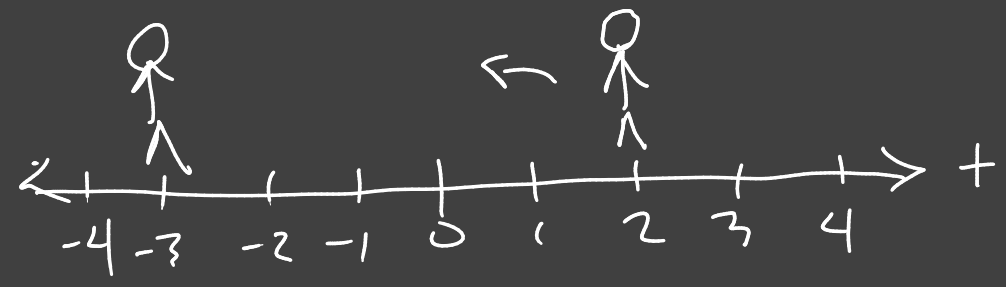
Physics for Society - PHYS 100

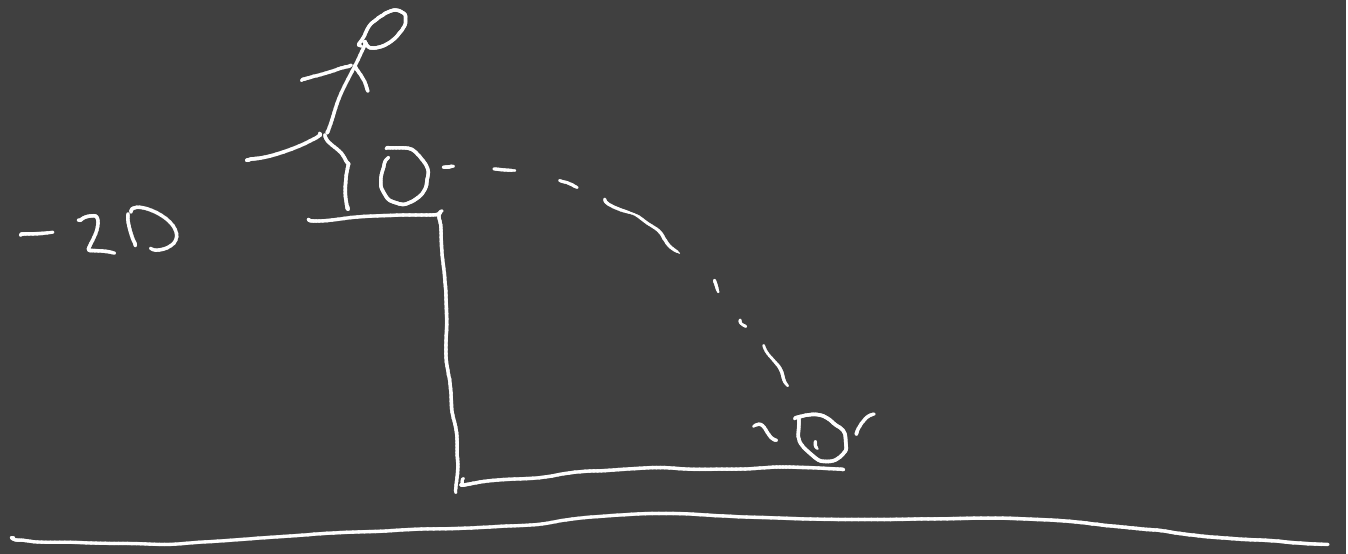
Chapter 1

Measurement

- length → dimension
  - 1D



  - 2D



  - meters

- mass
  - grams

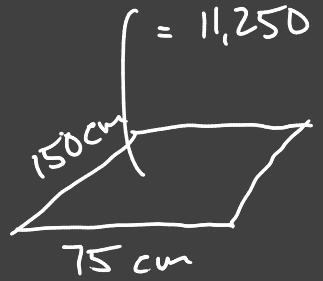
- time
  - seconds

Milli	Centi	Deci	Base	Deca	Hecto	Kilo
1/1000	1/100		1			1000
mm	cm		meter			km
mg			gram			kg
ms			second			

$A = l \cdot w$

$A = (150\text{cm}) \cdot (75\text{cm})$

$= 11{,}250\ \text{cm}^2$



So how do we convert from one to another?

by Chain method

- 10 meters → centimeters

$$\frac{10\ \text{meters}}{1} \cdot \underbrace{\frac{100\ \text{cm}}{1\ \text{meters}}}_{=1} = 1{,}000\ \text{cm}$$

- 1200 milligrams → kilograms

$$1200\ \text{mg} \cdot \frac{1\ \text{g}}{1000\ \text{mg}} \cdot \frac{1\ \text{kg}}{1000\ \text{g}} = .0012\ \text{kg}$$

What about imperial units?

? in = 5 mi

5280 ft = 1 mile

1 ft = 12 in

$$5\ \text{mile} \cdot \frac{5280\ \text{ft}}{1\ \text{mi}} \cdot \frac{12\ \text{in}}{1\ \text{ft}} = 316{,}800\ \text{in}$$

What about areas and volumes?

$$11{,}250\ \text{cm}^2 \cdot \frac{(1\ \text{m})^2}{(100\ \text{cm})^2} = 1.125\ \text{m}^2$$

What about time and rates?

60 miles per hour (speed)

$$60\ \frac{\text{mile}}{\text{hour}} \cdot \frac{5280\ \text{ft}}{1\ \text{mi}} \cdot \frac{12\ \text{in}}{1\ \text{ft}} \cdot \frac{1\ \text{hour}}{60\ \text{min}} \cdot \frac{1\ \text{min}}{60\ \text{sec}} = 1{,}056\ \frac{\text{in}}{\text{sec}}$$

Scientific Notation

to make big or small numbers easier to compare

Ex. which number is bigger?

1.87×10^{8} ← 187001280 or 815620000.01 → 8.16×10^{7}

order of magnitude

100,000,000,000 or 10,000,000,000

1.5×10^{7} or 8.6×10^{4}

6.1×10^{-5} or 1.38×10^{-11}

0.00000000000138

1.53872158E21

1.54×10^{21}

Significant Figures - estimate of uncertainty

$A = l \cdot w$

$A = (150\,cm) \cdot (75\,cm)$

$= 11{,}250\,cm^2 \rightarrow 11{,}000\,cm^2$

1.58692135

1.58692136

Accuracy vs precision in measurement

- close to the "true value" or reality
- randomly high or low of the true value
  - but on average true

- exactness to a high degree
- incorrect of off from the true value by a repeatable and systematic amount