Title: **Internal Resistance** Worksheet: 17

Course: Electrical Applications Unit: Electrical Theory CLO: 3

Name ANSWER KEY Grade 28pts Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Objectives**

1. Student shall calculate the internal resistance of a power source.
2. Student shall determine if a power source is efficient through calculation.

**Assessment**

Students shall demonstrate a comprehension of the objectives listed above by scoring a minimum of 75% on this Worksheet. Grading shall be based on an answer key.

**Theory**

Every power source has some sort of internal resistance that must be overcome before any power can be delivered to the power sources load. A new battery will have low internal resistance and therefore be able to supply an effective amount of power. Over time, the internal resistance will increase with usage as the batteries chemical process degrades. The internal resistance affects the amount of current the battery can output and hence the power supplied will be lower. Under very small loads, the internal resistance is difficult to detect. That is why measuring a 9V battery that has a higher internal resistance with a 10MΩ multimeter will still indicate the battery’s potential is 9V. If that same battery had a load during voltage measurement, the battery’s potentials would be much less. Below is a formula to calculate a sources efficiency based on internal resistance.

|  |  |
| --- | --- |
|  |  |

If a 12V car battery measures 11V under a 2.2A load, the internal resistance and source efficiency can be calculated as follows.

If the same 12V car battery measures 9V under a 2.2A load, the internal resistance and source efficiency can be calculated as follows.

Any source whose efficiency is 95% or higher is considered a highly efficient power source.



**Instructions**

Using for formulas on the previous page and the given values below, complete the following table.

Where;

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | P | I | R | E |
| RINT | 2.085W | 1.481A | 950mΩ | 1.407V |
| RL | 12.73W | 1.481A | 5.8Ω | 8.593V |
| Total | 14.815W | 1.481A | 6.75Ω | 10V |

Calculate the percent efficiency of the above circuit. 85.93%

Using for formulas on the previous page and the given values below, complete the following table.

Where;

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | P | I | R | E |
| RINT | 12.015W | 2.83mA | 1.5Ω | 4.245V |
| RL | 30.439W | 2.83mA | 3.8Ω | 10.755V |
| Total | 42.452W | 2.83mA | 5.3Ω | 15V |

Calculate the percent efficiency of the above circuit. 71.698%

1. If a 24V battery measures 23.99V under no load, this is an indication that the battery has a very low internal resistance.
   1. True
   2. False
   3. Don’t know
2. If a 12V battery that is producing 5.2A measures 11.75V at the load, this battery is considered highly efficient.
   1. True
   2. False
   3. Don’t know