Test Practice # 2

5/03/24 12:06 pm

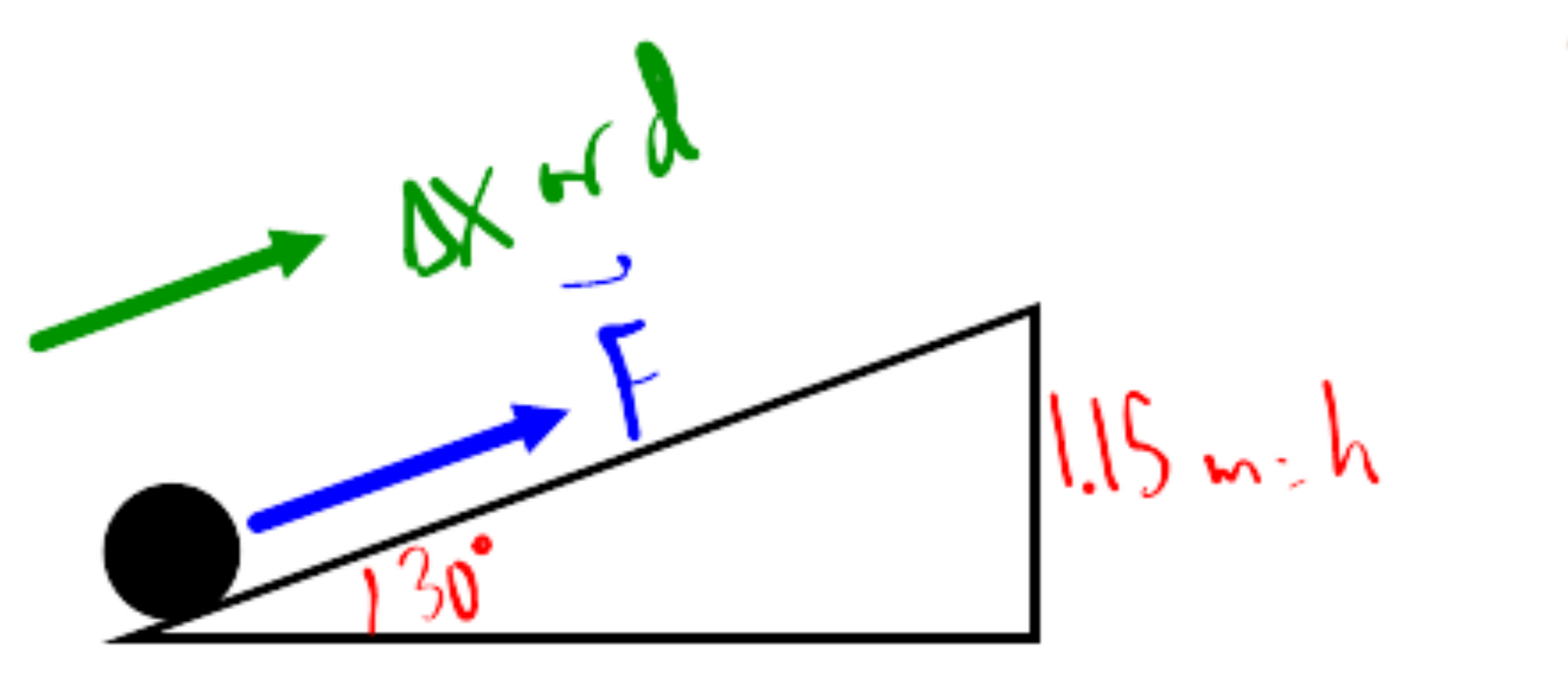
51. You slide a crate up a ramp at an angle of 30.0° to a vertical height of 1.15 m. You exert a 225-N force parallel to the ramp, and the crate moves at a constant speed. The coefficient of friction is 0.28. How much work do you do on the crate?

$$K = \frac{1}{2}mv^2$$

$$\Delta U_g = mg\Delta y$$

$$\Delta E = W = F_{\parallel}d = Fd\cos\theta$$

$$f_K = \mu_K \cdot F_N$$



$$W = Fd\cos\theta$$

$d = \Delta x = ?$

$\sin(30°) = \frac{1.15}{\Delta x}$

$\Delta x = \frac{1.15}{\sin(30°)} = 2.3\ m$

$W_F = 225 \times 2.3 \times \cos 0°$

$W_F = 517.5\ J \approx 518\ J$

If you want to calculate m = ?

