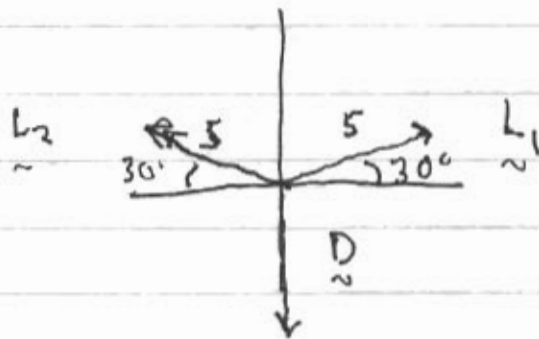


(1)



$$D = L_1 + L_2 + L_3$$

$$L_3 = D - L_1 - L_2 = D - (L_1 + L_2)$$

$$D_x = 0 \quad \text{but } (L_1 + L_2)_x = 0 \quad \text{and } (L_1 + L_2)_y > 0$$

$$\Rightarrow L_{3x} = 0 \quad \text{and } L_{3y} < 0 \Rightarrow 270^\circ$$

(2)

$$x_f - x_i = v_i t + \frac{1}{2} a t^2 = (-3) \times 4 + \frac{1}{2} \times 2 \times (4)^2 \text{ m}$$

$$= -12 + 16 \text{ m} = \boxed{4 \text{ m}}$$

(3)

$$x_{FA} = x_{IA} + v_{IA} t + \frac{1}{2} a_A t^2$$

$$x_{FP} = x_{IP} + v_{IP} t + \frac{1}{2} a_P t^2$$

If $x_{IP} = 0$, then $x_{IA} = 30 \text{ m}$

$$x_{FA} = x_{FP}$$

$$30 + 15t = \frac{1}{2} \times 4 t^2$$

$$2t^2 - 15t - 30 = 0$$

$$t = \frac{15 \pm \sqrt{(15)^2 + 4 \times 2 \times 30}}{4} = \frac{15 \pm 21.6}{4} \quad + 51 \mu$$

$$\boxed{t = 9.15}$$

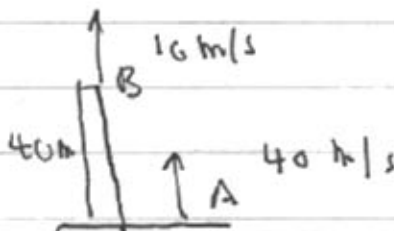
④ Phase 1: $x_{1F} - x_{1I} = \frac{1}{2}gt^2 = \frac{1}{2} \times 4 \times 100 = 200\text{m}$

$\Rightarrow x_{2F} - x_{2I} = 100\text{m}$ in phase 2

$v_{2F}^2 - v_{2I}^2 = 2a_2(x_{2F} - x_{2I})$

① - $(40)^2 - 0 = 2a_2(100)$

$a_2 = -8\text{ m/s}^2$



⑤

$y_{BF} = y_{AF}$

$40 + 10t - \frac{1}{2}gt^2 = 0 + 40t - \frac{1}{2}gt^2$
 $40 = 30t$ $t = 1.33\text{s}$

~~$y_{BF} = 40 + 10t - \frac{1}{2}gt^2$~~

⑥ A: $0 - v^2 = -2gh \Rightarrow v = \sqrt{2gh}$

B: $v_B^2 = 2g \times 4h = 8gh$

$v_B = \sqrt{8gh} = 2\sqrt{2gh} = \boxed{4v^*}$

⑦ $v_{Fy} = -v_I \sin 30 - gt$
 $y_F - y_I = v_{Fy}t - \frac{1}{2}gt^2$
 $-20 = -v_I \sin 30 t - \frac{1}{2}gt^2$

$v_{Fy} = -15 - 9.8(1) = -24.8\text{ m/s}$
 $v_F = \sqrt{v_{Fx}^2 + v_{Fy}^2} = \sqrt{10^2 + 615}$
 $= 36\text{ m/s}$

$\frac{1}{2}gt^2 + v_I \sin 30 t - 20 = 0$

$t = \frac{-v_I \sin 30 \pm \sqrt{(v_I \sin 30)^2 + 2g \times 20}}{g}$

$= \frac{-15 \pm \sqrt{(15)^2 + 2 \times 9.8 \times 20}}{9.8} \Rightarrow \boxed{1.04\text{s}}$

(8)

on Earth

$$X_E = \frac{v_I^2 \sin^2 \theta_I}{g_E} = \frac{v_I^2}{g_E}$$

$\theta = 45^\circ$ in maximum
range

On Planet X

$$X_X = \frac{v_I^2}{g_X}$$

$$\frac{X_X}{X_E} = \frac{g_E}{g_X} \Rightarrow g_X = \frac{X_E}{X_X} g_E$$

$$g_X = \frac{30}{45} \times 9.8 \text{ m/s}^2 = \boxed{6.53 \text{ m/s}^2}$$