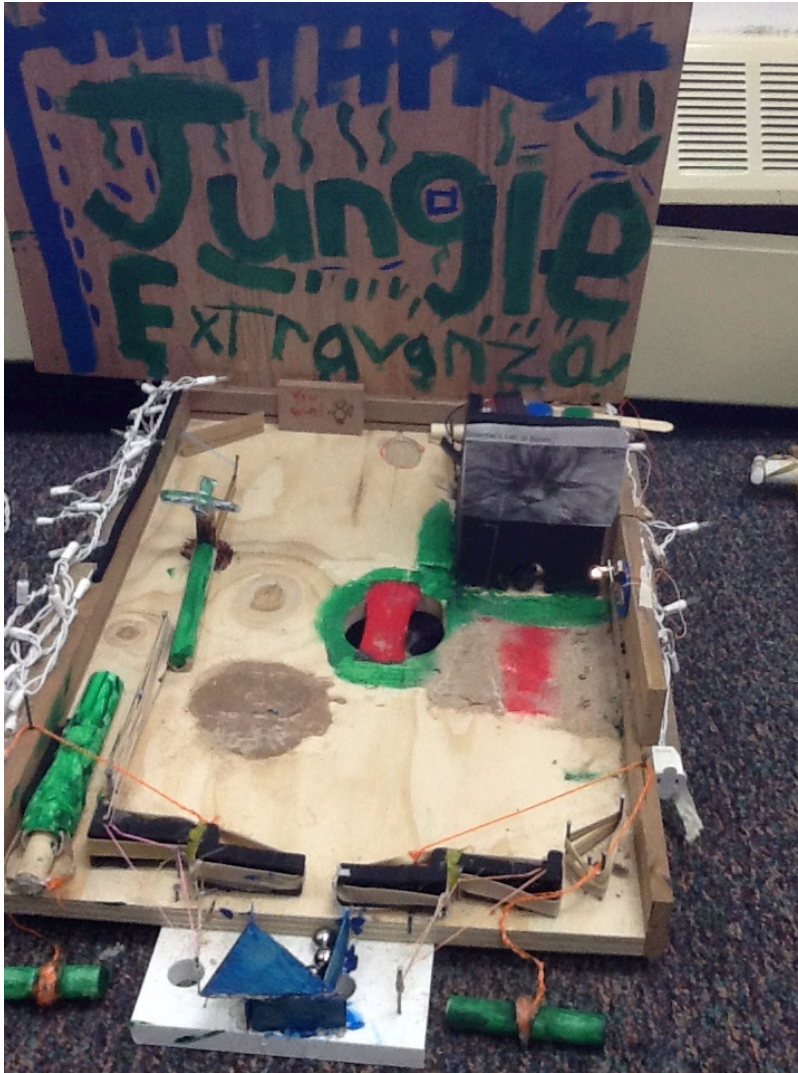


# How Scientific is a Pinball Machine?



Based On My  
Pinball Machine!

By: Lena Young

Made in: Mr Commeret's Class!

2013

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## Making a Bulb Light Up!

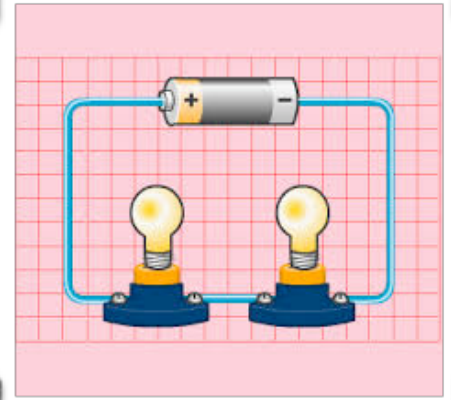
What I learned about life:

I learned how to make an experiment and how it can take a while to make it, I also learned that working and sharing your ideas with your group can be important. I learned that working with electricity can also be tough like working with magnets, circuits, nails and electromagnets can all be really tough to work with! Also, that you need to be patient with yourself and think big! I learned that the wire gets really hot when you are close to making the bulb light up (from a circuit) and that when the circuit is really cold you are not close at all so you need to keep trying!

It applies to a Pinball machine because when you work on making it really tough (because you are dealing with electricity) and you need to be patient with yourself when you are making it like say that you were making the load or something you would need to be patient with yourself and while you are working with a group say with a pinball machine that you work with new ideas and share them!

