

Physics Summary sheet

MOTION

SUVAT EQN's → formula sheet

$\text{kmh}^{-1}/3.6 \rightarrow \text{ms}^{-1}$

$$v_{\text{average}} = \frac{\Delta x}{\Delta t} \quad a_{\text{average}} = \frac{\Delta v}{\Delta t}$$

Graphs & const acc'n eqns

x – t graph: gradient = velocity

v – t graph: gradient = accel'n, area = Δx

av. v = area/time

a – t graph: area = Δv

Apparent weight/mass in a lift/spacecraft etc

UP acceleration:

Apparent W = Normal = $m(g + a)$ Newton

Apparent mass = $m(g + a)/g$ kg

DOWN acceleration:

Apparent W = Normal = $m(g - a)$ Newton

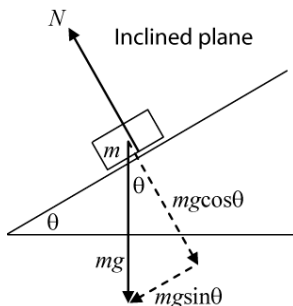
Apparent mass = $m(g - a)/g$ kg

Gravity = $g = 9.8 \text{m/s}^2$

Newton's 3 Laws of Motion

1. Inertia. No net force = no change in velocity (DOES NOT have to be stationary)
2. $F_{\text{net}} = ma$
3. Action/Reaction pairs (MUST be on the same 2 objects)

Inclined Planes



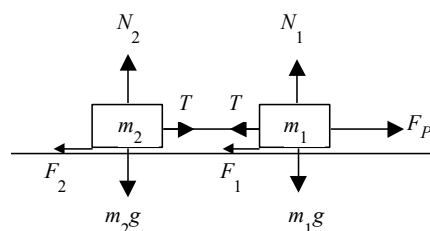
Component of gravity force down plane:

$$= mg \sin \theta$$

acceleration down slope: $a = g \sin \theta$ if no friction

Normal reaction = $mg \cos \theta$

Friction ALWAYS acts AGAINST motion



Forces on entire System: $F_p - F_1 - F_2 = (m_1 + m_2)a$

On m_1 : $F_p - F_1 - T = m_1a$

On m_2 : $T - F_2 = m_2a$

$N_1 = m_1g$ and $N_2 = m_2g$

Momentum: $P = mv$ (kgms^{-1}), **Impulse:** $I = Ft$ (Ns) or area under $F - t$ graph.

Explain question: When a car stops in a collision, a certain impulse ($I = Ft$) is required to stop the passenger. An air bag/crumple zone will increase the time t of collision. Since I is same, F must decrease, meaning less damage to passenger.

$$Ft = m\Delta v, \quad F = \frac{m\Delta v}{t}, \quad F = \frac{\Delta p}{t}$$

Momentum is ALWAYS conserved in a collision

$$P_{\text{final}} = P_{\text{initial}} \quad m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

Kinetic Energy = $1/2mv^2$ Inelastic: $\text{KE}_{\text{after}} < \text{KE}_{\text{before}}$

GPE=mg

SPE=1/2kx²=Area under F–x graph

k=spring const=stiffness

Work $W = Fd$ or $W = (F \cos \theta)d$

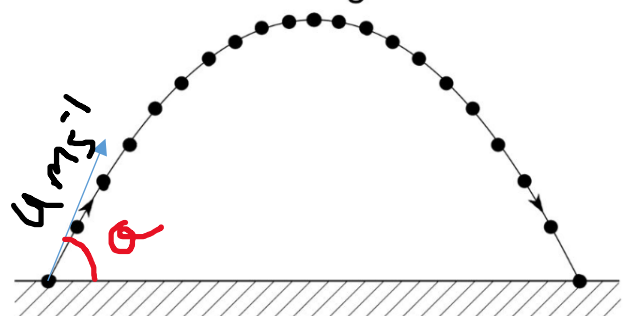
Projectile Motion shortcuts for parabola

Use ONLY if starting and finishing height are same

R=Range, H=max height, T=period in air

$$R = \frac{U^2 \sin(2\theta)}{g} \quad H = \frac{(U \sin \theta)^2}{(2g)} \quad T = \frac{2U \sin \theta}{g}$$

Projectile Diagram – Launched at an Angle



Circular Motion

$$F = \frac{mv^2}{R} \quad F = \frac{m4\pi^2 R}{T^2} \quad F = \frac{m2\pi v}{T} \quad F = m4\pi^2 R f^2$$

$$a = \frac{v^2}{R} \quad a = \frac{4\pi^2 R}{T^2} \quad a = \frac{2\pi v}{T} \quad a = 4\pi^2 R f^2$$

ADD SPRINGS!!