Introduction:

When we discuss resistance (or resistors) we need to also consider Conductive properties as well, measured in Mhos.

I dare say that most of us avoid thinking this way, but perhaps sometimes it can be quite relevant.

In many areas of electronics we need to deal with "reciprical values:
Frequency vs Time, and Resistance vs Conductance, to name a couple.

And while we are at it, we need to remember that **"illities"** and **"ivities"** are **properties**.
Conductivity vs Conductance
Resistivity vs Resistance
Reluctivity vs Reluctance

In tubes and FETs we often measure something called "**Transconductance**", which is where voltage controls the conductance of the device.

When FETs first came out, they were nicknamed "Space-Transistors" or simply "Spacistors" because they behaved more like vacumn tubes, as voltage controlled devices, rather than current controlled devices.

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Now the imfamous "Ladder Circuit":

This Series-Parallel-Combination-Circuit in **Illustration #3** has been my favorite for many years, because of how many ways you can present a quiz or test to anyone. Everything from basic Series-Parallel resistance calculations, voltage and current divisions, IR drops, and finally a lot of "deductive reasoning" challenges, especially when not showing a ground reference.

Illustration #4 shows how the Series-Parallel computations are performed down to the Total, and then using common voltage and common currents are used to perform expansions back out to RL.

Illustration #5 shows more detail of the computations involved used in Illustration #4. Please note the simple schematic at the top of the page. Wouldn't it be great if that could represent the complexity of all the values in the ladder circuit, as an "equivelant" to simplify changes in the load? The answer is 'yes', and it's call the **"Thevinins Equivelant Circuit Analysis"** method.

Moving on to **Illustration #5a**, is how this is acomplished:
First, remove the load RL to create an open circuit. Note that with no current flowing through R3 or R8, there are no voltage drops, and so we drop them out of our calculations as we compute everything toward the source, and then back out to the open circuit, where we determine to be **1.407V** accross the open circuit.

This is called **"EOC"**, as in **"Voltage of the Open Circuit Variety".**

Second, in **Illustration #5b**, replace the source with it's internal resistance, and compute what an Ohmmeter would measure as a substitute for RL. This should calculate to be **15.343K Ohms,** called **"R-Thev".** This value represents the "Equivalent Resistive Value" for the entire Ladder Circuit, minus the Load.

Thirdly, we can now compose the "EOC" as a new source voltage, and have the "R-Thev" as a simple Series Circuit to drive the Load RL.

Illustration #5c shows that by presenting the load RL (of any value) we can easily calculate the resulting current and IR drop accross RL. We also can now easily see that there is a set of "Min-Max" value limitations of both currents and voltages, similar to what we use as "Projected Load Lines" for either vacumn tube or transistor circuit designs.

Illustration #5d allows us to see a couple of remarkable equivalent circuit considerations:

First, it turns out that in Illustration #5c, we calulate that a short circuit current would be **91.7microamps**, which we call **"ISC".**

Secondly, there is a method of using that ISC as a Current-Source, rather than a Voltage Source, and then placing the *equivalent resistive value* in parallel with the load, for current division instead of voltage division. Although this equivalent resistance was called R-Thev, here it would be called **"R-Nort"**, even though it is actually the same equivalent circuit.

This version is called a **"Norton's Equivalent Circuit Analysis"**, and especially note that the two are *directly interchangeable*.

WA7RSO – 12/09/2020