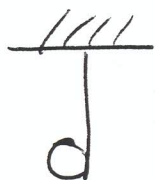
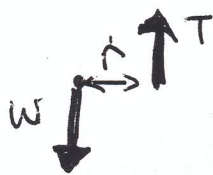


1978 Q6



Forces:



Acceleration



Geometry:

Circle \Rightarrow

$$x = r\theta$$

$$\text{N II} \Rightarrow \boxed{-T + W = m\ddot{x}} \quad (1)$$

N II (for rotation) [Principle of angular momentum]:

\Rightarrow Taking moments about axis (center) of G of Disk:

$$W(0) + Tr = I_{\text{disk}} \ddot{\theta}$$

$$\Rightarrow Tr = \left[\frac{1}{2} m r^2 \right] \ddot{\theta}$$

$$\Rightarrow \boxed{T = \frac{1}{2} m r \ddot{\theta}} \quad (2)$$

Geometry \Rightarrow

$$x = r\theta \Rightarrow \boxed{\ddot{x} = r \ddot{\theta}} \quad (3)$$

(2) and (3) \Rightarrow

$$T = \frac{1}{2} m \ddot{x}$$

$$\Rightarrow \boxed{2T = m \ddot{x}} \quad (*)$$

$$\therefore (1) \Rightarrow -T + W = 2T$$

$$\Rightarrow W = 3T$$

$$\Rightarrow \boxed{T = \frac{W}{3}} \quad N$$

$$\therefore (*) \Rightarrow \frac{2W}{3} = m \ddot{x}$$

$$\Rightarrow \frac{2mg}{3} = m \ddot{x}$$

$$\Rightarrow \boxed{\frac{2g}{3} = \ddot{x}}$$