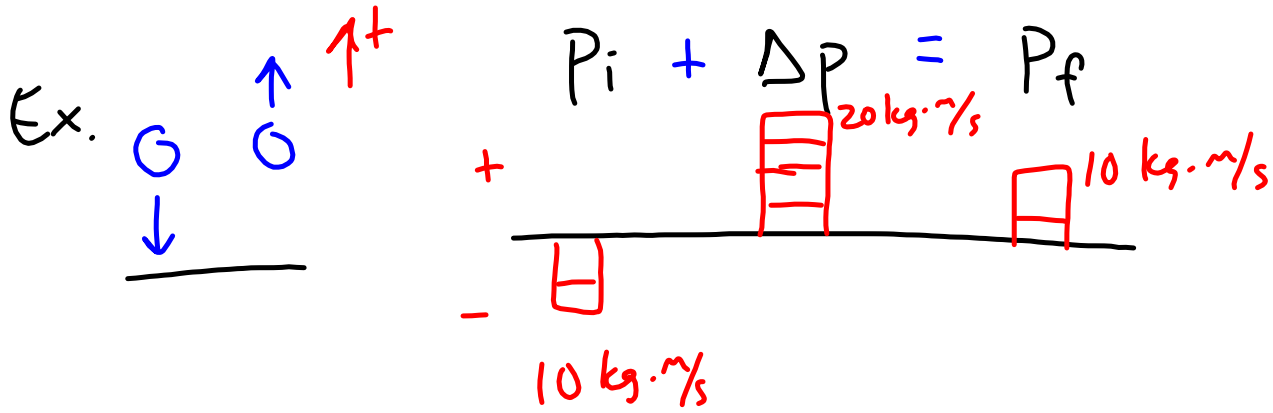
Energy and Momentum

- Perfectly elastic collisions → energy AND momentum conserved
- Perfectly inelastic collisions → momentum conserved, energy not conserved

