ScienceCube

Law of Inertia

Understanding the law of inertia and finding examples of its application in everyday life.

Fundamental Concept

1. **Law of Inertia (Newton's First Law of Motion)**

   If no external force acts on an object or if the net force acting on it is zero, an object at rest will remain at rest, and an object in motion will continue to move at a constant velocity in a straight line.

2. **Magnitude of Inertia**

   - Inertia of Rest: The tendency of an object at rest to remain at rest. The greater the mass of the object, the greater its inertia of rest.

     $$\text{Mass} \propto \text{Inertia}$$

   - Inertia of Motion: The tendency of a moving object to continue moving. The greater the speed, the greater the inertia.

     $$\text{Speed} \propto \text{Inertia}$$

3. **Examples of Inertia**

   ■ Inertia of Rest:

   ① When one piece of a stack of wooden blocks is struck with a hammer, only the struck piece is removed while the blocks above it remain in place.

   ② Dust falls off a blanket when it is struck with a bat.

③ When a string is suddenly pulled, the lower string holding a weight breaks.

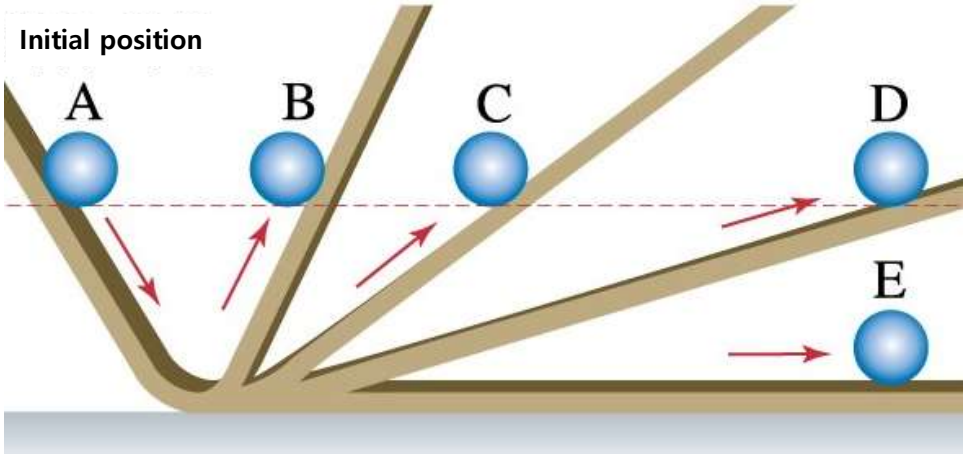
- Inertia of Motion:

① When a car suddenly stops, passengers are thrown forward

② A running person trips over a stone and falls..

③ Hitting the handle of a hammer on the ground fixes the hammerhead in place..

4. Galileo's Thought Experiment



< Galileo's Thought Experiment >

Galileo thought that the reason a moving object stops is due to the frictional force between the object and the surface. If there were no frictional force, an object in motion would continue to move at a constant velocity in a straight line without the need for an external force.

