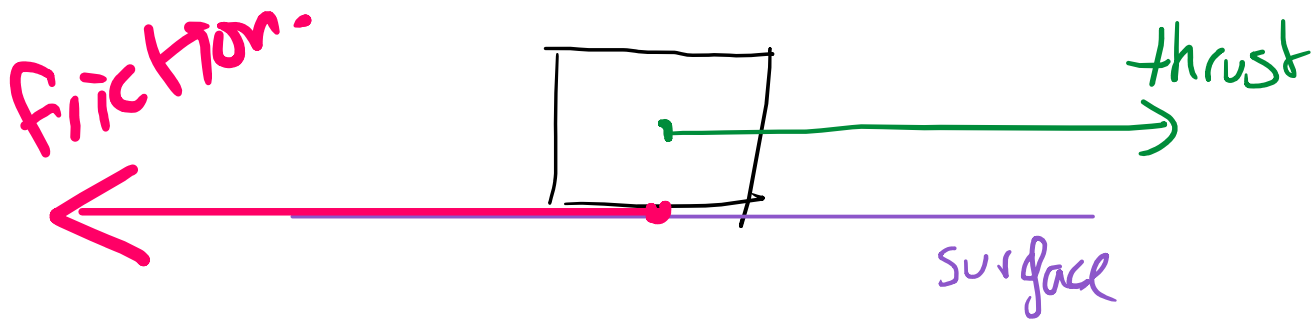
friction / falling / circular + Hookes law

