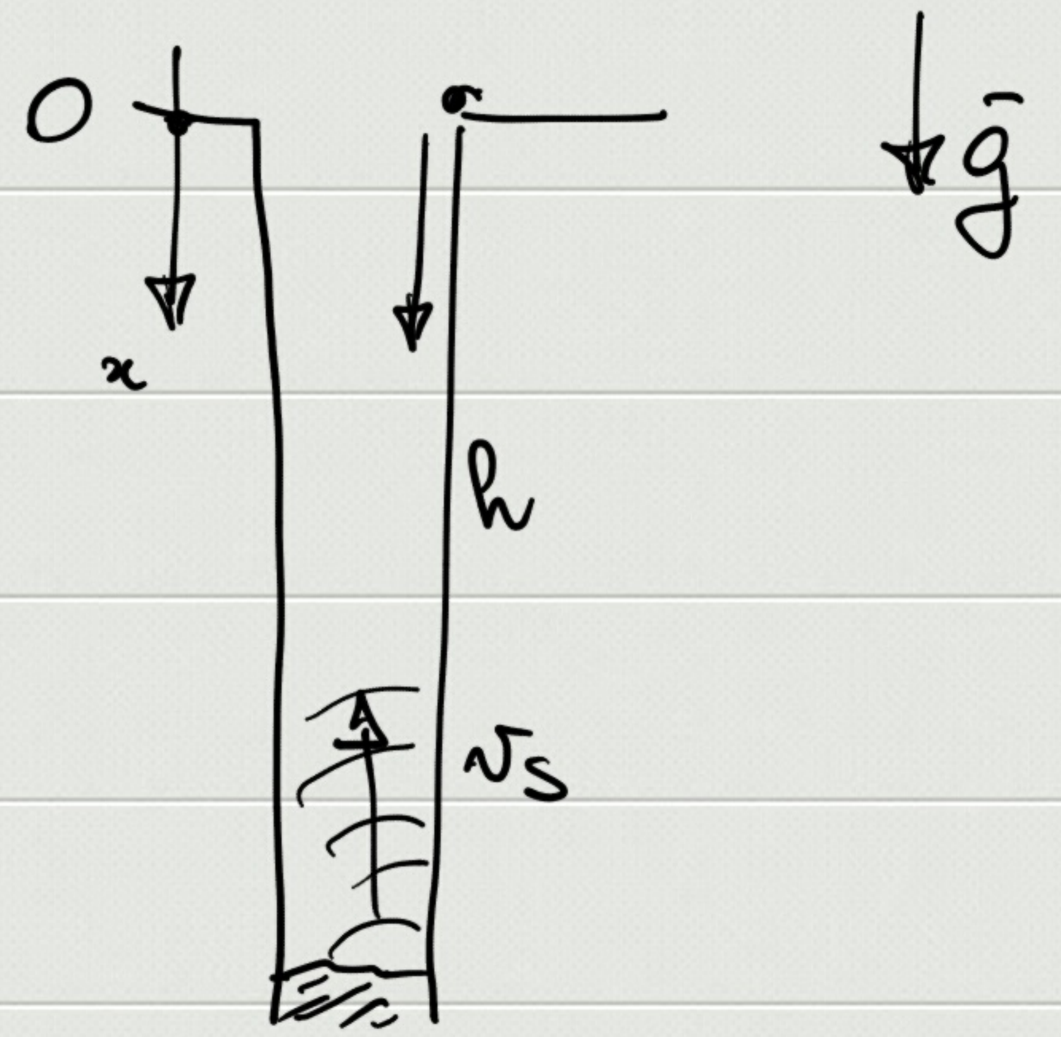
$T = 3.5\ s$

$v_s = 330\ m/s$

$h = ?$



$T = t_1 + t_2$

$h = \frac{1}{2} g t_1^2 \Rightarrow t_1 = \sqrt{\frac{2h}{g}}$

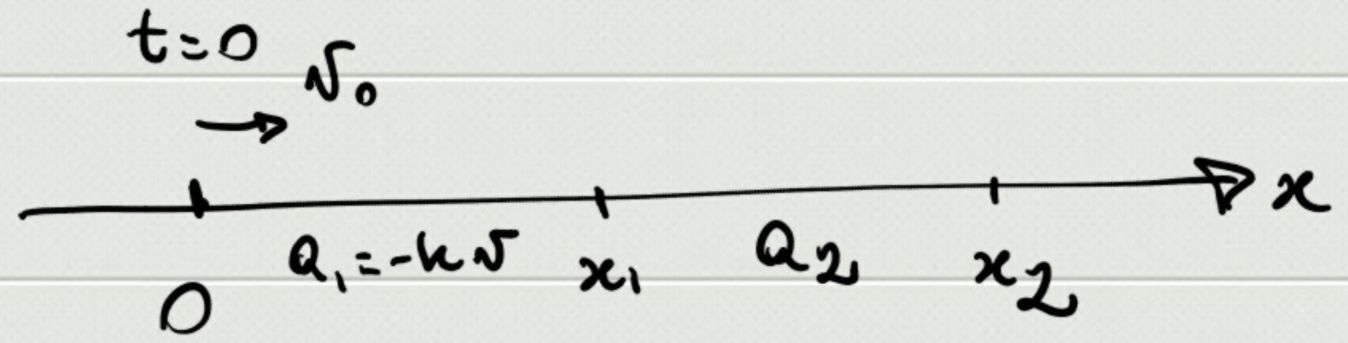
$h = v_s t_2 \Rightarrow t_2 = \frac{h}{v_s}$

$T = \sqrt{\frac{2h}{g}} + \frac{h}{v_s} \Rightarrow T - \frac{h}{v_s} = \sqrt{\frac{2h}{g}}$

$T^2 + \frac{h^2}{v_s^2} - \frac{2hT}{v_s} = \frac{2h}{g}$

$h^2 - 2h\left(v_s T + \frac{v_s^2}{g}\right) + T^2 v_s^2 = 0$

$h = \left(v_s T + \frac{v_s^2}{g}\right) \pm \sqrt{\left(v_s T + \frac{v_s^2}{g}\right)^2 - T^2 v_s^2} = \begin{cases} 55\ m \\ 24\ km \end{cases}$



$t_0 = 0 \quad x_0 = 0 \quad v(t_0) = v_0 = 14 \text{ m/s}$

$t > 0 \quad a_1 = -kv \quad k = 2.4 \text{ s}^{-1}$

$[0, x_1] \qquad x_1 = 4 \text{ m}$

