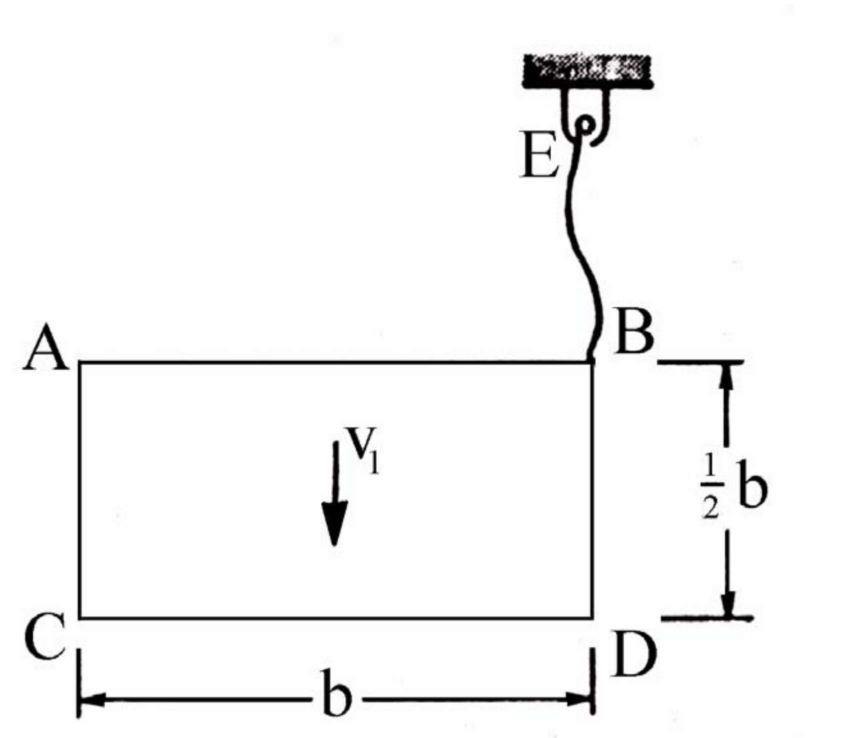
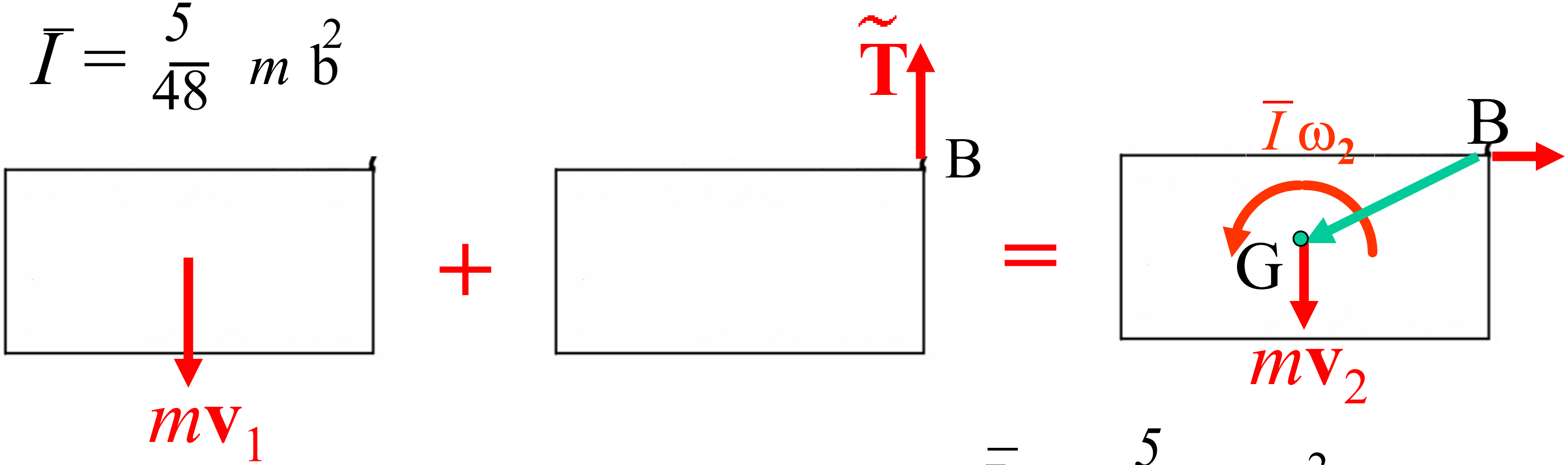


$$\bar{I} = \left(\frac{m}{12}\right)\left(\frac{b^2}{4} + b^2\right)$$

$$\bar{I} = \frac{5}{48}\, m\, b^2$$

The uniform plate ABCD is falling with a velocity v_1 when wire BE becomes taut. Assuming that the impact is perfectly plastic, determine the angular velocity of the plate and the velocity of its mass center immediately after the impact.

