Linear Motion

Spoken Tutorial Project
https://spoken-tutorial.org
National Mission on Education through ICT
http://sakshat.ac.in

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Learning Objectives

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- **Verify Newtons first law of motion using constant acceleration simulation**

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- **Calculate position and velocity of a car using equations of motion**

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- **Verify Newton's second law of motion using air track glider simulation**

System Requirements

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- **Ubuntu Linux OS v 16.04**

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- **Firefox Web Browser v 62.0.3**

- **Learner should be familiar with Apps on Physics**

Pre-requisites

- **Learner should be familiar with Apps on Physics**
- **For the pre-requisite tutorials please visit this site https://spoken-tutorial.org**

Link for Apps on Physics

https://www.walter-fendt.de/html5/phen

- **Motion with Constant Acceleration**

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- **Newton's Second Law Experiment**

Equations of Motion

Equations of Motion

- $v = v_0 + at$
- $x = x_0 + v_0 t + 1/2at^2$
- $v^2 = v_0^2 + 2a(x - x_0)$
- v_0 **and** v **are the initial and final velocities**
- x_0 **and** x **are the intial and final positions**

Tabular Column

Measured values from the Apps		Calculated values using Equations	
Position (x in m)	Velocity (v in m/s)	Position (x in m)	Velocity (v in m/s)

Equations of Motion

- $v = v_0 + at$
  $$= 5 + 2 \times 1.531$$
  $$= 8.06 \text{ m/s}$$

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  $$= 5 + 2 \times 1.531$$
  $$= 8.06 \; \mathbf{m/s}$$

- $x = x_0 + v_0 t + 1/2 at^2$
  $$= 5 + 5 \times 1.531 + 1/2 \times 2 \times (1.531)^2$$
  $$= 14.99 \; \mathbf{m}$$

Tabular Column

Tabular Column

Measured values from the Apps		Calculated values using Equations	
Position (x in m)	Velocity (v in m/s)	Position (x in m)	Velocity (v in m/s)
16.01	8.31	14.99	8.06

Assignment

- **Measure the position and velocity when the car reaches the red barrier**

Assignment

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- **Calculate the values using Equations of motion**

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- **Measure the position and velocity when the car reaches the red barrier**
- **Calculate the values using Equations of motion**
- **Complete the table and compare your answers with the ones shown in the App**

Tabular Column

Mass of the wagon (g)	Hanging mass (g)	Acceleration (m/s^2)

Tabular Column

Mass of the wagon (g)	Hanging mass (g)	Acceleration (m/s²)

Assignment

- **Change the values of mass of the wagon and note the changes in acceleration**

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- **For each value of mass of the wagon, change the value of the hanging mass**

Assignment

- **Change the values of mass of the wagon and note the changes in acceleration**
- **For each value of mass of the wagon, change the value of the hanging mass**
- **Observe the difference in the acceleration**

Tabular Column

Mass of the wagon (g)	Hanging mass (g)	Acceleration (m/s^2)
100		3.270
300	50	1.401
500		0.892
700		0.654

Tabular Column

Mass of the wagon (g)	Hanging mass (g)	Acceleration (m/s^2)
200	40	1.635
	60	2.264
	80	2.803
400	40	0.892
	60	1.280
	80	1.635
600	40	0.613
	60	0.892
	80	1.154

Summary

- Verified Newtons first law of motion using constant acceleration simulation
- Calculated position and velocity of a car using equations of motion
- Verified Newton's second law of motion using air track glider simulation

Acknowledgement

- **These Apps were created by Walter-fendt and his team**

About the Spoken Tutorial Project

- **Watch the video available at https://spoken-tutorial.org /What_is_a_Spoken_Tutorial**
- **It summarises the Spoken Tutorial project**

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- **If you do not have good bandwidth, you can download and watch it**

Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- **Conducts workshops using spoken tutorials**
- **Gives certificates to those who pass an online test**
- **For more details, please write to contact@spoken-tutorial.org**

Forum for specific questions

- **Questions in THIS Spoken Tutorial?**
- **Visit https://forums.spoken-tutorial.org**
- **Choose the minute and second where you have the question**
- **Explain your question briefly**
- **The Spoken Tutorial project will ensure an answer**

You will have to register to ask questions

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