Resistor Tree Experiment 分压电路实验概述

Initial Observations 初步观察:

In the **“Basic Resistor”** experiment three simple circuits were created and tested. Each of these circuits used a 1K (1,000Ω) resistor, but other values could have been used. These circuits included a control circuit, a parallel circuit, and a series circuit. However, none of these circuits included a power supply so there was no electricity flowing through each of the test circuits; therefore the only variable that could have been tested for was resistance which is measured in Ohms (Ω).

在“基本电阻器”实验中，创建并测试了三个简单电路。每个电路都使用1K（1000Ω) 电阻，但也可以使用其他值。这些电路包括一个控制电路、一个并联电路和一个串联电路，可是，这些电路都不包括电源，因此没有电流经过每个测试电路；因此，可以测试的唯一变量是电阻，即欧姆测量(Ω).

The control circuit, which had a single 1K resistor produced 1.0K Ω of resistance as expected; however, the other two circuits had very different results. The parallel circuit had a resistance value of 0.5K Ω, whereas the series circuit produced 2.0K Ω of resistance. Even though each circuit produced different results, there was a very distinct relationship that could be observed in each scenario.

控制电路有一个1K电阻能产生1.0KΩ 的阻力；然而，其他两个电路的结果却截然不同。并联电路的电阻值为0.5KΩ, 而串联电路产生2.0KΩ 的电阻。尽管每个电路产生不同的结果，但在每个场景中都可以观察到非常明显的关系。

> ***For Example:*** *the resistance was cut in half when two resistors of equal value were used in parallel to one another, whereas the resistance doubled when two resistors of equal value were used in series.*
>
> 例如：当两个相同值的电阻器并联使用时，电阻被切成两半，而当两个相同值的电阻器串联使用时，电阻加倍。

In other words, in the **“Basic Resistor”** experiment, we could have concluded that the resistance is divided by a factor of 2 when two resistors are used in parallel and multiplied by a factor of two when they are used in series. This mathematical relationship works in the given scenario and could also be applied to other combinations where both resistors have the same value. However, would this mathematical relationship work for every possible resistor combination? Or is the relationship more complex than what has been stated here?

也就是说，在“基本电阻器”实验中，我们可以得出这样的结论：当两个电阻器并联使用时，电阻除以因数2，当它们串联使用时，电阻乘以因数2。该数学关系适用于给定场景，也可应用于两个电阻器具有相同值的其他组合。然而，这种数学关系是否适用于所有可能的电阻器组合？或者这种关系比这里所说的更复杂?

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From this one observation we may be able to ask several new questions:
通过这一观察，我们可以提出几个新问题：

1. *What would happen if we had 3 or more resistors in each circuit?*
   如果每个电路中有3个或更多电阻器，会发生什么?
2. *What would happen if the value of the resistors was changed?*
   如果电阻器的值发生变化，会发生什么情况?
3. *What would happen if two resistors of different values were used?*
   如果使用两个不同值的电阻器，会发生什么情况?
4. *And what affect would resistance have on the flow of electricity if this circuit was expanded upon to include a source of power?*
   如果电路有电源通过的话，电阻会对电流产生什么影响?

As you can see, developing and testing a hypothesis will generally leave you with just as many questions, or sometimes even more questions, than what you originally had; however, the questions you now have are more complex in nature, and so the cycle of experimentation continues. As stated before, everything starts with an initial observation, which leads to a simple question that can be tested, but the results of these experiments generally lead to new observations which establishes a framework for even more complex questions being developed, tested and subsequently elaborated on.

正如你所看到的，提出和验证一个假设通常会引发很多甚至比原来更多的问题；那是因为你现在所面临的问题本身就很复杂，因此实验还得继续。如前所述，一切都从最初的观察开始，引出一个可以测试的简单问题，通过实验得出新的观察结果，从而为更为复杂的问题建立一个测试框架。

Assignment Details 任务明细:

You will be required to build the **“Resistor Tree”** experiment circuit board in class. Then for homework you will need to complete the first half of your lab report using the **“Scientific Method”** and proper report formatting conventions.

在课上搭建“分压电路”实验电路板，然后使用“科学方法”和适当的报告格式完成实验报告的前半部分作为家庭作业。

Introduction to the Resistor Tree Experiment 简介:

Although the **“Basic Resistor”** experiment has provided us with a better understanding of how resistors work within a circuit, there are still many unanswered questions left to be tested. Therefore, the **“Resistor Tree”** experiment is aimed at answering some of these new questions.

尽管“基本电阻器”实验使我们更好地了解了电阻器在电路中的工作原理，但仍有许多未回答的问题有待测试。因此，“分压电路”实验旨在回答其中一些新问题。

Resistor Tree Experiment 分压电路实验概述

NOTE 1: *It is important to determine what can, and should be, tested in an experiment. For example, if the experiment design is to broad the test results will not be valid. This is because we will not be able to identify which variables caused the other variable to change. Therefore, it is very important to determine what the focus of the experiment will be before designing and testing it.*

注*1*：实验中测试可能性喝必须性是很重要的。例如，如果实验设计过于宽泛，测试结果将无效。这是因为我们无法确定是哪些变量导致了另一个变量的更改。因此，在设计和测试之前，确定实验的重点是什么是非常重要的。

NOTE 2: *The maximum number of variables any experiment can have is two. These are known as* ***"Dependent"*** *and* ***"Independent"*** *variables.*

注*2*：任何实验最多可以有两个变量。这些变量称为*"*因变量*"*和*"*自变量*"*。

Question: How many variables were there in the **"Basic Resistor"** experiment? What was it an independent or a dependent variable?