$W_{net} = \Delta K = 0$ ← constant speed

$W_F + W_{F_f} + W_{F_g} + W_{F_N} = 0$ — zero, $\theta = 90°$, $\cos 90° = 0$

$517.5 + F_f \cdot \Delta x \cdot \cos(180°) + F_g \cdot \Delta x \cdot \cos(120°) = 0$

$517.5 - \mu \cdot mg\cos(30°) \cdot \Delta x + mg\,\Delta x \cdot \cos(120°) = 0$

$517.5 = \mu mg\cos(30°) \cdot \Delta x - mg\,\Delta x\cos(120°)$

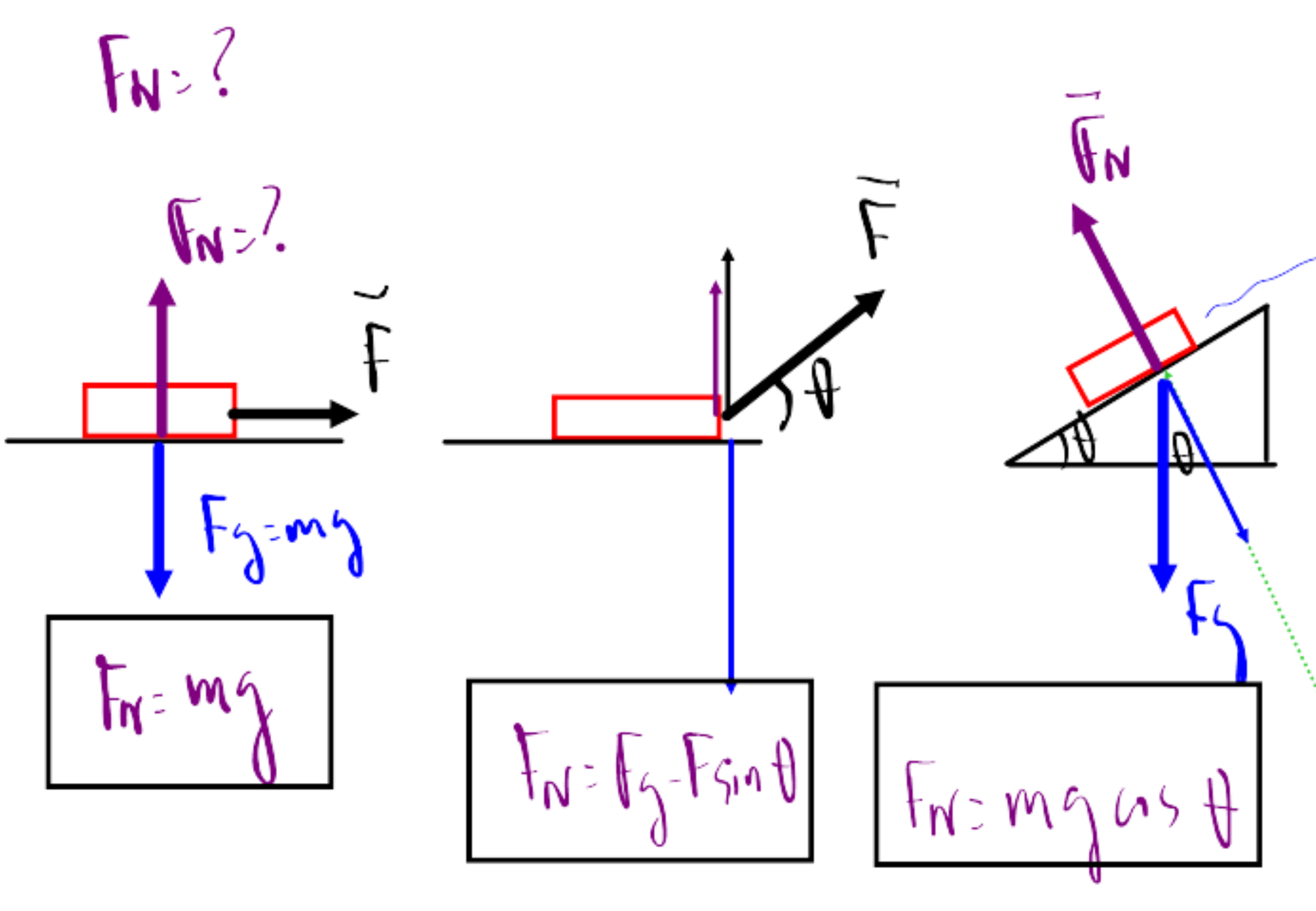
$517.5 = m\left[\mu g\cos(30°) \cdot \Delta x - g\,\Delta x\cos(120°)\right]$

