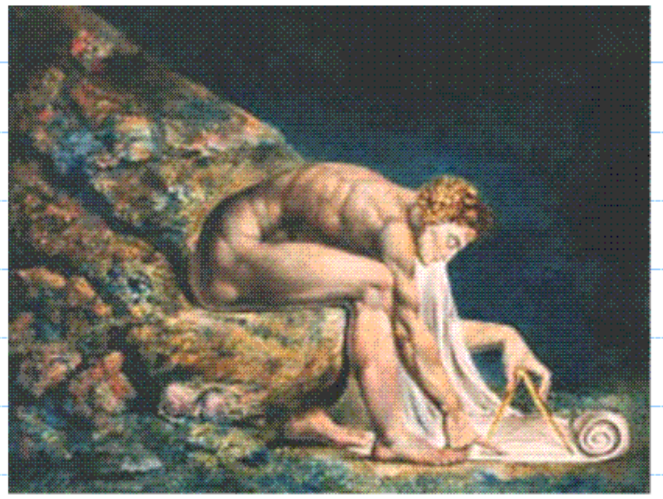
PHY100S - The Magic of Physics - Class 3



Newton, by William Blake (1795)

LAW OF INERTIA #2

A body subject to no external influences will be un-accelerated

CHAPTER 4 - WHY THINGS MOVE

Dynamics: relation between force and motion.

accelerations caused by pushes & pulls i.e. forces

actions by one body on another.

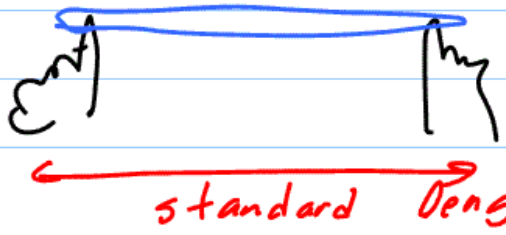
other forces! friction
air-resistance
gravity - exerted by Earth on an object.

Will expand this list

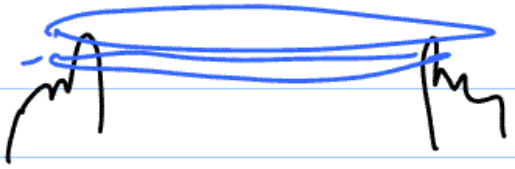
§4.2 - Force & Accelerations

"Thought experiments"

