Experiment

Beginner

Fruit Battery

sead : stem

Subjects

Chemistry

Topics

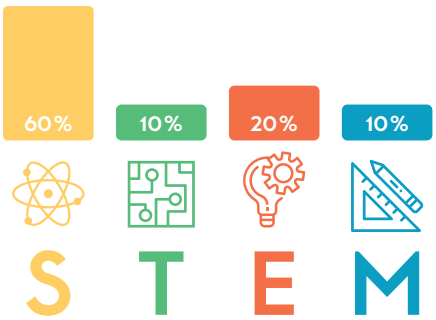
Chemical Reaction | Environment | Energy | Fluid & Electrolytes | Scientific Inquiry

Key Words

Sources of Energy | Chemical Reaction | Electrical Energy | Chemistry | Conversion of Energy

Connection to SDG

STEM Chart



Time for Activity

3 hours

Introduction

By 2030, everyone should have access to affordable, reliable and modern energy services. Electrical energy is an important component of our daily life. As we all know, some parts of the world face the lack of electricity and building an electrical generating facility is very expensive. This causes many problems such as the inability to provide schools with electrical power, thus affecting the quality of life. Because of that, many countries are looking into more unconventional and innovative ways to generate electricity.

Did you know that some fruits can produce electricity? This process occurs by converting chemical energy from foods to produce electrical current. One of the common examples of food used are lemons and potatoes.

In this activity, students will learn how fruits produce electricity when in contact with metal. They will investigate the relationship between pH and electrical current produced, and the number of fruits needed to light up a red LED. With this idea, the students will present a solution to provide affordable electricity to rural schools and houses around their area.

Key Objectives

1. Identifying the fruits that are the most suitable for power production
2. Identifying the relations between the pH of the fruits and electrical conductivity.
3. Presenting an idea to generate more affordable electricity to power rural schools / houses by using the idea obtained from the experiment.

Materials

1. Copper wire
2. Electrical wire
3. Alligator clip
4. pH indicator
5. Zinc nails
6. Lemons
7. Potatoes
8. Milliammeter
9. Knife

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Safety

1. Please be careful not to swallow any of the material.
2. Should there be any spillage or chemical reaction (irritation) on the skin, quickly rinse with running water and contact your teacher.
3. Some of the materials are corrosive.
4. Please handle the glass bottles with care.

Guiding Questions

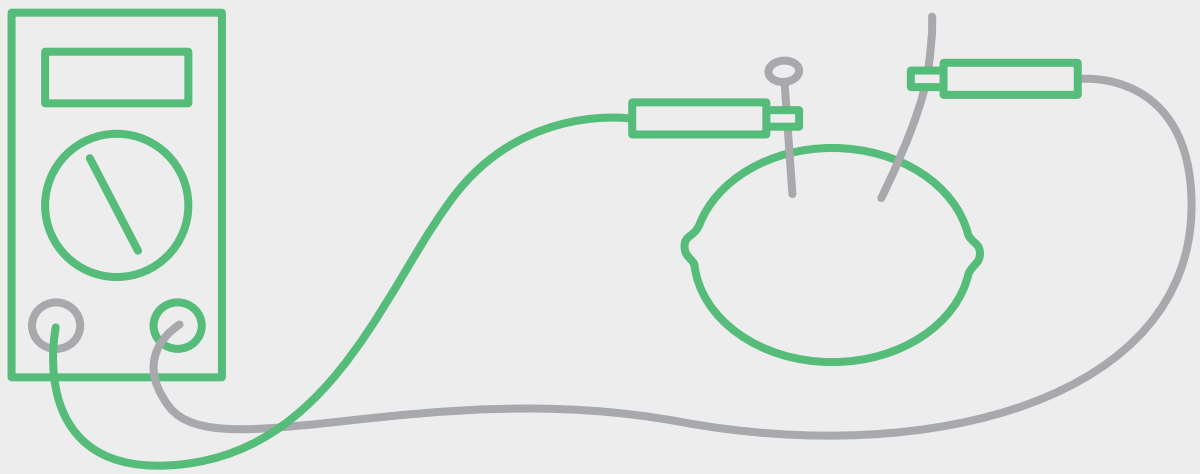
1. Which fruits are the most suitable for power production?
2. How many fruits are needed to light up a red LED light?
3. What is the relationship between pH and electrical conductivity?
4. How can this idea be adapted to supply rural schools and houses with electricity?

