



Review terms

- Energy- ability to create work/ change (J)
- Velocity- speed & direction (m/s²)
- Mass- amount of matter (kg)
- Weight- mass & gravity (N)
- Motion- change in position of object
- Gravity- force pulling objects (9.8m/s²)
- Inertia- objects stay as is, either at rest or in motion.

FORCE

• PUSH or PULL

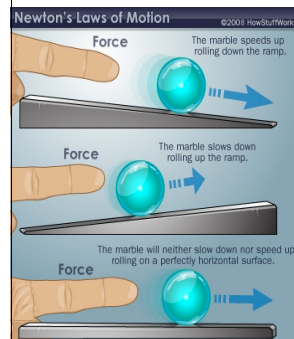
- Described by magnitude & direction
- Force applied to get work (movement)
- Types: gravity, EM, nuclear
- Measured in Newton's

$$F = MA$$

$$N = \text{kg} \times \text{m/s}^2$$



FORCE

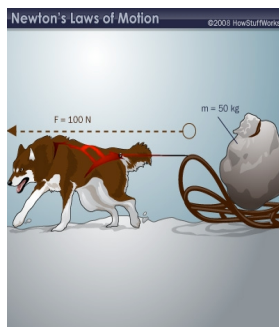


$$F = ma$$

THE NET FORCE EQUALS
THE MASS OF THE OBJECT
MULTIPLIED BY
THE AMOUNT
OF ACCELERATION

FORCE in Action

$$f = m \cdot a$$



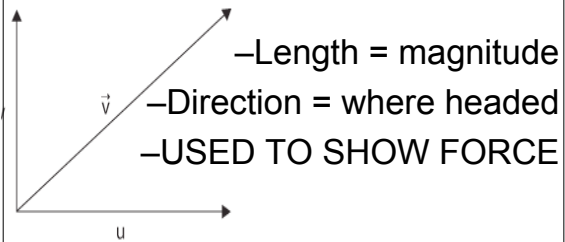
$$F = M \times A$$

$$? \text{ N} \rightarrow 1,000 \text{ kg} \rightarrow .05 \text{ m/s/s}$$



VECTORS

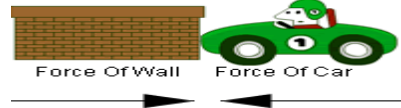
- Arrows to show movement.



FORCE

NET FORCES

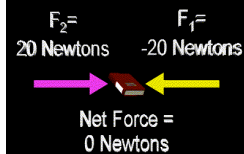
- all forces combined



FORCE

Balanced

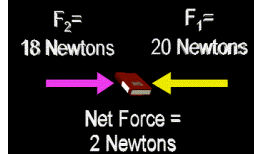
- No change in velocity
(speed & direction)
- Net = 0
- Equal forces



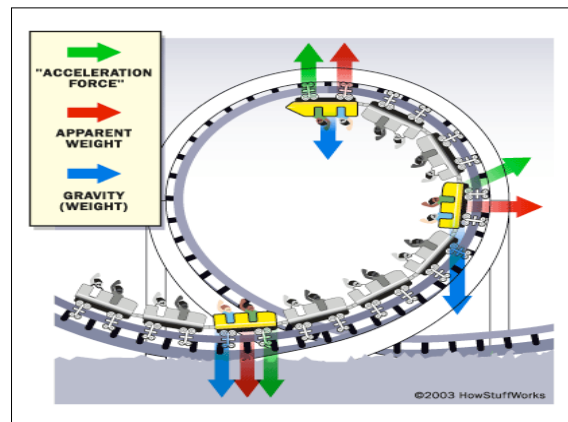
FORCE

Unbalanced

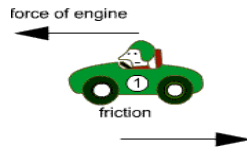
- Causes change in velocity
(speed/direction)
- Net: > 0
- Unequal Forces



