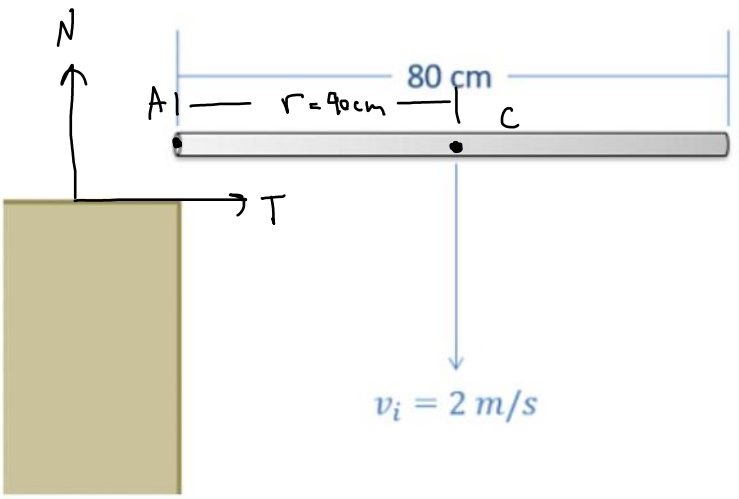
Problem 1

An 80 centimeter long 1 kilogram metal bar falling at 2 meters per second strikes the edge of a table as shown below. Assuming a coefficient of restitution of .9, what is the expected velocity and angular velocity of the bar after impact?



$V_{CNi} = -2\ m/s$

$V_{CTi} = 0$

$\omega_i = 0$

$$V_{TCf} = V_{TCi} = 0$$

$$e = .9 = -\frac{V_{ANf}}{V_{ANi}} \quad V_{ANi} = -2\ m/s$$

$$V_{ANF} = 1.8\ m/s = V_{CNF} - r\,\omega_f \quad (r = .4\ m)$$

$$1.8 = V_{CNf} - .4\,\omega_f$$

$$\vec{K}_{Af} = \vec{K}_{Ai}$$

$$I\vec{\omega}_f + \vec{r}_{G/A} \times (m)\vec{v}_{Gf} = \cancel{I\vec{\omega}_i}^{\,0} + \vec{r}_{G/A} \times (m)\vec{v}_{Gi}$$

$$\frac{1}{12}(1\text{kg})(.8\text{m})^2 \omega_f \hat{k} + \left(.4\hat{i} \times (1) v_{CNF} \hat{j}\right) = \left(.4\hat{i} \times (1)(-2)\hat{j}\right)$$

$$\frac{.64}{12}\omega_f \hat{k} + .4 v_{CNF} \hat{k} = -.8\hat{k}$$

everything in the same direction

$$\frac{.64}{12}\omega_f + .4 v_{CNF} = -.8$$

Use equation solver with previous two equations

$$\omega_f = -7.125 \qquad v_{CNF} = -1.05$$

After impact