LAKSHYA

MHTCET 2025

Physics | Lecture - 05

Rotational Dynamics

By - Sushant Sir

Topics *to be covered*

1. Conical Pendulum ✓
2. Vertical Circular Motion ✓

Doubts :

1) DPP Soln ⟶ either video on DPP or direct Sol^{n} by me.

2) Numerical Not able to solve ⟶ follow below steps.

1) See lecture.

2) Read notes & try to memorize.

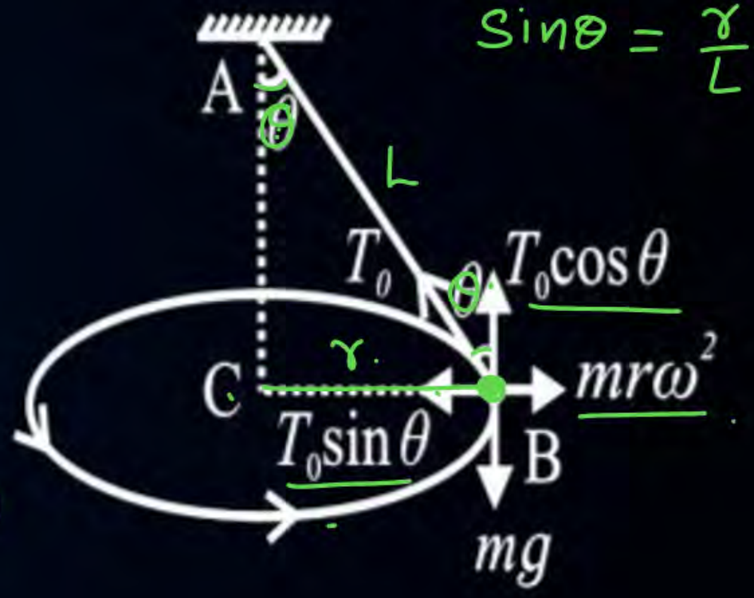
3) Read question & try to recollect topic.

4) Recollect the formula & Apply.

Max 100 que of different types from one chapter & revise it Multiple times.

Conical Pendulum

Conical Pendulum is a simple pendulum as far as structure is concerned. But here string moves along the surface of right circular cone & bod describes horizontal circular motion.



$\sin\theta = \frac{r}{L}$

from fig :

