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Changing your Tomorrow

Electrical resistivity, Conductivity, Carbon resistors, Color code of carbon resistors

CLASS-XII

SUBJECT : PHYSICS
CHAPTER NUMBER: 03
CHAPTER NAME : CURRENT ELECTRICITY

LEARNING OUTCOME

After this lesson, students will be able:

•Differentiate between resistance and resistivity

•Define the term conductivity

•Describe the electrical component known as a resistor

•State the relationship between resistance of a resistor and its length, cross-sectional area, and resistivity

•State the relationship between resistivity and temperature

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Slide 2

3	@Format for content and slide heading is missing? Just like you have mentioned in DOC., We need to specify, for each slide's heading and text content, what will be the font style +amanrouniyar@odmegroup.org _Assigned to you_ -Swoyan Satyendu , 6/17/2020

REVIEW

1. Define conductance.
2. Define electrical energy in terms of charge, voltage, current and resistance.
3. What is the expression of Ohm’s law in vector form?.
4. State electrical energy and power.
5. State Joule’s law of heating

Resistivity

As the resistance of a conductor is $R = \rho \frac{l}{A}$

Hence resistivity is ; $\rho = \frac{RA}{l}$

So resistivity of a conductor is defined as the resistance of a conductor made up of the same material having a unit length and unit area of cross-section.

S.I. unit of resistivity: In S.I. system the unit of resistivity is ohm meter (Ω**m**)

Dimensional formula : $[\rho] = \left[\frac{RA}{l}\right] = \left[\frac{(M^1L^2T^{-3}A^{-2})(L^2)}{L}\right] = [M^1L^3T^{-3}A^{-2}]$

Conductivity

Conductivity (σ): Conductivity is the reciprocal of resistivity.

So the conductivity of a conductor is

$$\sigma = \frac{1}{\rho} = \frac{l}{RA} = \frac{Gl}{A}.$$

So conductivity of a conductor is defined as the conductance of a conductor made up of the same material having a unit length and unit area of cross-section.

S.I. units of conductivity :

In S.I. system the unit of resistivity is **siemens/meter**

Dimensional formula : $[\sigma] = \left[\frac{Gl}{A}\right] = \left[\frac{(M^{-1}L^{-2}T^{3}A^{2})(L)}{L^{2}}\right] = [M^{-1}L^{-3}T^{3}A^{2}]$

Numerical

Question: How will the resistance and resistivity of a cylindrical wire change if

a) its length is doubled

b) It is doubled on itself

c) It is stretched to double its length?

Numerical

Question: How will the resistance and resistivity of a cylindrical wire change if

a) it is stretched to n times its length

b) It is stretched to have radius 1/n times the original value?

Show the graphical variation between the resistance of the wire and its radius.

Colour code for carbon resistors:

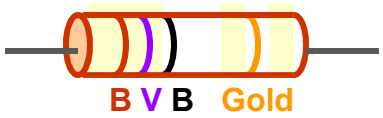
The first two rings from the end give the first two significant figures of resistance in ohm.

The third ring indicates the decimal multiplier.

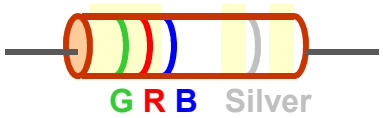
The last ring indicates the tolerance in per cent about the indicated value.

Eg. AB x 10^C ± D % ohm

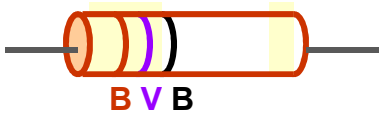
Letter	Colour	Number	Colour	Tolerance
B	Black	0	Gold	5%
B	Brown	1	Silver	10%
R	Red	2	No colour	20%
O	Orange	3		
Y	Yellow	4		
G	Green	5		
B	Blue	6		
V	Violet	7		
G	Grey	8		
W	White	9		



$17 \times 10^0 = 17 \pm 5\%\ \Omega$



$52 \times 10^6 \pm 10\%\ \Omega$



$17 \times 10^0 = 17 \pm 20\%\ \Omega$

B B ROY of Great Britain has Very Good Wife

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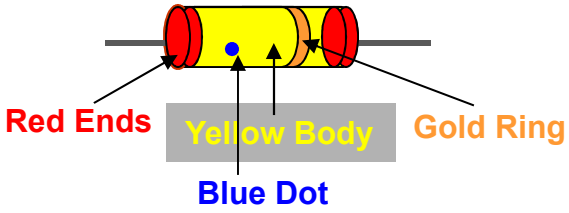
Another Colour code for carbon resistors:

i) The colour of the body gives the first significant figure.

ii) The colour of the ends gives the second significant figure.

iii) The colour of the dot gives the decimal multipier.

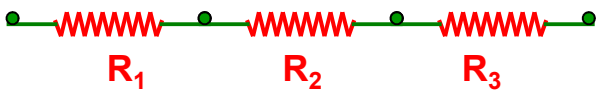
iv) The colour of the ring gives the tolerance.



YRB Gold

$42 \times 10^6 \pm 5\% \ \Omega$

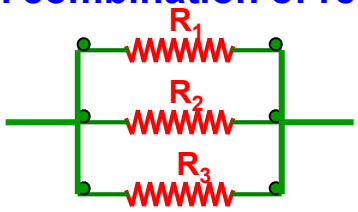
Series combination of resistors:



$R = R_1 + R_2 + R_3$

R is greater than the greatest of all.

Parallel combination of resistors:



$1/R = 1/R_1 + 1/R_2 + 1/R_3$

R is smaller than the smallest of all.

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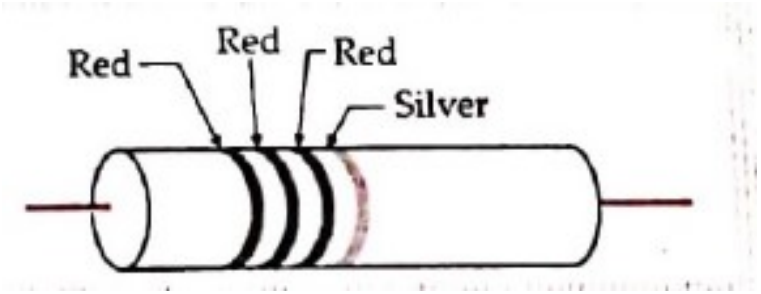
Numerical

Question: Give color coding for $42k\Omega \pm 10\%$ carbon resistance.

Letter	Colour	Number	Colour	Tolerance
B	Black	0	Gold	5%
B	Brown	1	Silver	10%
R	Red	2	No colour	20%
O	Orange	3		
Y	Yellow	4		
G	Green	5		
B	Blue	6		
V	Violet	7		
G	Grey	8		
W	White	9		

Numerical

Question: The figure shows the color-coding of a carbon resistor. Find its resistance.



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HOME ASSIGNMENT

1. Two wires of equal length, one of copper and the other of manganin have the same resistance. Which wire is thicker?
2. Two materials Si and Cu, are cooled from 300 K to 60 K. What will be the effect on their resistivity?
3. The sequence of colour bands in two carbon resistors R_1 and R_2 is
   a) Brown, green, blue and
   b) Orange, black, green
   c) Find the ratio of there resistances
4. Answer the following
   a) You are required to select a carbon resistor of resistance $47\ k\Omega \pm 10\%$ from a large collection. What should be the sequence of colour bands used to code it?
   b) Write the characters of manganin which make it suitable for making standard resistance

THANKING YOU

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