$$\bar{I} = \frac{5}{48}\, m\, b^2$$



$$\bar{I} = \frac{5}{12}\, m\, b^2$$

$\rightarrow$ $$0 + 0 = m v_{2x}$$

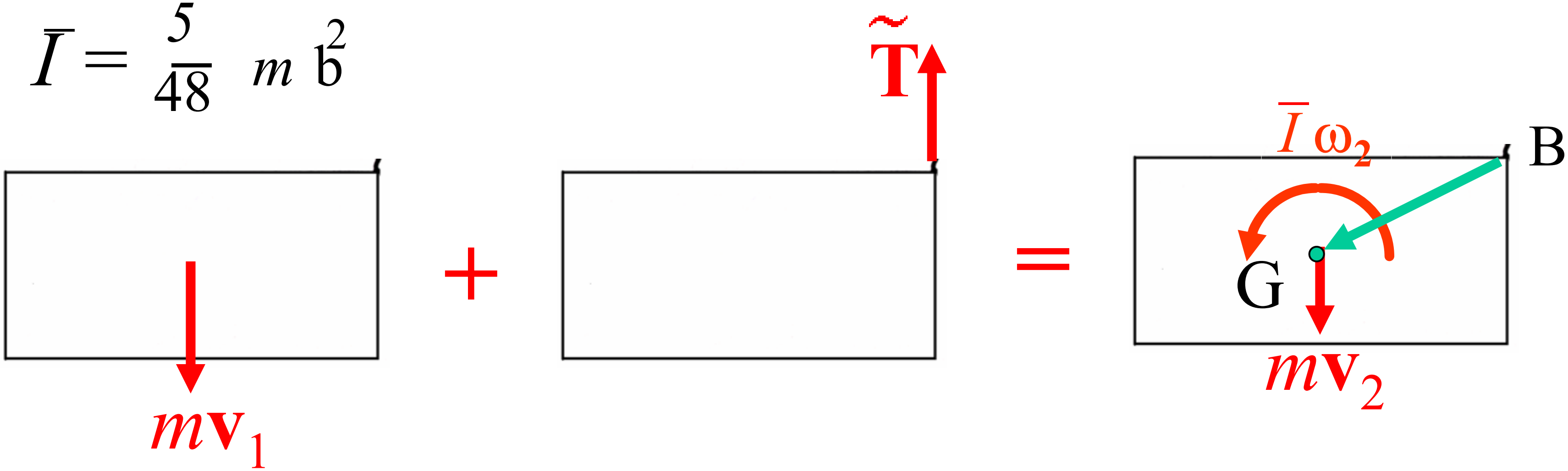
$\uparrow$ $$-\, m v_1 + \tilde{T} = m v_{2y}$$

B $\circlearrowleft$ $$\left[0 + \frac{b}{2} m\, v_1\right] + 0 = \left[\bar{I}\,\omega_2 + \frac{b}{2} m\, v_{2y}\right]$$

Kinematics: $\mathbf{v}_G = v_B\, \mathbf{i} + \omega_2 \times \mathbf{r}_{G/B}$

(for position 2 after the impact)

$$\bar{I} = \frac{5}{48}\, m\, b^2$$



Kinematics: $\mathbf{v}_G = v_B\,\mathbf{i} + \omega_2 \times \mathbf{r}_{G/B}$

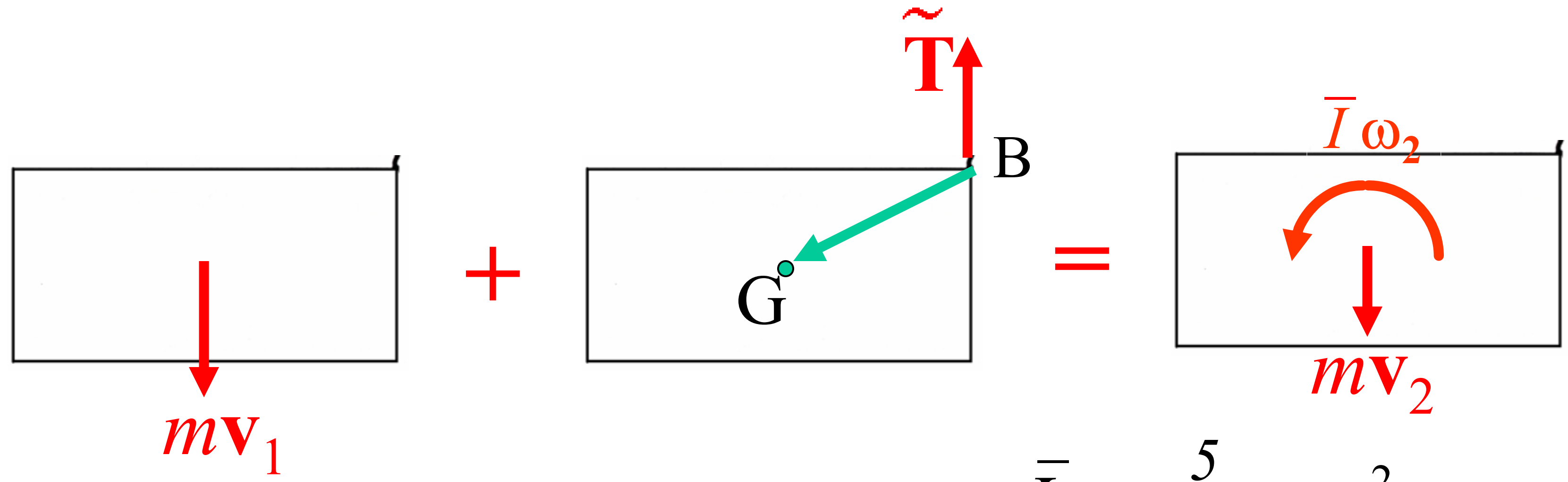
(for position 2 after the impact)

