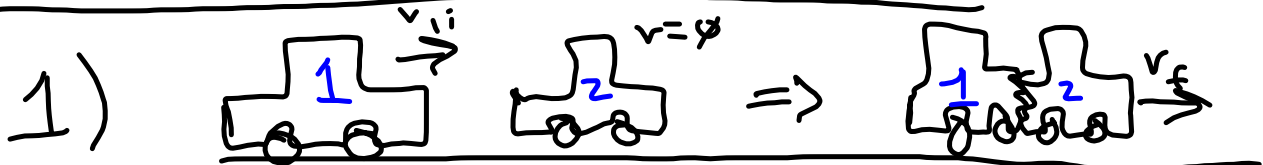


## CONSERVATION OF MOMENTUM



$$m_1 v_{1i} = (m_1 + m_2) v_f$$

Type: C

2) Type A

3) Type B

4) Type D

5) Base conservation of momentum equation

For problems:

- 1) Type
- 2) equation in variables
- 3) Answer with units

2) bowling ball  $\rightarrow$  1  
 $v_{1i} = ?$                        $v_{1f} = 1.8 \text{ m/s}$   
 $m_1 = 7 \text{ kg}$

pin  $\rightarrow$  2  
 $v_{2i} = 0 \text{ m/s}$                        $v_f = 3 \text{ m/s}$   
 $m_2 = 2 \text{ kg}$

Type B

$$m_1 v_{1i} = m_1 v_{1f} + m_2 v_{2f}$$

$$v_{1i} = \frac{m_1 v_{1f} + m_2 v_{2f}}{m_1}$$

$$= 2.66 \text{ m/s}$$

3) Cue ball  $\rightarrow 1$ 

$$m_1 = 0.05 \text{ kg}$$

$$v_{1i} = 3 \text{ m/s}$$

$$v_{1f} = 0 \text{ m/s}$$

Type B

8-ball  $\rightarrow 2$ 

$$m_2 = 0.03 \text{ kg}$$

$$v_{2f} = ?$$

$$v_{2i} = 0 \text{ m/s}$$

$$m_1 v_{1i} = m_2 v_{2f}$$

$$v_{2f} = \frac{m_1 v_{1i}}{m_2}$$

$$= \frac{(0.05 \text{ kg})(3 \text{ m/s})}{0.03 \text{ kg}}$$

$$= 5 \text{ m/s}$$

4) large fish  $\rightarrow 1$       small fish  $\rightarrow 2$   
 $m_1 = 1.4 \text{ kg}$        $m_2 = 0.35 \text{ m/s}$   
 $v_{1i} = 0 \text{ m/s}$        $v_{2i} = 3 \text{ m/s east}$

Type C

combined  
 $m_1 + m_2 = 1.75 \text{ kg}$   
 $v_f = ?$

$$m_2 v_{2i} = (m_1 + m_2) v_f$$

$$v_f = \frac{m_2 v_{2i}}{m_1 + m_2}$$

$$= 2.14 \text{ m/s east}$$

5) child + boat  $\rightarrow 1$       package  $\rightarrow 2$

Type A

$$m_1 = 60 \text{ kg} \qquad m_2 = 3.4 \text{ kg}$$
$$v_i = 0 \text{ m/s} \qquad v_i = 0 \text{ m/s}$$
$$v_{1f} = ? \qquad v_{2f} = 10 \text{ m/s}$$

$$0 = m_1 v_{1f} + m_2 v_{2f}$$

$$v_{1f} = \frac{-m_2 v_{2f}}{m_1}$$

$$= -0.57 \text{ m/s}$$

6) piece of putty  $\rightarrow 1$       piece of putty  $\rightarrow 2$

$m_1 = 0.002 \text{ kg}$        $m_2 = 0.003 \text{ kg}$

$v_{1i} = 4 \text{ m/s}$        $v_{2i} = -3 \text{ m/s}$

Typed

Combined pieces

$$m_1 + m_2 = 0.005 \text{ kg}$$

$$v_f = ?$$

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$v_f = \frac{m_1 v_{1i} + m_2 v_{2i}}{m_1 + m_2}$$

$$= \frac{(0.002 \text{ kg})(4 \text{ m/s}) + (0.003 \text{ kg})(-3 \text{ m/s})}{0.005 \text{ kg}}$$

$$= -0.2 \text{ m/s}$$