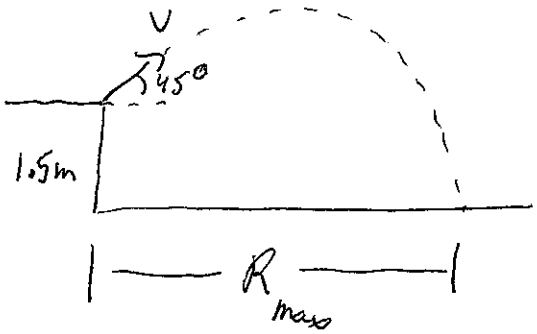
The Soviet-era RPG-7 has a muzzle velocity of 115 m/s and a launch tube that is 950. mm in length. Assuming a constant acceleration throughout the launch tube, determine (1) the maximum range under ideal conditions and (2) the average acceleration in the tube. (Let shoulder height ≈ 1.50m)

Solution (1)



determine time-of-flight

y-dimension

$x_0 = 1.5m$

$x = 0.0m$

$a = -9.80 m/s^2$

$V_y = 115 m/s \sin(45^\circ) = 81.32 m/s$

$$x = x_0 + V_0 \Delta t + \tfrac{1}{2} a \Delta t^2$$

$$0 = 1.5m + 81.32 m/s\ \Delta t + \tfrac{1}{2}\left(-9.80 m/s^2\right)\Delta t^2$$

$$0 = 1.5\,m + 81.32\,m/s\,\Delta t + -4.90\,m/s^2\,\Delta t^2$$

$$t = 16.61\,s$$

determine range

x-dimension

$x_0 = 0$

$x = R$

$V_0 = 81.32\,m/s$ $\qquad x = x_0 + V\Delta t$

$\Delta t = 16.61\,s$

$$R = 81.32\,m/s\,(16.61\,s)$$

$$= 1350.7\,m$$

$$\boxed{1350\,m}$$ 3-sig figs

solution (2)

$a = ?$

$V^2 = V_0^2 + 2a\Delta x$

$V_0 = 0$

$V = 115\ m/s$

$\Delta x = 950.\ mm$

$$a = \frac{V^2 - \cancel{V_0^2}^{\,0}}{2\Delta x}$$

$$= \frac{(115\ m/s)^2}{2(0.950\ m)}$$

$$= 6,960.5$$

$$\boxed{6960\ m/s^2}$$ 3 sig figs