ScienceCube

Uniform Linear Motion

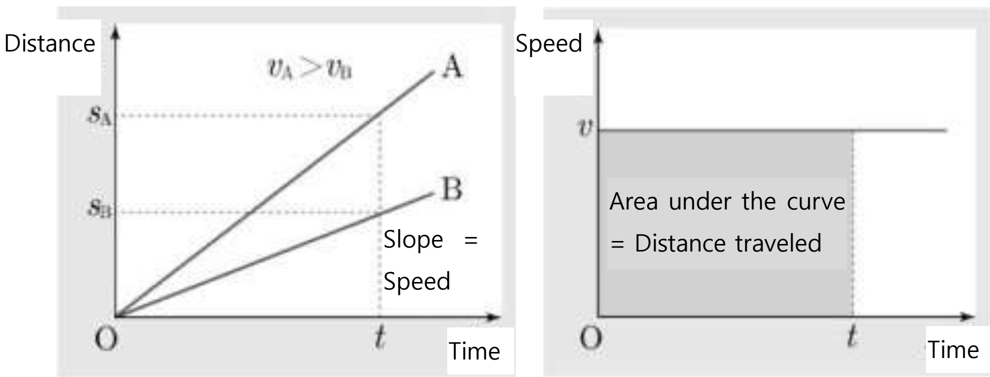
Explain the distance traveled and velocity of an object in uniform linear motion over time with graphs.

Fundamental Concept

1. Uniform Linear Motion

Uniform linear motion, or uniform motion, occurs when an object moves with constant speed and direction. Since the object moves at a constant speed, the distance traveled in uniform linear motion can be expressed as speed x time, indicating that the distance traveled is proportional to time

Distance = Speed × Time



In a 'speed-time' graph, the area under the graph represents the distance traveled. A 'time-distance' graph is a straight line with a constant slope, indicating constant speed.

2. **Friction**

Friction is the force that acts opposite to the direction of motion, hindering the movement of an object when it is either stationary or in motion. Friction occurs when objects are in contact. When an external force equal to the frictional force is continuously applied in the direction of the object's motion, the net external force becomes zero, allowing uniform motion

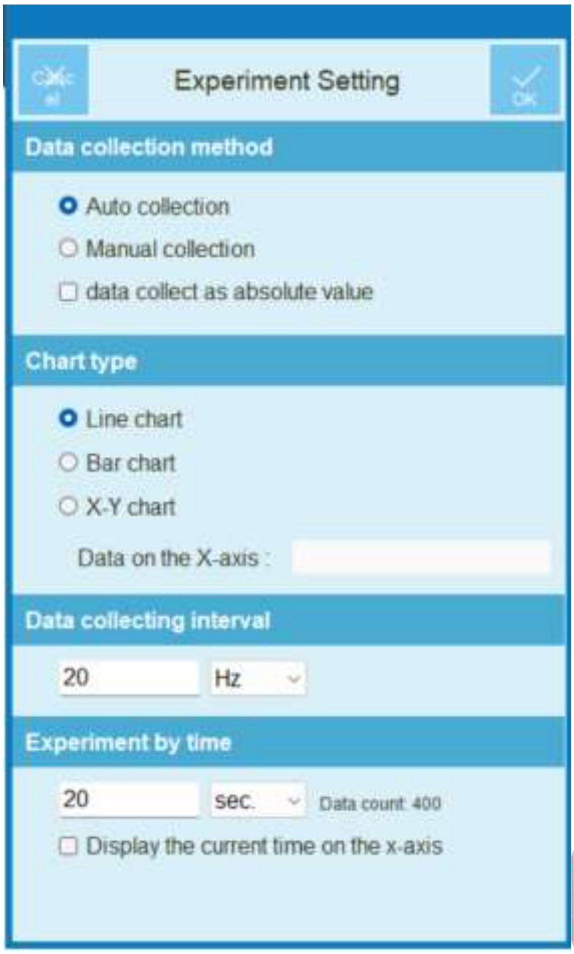
Experiment

Materials Needed

Interface, Science# Program, motion sensor, paper cup, string, cart, 20 clips, long table (at least 1 meter).