$[x_1, x_2] \quad x_2 = 8 \text{ m} \qquad a_2 = \text{cost} > 0$

$x = x_2 \qquad v(x_2) = v_0$

$a_2 = ?$

- $v(x_1) = v_0 + a_1 t_1$ No $a_1 \neq \text{cost}$

- $v^2(x_1) = v_0^2 + 2 a_1 x_1$ NO

- $v^2(x_1) = v_0^2 + 2 \int_0^{x_1} a_1(x)\, dx$

- $a = v \dfrac{dv}{dx} = -kv$ *

$$a = \frac{dv}{dt} = \frac{dv}{dx}\frac{dx}{dt} = v\frac{dv}{dx} \Bigg\} \quad \boxed{dv = -k\,dx}$$

$= -kv$

$$\int_{v_0}^{v_1} dv = -k \int_0^{x_1} dx \quad \Rightarrow \quad \overbrace{\boxed{v_1 = v_0 - k x_1}}^{v(x_1)}$$

$$v_f^2 = v_i^2 + 2a(x_f - x_i)$$

$$v^2(x_2) = v_0^2 = v_1^2 + 2a_2 (x_2 - x_1)$$

$$\Rightarrow \quad a_2 = \frac{v_0^2 - v_1^2}{2(x_2 - x_1)} =$$

$$= \frac{\cancel{v_0^2} - \cancel{v_0^2} + 2kv_0x_1 - k^2x_1^2}{2(x_2 - x_1)} =$$

$$= \frac{kx_1(2v_0 - kx_1)}{2(x_2 - x_1)} = 22.1 \ m/s^2$$