

Unit 1 Worksheet 12: Last Set of Freefall Problems

- 1) Armand Ganajian is hovering 1500 m above the earth's surface in his homemade hot air balloon. Armand notices there is a swimming pool below and decides to go for a swim. A) Assuming Armand hangs over the edge and lets go of the side, how long does it take Armand to reach the pool? B) How fast is Armand going when he reaches the pool? C) If 1 mph is equal to 0.447 m/s, how fast is Armand going in mph?

$$\begin{aligned} v_0 &= 0 \text{ m/s} \\ g &= -10 \text{ m/s}^2 \\ \Delta y &= -1500 \text{ m} \\ t &=? \\ v_f &=? \end{aligned} \quad \begin{aligned} \text{A) } \Delta y &= \frac{1}{2} g t^2 + v_0 t \\ -1500 &= \frac{1}{2} (-10) t^2 \\ t^2 &= \frac{-1500}{\frac{1}{2} (-10)} \\ \boxed{t} &= 17.32 \text{ s} \end{aligned}$$

- 3) Michael Sarna is testing his egg drop project for physics. He climbs to the top of his 2nd story house, 20 m, to begin the test. A) What velocity must he throw the egg up with to reach a height of 40 m from the ground? B) How long does it take for the project to get back to the height it was thrown from? C) If the project can only handle hitting the ground with a speed of 31.6228 m/s, from what height can it be dropped?

$$\begin{aligned} v_0 &=? \\ g &= -10 \text{ m/s}^2 \\ \Delta y_A &= 40 - 20 = 20 \text{ m} \\ v_f &= 0 \end{aligned} \quad \begin{aligned} \text{A) } v_f^2 &= v_0^2 + 2g\Delta y \\ 0^2 &= v_0^2 + 2(-10)(20) \\ v_0^2 &= 400 \\ \boxed{v_0} &= 20 \text{ m/s} \end{aligned}$$