تعريف الوحدات الأساسية للفولتية والتيار والمقاومة

و

العوامل التي تؤثر على قيمة المقاومة

B –Rationale مبررات الوحدة

- It is very important to study Units system
- Also to study the elements effect of at resistance.

C – Central الفكرة المركزية Idea

- Definition voltage , current and resistance
- units system
- The element effect at resistance .

الهدف من المحاضرة

D - Aim of lecture : To let the student be able to identify the analyses different elements effect at the resistance value .

Pretest ألاختبار القبلي

1): Define :-
(Resistance, current , Potential difference ,voltage , E.m.f.) .

2): Write Ohm's law

3) What is the meaning of the Ampere (A)?

Solution

: 1): R (The appetite of material to appose the flow of electrons, its unit . is (Ω)

I (The electric current means the flow of electrons through the conductor)

Potential difference :(The difference in potential between two points in .an electrical system , its unit is volt (V)

Volt (V) : The unit of measurement applied to the difference in potential between two points

E.m..f. (the electro motive force means the sorce of voltage produced from Generator which causes current to flow).

2) **V = IxR (volts)**

3) (A) : The unit of measurement applied to the flow of charge through a conductor.

Units system(نظام الوحدات)

m-k-s-A system (international unit (ألمعتمد منذ عام 1960م) نظام ألمتر – كيلوغرام –ثانية –أمبير)

Quantity	unit	symbol
Length	meter	m
Mass	Kilogram	Kg
Time	Second	S
Current	Amper	A
Temperature	Kelvin	K
Luminous intensity شدة ألإضاءة	candela	cd

From these basic quantity we derive :- نستنتج

Quantity	unit	symbol
Electric charge	Coulomb	C
Electric potential	Volt	V
Resistance	Ohm	Ω
Capacitance	Farad	F
Inductance	Henry	H
Conductance	Siemens , mho	S
Frequency	Hertz	Hz
Power	watt	W

Notations:-

$1=10^0$	
$10=10^1$	$1/10=0.1=10^{-1}$
$100=10^2$	$1/100=0.01=10^{-2}$
$1000=10^3$	$1/1000=0.001=10^{-3}$

Power of 10	**prefix**	symbol
10^6	Mega	M
10^3	Kilo	K
10^{-3}	mille	m
10^{-6}	Micro	μ
10^{-9}	Nano	n
10^{-12}	pico	p

Examples:-

a) : 1000 000Ω = $1x10^6$ Ω =1 mega ohm =1MΩ

0.000001 farad=$1x10^{-6}$ farad =1 Micro farad= 1μF

0.0001 second=$0.1x10^{-3}$ second = 0.1 mille second =0.1 ms 10^n x 10^m = $10^{(n+m)}$

b) :

1000 x10 000= 10^3 x 10^4 = 10^{3+4} =10^7

0.00001 x 100 = 10^{-5} x 10^2 =10^{-3}

$10^n/10^m=10^{n-m}$

C) . 100000/100 =$10^5/10^2=10^{5-2}=10^3$

1000/0.0001=$10^3/10^{-4}$ = $10^{3-(-4)}=10^7$

$(10^n)^m=10^{nxm}$

d) . $(100)^4=(10^2)^4=10^{2x4}=10^8$

$(1000)^{-2}=(10^3)^{-2}=10^{3x-2}=10^{-6}$

$(0.01)^{-3}=(10^{-2})^{-3}=10^{-2x-3}=10^6$

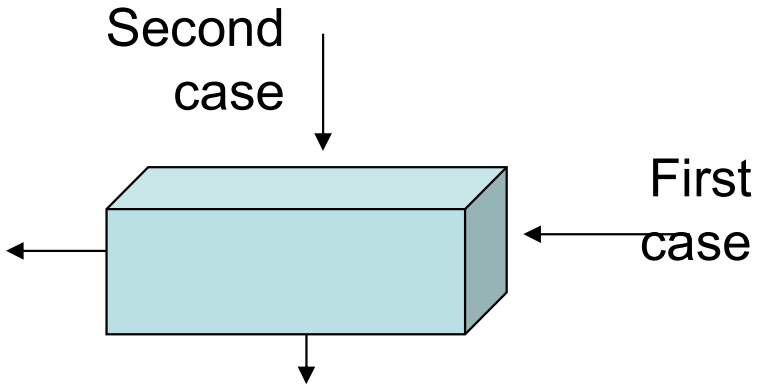
The elements effect of at resistance (العوامل المؤثرة على قيمة المقاومة)

1- The Resistance varies directly with (Length) { L } .
2- It varies inversely with (the cross section area) { A } .
3- It depends on the nature of the material { specificin (p) }.
4- It also depends on the temperature of the conductor { T } .