Friction

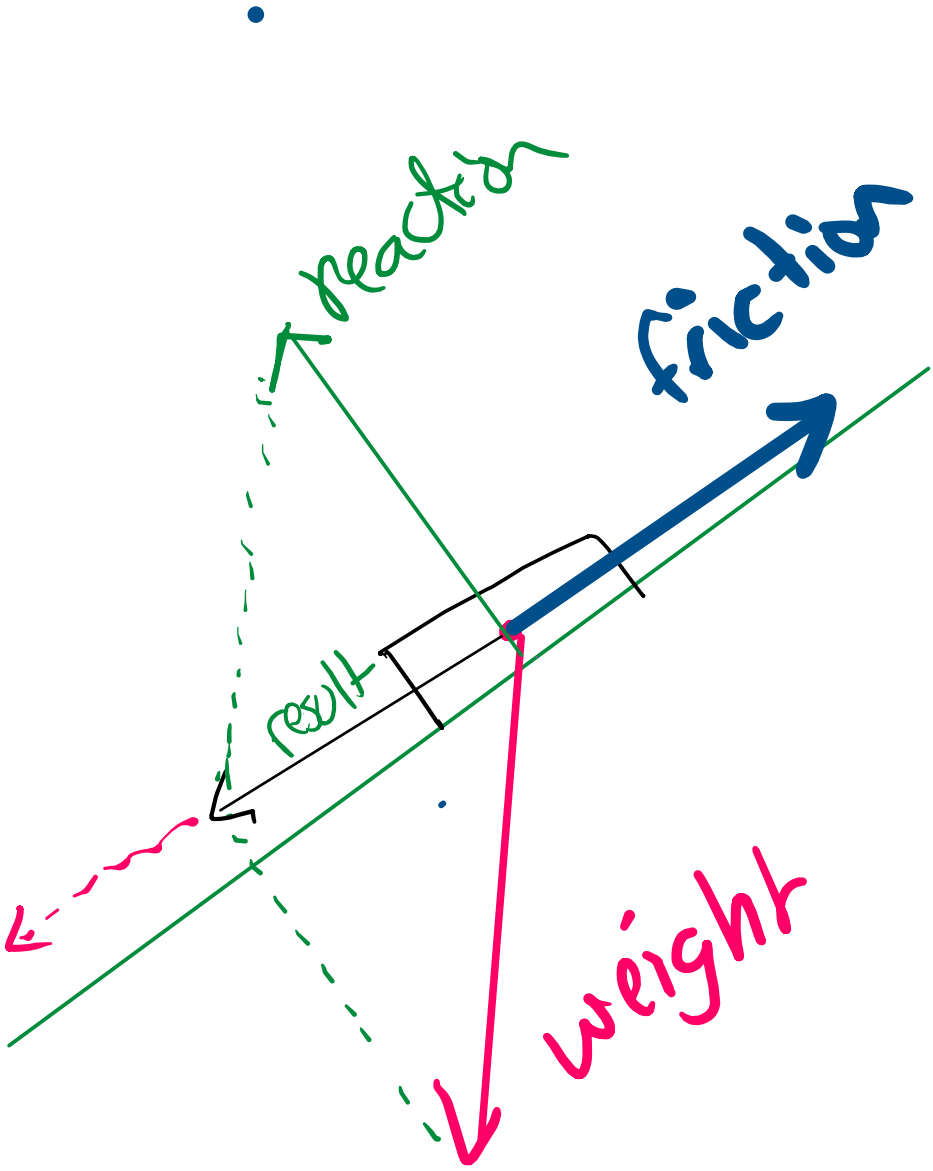
① rubbing between 2 objects

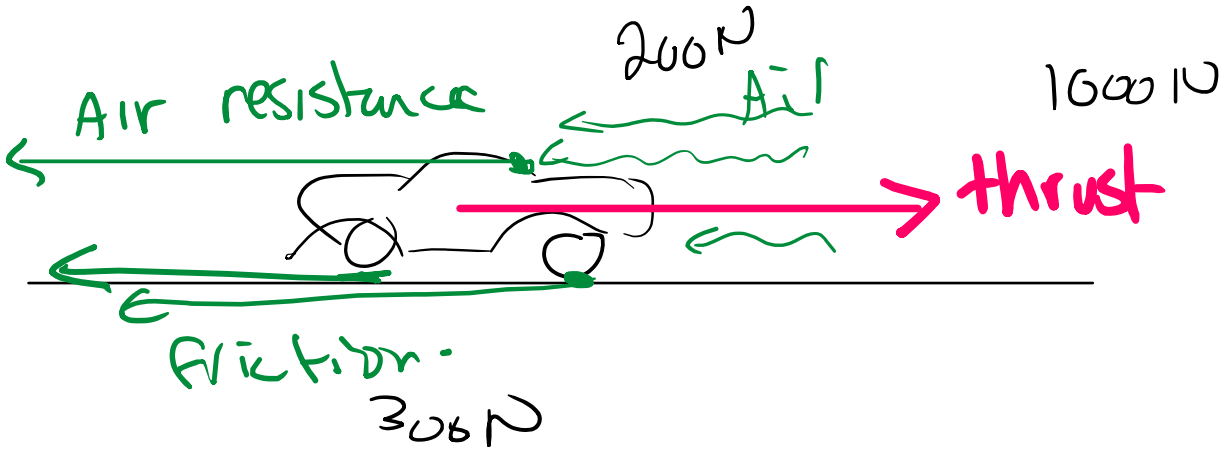
- 2 solids → Friction
- 1 fluid → DRAG
- 1 Air → Air resistance

Tries to oppose motion or any attempt to start motion



1. Friction is opposite to the **Resultant force** causing the motion.
2. **friction ∝ speed**
3. **friction ∝ Surface Area.**
4. Friction generates heat & sound as wasted energy.





$F = ma$.

thrust air friction

Resultant $f = Th - AR - fR = ma$.

$= 1000 - 200 - 300 = 500 = \frac{m}{1000} a$

$a = \frac{500}{1000} = 0.5\ m/s^2$

If Speed ↑ AR↑ frict ↑

$Rf = 1000 - 400 - 600 = 0 = m\ a$

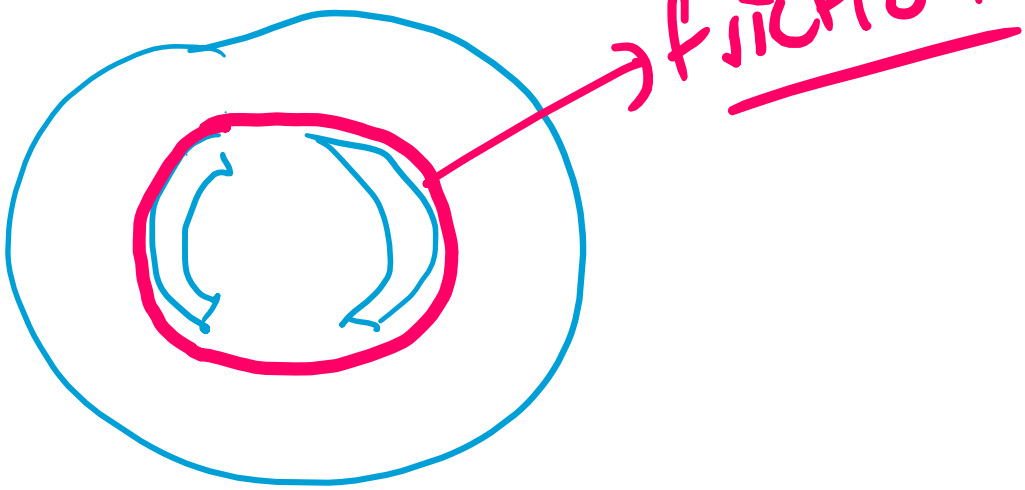
$a = 0$

$Rf = Th - AR - frict = 0$

$1000 - 400 - 600$

if I want to Stop?

$Rf = Th - AR - frict - Brakes$

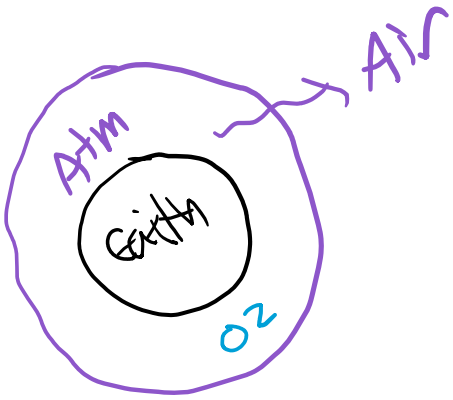


Resultant = th − Ar − frict − Brakes

Rf = −ve = − acc.

falling bodies

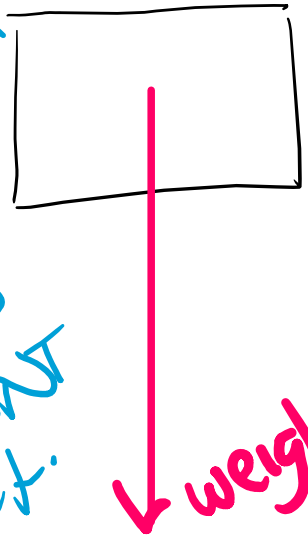
(1) No atmosphere ⇒ No Air, no AR.



