

### Answer on Question #69259 Physics / Other

A  $m = 4.3 \text{ kg}$  object traveling at  $v = 2.5 \text{ m/s}$  to the right collides head-on with a  $M = 3.8 \text{ kg}$  object which is at rest. If the impact is perfectly elastic, the velocity of the  $3.8 \text{ kg}$  object after the impact is \_\_\_ m/s.

#### Solution:

The momentum conservation law

$$mv = mv' + Mu$$

The energy conservation law

$$\frac{mv^2}{2} = \frac{mv'^2}{2} + \frac{Mu^2}{2}$$

So

$$v' = v - \frac{M}{m}u$$

$$v^2 = \left(v - \frac{M}{m}u\right)^2 + \frac{M}{m}u^2$$

$$v^2 = v^2 - 2\frac{M}{m}vu + \frac{M^2}{m^2}u^2 + \frac{M}{m}u^2$$

$$u\left(\frac{M^2}{m^2} + \frac{M}{m}\right) = 2\frac{M}{m}v$$

$$u\left(\frac{M}{m} + 1\right) = 2v$$

$$u = \frac{2v}{1 + \frac{M}{m}} = \frac{2 \times 2.5}{1 + \frac{3.8}{4.3}} = 2.65 \frac{\text{m}}{\text{s}}$$

**Answers:**  $u = 2.65 \frac{\text{m}}{\text{s}}$ .

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