# Newton's 2nd Law Notes

- Net forces cause acceleration
- mass resists acceleration (changes in motion)

$F = ma$ $\qquad$ $F = Ma$

- Newton's 2nd Law $\qquad$ $\underline{\underline{F_{net} = ma}}$

ex: $m = 2000\,kg$
$a = 1.5\ m/s^2$
what force is needed?

$F = ma$
$F = (2000\,kg)(1.5\,\frac{m}{s^2})$
$F = 3000\,kg \cdot \frac{m}{s^2}$
$\downarrow$
$F = 3000\,N$

$\boxed{\text{Note}}$ $1\,\text{Newton} = 1\,kg \cdot 1\,\frac{m}{s^2}$

## Balanced Forces

20N ← □ → 20N

- no net force
- no acceleration
- no <u>change</u> in motion
- could be at rest <u>OR</u> at constant speed.
- at equilibrium

## Unbalanced Forces

5N ← □ → 20N

- net force = 15 N, right
- acceleration to right
- if moving right, object speeds up
- if moving left, object slows down.

## A special case...

$$F = ma$$

When the acceleration of the object is due to gravity, the <u>force</u> it applies to the ground is called <u>weight</u>.

$$F = ma$$

Weight ↑ gravity ↖

$$W = mg$$

Weight is a force and will be measured in Newtons.

## Skydiving

jump


unbalanced — acceleration ↓


unbalanced — acceleration ↓


balanced — constant speed (terminal velocity)

pull parachute cord


unbalanced — acceleration ↑


balanced — constant speed

hit ground


unbalanced — acceleration ↑