Ex. on the moon

(1) Force of gravity is CONSTANT on Each planet

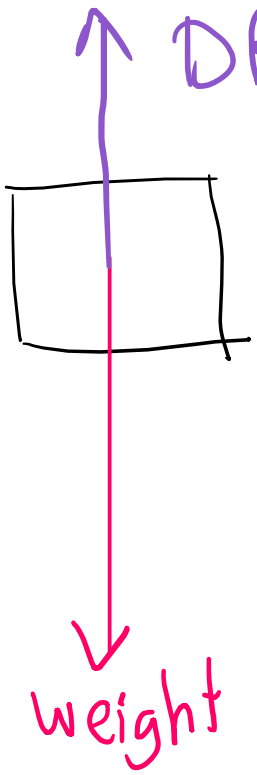
(2) Acc of gravity is CONSTANT on same planet.



weight ↓ F = m a ↓ 9.8 N/kg = 1 ↓ 9.8 m/s²

ground

falling inside fluids → liquid. gas



Resultant force = w − Drag

w > Drag = a ↑

w = Drag = 0 → const speed

can never have

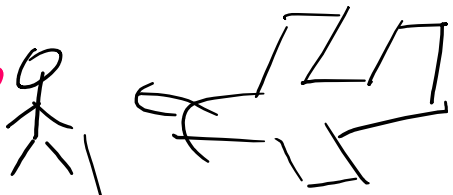
no friction at rest. → SP = 0

w < Drag = −ve → −a

example.

$W = m \times g$ 10×10

$t = 0$ $W = 100N$ $S = 0$ $AR = 0$



$RF = W - AR = 100$

$F = ma$ $a = \frac{F}{m} = \frac{100}{10} = 10 m/s^2$

$t = 1$ $W = 100$ $S = 10$

$AR = 25$

$RF = W - AR = 100 - 25 = 75$

$a = \frac{F}{m} = \frac{75}{10} = 7.5 m/s^4$

$t = 4$ $W = 100$ $AR = 100$

$RF = W - AR = 0$

$a = 0$

speed → const

terminal velocity (50m/s)

convert 50 m/s → km/hr

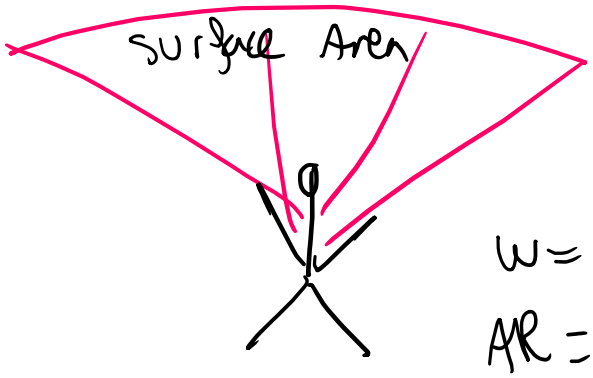
$50 \frac{60 \times 60}{1000} =$ **180 km/hr**