$517.5 = m\left(0.28 \cdot 9.8 \cdot \cos(30°) \cdot 2.3 - 9.8 \times 2.3 \times \cos(120)\right)$

$517.5 = m\left[5.47 - (-11.3)\right] = 16.7 \cdot m$

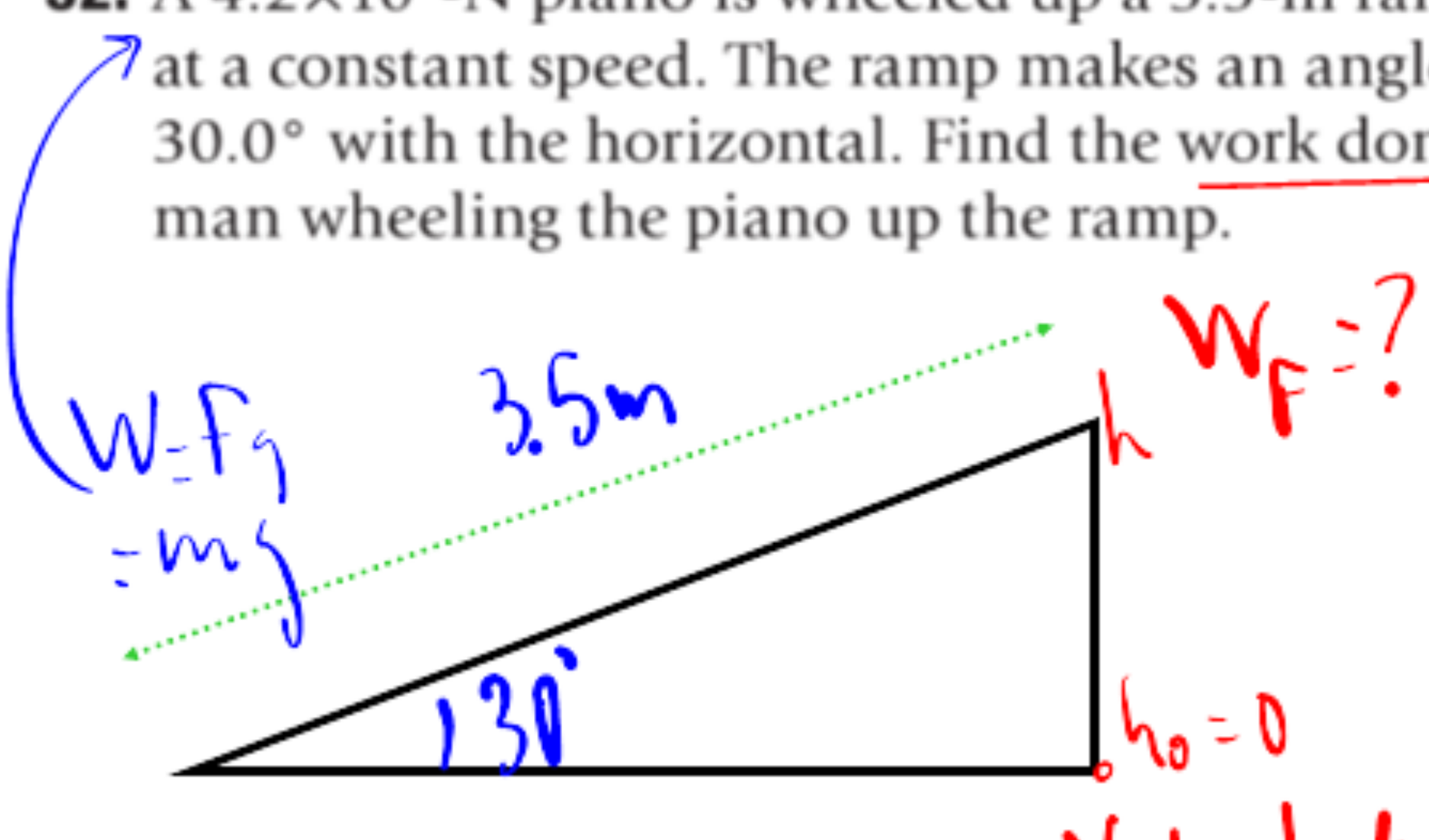
$\frac{517.5}{16.7} = m = 30.9\ kg \approx 31\ kg$

