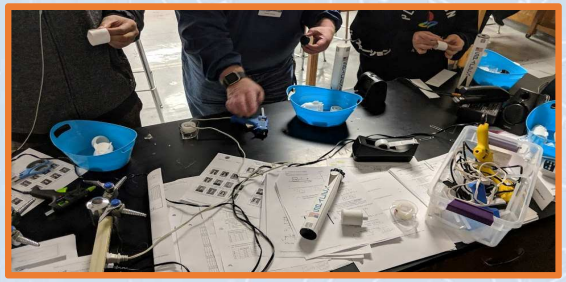
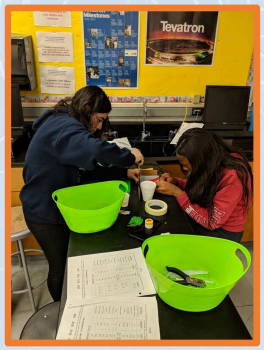
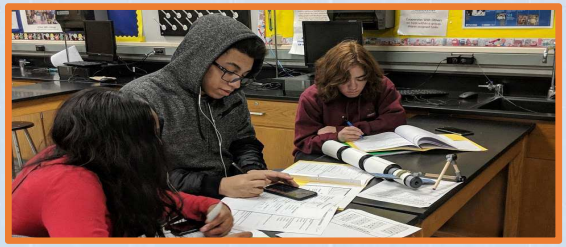
WHEATON NORTH HIGH SCHOOL

"ENERGY IN OUR WORLD"

ROBERT GRIEGOLIET







My classroom is a smaller direct level special education physics course. Students range in ability level; including students on the autism spectrum, with math learning deficits, and behavioral/emotional disabilities. This group of students has had a record of low work completion, mastery, and retention of material. Using these energy-driven activities motivated this group to go above and beyond to create some amazing products and master challenging skills!

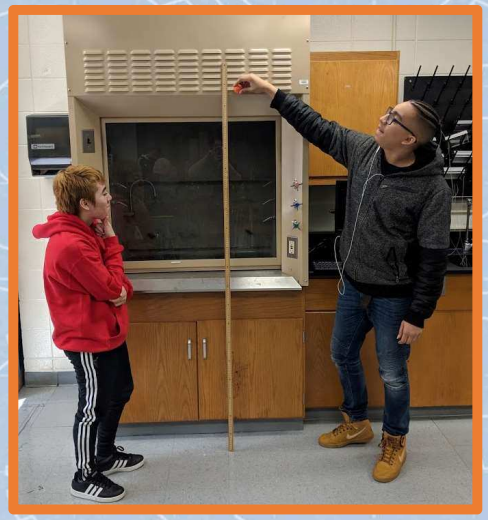
The theme of our 2nd semester physics curriculum is "energy," but energy topics are typically contained to one unit. I wanted to emphasize energy in an engaging way throughout the whole semester. I mixed NEED activities into my typical energy unit to cover motion/kinetic energy. Once students mastered those concepts, I tried to find engaging hands-on activities that tied the forms of energy into light, sound, and electricity. Extending energy concepts into other units gave students the chance to retain the material over time.

PROJECT GOALS

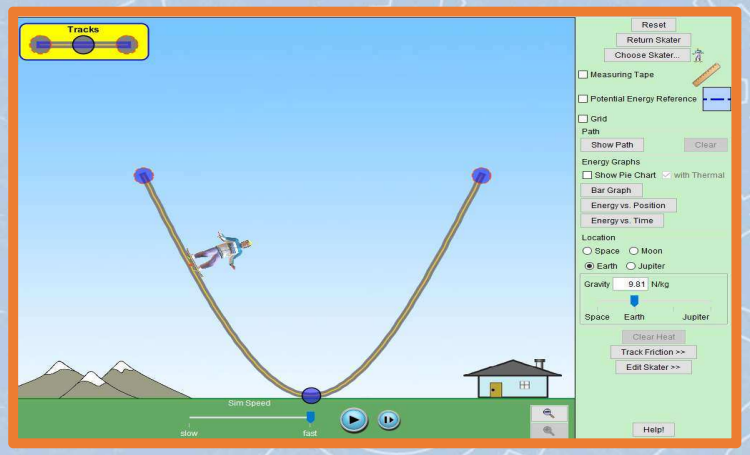
- **Goal 1:** Students will master all of the learning targets of the energy unit.
  - I can represent the forms of energy during an energy transformation.
  - I can calculate the amount of energy in a system at a given moment.
  - I can solve for an unknown variable after an energy transformation.
  - I can identify and explain all 10 sources of energy.
- **Goal 2:** Extending the idea of energy, students will make connections to light, sound, and mechanical waves.
- **Goal 3:** Students will create a 1 ft to 1 inch scale tiny house that meets the following requirements:
  - Custom-designed living environment
  - Working LED Lights
  - Solar Powered
  - Capable of Charging Its Powerwall

