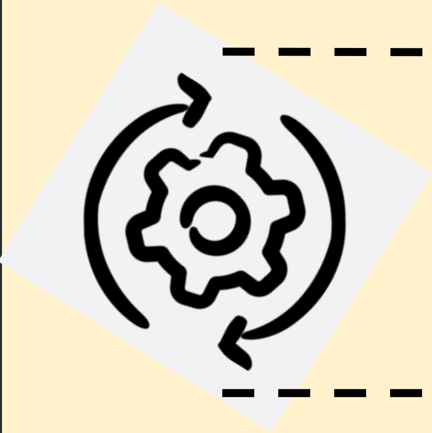
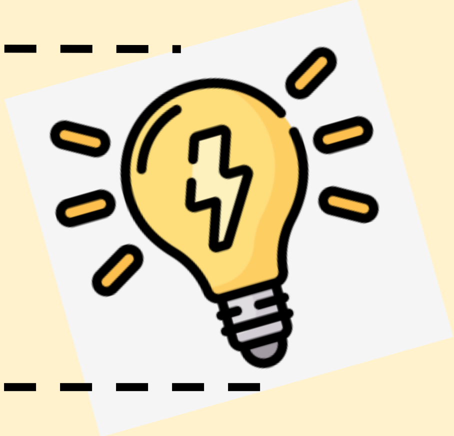


Spin it to Light it



How light bulbs with different voltage need different energy levels for it to light the brightest

By Lana Z, Gr.5

Hypothesis

If the light bulb has **higher voltage**, then it would require **more force and speed** because we need **more electricity** to light up the light bulb.

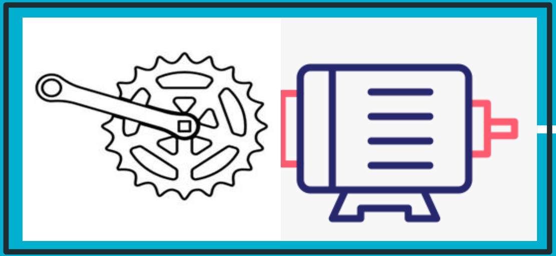
Research

- **Electricity** is energy that is used to power up homes and cities.
- To light a light bulb, there must be a **closed circuit**.
- A closed circuit needs to have an **electricity supply**, **conductors** and a **light bulb**.
- The light bulb will tell you if the circuit is **closed or not**.
- There are two **types of circuits**: series circuit and parallel circuit.
- In my experiment, I used a **dynamo with a hand cranker** as my electricity supply instead of a battery.
- When you spin the hand cranker, the magnet in the dynamo will rotate which creates kinetic energy. Using the **properties of electromagnetism**, it will convert the **kinetic energy into electrical energy**, also known as electricity, which will flow through the **copper wires** and **light up** the light bulb.

Circuit diagram

Using properties of electromagnetism converts kinetic energy to electricity

Kinetic energy when you spin the hand cranker

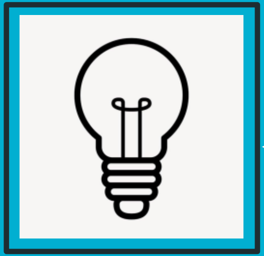


Hand cranker

Dynamo

Electricity flows through copper wires

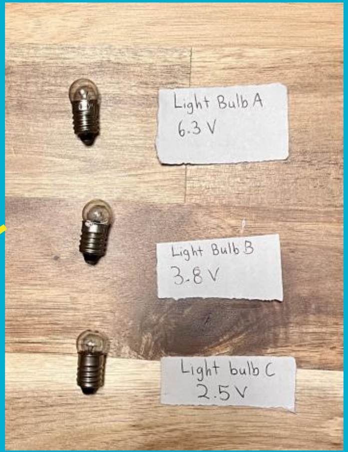
Light bulb



Copper wires

Dynamo with hand cranker and with two terminals

Voltmeter with positive and negative terminals



3 light bulbs with different voltage but the same ampere

Materials needed

4 copper wires

Lamp socket with two terminals

Variables

- Copper wires
- Dynamo with hand cranker
- Voltmeter
- Light bulbs with different voltage
- Speed and force

Controlled variables

Responsive variable

Manipulative variables

Procedures (1 / 4)