Task A

Lemon

with a copper wire and a zinc-coated iron nail, connected to a measuring instrument for measuring the voltage.

Set 1



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1. Roll the lemon gently on a table to break the cell walls and loosen up the juices inside. The sour juices are needed for the chemical reaction to occur.
2. Cut a small part of the lemon to measure the pH level by using a piece of pH paper.
3. Carefully stick the copper wire about 1 inch into the lemon.
4. Stick the zinc-covered nail into a spot in the lemon about ¼ inch away from the cooper wire. Make sure the wires don't touch.
5. Connect the ammeter's negative lead to the zinc nail and the positive lead to the copper wire to determine how much voltage is produced by one lemon. Record the data in the results table below.
6. Repeat steps No. 3, No. 4 and No. 5 using a potato, an onion, an apple and record the data in the results table.

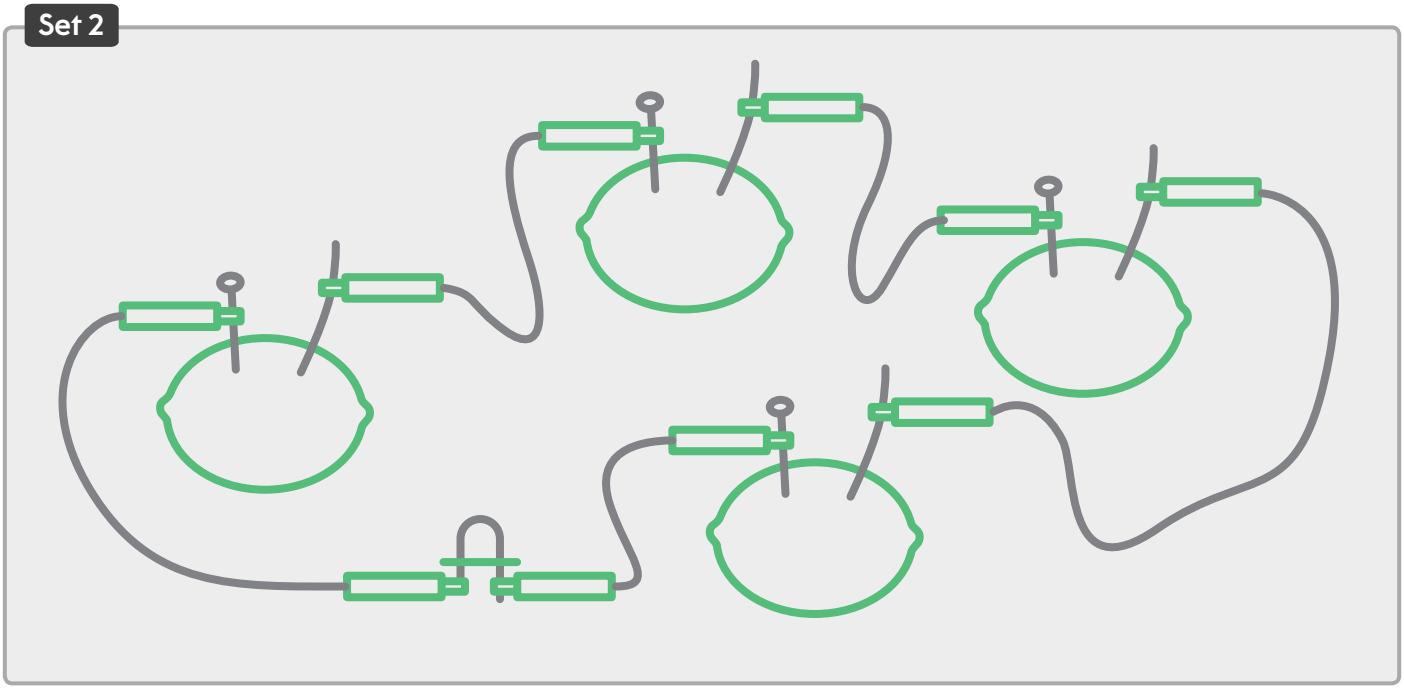
Fruit	pH	Voltage
Lemon		
Potato		
Onion		
Apple		