FORCES are all around us



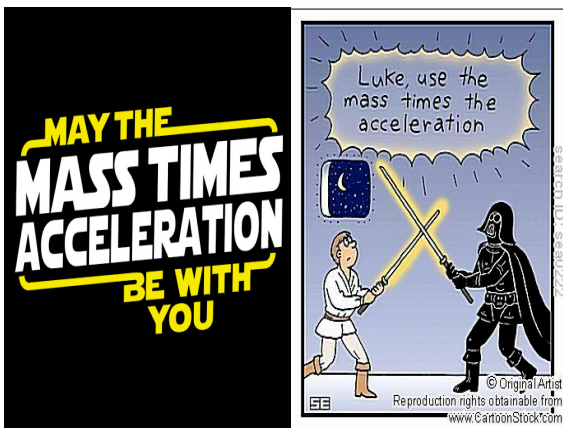
FRICTION



- Unbalanced force
- Rubbing between 2 surfaces
- Force acting opposite object in motion
 - Causes things to slow down/stop
 - Strength dependant on surface type
 - Types: static, sliding, rolling, fluid

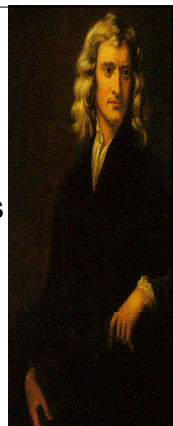
FRICTION

Explain the friction at work.



NEWTON

- Sir Isaac Newton
- 1642-1727/England
- Theory of Gravity & Optics
- Laws of Motion:
 - [3 stages- rest, constant motion, accelerated motion]



Newton's 1st Law

- Things stay as is, at rest or in motion, unless acted upon by unbalanced force.
- Inertia- resist change
Measured by mass



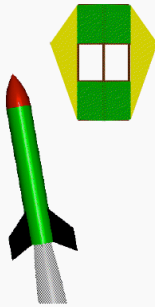


Newton's First Law

"Every object persists in its state of rest or uniform motion in a straight line unless it is compelled to change that state by forces impressed on it."

Glenn Research Center







Newton's 2nd Law

- Net force decides velocity of object.
- Force = Mass x Acceleration



Newton's Second Law
Definitions

Glenn
Research
Center

Differential Form: Force = change of momentum with change of time

With mass constant: Force = mass X acceleration

Force = mass X change in velocity with time

Force, acceleration, momentum and velocity are all vector quantities.
Each has both a magnitude and a direction.

$$F = \frac{d(mv)}{dt}$$

$$F = m a$$

$$F = \frac{m (V_1 - V_0)}{(t_1 - t_0)}$$



Newton's 3rd Law

- Forces act in equal but opposite actions.
- Momentum- movement based on mass & velocity. $M = m \cdot v$
- Law of conservation of momentum- total doesn't change.



Newton's Third Law
Applied to Aerodynamics

Glenn
Research
Center

For every action, there is an equal and opposite re-action.

Airfoil

Foil deflected up.
Flow deflected down.

Ball deflected up.

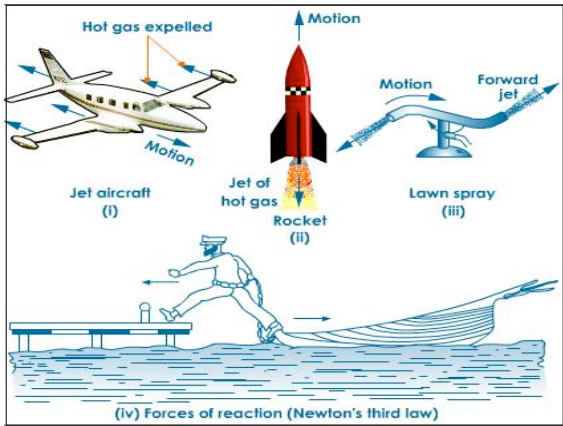
Flow deflected down.

Spinning Ball

Engine pushed forward.

Flow pushed backward.

Jet Engine

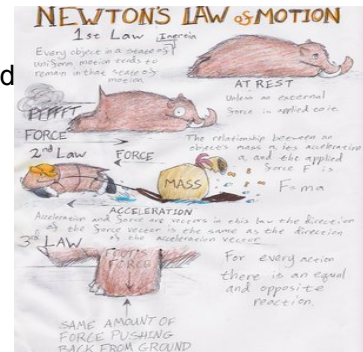


Review of Newton's Laws:

1- inertia/
unless altered

2- net force/
direction

3- equal/
opposite
reactions



Explain the laws for each picture.

