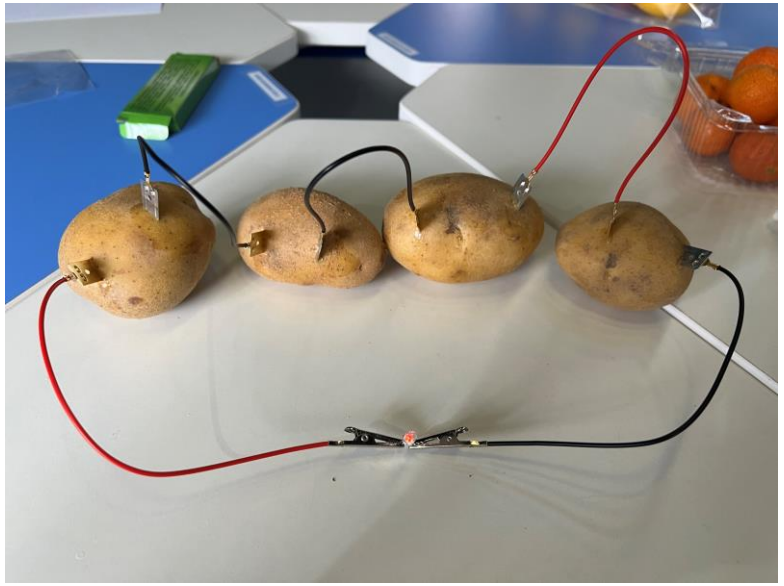
J.5 SCI
STREAM Project
Fruit battery

Stewards Pooi Kei Primary School



Class : J. 5

Course book : School-based project

Cycle	Date	Period	Module	Unit Title	Learning Objectives	Experiment & Activities	Follow-up Exercise	E.T.V. / e-resources	Remarks
14-15	22/1 - 21/2	6	/	Fruit Battery	◆ Understand the uses of batteries (S) ◆ Understand the basic principle of fruit battery (S) ◆ Using digital multimeter/voltmeter to measure the voltage generated by fruit battery (T) ◆ Read the articles about the history and importance of battery (R) ◆ Plot the data by using graph paper (M) ◆ Data handling (M)	Lesson 1 (35 minutes) ◆ Students read the two articles about the history and the importance of batteries, and then think-pair-share with groupmates. ◆ Teacher invites the group representatives to share, and then point out the importance and uses of batteries ◆ Teacher shows the videos about how the fruit battery work Lesson 2 (35 minutes) ◆ Students point out the three main components of a circuit (power source, wires, and electrical transducer), now the fruit battery can provide electricity to drive an LED on. ◆ Teacher discusses the experimental procedures with the students, students can identify the independent variables, controlled variables, and dependent variables. ◆ Students can construct the circuit diagram to measure the voltage generated by lemons with the connection of the LED, switch and digital multimeter/voltmeter. Lesson 3-4 (70 minutes) ◆ Teacher guides the experimental procedure to students. ◆ Students form groups, conduct the experiments, and record the results by using padlet.	◆ Fruits ◆ Wires ◆ Cu, Zn strip ◆ Digital multimeter ◆ LED	◆ PHET ◆ Padlet	

Class : J. 5

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						Lesson 5-6 (70 minutes) ◆ Students form groups, conduct the experiments, and record the results by using padlet. ◆ Students plot the graph by using graph paper / google spreadsheet / ms excel. ◆ Teacher discusses the precautions and errors with students	◆ Fruits ◆ Wires ◆ Cu, Zn strip ◆ Digital multimeter ◆ LED	◆ Padlet	

六個課節，共210分鐘

Notion

SPKPS_J5_STREAM Project_Fruit Battery

Articles

A simple history of batteries - Panasonic Energy Co., Ltd.