Task B

Lemon

The setup is similar with the other fruits and vegetables.

Set 2



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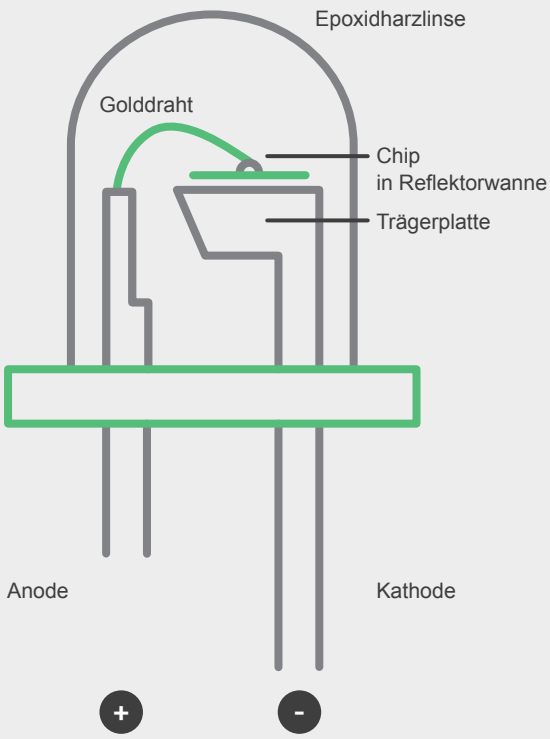
Set 2



Fruit	Number of fruits needed to light up a red LED
Lemon	
Potato	
Onion	
Apple	

1. You can generate more electrical current to power a red LED light by adding more fruits.

2. Light-emitting diodes (LEDs) require a certain voltage to glow. Connect the copper wire of the first lemon to the zinc-coated iron nail of the second lemon. Try to make the red LED light up by connecting the copper wire of the second lemon with the short leg of the LED and the zinc-covered iron nail of the second lemon with the long leg of the red LED.

   Does it light up? If not, connect a third lemon by connecting the copper wire of the second lemon to the iron nail of the new lemon. Now connect the LED with the iron nail of the first lemon and the copper rod of the third lemon. Repeat this with new lemons until the LED lights up.

3. Repeat step No.1 using lemon, potato, onion, apple, and record the data in the table provided.

4. Connect as many fruits as necessary until the LED lights up.

5. In the respective experiment groups, the students discuss and present the solution to power up a rural school or houses in a creative way, using ideas from this experiment.

Conclusion

6. Explain the relationship between the pH value of the fruit and the voltage produced.

7. How does the tension change when you connect several fruits in series?

8. Why do you need different numbers of fruits to make the LED light up?

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Assessment

Evaluation Criteria	4	3	2	1
Procedures	Procedures are listed in clear steps. Each step is numbered and is a complete sentence	Procedures are listed in a logical order, but steps are not num-bered and/or are not in complete sentences	Procedures are listed but are not in a logical order or are difficult to follow	Procedures do not accurately list the steps of the experiment
Ability to explain the reaction between fruits and their conductivity	Demonstrate clear understanding of the reaction between fruits and their conductivity	Demonstrate clear understanding of reaction between fruits and their conductivity but cannot explain in detail	Demonstrate superficial knowledge in the reaction between fruits and their conductivity	Unable to demonstrate the understanding of the reaction between fruits and their conductivity