

# instrument choice.com.au™

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## How many lemons does it take to power a thermometer? We did the experiment, find out here.

Did you learn at school that you can produce electricity from common fruit and vegetables? We did and it got Daniel our Scientific Sales Consultant thinking. Could we power some of our equipment from the raw energy of a lemon, or even from some potatoes? The results we found very interesting, please read on.

With Christmas coming quick we have our Christmas Weather Station flyer, [check it out here](#).

In the [weather stations division](#) we now have available a selection of the fantastic [AcuRite Weather Stations](#) from the USA, we think they will prove very popular due to their sleek and high quality design, (they certainly have blown away the competition in the USA).

Do you have an experiment you would like us to perform? Let us know, just reply to this email.

Please remember if you have any questions regarding tests you need to conduct or specific instrumentation please give us a call on 1300 737 871.

Until next month...  
Tyson Grubb

## Product of the month: [AcuRite Combo Deal](#)



Get our 2 most popular AcuRite stations, the IC00639 and the IC00899 in one combo kit.

For more information click [here](#).



## Can we power a thermometer using only fruit and vegetables?

For this month's experiment we are going to determine if it is possible to power one of our IC800040R thermometer's using fruit and vegetables. Lemons, limes, oranges, tomatoes and potatoes will be used for the basis of our batteries as they contain acid and zinc plated (galvanised nails) and copper wire will be used for terminals. The fruit and vegetables act as an acidic electrolyte which allows for the flow of ions through the medium. The acid contained within the fruits and vegetables steadily eat away at the zinc on the nail releasing spare zinc electrons. These electrons then join with spare hydrogen ions contained within the fruit/vegetable to create hydrogen gas. If only the zinc electrode was connected, little would occur, however when a piece of conductive wire is connected between the terminals the spare zinc electrons are intent on forming hydrogen gas but find it easier to do so with the hydrogen ions surrounding the zinc terminal so electrons travel through the copper terminal to get to the zinc electrons hence creating a circuit. This flow of electrons causes the production of electricity. We are going to see if we can use this reaction to power our thermometer. Read on to find out if it worked!

### Equipment used:

- 4 x 50mm pieces of copper wire 50mm long
- 4 x galvanised nails 50mm long
- Insulated wire, 50cm long
- 2 x Alligator clips
- 1 x IC800040R thermometer (low voltage and current requirements)
- 1 x QM-1543 Multimeter
- 1 x EC-PHTESTR30 pH meter
- 4 Lemons, 4 Tomatoes, 4 Potatoes, 4 Oranges, 4 Limes

### Method:

- 1) The current draw of the IC800040R was tested by connecting the multimeter in a series with a battery to ascertain what current would be required to run the thermometer.
- 2) The voltage was confirmed by checking the voltage of the battery. Both of these results were recorded for reference.
- 3) Each piece of fruit/vegetable was rolled gently against the table to loosen the juice inside.
- 4) A piece of copper wire and a galvanised nail was then inserted into each of the pieces of fruit/vegetables approximately 3cm apart, ensuring the skin was not ruptured on the opposite side.
- 5) Each of the fruit/vegetables was then connected in a series with the thermometer starting with one and then increasing it to four one by one. Voltages were checked by connecting a multimeter set to measure volts to the terminal connections on the thermometer. The results were recorded and the thermometer checked to see if it was powering on.



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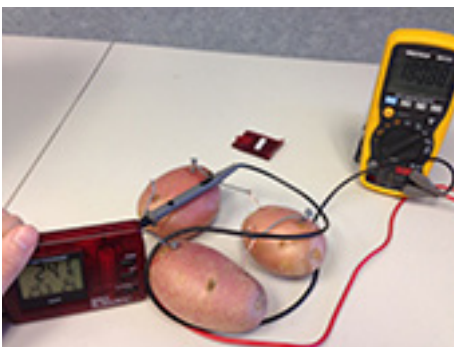
- 6) The current was then tested by connecting the multimeter set to measure milli-amps in a series with a piece of fruit/vegetable. The setup was repeated until all 4 pieces of fruit/vegetables current production was ascertained.
- 7) The pH of each fruit and vegetable was also taken for reference by cutting them in half and producing enough juice to cover the EC-PHTestr30's electrode and obtain a result.

