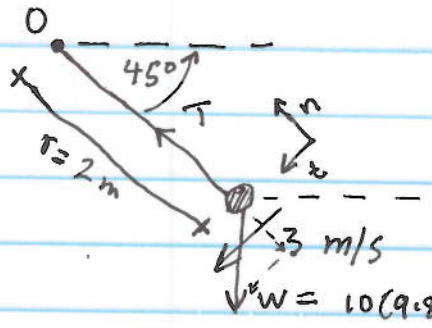
Newton's 2nd Law – Normal & Tangential Components

F 13 – 11



Free body diagram

We can apply Newton's 2nd law to the tangential and then the normal component of the motion.

$$\Sigma F_n = T - W\cos 45^\circ$$

$$= T - 10(9.81)\cos 45$$

$$\Sigma F_n = T - 98.1\cos 45 = T - 69.37$$

but $\Sigma F_n = ma_n$

$$a_n = \frac{v^2}{\rho} = \frac{3^2}{2} = \frac{9}{2} = 4.5 \text{ m/s}^2$$

so

$$10(4.5) = T - 69.37$$

$$T = 45 + 69.37 = 114.37 \text{ N}$$

$$\Sigma F_t = ma_t$$

$$W\sin 45 = 10\, a_t$$

$$a_t = g\sin 45 = 9.81(\sin 45) = 6.94 \text{ m/s}^2$$

$$a = \sqrt{4.5^2 + 6.94^2} = 8.27 \text{ m/s}^2$$