Follow the evolution of the battery since its invention and see how milestone products align with events in world history.

https://www.panasonic.com/global/energy/study/academy/history.html

Batteries are a key part of the energy transition. Here's why

With transport generating around 30% of global emissions, using energy-efficient

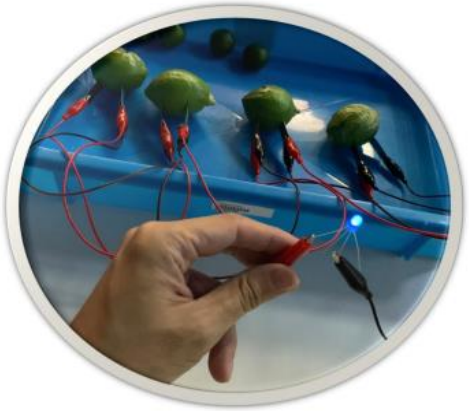
Suggested answer

Stewards Pooi Kei Primary School X QTN-T EDUHK

2023-2024

J.5 STREAM Project (SCIENCE)

Fruit Battery

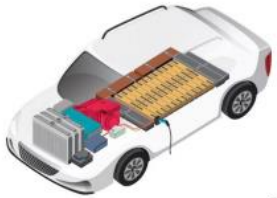


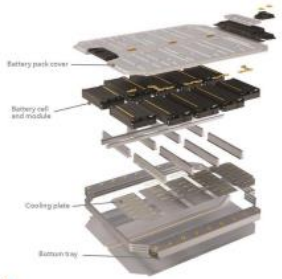
Name: _____ **Class:** _____

Reading

Read the following articles about batteries.

Title	QR Code
<History of batteries> From Panasonic Energy Co., Ltd  	
<Batteries are a key part of the energy transition. Here's why> From World Economic Forum	





Uses of Batteries

- as a portable temporary source of electrical energy
- as an energy storage (store the energy produced by sustainable energy sources, e.g. solar power, wind power)

As we know, fruits provide energy! Can we make use of the fruits to generate electricity? We want to investigate the fruit battery.

Video to watch	QR code
<This battery is made from 3,000 LEMONS - Guinness World Records> By Guinness	
<Fruit-Power Battery> By Sick Science	

Student work

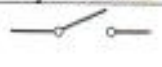
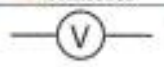
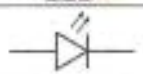
Prerequisite (Fair test)

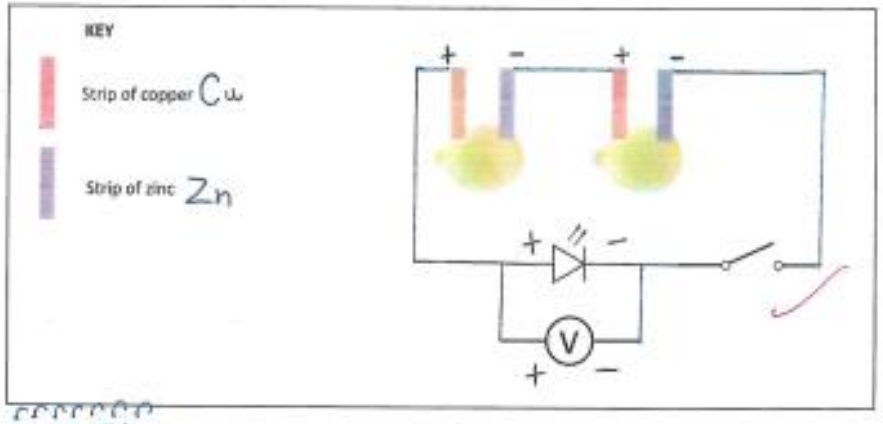
Put a "✓" in appropriate box(es) for making a fruit battery in a fair test.

Independent variable (**unique** factor to be changed)	✓	Type of fruit
		Type of the wire
		Type of the voltmeter/multimeter
		Type of metal combination used
Controlled variable (factor(s) remains unchanged)		Type of fruit
	✓	Type of the wire
	✓	Type of the voltmeter/multimeter
	✓	Type of metal combination used
Dependent variable (factor to be measured)	✓	Light up or not light up of the LED
	✓	Voltage generated
		Taste of fruit

Prerequisite (Experimental set-up)

Draw a circuit diagram to show how to measure the voltage generated by lemons with the connection of the LED.

Open switch	Voltmeter	LED
		



紅正黑負
長正短負

Equipments / Experimental set-up

- Fruits/Vegetables (e.g. lemons, apples, potatoes……)
- Electrical components (LED, Voltmeter/Multimeter, wires)
- Strip of zinc (Zn), Strip of copper (Cu)

Part 1 Fruit batteries by using lemons

Access the performance of the fruit batteries using lemons and record the results.