$$T_0 \cos\theta = mg$$

$$T_0 \sin\theta = mr\omega^2$$

$$\frac{\cos\theta}{\sin\theta} = \frac{g}{r\omega^2}$$

$$\frac{\cos\theta}{\sin\theta} = \frac{g}{L\sin\theta\,\omega^2}$$

$$\omega^2 = \frac{g}{L\cos\theta}$$

$$\omega = \sqrt{\frac{g}{L\cos\theta}}$$

$$\frac{2\pi}{T} = \sqrt{\frac{g}{L\cos\theta}}$$

$$T = 2\pi\sqrt{\frac{L\cos\theta}{g}}$$

— time period of conical pendulum

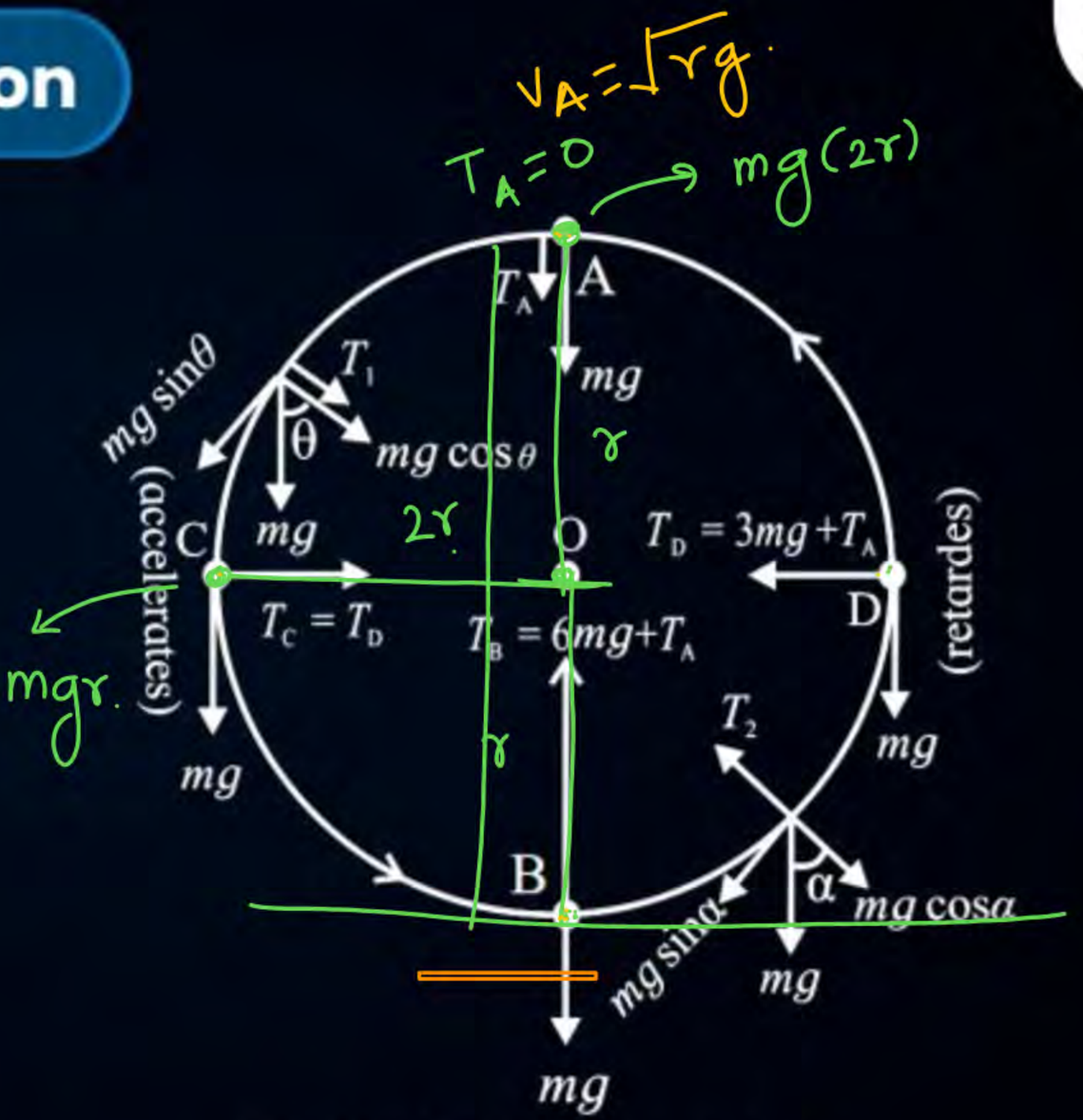
Vertical Circular Motion

At point A :

