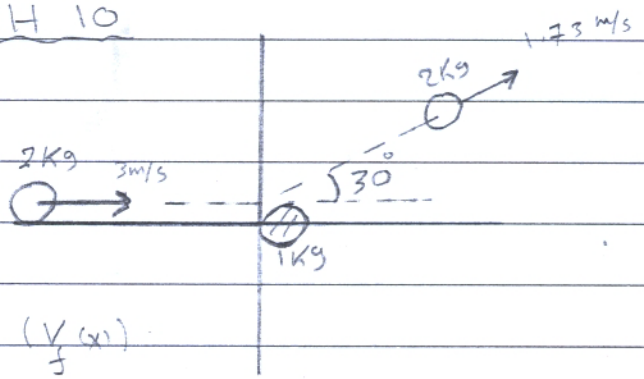
CH 10

Q. 1



1) $P_i(x) = P_f(x)$

$2 \times (3) = (1.73 \cos 30)(2) + 1\,(V_f(x))$

$V_f(x) = 3 \text{ m/s}$

2) $P_i(y) = P_f(y)$

$0 = 2(1.73 \sin 30) + 1\,V_f(y)$

$\Rightarrow V_f(y) = -1.73$

$\Rightarrow V_f = \sqrt{(3)^2 + (-1.73)^2}$

$$\boxed{V_f = 3.46 \text{ m/s}}$$

Q. 2 We have the special case of the elastic collision:

$$V_2(f) = \frac{2m_1}{m_1 + m_2} V_1(i)$$

$$6 = \frac{2(3)}{M+3}\,8$$

$$\Rightarrow (M+3) = 8$$

$$\therefore \boxed{M = 5 \text{ Kg}}$$

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Q.3 $P_i = P_f$ (Completely inelastic collision)

$$(2)(5) + (3)(2) = (2+3)\, V_f$$

$$\Rightarrow V_f = 3.2 \text{ m/s} \quad \text{(Same Direction)}$$

Q.4

$$\vec{J} = m_A \Delta \vec{v}_A$$

$$= 2\left(\vec{V}_f(A) - \vec{V}_i(A)\right)$$

$$= 2\left(-5\hat{i} + 10\hat{j} - (10\hat{i} + 20\hat{j})\right)$$

$$\vec{J} = 2(-15\hat{i} - 10\hat{j}) = -30\hat{i} - 20\hat{j}$$

$$|\vec{J}| = \sqrt{(-30)^2 + (-20)^2} = 36 \text{ kg.m/s}$$

$$J = 36 \text{ kg.m/s}$$

Q.5 $P_i = P_f$ bullet : b, Block : B

$$m_b V_i(b) + M_B V_i(B) = m_b V_f(b) + M_B V_f(B)$$

$$0.02(10) + 0 = 0.02(5) + 0.1\, V_f(B)$$

$$\Rightarrow V_f(B) = 1 \text{ m/s}$$

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Q.6 $W = \Delta K$ (for the bullet)

$= \frac{1}{2} m (v_f^2 - v_i^2) = \frac{1}{2} \times 0.03 (0 - (600^2))$

$= -5400$ J

Now

the work Done by the bullet $= W_a = 5400$J

$\Rightarrow W_a = F_{avg} \, d$

$\Rightarrow F_{avg} = \frac{W_a}{d} = \frac{5400}{0.12}$

$\boxed{F_{avg} = 45000 \text{ N}}$

Note: you can solve it by using (Newton's second Law).

Q.7 $P_i = P_f$

$m_A = 4000$ kg

$m_B = 6000$ kg

$m_A v_A(i) + m_B v_B(i) = (m_A + m_B) v_f$

$4000(4) + 0 = (4000 + 6000) v_f$

$\boxed{v_f = 1.6 \text{ m/s}}$

Q.8 $P_i = P_f$

m_b (bullet) $= 3 \times 10^{-3}$ kg

M_B (Block) $= 3$ kg

$m_b v_b(i) = (m_b + m_B) v_f$

$3 \times 10^{-3} (400) = (3 \times 10^{-3} + 3) v_f$

$\boxed{v_f = 0.4 \text{ m/s}}$

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Q.9 To find V_f first:

$$P_i = P_f$$

$$m_A V_A(i) + m_B V_B(i) = (m_A + m_B) V_f$$

$$2(50) + 4(-25) = (2+4) V_f$$

$$V_f = 0 \quad \text{(for Both A \& B)}$$

$$\Rightarrow \Delta K = \frac{1}{2} m_A \left(V_A(f)^2 - V_A(i)^2\right) + \frac{1}{2} m_B \left(V_B(f)^2 - V_B(i)^2\right)$$

$$\Rightarrow \Delta K = \frac{1}{2}(2)(0 - 50^2) + \frac{1}{2}(4)(0 - (-25)^2)$$

$$(\Delta K = -3750\ J)$$

Q.10 $P_i = P_f$

$$5(2) + 3(-2) = (5+3) V_f$$

$$4 = 8 V_f$$

$$V_f = 0.5\ m/s$$

$$\Delta K = \frac{1}{2}(5)(0.5^2 - 2^2) + \frac{1}{2}(3)(0.5^2 - 2^2)$$

$$\boxed{\Delta K = -15\ J}$$

end.