Experiment

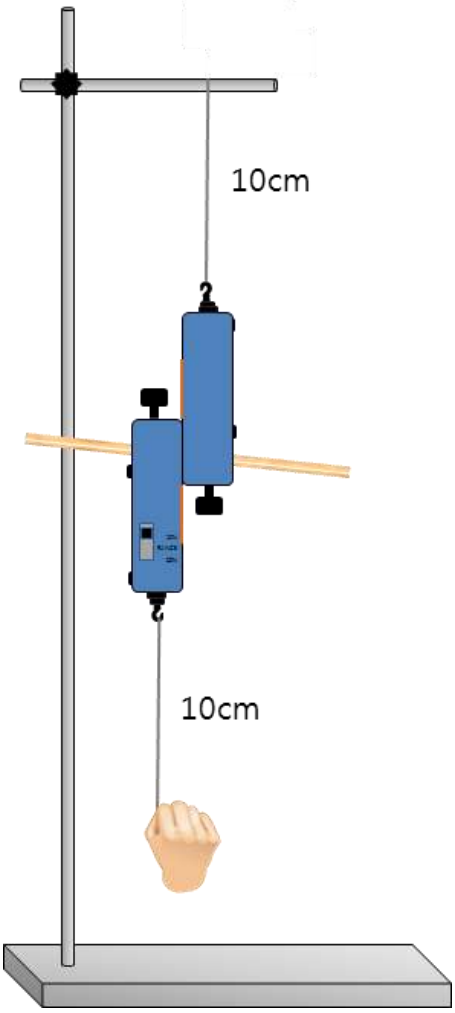
Materials Needed

Interface, Science# Program, 2 force sensors, breakable string, stand, wooden chopstick

Preparation of Experimental Apparatus

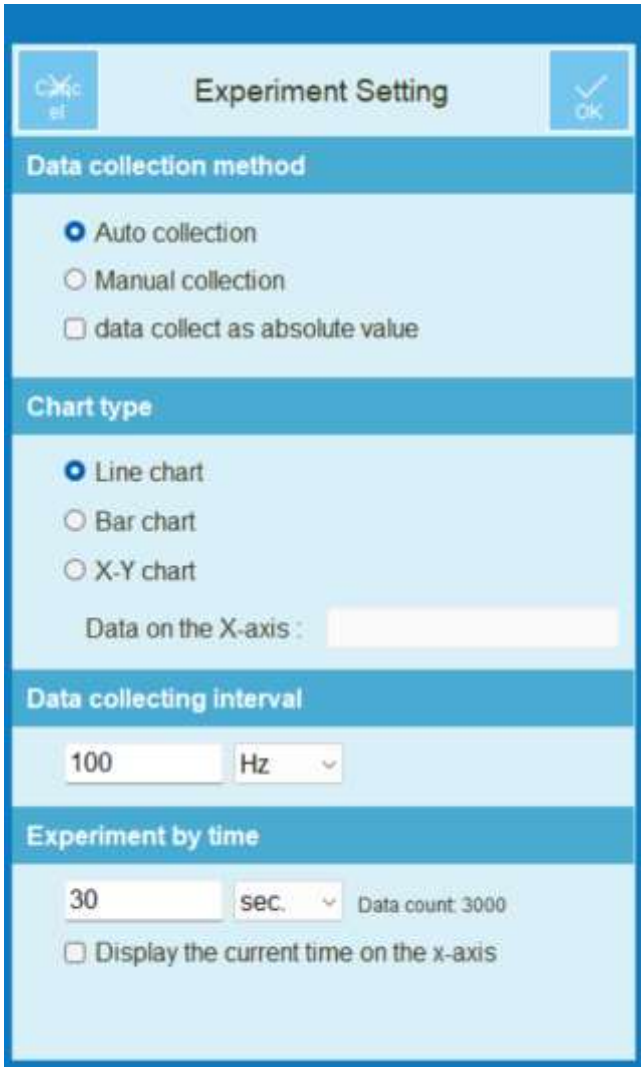
1. Connect the two force sensors using a wooden chopstick as shown in the diagram. Tighten the screws on the force sensors to secure the chopstick firmly.

2. Prepare two pieces of string about 15 cm long and create loops at both ends.
3. Connect the force sensors to the stand with the strings as shown in the diagram, and attach the string to the lower force sensor..