What I learned about circuits:

I also learned to make a Light bulb light up, heres how: To make a circuit light up first of all you need all of the right materials, a battery, a battery holder, a mini light bulb, 2 wires and a light bulb holder! Then you take the battery and you put it into the battery holder and then after that you take the light bulb holder and you take the light bulb and put it in the light bulb holder. then you take 1 wire and you put it into the light bulb holder, wrap it once and then you take the other side of the wire and you put that side into the battery and twist that once and if the light bulb is not going on then screw it on tighter then you have a lit up light bulb that YOU lit up! If the light bulb isn't screwed in all the way then there will be no electric current. Say that you have a light switch. When you switch the light switch up then it will flip down and touch the wire which will make electricity and if you keep the switch down then it will stay up which will not make electricity!



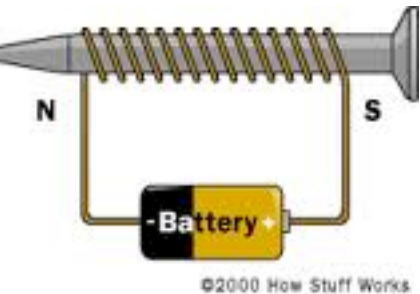
## Where is a Circuit Found in a Pinball Machine

In our Pinball Machine the circuit was right by our “Scientist’s Lab of Boom” and the thing that you wanted to do was not get in it there. We used a magnet to attract the ball (because it was metal) and then we used a circuit in there just for a little fun because we tried an experiment with the circuit and it failed so now we think that we should just light up the circuit by ourselves (with our hands) when the people that our playing the game lose! You can find our circuit in our Scientist’s Lab of Boom!

# Electromagnets

## What I Learned

- That the north and the north side of a magnet can not go together and instead that they pull away from each other.
- Magnets are magnetic all the time and electromagnets are only magnetic when electricity runs through them.
- When you are making an electromagnet you need to make sure that you twist it the right amount of times otherwise it does not work.



## Where You Will See It On My Pinball Machine:

We have a magnet on our pinball machine and the magnet is hidden in our “Scientist’s Lab Of Boom!” The ball is also metal so the ball will attract to the magnet and they when the people who are playing it get close to the “Scientist’s Lab Of Boom” the ball will go in there and then they will lose.

# Newton's Laws of Motion / The Awful Accident

## Law #1 - Law of inertia

- An Object at rest will remain at rest unless acted on by an unbalanced force. An object in motion continues in motion with the same speed and in the same direction unless acted upon by an unbalanced force.
  - Say that you are in a car and you forgot to wear a seatbelt or just didn't wear a seatbelt and the car hit something like a tree or another car, then your body would pull you forward and since you weren't wearing a seat belt and either the airbag would save you or you would fly through the windshield and fall you would probably break something too! That's all because your body wants to keep going further and it doesn't want to stop!
  - Say that you are lying on the couch watching t.v. or reading with your favorite snack with your favorite blanket. Your body would want to stay at rest because it's comfortable and that would be a time when your body would want to be at rest!

One Night we were going to the beach because my Dad wanted to go surfing and my Mom had to go to work so we made a simple plan. The plan was that my brother and sister and I would stay in the car and watch a movie while my dad was surfing and while my Mom was at work. So my Dad went in one car and Me, my Sister, my Brother, and My Mom went in another car, as we were driving my Dad called my Mom and said the scariest thing that could probably have happened at that very moment..... My Dad got into a car accident!!! My Mom started saying things like "Lance we will be right there" and "Are you Ok, Oh my Goodness" Apparently all 3 of us kids knew there was something wrong so my Brother and I started crying but my Sister didn't she is the chill kind of person. Soon we got to the place where my Dad been in the car accident and we all found out that a teenage girl was on her phone and accidentally hit my Dad. My Dad got really hurt and he needed a neck brace for a while and the girl had owes all over her from the air bag and the cars were really smashed up! The ambulance came and the police came and the fire truck also came and soon my Dad and the girl's parents gathered up in the rain and storm ( that's how the weather was that night - it matched the car accident tragedy perfectly.) and Prayed. Soon my grandparents came and took us all home. Later time passed and my dad ended up ok! This story had to do a lot with Newton's first Law because when the girl wasn't paying attention and so the car kept going and by the time she realized that she was going to hit my Dad it was too late to hit the brakes because her car was too close to his and then the 2 cars hit but in the end at least everyone was ok!

