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## Newton's 1<sup>st</sup> Law?

**Silently observe the demonstrations and record any observations, thoughts, or questions that you may have about what you're seeing.**

Observations	Thoughts	Questions

**After discussing with your partner, do you notice any pattern or similarities amongst the demonstrations? Record your thoughts below.**

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## **Investigation**

In the table below, describe each object and record its mass in grams.

<b>Object Description</b>				
<b>Object Mass (g)</b>				

Which object do you think will travel the furthest distance in the shortest amount of time?  
Explain your reasoning.

Prediction:

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Using the force apparatus at either end of the classroom, apply the same amount of force to each object as described by your teacher. Measure and record the distance the object traveled and the amount of time that it took for that object to travel. Calculate the speed of each object once you have recorded your data.

<b>Object Description</b>				
<b>Distance Traveled (cm)</b>				
<b>Time (s)</b>				
<b>Calculated Speed (cm/s)</b>				

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**What relationship was there between the mass of the object and the speed and or distance that the object traveled?**

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**What is this relationship called and what exactly does it state?**

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**Watch the video of the crash test dummy during a collision, based on what you have just learned and the relationship you've observed, why does the crash test dummy continue to move after the collision?**

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## How is force measured?

Before you begin to plan and build your force meter that will measure the force of gravity, list the materials that you will have access to in order to build your force meter.

Materials:


Write down what you know about gravity:

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Based on what you know about gravity and how it pulls objects towards the center of the Earth, how will you design your force meter that measures gravity? Draw a Blue print or plan below.

[illegible]



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After building your first prototype of the force meter, what do you need to change in order for it to match the model provided for you?

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What is the equation created by Sir Isaac Newton that quantifies force?

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Describe how we are going to use the equation above to calculate the force of gravity. (Remember: Our weight is the measurement of gravity and our mass)

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In the space below record your data and results that you used in order to calibrate your force meters.

Force (You calculate this)	Mass (You measure this in kg)	Acceleration (This the acceleration of gravity)

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## Why do some objects move and not others?

Based on what you have learned so far, describe what Newton's 1<sup>st</sup> and 2<sup>nd</sup> laws state:

Newton's 1<sup>st</sup> Law:

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Newton's 2<sup>nd</sup> Law:

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What is your hypothesis as to why an object does not move even though a force is being applied to it?

Hypothesis:

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- Using your force meters, attach a wood block and place it on one of the textured surfaces.
- Pull the wood block with your force meter and record the highest measurement of force **before** the wood block starts to move across the surface.

Description of Surface/ Panel #	Force measurement before object moved

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Description of Surface/ Panel #	Force measurement before object moved

Based on your previous hypothesis and what you have just tested, why do you think that the wood block does not move when you apply a force? **Be sure to cite evidence from your observations/measurements.**

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Draw a free body acting on the wood block for 4 of the textures that you have tested, be sure to include units for each of the forces acting on the object.

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## Newton's 3<sup>rd</sup> Law

After observing the students in the rolling chair and recording your observations, create four similar situations in which one object is exerting, or applying, a force on another object. Describe your four situations below.

Situation 1:

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Situation 2:

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Situation 3:

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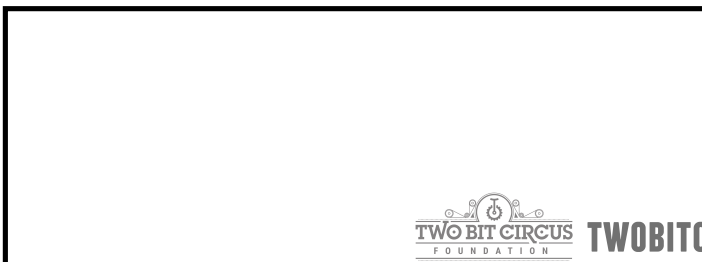
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Situation 4:

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Based on your knowledge of free body diagrams, balanced and unbalanced forces, and Newton's laws, draw what you think the free body diagrams will look like for each situation, or system.



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- Pair up with another student that has a force meter and connect them end to end.
- Similarly to the demonstration, only one person apply force to the force meter while the other holds the other force meter to provide some resistance.
- Record your observations below

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What does Newton's 3<sup>rd</sup> law state?

