MOMENTUM - PROBLEM SET 2

① $F = 8.00N$, $m = 4.00kg$, $t = 12.0s$ — $Ft = m\Delta v$

Ⓐ $\Delta v = \frac{Ft}{m} = \frac{(8.00N)(12.0s)}{4.00kg} = 24 m/s$ **$\Delta v = 24.0 m/s$**

Ⓑ $\Delta p = m\Delta v = (4.00kg)(24 m/s) = 96 kgm/s$ **$\Delta p = 96.0 kgm/s$**

② $m = 420kg$, $t = 72.0s$, $v_1 = 11.00m/s$, $v_2 = 38.0m/s$

Ⓐ $\Delta p = m\Delta v = 420kg(38.0m/s - 11.00m/s) = 11340 kgm/s$

Ⓑ $\Delta p = Ft$ $F = \frac{\Delta p}{t} = \frac{11340 kgm/s}{72.0s} = 157.5N$ **$\Delta p = 11300 kgm/s$** **$F = 157N$**

③ $F = 2.56 \times 10^3 N$, $m = 1.50 \times 10^3 kg$, $v_1 = 0$, $v_2 = 3.00 \times 10^2 m/s$

$Ft = m\Delta v$

$t = \frac{m(v_2 - v_1)}{F} = \frac{(1500kg)(300.m/s - 0)}{2.56 \times 10^3 N} = 175.8s$

$t = 176s$

④ $W = 16850N$, $F = -720N$, $v_2 = 0$, $v_1 = 18.0m/s$

Ⓐ $W = mg$ $m = \frac{W}{g} = \frac{16850N}{10 m/s^2} = 1685.0 kg$ **$m = 1680kg$**

Ⓑ $p_1 = mv_1 = (1685kg)(18.0m/s) = 30330 kgm/s$ **$p_1 = 30300 kgm/s$**

Ⓒ $\Delta p = m\Delta v (1685kg)(0 - 18m/s) = -30330 kgm/s$ **$\Delta p = -30300 kgm/s$**

Ⓓ $Ft = \Delta p$ $t = \frac{\Delta p}{F} = \frac{-30330 kgm/s}{-720N} = 42.125s$ **$t = 42.1s$**

⑤ $m = 2.4 \times 10^4 kg$, $F = 2.1 \times 10^5 N$, $v_1 = 0$, $t = 18.0s$

$Ft = m\Delta v = m(v_2 - v_1)$

$v_2 = \frac{Ft}{m} + v_2 = \frac{(2.1 \times 10^5 N)(18.0s)}{2.4 \times 10^4 kg} + 0 = 157.5 m/s$

$v_2 = 157 m/s$

⑥ $p_1 + p_2 = p_1' + p_2'$

$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$

$(4kg)(22m/s) + (15kg)(12m/s) = (4kg)(9m/s) + (15kg)(v_2')$

$v_2' = 15.466 m/s$ **$v_2' = 15.5 m/s$**

⑦ $p_B + p_W = p_{B+W}'$

$m_B v_B + m_w v_w = m_{B+W} v_{B+W}'$

$(.042kg)(v_B) + (9.0kg)(0) = (.042 + 9kg)(9.2m/s)$

$v_B = 1980.6 m/s$ **$v_B = 1980 m/s$**

MOMENTUM PROBLEM SET 2

(8) $P_{M+B} = P_M' + P_B'$ $\quad (m_M+m_B)v_{M+B} = m_M v_M' + m_B v_B'$

$(65kg+12kg)(6m/s) = (65kg)(7.5m/s) + (12kg)v_B'$

$v_B' = -2.125 m/s$

$v_B' = 2.12 m/s$ WEST

(9) $P_B + P_W = P_B' + P_W'$ $\quad m_B v_B + m_W v_W = m_B v_B' + m_W v_W'$

$(0.038kg)(495m/s) + (3.0kg)(0) = (0.038kg)(260m/s) + (3.0kg)(v_W')$

$v_W' = 2.976$

$v_W' = 2.98 m/s$

(10) $P_1 + P_2 = P_1' + P_2'$ $\quad m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$

$(0.32kg)(0.27m/s) + (0.150kg)(0.13m/s) = (0.32kg)v_1' + (0.150kg)(0.24m/s)$

$v_1' = 1.0325 m/s$

$v_1' = 1.03 m/s$

(11) IMPULSE $= F\Delta t$

$(35.0N)(0.21s) = 7.35 N\cdot s$

IMPULSE $= 7.35 N\cdot s$

(12) $m = 0.30kg$
$v_1 = 5.8 m/s$
$v_2 = -16 m/s$
$t = 2.3\times10^{-2} s$

$Ft = m\Delta v$

$F = \frac{m(v_2 - v_1)}{t} = \frac{(0.30kg)(-16m/s - 5.8m/s)}{2.3\times10^{-2}s} = -284.3N$

$F = 284N$ IN THE FINAL VELOCITY DIRECTION

(13) $m = 800kg$
$v = 95 km/hr =$

$95\frac{km}{hr}\cdot\frac{1000m}{1km}\cdot\frac{1hr}{3600s} = 26.39 m/s$

(A) $p = mv = (800kg)(26.39m/s) = 2.111\times10^4 kg\,m/s$

$p = 2.11\times10^4 kg\,m/s$

(B) $p = mv$ $\quad v = \frac{p}{m}$ $\quad \frac{2.111\times10^4 kg\,m/s}{2385kg}$

$v = 8.851 m/s$

$8.851\frac{m}{s}\cdot\frac{3600s}{1hr}\cdot\frac{1km}{1000m} = 31.86 km/hr$

$v = 31.9 km/hr$

(14) $m = 550kg$
$v_1 = 8.0 m/s$
$v_2 = 38.0 m/s$
$t = 62.0s$

(A) $\Delta p = m\Delta v = m(v_2 - v_1) = (550kg)(38.0 - 8.0 m/s) = 16500 kg\,m/s$

$\Delta p = 16500 kg\,m/s$

(B) $\Delta p = Ft$ $\quad F = \frac{\Delta p}{t} = \frac{16500 kg\,m/s}{62.0s} = 266.1 N$

$F = 266N$