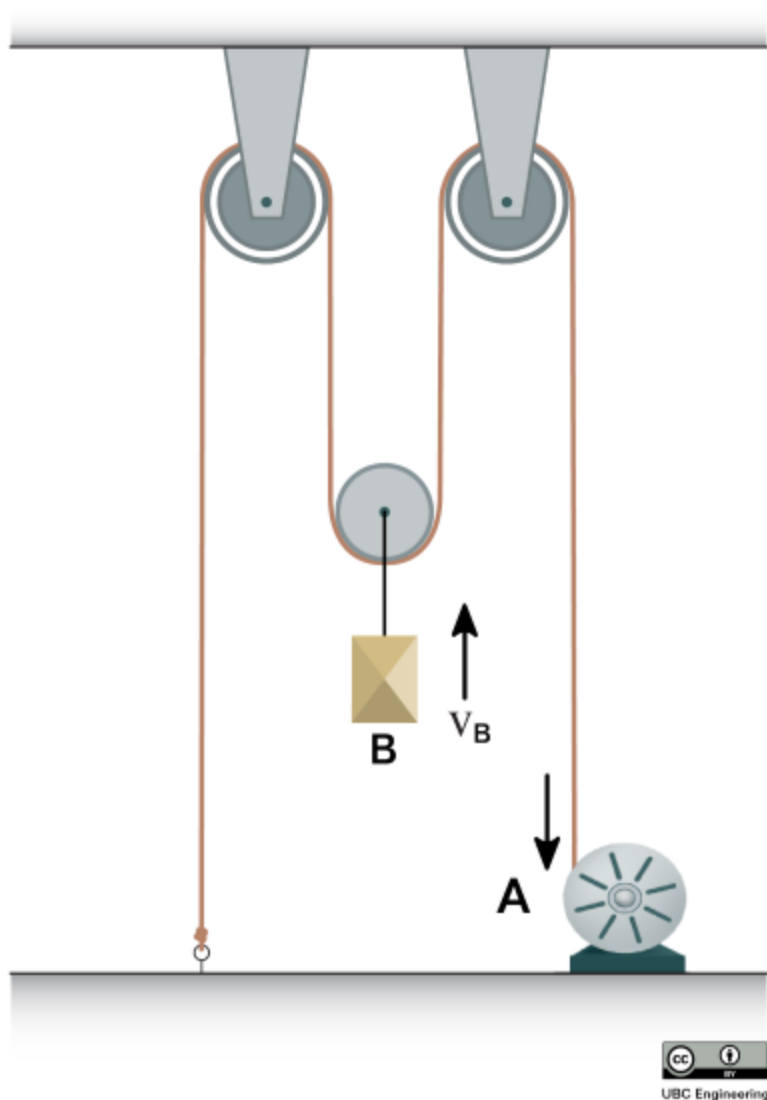


21-P-WE-GD-014

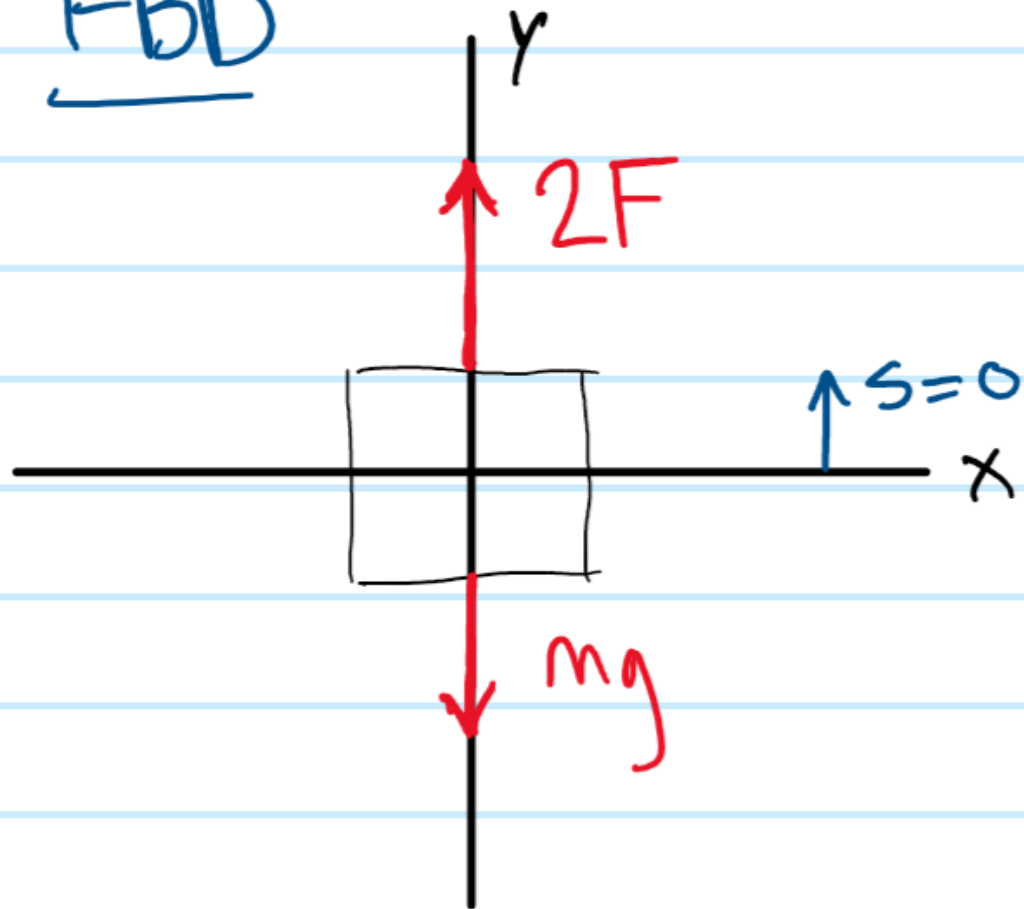


The m kg mass (B) is lifted by the pulley system. If the winch (A) exerts a constant downward force of F N, how much power must be supplied to the motor when the mass has been lifted s m, from rest? The winch's efficiency is ϵ .

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

given m, F, s, ε
find P_{in}

FBD



Force Equilibrium

$$\sum F_y = ma = 2F - mg$$

$$a = \frac{2F - mg}{m}$$

Kinematics

$$v^2 = \cancel{v_0^2} + 2a\Delta s$$

$$v = \sqrt{2a\Delta s}$$

Power

$$P_{out} = F \cdot v$$

Efficiency

$$\epsilon = \frac{P_{out}}{P_{in}} \rightarrow P_{in} = \frac{P_{out}}{\epsilon}$$