R Œ L/A :. $R = \rho \cdot L/A\ (\Omega)$, $\rho = R.A/L = \frac{\Omega.m^2}{m} = \Omega.m$

When R: resistance, p= specificin or resistivity , L= length.
A =cross section area

Ex1: A rectangular carbon block has dimensions (1 cm ,1 cm ,50 cm) .
1- what is the resistance measured between the two square ends .
2- Between two opposing rectangular faces if P = 3.5×10^{-5} Ω. m



Solution: •

1- $R = P \cdot L / A \ (\Omega) = 3.5\times10^{-5} \times 0.5/(1\times10^{-2} \times 1\times10^{-2})$

$\therefore R = 0.175\ \Omega$

2- $R = P \cdot L / A \ \Omega = 3.5\times10^{-5}\ 1\times10^{-2}/(1\times10^{-2}\times50\times10^{-2})$

$\therefore R = 0.00007\ \Omega$

Ex 2: The wire resistance equal to (40 Ω) and length (1km) if the resistivity=2×10^{-8} Ω.m , calculate: the diameter of the circular type wire.

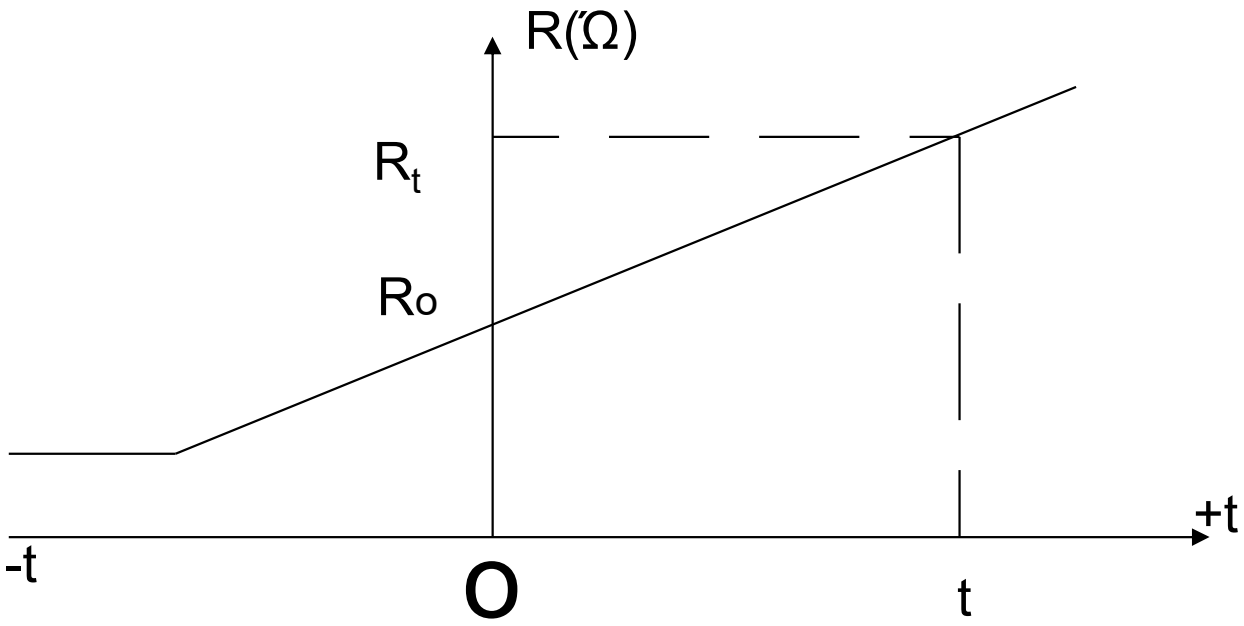
Solution : Area=$(d^2/4)\,\pi$, $R = P \cdot L / A\ \Omega$ $\therefore A = P \cdot L / R = (2\times10^{-8} \times 1\times10^{3}) / 40 = 0.5\times10^{-6}\ m^2$

$A = (d^2/4).\pi$ $d^2 = 4.A/\pi$ $\therefore d = \sqrt{4\times0.5\times10^{-6}/3.14} = 0.8\times10^{-3}$mm

The temperature effects at the resistance

تأثير درجة الحرارة على المقاومة

The resistance of the material depends on the temperature, When (T) increased, R also increased



