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Science

May 25, 2012

Electricity

**Objective:** How does batteries and light bulbs’ circuits (Series and Parallel) affect the energy that the light bulb consumes? Which consumes the most energy?

**Hypothesis**

The series position will be dimmer than the parallel because series divide the energy (V) into the number of lamp but, in the parallel the energy (V) doesn’t divide into the number of lamps. For example, there are 2 light bulb in series position. The electric energy is 1V. So, each lamp will consume around 0,5 V. So in conclusion parallel consumes the most energy.

**Variables**

Independent

* Lamp position (Series, parallel, and combination)
* Batteries position (Series, parallel, and combination)

Dependent

* Voltage
* Current
* The light bulb’s brightness

Control

* The battery voltage
* Light bulb
* Resistance
* Power cable

**Method**

1. Install the light bulb into the light bulb fitting
2. Cut the wire into the same length (approx. 10cm long)
3. Then, cut away the cable protector and prevent the cable inside get cut. (approx. 3cm)
4. Twist the cable slowly so that it will become one.
5. Repeat step 3 and 4 for 10x
6. Then, connect the cable into the hole in the light bulb hole’s fitting.
7. Compare which one is brighter (Parallel or series).
8. Calculate using multimeter to measure the voltage and the current by connecting the connector to the circuit’s cable.
9. Input the data and compare.

**Materials**

1. 3 Batteries type D
2. 200cm of power cable
3. 4 light bulbs of 1.5v (for torch)
4. 4 fittings (for 1.5v light bulb)
5. 1 Multimeter
6. Ampere meter
7. Volt meter

**Safety**

We are working with low voltage electricity, so its really not that dangerous.We don’t need to wear rubber gloves or anything like that.

**Cooperative**

We work together during the experiment, because we didn’t have enough proper equipment. One person was needed to hold the battery, and the other holding the end of the cable to the pole of the battery, and the other one holding the the end of the cable into the fittings.

**Data (Collecting)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| No | Battery circuit type | Voltage produced (V) | Current produced (A) | Light bulb circuit type | Brightness\*\* | Current on circuit (A) | Voltage on each light bulb (V) |
| 1 | Series | 4.5V | 9A | Series | D | 0.5 A | 0.5625 v |
|  |  | 4.5V | 9A | Parallel | B | 0.5 A | 1.125 v |
|  |  | 4.5V | 9A | Combination\* | S=dimP=bright | S= 0.5AP=0.5 A | S=0.5625VP=1.125V |
|  |  |  |  |  |  |  |  |
| 2 | Parallel |  4.5V | 9A | Series | D | 0.5 A | 0.5625 v |
|  |  | 4.5V | 9A | Parallel | B | 0.5 A | 1.125v |
|  |  | 4.5V | 9A | Combination\* | S=dimP=bright | S= 0.5AP=0.5 A | S=0.5625VP=1.125V |
|  |  |  |  |  |  |  |  |
| 3 | Combination | 4.5V | 9A | Series | D | 0.5 A | 0.5625 v |
|  |  | 4.5V | 9A | Parallel | B | 0.5 A | 1.125 v |
|  |  | 4.5V | 9A | Combination\* | S=dimP=bright | S= 0.5AP=0.5 A | S=0.5625VP=1.125V |

\**\*B=Bright and D=Dim; S= Series, P=Parallel*

*Resistance in our circuit: 7 Ω*

To know the power of the lightbulb which affects the brightness of the lamp, we need to know this formula.

*P = V . I*

Power of the lamp in the series

*P= 0.5625 V x 0.5 A*

*P= 0.28125 W*

Power of the lamp in parallel

*P= 1.125 V x 0.5 A*

*P= 0.5625*

|  |  |
| --- | --- |
| *Power of each lightbulb in series* | *Power of each lightbulb in parallel* |
| *0.28125 W* | *0.5625 W* |

**Presentation**

X axis = Circuit

Y axis = Watt

Legend = Power

|  |  |
| --- | --- |
| *Circuit type (lamp)* | Condition of the lamp |
| *Series* | *D* |
| *Parallel* | *B* |
| *Combination* | *Series: D**Parallel: B* |

Series

* Current is not diverted and is the same in each component. Electromotive force is shared between the component.

Parallel

* Has at least 2 possible branches, the current can be different in each branch but it adds up to the current that is drawn from the cell. The voltage drop across each branch is the same as the EMF of the cell.

EMF

* Electrical pressure difference; often is a cell the amount of ‘electrical pressure difference’ that it can provide is teh electromotive force (EMF) of teh cell.
* The vold is the unit of EMF. A cell will have it’s EMF written on teh cassing
* A voltmeter connected across a lamp will measure the votage drop across teh lamp. This is the ‘electrical pressure difference’ required to maintain the current through the lamp. Voltage drop is also measure in volts

Resistance:

* If there is no resistance, then the light would be lighter.
* The EMF provided by a cell drives the current through the components in the circuit. The amount of current depends on teh total resistance of a circuit. The lower the resistance, the greater the current that can be maintained by a given EMF
* Resistance of a conductor is the ratio between the voltage drop across it and the current through it

|  |  |  |
| --- | --- | --- |
| Circuit | Current | Voltage |
| Series | Same | Splits |
| Parallel | Splits | Same |

**Explanation**

The data before are the datas that I got from doing the experiment. From the data, the initial voltage are always the same even though the circuit types are different, using parallel circuits or series circuits. This thing happens because the circuit type doesn’t affect the value of power to produce voltage.From the data, the voltage needed for the light bulbs in each circuit is different. For series, voltage that the circuit received is broken down according to the number of light bulb present in the circuit. For example if the initial voltage of the series circuit is 20 V, and there are 2 light bulbs, each light bulb would receive the same amount of voltage from the initial voltage so each light bulb would receive 10 V each. For the parallel, it is not the same. The initial voltage of the circuit will always be the same with the voltage that the light bulbs received. By knowing the voltage and the current, we calculate the power that is needed by the light bulbs to shine. According to our calculation each light bulbs produce more power than the light bulbs on the series circuit. From this data we can conclude that the light bulbs using parallel circuit will be brighter than the ones on the series circuit.

**Evaluation**

The data that we received are right because we checked it using two methods. The first way is using simple formula of energy and also using the volt and ampere meter. And we got the same result for both ways. We have also checked it more than one time so that we could know that we didn’t make any mistake on calculating and inputting the data.

**Conclusion**

So, in conclusion the 2 different circuits affect the energy that is needed for the light bulbs. If we are using series circuit, than the initial voltage will be split up into each light bulb. If we are using parallel circuit, than the initial voltage will be the same with the voltage each light bulbs received. According to our data and experiment, the one that consumes the most energy is the parallel circuit. The light bulbs using parallel circuit are brighter than the one using series circuit. The brighter they are, the more energy they need. Therefore the light bulbs on the parallel circuit will obviously need more energy than the series circuit. From this, I can say that my hypothesis is correct.

So in conclusion:

Batteries position (series and parallel) doesn’t affect the energy that the light bulbs consumes

Different kind of circuit (series and parallel) affect the energy that the light bulbs consumes

Parallel circuit consumes more energy than series circuit

**Evaluation**

The thing that I should change for next experiment is the voltmeter. The voltmeter that we used during the experiment was the digital one. If we are using the needle one than we can get the result faster because it calculates faster, so it takes more time to do the experiment.

**Extension**

How do different cables affect the current and voltage of electricity?

How do room temperature affects the current of electricity?