P #G

Ch 6

$m_1 = 10.0\ g = .010\ kg$ (bullet)
$v_1 = ?$

$m_2 = .500\ kg$ (block)
$v_2 = 0$

$\nu = .55$
$d = 1.15\ m$

Use conservation of energy to find v' of bullet and block

$$PE_1 + KE_1 + W = PE_2 + KE_2$$

$$0 + \tfrac{1}{2} \cdot m \cdot v_1^2 + F_f \cdot d = 0 + 0$$

$$\tfrac{1}{2}(.5\ kg + .01\ kg) \cdot v^2 + (-\nu \cdot F_N \cdot d) = 0$$

$$\tfrac{1}{2}(.51\ kg)v^2 + (-.55)(9.8\ m/s^2)(.51 kg)(1.15 m) = 0$$

$v = 3.5\ m/s$ (velocity of bullet + block together after collision)

Use conservation of momentum to find initial velocity of bullet

$$m_1 \cdot v_1 + m_2 \cdot v_2 = (m_1 + m_2) \cdot v'$$

$v' = 3.5\ m/s$ (from energy calculation)

$$(.010\ kg) \cdot v_1 + (.500\ kg) \cdot 0 = (.51\ kg) \cdot (3.5\ m/s)$$

$$\boxed{v_1 = 180\ m/s}$$