$S = 50\ m/s$

$W = 100$

$AR = 100$

$Acc = 0$



$W = 100$

$AR = 500$

Res. force $= 100 - 500 = -400$

$$a = \frac{f}{m} = \frac{-400}{10} = -40\ m/s^2$$

↓ speed slows down 40 m/s every second

↓ after 1 sec $SP = 10\ m/s$

until $AR = W$

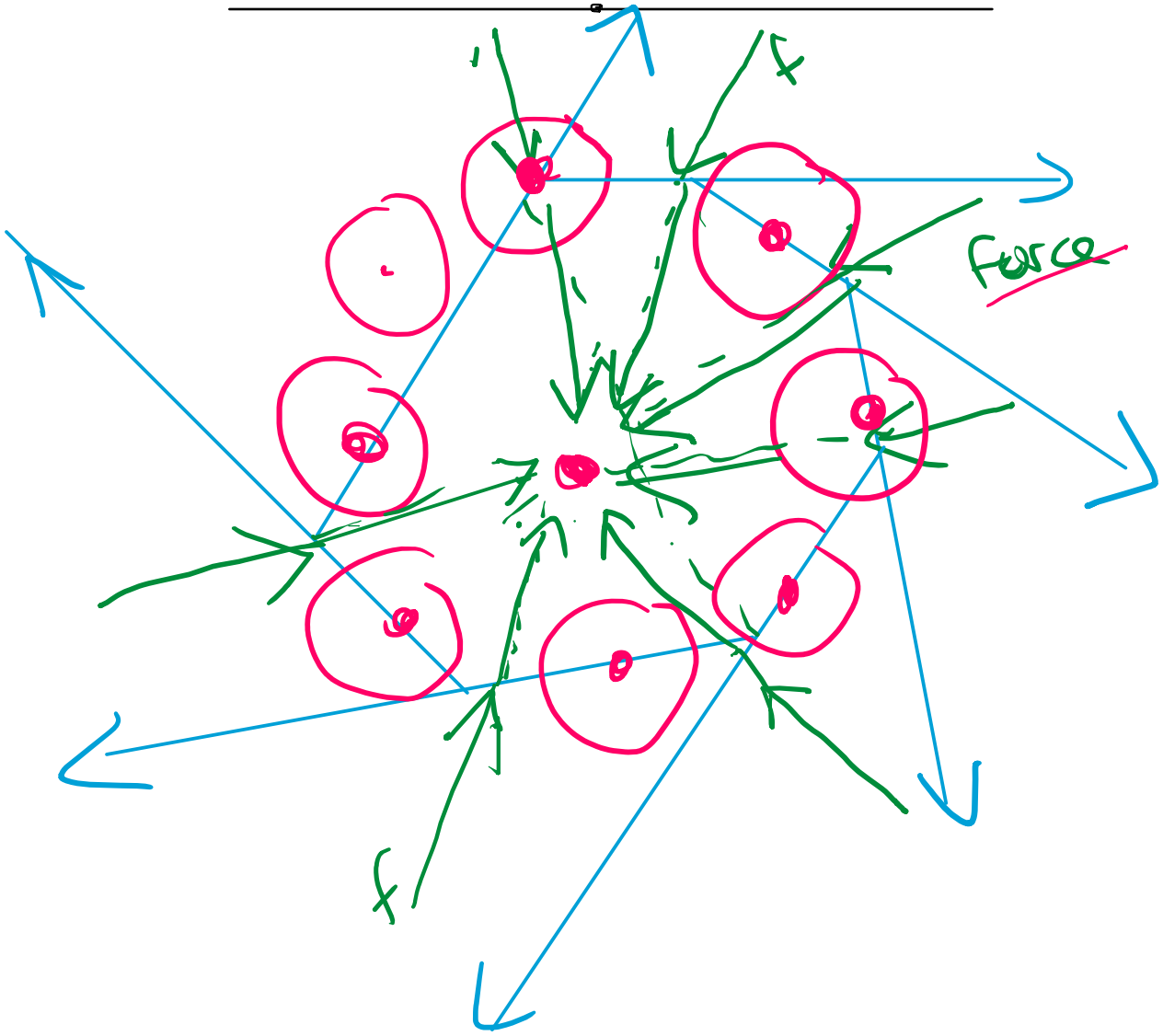
→ $acc = 0$ speed constant

Terminal v

$= 10\ m/s$

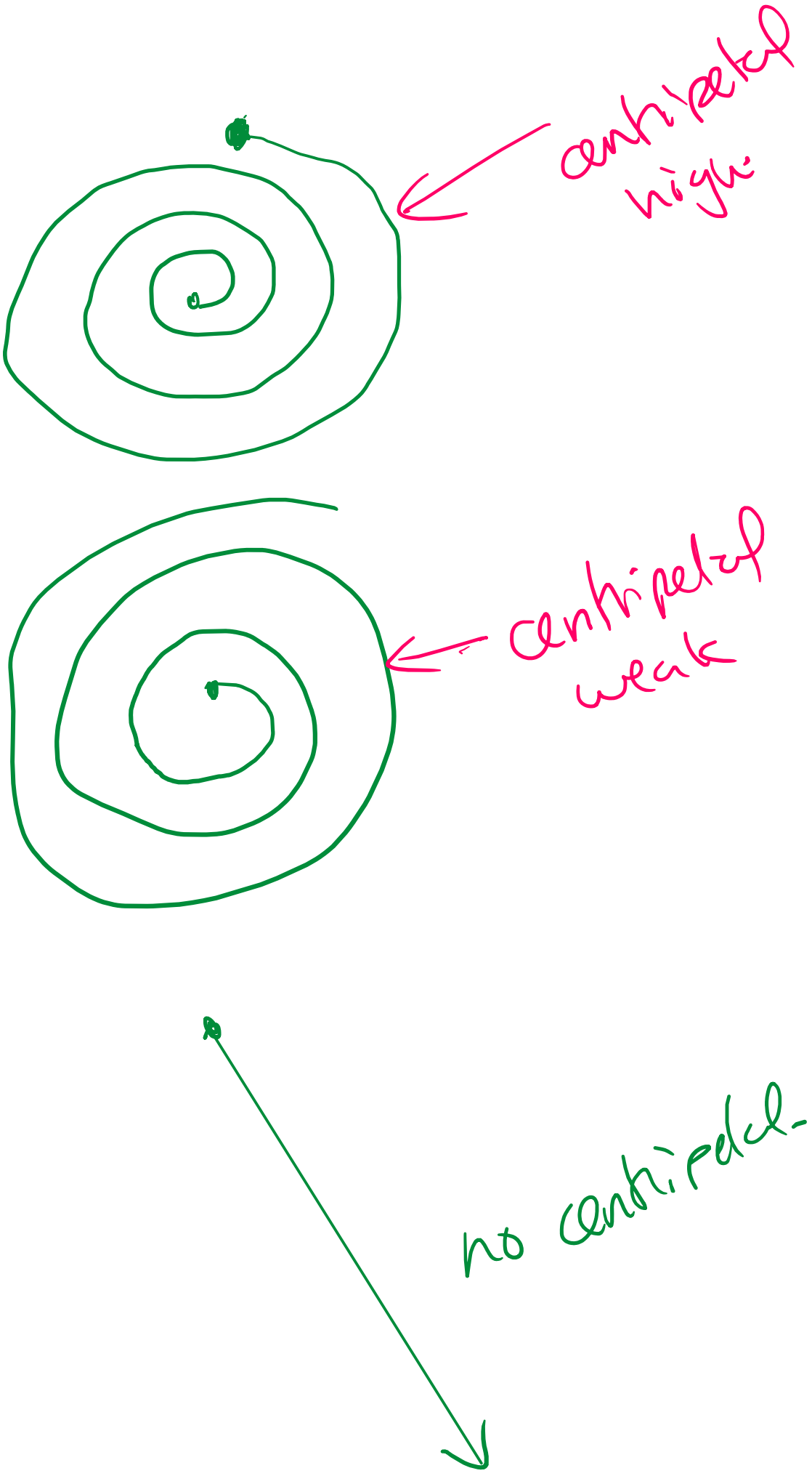
$36\ km/hr$

