

# Student Worksheet

# INVESTIGATING

# STRAIGHT-LINE MOTION

Uniform Linear Motion (ULM) and Uniformly Accelerated Linear Motion (UALM)

Physics Class X



$$a = \frac{v_f - v_i}{t}$$

$$s = \frac{d}{t}$$



Students Identity

Class

Students Name

# Uniform Linear Motion (ULM) and Uniformly Accelerated Linear Motion (UALM)

## Learning Objective

1. Analyze the differences in physical quantities between Uniform Linear Motion (ULM) and Uniformly Accelerated Linear Motion (UALM).
2. Present data and graphs from the simulation to investigate the characteristics of ULM and UALM.
3. Conclude the differences between ULM and UALM based on graph analysis.

## Orientation

Instructions: Observe the video/images presented by the teacher, then answer the following questions!



[https://youtu.be/eoFAIX9rxhE?si=7Kt0uzOjfm9Vil\\_x](https://youtu.be/eoFAIX9rxhE?si=7Kt0uzOjfm9Vil_x)

**After observing, answer the following questions:**

**1** What differences do you observe in the motion of the two cars?

**2** In your opinion, do both cars have the same type of motion? Explain!

**3** How can we distinguish between these two types of motion mathematically and graphically?

### ● Problem Formulation

**Based on the orientation above, formulate the problem statements!**

Write down the questions you want to investigate through this experiment!



### ● Hypothesis Submission

**Based on your initial understanding, write a preliminary guess (hypothesis) for the questions above**

Hypothesis



**1. What is the shape of the Position-Time graph in ULM?**

answer: \_\_\_\_\_

**2. What is the shape of the Velocity-Time graph in ULM?**

answer: \_\_\_\_\_

**3. What is the shape of the Velocity-Time graph in UALM?**

answer: \_\_\_\_\_

**4. What is the shape of the Position-Time graph in UALM?**

answer: \_\_\_\_\_

**5. What is the main difference between ULM and UALM?**

answer: \_\_\_\_\_

## Data Collection

### Learning Resources and Materials

1. PhET Simulation "The Moving Man"



<https://phet.colorado.edu/sims/cheerpj/moving-man/latest/moving-man.html?simulation=moving-man>



2. Smartphones/Laptops/Other Electronic Devices
3. Student Worksheet

### Investigation Procedures

#### Uniform Linear Motion (ULM)

1. Open the PhET "The Moving Man" simulation.



Fig 1. Virtual Capacitor Lab simulation view

2. Set the values: Position = -5 m, Velocity = 2 m/s, Acceleration = 0 m/s<sup>2</sup>.
3. Click Play. Observe the movement of "The Moving Man".
4. Record "The Moving Man's" position every 1 second for 4 seconds in Table A.
5. Once finished, click the "Charts" tab. Observe the shapes of the Position vs Time and Velocity vs Time graphs.
6. Sketch these graphs in the provided column.

#### Uniformly Accelerated Linear Motion (UALM)

1. Still in the same simulation. Click "Reset All" or reset the values.
2. Set the values: Position = -5 m, Velocity = 0 m/s, Acceleration = 1.50 m/s<sup>2</sup>.

3. Click Play. Observe the movement of "The Moving Man".
4. Record "The Moving Man's" velocity every 1 second for 4 seconds in Table B.
5. Once finished, click the "Charts" tab. Observe the shapes of the Position vs Time, Velocity vs Time, and Acceleration vs Time graphs.
6. Sketch these graphs in the provided column.

## Observation data

### Investigation 1

#### Uniform Linear Motion (ULM)

Table 1. Observation Data ULM

| No | Time (s) | Velocity (m/s) | Acceleration (m/s <sup>2</sup> ) | Position (m) |
|----|----------|----------------|----------------------------------|--------------|
| 1  | 0        | 2              | 0                                |              |
| 2  | 1        |                |                                  |              |
| 3  | 2        |                |                                  |              |
| 4  | 3        |                |                                  |              |
| 5  | 4        |                |                                  |              |

#### ULM Graph Sketches

Position vs Time (s-t)

Velocity vs Time (v-t)





## Investigation 2

### Uniformly Accelerated Linear Motion (UALM)

Table 2. Observation Data of UALM

| No | Time (s) | Acceleration (m/s <sup>2</sup> ) | Velocity (m/s) | Position (m) |
|----|----------|----------------------------------|----------------|--------------|
| 1  | 0        | 1.50                             |                |              |
| 2  | 1        |                                  |                |              |
| 3  | 2        |                                  |                |              |
| 4  | 3        |                                  |                |              |
| 5  | 4        |                                  |                |              |

#### UALM Graph Sketches

Position vs Time (s-t)

Velocity vs Time (v-t)

Acceleration vs Time (a-t)

## Hypothesis Testing

Analyze the data you obtained from investigations A and B, then answer the following questions!

- 1 Based on Table 1, what is the relationship between time and position? Is the velocity constant? Explain!



**2**

What is the shape of the Position vs Time and Velocity vs Time graphs in ULM? What does this tell you about the acceleration?

**3**

Based on Table 2, what is the relationship between time and velocity? Is the acceleration constant? Explain!

**4**

What is the shape of the Position vs Time and Velocity vs Time graphs in UALM? How does it differ from ULM?

Complete the following comparison table based on your investigation results!

| Aspect                              | ULM | UALM |
|-------------------------------------|-----|------|
| Velocity                            |     |      |
| Acceleration                        |     |      |
| Position-Time (s-t) Graph Shape     |     |      |
| Velocity-Time (v-t) Graph Shape     |     |      |
| Acceleration-Time (a-t) Graph Shape |     |      |

## ● Conclusion Formation

Based on all the data and analysis you have done, answer the following questions!

1. Is your hypothesis accepted or rejected? Explain!

2. Write your conclusion about the characteristics of Uniform Linear Motion (ULM) and Uniformly Accelerated Linear Motion (UALM)!

ULM:

UALM:

3. Write the main difference between ULM and UALM based on your experiment!

4. Give an example of application of ULM and UALM in everyday life!

