



$$10g = M_{M_1} = M_{M_2} = M_{B_1} = M_{B_2}$$

$$6.35 = r_{M_1} = r_{M_2} = r_{B_1} = r_{B_2}$$

$$\Delta P_{\text{system}} = 0 \Rightarrow P_i = P_f$$

$$P_i = (M_{M_1})(V_{M_1,BC}) + (M_{M_2+B_1+B_2})(V_{(M_2+B_1+B_2)BC})$$

$$= (0.01\text{kg})(0.700\frac{\text{m}}{\text{s}}) + (0.03\text{kg})(0.000\frac{\text{m}}{\text{s}})$$

$$= \boxed{0.007\frac{\text{kg}\cdot\text{m}}{\text{s}}}$$

$$P_f = (M_{M_1+M_2+B_1+B_2})(V_{(M_1+M_2+B_1+B_2)AC}) + (M_{B_2})(V_{B_2,AC})$$

$$= (0.03\text{kg})(-0.387\frac{\text{m}}{\text{s}}) + (0.01\text{kg})(1.815\frac{\text{m}}{\text{s}})$$

$$= \boxed{0.00654\frac{\text{kg}\cdot\text{m}}{\text{s}}}$$

Error here resulting from video not capturing Vec of $M_2+B_1+B_2$ due to frame rate. We can work with this error as the Percent Error is less than 10%

$$\%E = \frac{| \text{Measured} - \text{Actual} |}{1 \text{ actual}} = \frac{0.007 - 0.00654}{0.00654}$$

$$= 0.0703 \text{ or } 7.03\% \text{ Error}$$

7.03% < 10%

V_i	$V_{\text{Before collision}}$	$V_{\text{After collision}}$
$0.626\frac{\text{m}}{\text{s}}$	$0.700\frac{\text{m}}{\text{s}}$	$-0.387\frac{\text{m}}{\text{s}}$
$0.000\frac{\text{m}}{\text{s}}$	$0.000\frac{\text{m}}{\text{s}}$	$-0.387\frac{\text{m}}{\text{s}}$
$0.000\frac{\text{m}}{\text{s}}$	$0.000\frac{\text{m}}{\text{s}}$	$1.815\frac{\text{m}}{\text{s}}$

$$\langle E_i = \frac{1}{2}(M_{M_1})(V_{ecM_1})^2 + \frac{1}{2}(M_{M_2+B_1+B_2})(V_{(M_2+B_1+B_2)BC})^2$$

$$= \frac{1}{2}(0.01\text{kg})(0.700\frac{\text{m}}{\text{s}})^2 + \frac{1}{2}(0.03\text{kg})(0.000\frac{\text{m}}{\text{s}})^2$$

$$= \boxed{0.00245\text{J}}$$

$$KE_f = \frac{1}{2}(M_{M_1+M_2+B_1})(V_{(M_1+M_2+B_1)AC})^2 + \frac{1}{2}(M_{B_2})(V_{B_2,AC})^2$$

$$= \frac{1}{2}(0.03\text{kg})(-0.387\frac{\text{m}}{\text{s}})^2 + \frac{1}{2}(0.01\text{kg})(1.815\frac{\text{m}}{\text{s}})^2$$

$$= \boxed{0.0187\text{J}} \Rightarrow 0.0187\text{J} - \boxed{0.00245\text{J}} = \boxed{\Delta KE = 0.01625\text{J}}$$

Make sure this "creation" of KE isn't the result of, we did this calculation using the theoretical optimal Vec for $M_2+B_1+B_2$ to make sure that momentum was conserved perfectly. See attachment A.