LECTURE 6: NEWTON'S FIRST LAW – NO NET FORCE

1. The purpose of the experiment:

The purpose of this activity is to investigate the motion of an object when there is no net force applied compared to the motion when there is a net force applied.

2. The Equipment

For this lab you will be using these equipments:
- 1 PASPORT Motion Sensor PS-2103
- 1 1.2 m PASCO Track
- 1 GOcar ME-6951
- 1 Fan Accessory ME-9491
- 1 Friction Block ME-9807
- Braided Physics String SE-8050

3. Background

After doing experiments with balls rolling down ramps, Galileo proposed that an object in motion would continue in motion forever if the floor it rolls on were perfectly smooth and continued to infinity. Galileo used the word inertia as the label for this tendency of an object to continue its state of motion

Isaac Newton developed Galileo's ideas. What condition must exist for an object to maintain its state of motion? Newton said that an object at rest tends to stay at rest and an object in motion tends to stay in motion if there is no net force acting on the object. In other words, if the net force on an object is zero, its acceleration (change in motion) is also zero.

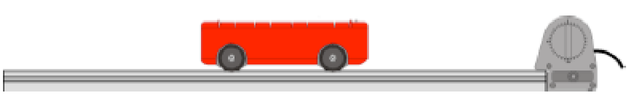
Prediction

1. What will happen to an object at rest if no force is applied?
2. What will happen to an object at rest if it is pushed, but there is a large frictional force acting on the object?
3. What will happen to the motion of an object that is pushed, and there is very little frictional force acting on the object?
4. What will happen to the motion of an object if there is a constant net force applied to it?

4. Procedure

4.1. Setup

1. Connect the Motion Sensor to one of the sensor ports on the top end of the Conputer. Put the range switch on the top end of the Motion Sensor to the 'near' (cart) setting.
2. Turn on the Program Logger Pro.
• The Graph screen opens with a graph of Position (m) versus Time (s).
3. Place the track on a horizontal surface and level the track. (Place the GOcar on the track. If the cart rolls one way or the other, adjust the track to raise or lower one end.)
4. Attach the Motion Sensor to one end of the track. Place the cart about 20 cm from the sensor. Aim the sensor at the cart.



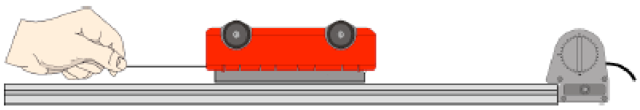
4.2. Record Data

Part 1: No Net Force Applied

1. Press Start to start recording data. Do not touch the cart
2. After 3 seconds, press to stop recording data.

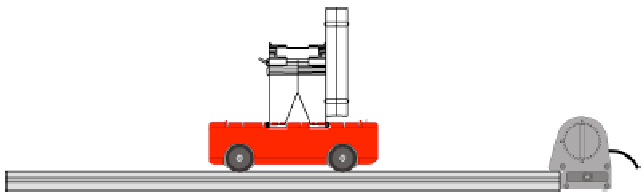
Part 2: Friction Block

1. Tie a string to one end of the cart.
2. Place the friction block, with felt side up, in the tray of the cart. Turn the cart over and place it 20 cm in front of the Motion Sensor with the string end facing away from the sensor.
3. Press Start to start recording data. Wait one second and then give the cart and block a brief pull away from the sensor.
4. After 3 seconds, press to stop recording data.



Part 4: Fan Cart

1. Finally, clip a Fan Accessory to the cart and place the cart 20 cm in front of the sensor.
2. Start the fan, but hold the cart in place. Make sure the fan is arranged so it will push he cart away from the sensor.



3. Press Start to start recording data. Wait one second and then release the cart.
4. After 3 seconds, press to stop recording data.

• NOTE: Don’t let the fan cat hit the end of the track or it might be damaged.

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REPORT

Name:……………………………………………………………….

Class:………………………………………………………………..

1. Purpose:

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2. Results:

2.1. Predict

1. What will happen to an object at rest if no force is applied?

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2. What will happen to an object at rest if it is pushed, but there is a large frictional force acting on the object?
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3. What will happen to the motion of an object that is pushed, and there is very little frictional force acting on the object?
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4. What will happen to the motion of an object if there is a constant net force applied to it?…………………………………………………………………………………………
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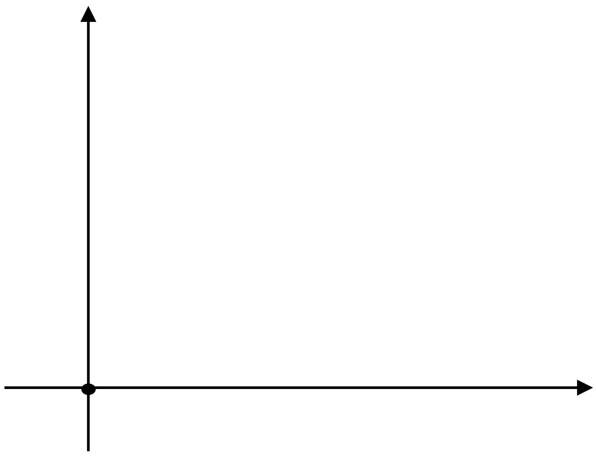
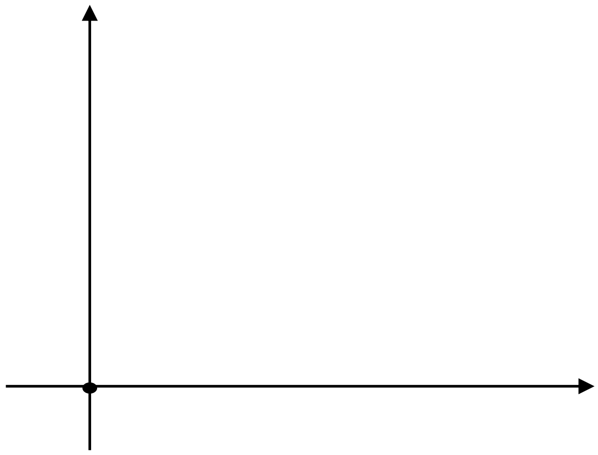
2.2. Data

Sketch your graphs of position versus time for the cart for all four runs. Include labels and units for your y-axes and x-axes.



Sketch your graphs for velocity versus time for the cart for all four runs. Include labels and units for your y-axes and x-axes.



Questions

1. What do your graphs show for the car in Run #1 (no force applied)?

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2. What does your velocity graph show for the cart in Run #2 (friction cart – cart is pushed, but has a large frictional force)?

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3. Why does the cart keep moving in Run #3 (low friction cart – cart is pushed, and has little frictional force)?

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4. Which data run represents constantly accelerated motion?

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5. Why does the cart sliding on the friction block (Run #2) come to a stop so quickly?

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6. What happens to an object at rest if no force is applied?

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7. What happens to an object in motion is no force is applied?

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8. Do your results support your predictions?

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