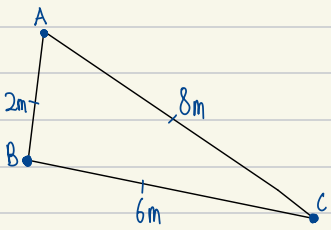
CHP 2 - FORCE & MOTION I



If route taken:

A → B → C → A

Displacement - 0 m

Distance - (2+6+8) m = 16 m

speed
ms^{-1}

rate of change of distance

$\frac{m}{s} = ms^{-1}$

velocity
ms^{-1}

rate of change of displacement

$\frac{m}{s} = ms^{-1}$

acceleration
ms^{-2}

rate of change of velocity

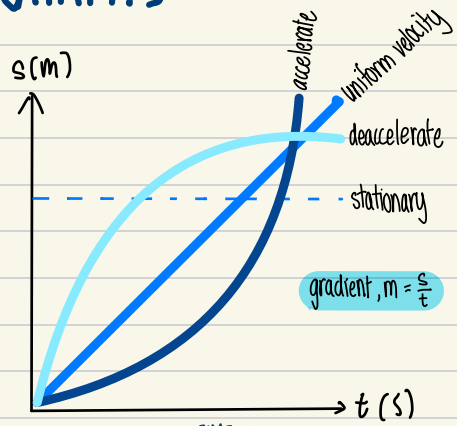
$\frac{m}{s} \div s = \frac{m}{s} \times \frac{1}{s}$

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

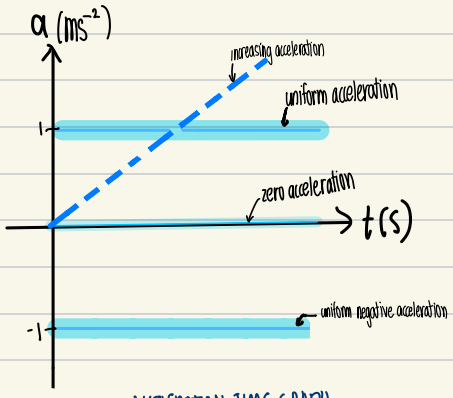
$= ms^{-2}$

!! RATE OF : given measure time

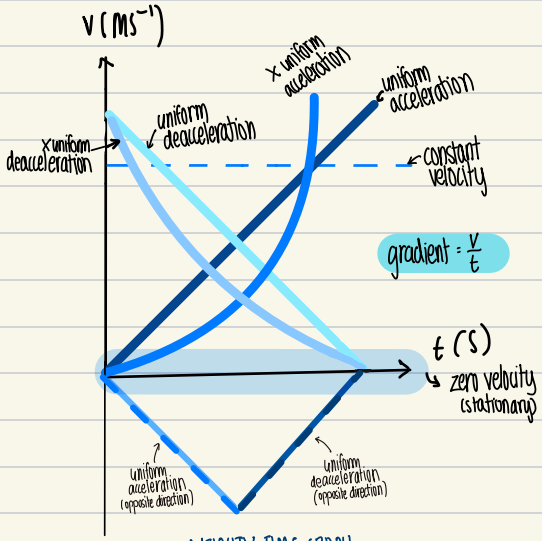
GRAPHS



DISPLACEMENT - TIME GRAPH



ACCELERATION - TIME GRAPH



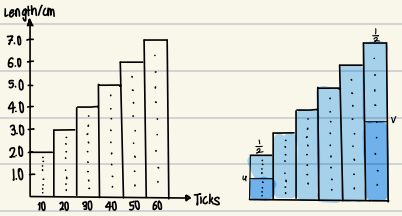
VELOCITY - TIME GRAPH

TICKER TAPE

↑ tick length, ↑ speed
(More distance covered in same time)

1 tick is 50 Hz (0.02s)

$50 Hz = 50 s^{-1} = \frac{1}{50} s = 0.02 s$



Formulas

Avg velocity:

$\frac{\text{Total displacement (Total length of strip)}}{\text{Total time (Total no. of ticks x 0.02s)}}$

Avg initial velocity, $u = \frac{\text{Length of first strip}}{0.02s}$

Avg final velocity, $v = \frac{\text{Length of last strip}}{0.02s}$

Acceleration, $a = \frac{v-u}{t}$

$t = T(n-1) \times 0.02s$

t = time **only for ticker time acceleration
n = no. of strips
T = no. of ticks in each strip

(n-1) as first half and last half of first and last strip respectively cannot be counted as it is not within average velocity, u and v.

s displacement **u** initial velocity **v** final velocity **a** acceleration **t** time

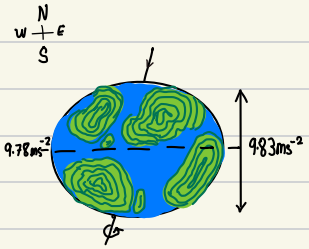
$v = u + at$ (No s)

$a = \frac{v-u}{t}$ $s = ut + \frac{1}{2}at^2$ (No v)

$s = \frac{1}{2}(u+v)t$ (No a)

$v^2 = u^2 + 2as$ (No t)

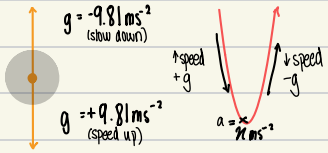
FREE FALL MOTIONS



$\left(\frac{9.83 + 9.78}{2}\right) ms^{-2} = 9.81 ms^{-2}$

g: gravitational acceleration constant found from avg of horizontal and vertical gravitational acceleration towards Earth's core

g is constant $9.81 ms^{-2}$



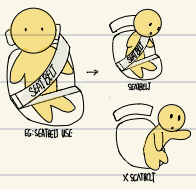
When solving: @ is constant / always known ($\pm 9.81 ms^{-2}$)

suvat → suvat

NEWTON'S LAW

1st - Inertia
2nd - F = ma
3rd - Opposite

1st law (Inertia)



Obj remains at rest / uniform velocity UNLESS acted upon by an external force.

INERTIA: tendency of Obj to remain at rest / uniform velocity (when moving in a straight line)

2nd law (F=ma)

Force is equal to rate of change of momentum. mv (kgms⁻¹)

$F = m\left(\frac{v_2 - v_1}{t_2 - t_1}\right)$ ← a

$\therefore F = ma$

$p = mv$

momentum formula

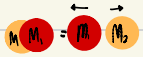
elastic collision (seperate → seperate)

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

inelastic collision (seperate → combined)

$m_1u_1 + m_2u_2 = (m_1 + m_2)v_3$

explosion (stationary → split)



$(m_1 + m_2) \times 0 ms^{-1} = 0$

$0 = m_1v_1 - m_2v_2$

$m_1v_1 = -m_2v_2$

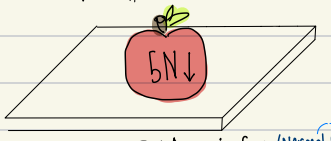
Impulse	Impulsive Force, F
• change in momentum	• rate of change of momentum
Impulse = Ft / Impulse = mv - mu	Impulsive force, $F = \frac{mv - mu}{t}$
F - force t - time	m - mass v - final velocity u - initial velocity t - time

Applications: high jump mattress, baseball follow through, rugby equipment, SSM 2023 ESSAY pile driver

!! RATE OF : given measure time

3rd law (Opp)

For every force applied, there is a reaction force of same magnitude but opposite direction



∴ Apple stays still on table

5N ↑ Opposing force (Normal Force) — for this case