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SEKOLAH KLUSTER KECEMERLANGAN

PHYSICS PROJECT 2013:

CIRCUIT POWERED BY SOLAR USING MICROSCALE KIT

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ABSTRACT

Our objective is to demonstrate how solar cells and panels are connected, like batteries, to achieve certain ratings of voltage and amperage. We will develop this idea by measuring the no-load voltage and amperage of solar cells connected in series and in parallel.

Solar cells are junction diodes usually made from silicon which work by using charged particles to transfer energy from incoming light radiation to an external circuit. The silicon has different impurities introduced on each side of the junction. The front of the cell has to be transparent to allow light to pass through to the material underneath.

The top surface is coated with an anti-reflection coating so that as much light as possible is absorbed. Electrons naturally drift to one side of the junction so there is an excess of electrons on one side and a shortage of electrons on the other, giving negatively and positively charged sides. When light falls on the cell the electrons get enough energy to move, either back across the junction or more usefully around an external circuit.

To get the maximum power from the cells it is important that the external load is matched to the internal resistance of the cell. However maximum power does not always mean maximum efficiency. The cells used by DUSC are 16% efficient.

Solar cells, also called photovoltaic or PV cells, change sunlight directly to electricity. When sunlight strikes the solar cell, electrons are knocked loose. They move toward the treated front surface. An electron imbalance is created between the front and back. When the two surfaces are joined by a connector, like a wire, a current of electricity travels between the negative and positive sides. Solar cells are used to power calculators and watches as well as lights, refrigerators, and even cars.

In 35 states, solar energy can be fed back to the utilities to eliminate the need for a storage system as well as eliminating or dramatically reducing your electric bills.Solar energy systems are now designed for particular needs. For instance, you can convert your outdoor lighting to solar. The solar cells are directly on the lights and can’t be seen by anyone. At the same time, you eliminate all costs associated with running your outdoor lighting.

1.0 : INTRODUCTION

As early as 7th Century B.C. humans were harnessing the sun for solar energy. The Greeks and Romans were the first to use concentrated solar rays to ignite fires, illuminate their buildings, and even as military weapons. As early as the 1st Century, humans were taking advantage of solar energy by building homes with south-facing windows to provide heat. In 1767, Horace de Saussure created the world's first solar collector to cook food and became the first individual to create a device that actively took advantage of the sun's rays.

In the 19th Century progress was made towards the mechanical conversion of light into energy, with the discovery of the photovoltaic effect. Also discovered during this time period was the photoconductive nature of selenium, that when exposed to light, generates an electric current. This principle is the foundation of today's solar panel technology. In 1891, the first solar water heater was invented, which is an early predecessor to today's solar thermal technology. In 1954, Bell Laboratories patented the first solar photovoltaic technology capable of creating enough electricity to power electronic devices. It was only 4-11% efficient. The 1970s witnessed a significant reduction in the price of solar cells, with the cost falling from around $100 per watt to around $20 per watt.

Along with a significant price reduction, the 1970s witnessed the introduction of solar technology into housing and space technology in the United States. In addition, research and development continued with the creation of the Solar Energy Research Institute, which is a branch of the Department of Energy specializing in solar energy. In 1982, Solar One came online near Barstow, California. The power plant was capable of generating 10 megawatts of electricity through the use of solar-thermal, proving that solar power is a capable and viable source of large-scale electrical power generation.

Photovoltaic (PV) technology also continued to increase in power and efficiency during this time period. Pacific Gas and Electric introduced a 500-kilowatt PV system in 1993, which showed that PV could be effectively tied into the national electric grid to provide energy. From this expensive large-scale implementation in 1993, PV technology costs decreased so much that in 2001 Home Depot began selling solar power systems in some of their California stores. Over the past 10 years there has been drastic growth in both the PV and solar-thermal manufacturing industries.

2.0 : OBJECTIVE

The objectives of our project is :

2.1 To describe how energy is transferred and converted from sunlight in order to power a device.

2.2 To define the organic solar cell.

2.3 To list the benefits and drawbacks of organic solar cells.

2.4 To define renewable energy.

2.5 To save the environment.

3.0 : BENEFITS OF SOLAR ENERGY

3.1 The power source of the sun is absolutely free.
3.2 The production of solar energy produces no pollution.
3.3 The technological advancements in solar energy systems have made them extremely cost effective.
3.4 Most systems do not require any maintenance during their lifespan, which means you never have to put money into them.
3.5 Most systems have a life span of 30 to 40 years.
3.6 Most systems carry a full warranty for 20 to 30 years or more.
3.7 Unlike traditional monstrous panel systems, many modern systems are sleeker such as Uni-Solar rolls that lay directly on the roof like regular roofing materials.
3.8 In 35 states, solar energy can be fed back to the utilities to eliminate the need for a storage system as well as eliminating or dramatically reducing your electric bills.
3.9 Solar energy systems are now designed for particular needs. For instance, you can convert your outdoor lighting to solar. The solar cells are directly on the lights and can't be seen by anyone. At the same time, you eliminate all costs associated with running your outdoor lighting.