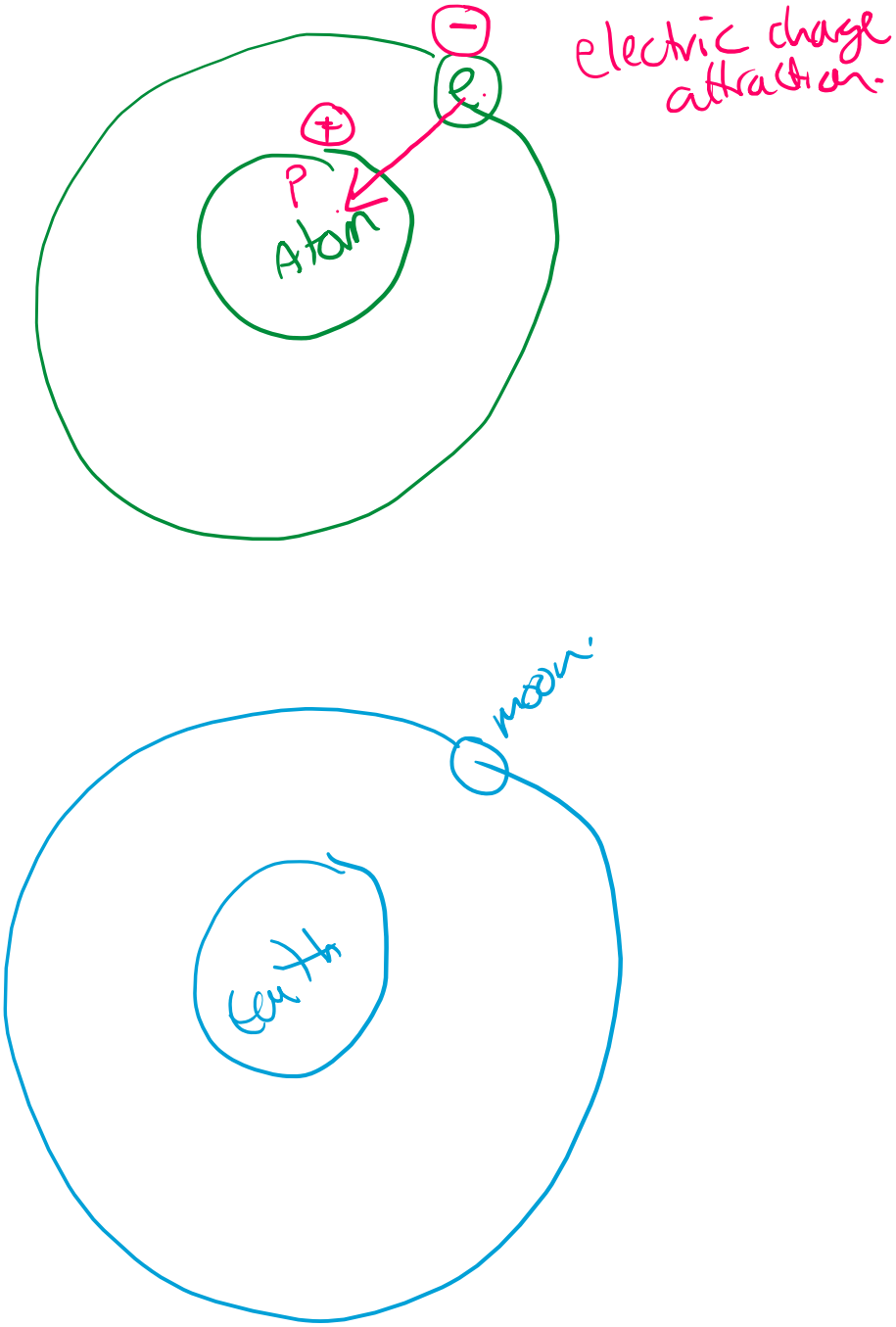
Circular motion

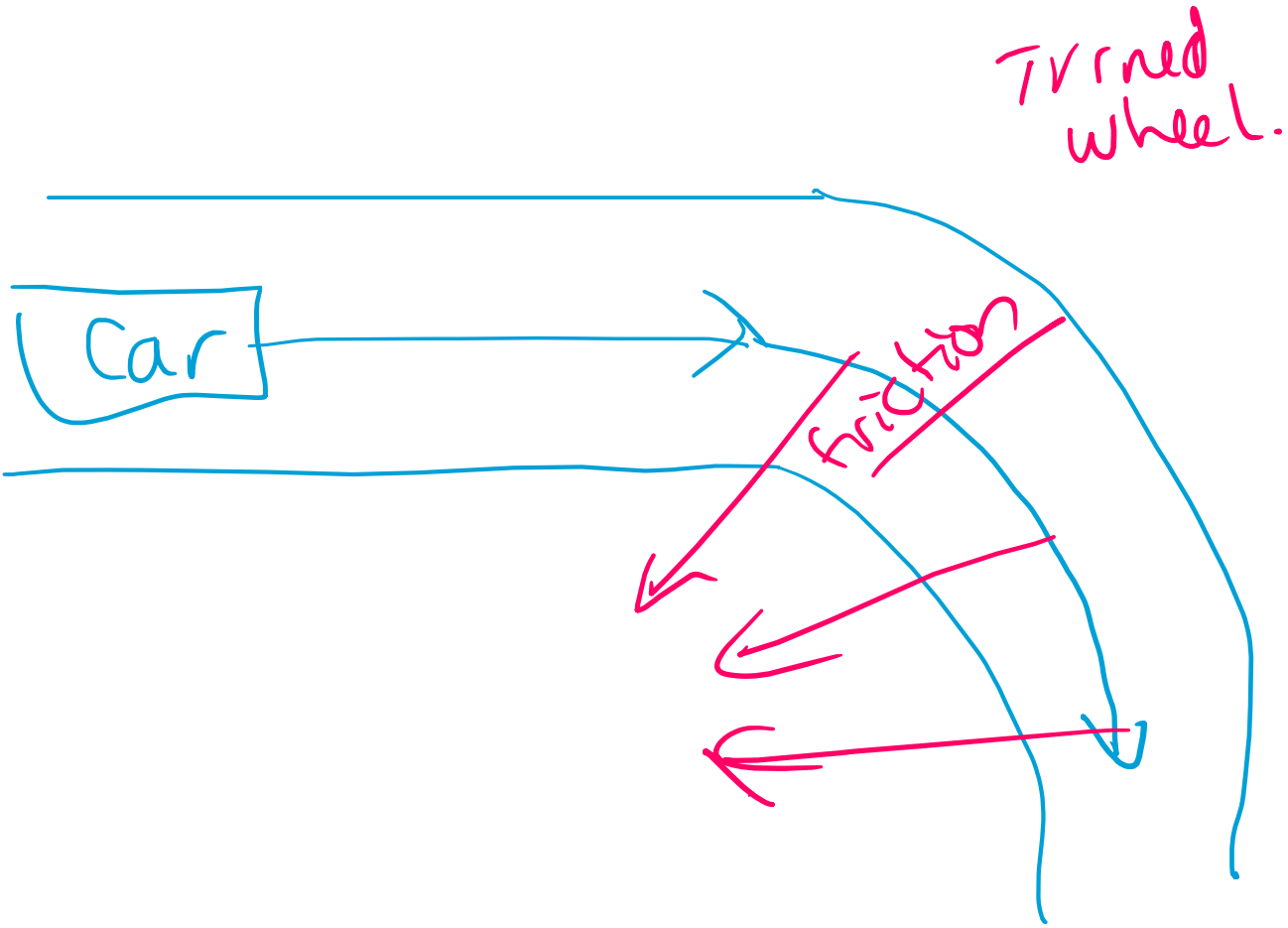


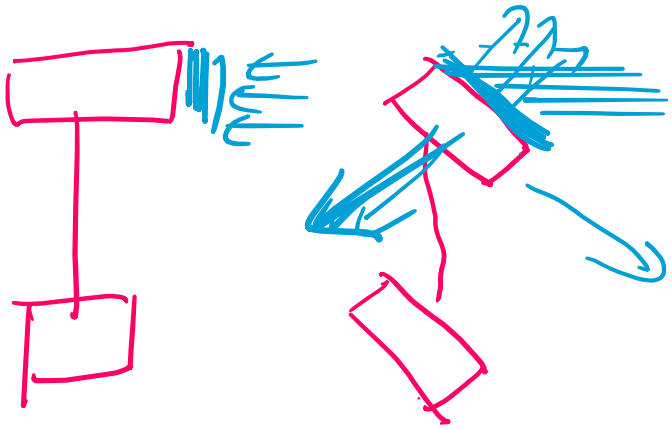
force = center seeking

⇒ centripetal force.


