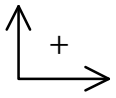
P11 - 3.1 - $F = ma$ Newton's Laws Notes



Force - A Push or pull

Four Fundamental Forces
1.Gravitational P11
2.Electromagnetic (e^-)
3.Strong Nuclear (keeps p^+ in nucleus)
4.Weak Nuclear (Radioactive Decay)

Force of Gravity - Attracts Matter to Matter
Matter - Anything that has Mass and takes up space.
Mass - Amount of Matter an object holds
Weight - The force of Gravitational Attraction

Mass is **constant** throughout the universe.
Weight **depends** on your location. (Earth, Moon, Space …)
g, depends on the m of the planet and d from it's centre

Units: Newton's (N)

$1\ Newton: The\ force\ required\ to\ accelerate\ a\ 1kg\ object\ at\ 1\frac{m}{s^2}.$

$$1N = \frac{1kgm}{s^2} \qquad F = ma \qquad N = kg\frac{m}{s^2}$$

Newton's 3 Laws:

Including at rest

1 Inertia - An object will continue at a constant velocity, unless acted upon by a non-zero sum force.

$F_{net} = ma$

2 The sum of the forces in the direction of motion, minus opposing forces.

$$\Sigma F = ma$$
$$F_a - F_f = ma$$

(Winners minus losers.)

Tug of War

3 Every force has an equal and opposite force. (You push me, I push back)

The Gravitational Force: $F_g = mg$

$F_g: Force\ of\ Gravity, (Gravitational\ Force)$
$m: Mass$
$g: Gravity$

$g = -9.8\frac{m}{s^2}$

$\frac{N}{kg} = \frac{m}{s^2}$

$What\ is\ the\ Pull\ Force\ required\ to\ accelerated\ a\ 15kg\ object\ at\ 2\frac{m}{s^2}?$

1 $a = 2\frac{m}{s^2}$, $F_p = ?$, 15

$F_n: Normal\ Force\ (Weight)$
$F_p: Force\ Pull$
$F_f: Force\ of\ Friction$

2 FBD Free Body Diagram:

$F_n = F_g^*$
$F_n = 147N$

$F_n = F_g^*, \theta = 0$

$F_f = 0$, $F_p = ? = 30N$

$F_g = mg$
$F_g = 15 \times 9.8$
$F_g = 147\ N$

$g = 9.8\frac{m}{s^2}$

$+ve\ downward!$

$F = ma$
$F = (15)(2)$
$F = 30\ N$

3
$F_{net} = ma$
$F_p - F_f = ma$
$F_p - 0 = 15 \times 2$
$F_p = 30\ N$

We were actually supposed to subtract a non-existent Frictional Force.

1st

$What\ is\ the\ Pull\ Force\ required\ to\ Accelerated\ a\ 15kg\ object\ at\ 2\frac{m}{s^2}, with\ a\ F_f\ of\ 3\ N?$

$a = 2\frac{m}{s^2}$, $F_f = 3$, $F_p = ? = 33N$, 15

$F = ma$
$F_p - F_f = ma$
$F_p - F_f = ma + F_f$
$F_p = 30 + 3$
$F_p = 33\ N$

$Obviously\ 3\ more\ Newton's\ than\ without\ Friction = 3N.$

FBD
$F_n = 147N$
$F_f = 3$, $F_p = ? = 33N$
$F_g = mg$
$F_g = 15 \times 9.8$
$F_g = 147\ N$