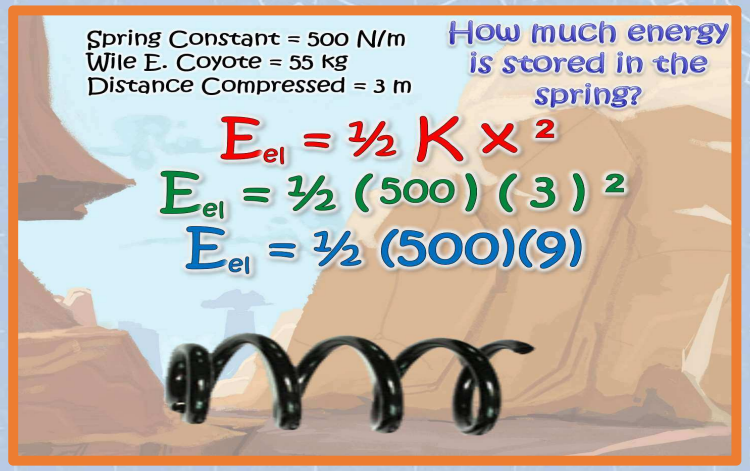
SCIENCE OF ENERGY: STATION #1

- Independently, students watched a flipped video lesson that covered:
  - Forms of Energy
  - Station Instructions
  - Data Collection
- In class, we reviewed the forms of energy and collected lab data for a variety of toy cars and bouncy balls.
- Students created pie charts to represent the transformation of energy for common moving objects.



KINETIC ENERGY EQUATIONS

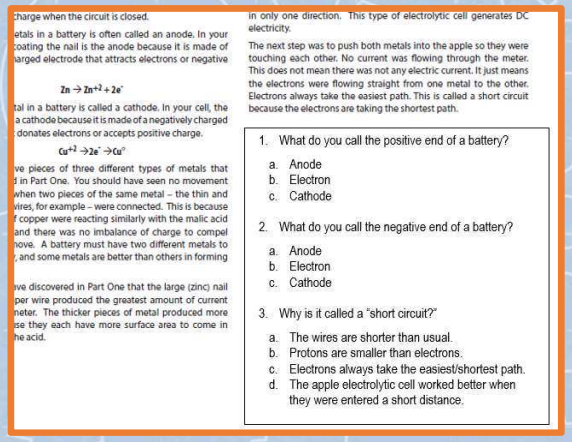




- Independently, students watched a video lesson on energy equations.
- As a group, they calculated and concluded their Station #1 data.
- Students explored a PHET skateboard simulation to practice:
  - Representing forms of energy in pie charts
  - Quantifying energy using equations.
- As a class, we calculated the energy involved in the old Road Runner cartoons.

SCIENCE OF ENERGY: STATION #4/5

- Thermal and chemical energy are rarely covered in our physics curriculum. This helped bridge the gap to last year's chemistry class and pre-taught vocabulary for our circuitry unit.
- The "What Was Happening" readings were paired with multiple choice questions to practice for the SAT.
- Since these topics were "beyond" our typical curriculum, it allowed me a time differentiate. Students who were struggling received one on one work time.



charge when the circuit is closed.

etals in a battery is often called an anode. In your coating the nail is the anode because it is made of harged electrode that attracts electrons or negative

$Zn \rightarrow Zn^{+2} + 2e^-$

tal in a battery is called a cathode. In your cell, the a cathode because it is made of a negatively charged donates electrons or accepts positive charge.