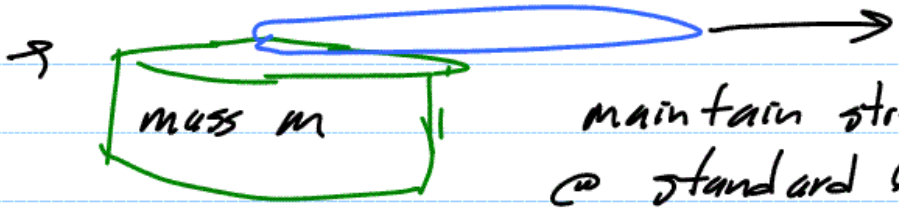
Slightly different from text



Feel force F



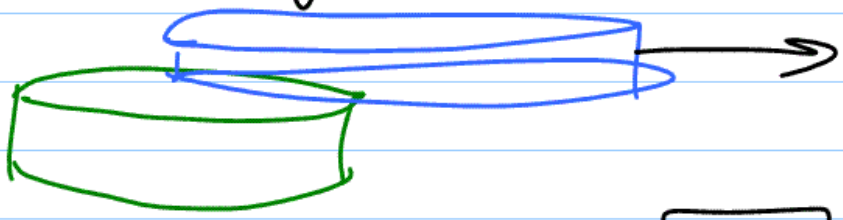
Feel force
2F



maintain stretch
@ standard length

measure acceleration

get $\boxed{a}$ ←



acceleration = $\boxed{2a}$

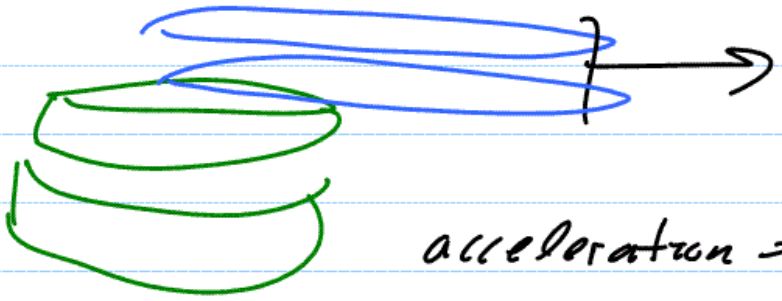
∴ acceleration $\propto$ force

↑ proportional to

2 pucks
mass $2m$

acceleration $= \frac{1}{2} a$

acceleration $\propto \frac{1}{\text{mass}}$



acceleration $= a$

acceleration $\propto \frac{\text{force}}{\text{mass}}$

constant of proportionality?

units of acceleration

$$\frac{\text{change in speed}}{\text{time}} = \frac{m/s}{s} = m/s^2$$

units of mass! kg

choose units for force so that

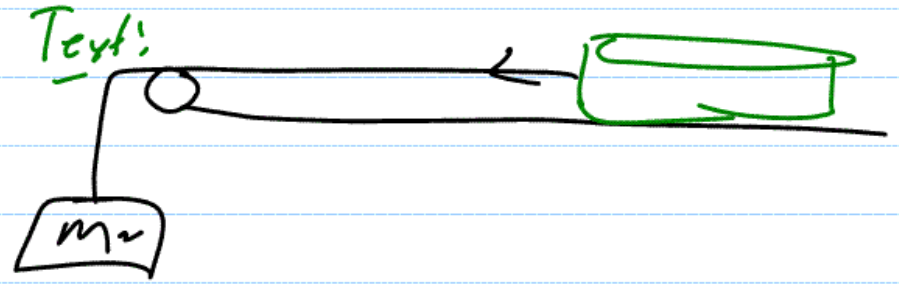
$$\text{acceleration} = \frac{\text{force}}{\text{mass}}$$

$$a = \frac{F}{m}$$

Newton's 2nd Law

unit of force "newton", "N"

Text:



§4.3- Couple of Details

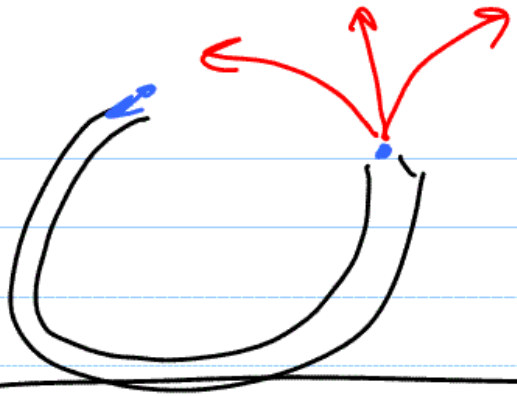
(1) more than 1 force acting.

"net Force" F_{net}

$$a = \frac{F_{net}}{m}$$

better Newton's 2nd Law

(2) accelerations in direction of force

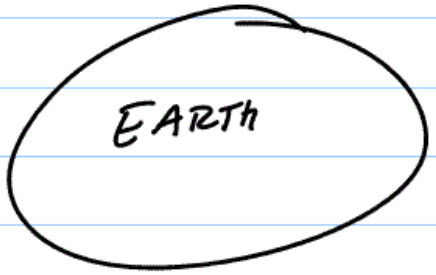


Law of Inertia #3

If no net force acts on a body, it is un-accelerated

§4.4 WEIGHT

Book  accelerates down



weight ≡ force due to gravity by Earth.

near Earth's surface accel due to gravity

Same for all objects

(neglect air resistance)

$9.8\ m/s^2$

$g = \frac{weight}{mass}$

1 kg of gold on Earth has a weight

$weight = g \times mass = 9.8\ N$