anticlockwise high
anticlockwise weak
no anticlock-

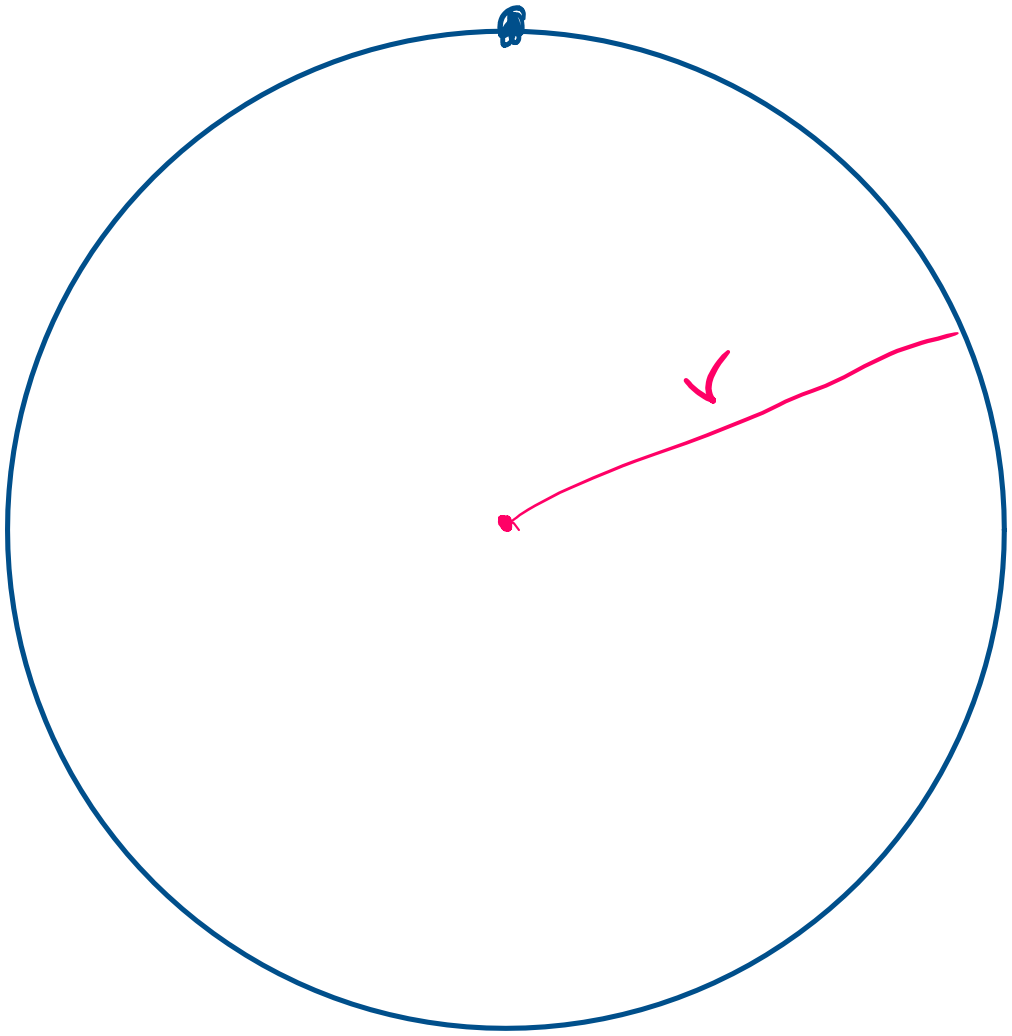

electric charge attraction.
P
Atom
moon.
Earth





Traction

ABS



$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

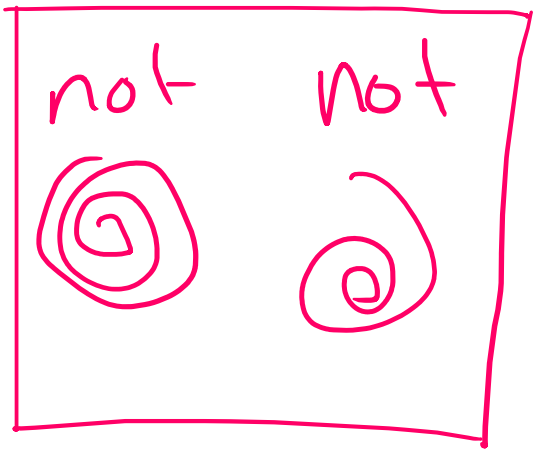
Perimeter

$$\text{Circumference} = 2\pi r$$

$$\text{circular speed} = \frac{2\pi r}{t}$$

$$\text{angular speed} =$$

objects moving in a perfect circle.

