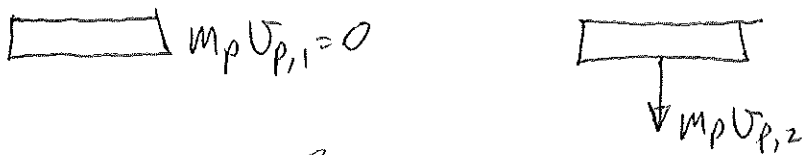


PROB. 13-151

$m_B = 0.125 \text{ kg}$, $v_{B,1} = 3 \frac{\text{m}}{\text{s}}$, $m_P = 0.25 \text{ kg}$, $v_{P,1} = 0$

a) FIND $v_{B,2}$



$\sum m \vec{v}_1 + \sum \vec{I}_{P,1-2} = \sum m \vec{v}_2$ NO EXTERNAL IMPULSES

$-m_B v_{B,1} + 0 = m_B v_{B,2} - m_P v_{P,2}$

NO ENERGY LOST IN IMPACT: KINETIC ENERGY CONSERVED

$T_1 = T_2 : \frac{1}{2} m_B v_{B,1}^2 + 0 = \frac{1}{2} m_B v_{B,2}^2 + \frac{1}{2} m_P v_{P,2}^2$

FROM ABOVE, $v_{P,2} = \frac{m_B}{m_P} (v_{B,2} + v_{B,1})$

$m_B v_{B,1}^2 = m_B v_{B,2}^2 + m_P \left[\left(\frac{m_B}{m_P} \right) (v_{B,2} + v_{B,1}) \right]^2$

$v_{B,1}^2 = v_{B,2}^2 + \left(\frac{m_P}{m_B} \right) \left(\frac{m_B}{m_P} \right)^2 (v_{B,2}^2 + 2 v_{B,1} \cdot v_{B,2} + v_{B,1}^2)$

$\left(1 + \frac{m_B}{m_P} \right) v_{B,2}^2 + \left[2 \left(\frac{m_B}{m_P} \right) \cdot v_{B,1} \right] v_{B,2} + \left[\left(\frac{m_B}{m_P} \right) - 1 \right] v_{B,1}^2 = 0$

$\left(1 + \frac{m_B}{m_P} \right) = 1 + \frac{(0.125)}{(0.25)} = 1.5$

$2 \left(\frac{m_B}{m_P} \right) v_{B,1} = 2 \left(\frac{0.125}{0.25} \right) \left(3 \frac{\text{m}}{\text{s}} \right) = 3$

$\left[\left(\frac{m_B}{m_P} \right) - 1 \right] v_{B,1}^2 = \left[\left(\frac{0.125}{0.25} \right) - 1 \right] (3)^2 = -4.5$

PROB. 13-151 CONT.

$$1.5 v_{B,2}^2 + 3 v_{B,2} - 4.5 = 0$$

$$v_{B,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(3) \pm \sqrt{9 - 4(1.5)(-4.5)}}{2(1.5)}$$

$$v_{B,2} = -3 \text{ OR } 1$$

$$v_{B,2} = 1 \frac{\text{m}}{\text{s}} \uparrow$$

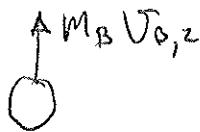
b) FIND IMPULSE OF THE FORCE EXERTED BY THE PLATE ON THE BALL



+



=



$$m_B v_{B,1} + \sum \text{IMP}_{1-2} = m_B v_{B,2}$$

$$\sum \text{IMP}_{1-2} = m_B (v_{B,2} - v_{B,1})$$

$$= (0.125 \text{ kg}) \left[(+1) - (-3) \frac{\text{m}}{\text{s}} \right]$$

$$\sum \text{IMP}_{1-2} = 0.5 \text{ N}\cdot\text{s}$$