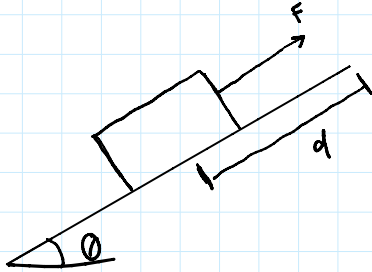


20-R-WE-DK-18 Beginner Power and efficiency

Inspiration: None

You ask your little cousin to move a 1 kg box up a hill with a coefficient of kinetic friction $\mu_k = 0.2$. Rather than carrying the box, he overthinks things and drags the box up the hill with a rope. Determine the average power exerted by your little cousin if he applies a force $F = 10 \text{ N}$ and he drags the box up the hill $d = 3 \text{ m}$ with an incline of $\theta = 30$ degrees.



$$\sum F_x = F - F_f - F_g \sin \theta = m a_{gx}$$

$$\sum F_y = N - F_g \cos \theta = 0$$

$$N = (1)(9.81) \cos 30 = 8.4957$$

$$U_F = F \cdot d = 10(3) = 30 \text{ J}$$

$$U_{FF} = (0.2)(8.4957)(3) = 5.097426 \text{ J}$$

$$10 - (0.2)(8.4957) - (1)(9.81) \sin 30 = a_{gx}$$

$$a_{gx} = 3.395654$$

$$\Delta s = v_0 t + \frac{1}{2} a t^2 \quad 3 = 0 + \frac{1}{2} (3.3956) t^2$$

$$t = 1.32923 \text{ s}$$

$$\Delta v = \frac{\Delta s}{\Delta t} = \frac{3}{1.32935} = 2.256937261$$

$$\Delta P = F \Delta v = 10(2.256937261) = 22.569 \text{ W} \quad \text{or} \quad \frac{U_F}{\Delta t} \quad \text{Input}$$