Momentum Diagram



Problems

p. 201 → 1, 3

p. 209 → 1, 3

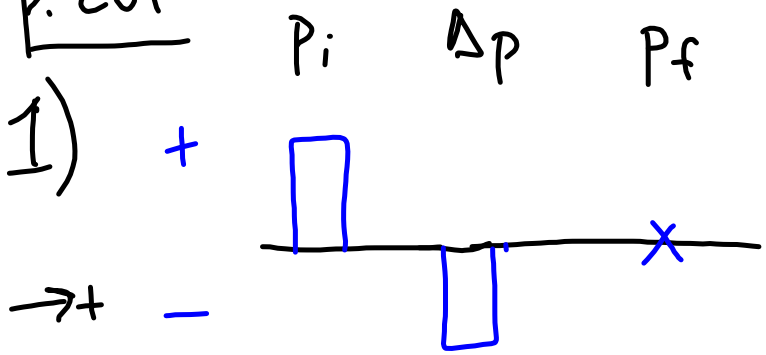
p. 219 → 1a, 3a

p. 225 → 31, 35,

p. 226 → 45

* Do a $p_i / \Delta p / p_f$ diagram for each problem

P. 201

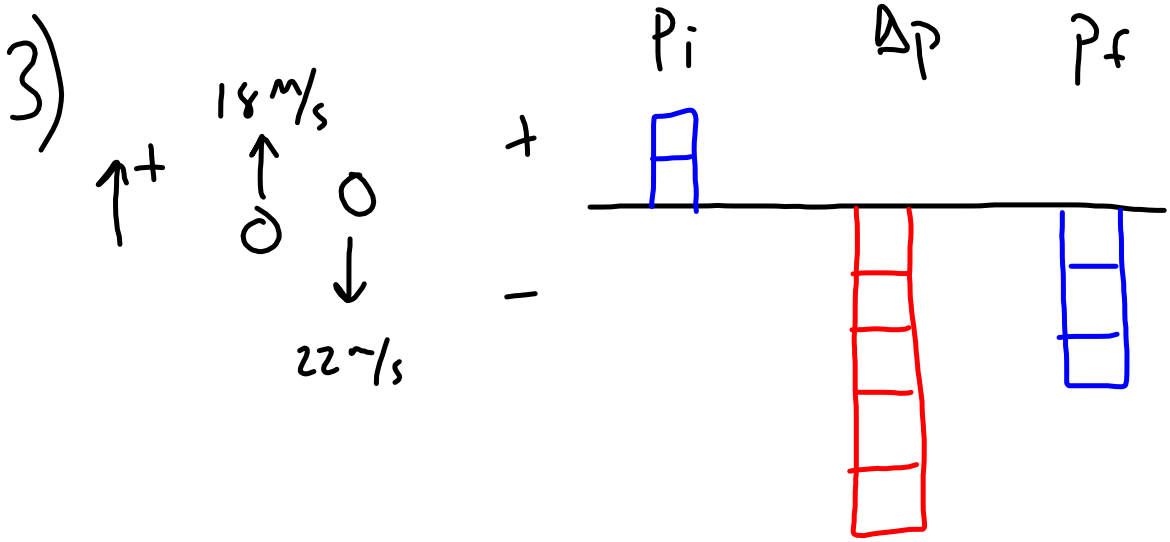


$\bar{p}_i = m\bar{v}_i = (0.5\ kg)(15\ m/s) = 7.5\ kg\cdot m/s$

$\Delta p = -7.5\ kg\cdot m/s$

$F\Delta t = \Delta p$

$F = \frac{\Delta p}{\Delta t} = \frac{-7.5\ kg\cdot m/s}{0.025} = -375\ N$



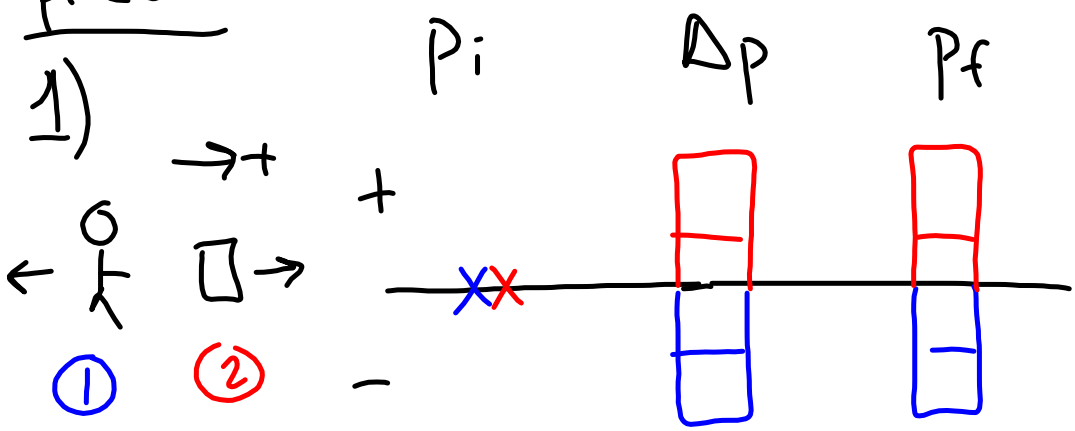
$\text{impulse} = \Delta\bar{p} = \bar{p}_f - \bar{p}_i$

$= (0.4\ kg)(-22\ m/s) - (0.4\ kg)(18\ m/s)$

$= -16\ kg\cdot m/s$

p. 209

1)



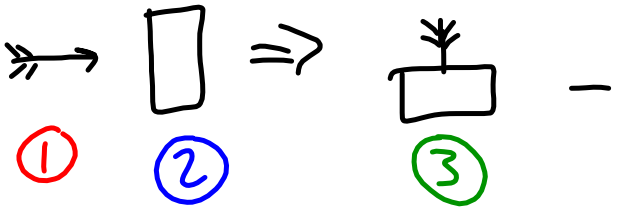
$$\bar{p}_i = \bar{p}_f$$

$$0 = m_1 \bar{v}_{1f} + m_2 \bar{v}_{2f}$$

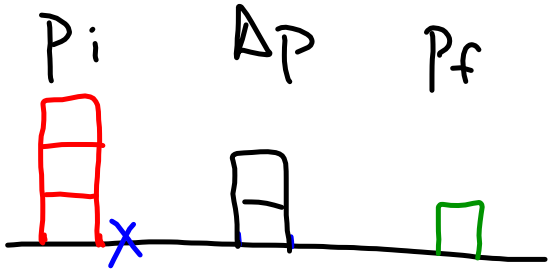
$$v_{1f} = \frac{-m_2 v_{2f}}{m_1} = \frac{(10\,kg)(12\,m/s)}{63\,kg} = -1.9\,m/s$$

P. 216

1) a. → +



+



$$m_1\bar{v}_{1i} + m_2\bar{v}_{2i} = (m_1+m_2)\bar{v}_f$$

$$v_f = \frac{m_1 v_{1i}}{m_1+m_2} = \frac{(0.25\,kg)(12\,m/s)}{(0.25\,kg+6.8\,kg)} = 0.43\,m/s$$

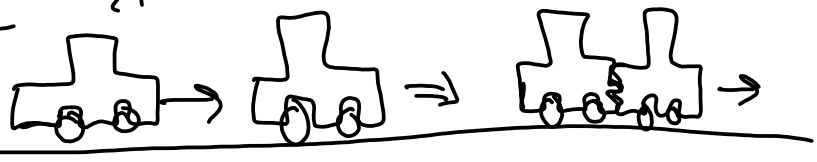
b. $\Delta K = K_f - K_i$

$$= \frac{1}{2}(m_1+m_2)v_f^2 - \frac{1}{2}m_1 v_{1i}^2$$

$$= \frac{1}{2}(.25\,kg+6.8\,kg)(0.43\,m/s)^2 - \frac{1}{2}(0.25\,kg)(12\,m/s)^2$$

$$= -17.3\,J$$

p.224 →+

45) 

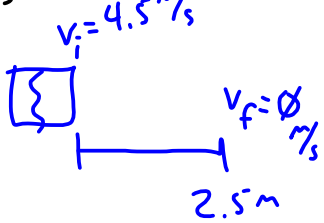
① find v_f

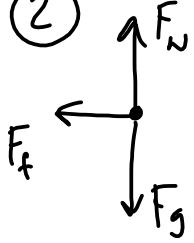
② find F_f

③ find μ

① $m_1\bar{v}_{1i} + m_2\bar{v}_{2i} = (m_1+m_2)\bar{v}_f$ ($\bar{v}_{2i} = 0$)

$$v_f = \frac{m_1 v_{1i}}{m_1+m_2} = 4.5\ m/s$$



② 

$\sum \bar{F} = m\bar{a}$

$-F_f = m\bar{a}$

$F_f = -m\bar{a}$

$= -(2250\ kg + 2750\ kg)(-4.05\ m/s^2)$

$= 20250\ N$

$v_f^2 = v_i^2 + 2a\Delta x$

$a = \frac{v_f^2 - v_i^2}{2\Delta x}$

$= \frac{(0\ m/s)^2 - (4.5\ m/s)^2}{2(2.5\ m)}$

$= -4.05\ m/s^2$

③ $\mu = \frac{F_f}{F_N}$

$F_N = F_g = (2250\ kg + 2750\ kg)(9.8\ m/s^2)$

$= 49000\ N$

$= \frac{20250\ N}{49000\ N}$

$= 0.413$