$Cu^{+2} \rightarrow 2e^- \rightarrow Cu^0$

ve pieces of three different types of metals that in Part One. You should have seen no movement when two pieces of the same metal – the thin and wires, for example – were connected. This is because copper were reacting similarly with the malic acid and there was no imbalance of charge to compel ove. A battery must have two different metals to , and some metals are better than others in forming

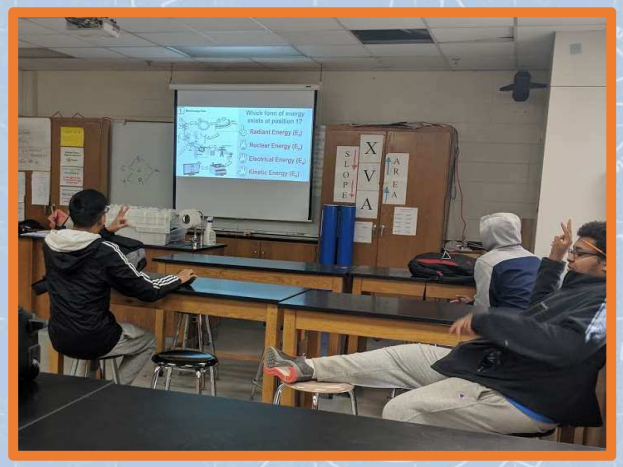
ve discovered in Part One that the large (zinc) nail per wire produced the greatest amount of current neter. The thicker pieces of metal produced more se they each have more surface area to come in he acid.

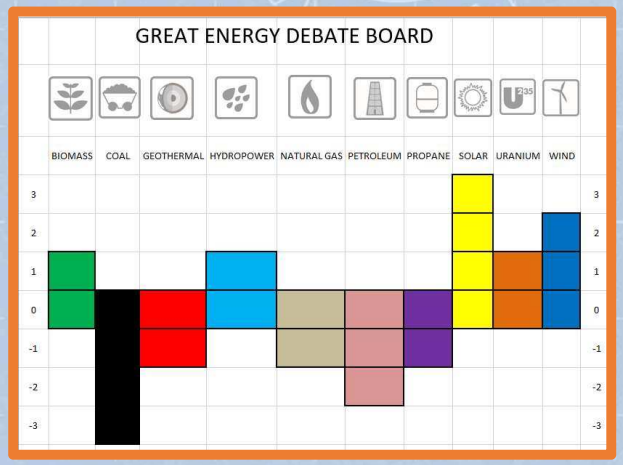
in only one direction. This type of electrolytic cell generates DC electricity.

The next step was to push both metals into the apple so they were touching each other. No current was flowing through the meter. This does not mean there was not any electric current. It just means the electrons were flowing straight from one metal to the other. Electrons always take the easiest path. This is called a short circuit because the electrons are taking the shortest path.

1. What do you call the positive end of a battery?
   a. Anode
   b. Electron
   c. Cathode
2. What do you call the negative end of a battery?
   a. Anode
   b. Electron
   c. Cathode
3. Why is it called a "short circuit?"
   a. The wires are shorter than usual.
   b. Protons are smaller than electrons.
   c. Electrons always take the easiest/shortest path.
   d. The apple electrolytic cell worked better when they were entered a short distance.