Interface Setup

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



자동설정

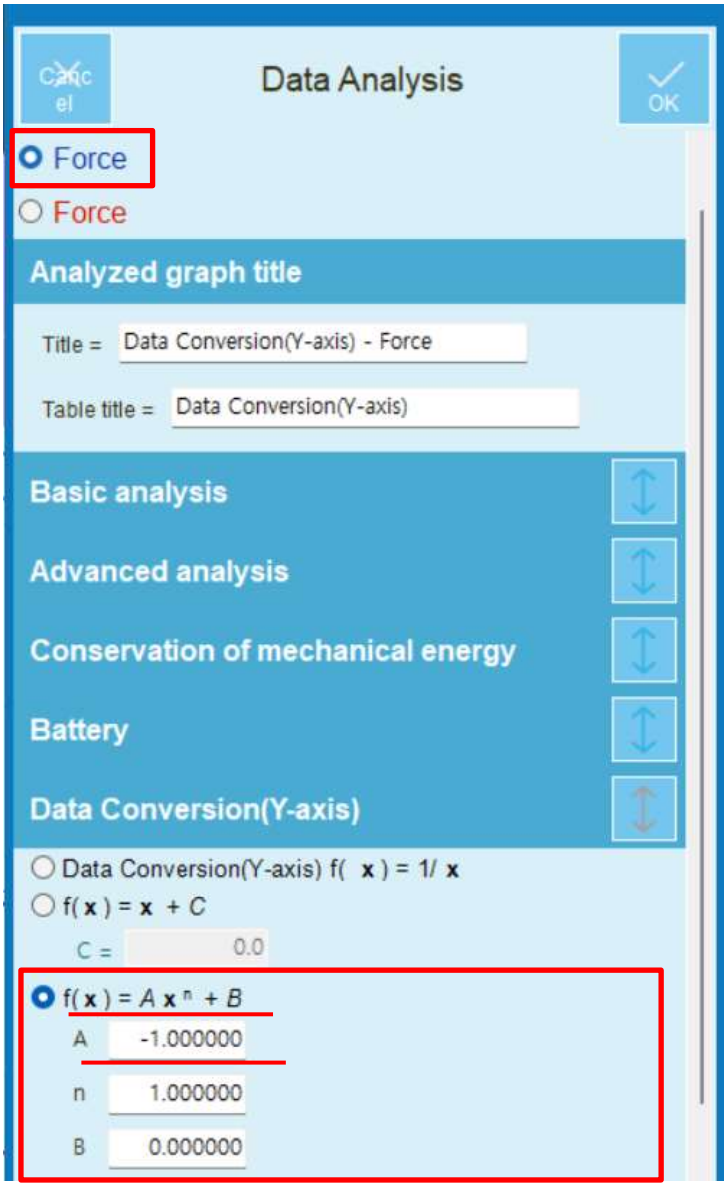
Data Collection

[When pulling the string slowly]

1. Click to start collecting data.
2. Pull the string downward slowly until it breaks.

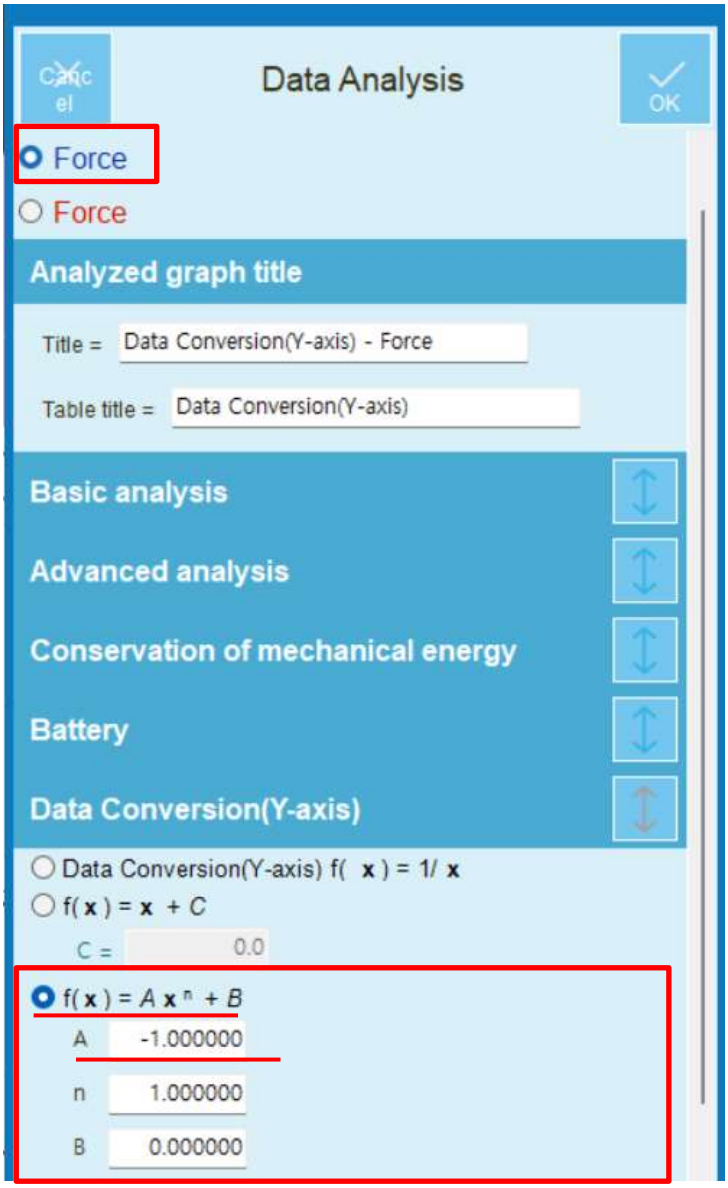
3. Click  to stop collecting data.