$F_N = ?$



52. A 4.2×10³-N piano is wheeled up a 3.5-m ramp at a constant speed. The ramp makes an angle of 30.0° with the horizontal. Find the work done by a man wheeling the piano up the ramp.

$W = F_g = mg$



$W_F = ?$

$W = F \cdot \Delta x \cdot \cos\theta$

$W_{NC} = \Delta E$

$W_{net} = \Delta K$

V = constant, zero

$W_{NC} = \Delta E$

$W_F + W_{F_f} + W_{F_N} = \Delta K + \Delta U_g$

$F_f = 0$; W_{F_N} zero always, $\theta = 90°$, $\cos 90° = 0$

$W_F = \Delta U_g = U_g - U_{g_0}$ ($U_{g_0} = 0$, $h_0 = 0$)

$W_F = mgh$

h = ?

$\sin(30°) = \frac{h}{3.5}$

$3.5\sin(30°) = h$

$h = 1.75\ m$

$W = mgh$

$W = 4.2 \times 10^3 \times 1.75$

$W = 7350\ J$

Another way

$W_{net} = \Delta K$ → Const. speed!

$W_F + W_{F_g} + W_{F_f} + W_{F_N} = 0 \sim W_F + W_{F_g} = 0$ (zero)

$W_F = -W_{F_g} = -F_g \cdot \Delta x \cdot \cos(120°)$ ← 30° + 90°

$W_F = -mg\Delta x\cos(120°)$

$W_F = -4.2 \times 10^3 \times 3.5 \times (-0.5)$

$W_F = 7350\ J$

57. Maricruz slides a crate up an inclined ramp that is attached to a platform as shown in **Figure 20**. A 400.0-N force, parallel to the ramp, is needed to slide the crate up the ramp at a constant speed.

a. How much work does Maricruz do in sliding the crate up the ramp?

b. How much work would be done on the crate if Maricruz simply lifted the crate straight up from the floor to the platform at a constant speed?

$W_F = F \cdot \Delta x \cdot \cos\theta$

$W_{net} = \Delta K$ ← ?