$$T_A + mg = \frac{mv^2}{r}$$

for performing just one

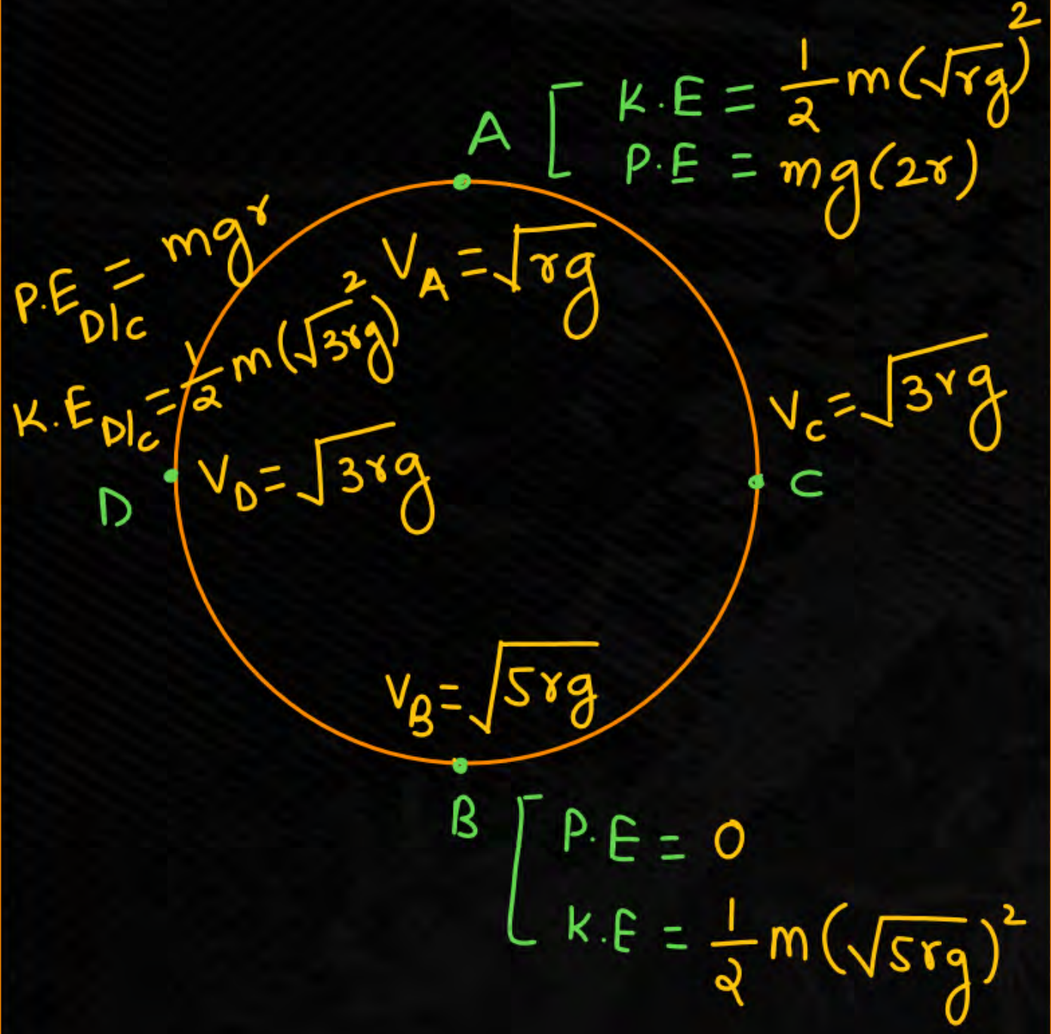
V_{CM} $\boxed{T_A = 0}$



Vertical circular motion

$$mg = \frac{mv_A^2}{r}$$

$$\boxed{v_A = \sqrt{rg}}$$



According to law of conservation of energy

Total Energy at A = Total Energy at B.

$$\frac{1}{2}mrg + 2mgr = \frac{1}{2}mv_B^2$$

$$5/2\,gr = \frac{1}{2}v_B^2$$

$$\therefore V_B = \sqrt{5rg}$$

$$V_C = V_D = \sqrt{3rg}$$

Tension difference :

$$T_B - T_A = 6mg$$

$$T_C - T_A = T_D - T_A = 3mg$$

Summary

1) Conical Pendulum $\longrightarrow T = 2\pi\sqrt{\frac{l\cos\theta}{g}}$

2) VCM $\longrightarrow V_A = \sqrt{rg}$

$V_B = \sqrt{5rg}$

$V_C = \sqrt{3rg}$.

Homework

1) Revise lecture

2) Solve numericals based on todays lecture.


धन्यवाद