I. Introduction

Explain Newton’s first law in your own words:

A. Law of Inertia https://goo.gl/ShrvN7

Part 1:

A. Watch the Study Jam on Newton’s first law. https://goo.gl/4ChDCD

What is inertia?

What causes objects in motion to slow down?

Objects will keep moving_____________________ forever without ______________ to stop it.

Velocity = ______________________________

Why does your body slide when going around a sharp turn?

Objects at______________ stay at ______________.

The heavier things are the **more or less** inertia they have.

B. Go to https://goo.gl/7hSNm4

1. Watch the truck and ladder animation. What is another name for Newton’s First Law?

2. What do people wear in cars to protect themselves against this law?

3. Investigate and apply Newton’s Laws to **vehicle restraints**.
C. Go to [https://youtu.be/8b-Mqgy1h4](https://youtu.be/8b-Mqgy1h4)
   a. Describe how Newton’s First Laws can apply in a car crash.

   b. Compare and contrast the results of a crash while the passengers are not wearing seat belts and while they are wearing seat belts.

Review what you have learned about Newton’s First Law by working through the questions in the chart below.

<table>
<thead>
<tr>
<th>Question</th>
<th>True or False</th>
<th>Why</th>
</tr>
</thead>
<tbody>
<tr>
<td>If a hockey puck slides on a perfectly frictionless surface, it will eventually slow down because of its inertia.</td>
<td></td>
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</tr>
<tr>
<td>Inertia is the property that every material object has that causes objects to resist changes in its state of motion.</td>
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<tr>
<td>The law of inertia applies to both moving and nonmoving objects.</td>
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<tr>
<td>The reason a penny thrown straight up inside a bus will come back to your hand is that you, the bus, the air inside the bus, and the penny are all moving at the same velocity.</td>
<td></td>
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<tr>
<td>An object wants to maintain its state of motion because it has mass.</td>
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</tbody>
</table>
II. Introduction
A. Explain Newton’s second law in your own words:
   Law of Force and Acceleration https://goo.gl/XCngBM

   ___________________________________________________________
   ___________________________________________________________
   ___________________________________________________________

B. Watch the presentation and learn about Newton’s Second Law https://goo.gl/XTjbyN

1. In what direction does an object move when affected by an unbalanced force?

2. Large force=____________.. Small force=___________________

3. Large Mass=____________.. Small Mass=___________________

C. Go to https://goo.gl/ar1pbo
   Fill in the blanks:
   • ________________ is a push or pull on an object.
   • ________________ is the difference between two opposing forces.
   • Newton’s 2nd Law of Motion states that if a net force acts on an object, the object will ________________ in the direction of the force.
   • Acceleration is a change in ________________.
   • It can either be ________________ or ________________.
   • Mass is the amount of matter contained in an object.
   • Mass does not change with changes in ________________.
   • The acceleration of any object falling to the surface of the Earth is ________________. This means that at the first second, the object will be falling with a speed of 9.8. m/s². At 2 seconds, the object will be falling at the rate of ________________; at 3 seconds, it will be falling at the rate of ________________, and so on.
Procedure for Simulation

A. Copy down the Data Table below.
B. Click the arrow under Location 1 & select any planet. Click the arrow under Object 1 selection the Pumpkin. Record the rate of acceleration for this location and the object’s mass in the data table. Select another planet & the Pumpkin under Location 2 & Object 2. Record the information.
C. Click the Drop button and observe the object’s fall. The green lines indicate the object’s position at each second.
D. Calculate the force of the objects (weight) using Force = Mass x Acceleration. Record.
E. Tests 3 & 4: Repeat steps 1-3 for the Car.
F. Tests 5 & 6: Repeat steps 1-3, but select the planet Venus for both locations and choose any object.
G. Tests 7 & 8: Repeat steps 1-3, selecting Jupiter for both locations and choose any object.
H. Tests 9 & 10: Repeat steps 1-3, selecting any planet and any object.

Data Table: Gravitational Acceleration, Mass, & Weight

<table>
<thead>
<tr>
<th>Test</th>
<th>Location</th>
<th>Object</th>
<th>Acceleration (m/s²)</th>
<th>Mass of Object (kg)</th>
<th>FORCE or Weight (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pumpkin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Pumpkin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Car</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Car</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Venus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Venus</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Jupiter</td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>Jupiter</td>
<td></td>
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<td>9</td>
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<td>10</td>
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Analysis Questions:

1. How is Newton’s 2\textsuperscript{nd} Law related to gravity?

2. How does the force of gravity affect the rate of acceleration?

3. Describe what happens when identical objects are dropped on planets with different gravitational conditions.

4. Describe what happens when different objects are dropped under the same gravitational conditions.

5. Based on your data, how does mass affect weight?

6. What is the weight of a 24.52 kg Television dropped on Pluto (acceleration of 0.59 m/s\textsuperscript{2})?

7. What is the weight of a 45.40 kg Barbell dropped on Earth?

8. A hammer is dropped on Planet X. If the hammer has a mass of 3kg and a weight of 9N, what is the gravitational acceleration of Planet X and is it more or less than that of Earth?

If finished play game [https://ssec.si.edu/bumperducks](https://ssec.si.edu/bumperducks)
Newton’s Laws WebQuest Part 3

Part 3


____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

B. Go to the following web site about Newton’s 3rd Law of Motion... [https://goo.gl/PJFAPQ]
1. For every force there is one that is ___________ in size but ______________ in direction.
2. Write down the five action forces and their reaction forces from the page.

<table>
<thead>
<tr>
<th>Action force(s)</th>
<th>Reaction Force(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

3. In a rocket what creates the initial action?

4. In the rocket what is the equal and opposite reaction?

5. Draw and label the rocket picture
C. Design a Roller Coaster – https://goo.gl/zUdj8q
Design your roller coaster to achieve an overall “thumbs up” rating for Fun and Safety. List below what the individual designs would have to be for

1. Height of the First Hill =

2. Shape of the First Hill =

3. The Exit Path =

4. Height of the Second Hill =

5. The Loop =

D. The Physics of Baseball
2. Read all of the text and fill in the blanks:

The distance a baseball travels depends on __________ primary factors: the __________________ at which the ball leaves the bat, and how __________ the ball is hit. The ______________ of the ball depends on both the speed of the ______________ and the speed of the ______________.

Gravity is always pulling __________________ on the ball. If you hit the ball straight up, it spends quite a bit of time in the air, but doesn’t travel far from home plate. If you hit the ball horizontally, as in a line drive, the ball moves away from home plate at maximum velocity, but quickly hits the ground because of ______________ -- still not very far from home plate. To maximize your hitting ______________, you need to have both a high horizontal ______________ AND you need to keep the ball in the air for a ______________ time. You can do this by hitting the ball at an __________________ angle.