PENANG SANGAM HIGH SCHOOL
P.O.BOX 44, RAKIRAKI

WEEK 12 WORKSHEET

Subject: Applied Technology **Year/Level:** 13

Strand: 4	**Basic Home Improvement**
Sub Strand	General Trade Skills
Content Learning Outcome	Demonstrate Knowledge of general trade skills.

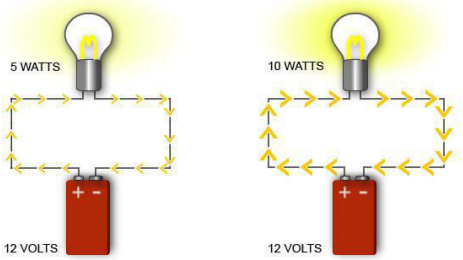
LESSON NOTES

Chapter 4: Basic Home improvement.

Electricity

Continued from week 11 Lesson notes....

Power - Power in an electrical circuit refers to the rate at which electrical energy is converted to some other form, such as heat or magnetism. The unit of measurement for power is the **watt**.



Quantity	Symbol	Unit	Abbreviation	Meaning
power	P	watt	W	power dissipated

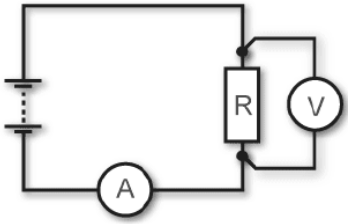
The formula for calculating power is:

P = VI

Therefore double the current multiplied by double the voltage will quadruple the power.

Ohm's law for calculating power dissipation

The worked examples are based on the circuit diagram shown.

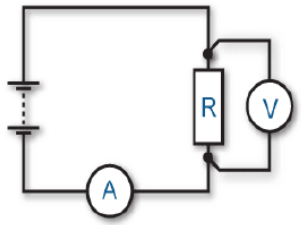


1. What power would be dissipated by resistor (R) if the circuit has a current flow (A) of 2A with an applied voltage (V) of 24V?
   - P = VI
   - P = 24 x 2
   - P = **48W**
2. What power would be dissipated by resistor (R) if the circuit has a current flow (A) of 2uA with an applied voltage (V) of 10mV?
   - P = VI
   - A and V are both submultiples and must be converted to base units
   - A = 2uA = 2 x 0.000,001 = 0.000,002A
   - V = 10mV = 10 x 0.001 = 0.01V
   - P = 0.01 x 0.000,002
   - P = **0.000,000,02W** or **20nW**

Formula substitution

In keeping with Ohm's law, power dissipated is directly related to the applied voltage and the amount of current flowing. This directly relates to the amount of resistance. If any two values of a circuit are known, we can calculate the other two values by using substitution.

Example



1. In this example if the battery voltage is 20V and the resistance (R) has a value of 100Ω, then what would the power dissipated be?
   - Formula for calculating power is:
   - P = VI
   - We don't know the current flow (I). We could use Ohm's law $I = {}^{V}/_{R}$ to calculate the current flow, then use the calculated value in the power formula above.
   - The answer can be found with one formula:
   - P = VI replace the I with $^{V}/_{R}$
   - This will give you a formula:
   - $P = {}^{V \times V}/_{R}$ volts multiplied by volts divided by resistance)
   - Volts multiplied by volts is expressed as V^2 (volts squared). So the final formula would be:
   - **$P = V^2/R$**
   - $P = 20^2/100$ which is the same as (20 x 20 / 100)
   - P = 400/100
   - **P = 4W**
2. If the circuit has a total resistance of 80Ω and the current flow is 2A, what is the power dissipation?
   - P = VI we don't know the voltage, but using Ohm's law V = IR. Therefore the formula is:
   - **P = I x R** x I which is the same as I x I x R which is the same as I^2R so the formula is:
   - **$P = I^2R$**
   - $P = 2^2/80$
   - P = 4/80
   - **P = 0.05W** or **70.71mW**
3. If the power dissipated in the circuit is 500W and the current flow is 2A, what is the total resistance?
   - R = V/I is the formula for calculating resistance, but voltage is unknown.
   - The power formula V = P/I could be used to find voltage, but this can be substituted into the first formula as follows:
   - R = (P/I)/I (Resistance equals watts divided by amps and then divided by amps again.)
   - This equation can however be simplified as P/(I x I) and so therefore can be expressed as:
   - **$R = P/I^2$**
   - $R = 500/2^2$
   - **R = 125Ω**
4. If the power dissipated in the circuit is 10W and the total resistance is 5Ω, what is the applied voltage?
   - V = IR is the formula for calculating voltage, but the current value is unknown.
   - The power formula V = P/I can't be used to find voltage because current is also unknown. However, because of the direct relationship of these values, formula substitution can be used.
   - We know that the voltage would be equal to V = P/I and current would be I = V/R therefore
   - V = P/(V/R) which is the same as V = PR/V and after transposing this would be $V^2 = PR$
   - We want to know the voltage, not the square of the voltage, so the square root (√) of **PR** will give the answer.
   - Therefore, the formula is:
   - **$V = \sqrt{PR}$**
   - $V = \sqrt{(10 \times 5)}$
   - $V = \sqrt{50}$

STUDENT ACTIVITY

1. In this example if the battery voltage is 20V and the resistance (R) has a value of 100Ω, then what would the power dissipated be?

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   _____
   _____
   _____
   _____

2. If the circuit has a total resistance of 80Ω and the current flow is 2A, what is the power dissipation?

   _____
   _____
   _____
   _____
   _____

3. If the power dissipated in the circuit is 500W and the current flow is 2A, what is the total resistance?

   _____
   _____
   _____
   _____
   _____

4. If the power dissipated in the circuit is 10W and the total resistance is 5Ω, what is the applied voltage?

   _____
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THE END