4.0 : CONTENT

4.1 Aim :

To study the brightness of the bulbs arranged in series circuit between the bulbs arranged in parallel circuit.

4.2 Problem statement :

How can we optimise the energy we get from sun using solar circuit ?

4.3 Apparatus and materials :

Bulb , bulb holder , resistor , spring , 8mm copper strip , 5.50 V solar panel , combo plate , connecting wire.

4.4 Procedure :

4.4.1 Series circuit

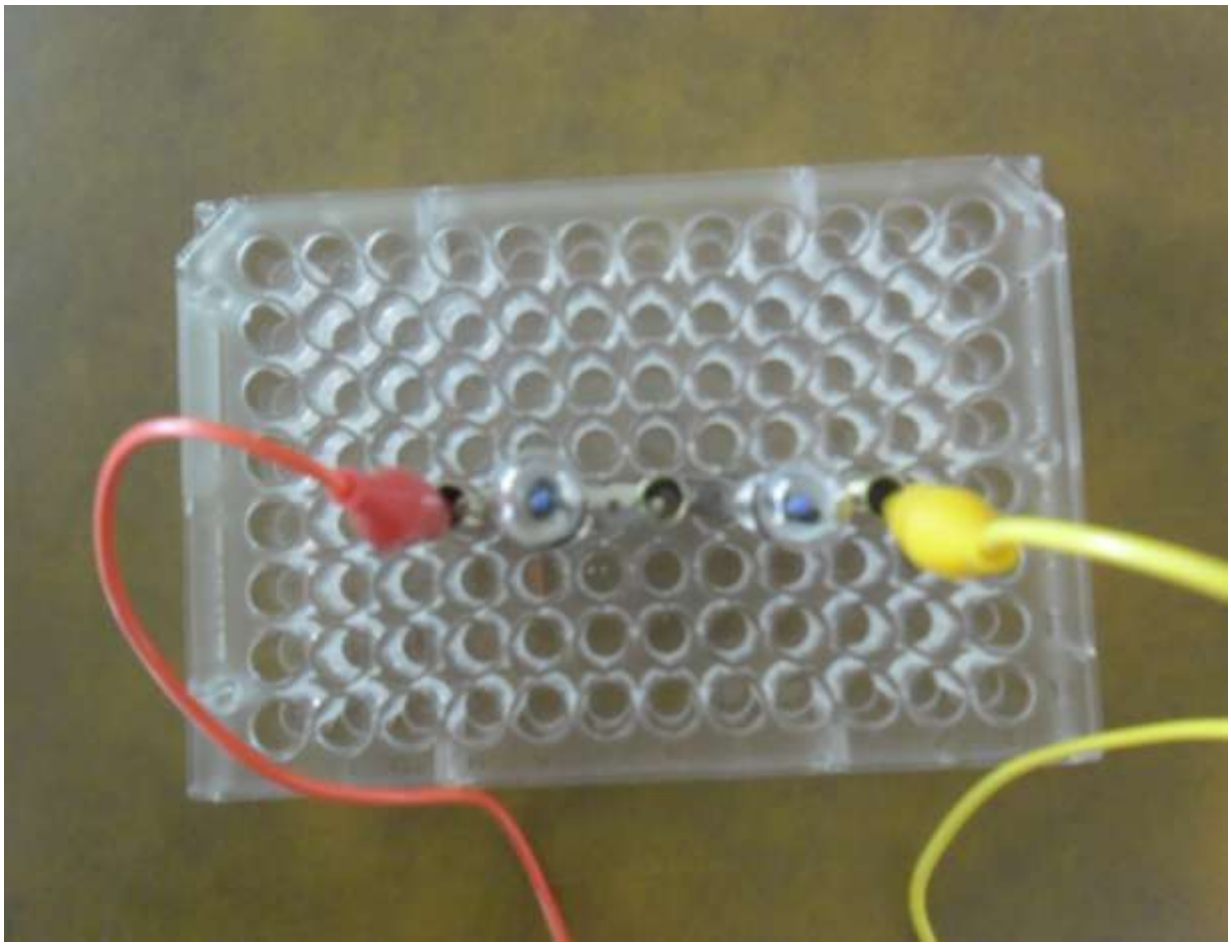
1. Three springs are placed in the hole of the combo plate.
2. Two bulb holders are attached between the springs.
3. Then, the bulb is placed inside the bulb holder.
4. Two connecting wires are connected at the end of the spring and the other end of the wire are connected to the solar panel.
5. One of the wire is connected to the positive terminal and the other wire is connected to the negative terminal.
6. Next, the circuit is placed under direct sunlight.
7. The observation is observed and recorded.

