

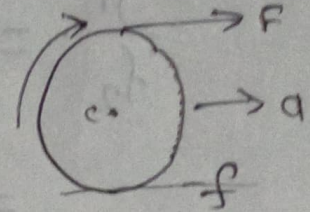
↳ Dynamic of Rolling Motion

$$v = R\omega$$

$$\Rightarrow \frac{dv}{dt} = R \frac{d\omega}{dt} \Rightarrow a = R\alpha$$

$$a = \frac{F_{\text{net}}}{M} = \frac{F + f}{M}$$

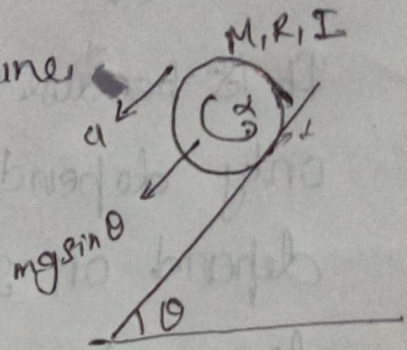
$$\alpha = \frac{\tau_c}{I} = \frac{(F - f)R}{I}$$



↳ For Rolling on Rough Inclined plane

$$a = \frac{Mg \sin \theta - f}{M}$$

$$\alpha = \frac{fR}{I}$$



For pure rolling $a = R\alpha$

$$f = \frac{Mg \sin \theta}{1 + \frac{MR^2}{I}}$$

$$a = \frac{g \sin \theta}{1 + \frac{I}{MR^2}}$$

For pure rolling

$$\mu \geq \frac{\tan \theta}{1 + \frac{MR^2}{I}}$$