Results:

Number of lemons used	Does the bulb light up?	Voltage Generated (V)			
		1st	2nd	3rd	Average
1	(YES / (NO))	0.87	0.86	0.79	0.84
2	(YES / (NO))	1.55	1.53	1.55	1.55
3	((YES) / NO)	1.63	1.64	1.63	1.63
4	((YES) / NO)	1.65	1.66	1.65	1.65

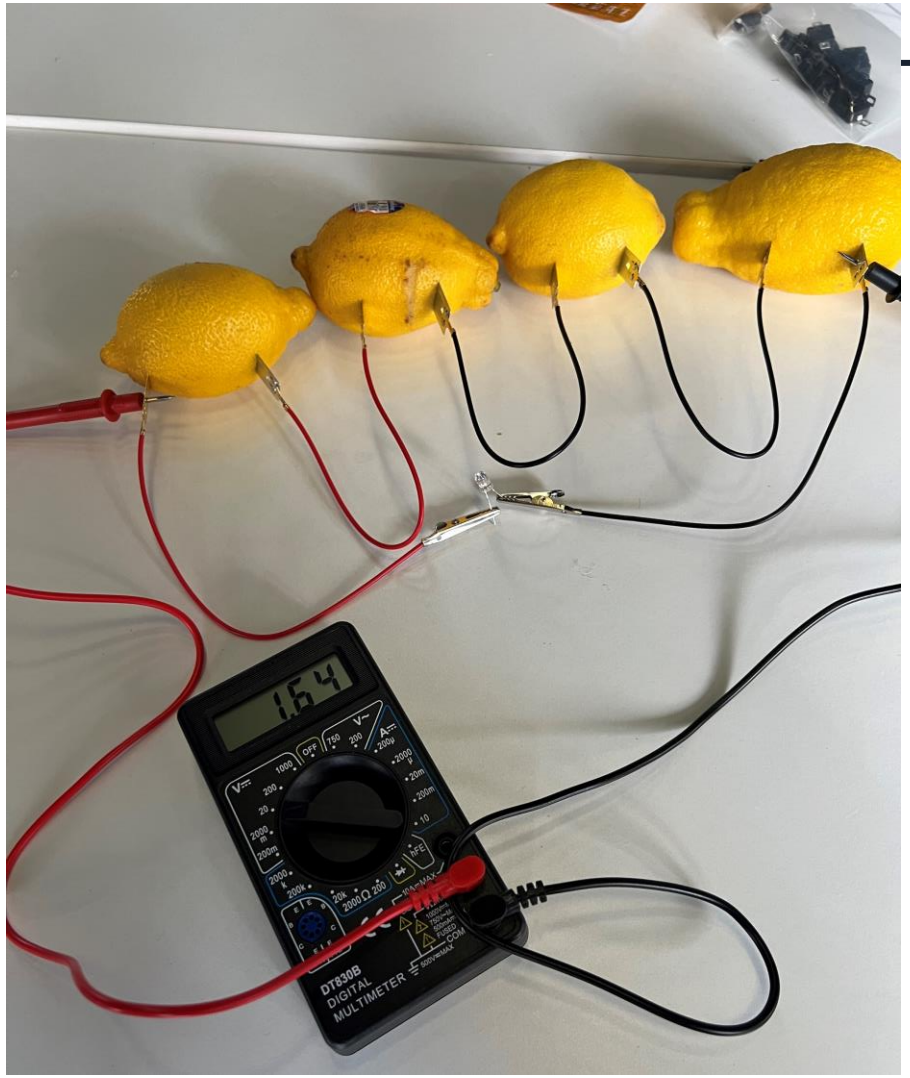
Remarks: Round the result of average voltage up to 2 decimal place.