Let the resistance of a conductor at 0Ċ=R_oΩ
Let the resistance of a conductor at tĊ=R_t Ω
Let the temperature cofficient of material at 0Ċ=α_o / k
Let the temperature cofficient of material at tĊ=α_t / k

1- $R_t=R_o(1+\alpha_o t)$

2- $R_2=R_1(1+\alpha_1(t_2-t_1))$

3- $\alpha_t=\alpha_o/(1+\alpha_o.t$

4- $\alpha_t=(R_t-R_O)/R_t.t$

Ex.3: A lamp of (100 watt) power, (240 volt) reaches(2000Ċ) if the temperature coefficient of the lamp at (15Ċ) is œ=$5x10^{-3}$ /k calculate the current through the lamp

Solution: $p=v^2/R$:. $R=(240)^2/100=576\Omega$

$R_2=R_1(1+œ_1(t_2-t_1))$:. $576=R_1[1+5x10^{-3}(2000-15)]=R_1(1+9.92)$

:. $R_1=576/10.92=52.7\ \Omega$:. $I=v/R=240/52.7=4.55A$

Ex.(4): Palatine coil of resistance(3.717Ω) at (100Ċ). Calculate 1-The resistance at zero degree. 2- the temperature coefficient of resistance at 40Ċ **(H .W)**

Notes: 1- Ro= 2.781 Ω

2-$œ_t$= 0.00284/k

Ex5 : **A(1A) pass through a copper conductor the Potential difference through it is (10 v) at (20Ċ) after Sam times the current decrease to** (0.95A) , (**Potential difference** not changed) , Find the temperature of the conductor if the temperature coefficient of the copper at zero **Ċ** **(α_o)= 4.28×10^{-3}/k**

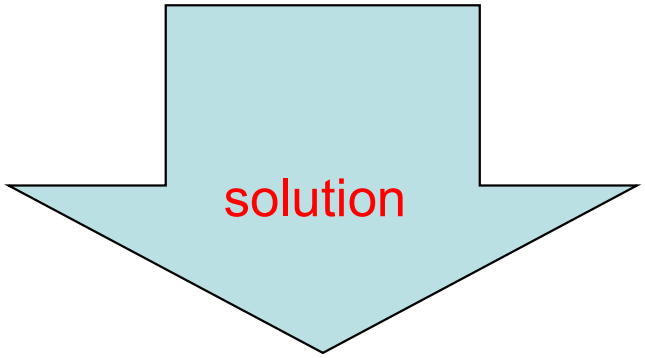
Solution: $R1=v/I_1=10/1=10\Omega$, $R2=v/I_2=10/0.95=10.53\ \Omega$,

$R_t=R_o(1+\alpha_o t)$:. $R_1/R_2=R_o(1+\alpha_o t1)/R_o(1+\alpha_o t_2)$

:.$10/10.53=(1+4.28\times10^{-3}\ x2o)/\ (1+4.28\times10^{-3}\ x\ t_2\ )$:. $t_2=33.4$Ċ

Ex(6). A copper conductor of (100m) length ,with a diameter of (1mm) ,if the resistivity of a copper is 0.0159 uΩ.m , find the resistance of the conductor.

مثال : موصل نحاسي طوله 100متر وقطره 1ملم اذا كانت المقاومة النوعية للنحاس 0,0159مايكرو اوم xمتر, اوجد مقاومة النحاس .



$R=\rho L/ A$:. $A= r^2 .\pi= (1/2 \times 10^{-3})^2 \times 3.14\ m^2$:. $R=(0.0159 \times 10^{-6} \times 100)/ 0.5^2.\pi \times 10^{-6}$

:.$R= 2.02\Omega$

ألاختبار ألبعدي

Posttest

Ex:(7) An electric heater takes a current of (15A) from a (115v) source. The cables connecting the heater to the supply are each (43m) long. If the voltage drop along the cables is not exceed (12v) .Determine the diameter of suitable copper wire and select p=1.72x10-8 Ω.m

Solution

R=E/I=12/15=0.8Ω , total length of wire =2x43=86m

$R=p.L/A$:. $A=p.L/R = (1.72\times10^{-8}\times86) / 0.8 = 1.849\times10^{-6}\ m^2$

$A=[(1/2).d]^2.\prod$

$A=(d^2/4).\prod$:. $d^2= 4A/\prod$:. $d=\sqrt{4A/\prod}$

$d=\sqrt{(4\times 1.849\times10^{-6} /\prod} = 1.5mm$