$W_{NC} = \Delta E$

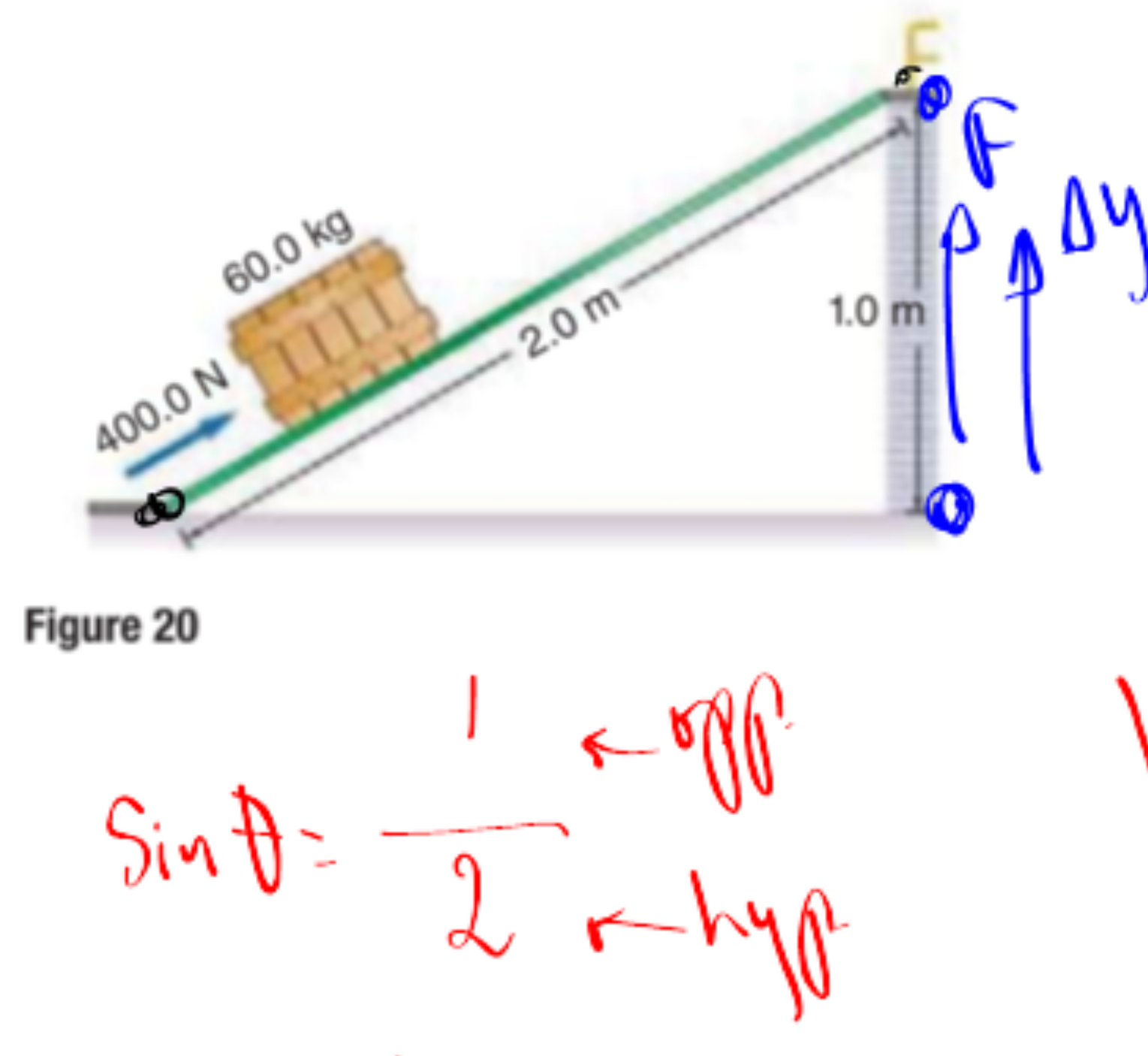


Figure 20

$W_{net} = \Delta K$

$W_F + W_{F_g} + W_{F_N} = 0$ (zero)

$\sin\theta = \frac{1}{2}$ ← opp, ← hyp

$\theta = \sin^{-1}\left(\frac{1}{2}\right) = 30°$

$W_F = -W_{F_g}$

$W_F = -F_g \cdot \Delta x \cdot \cos(120°)$ ← 30° + 90°

$W_F = -mg\Delta x\cos(120°)$

$W_F = -60 \cdot 9.8 \cdot 2 \cdot \cos(120°)$

$W_F = 588\ J$

b) Lifted ($F = F_g$)

$W_F = F \cdot \Delta y \cdot \cos 0°$ (= 1)

$W_F = mg\Delta y$

$W_F = 60 \times 9.8 \times 1 = 588\ J$