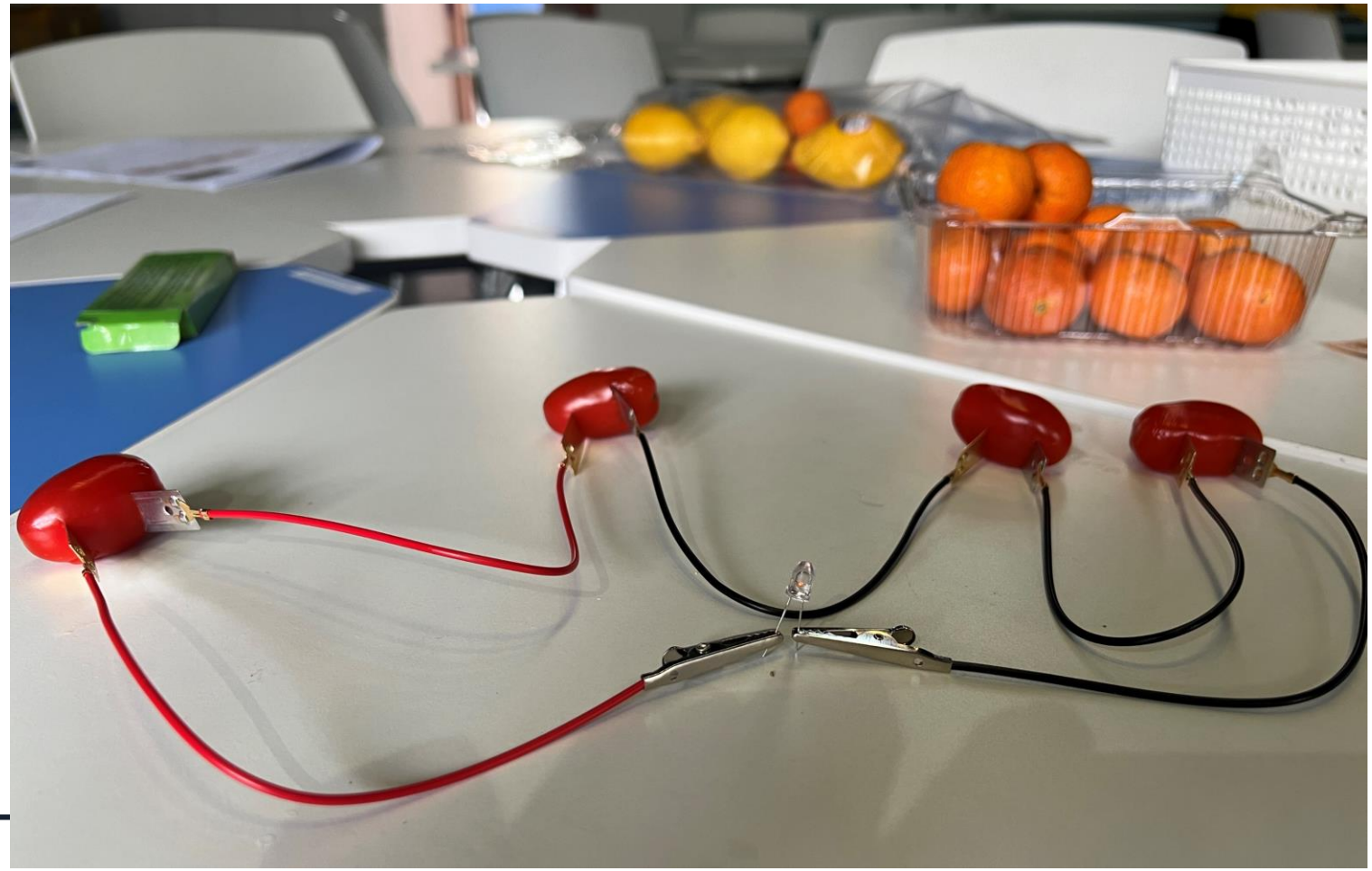
Conclusion:

The LED ((can) / cannot) be lighted up by the fruit battery using 3-4 lemons.

The average voltage generated is 1.65 V.

1.63


1.54
DT830B
DIGITAL
MULTIMETER



Part 2 Fruit batteries by using other kinds of fruits or vegetables

Access the performance of the fruit batteries using different kinds of fruits or vegetables and record the results.

