Physics 201
Profs Coppersmith + Smith

Account reserves
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Measurements

Length (1 inch = 2.54 cm)
Time (seconds)
Mass (kilogram (1 lb → .454 kg))

Dimensional Consistency

Physics quantity = # + unit

$S = Vt$

S = distance = 10 m
V = speed = 2 m/s
t = time = 5 sec

$10\,m = 2\,\frac{m}{s} \times 5\,s$

Useful check ✓

Require units for all answers.

Conversion of units

$50\,\frac{km}{hr}$ into $\frac{meters}{second}$

multiply by $\frac{1}{1}$ $\frac{1}{1}$

$50\,\frac{km}{hr} = 50\,\frac{km}{hr} \times \left(\frac{1000\,m}{1\,km}\right) \times \left(\frac{1\,hr}{3600\,s}\right)$

$= 13.9\,m/s$ (sig figs!)

Any measured (experimental) number has an error = how well it is measured

Length of Bridge

$l = (3.58 \pm .02) \times 10^3$ ft

fractional error = .0056
= .02/3.58

Percent error = .56%
(mult frac error x 100)

Absolute error:
$.02 \times 10^3$ ft = 20 ft

Explicit Errors

Implicit Error:
6.2 means real
Value is b/w 6.15
and 6.24999...

Significant figures
Scientific Notation

Example:
Mass of earth = 5.98×10^{24} kg
Radius of earth = 6.38×10^6 m

Density = ? (uniform)
= Mass / Volume
Volume = $\frac{4}{3}\pi r^3$ =

$\frac{4}{3} \times 3.141 \times (6.38 \times 10^6 \text{ m})^3$

$= 1.087252515 \times 10^{21} \text{ m}^3$
Adjute

Density in kg/m^3

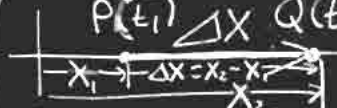
$\rho = \frac{m}{V} = \frac{5.98 \times 10^{24} \text{ kg}}{1.087 \times 10^{21} \text{ m}^3}$

$D = 5\,50 \times 10^3\ kg/m^3$
$(5,500\ kg/m^3)$
Keep sig fig + 1 internally, then put final ans. in correct sig figs

Does answer make sense?
$D = m/V$ Take values $\to 0$ or $\infty \Rightarrow$ answer)

Motion on a straight line

Average Velocity

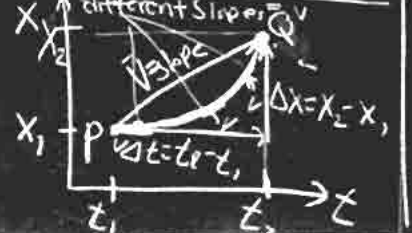


Start at P at t_1
finish at Q at t_2
Displacement from P to Q during time interval $\Delta t = t_2 - t_1$

Displacement $= \Delta X = X_2 - X_1$

Average Velocity

$$\bar{V} = \frac{X_2 - X_1}{t_2 - t_1} = \frac{\Delta X}{\Delta t}$$



If
Define $x_1 = 0, t_1 = 0$
$x = x_2, t = t_2 \Rightarrow$
$\bar{V} = x/t \Rightarrow x = \bar{V}t$

Instantaneous Velocity

$V = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} \Rightarrow V = \frac{dx}{dt}$

happens at a point
Slope at a point = V