4.4.2 Parallel circuit

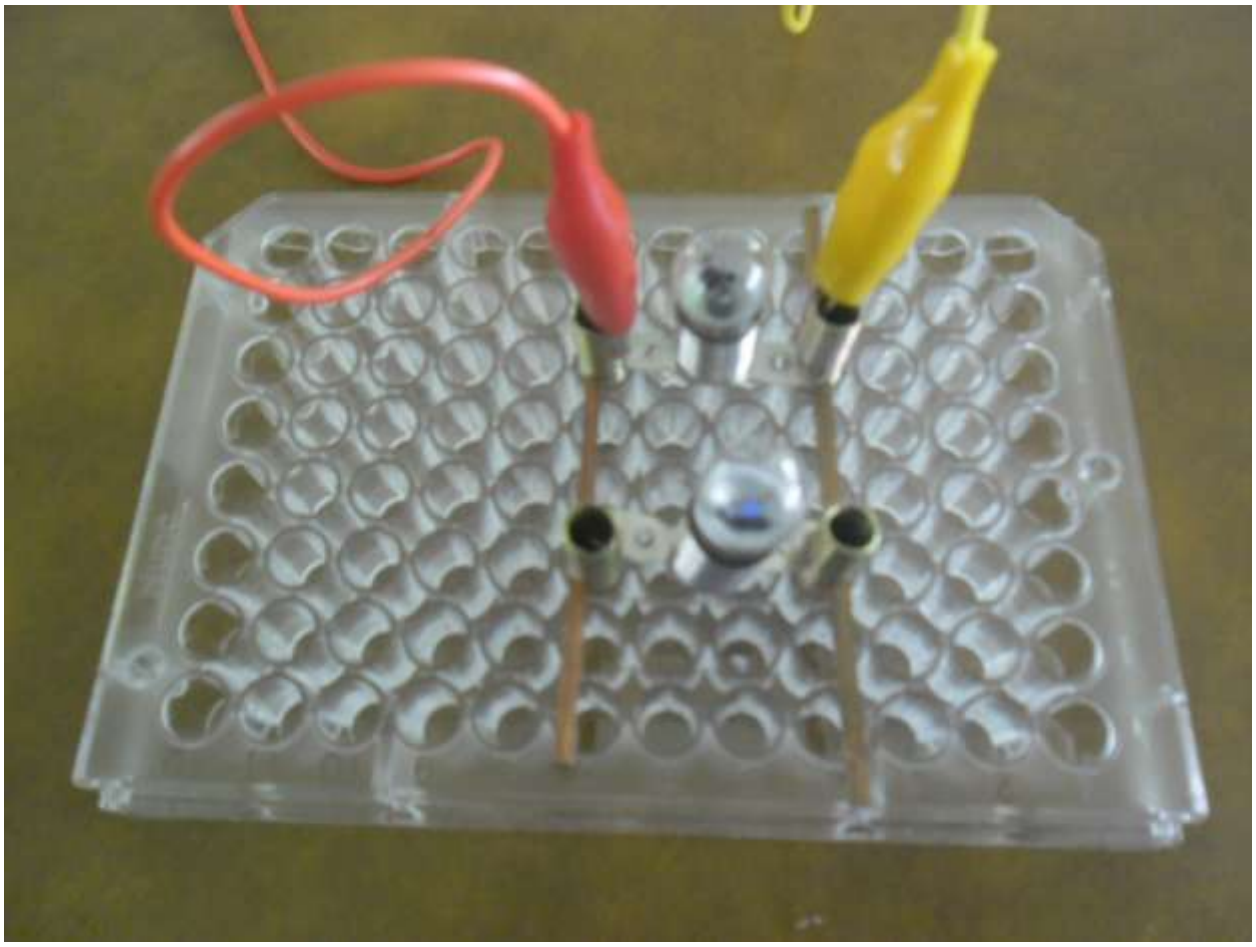
1. Four springs are placed in the hole of the combo plate.
2. Two bulb holders are placed between two springs.
3. Then , the bulb are placed into the bulb holder.
4. Two copper strip are used to connect each bulb at the spring.
5. Two connecting wires are connected at the end of the spring and the other end of the wire are connected to the solar panel.
6. One of the wire is connected to the positive terminal and the other wire is connected to the negative terminal.
7. Next, the circuit is placed under direct sunlight.
8. The observation is observed and recorded.