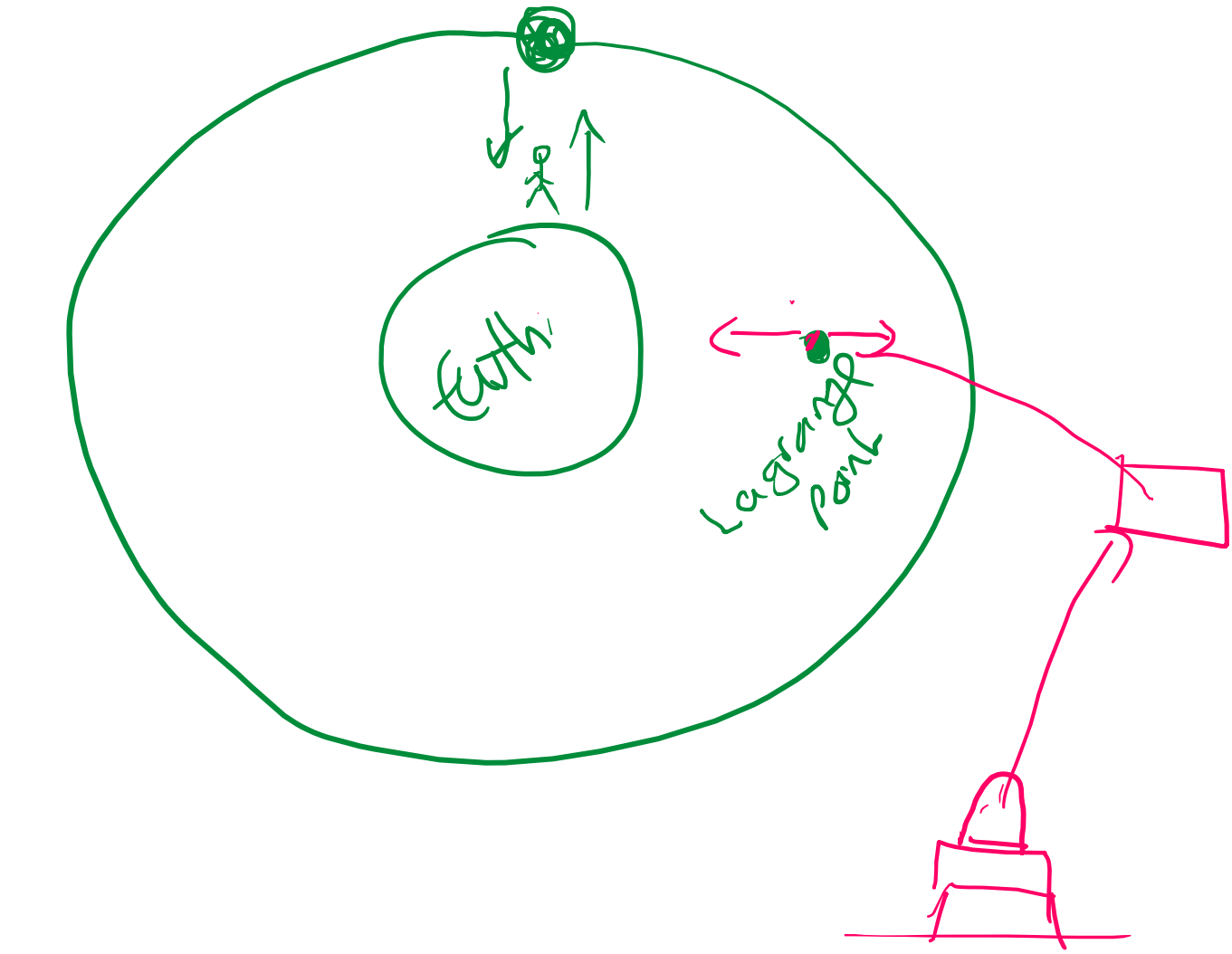


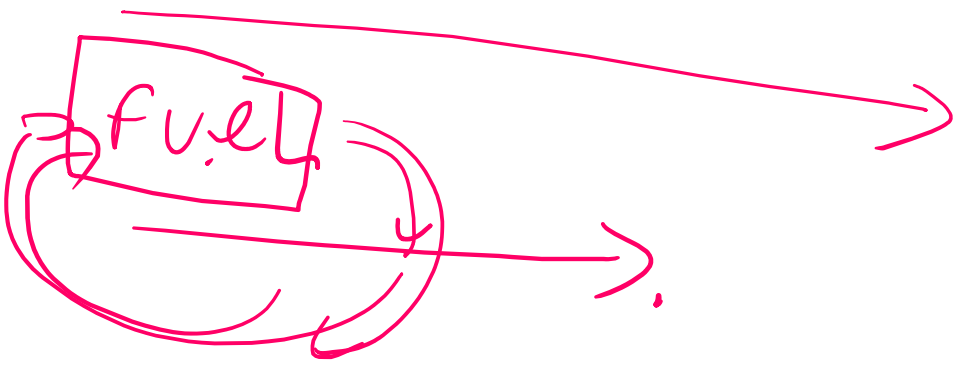
constant-speed changing direction → "changing" velocity → acceleration.

So

objects in a perfect circles are ACCELERATING at constant SPEED

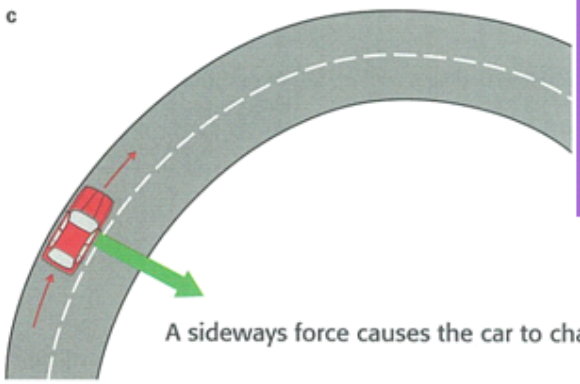
The moon is accelerating towards Earth !!





Circular Motion

1. speed increases if force increases, with mass and radius constant
2. radius decreases if force increases, with mass and speed constant
3. an increased mass requires an increased force to keep speed and radius constant



Force ↑	Speed ↑	Radius ↓
Mass ↑	Speed ↓	Radius ↑