A. Fruit / Vegetable used: potato

Number of potato used	Does the bulb light up?	Voltage Generated (V)			
		1st	2nd	3rd	Average
1	(YES / NO)	0.95	0.84	0.89	
2	(YES / NO)	1.59	1.59	1.59	
3	(YES / NO)	1.69	1.68	1.68	
4	(YES / NO)	1.71	1.70	1.70	1.70

B. Fruit / Vegetable used: Mini tomato

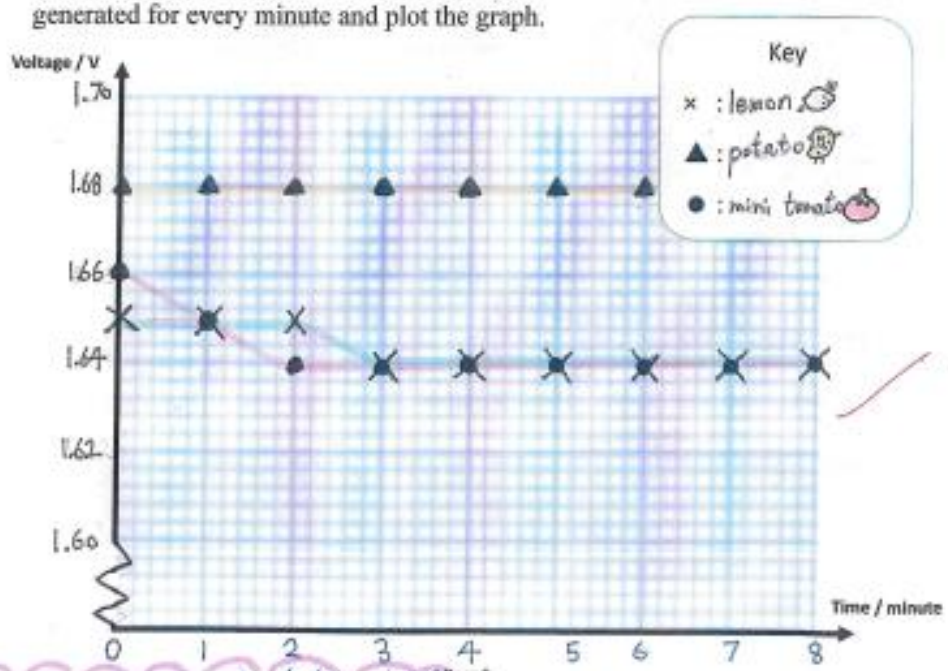
Number of mini tomato used	Does the bulb light up?	Voltage Generated (V)			
		1st	2nd	3rd	Average
1	(YES / NO)	0.32	0.29	0.30	
2	(YES / NO)				
3	(YES / NO)				
4	(YES / NO)				

Summarize the results with other groups and compare the results

Fruit or vegetables used	Minimum number needed to light up the LED	Average voltage generated to light up the LED (V)
potato	(1 / 2 / 3 / 4 / 5)	1.6 V
mini tomato	(1 / 2 / 3 / 4 / 5)	( )
lemon	(1 / 2 / 3 / 4 / 5)	1.63 V
	(1 / 2 / 3 / 4 / 5)	

Part 3 Life span of the fruit battery (Googlespreadsheet / Excel)

Connect 4 fruits/vegetables of same type with a LED, record the voltage generated for every minute and plot the graph.



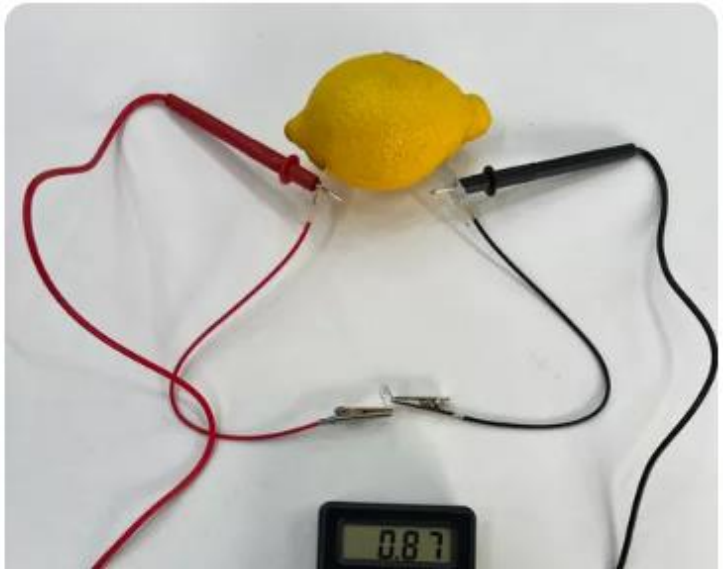
life span → provide stable voltage? → electrical components can work normally.