Interface Setup

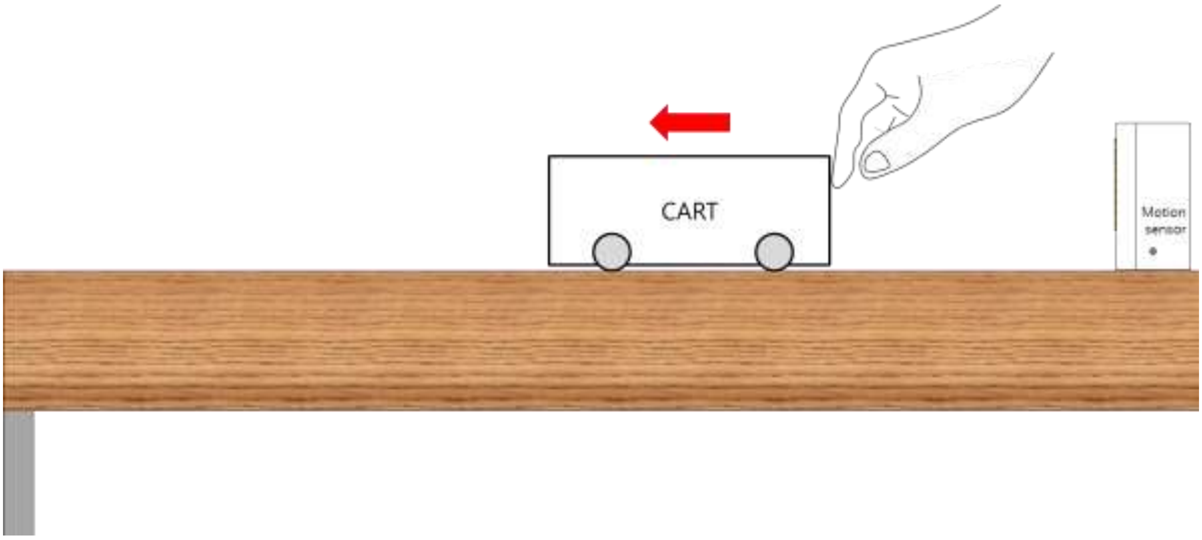
1. Run the Science# program.
2. Connect the motion sensor to the interface
3. Click to set up the experimental environment as shown below or click to automatically set up.

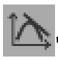


Data Collection

[Motion of a Cart with Friction]

1. Place the motion sensor at one end of the table.
2. Place the cart 15 cm away from the motion sensor.
3. Click  to start data collection.
4. Gently push the cart in the direction opposite the motion sensor.

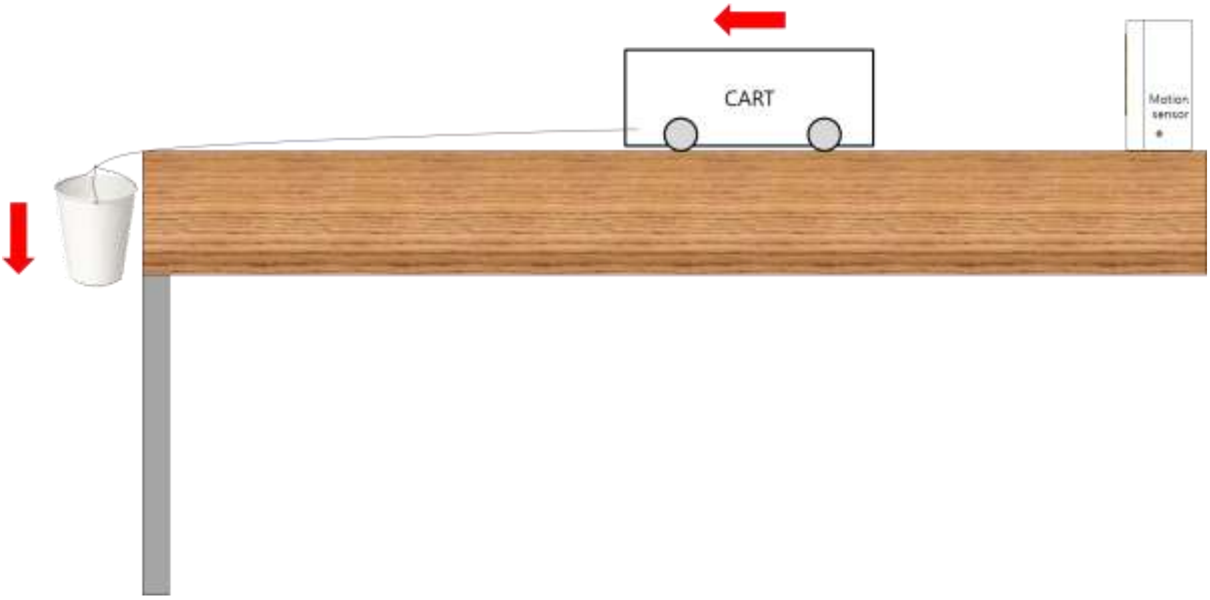


5. Click 'Differential' to plot the velocity graph. (You can click  to delete unnecessary data.)

[Uniform Motion of a Cart with Friction Balanced]