Preparing the circuit

1

1. Connect the red terminal of the dynamo to the positive terminal of the voltmeter using one copper wire

2. Connect the black terminal of the dynamo to the negative terminal of the voltmeter using one copper wire

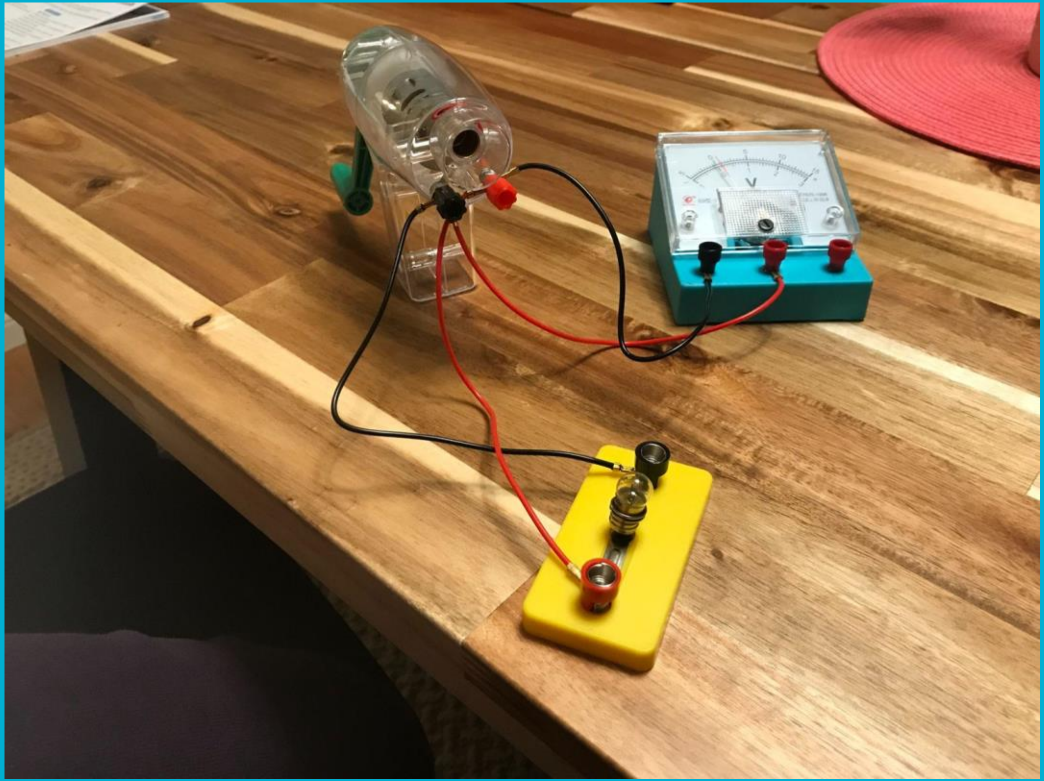
3. Connect one terminal of the dynamo to one terminal of the lamp socket using one copper wire

4. Connect the other terminal of the dynamo to the other terminal of the lamp socket using one copper wire

Note: There are two wires on each terminal of the dynamo. This will create a parallel circuit

5. Add Light Bulb C to the lamp socket. Twist the light bulb until it tightens and the bottom touches the metal plate

This is what the circuit looks like



Procedures (2 / 4)

2

Experiment

1. Spin the hand cranker that is on the dynamo in a clockwise direction
2. Spin the hand cranker until the voltmeter reads 1 volt
3. Observe the brightness of the light bulb and record your observations
4. Spin the hand cranker faster until the voltmeter reads 2 volts
5. Observe the brightness of light bulb and record your observation
6. Spin the hand cranker even faster until the voltmeter reads 3 volts
7. Observe the brightness of the light bulb and record your observations
8. Repeat the steps above with Light Bulb B then Light Bulb A

Procedures (3 and 4 / 4)

3

Analyse

Perform your analysis by comparing your observations on the brightness of Light Bulb A, B and C

4

Conclude

Form your conclusion

Observations for Light Bulb C

Spin faster

Spin even faster

Light bulb	Voltage	Reading on the voltmeter		
		1 volt	2 volts	3 volts
C	2.5V	Dim	Bright	Very bright
C	2.5V	Dim	Bright	Very bright
C	2.5V	Dim	Bright	Very bright
C	2.5V	Dim	Bright	Very bright
C	2.5V	Dim	Bright	Very bright

Observations for Light Bulb B

Spin faster　　Spin even faster

Light bulb	Voltage	Reading on the voltmeter		
		1 volt	2 volts	3 volts
B	3.8V	Very dim	Dim	Bright but not as bright as Light Bulb C
B	3.8V	Very dim	Dim	Bright but not as bright as Light Bulb C
B	3.8V	Very dim	Dim	Bright but not as bright as Light Bulb C
B	3.8V	Very dim	Dim	Bright but not as bright as Light Bulb C
B	3.8V	Very dim	Dim	Bright but not as bright as Light Bulb C