问题："基本电阻器"实验中有多少变量？什么是自变量还是因变量?

Experiment Design 实验设计:

This experiment will focus on determining how resistance will increase when 2 or more resistors are used in series, and how the change in resistance will affect the electricity (measured in Volts) flowing through the circuit.

本实验将着重于确定当两个或更多电阻器串联使用时，电阻如何增加，以及电阻的变化如何影响流经电路的电流（以伏特为单位）。

Question: How many variables do we have in this experiment? What are their names? Which variables are the independent and dependant variables? What justification can you provide to support your answer?

问题：在这个实验中我们有多少变量？分别是什么？哪些变量是自变量和因变量？你能提供什么理由来支持你的答案?

In-order to conduct this experiment a simple series circuit has been created. The circuit is a closed loop circuit with 6 wire taps. The main purpose of these "wire taps" is to allow easy measurements to be taken and recorded at each point of the circuit. In this circuit electricity will flow out of the battery through all five resistors and back to the battery again. Measurements for resistance and voltage will be taken at each wire tap.

Resistor Tree Experiment 分压电路实验概述

为了进行这个实验，我们制作了一个简单的串联电路，带有6个测量点的闭环电路。这些“测量点”的主要目的是便于在电路的每个点进行测量和记录。在该电路中，电流将通过所有五个电阻器从蓄电池中流出，然后再次流回蓄电池。将在每个测量点测量电阻和电压。

> ***NOTE:*** *In this experiment a 9V battery and 1K resistors will be used, but other values could have been used instead.*
>
> 注：在本实验中将使用*9V*电池和*1K*电阻，但也可以使用其他值。

Developing your Hypothesis提出假设:

Based on the knowledge that you have gained from the **“Basic Resistor”** experiment, what do you predict will happen in the “**Resistor Tree**” experiment?

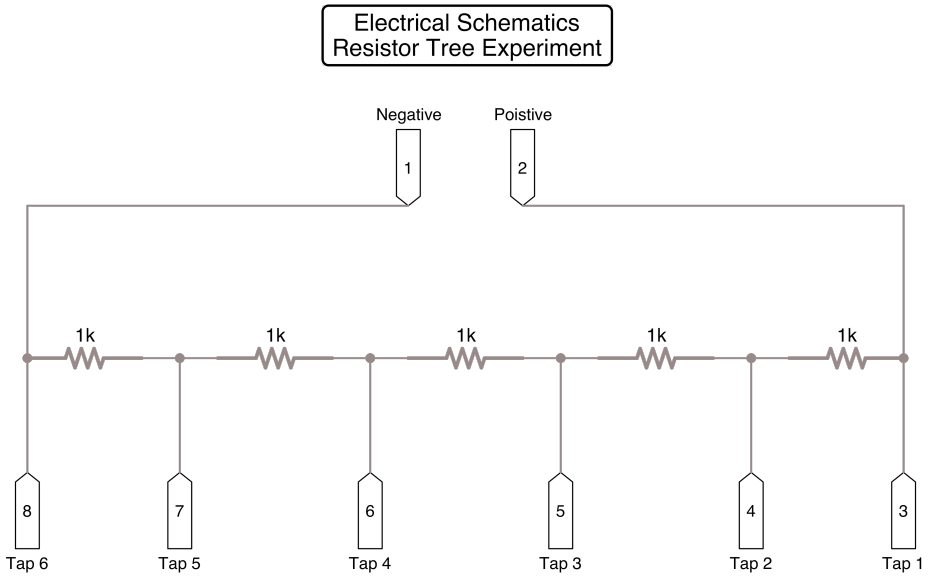
根据从“基本电阻器”实验中获得的知识，预测“分压电路”实验中会发生什么?

More specifically, what do you predict the resistance value will be at each wire tap? Do you think voltage will be affected by the changes in resistance? If so, how do you think the voltage will be affected by the stated changes in resistance? Do you think there may be any mathematical correlation between these two values? If so, what might the correlation between these two variables be?

更具体地说，你预测每个测量点的电阻值是多少？你认为电压会受到电阻变化的影响吗？如果是，你认为电阻的变化会对电压产生怎样的影响？你认为这两个值之间有数学上的关联吗？如果是这样，这两个变量之间的相关性可能是什么?

Resistor Tree Experiment 分压电路实验概述

Electrical Schematics:



Experiment Design 实验设计:

The experiment uses a simple closed loop circuit design with 6 wire taps being included which allows for easy measurements of the test variables to be taken.
这是一个简单的带有6个测量点的闭环电路，便于测试变量。

For example measuring resistance from **“Tap 1**” to **“Tap 2”** will provide a measurement for a single resistor. Whereas, measuring from **“Tap 1”** to **“Tap 3”** will provide a measurement for two resistors in series, and measuring from **“Tap 1”** to **“Tap 6”** will provide a measurement for all five resistors.

例如：测量从“1”到“2”的电阻会提供单个电阻器的测量值。然而，从“1”到“3”的测量将提供两个串联电阻器的测量值，从“1”到“6”的测量将提供五个电阻器的测量值。

Likewise, measuring in the opposite direction will allow us to see what the voltage is at each stage of the circuit. For example, measuring volts from **“Tap 6”** and **“Tap 5”** will show what the voltage is at that point (i.e. at Tap 5) in the circuit, and measuring volts from **“Tap 6”** to **“Tap 4”** will show what the voltage is at that point (i.e. at Tap 4).

同样，从相反方向测量会得到电路每个阶段的电压，如，测量“6”和“5”之间的电压将显示电路中该点（即分接头5）处的电压，测量“6”到“4”之间的电压将显示该点（即分接头4）处的电压。