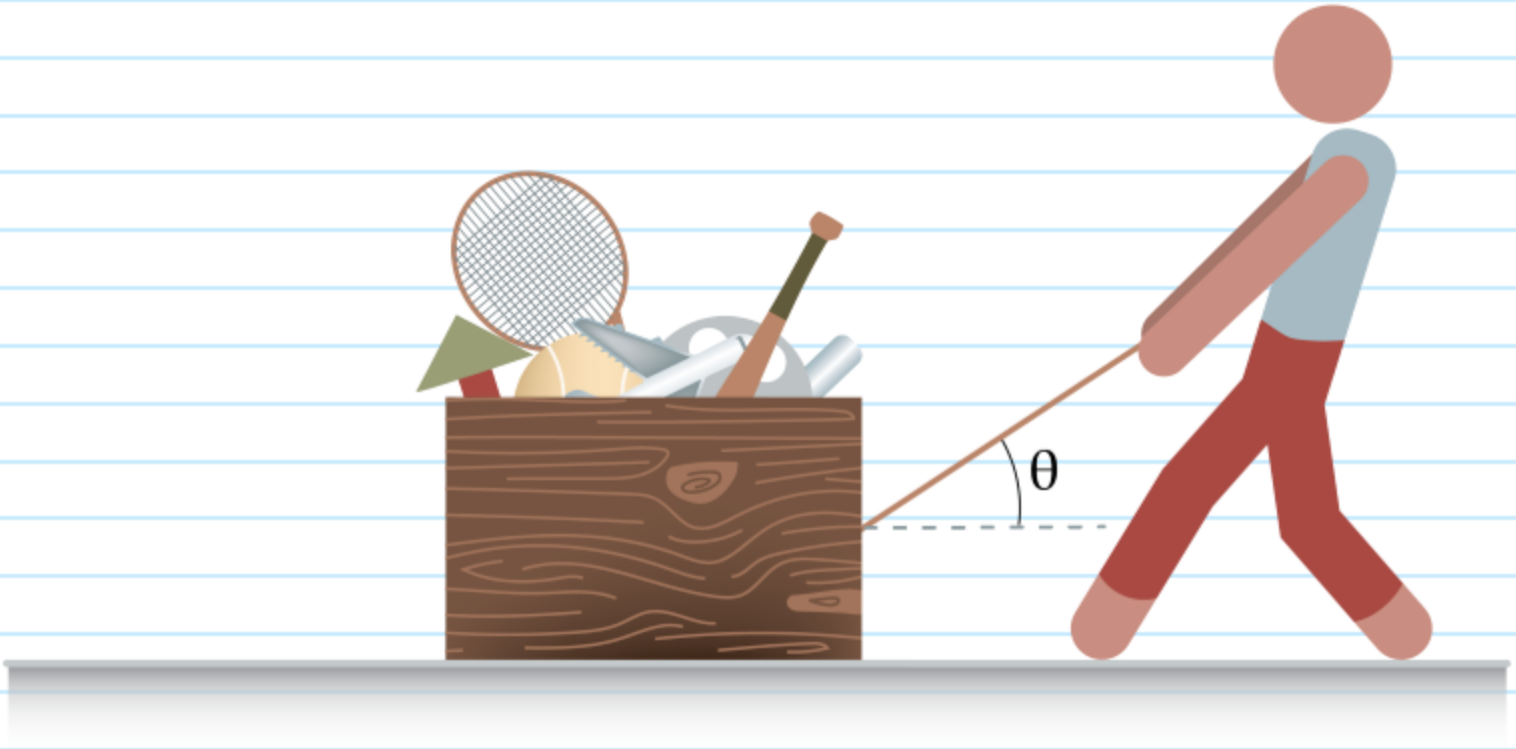
21-P-WE-GD-011



A child is pulling a m kg box of toys across the floor with a rope extending upward at an angle of θ degrees. The child is pulling with a force of T N, the coefficient of kinetic friction between the floor and the box is μ_k and the box starts at rest.

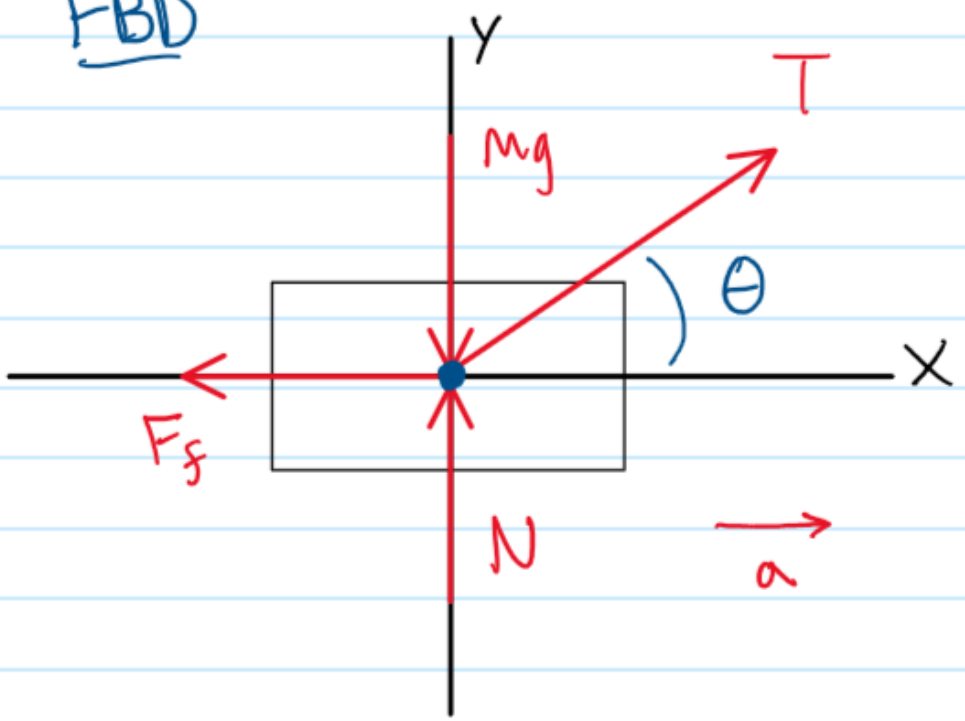
How much power is supplied by the child when time t s?

(Assume $g = 9.81\ m/s^2$)

given $m, g, \theta, T, \mu_k, t$

Find P

FBD



Force Equilibrium

$$\Sigma F_x = ma_x = T\cos\theta - F_f$$

① $$a_x = \frac{T\cos\theta - F_f}{m}$$

$$\Sigma F_y = 0 = T\sin\theta + N - mg$$

② $$N = mg - T\sin\theta$$

③ $$F_f = \mu_k N$$

$[② \rightarrow ③] \rightarrow ①$

$$a_x = \frac{T\cos\theta - \mu_k(mg - T\sin\theta)}{m}$$

Velocity at t

$$v = \cancel{v_0}^{0} + a_x t$$

Power supplied by child at t

$$P = T \cdot v$$