Observations for Light Bulb A

Spin faster Spin even faster

Light bulb	Voltage	Reading on the voltmeter		
		1 volt	2 volts	3 volts
A	6.3V	Very dim, Almost no light	Very dim	Dim
A	6.3V	Very dim, Almost no light	Very dim	Dim
A	6.3V	Very dim, Almost no light	Very dim	Dim
A	6.3V	Very dim, Almost no light	Very dim	Dim
A	6.3V	Very dim, Almost no light	Very dim	Dim

Overall Observations

Each light bulb gave the same results for all five attempts

Spin faster

Spin even faster

Light bulbs	Voltage	Reading on the voltmeter		
		1 volt	2 volts	3 volts
C	2.5V	Dim	Bright	Very bright
B	3.8V	Very dim	Dim	Bright but not as bright as Light Bulb C
A	6.3V	Very dim, Almost no light	Very dim	Dim

Analysis

- In order to get a higher voltage, I need to spin the hand cranker faster
- When I spun the hand cranker until the reading on the voltmeter said 3 volts, Light Bulb B was not as bright as Light Bulb C because Light Bulb B is with a higher voltage compared to Light Bulb C (3.8V vs 2.5V) and 3 volts is not enough for Light Bulb B to light up the brightest because it requires 3.8V for that
- At 3 volts, Light Bulb A was the least bright because it requires the highest voltage (6.3V vs 3.8V vs 2.5V) to light the brightest
- Even if there is not enough voltage flowing, a light bulb can still light up, but it will not be at its brightest just like Light Bulb C

Sources of Error

When the circuit is not closed. Could be because of:

- Wires are not connected properly
- Light Bulb is burned out
- The motor might not be working

Conclusion

The **higher the voltage** of the bulb is, the **faster** I need to spin the hand cranker using **more energy** so that there is **enough electricity flow** to light up the light bulb the brightest.

Concept Application

In a **bike spinning gym**, we can apply this concept as an **alternative source** of electricity to light the gym up by having light bulbs on the bikes. **When someone cycles on the bike** it will light the light bulb up using **kinetic energy** which will then **brighten up the gym**.

The more people cycle on a higher speed, the brighter the gym will be!

BENEFITS

- ★ Save on electricity bills
- ★ Cheaper membership fees
- ★ Attracts more people to the gym

Current Applications

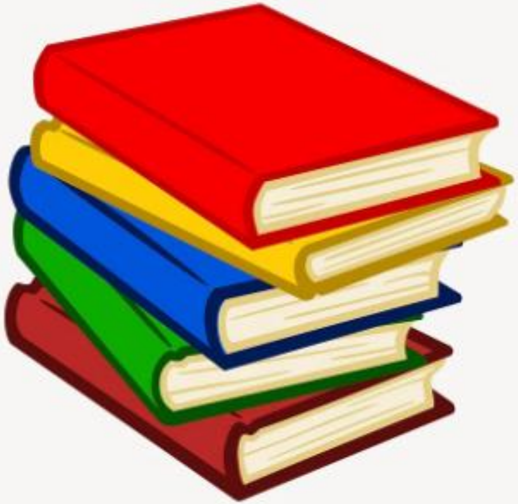
In a **hydropower plant**, when the moving water hits the turbine, similar to the dynamo concept, it will create electricity enough to light up a city.

Dynamo-operated handheld **flashlights**

Light on a bicycle where the light will light up as the cyclist cycles

Citations

1. Khan Academy https://www.khanacademy.org/
2. Britannica Kids https://kids.britannica.com/
3. Twinkl https://www.twinkl.ca/
4. Study.com https://study.com/
5. BYJU'S https://byjus.com/
6. U.S Energy Information Administration https://www.eia.gov/
7. JLab https://education.jlab.org/
8. Quizlet https://quizlet.com/gb
9. A True Book™ - Physical Science: Electricity and Magnetism By Cody Crane



Acknowledgement

- ★ I thank my **mom and dad** for helping and supporting me through my science fair challenges
- ★ I would also thank **Ms.Tang** for giving me guidance and feedback to complete my science fair project
- ★ Thank you to my homeroom teacher, **Mr.Chris** who introduced me to electricity circuits which I then developed further by using dynamos in the circuit

Thank you!