

DISCOVERING PHOTOVOLTAIC TECHNOLOGY AND ITS USES



🕒 Inquiry 1

Discuss the meaning and origin of the scientific word “*photovoltaic*”?

Before you try to answer Inquiry 1, have a go at answering supporting questions 1A, 1B, 1C and 1D on the next page.

The websites below may help you research information on these questions.

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Renewable Electricity Generation with Photovoltaic Cells
http://schoolgen.co.nz/pdf/SE_L5-6_SF_Photovoltaic.technology.fact.sheet.pdf

A Short History of Photovoltaic Cells
http://www.schoolgen.co.nz/pdf/SE_L3-4_SF_History.Photovoltaic.cells.fact.sheet.pdf

Ancient Origins of Scientific Words
http://en.wikipedia.org/wiki/Greek_and_Latin_roots_in_English

Solar Energy Frequently Asked Questions
<http://www.schoolgen.co.nz/students/solar-energy-faqs>

Supporting Question 1A

What are the 2 “mini” words in photovoltaic? What do they mean? What is their historical origin?

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Supporting Question 1B

Explain the difference between a photovoltaic panel and the solar panel that heats water? (It might help to think about *energy transformations*)

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Supporting Question 1C

When was the “photovoltaic effect” first discovered by science? How many years did it take to develop into a useful technology?

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Supporting Question 1D

Why do you think scientists often use unfamiliar sounding words from Ancient Greece (about 500 BC) or other historical sources?

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⦿ Inquiry 2

What are some beneficial or interesting uses for photovoltaic panels?

Before you try to answer Inquiry 2, have a go at answering supporting questions 2A, 2B, 2C and 2D on the next page.

The websites below may help you research information on these questions.

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Solar Plane: <http://www.solarimpulse.com/>

Solar Boat: <http://www.planetsolar.org/>

Waka-waka Solar Light: <http://waka-waka.com/>

Make Your Own Solar Battery Charger
<http://www.reuk.co.uk/Basic-4-AA-Solar-Battery-Charger-Plans.htm>

Build It Solar – Range of PV-based projects to make yourself
<http://www.builditsolar.com/Projects/PV/pv.htm>

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Supporting Question 2A

State at least 5 places you might find photovoltaic technology used:

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Supporting Question 2B

In 2012 a boat circumnavigated the world using only solar energy. In 2015 a solar powered plane will try to circumnavigate the world. What are they trying to show about photovoltaic technology? Briefly research these vehicles.

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Supporting Question 2C

What other electrical devices, apart from photovoltaic cells, are required to use the solar energy to achieve the bold aims of these adventures?

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Supporting Question 2D

Apply solar energy in your own life: How could you personally benefit from photovoltaic technology? (Be practical and/or creative!)

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Supporting Question 3A

Which common chemical element is used to make a typical photovoltaic cell? Write its chemical *symbol*, *atomic number* and *mass number*, and draw its *atomic structure*. How many electrons are in the *valence (outer) shell*? What kind of *chemical bonds* does it make with other atoms of the same kind?

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Supporting Question 3B

What chemical reactions can be used to extract the desired element from the other atoms in sand?

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Supporting Question 3C

What chemical element is typically used to conduct electricity from the top (front contact) of the photovoltaic cell to the circuit? Do the same as for 3A.

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Supporting Question 3D

You can buy photovoltaic cells by themselves and make your own panels but you need to find a way to protect the very *brittle* photovoltaic cells. To be useful they must be protected by more *durable* materials. What do they need to be protected from? How long do they need to last for?

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◎ Inquiry 4

How much electricity can photovoltaic panels generate on my roof?

Before you try to answer Inquiry 4, have a go at answering supporting questions 4A, 4B, 4C and 4D on the next two pages.

The websites below may help you research information on these questions.

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Energy Efficiency and Conservation Authority – Solar energy map of NZ
<http://www.eeca.govt.nz/efficient-and-renewable-energy/renewable-energy/maps/solar>

Solar panels in New Zealand schools – see how much a 2kW system generates
<http://www.schoolgen.co.nz/community/schoolgen-schools>
<http://www.schoolgen.co.nz/community/compare-schools>

SolarView Calculator – Calculates how much solar energy will be received at a certain site through the year – useful for planning the installation of a PV or solar hot water system.
<http://www.niwa.co.nz/our-services/online-services/solarview>

Solar Energy Frequently Asked Questions
<http://www.schoolgen.co.nz/students/solar-energy-faqs>

Renewable Electricity Generation with Photovoltaic Cells
http://schoolgen.co.nz/pdf/SE_L5-6_SF_Photovoltaic.technology.fact.sheet.pdf

Businesses that install solar in NZ (this is just a small selection)
<http://www.seanz.org.nz/Directory>
<http://www.ecoinnovation.co.nz/default.aspx>

Supporting Question 4A

Outline the energy transformations involved in a photovoltaic cell generating electricity. Illustrate each step with a diagram or picture.

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Supporting Question 4B

How much solar energy shines on the area where you live? How much does this vary between summer and winter? (You might like to show this with a graph).

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Supporting Question 4C

A single photovoltaic panel, depending on brand/model, can generate a voltage of about 30 volts and a current of about 8 amperes in perfect sunny conditions. How much power is each panel generating? If there are 8 panels connected together (series or parallel), how much power is the whole system generating? Show your working and remember to state the unit of power.

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Supporting Question 4D

If each PV panel is 1.6 m high by 1.0 m wide, and your roof is north-facing with dimensions of 7.5 m by 5 m, how many of these panels could you fit on the roof? (Sketch out the roof area first.)

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