SOURCES OF ENERGY

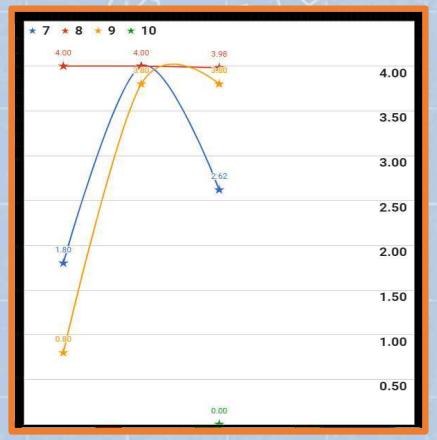


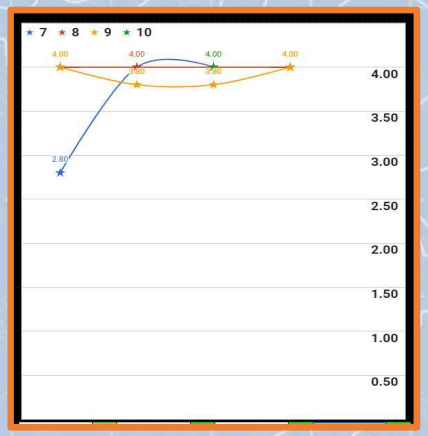


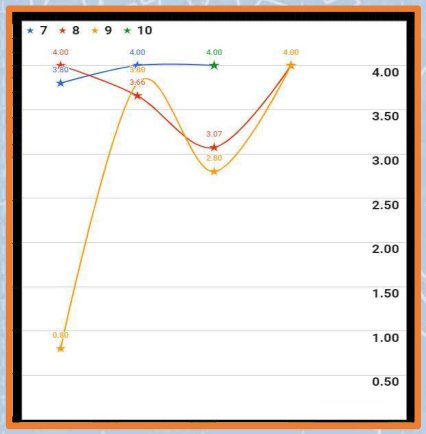
- Independently, students watched a flipped video lesson on the sources of energy.
- In class, we discussed the forms of energy transformations that explain each source.
- Students debated which source is “best.” Wind and solar won the debate. Students decided to used wind and solar to power our future tiny homes and Mars habitats.

GOAL 1 PROGRESS

- Mastery data was collected through formative and summative assessments.
- A 0 – 4 standards-based grading model employed the median score of learning targets across multiple summative assessments.
- Most students mastered the skills in the 3.5 – 4 range over time.
- Students who did not master the skills showed growth in all learning targets.

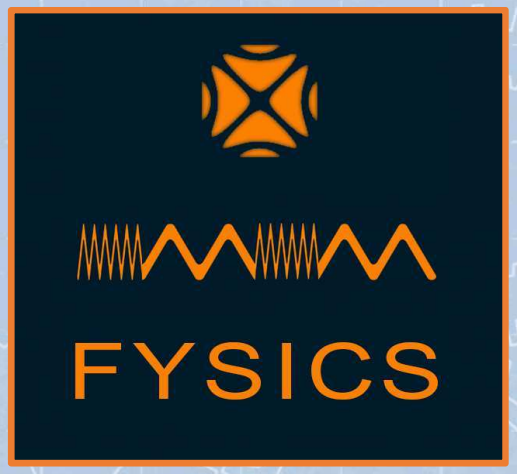


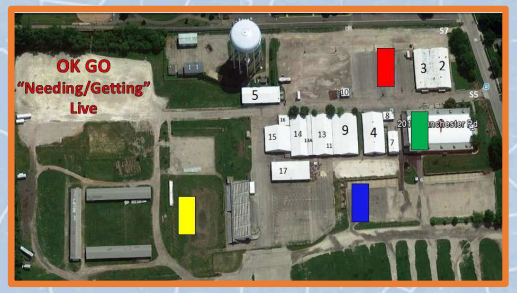


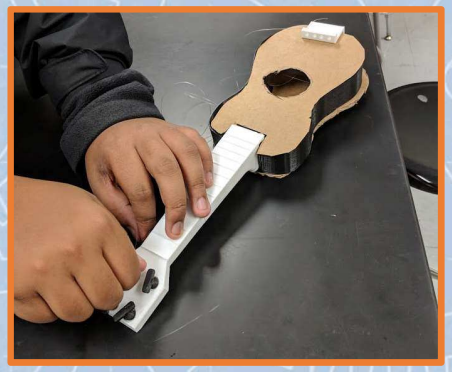


FYSICS FESTIVAL

- The class explored sound and radiant energy by planning their own music festival.
- The class planned a schedule of artists and unique acts that reflected physics concepts at our local county fairgrounds.
- Each student designed, tuned, and played their own ukulele to understand sound and mechanical waves.
- Using an interview with Chris Douggs McDougall (recorded just for our class), students applied their energy equations to calculate the mass needed to safely launch him in the air.