4.5 Set up apparatus :

4.5.1 Series circuit :



4.5.2 Parallel circuit :



4.6 Observation :

The bulbs arranged in parallel glows brighter than the bulbs arranged in series.

4.7 Analysing data :

Type of circuit	Brightness of bulb
Series circuit	Dimmer
Parallel circuit	Brighter

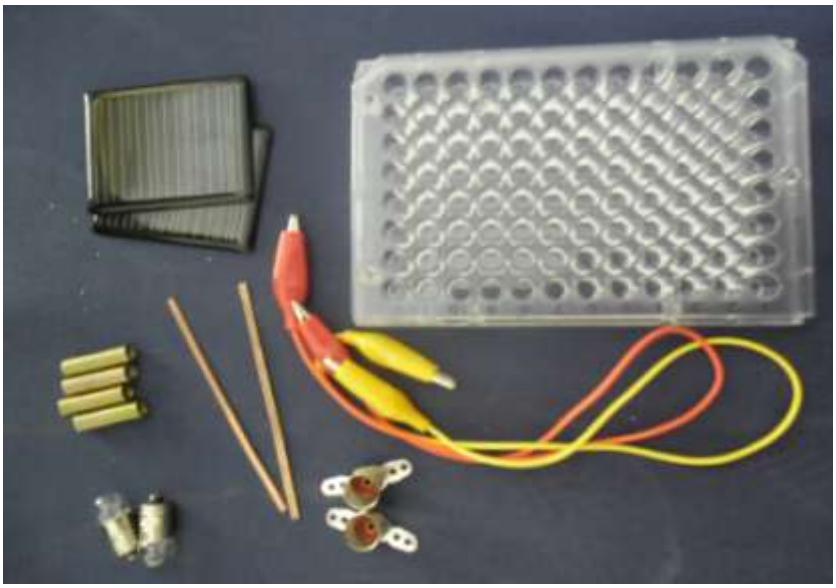
5.0 : FINDING AND DISCUSSIONS

5.1 The bulbs that are arranged in series had to share the current from the solar panel.
5.2 However, the bulbs that are arranged in parallel consume the same amount of current from the solar panel.

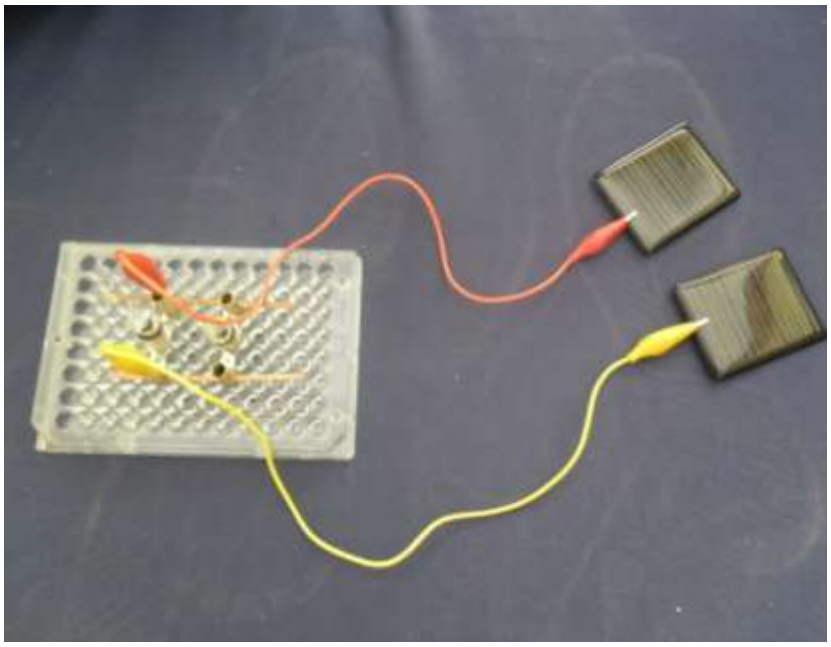
6.0 : CONCLUSION

The bulbs that are arranged in parallel glows brighter than the bulbs arranged in series.

7.0 : APPENDIX



The apparatus used in the experiment.



The apparatus is set up.

The circuit is placed under direct sunlight.

8.0 : REFERENCES

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