Terminal Velocity Lab

- Results - raw data
  - sample graph (v-t) for 1 trial (stats)
    - label as to what trial | # of filters.
  - data table

coffee	mass	Terminal velocity: Trial 1	2	...	5	Mean
1						
2						
3						
4						
5						

- Data Presentation
  - graph v vs m
- Analysis of the raw data
  - What relationship might the data suggest? (proportionality)
- Data Processing
  - new data table with modified data.

mass	modified terminal v

- Presentation and Analysis of Processed Data
  - Graph (hopefully linear)
  - find slope and y-intercept (with uncertainties
  - write a final equation

$v^2 \propto m$

$v^2 = (\text{slope})$

$g v^2 = (\text{slope})$

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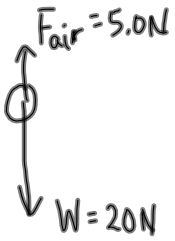
Resultant Forces

- A resultant force is just the sum of all forces acting on a body. You need to do vector addition!
- Sometimes it is referred to as the net force or total force.

Example

Determine the resultant force acting on a 20N weight which is falling through the air. The force of air resistance is 5.0N upwards.



$\vec{F}_{net} = \vec{F}_{air} + \vec{W}$

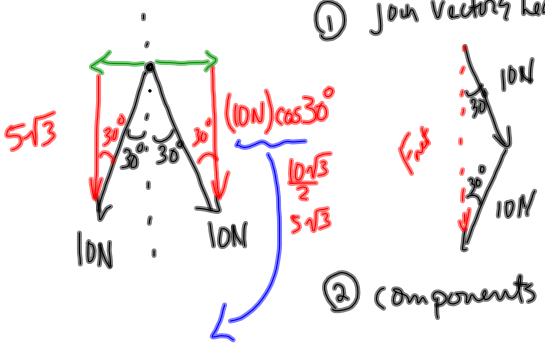
$\vec{F}_{net} = 20N\,[down] + 5.0N\,[up]$

$\vec{F}_{net} = 15N\,[down]$

Example

Two forces, each 10N, act downwards on a nail. One force is inclined at 30° to the left of vertical and the other is inclined at 30° to the right of vertical. What is the resultant force?

① join vectors head to tail



② components (easier -> right triangles)

$\cos\theta = \frac{adj}{hyp}$

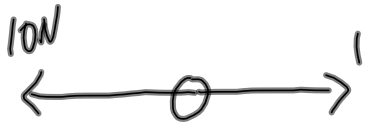
$adj = (10N)\cos 30°$

$5\sqrt{3} + 5\sqrt{3} = (10\sqrt{3})_N = 17N$

$\vec{F}_{net} = 17N\,[down]$

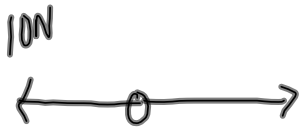
Balanced and Unbalanced Forces

Balanced: If two or more forces acting on a body add to zero, the forces are said to be balanced.



$\vec{F}_{net} = 0$

Unbalanced: If one or more forces acting on a body add to a non-zero force, the forces are said to be unbalanced.



$\vec{F}_{net} = 2N\ [right]$

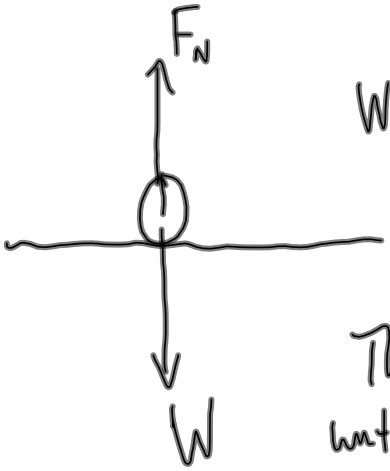
Newton's First Law of Motion

A body at rest will remain at rest, and a body which is moving will continue to move with a constant speed in a straight line, unless acted upon by an unbalanced force.

i.e. $\vec{F}_{net} = 0$ then $\vec{a} = 0$

(forces are balanced) (not moving or constant velocity)

Consider a ball resting on a table:



$W = F_N$ ∴ the forces are balanced and $\vec{F}_{net} = 0$ and $\vec{a} = 0$

The ball will remain at rest until there is an unbalanced force acting on it.