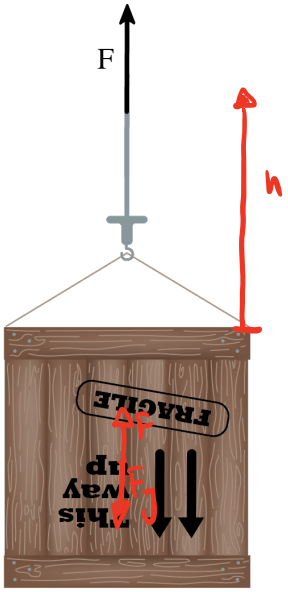
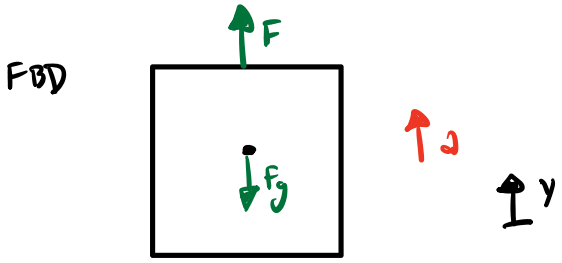
A crane lifts up a crate with mass $m = 30kg$ by a cable. If the crane applies a force of $F = 400N$ and lifts it up to a height of $h = 5m$, determine the work done by both the crane and gravity, and the crate's final velocity if it started from rest.





$$U_G = -F_g h = -mgh = -(30\,kg)(9.81\,m/s^2)(5m)$$

$$U_G = -1471.5J$$

$$U_C = Fh = (400N)(5m) = 2000J$$

$$\boxed{U_G = -1471.5J \quad U_C = 2000J}$$

$$v_f^2 = v_0^2 + 2ad$$

$$\Sigma F_y = ma_y \Rightarrow F - F_G = ma_{Gy} = ma$$

$$a = \frac{400N - (30kg)(9.81\,m/s^2)}{(30kg)} = 3.5233\,m/s^2$$

$$v_f = \sqrt{2(3.5233\,m/s^2)(5m)} = 5.9\,m/s$$

$$\boxed{v_f = 5.9\,m/s}$$