**Newton's First Law**  
Applied to Kites

Glenn Research Center

"Every object persists in its state of rest or uniform motion in a straight line unless it is compelled to change that state by forces impressed on it."

**Initial Conditions:**  
Kite in stable flight. Zero vertical velocity.  
Lift balances Weight and vertical Pull.

**Wind Increases:**  
Lift depends on wind speed - lift increases.  
Forces unbalanced - kite climbs - positive vertical velocity.

**Tension in line increases:**  
Vertical pull depends on line tension - vertical pull increases.  
Forces balanced - zero vertical velocity - kite in new stable flight.

**Newton's Second Law**  
Definitions

Glenn Research Center

**Differential Form:** Force = change of momentum with change of time  $F = \frac{d(mv)}{dt}$

**With mass constant:** Force = mass X acceleration  $F = ma$

Force = mass X change in velocity with time  $F = \frac{m(V_1 - V_0)}{(t_1 - t_0)}$

*Force, acceleration, momentum and velocity are all vector quantities. Each has both a magnitude and a direction.*

**Newton's Third Law**  
Applied to Aerodynamics

Glenn Research Center

For every action, there is an equal and opposite re-action.

**Airfoil**

Flow deflected down.

**Foil deflected up.**

Flow deflected down.

**Engine pushed forward.**

Jet Engine

**Flow pushed backward.**

Spinning Ball

## More Of Newton's Laws of Motion

### Law #2 - $F=ma$

(Force = Mass x Acceleration)

“Acceleration is produced when a force acts on a mass.”

The greater the mass, (of the object being accelerated), the greater the amount of force needed (to accelerate the object).”

For Example,

- If you were pushing someone on the swing then you would need to have enough force to accelerate the mass.
- Or If you were pulling someone on a sled then you would need enough force to accelerate the mass!
- That's all Because its Heavy and without force the mass won't accelerate and stay still!

### Law #3

Action & Reaction

“For Every action there is an equal and opposite reaction”

For Example,

If 2 people were pushing against each other with their hands and they were on scooters then they would both push backwards!

Or

If you were to tie a balloon with air in it, and not tie it put it on a string in a straight and then let it go then it would go straight down the line of the string and blow the spit out everywhere!

These examples are both examples of Newton's 3rd Law of motion because the Law is about Action and Reaction and for the 1st example it had a lot to do with action and reaction because when 2 people push their hands against each other like the law is when they push their hands against each other then

they would both go backwards because when they push their hands against each other then the action is them pushing their hands against each other and the reaction is them both pushing back. But there is one small thing that could make one person stay where they are and then the other person would go backwards and that would be if that person would weigh a lot more than the other person but that normally would not happen it could sometimes though!

### Where You Will See It On My Pinball Machine

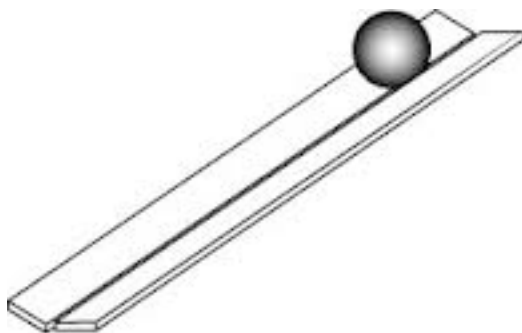
There is Newton's Laws of Motion all over my pinball it is when you hit the bumpers against the ball and also because of the law. Which is Law #1. Another way it can connect to Law #1 is when you launch the ball and you move it because the ball will not move unless you hit it. Just like it says in Law #1.



## Pinball Wizard - Marbles On the Ramp!

### What Did I Learn?

- I learned that a marble that has more force - mass will go faster
- I learned that gravity is what makes the marble go and the speed to go really fast
- I learned that friction is the thing that makes the marble stop
- I learned that the bigger the marble the more acceleration it will have and the smaller the marble the slower it will go!





## About the Author - Lena Young

Lena Young is the author of the book “How Scientific is a Pinball Machine with help from her great science group. She Lives in Holland, Michigan with her encouraging family! Lena enjoys things like swimming, watching movies and playing sports. Lena’s whole family loves sports. Her cousin Dakota was in varsity football and won the state championships - which got him into the ford field to play and he won that game too! Lena’s Brother and Dad love to play football too! Lena’s mom is very nice and loves to cheer her family on - kind of like a cheerleader! Lena’s sister has a thing for tennis and is really good! Her dog Milo can even beat everyone in soccer! Lena has 2 dreams for her life and those are to become a comedian and to be in the Olympics!



