# Chapter 8
# Momentum
# Homework Solutions

PHY 2425

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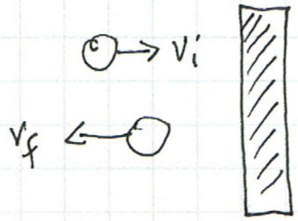
CHAP 8 #49




GIVEN: $v_i = +10\ m/s$
$v_f = -8.0\ m/s$
$m = 0.060\ g$ ← should be kg

QUES: (a.) IMPULSE EXERTED BY WALLS
(b.) $\Delta t = 3.0\ ms$; $F_{AVG} = ?$
(c.) REBOUNDING BALL BROUGHT TO REST. HAND MOVES $\Delta x = 0.50\ m$. I RECEIVED BY PLAYER?
(d.) $F_{AVG}$

(a.) $I = \Delta \vec{p} = m v_f - m v_i$
$= m(v_f - v_i) = 0.06(-8 - 10)$
$\Delta p = -1.08\ N \cdot s$ ON BALL
$I = +1.08\ N \cdot s$ EXERTED ON WALL.

(b.) $I = 1.08\ N \cdot s = F_{AVG} \cdot \Delta t$

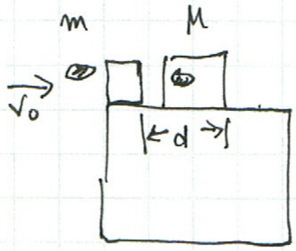
$F_{AVG} = \dfrac{1.08}{3 \times 10^{-3}} = 360\ N$ INTO WALL

(c.) ← $-v_f$ (ball, $m$)

$p = m v_f = 0.06(-8) = -0.48\ N \cdot s.$
$I = \Delta p = -0.48\ N \cdot s.$

(d.) $v^2 = v_f^2 - 2a\Delta x$
$0 = v_f^2 - 2\dfrac{F}{m}\Delta x$
$v_f^2 = 2\dfrac{F}{m}\Delta x$
$\dfrac{m v_f^2}{2} = F\Delta x$
$\dfrac{m v_f^2}{2\Delta x} = F = \dfrac{0.06(8)^2}{2(0.50)} = 38.4\ N$
AWAY FROM WALL

CHAP 8
#39




GIVEN:

$m = 1.2g = 0.0012kg$

$M = 120g = 0.120 kg$

$v_0 = 65 m/s$

$d = 25cm = 0.25m$

QUES

$\mu = ?$

MOMENTUM CONSERVATION

$m v_0 = (m + M) u$

$u = \frac{m}{m+M} v_0 = \frac{1.2}{121.2} 65$

$u = 0.644 \, m/s$

ΔKE = WORK AGAINST FRICTION

$KE_f - KE_i = -fd = -\mu(m+M)gd$

$KE_f = 0$

$KE_i = \mu(m+M)gd$

$\frac{1}{2}(m+M)u^2 = \mu(m+M)gd$

$\frac{u^2}{2gd} = \mu$

$\mu = \frac{(0.644)^2}{2(9.8)(0.25)}$

$\mu = 0.0846$

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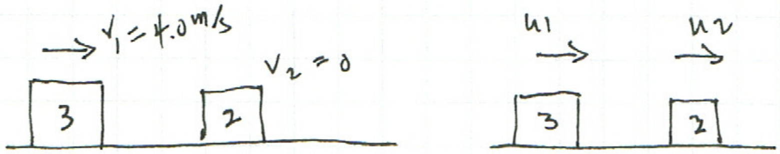
CHAP 9 #58




ELASTIC – HEAD ON COLLISION

QUES: (a) FIND $u_1$ AND $u_2$ USING $\Delta p = 0$ AND RELATIVE V FORMULA.

(b.) CK WITH KE

$$p^{Before} = p^{After}$$

$$m_1 v_1 + m_2(0) = m_1 u_1 + m_2 u_2$$

$$m_1 v_1 = m_1 u_1 + m_2 u_2$$

$$v_1 = u_1 + \frac{m_2}{m_1} u_2$$

RELATIVE VELOCITY FORMULA

$$u_2 - u_1 = v_1 - 0$$

$$u_2 = v_1 + u_1$$

$$v_1 = u_1 + \frac{m_2}{m_1}(v_1 + u_1)$$

$$\left(1 - \frac{m_2}{m_1}\right) v_1 = \left(1 + \frac{m_2}{m_1}\right) u_1$$

$$u_1 = \left[\frac{1 - \frac{m_2}{m_1}}{1 + \frac{m_2}{m_1}}\right] v_1 = \left[\frac{1 - \frac{2}{3}}{1 + \frac{2}{3}}\right] 4 = \frac{1/3}{5/3} 4 = \frac{4}{5} = 0.80\ m/s$$

$$\boxed{u_1 = 0.80\ m/s}$$

$$u_2 = v_1 + u_1 = 4.0 + 0.80 = \boxed{4.80\ m/s}$$

CK $\quad KE_{Before} \stackrel{?}{=} KE_{After}$

$$KE_{Before} = \tfrac{1}{2} m_1 v_1^2 = \tfrac{1}{2}(3)(4)^2 = 24.00\ J$$

$$KE_{After} = \tfrac{1}{2} m_1 u_1^2 + \tfrac{1}{2} m_2 u_2^2$$

$$= \tfrac{1}{2}(3)(0.80)^2 + \tfrac{1}{2}(2)(4.80)^2$$

$$= 0.960 + 23.040$$

$$KE_{After} = 24.00\ J$$

CHAP. 8 #80


QUES: (a.) $u_2 = ?$
(b.) FIND KE "LOST"
(c.) COEFF OF RESTITUTION

GIVEN: $m_1 = 2\,kg$ $m_2 = 4\,kg$ $v_1 = 6\,m/s$ $v_2 = 0$ $u_1 = -1\,m/s$ $u_2 = ?$

(a.) $P_{Before} = P_{After}$

$$m_1 v_1 + m_2 v_2 = m_1 u_1 + m_2 u_2$$

$$2(6) + 4(0) = 2(-1) + 4u_2$$

$$12 = -2 + 4u_2$$

$$\boxed{u_2 = \frac{14}{4} = 3.5\,m/s}$$

(c.) $e = \dfrac{u_2 - u_1}{v_1 - v_2}$

$$e = \frac{3.5 - (-1)}{6 - 0}$$

$$\boxed{e = \frac{4.5}{6} = 0.75}$$

(b.) $KE_{Before} = \frac{1}{2} m_1 v_1^2 = \frac{1}{2}(2)(6)^2 = \boxed{36\,J}$

$$KE_{After} = \frac{1}{2} m_1 u_1^2 + \frac{1}{2} m_2 u_2^2$$

$$= \frac{1}{2}(2)(-1)^2 + \frac{1}{2}(4)(3.5)^2$$

$$= 1 + 2(12.25)$$

$$\boxed{KE_{After} = 25.50\,J}$$

$$\Delta KE = KE_{After} - KE_{Before} = 25.50 - 36$$

$$\boxed{\Delta KE = -10.5\,J}$$