Read 2.1-2.4

If cannot log into webassign see me

Start "test" clickers next lecture

Extra syllabus at front

Video lectures linked from class web page

H.W #1 Available Friday

Counted correct if within 5% of answer
unless specified do not use correct # of
significant digits
use many digits in answer

i.e
True answer 0.37451
You answer 0.4
more than 5% off and will be
counted wrong

chapter 1

- scientific notation
- significant digits
- units
- estimating
- Dimensional analysis

What is Physics?

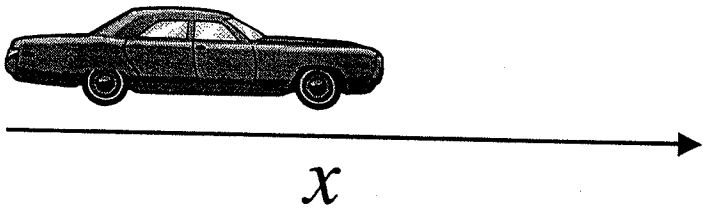
An *experimentally* based science with a goal of understanding and explaining the *fundamental* principles that govern the physical universe.

"The goal of physics is to predict the future."

–Dr. C. Fronsdal

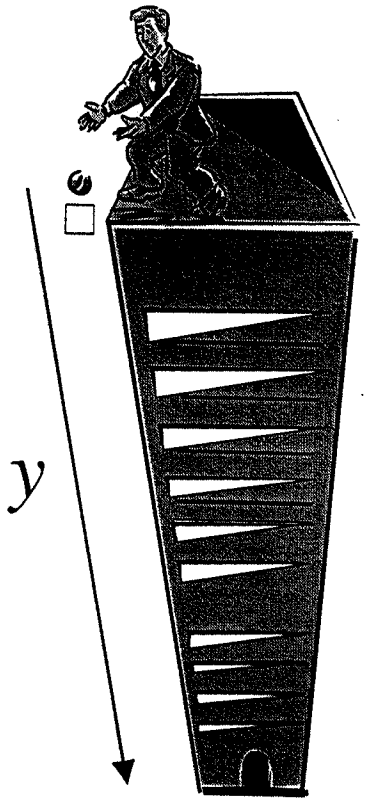
Physics and Mathematics

Equations have meaning:



$x = vt$

x



y

Equations allow quantitative reasoning:

$$y = \frac{1}{2} g t^2$$

Physics Has a Few Major Themes:

This semester:

1. Kinematics (how objects move)
2. Dynamics (why objects move)
3. Conservation of Energy
4. Conservation of Momentum

and other ideas usually developed from the major themes.

When solving problems, look for the big idea first.

Units

A number without units is meaningless:

"I'm driving with a speed of 30."

We usually use the International System of Units (Système International (SI)) units.

Length: meter (m)
Time: second (s)
Mass: kilogram (kg)

Problem: You are traveling 65 miles/hour.
How fast is this in ft/second? meters/second?

$$\left(\frac{65\ \text{mi}}{1\ \text{hr}}\right)\left(\frac{5280\ \text{ft}}{\text{mi}}\right)\left(\frac{1\ \text{hr}}{3600\ \text{s}}\right)$$

$$95\ \text{ft/s}$$

$$\left(\frac{95\ \text{ft}}{\text{s}}\right)\left(\frac{12\ \text{in}}{\text{ft}}\right)\left(\frac{2.54\ \text{cm}}{\text{in}}\right)\left(\frac{1\ \text{m}}{100\ \text{cm}}\right)$$

$$29\ \text{m/s}$$

Problem: You are traveling 30 meters/second. How far do you travel in one hour?

$$\left(\frac{30\,m}{s}\right) / \text{hour} \Rightarrow \frac{30\,m\text{-hour}}{s}$$

$$\left(\frac{30\,m}{s}\right)\left(\frac{3600\,s}{\text{hour}}\right) \Rightarrow 108{,}000\,\frac{m}{\text{hour}}$$

$$\left(\frac{108{,}000\,m}{\text{hour}}\right)\left(1\,\text{hour}\right)$$

$$\boxed{108{,}000\,m}$$

Problem: A swimming pool is filled with 16,000 cubic feet of water

How many cubic meters is this?

$$16{,}000\ \text{ft}^3 \left(\frac{12\ \text{in}}{1\ \text{ft}}\right)\left(\frac{12\ \text{in}}{1\ \text{ft}}\right)\left(\frac{12\ \text{in}}{1\ \text{ft}}\right)$$

$$\left(\frac{2.54\ \text{cm}}{1\ \text{in}}\right)\left(\frac{2.54\ \text{cm}}{1\ \text{in}}\right)\left(\frac{2.54\ \text{cm}}{1\ \text{in}}\right)$$

$$\left(\frac{1\ \text{m}}{100\ \text{cm}}\right)\left(\frac{1\ \text{m}}{100\ \text{cm}}\right)\left(\frac{1\ \text{m}}{100\ \text{cm}}\right)$$

$$453.069\ \text{m}^3$$

$$\boxed{450\ \text{m}^3}$$

SIGNIFICANT DIGITS

- Non zero digits significant 1349.6

- Final or zeros to right of decimal significant 3.000

- zeros for spacing not significant 0.0004

- zeros between significant numbers significant 30.0004

IDENTIFY Number of significant digits and rewrite in scientific notation

a) 0.00574 kg — 3 — 5.74×10^{-3} kg

b) 2 m — 1 — 2×10^{0} m

c) 0.450×10^{-2} m — 3 — 4.50×10^{-3} m

d) 45.0 kg — 3 — 4.5×10^{1} kg

e) 10.09×10^{4} s — 4 — 1.009×10^{5} s

f) 0.9500×10^{3} mL — 4 — 9.500×10^{2} mL

g) 10.m

Rules

multiplying

Answer has as many significant digits as number with least number of sig. digits

$3.2 \times 5.63 = 18.016$

$= 18$

- adding/subtracting

number of decimal places in answer = number with smallest number of decimal places

$3.26 + 4.3 = 7.56 = 7.6$

Calculate using correct number of significant digits

a) $3.783 \times 10^6 + 1.25 \times 10^8$

$1.28783 \times 10^8 = 1.29 \times 10^8$

37830000
125*00000
128

b) $3.783 \times 10^6 \div 3.0 \times 10^{-2}$

$1.261 \times 10^8 \Rightarrow 1.3 \times 10^8$

c) $6.12 \times 10^{-5} + 3.9 \times 10^{-7}$

6.159×10^{-5}

0.0000612?
0.0000039
0.0000615*

6.16×10^{-5}

Ratios / scaling

Circle of radius r

increase radius by 20%

How much larger is Area?

$$A_{orig} = \pi r_{orig}^2$$

$$A_{new} = \pi r_{new}^2$$

$$r_{new} = r_{orig} + .2 r_{orig} = r_{orig}(1 + 0.2)$$

$$r_{new} = 1.2\, r_{orig}$$

$$A_{new} = \pi r_{new}^2 = \pi (1.2\, r_{orig})^2$$

$$\frac{A_{new}}{A_{orig}} = \frac{\pi (1.2)^2 r_{orig}^2}{\pi r_{orig}^2} = (1.2)^2 = 1.44$$

$$\frac{A_{new}}{A_{orig}} = 1.44$$

$$\boxed{A_{new} = 1.44\, A_{orig}}$$