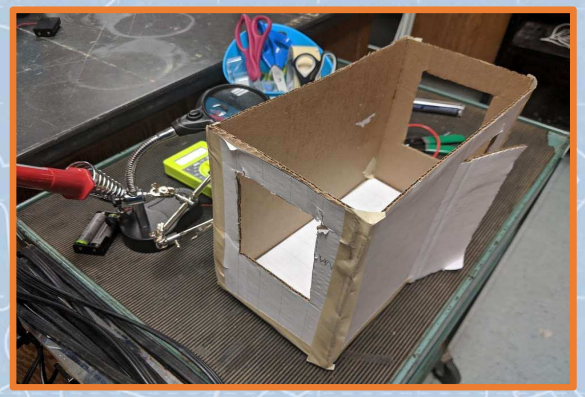


ELECTROMAGNETIC ART GALLERY

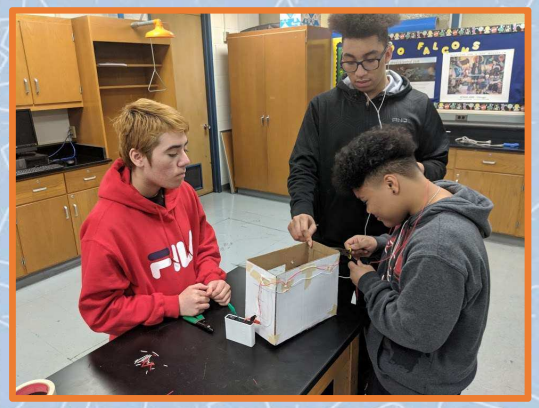
- Students explored radiant energy and the electromagnetic spectrum using:
  - 3D printing pens
  - Flir Camera Selfies
  - Highlighters
  - Geiger Counter/Radiation Samples
- Using microwaves, students calculated the speed of light with 2 % accuracy.

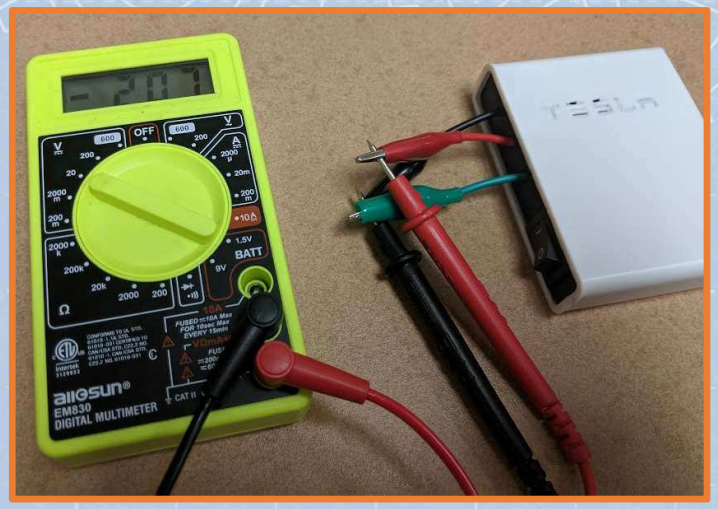
TINY HOUSES: ROAD TRIPS

- To introduce the road trip theme, students played Pretzel Power.
- Using RoadTrippers.com, students designed their own dream road trips.
- In groups, they were challenged to build a scaled model of a 5x10 foot scaled tiny house to take on their road trips.



