HW # 2

1) Truck - big m, bullet large v $\quad p = mv$

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2) Ft = impulse $= \Delta p = m\Delta v \qquad Ft = m\Delta v$

$F = \dfrac{mv_f - mv_i}{t}$ $\qquad m = 7250\ kg$

$v_i = 7.65\ m/s$

Want t $\qquad v_f = 0$

$F = 426{,}000\ N$

$t = \dfrac{m(v_f - v_i)}{F} = \dfrac{(7250\,kg)(0 - 7.65\,m/s)}{426{,}000}$

3) $Ft = m\Delta v = \Delta p \qquad \Delta v = 7.65\ m/s$

$Ft = (7250)kg\ (7.65\ m/s) = 55462.5\ kg\ m/s$

$t = \dfrac{55462.5\ kg\ m/s}{426000\ kg\ m/s^2} = \boxed{0.130\ s}$

3) vehicle speed $= 86.6\ km/h = 86.6\ \dfrac{km}{h}\ \dfrac{1h}{3600s}\ \dfrac{1000m}{1km}$

a) $\Delta p = \Delta m v$

$= 24.611\ m/s$

$\Delta p = m\Delta v$ $\quad \Delta v = 24.611\ m/s$

$\Delta m_{\text{adult}} = (66.4\,kg)\ 24.611\ m/s = \boxed{1{,}663\ kg\ m/s}$

Pg 150

$\Delta m_{\text{child}} = (34.2\,kg)(24.611\,m/s) = \boxed{841.69\ kg\ m/s}$

b) $Ft = \Delta p$

Adult $\quad (1663)/0.564s = \boxed{2{,}984.042\ kg\ m/s^2}$

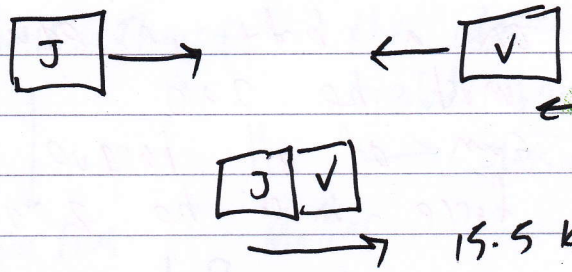
child $\quad (841.69)/0.260s = \boxed{3{,}237\ kg\ m/s^2}$

$= \boxed{3237\ N}$

HW 2 (cont)

4) Jeep $m = 1720$ kg Volkswagen $m = 1510$ kg

Backwards



$$\left(75.7 \frac{km}{h}\right)\left(\frac{1\,h}{3600\,s}\right)\left(\frac{1000\,m}{1\,km}\right) = 21.03\ m/s = V_{volkswagen}$$

→ EAST

Final velocity $\left(-15.5 \frac{km}{h}\right)\left(\frac{1\,h}{3600\,s}\right)\left(\frac{1000\,m}{1\,km}\right) = -4.31\ m/s$

← 4.31 m/s west

$$m_J v_J + m_V v_V = (m_V + m_J) v_F$$

$$v_J = \frac{(m_V + m_J) v_F - (m_V v_V)}{m_J}$$

$$v_J = \frac{(1510 + 1720)(-4.31\ m/s) - (1510)(21.03)}{1720\ kg}$$

$$= \frac{(3240)(-4.31) - (31,755.3)}{1720}$$

$$= \frac{-13964.4 - 31755.3}{1720} = \frac{-45,719.7}{1720}$$

$$= -26.5818\ m/s$$

$$= (-26.58)\ m/s \ \frac{3600\,s}{1\,hr} \ \frac{1\,km}{1000\,m} = -95.69\ km/h$$

HW # 2 (cont)

5) Equilibrium

See 172, 186, 196

Pg 186 - The sum of all parallel forces on a body in equilibrium must be zero

Pg 147 - sum of all torque (twisting force must be zero)

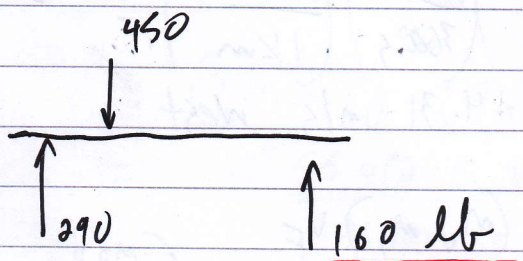
6)

Blue
220 + 340 + 180 + 560
= 1300N

Red
250 + 160 + 420
= 830N

4th red must equal 470N

7) See Section 7.4



8) See 7.3

Torque depends on Force applied and length of torque arm

a) (1 ft)(25 lbs) = 25 ft lbs

b) (2)(12.5 lbs) = 25 ft. lbs

See 8.1

9) $W = F d \cos\theta = (900)(35)(\cos 40°) = 24{,}130 = 24.13$ KJ

Section 8.2

10) $P = W/t \quad W = Fs = (475\text{ kg})(10\text{ m}) = 4750\text{ kg}\cdot\text{m}$

$(4750\text{ kg}\cdot\text{m})/24\text{s} = 197.91$ kw

11) $v = \sqrt{2gs} = \sqrt{2(9.8\text{ m/s}^2)50\text{ m}} = 31.3$ m/s.

Sec 6.3

12) a) $PE = mgh \quad (1250\text{kg})(9.8\text{ m/s}^2)(12.7\text{m}) = 155{,}575$ J

b) 155,575 J

c) $F = KE/s = (155{,}575)/(.437) = 356{,}006.9$ J

d) $PE = 0$