6. Make a basket for the clips by piercing a hole in a paper cup and threading string through it.

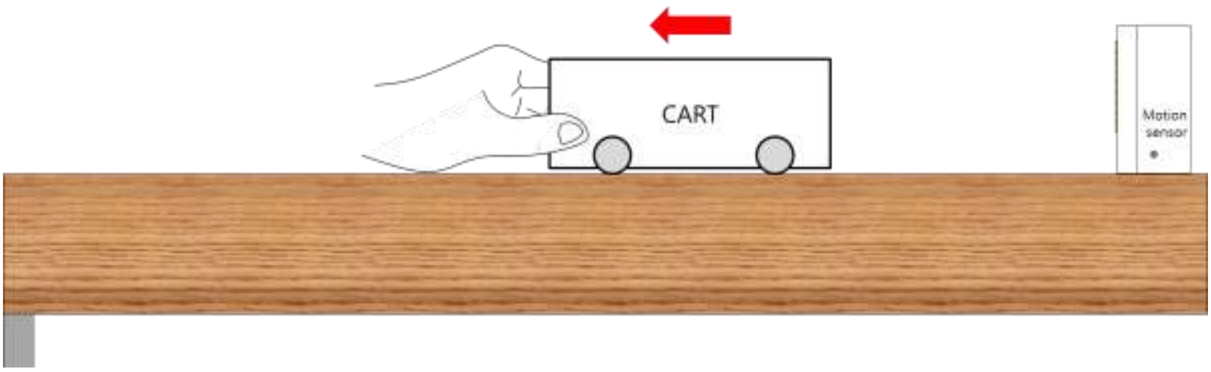
7. Place the cart 15 cm away from the motion sensor and connect the cart and the paper cup with the string.



8. Add one clip (each clip weighs about 0.6g) to the paper cup, gently push the cart as in step #4, and plot the velocity graph.
9. If a uniform motion graph does not appear, increase the number of clips to balance the friction.

[Creating Uniform Motion of a Cart]

10. Click  to start data collection.
11. Pull the cart by hand in the direction opposite the motion sensor to create uniform motion.
12. Click  'Differential' to plot the velocity graph..



Data Analysis

Recording Data

[Motion of a Cart with Friction]

1. Plot the distance-time graph for the cart with friction.

2. Differentiate the distance-time graph for the cart with friction to plot the distance-velocity graph.

3. Describe how the distance traveled and velocity of the cart change over time.

4. Describe the type of motion the cart exhibited and explain why.

[Uniform Motion of a Cart with Friction Balanced]

5. Plot the distance-time graph for the cart with balanced friction.

6. Differentiate the distance-time graph for the cart with balanced friction to plot the distance-velocity graph.

7. Describe how the distance traveled and velocity of the cart change over time.

8. Describe the type of motion the cart exhibited and explain why.

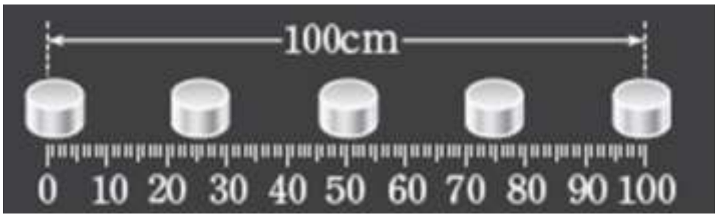
[Creating Uniform Motion of a Cart]

9. Plot the distance-time graph for the cart in uniform motion.

10. Differentiate the distance-time graph for the cart in uniform motion to plot the distance-velocity graph..

Data Application and Extended Activity

The following is a stroboscopic photograph of an ice hockey puck in uniform linear motion, taken every second. [Unit: cm]



1. Record the distance traveled from the initial position of the puck at 1 second, 2 seconds, etc., in the table below.

Time (s)	0	1	2	3	4
Distance (cm)					

2. Calculate the distance traveled and speed of the puck every second and record the values in the table below

Time (s)	0~1	1~2	2~4	3~4
Distance traveled every second (cm)				
Speed (cm/s)				

3. Plot graphs showing the distance traveled and speed of the puck over time.