Lee Chi Kin李志堅 + 8 • 5個月

SPKPS_Fruit battery

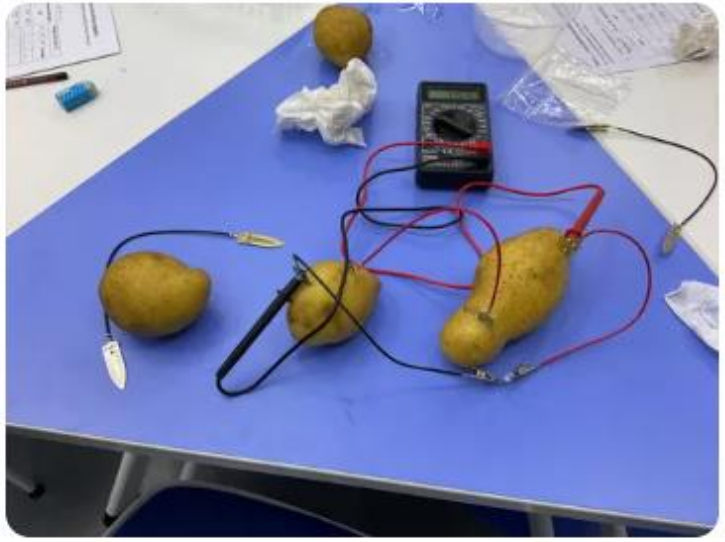
Part 1_Fruit batteries by using lemons

Mr Lee (1 lemon 0.87 V)



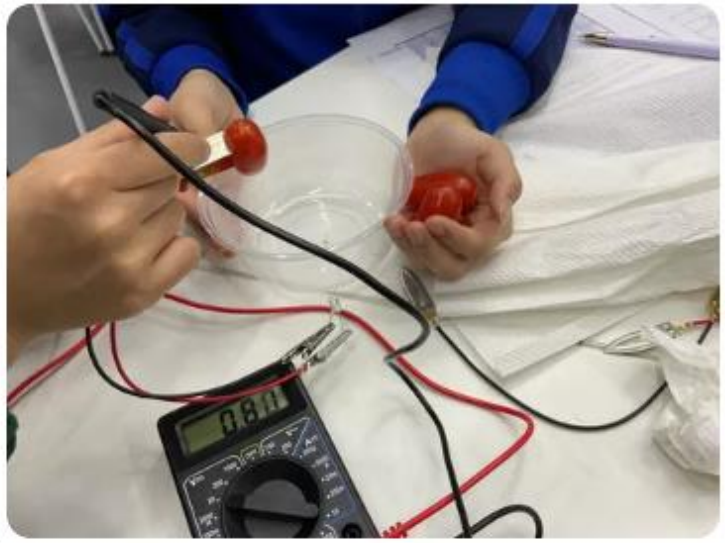
Part 2a_Fruit batteries by using _____

Potato gp.3 (1.55v)



Part 2b_Fruit batteries by using _____

Gp5 0.8



Discussions

1. Which fruit or vegetable can generate the highest voltage? Suggest a possible explanation why this fruit or vegetable can generate the highest voltage (think about the taste, liquidity, texture, etc)

Excellent !

Citrus fruits like lemons and oranges have high acidity, water content, and citric acid, which enable them to generate higher voltages in fruit battery experiments. Their juicy and juicy texture facilitates efficient contact between the electrodes.

2. What are the precautions / errors of the experiment? How can you improve the experiment?

Good !

For a successful fruit battery experiment, clean the fruit, place electrodes consistently, use fresh fruit, and choose appropriate materials. Improve by comparing fruits, measuring voltage with multiple cells, and exploring different electrode materials

Evaluation

	Items	Rating
Self-evaluation	Understand on how a closed-circuit work.	☆☆☆☆☆
	Understand on how a fruit battery work.	☆☆☆☆☆
Peer's evaluation	Degree of participation in the group activity.	☆☆☆☆☆
Parent's evaluation	Understand on how a closed-circuit work.	★★★★☆
	Understand on how a fruit battery work.	★★★★☆
Teacher's evaluation	Comments: Excellent work !	

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