$$-\,v_{2y}\,\mathbf{j} = v_B\,\mathbf{i} + \omega_2\,\mathbf{k} \times [((-b/2)\,\mathbf{i}) + (-b/4)\,\mathbf{j})\,]$$

$$-\,v_{2y}\,\mathbf{j} = v_B\,\mathbf{i} + \omega_2\,[\,(-b/2)\,\mathbf{j}) + (b/4)\,\mathbf{i})\,]$$

$$-\,v_{2y} = \omega_2\,(-b/2)$$

$$0 = v_B + \omega_2\,(b/4)$$



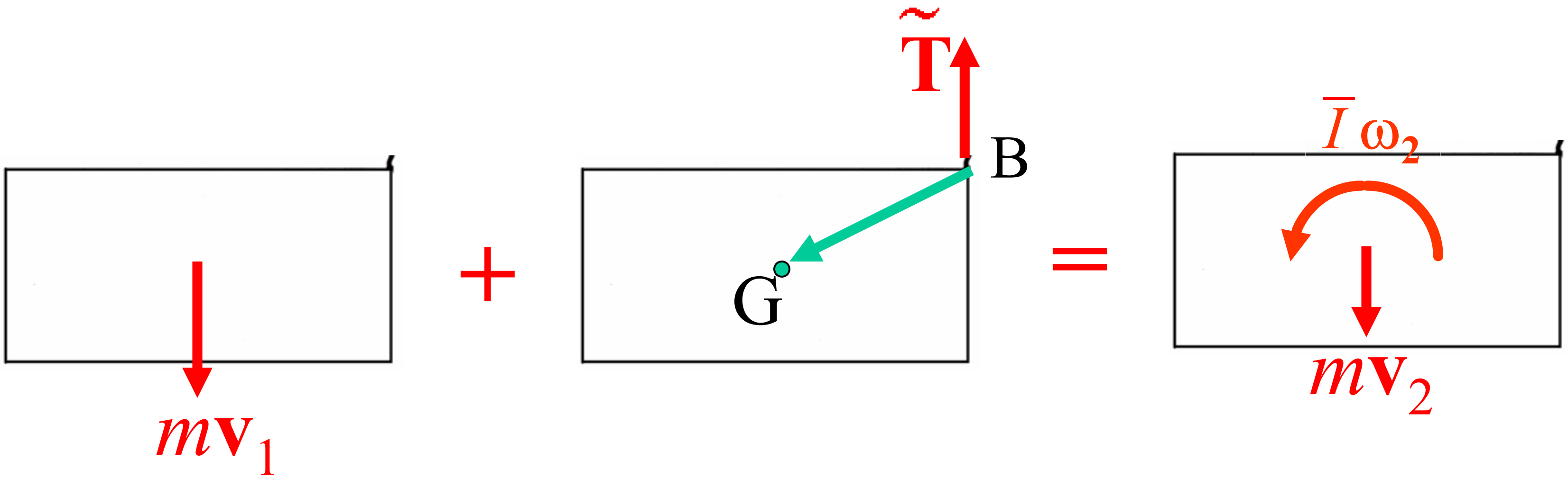
$$\bar{I} = \frac{5}{48}\, m\, b^2$$

$\rightarrow$ $$0 + 0 = m v_{2x}$$

$\uparrow$ $$-m v_1 + T = m v_{2y}$$

B $\circlearrowleft$ $$\left[0 + \frac{b}{2} m\, v_1\right] + 0 = \left[\bar{I}\omega_2 + \frac{b}{2} m\, v_{2y}\right]$$

Kinematics: $$-v_{2y} = \omega_2\,(-b/2)$$



B ↺ $$\left[0 + \frac{b}{2} m v_1\right] + 0 = \left[\bar{I}\omega_2 + \frac{b}{2} m v_{2y}\right]$$

Kinematics: $-v_{2y} = \omega_2 (-b/2)$ $\qquad \bar{I} = \frac{5}{48} m b^2$

$$\frac{b}{2} m v_1 = \frac{5}{48} m b^2 \omega_2 + \frac{b}{2} m \omega_2 (-b/2)$$

$$\omega_2 = \frac{24}{17} \frac{v_1}{b} \qquad v_{2y} = \frac{12}{17} v_1$$

17.140 A square block of mass m is falling with a velocity $\bar{\mathbf{v}}_1$ when it strikes a small obstruction at B. Assuming that the impact between corner A and the obstruction B is perfectly plastic, determine immediately after the impact (*a*) the angular velocity of the block (*b*) the velocity of its mass center G.

17.141 Solve Prob. 17.140, assuming that the impact between corner A and the obstruction B is perfectly elastic.