Position Vs Time for a Rolling Ball

Name _ANSWER KEY_

Period _____

Lab Partners _The whole class_____

Introduction:

The objective of this investigation is to graphically analyze the position of a rolling bowling ball as a function of time; and to determine the mathematical relationship between speed, distance, and time.

Data Table:

Location	Distance (meters)	Time (sec)
1	2	0.41
2	4	0.99
3	6	2.06
4	8	2.54
5	10	3.08
6	12	3.67
7	14	4.4
8	16	4.88
9	18	5.88
10	20	6.7
11	22	7.2
12	24	8.2

Determine the scale for your Graph:

Show your calculation for determining the scale for the Independent and dependent axes below. Show the scale before and after rounding.

Note: For this we will treat time as the independent variable

Independent (Horizontal)-axis Time

$$\frac{8.2}{26} = 0.31 \Rightarrow 0.5$$

4 BOXES = 2

Dependent (vertical)-axis distance

$$\frac{24}{36} = 0.66 \Rightarrow 1$$

5 BOXES = 5

Data Analysis:

1. Plot the distance time graph. Make sure to scale the graph to use at least half of the graph paper, include a title on your graph, and label each axis with the proper variable and units.

2. Find the relationship between your variables (the equation for your line) by **adding the following information to your graph:**

   - Write the equation for the slope of the line in terms of physics variables
   - Pick two points on your line for which your slope calculation will be based on. Indicate the distance and time values for these points.
   - Calculate the slope of your line.
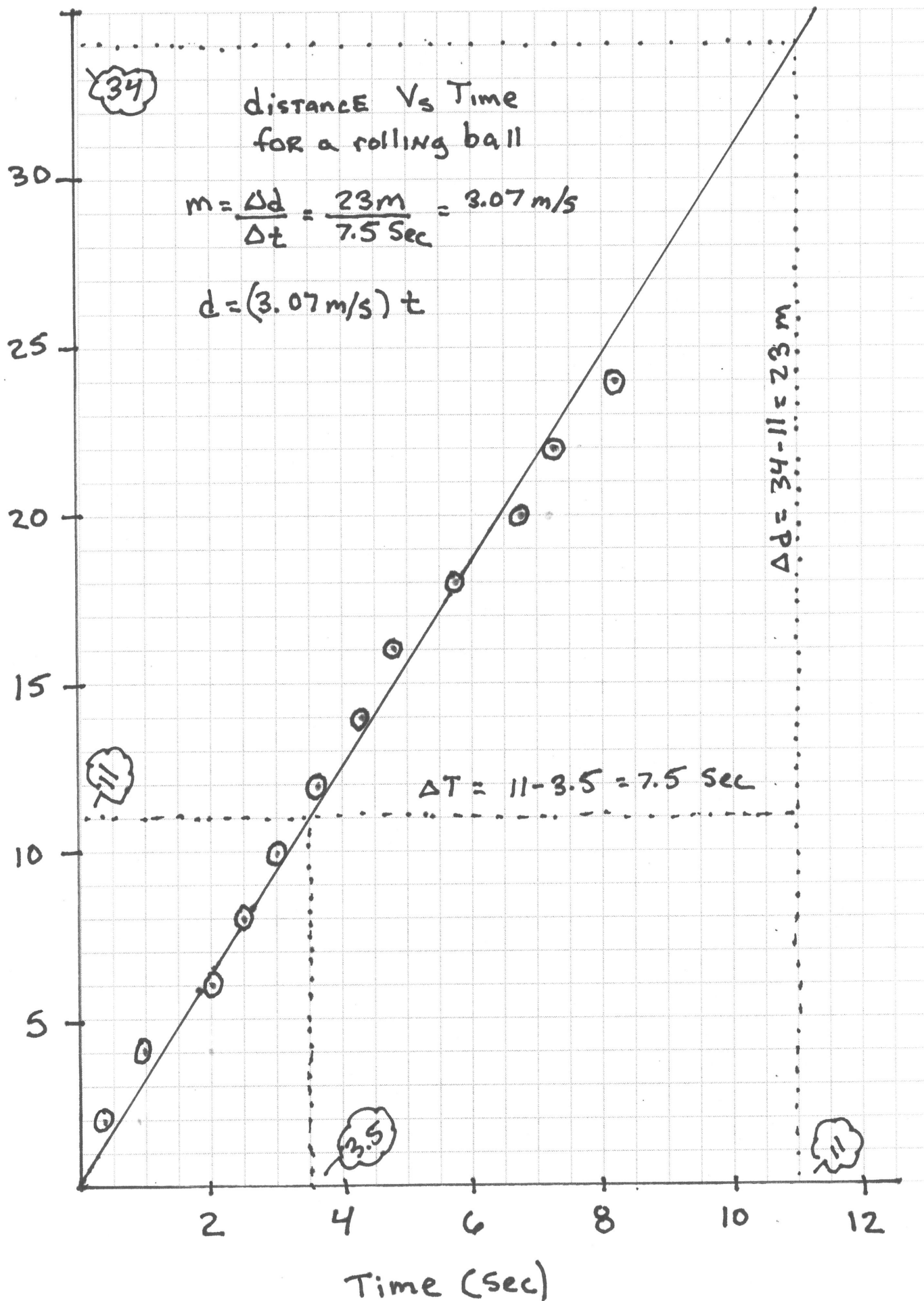   - Calculate the units of the slope of your line.

distance Vs Time
for a rolling ball

$$m = \frac{\Delta d}{\Delta t} = \frac{23m}{7.5 \, Sec} = 3.07 \, m/s$$

$$d = (3.07 \, m/s) \, t$$

$\Delta d = 34 - 11 = 23 \, m$

$\Delta T = 11 - 3.5 = 7.5 \, Sec$

distance (m)

Time (sec)

34

11

3.5

11

3.   What is the slope of your graph, make sure include the units.

$$m = 3.07 \text{ m/s}$$

4.   Write your equation in terms of the physics variables that you used not "x" and "y"

$$d = (3.07 \text{ m/s})(time)$$

Questions:

1.   Examine the units for your slope. What physics variable does a number with these units represent?

m/s is a measurement of Speed. The slope of the d-t graph is speed of the Ball.

2.   Does the ball speed up, slow down, or stay at a constant speed?

The speed is Constant.

How do you know?

The graph is Linear or you could say that the slope is CONSTANT

3.   Using your equation, calculate the distance that the ball traveled in 1.5 seconds.

$$d = 3.07(1.5) = 4.61 \text{ m}$$

4.   The distance from the South entrance to the cafeteria is 180.4 meters, assuming you could roll the bowling ball perfectly straight and it does not change speed, how long will it take to go from cafeteria to the South entrance?

$$d = 3.07 \cdot t$$
$$180.4 = 3.07 t$$
$$t = \frac{180.4}{3.07} = 60.1 \text{ SEC}$$

Position Vs Time for a Rolling Ball

Distance = (2.89 m/s) *time

LINEAR ✕

x-range: 0.42 - 8.20 sec

$y = mx + b$

m: 2.893
b: 0.9421
r: 0.9976
RMSE: 0.5262

Distance (m)

Time (sec)