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15-42.

A 0.03-lb bullet traveling at 1300 ft/s strikes the 10-lb wooden block and exits the other side at 50 ft/s as shown. Determine the speed of the block just after the bullet exits the block. Also, determine the average normal force on the block if the bullet passes through it in 1 ms, and the time the block slides before it stops. The coefficient of kinetic friction between the block and the surface is $\mu_k = 0.5$.

SOLUTION

$$\begin{pmatrix} \pm \\ \end{pmatrix} \qquad \Sigma m_1 v_1 = \Sigma m_2 v_2 \\ \left(\frac{0.03}{32.2}\right) (1300) \left(\frac{12}{13}\right) + 0 = \left(\frac{10}{32.2}\right) v_B + \left(\frac{0.03}{32.2}\right) (50) \left(\frac{4}{5}\right) \\ v_B = 3.48 \text{ ft/s} \qquad \text{Ans.} \\ (+\uparrow) \qquad mv_1 + \Sigma \int F \, dt = mv_2 \\ - \left(\frac{0.03}{32.2}\right) (1300) \left(\frac{5}{13}\right) - 10(1) (10^{-3}) + N(1) (10^{-3}) = \left(\frac{0.03}{32.2}\right) (50) \left(\frac{3}{5}\right) \\ N = 504 \text{ lb} \qquad \text{Ans.}$$

$$\left(\stackrel{\pm}{\rightarrow} \right) \qquad mv_1 + \sum \int F \, dt = mv_2$$
$$\left(\frac{10}{32.2} \right) (3.48) - 5(t) = 0$$
$$t = 0.216 \, \mathrm{s}$$

 $\frac{5}{4}$ 3 50 ft/s 1300 ft/s T 1016 0.5(10)=516 N=1016 Ans.

Ans: $v_B = 3.48 \text{ ft/s}$ $N_{\text{avg}} = 504 \text{ lb}$ t = 0.216 s