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Based on what you saw with your force meter and Newton's 3<sup>rd</sup> law, recreate your free body diagrams for each situation with accurate vectors.



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## Collision Safety Research

In your own words explain what Newton's 3<sup>rd</sup> law states and why it is so relevant when discussing how objects collide.

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As explained, we will be testing the forces acting on an egg during a collision with a stationary object, before we do any testing, draw what you think the forces acting on the egg will be like as it is:

- At the top of the ramp
- At the bottom of the ramp
- At Collision

At Collision	At bottom of the ramp	At top of the ramp

Based on the force you have seen acting on the car at the collision and what can happen to the egg, your challenge will be to create a safer vehicle for your egg so that when the collision occurs your "passenger" has a higher chance of survival.

Resources:

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**How Air bags work:**

<http://auto.howstuffworks.com/car-driving-safety/safety-regulatory-devices/airbag.htm>

**What happens to passengers:**

[http://www.rms.nsw.gov.au/geared/your\\_driving\\_skills/car\\_crashes/anatomy\\_of\\_a\\_crash.html](http://www.rms.nsw.gov.au/geared/your_driving_skills/car_crashes/anatomy_of_a_crash.html)

**How Seat belts work:**

<http://auto.howstuffworks.com/car-driving-safety/safety-regulatory-devices/seatbelt.htm>

**Three Collisions of a Car Crash:**

<http://buckleup.mt.gov/docs/three-collisions-in-crash.pdf>

**How Crumple zones work:**

<http://auto.howstuffworks.com/car-driving-safety/safety-regulatory-devices/crumple-zone.htm>

Using the resource provided to you, what types of safety precautions are you going to build into your cars? Be sure to explain how your safety designs will work and why you chose them based on your knowledge of Newton's Laws.

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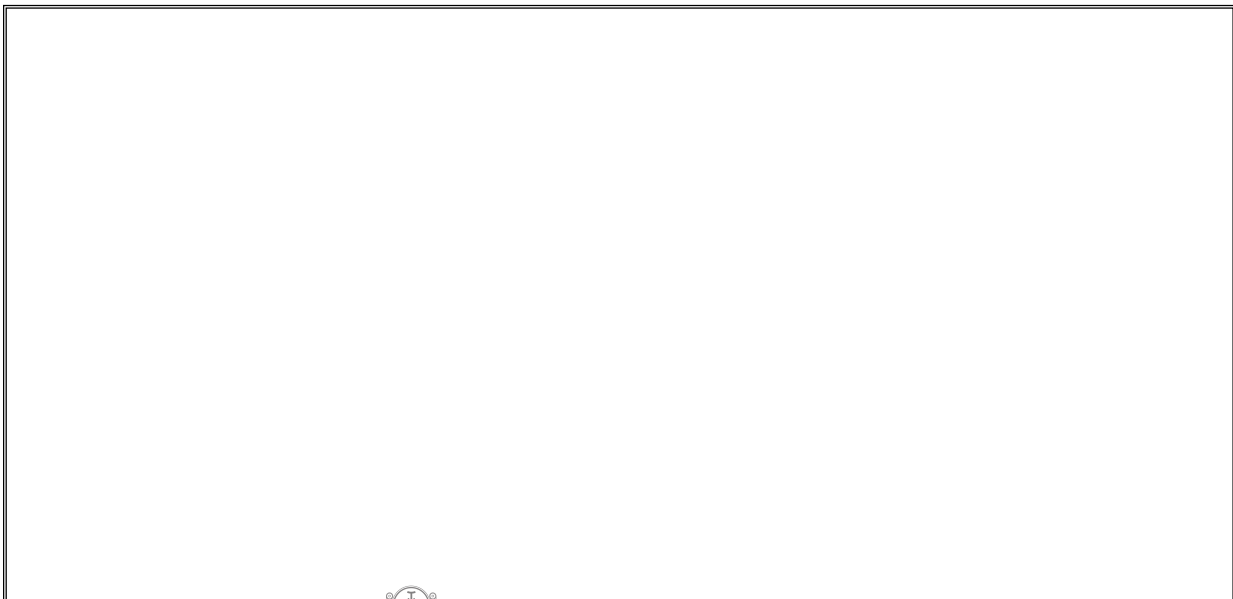
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Draw a blue print of your car with labels explain what each part is/ constructed of.





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