TINY HOUSES: POWERWALLS

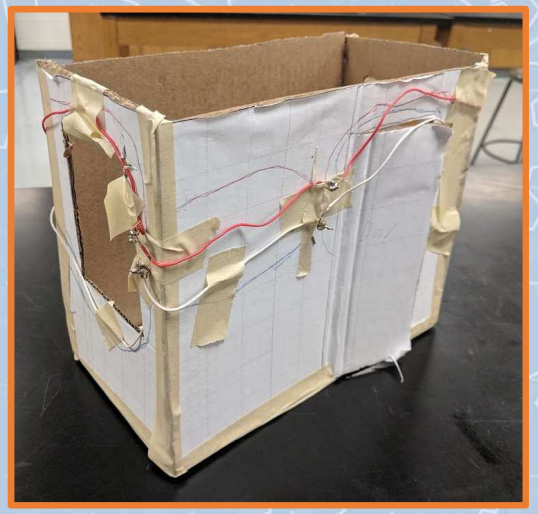




- Students researched the Tesla Powerwall via their website.
- Each team was given a scaled down and chargeable Powerwall with 3V of output.
- We explored how to use a multi-meter to read the voltage and current of the Powerwall. This helped build our understanding of Ohm's Law.
- Students brainstormed how they'd like to charge their Powerwalls and settled on solar panels.

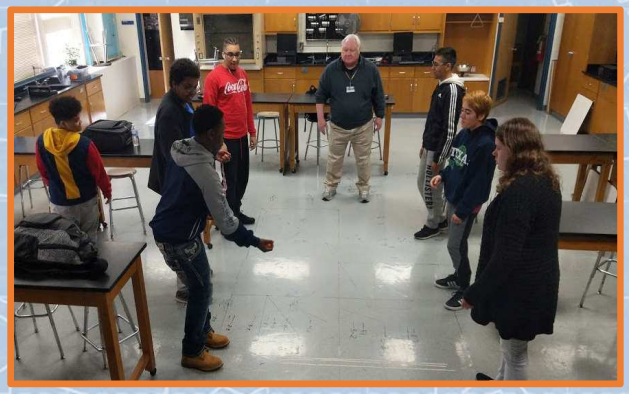
TINY HOUSES: CIRCUITRY

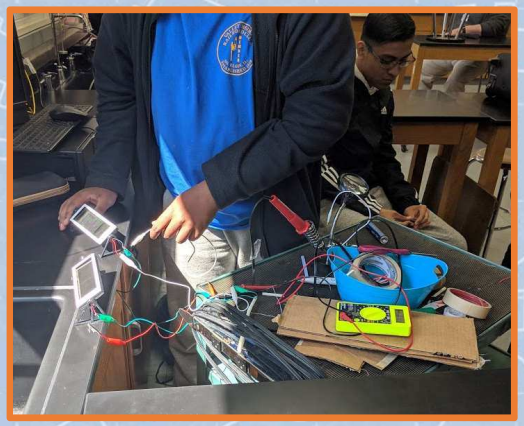
- Students explored basic series and parallel circuits using Squishy Circuits.
- Each group drew a schematic diagram on their lighting on the outside of their house, emphasizing the anode/cathode we discovered in Station #5
- Students learned how to use soldering irons, wire strippers, and multimeters.



TINY HOUSES: SOLAR PANELS

- Independently, students watched a flipped video lesson on the photoelectric effect.
- In class, students simulated a PV cell using the “Ping Pong PV” activity.
- Using their circuitry and multi-meter knowledge, students explored the differences between wiring solar panels in parallel versus series.





GOAL 2 PROGRESS

- Informal data was collected in class and students performed well on that portion of the light and sound assessments.
- This lesson was featured in the local media and students will be recreating it during an upcoming district event.

Art, Marshmallows, and the Speed of Light at Wheaton North HS

In a recent Physics lesson, students explored the electromagnetic spectrum with hands on activities.

By Wheaton Warrenville Education Association (WWEA), Neighbor | Apr 7, 2019 6:00 am ET | Updated Apr 7, 2019 6:03 am ET

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Mr. Rob Griegoliet and Mr. Don Helberg co-teach Physics at Wheaton North High School in CUSD200. This teaching duo has a reputation for creativity and high levels of student engagement. In a recent

GOAL 3 PROGRESS

- Students did not complete their tiny houses in time for the April 15th submission date due to multiple days of SAT testing accommodations.
- They will continue to decorate their tiny houses and be assessed on circuitry, solar energy, and fossil fuels in the coming days.