4. Click  to analyze the data and convert the graph as shown below.



[When pulling the string quickly]

5. Add a new chart.
6. Click  to start collecting data.
7. Quickly pull the lower string so that it breaks.
8. Click  to stop collecting data.
9. Click  to analyze the data and convert the graph as shown below.



Data Analysis

Recording

[When pulling the string slowly]

1. Draw a graph showing the changes in the forces acting on the upper and lower strings as you pull the string slowly.

2. Based on the graph, compare the forces acting on the upper and lower strings at the moment the string breaks using inequality signs, and indicate which string broke.

Force on Upper String (N)	Inequality	Force on Lower String (N)

Broken string:

[When pulling the string quickly]

3. Draw a graph showing the changes in the forces acting on the upper and lower strings as you pull the string quickly.

4. Based on the data from pulling the string slowly, compare the forces acting on the upper and lower strings at the moment the string breaks using inequality signs, and indicate which string broke.

Force on Upper String (N)	Inequality	Force on Lower String (N)

Broken string:

Data Application

1. Explain the phenomenon observed when pulling the string slowly based on the experimental results.

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2. Explain the phenomenon observed when pulling the string quickly based on the experimental results.

Extended Activities

1. Select all examples related to the law of inertia from the list below.

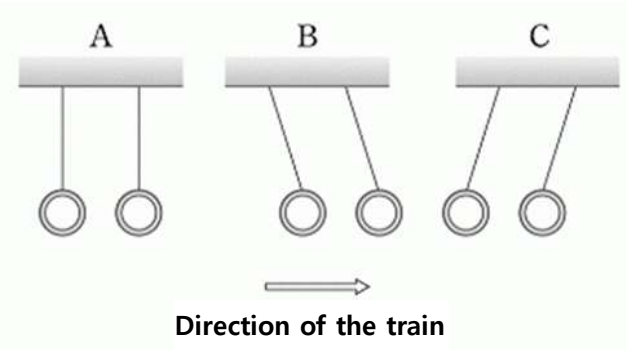
A. Flicking cigarette ash
B. A boat moves forward when rowed
C. A person inside a bus leaning to the side when it turns
D. A cannon recoils when fired

Answer:

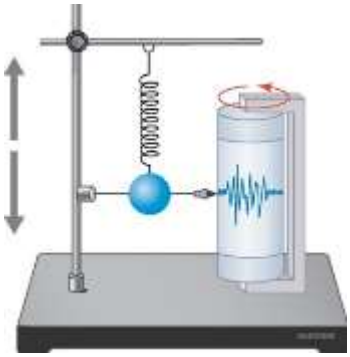
Situation	(a)	(b)	(c)

Diagram			

2. The following illustration (A) shows the handle of a stationary train seen from the side. Indicate the appearance of the handle when the train starts moving in the direction of the arrow (a), when it moves at a constant speed (b), and when it stops (c).



3. Explain the principle of the seismometer shown in the diagram using the concept of inertia..



4. Provide three examples each of phenomena related to inertia of rest and inertia of motion that can be observed in everyday life.


Report
(For Teachers)
Report
(For Students)