional Analysis

- Often we can make reasonable calculations of quantities by examining the units (dimensional analysis) and finding a way to combine them to get what we want.
- Examples:
  - It's 80 miles to South Bend. If a car gets 24 mpg, how many gallons will it take to get there? If gas costs $2.60 per gallon, how much will the trip cost?
  - U.S. "proved" oil reserves are estimated (2017) to be about 39.2 billion bbl (bbl = barrels). How many years will these reserves last at our current consumption rate of about 20.45 million bbl/day (2018 data)?

# Have a nice weekend