### Results:

The IC800040R was found to require between 0.042 and 0.112mA current along with a voltage of 1.5V in order to operate when tested with the 1.5V AAA battery that it normally uses. The results for each of the voltage and current tests along with the pH tests are shown below:

Fruit/Vegetable	pH	1 pc Fruit/Vegetable			2 pcs Fruit/Vegetables		
		Voltage	mA	Thermometer	Voltage	mA	Thermometer
Lime	2.35	0.78	0.012	N	1.52	0.047	Y (Flashes on/off)
Lemon	2.25	0.8	0.012	N	1.54	0.045	Y (Flashes on/off)
Orange	4.16	0.71	0.016	N	1.41	0.045	N
Tomato	4.45	0.78	0.02	N	1.47	0.05	Y (Flashes on/off)
Potato	5.18	0.72	0.014	N	1.41	0.056	N
Fruit/Vegetable	pH	3 pcs Fruit/Vegetables			4 pcs Fruit/Vegetables		
		Voltage	mA	Thermometer	Voltage	mA	Thermometer
Lime	2.35	2.3	0.059	Y (Flashes on/off)	2.93	0.066	Y
Lemon	2.25	2.11	0.055	Y (Flashes on/off)	3	0.061	Y
Orange	4.16	2.1	0.056	Y (Flashes on/off)	2.89	0.063	Y
Tomato	4.45	2.19	0.055	Y (Flashes on/off)	2.92	0.069	Y
Potato	5.18	2.07	0.059	Y (Flashes on/off)	2.82	0.064	Y

The results definitively prove that you can power our IC800040R using only fruit and vegetables; however it is a condition that the current and voltage be at a level that is sufficient to keep the thermometer running. All five of the tested fruits and vegetables powered the thermometer when they were connected in series of four. It is interesting to note that the currents and voltages were fairly consistent across the board and that the fruits with higher pH's did not produce a significant increase in current or voltage.



*Thermometer powering on with 3 potatoes; however it would drop in and out. 4 were required to keep it running.*

### Have your say!

What else do you think we could have powered using only fruit and vegetables?

Do you think there was a way that we could have increased the current or voltage using the same number of fruits and vegetables?

Do you think using zinc and a different material would have yielded different results?

Write an email to Daniel at [daniel@instrumentchoice.com.au](mailto:daniel@instrumentchoice.com.au) or give us a call on **1300 737 871**.



This month the team at Instrument Choice have been busy adding products to our website. Some of the most interesting items are the range of AcuRite weather stations. The AcuRite stations are manufactured by the Chaney Instrument Company who were founded in the US in 1943. They are now the #1 brand in the US for weather products. We have added the IC00899 wireless, self-emptying rain gauge, which is already proving to be quite popular. It has a wireless range of 100m line of sight, and a built in clock and calendar. The easy to read display allows you to view daily totals for the last 7 days, as well as weekly totals for the last seven weeks.



We have also added the IC02001A1 which is a chic weather station that features indoor and outdoor temperature and humidity measurements as well as patented forecasting technology. Once you set this station up in your house, it analyses the weather trends for 14 days, and from then on it is able to give some of the most accurate 12-24 hour forecasting. The last item that we have added is the IC00639 Professional weather center which features the same forecasting as the IC02001A1 but is also able to measure wind speed. The display on this unit is also more detailed giving you information on the heat index, the wind speed/wind chill, and the moon phase as well as standard readings of indoor and outdoor temperature and humidity. It also features a history chart which allows you to easily see how the conditions for temperature, humidity, wind speed, wind peak, and barometric pressure have changed over the last 12 hours.

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## Thank you

from everyone at Instrument Choice - stay tuned for next months issue.



### Contact us.

Our experts are happy to help and discuss your project.

Call 1300 737 871 or write an email to [customer-service@instrumentchoice.com.au](mailto:customer-service@instrumentchoice.com.au)



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