

## To investigate the effect of electrical power on Grätzel solar cells using different organic dyes

### Introduction


Electricity is an electrical current. An electrical current is created when an *electric charge* flows along a wire. This electric charge is made up of electrons.

There are three components that make up an electrical circuit. These are current, voltage and resistance.

### What is Current?

- ✓ Current is the flow of electric charge (electrons).
- ✓ Current is measured in amperes.
- ✓ The units of current is A


An ammeter is used to measure the current in a circuit.

 This is the circuit symbol for an ammeter

### What is Voltage?

- ✓ Voltage is the energy required to push a current through a circuit
- ✓ Voltage is measured in volts
- ✓ The units of voltage is V

A voltmeter is used to measure the voltage in a circuit.

 This is the circuit symbol for a voltmeter

### What is Resistance?

- ✓ Resistance opposes the flow of current
- ✓ Resistance is measured in ohms
- ✓ The units of resistance is  $\Omega$

All three components can be related to equation below

**Voltage = Current x Resistance**

$$V = I \times R$$

From knowing the current and voltage, the electrical power can be calculated using the below equation

**Power = Voltage x Current**

$$P = V \times I$$

In this experiment you will measure the voltage and current of various Grätzel solar cells prepared from different dyes. You will then calculate the electrical power that is produced by each of the Grätzel solar cells.

**Keywords:** Power ( $P=IV$ ), Series Circuit, Resistance, Current, Voltage,

**Circuit Symbols:**

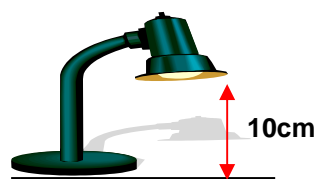


**Materials:** Grätzel solar cells, ammeter, voltmeter, resistor, crocodile clips, ruler, light source (desk lamp)

**Experimental:**

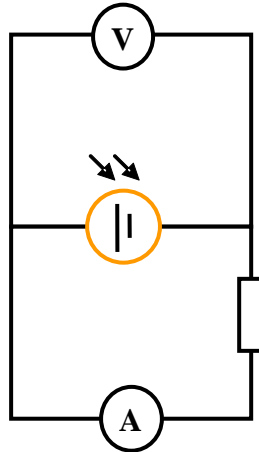
### 1. Setting up the light source (desk lamp)

- Point the head of the desk lamp onto the bench.
- Using a ruler, measure the distance between the head and the bench top.
- Adjust the head so that there is a 10cm gap.



## 2. Making current and voltage measurements

- a. Connect one Grätzel solar cell in series with a ammeter and resistor. Connect the voltmeter parallel to the circuit.



- b. Place the Grätzel solar cell directly under the light source.  
 c. Measure the voltage and current output and note down the measurements in the table below.  
 d. Repeat until you have tested all the Grätzel solar cells

### Results

1. Table of results

No Of Solar Cells	Voltage / volts V	Current / amps $\mu\text{A}$	Power / watts $\mu\text{W}$
1			
2			
3			
4			

2. Using the voltage and current measurements in the table above, calculate the power produced. The equation is below,

$$\text{Power} = \text{Voltage} \times \text{Current}$$

3. Which dye has produced the highest electrical current

4. What is Voltage, Current and Resistance ?

Voltage: .....

Units:.....

Current: .....

Units.....

Resistance.....

Units.....

Ohms law relates voltage, current and resistance, as shown in equation [ 1 ].

$$\text{Voltage} = \text{Current} \times \text{Resistance} \quad [ 1 ]$$

$$V = I \times R$$

The equation can also be written as  $I = V / R$  or  $R = V / I$

1a. Plot a graph of Voltage vs. Current

2. Using the current-voltage graph find the current values for when  $V = 0.2$ ,  $V = 0.4$  and  $V = 0.6$

Voltage/ V	Current / $\mu\text{A}$	Resistance / $\Omega$
<b>0.2</b>		
<b>0.4</b>		
<b>0.6</b>		

3. Using the voltage and current values in the table above, calculate the resistance using equation  $V = IR$ .

$$\text{Voltage} = \text{Current} \times \text{Resistance}$$

(volts)      (amps)      (ohms)

The equation can also be written as  $I = V / R$  or  $R = V / I$

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.....Answer.....Units.....