

VIDEO SUMMARIES: MECHANICS

GENERAL MECHANICAL EQUATIONS

What you need to know:

- Distance (d)
 - Initial velocity (v_i)
 - Final velocity (v_f)
 - Acceleration (a)
 - Time (t)
 - Force (F)
 - Work (W/E)
 - Power (P)
$$v_f = v_i + at$$
$$d = \frac{v_i + v_f}{2}t$$
$$F = ma$$
$$F = mg$$
$$v_f^2 = v_i^2 + 2ad$$
$$v = \frac{\Delta d}{\Delta t}$$
$$W = Fd$$
$$d = v_i t + \frac{1}{2}at^2$$
$$a = \frac{\Delta v}{\Delta t}$$
$$P = \frac{W}{t}$$
- Work: Force and distance must be in the same direction
- Work = Energy
- Power measures how fast work is done.

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VECTORS

What you need to know:

- Vector quantities are those that have a direction (distance, velocity, acceleration, momentum, force)
- These are represented by arrows
 - Size is shown by length of the arrow
 - Direction is shown by direction of the arrow (θ)
- $\Delta v = v_f - v_i$
 - When + or - : Head to tail
 - When finding result: start to finish

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VIDEO SUMMARIES: MECHANICS

PROJECTILE MOTION

What you need to know:

1. Gravity is the only force acting
2. Always treat horizontal and vertical components separately
3. Vertical movements **ALWAYS** have an acceleration $a = -9.8\text{ms}^{-2}$
4. Formula:

$$v_f = v_i + at \quad v_f^2 = v_i^2 + 2ad \quad a = \frac{\Delta v}{\Delta t}$$
$$d = v_i t + \frac{1}{2}t^2 \quad d = \frac{v_i + v_f}{2}t \quad v = \frac{\Delta d}{\Delta t}$$

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CIRCULAR MOTION

What you need to know:

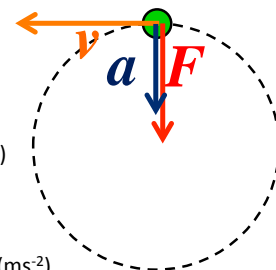
1. Velocity is always at a tangent to circle – This velocity is always changing direction (turning toward the centre)
2. Because of the change of velocity there is an acceleration toward the

centre. $a = \frac{\Delta v}{\Delta t}$

3. Because of the acceleration there is a force towards the centre $F = ma$

4. Formula: $F_c = \frac{mv^2}{r}$ $a_c = \frac{v^2}{r}$

F_c = Centripetal force (N)
 m = Mass (kg)
 v = Velocity (ms^{-1})
 r = Radius (m)
 a_c = Centripetal acceleration (ms^{-2})



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VIDEO SUMMARIES: MECHANICS

MOMENTUM – PART 1

What you need to know:

1. Momentum is the strength of movement of an object

2. $p = mv$
 p = Momentum (kgms^{-1})
 m = Mass (kg)
 v = Velocity (ms^{-1})

3. Momentum is conserved
 - As long as no external forces are acting

4. In a collision: $p_{\text{before}} = p_{\text{after}}$

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MOMENTUM – PART 2

What you need to know:

1. Impulse formula: $\Delta p = F \Delta t$
 Δp = Change in momentum (kgms^{-1})
 F = Force (N)
 Δt = Change in time (s)

2. An inelastic collision: energy is NOT conserved

3. An elastic collision: energy is conserved $E_k = \frac{1}{2}mv^2$

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VIDEO SUMMARIES: MECHANICS

SPRINGS AND ENERGY

What you need to know:

1. Energy cannot be created or destroyed it can only change from one form to another

$$E_p = mg\Delta h \quad E_k = \frac{1}{2}mv^2 \quad E_p = \frac{1}{2}kx^2$$

2. k is the spring constant
 - this is a measure of the stiffness of a string
$$F = -kx \quad (F = mg)$$
3. Use formula for explanations

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TORQUE AND EQUILIBRIUM

What you need to know:

- $\tau = Fd$
- Any stationary object is in equilibrium
This Means:
 - Forces balance ($F_{up} = F_{down}$)
 - Torques balance ($\tau_{clock} = \tau_{anti}$)
- When answering questions:
 1. Draw all forces ($F = mg$)
 2. Choose a pivot point
 3. $\tau_{clockwise} = \tau_{anticlockwise}$
 4. Force up = force down

τ = Torque (Nm)
 F = Force (N)
 d = distance (m)

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