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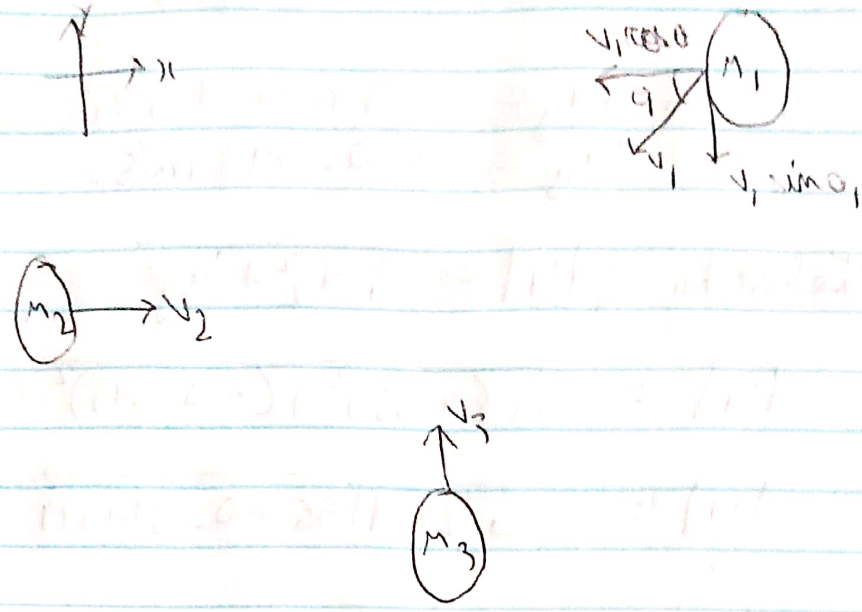
PHYS - 230

LAB QUIZ #7

Ans.



(a) Conservation of momentum in x-axis :-

$\Rightarrow M_1 v_1 \cos\theta_1 + M_2 v_2 + M_3 \times 0 = (M_1 + M_2 + M_3) V_x$

[redacted]

$\Rightarrow -5.1 \times 10.3 \cos(45°) + 7.3 \times 15.7 = (5.1 + 7.3 + 4.2) V_x$

[redacted]

$\Rightarrow -37.14 + 114.61 = 16.6\, V_x$

$V_x = \underline{4.66\ m/s}$

P.T.O

Conservation of momentum in y-axis :-

$$\Rightarrow -M_1 V_1 \sin\theta_1 + M_2 \times 0 + M_3 V_3 = (M_1 + M_2 + M_3) V_y$$

$$\Rightarrow -5.1 \times 10.3 \sin(45^\circ) + 4.2 \times 6.5 = 16.6\, V_y$$

$$\Rightarrow \therefore 16.6 V_y = -37.14 + 27.3$$

$$V_y = -0.593 \text{ m/s}$$

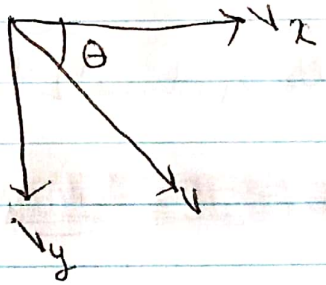
Velocity, $|V| = \sqrt{V_x^2 + V_y^2}$

$$|V| = \sqrt{(4.66)^2 + (-0.593)^2}$$

$$|V| = \sqrt{21.7156 + 0.351649}$$

$$|V| = 4.7 \text{ m/s}$$

Direction :-



$$\tan\theta = \frac{V_y}{V_x} = \frac{0.593}{4.66}$$

$$\tan\theta = 0.1272$$

$$\theta = 7.25^\circ$$

(b) Kinetic Energy before collision

$$K.E._i = \frac{1}{2} M_1 V_1^2 + \frac{1}{2} M_2 V_2^2 + \frac{1}{2} M_3 V_3^2$$

P.T.O.

$K.E._i = \frac{1}{2} \times 5.1 \times (10.5)^2 + \frac{1}{2} \times 7.3 \times (15.7)^2 + \frac{1}{2} \times 4.2 \times (6.5)^2$

$= \frac{1}{2} \left(541.059 + 1799.377 + 177.45 \right)$

$K.E_i = 1258.943\ J$

Kinetic energy after collision,

$K.E_f = \frac{1}{2} (M_1 + M_2 + M_3) v^2$

$= \frac{1}{2} (9.1 + 7.3 + 4.2) \times (4.7)^2$

$K.E._f = 183.347\ J$

∴ Kinetic energy lost $= K.E._i - K.E._f$

$= 1258.943 - 183.347$

$= 1075.6\ J$