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Class: PHYS 2211L - G02

Lab: 1 "Constant Acceleration 1-D Motion and Data Fitting"

Grade: _____

1) Objective: To plot reference points for time and position on graphs and to understand their correlation.

2) Theory: Using formulas learned in lecture, students should be able to use given information and complete the problems.

3) Procedure:

- Using formulas listed below, plot points on graphs in Parts 1 & 2.
- Using the same formulas and intuition, match the pictured graphs to the corresponding data in Part 3.
- Use the provided app to fill in the missing information in Part 4.

4) Data: Formulas used in this lab

- $A * T_f - T_i = V_f - V_i$
- $X_f - X_i = V_i * T_f - T_i + .5 * (T_f - T_i)^2$

5) Calculations: (attached)

6) Results: (attached)

7) Comments: none

Lab 1 Constant Acceleration 1D Motion

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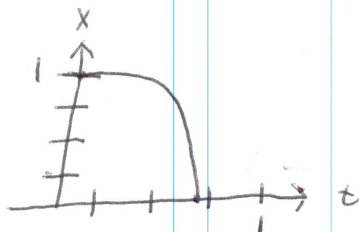
Part 1.

$$\begin{aligned} X_i &= 1.0 \text{ m} \\ V_i &= 2.1 \text{ m/s} \\ a &= -9.8 \text{ m/s}^2 \\ t_i &= 0 \text{ s} \\ t_f &= .71 \text{ s} \end{aligned}$$

$$\Delta X = V_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$\begin{aligned} -1 &= 2.1 \times t_f + \frac{1}{2} \times -9.8 \times t_f^2 \\ &= -4.9 t_f^2 + 2.1 t_f + 1 \end{aligned}$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-2.1 \pm \sqrt{2.1^2 - (4 \times 4.9 \times 1)}}{2 \times -4.9} = .71 \text{ s}$$



Part 2

Part 3

$$\begin{aligned} - X_i &= 0 \text{ m}, V_i = -5 \text{ m/s}, a = 5 \text{ m/s}^2 = \text{red graph} \\ \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} &= \frac{+5 \pm \sqrt{25 - 10}}{5} = 2 \text{ s} \end{aligned}$$

red graph is the only graph that intersects at $t = 2$

$$\begin{aligned} - X_i &= 0 \text{ m}, V_i = 2 \text{ m/s}, a = -4 \text{ m/s}^2 = \text{blue graph} \\ \text{Negative } a &\text{ will cause negative } x \text{ values over time.} \end{aligned}$$

$$\begin{aligned} - X_i &= 8 \text{ m}, V_i = 4 \text{ m/s}, a = 3 \text{ m/s}^2 = \text{green graph} \end{aligned}$$

X axis represents distance and graph starts at 8 on X axis.

$$X_i = 8.$$

Part 4

Planet 1

a) 8.28 m/s^2

b) down then up

c) -13.58 m/s

d) 20.27 m

Planet 2

a) 12.15 m/s^2

b) up

c) 6.76 m/s

d) -14.64 m