Newton’s Laws of Motion Project-Based Learning
✓ Students will be able to explain why a body is jerked forward when a moving vehicle comes to a sudden stop.

✓ Students will identify how tension, stress, shear, bending and torsion influence bridges construction.

✓ Students will apply the concept of action and reaction to the NASA space mission.
1. An object tends to keep moving because it has this quality ________.

2. The more of this an object has, the more force it takes to move it. ________.

3. The speed and direction of a moving object is known as ________.

4. Everything gets pulled down toward the earth’s center because of ________.

5. ________ is the result of unbalanced forces making an object speed up.

Balanced forces  **Inertia**  **Mass**  **Gravity**  **Acceleration**  **Force**  **Kinetic energy**  **Velocity**  **Potential energy**  **Unbalanced forces**
6. What you get when you multiply an object’s mass times the acceleration ________.

7. A skier at the top of a hill has more ________ energy than a skier at the bottom.

8. A skier traveling downhill has this type of __________ energy.

9. When two forces acting on an object are equal, they are ________.

10. When two forces are _____ there is a change in position or motion.

Balanced forces  INERTIA  Mass  Gravity  Velocity
Acceleration  Force  Kinetic energy  Potential energy

Unbalanced forces
Newton’s first law of motion

An object in motion will stay in motion and an object at rest will stay at rest unless acted upon by an unbalanced force.

- An object will not change its motion unless a force acts upon it.
- All objects resist having their motion changed.
- The tendency to resist a change in motion is called inertia.
- The more mass an object has, the greater its inertia.
1. Why do we have to wear seatbelts?

2. Think of an alternative to seatbelts, describe how it would be designed and manufactured.

3. What if I cannot wear a seatbelt due to medical reasons, how can I protect myself?
Newton’s second law of motion

The force of an object is equal to its mass times acceleration. (F=ma)

- A net force changes the velocity of the object, and causes it to accelerate.

- If an object is acted upon by a net force, the change in velocity will be in the direction of the net force.

- The acceleration of an object depends on its mass. The more mass an object has or the more inertia it has, the harder it is to accelerate.
Small cars, big trucks, bikes speeding down the bridge...

1. How do tension, compression, shear, torsion, and bending determine how a bridge is build?

2. What causes bridges to collapse?

3. How can the issue of bridge collapsing be prevented?
Newton’s third law of motion

For every action, there is an equal and opposite reaction.

- When object exerts a force on a second object, the second object exerts and equal force in the opposite direction on the first object.
- The force exerted by the first object is the action force.
- The force exerted by the second object is the reaction force.
The sky is not the limit…

Up! Up we go

1. How does NASA apply the concept of “action and reaction?”

2. How else can the concept of Newton’s 3rd law of motion be applied in the society?

Answers should include specific examples, and illustrations.
## Research Rubric

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>20</th>
<th>15</th>
<th>10</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>Quality of Information</td>
<td>Information clearly relates to the main topic. It includes several supporting details and/or examples.</td>
<td>Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.</td>
<td>Information clearly relates to the main topic. No details and/or examples are given.</td>
<td>Information has little or nothing to do with the main topic.</td>
</tr>
<tr>
<td>Amount of Information</td>
<td>All topics are addressed and all questions answered with at least 2 sentences about each.</td>
<td>All topics are addressed and most questions answered with at least 2 sentences about each.</td>
<td>All topics are addressed, and most questions answered with 1 sentence about each.</td>
<td>One or more topics were not addressed.</td>
</tr>
<tr>
<td>Organization</td>
<td>Information is very organized with well-constructed paragraphs and subheadings.</td>
<td>Information is organized with well-constructed paragraphs.</td>
<td>Information is organized, but paragraphs are not well-constructed.</td>
<td>The information appears to be disorganized.</td>
</tr>
<tr>
<td>Internet Use</td>
<td>Successfully uses suggested internet links to find information and navigates within these sites easily without assistance.</td>
<td>Usually able to use suggested internet links to find information and navigates within these sites easily without assistance.</td>
<td>Occasionally able to use suggested internet links to find information and navigates within these sites easily without assistance.</td>
<td>Needs assistance or supervision to use suggested internet links and/or to navigate within these sites.</td>
</tr>
<tr>
<td>Diagrams &amp; Illustrations</td>
<td>Diagrams and illustrations are neat, accurate and add to the reader's understanding of the topic.</td>
<td>Diagrams and illustrations are accurate and add to the reader's understanding of the topic.</td>
<td>Diagrams and illustrations are neat and accurate and sometimes add to the reader’s understanding of the topic.</td>
<td>Diagrams and illustrations are not accurate OR do not add to the reader's understanding of the topic.</td>
</tr>
<tr>
<td>Sources</td>
<td>All sources (information and graphics) are accurately documented in the desired format.</td>
<td>All sources (information and graphics) are accurately documented, but a few are not in the desired format.</td>
<td>All sources (information and graphics) are accurately documented, but many are not in the desired format.</td>
<td>Some sources are not accurately documented.</td>
</tr>
</tbody>
</table>
Resources

Newton’s Laws of motion:
http://www.youtube.com/watch?v=mn34mnnDnKU
http://science.discovery.com/interactives/literacy/newton/newton.html

Motion interactive/simulation resources
http://concord.org/stem-resources/subject/physics?gclid=CMjnq8mK3bYCFYef4AodflkANQ
http://phet.colorado.edu/en/simulation/moving-man
Resources

Bridges
Build bridge information on the 4 types of bridge (arch, beam, suspension, and cable-stayed bridges) and more
http://www.pbs.org/wgbh/nova/tech/build-bridge-p1.html

This libguide is designed to help guide high school students when researching and building bridge structures.
http://uwsslec.libguides.com/content.php?pid=190501&sid=1718522

West Point Bridge Simulation will engage students at school and at home.
https://21centuryedtech.wikispaces.com/Bridges

Video
http://www.youtube.com/watch?v=mn34mnnDnKU