## Final Reflection

What was the **BEST** part of working in your group?

I think that the best part of working in my group was how fun the other people in my group are. They both have a good sense of humor and they are both really funny! They are good at science too! I think also that we all work great together. We are all really creative so when the 3 of us work together then we create something really cool!

What were some of the **JOYS** of working in a group?

I think that it was my great group. We argued a LOT but soon we always found an agreement and we were friends again. Everyone in our group is very creative and we all had different ideas so by the time that we stopped arguing we found a way to combine our ideas to make it even cooler! We all had a lot of crazy fun ideas! We acted silly and creative and we worked hard each day when we worked on the pinball machine!

What were some of the **STRUGGLES** of working in a group?

I think some of the struggles in our group where when we had way too many ideas, we were blowing up at each other and there was a lot of drama! I think one of the biggest struggles for me was who got the pinball machine.(I'm not trying to complain) What we were doing was, we each picked a pencil from our teacher's hand and whoever got the one with the black mark at the bottom got to keep the pinball machine and unfortunately it was me who got it. One person in

our group was really sad and started crying, I felt really bad about it but at the same time I was really mad because all my friends told me that I should give the pinball machine to the sad person but God talked to me about it and so did my Dad and over break I brought it to the person's house. I thought that it felt good to do something nice and now my Dad and I have a great pinball machine to ourselves!

### **GOALS** for group work:

- Less Drama and Fighting
- Know that theres room for everyones ideas
- Be nice to each other even when you are mad at the other person
- Work hard on everything on your pinball machine
- Have fun working
- Work a little harder each day
- Don't be grumpy even though you might be mad at the other person
- Be nice about everyones ideas and don't be hating on it even if you don't like it!

## Glossary

**Attract** - To attract means to pull toward one another. Iron and steel are objects that are attracted to magnets.

**Battery** - A Battery is an electronic device that provides electricity and that creates a power source.

**Closed Circuit** - A closed circuit has a complete path, which allows electricity to flow continuously.

**Conductor** - A conductor is a material that allows electricity to flow through!

**Current Electricity** - Current electricity is the flow

**Electricity** - Electricity is a form of energy this is found in nature (lightning, static) and can also be produced through rubbing, chemical reactions, and generators. Electricity is produced through the movement of electrical charges.

**Electromagnet** - An electromagnet is produced when electricity flows through a coil of wire wrapped around an iron bar. It acts like a magnet.

**Friction** - Friction is the rubbing of surfaces. Friction can produce heat energy too.

**Light Bulb** - A light bulb is a lamp or light source whose light is produced by the glow of a heated wire. The light bulb requires an electrical circuit to heat the wire.

**Load** - A load is the part of a circuit that uses electricity by giving off light, sound, heat, or increasing magnetic interaction. Light bulbs, motors, and electromagnets are examples of loads.

**Magnet** - A magnet is a material that has the ability to attract iron, steel, or an iron alloy.

**Magnetic** - A magnetic material is a substance that is attracted to a magnet and can act like a magnet.

**Magnetic Field** - A magnetic field is the area of attraction and repulsion that surrounds a magnet.

**Magnetic Pole** - A magnetic pole is a place on a magnet where the magnetic effect is the strongest. The two ends of a bar magnet are its poles.

**Magnetically Attract** - If two objects magnetically attract each other, they are pulled toward each other. Iron and steel objects are magnetically attracted to magnets. When two unlike poles of magnets are placed near they are magnetically attracted.

**Magnetically Repel** - If two objects magnetically repel each other, they are pushed away from each other. When two like poles of magnets are placed near, they are magnetically repelled.

**Open Circuit** - A circuit that is not connected to the path.

**Path** - A Path is a part of a circuit along which electricity travels. The path is made of conducting material.

**Repel** - To repel means to push away from one another

**Simple Circuit** - A simple circuit is the circular path of electric current, from the source of energy and back. A complete circuit includes a source, path, and load.

**Source** - A source is the part of a circuit that pushes electric current from the conducting material along the path. Batteries are examples of a source.

**Switch** - A switch is a device made of conducting material that can open and close an electric circuit.

**Wire** - The wire in an electrical circuit provides a path for the flow of electrons from the source (battery) to load (light bulb).