# Motion

As you work through the steps in the lab procedure, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

## Part I: Data

Complete Table 1. Record all data to three decimal places (e.g., 4.000 or 6.325 or 0.000). Do not include units in your answer.

**Table 1**

| Initial Settings | AT (m) | Time (s) | Calculated Position (m) | Describe |
|---|---|---|---|---|
| $\boldsymbol{x = 0.00}$ **m**<br>$\boldsymbol{v = 5.00}$ **m/s**<br>$\boldsymbol{a = 0.00}$ **m/s$^2$** | 20 | | | Position ($x$) vs. Time graph |
| | 40 | | | Velocity ($v$) vs. Time graph |
| | 50 | | | Acceleration ($a$) vs. Time graph |
| $\boldsymbol{x = 0.00}$ **m**<br>$\boldsymbol{v = 10.0}$ **m/s**<br>$\boldsymbol{a = 0.00}$ **m/s$^2$** | 20 | | | Position ($x$) vs. Time graph |
| | 40 | | | Velocity ($v$) vs. Time graph |
| | 50 | | | Acceleration ($a$) vs. Time graph |

## Part I: Questions

Please include units in your answer.

- Use the correct unit abbreviation.

By observing the Position vs. Time graph in Step 2 of the instructions, what physical quantity does the slope of this line correspond to?

By observing the Position vs. Time graph in Step 2 of the instructions, what is the value of the slope of this line?

By observing the Velocity vs. Time graph in Step 3 of the instructions, what physical quantity does the slope of the line correspond to?

By observing the Velocity vs. Time graph in Step 3 of the instructions, what is the value of the slope of this line?

## Part II: Data

Complete Table 2. Record all data to three decimal places (e.g., 4.000 or 6.325 or 0.000). Do not include units in your answer.

**Table 2**

| Initial Settings | AT (m) | Time (s) | Calculated Position (m) | Calculated Velocity (m/s) | Describe |
|---|---|---|---|---|---|
| $\boldsymbol{x = 0.00}$ **m**<br>$\boldsymbol{v = 0.00}$ **m/s**<br>$\boldsymbol{a = 1.00}$ **m/s$^2$** | 20 | | | | Position ($x$) vs. Time graph |
| | 40 | | | | Velocity ($v$) vs. Time graph |
| | 50 | | | | Acceleration ($a$) vs. Time graph |
| $\boldsymbol{x = 0.00}$ **m**<br>$\boldsymbol{v = 0.00}$ **m/s**<br>$\boldsymbol{a = 2.00}$ **m/s$^2$** | 20 | | | | Position ($x$) vs. Time graph |
| | 40 | | | | Velocity ($v$) vs. Time graph |
| | 50 | | | | Acceleration ($a$) vs. Time graph |

I observed that as time increased, the velocity vector decreased in length.

- True
- False

I observed that as time increased, the acceleration vector stayed the same length.

- True
- False

## Part II: Questions

Please include units in your answer.

- Use the correct unit abbreviation.

By observing the Velocity vs. Time graph in Step 2 of the instructions, what physical quantity does the slope of this line correspond to?

By observing the Velocity vs. Time graph in Step 2 of the instructions, what is the value of the slope of this line?

By observing the Acceleration vs. Time graph in Step 3 of the instructions, what is the value of the slope of this line?

By observing the Acceleration vs. Time graph in Step 3 of the instructions, what is the value of the acceleration ($a$) of this graph?

## Part III: Data

Complete Table 3. Record all data to the nearest *WHOLE NUMBERS*. Do not include units in your answer.

**Table 3**

| Initial Settings | Readings from the Graphs | | | | Describe |
|---|---|---|---|---|---|
| | **Dist. (m)** | **Time (s)** | **Vel. (m/s)** | **Acc. ($m/s^2$)** | |
| $\boldsymbol{x = 0.00}$ **m**<br>$\boldsymbol{v = 10.0}$ **m/s**<br>$\boldsymbol{a = -2.00}$ **m/s$^2$** | | | | | Position ($x$) vs. Time graph |
| | | | | | Velocity ($v$) vs. Time graph |
| | | | | | Acceleration ($a$) vs. Time graph |

## Part III: Questions

Please include units in your answer.

- Use the correct unit abbreviation.

What is the value of the acceleration?

Describe what happens to the velocity vector as the car goes forward and then returns to 0.00 m.

From the Position vs. Time graph, read the furthest distance the car reaches from the starting point.

From the Position vs. Time graph, what is the time that the car reaches this furthest distance?

Using the time you found in the previous question and looking at the Velocity vs. Time graph, what is the velocity at this time?

Using the time you found above and looking at the Acceleration vs. Time graph, what is the acceleration at this time?

Considering your last two answers, is it possible for an object to have zero velocity while at the same time having a nonzero acceleration?