Diploma of Audio Production Name_____

Analogue Fundamentals

Module 3

The Power Law: Watts etc

I think we have all heard of Amplifier power rated in so many Watts as being the "Power" output of the Amplifier but where does the figure come from? Well if a source of EMF is able to drive an Electric current through a Circuit which offers resistance to this flow, it is said that work is being done and therefore heat is being generated. Remember our experiment from last week where the lamps felt hot when they were on. Now the heat produced can be expressed in Watts and the amount of "Watts" is the product of the amount of EMF applied (the Voltage) and the resulting Current.
That is:

Power = Voltage x Current, or P = V x I

An example: Each Headlight on your car takes about 5 Amps from the battery so what is the wattage of each lamp.

P (watts) = V (volts) x I (amps)
P = 12V X 5A
P = 60 Watts. (Find out if this is correct)

So the Wattage of each lamp is around 60 Watts

Variations of the Formula; **$I = {}^{P}/_{V}$ and $V = {}^{P}/_{I}$**

If we go back to the original formula for power we are able to make some modifications to suit applications where we may not know either the Current or the Voltage. One very common application is when we are determining the power output of an Audio Amplifier where it is not common to measure the "signal" or audio current in the loudspeaker.

So given the basic formula for power, P = V x I , if we substitute ${}^{V}/_{R}$ for I then we have;

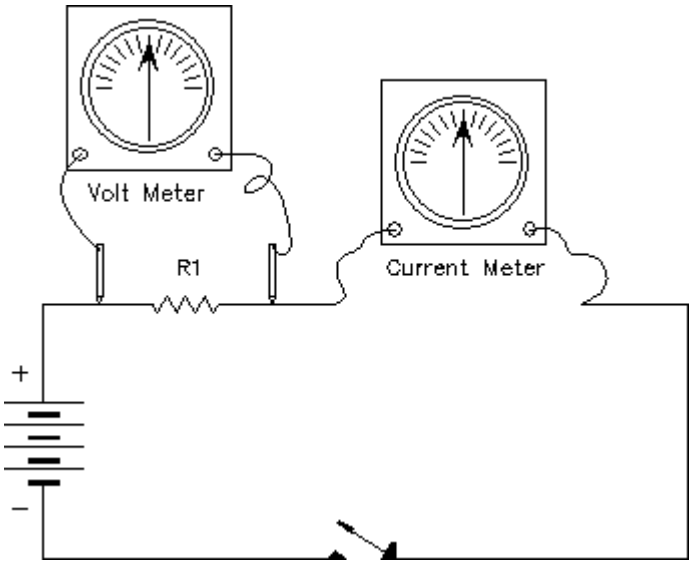
$$\text{Power} = \frac{V \times V}{R}$$

Therefore Power = V^2/R

And substituting I x R for V in the original formula then we have

Power = I x R x I , Therefore power also = I^2 x R

We will be using V^2/ R quite a deal when we start testing amplifiers to ascertain their output power.



Summing up the basics of Ohms Law:

Current (I) in a circuit (e.g. R1) = voltage over R1 divided by the resistance of R1:

$$I = \frac{V}{R}$$

The voltage over R1 = the resistance of R1 multiplied by the current through R1:

$$V = I \times R$$

The resistance of R1 (in ohms represented by the symbol Ω) = the voltage over R1 divided by the current in R1:

$$R = \frac{V}{I}$$

… We have expressed Ohms Law three ways.

Power in a component or circuit in 'Watts' (in this case a resistor R1) is equal to the voltage over R1 multiplied by the current passing through R1.
Liken this to the water pumping station where the ***energy*** contained in the water supply is the **product** of the **pressure x quantity**.

Power (P) = Voltage x Current:

$$P = V \times I$$

As before, we can express this different ways by substituting (for example) I. We know that I = V/R therefore we can say:

P = V x (V/R) which =

$$P = \frac{V^2}{R}$$

And we also know that $V = I \times R$, so we can say that:

P = I x (I x R) which = I^2R

$$P = R I^2$$

Therefore we have expressed the Power Law in three ways.

Below is a table, which derives anything you need from the power equation: