شكراً لتحميلك هذا الملف من موقع المناهج الإماراتية

مراجعة الوحدة الخامسة resistance and current التيار والمقاومة

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التواصل الاجتماعي بحسب الصف الثاني عشر المتقدم

روابط مواد الصف الثاني عشر المتقدم على تلغرام

التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة فيزياء في الفصل الثاني

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اسم الطالب: .....

EINSTEIN
In Physics

TERM 2

1-Electric Current

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Chapter 5
Current and Resistance

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2024

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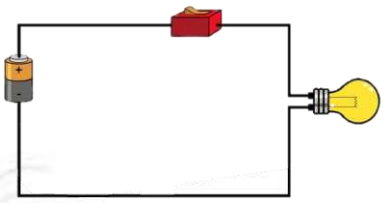
Electric Current 1

The electrical circuit consists of :



1. Connecting wires
2. Battery (voltage difference source)
3. Device (Resistance)
4. Switch

The electric current (I):

is the net charge passing a given point in a given time, divided by that time .

$$(\mathbf{I})\text{Electric current} = \frac{(\mathbf{Q})\text{electric charge}}{(\mathbf{t})\text{ time}}$$

unit of current is C/s and is called Ampere(A).

Direct current:

current that flows in only one direction, which does not change with time.

Important Notes	
2. $mA = 10^{-3}A$	1. Min = 60S
4. $\mu A = 10^{-6}A$	3. Hour = 60×60

$$(C)Coulomb = (A)ampere \times (\text{S})\text{second}$$

$$mAh(\text{milliampere. hour})$$

$$mAh = 10^{-3} \times 60 \times 60 = 3.6\text{C}$$

mAh Unit of electric charge

Check your understanding:

$$3mAh = \qquad \text{C}$$

Electric charge equation:

The current is equal to the derivative of the electric charge with respect to time.

$$i = \frac{dq}{dt}$$

Check your understanding:

1. A charge flows in a conducting wire whose strength changes with time according to the equation [$q_{(t)} = 5t^2 + 7t + 4$], where the time is measured in seconds, and the charge is measured in Coulomb. How much current does this pass in 2.5 s?

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2. If the equation between charge and time is ($q = 5t^2 + 3t$). What is the correct expression of *the current (i)?*

ⓐ $\text{i} = 5t^2 + 3t$ ⓑ $\text{i} = 10t + 3t$ ⓒ $\text{i} = \frac{5t^3}{3} + \frac{3t}{2}$ ⓓ $\text{i} = 10t + 3$

Electric current equation:
The charge is equal to the Integration of the electric charge with respect to time.

$$q = \int_{t_i}^{t_f} i\,dt$$

Check your understanding:

1. *A current flows in a conducting wire whose strength changes with time according to the equation* $[i_{(t)} = 6t^2 - 3t]$ *, where the time is measured in seconds, and the current is measured in amperes. How much charge does this current pass in t=3s , t=1s ?*

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2. *In a certain circuit, the current as a function of time is given as:* $i_{(t)} = 3t^2 - 2t$ *where* i *is measured in amps and* t *is measured in seconds. How much charge passes through this circuit during the interval* $0 < t < 5.00\ s$*?*

$q = 65C$ ⓓ $q = 150C$ ⓒ $q = 100C$ ⓑ $q = 28C$ ⓐ

Problem book :

3. *A nurse wants to administer 80 µg of dexamethasone to the heel of an injured soccer player. If she uses an iontophoresis device that applies a current of 0.14 mA, how long does the administration of the dose take? Assume that the instrument has an application rate of 650 µg/C and that the current flows at a constant rate.*

SLOVE

$$\text{Rate} = \frac{Mass}{Charge}$$

$$q = \frac{80}{650} = 0.123C$$

$$how\ long(time)\ t = \frac{q}{i}$$

$$t = \frac{0.123}{14 \times 10^{-3}} = 878.57s$$

4. *A typical rechargeable AA battery is rated at 700 mAh. How long can this battery provide a current of 100 µA?*

SLOVE

$$how\ long(time)\ t = \frac{q}{i}$$

$$t = \frac{700 \times 10^{-3} Ah}{100 \times 10^{-6} A} = 7000\ h$$

اسعي دائما نحو القمة فالتاريخ لا يعرف الا العظماء

Current Density 2

Current density :

The current per unit area flowing through the conductor.

$$(J)\text{Current density} = \frac{\text{current}(i)}{\text{area}(A)}$$

Unit : $C/m^2.s$ or A/m^2

current $i = \int J \,.\, dA$

Important Notes	
Diameter giver $r = \frac{d}{2}$	*Radius given area is* $A = \pi r^2$
Convert from $cm^2 = \times 10^{-4} m^2$	*Convert from* $cm = \times 10^{-2} m$
Convert from $mm^2 = \times 10^{-6} m^2$	*Convert from* $mm = \times 10^{-3} m$

Check your understanding:

1. *What is the current density in an aluminum wire having a radius of 1.00 mm and carrying a current of 1.00 mA?*

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2. *A current of 0.123 mA flows in a silver wire whose cross-sectional area is 0.923 mm2. Find the current density in the wire assuming that the current is uniform.*

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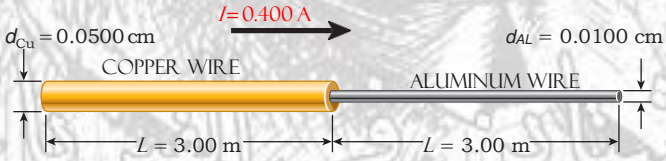
3. *A copper wire has a diameter* $d_{Cu} = 0.0500$ *cm, is 3.00 m long , and the copper wire is attached to an equal length of aluminum wire with a diameter* $d_{Al} = 0.0100$ *cm . A current of 0.400 A flows through the copper wire.*
What is the ratio of the current densities in the two wires, J_{Cu}/J_{Al}*?*



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4. Two wires carry the same current, but if the area of the second wire is 3 times the area of the *first wire, which of the following is true?*

$J_2 = \frac{1}{9}J_1$ ⓓ $J_2 = 9J_1$ ⓒ $J_2 = \frac{1}{3}J_1$ ⓑ $J_2 = 3J_1$ ⓐ

على قدر حلمك تتسع الأرض

Resistivity and Resistance 3

Ohm`s Law:

The electric current flowing through a conductor is directly proportional to the potential difference across it.

$$(V)potential\ difference = (I)current \times (R)resistance$$

The Resistance (R) :

opposition to the flow of electric current.

$$(\mathbf{R})resistance = \frac{(\mathbf{V})potential\ difference}{(\mathbf{I})current} \quad \text{or } \mathbf{R} = \boldsymbol{\rho}\frac{\mathbf{L}}{\mathbf{A}}$$

Unit : $\mathbf{1\Omega\ ohm} = \frac{\mathbf{1}V\ volt}{\mathbf{1}A\ \text{amp}}$

The Resistivity (ρ):

A measure of how strongly a material opposes the flow of electric current.
It equals the ratio of the applied electric field to the current density.

$$(\boldsymbol{\rho})Resistivity = \frac{(\boldsymbol{E})electric\ field}{(\boldsymbol{J})current\ density} \boldsymbol{or}\ \boldsymbol{\rho} = \frac{\mathbf{R}\ \mathbf{A}}{\mathbf{L}}$$

Unit : $\boldsymbol{V.m/A} = \Omega.\boldsymbol{m}$

The Conductance (G) :

Conductance is the reciprocal of resistance.

$$(G)Conductance = \frac{\mathbf{1}}{(\boldsymbol{R})resistance} = \frac{(\mathbf{I})current}{(\mathbf{V})potential\ difference}\ or\ \frac{\mathbf{A}}{\boldsymbol{\rho}\mathbf{L}}$$

Unit : $(S)siemens = \frac{1}{(\Omega)\boldsymbol{ohm}} = \frac{1A\ \text{amp}}{1V\boldsymbol{volt}}$

The Conductivity (σ) :

Conductivity is the reciprocal of resistivity.

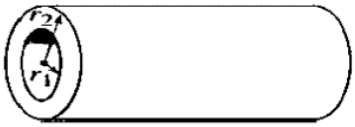
$$(\sigma)Conductivity = \frac{1}{(\boldsymbol{\rho})\ resistivity}\ \boldsymbol{or}\ \boldsymbol{\sigma} = \frac{\mathbf{L}}{\mathbf{R}\ \mathbf{A}}$$

Unit : $\Omega^{-1}m^{-1}$ *or* $\frac{1}{\Omega.\boldsymbol{m}}$

NOTES

Hollow cylinder area : $A_{out} - A_{into}$

$$A = \pi {r_2}^2 - \pi {r_1}^2$$



Made of the same material $(\boldsymbol{\rho_1} = \boldsymbol{\rho_2})$
The same resistance $(\boldsymbol{R_1} = \boldsymbol{R_2})$

Example :

1. *A potential difference of 12.0 V is applied across a wire of cross-sectional area 4.50 mm^2 and length 1000 km. The current passing through the wire is 3.20 $X10^{-3}$ A.*

What is the resistance of the wire?
What resistivity?

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2. *A copper wire has radius r = 0.0250 cm, is 3.00 m long, has resistivity $\rho = 1.72\ X{\cdot}10^{-8}$ Ω m, and carries a current of 0.400 A.*

What is the resistance, R, of the wire?
What is the electric potential difference, ΔV, across the wire?
What is the electric field, E, in the wire?

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3. *What is the resistance of a copper wire of length l = 10.9 m and diameter d = 1.30 mm? The resistivity of copper is 1.72 $X10^{-8}$ Ω m.*

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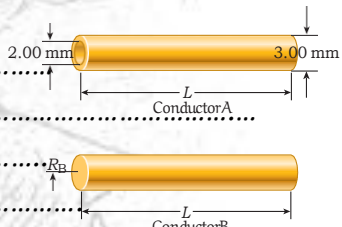
4. *Two conductors are made of the same material and have the same length L. Conductor A is a hollow tube with inside diameter 2.00 mm and outside diameter 3.00 mm; conductor B is a solid wire with radius R_B. What value of RB is required for the two conductors. have the same resistance measured between their ends?*



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5. *A rectangular wafer of pure silicon, with resistivity $\rho = 2300\ \Omega$ m, measures 2.00 cm by 3.00 cm by 0.0100 cm. Find the maximum resistance of this rectangular wafer between any two faces.*

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6. *A cylindrical aluminum wire is (32m) long and has a resist the resistivity of aluminum is (2.82 $x10^{-8}$ Ω.m). What is the radius?*

$4.512 \times 10^{-6}m$ ⓓ $1.436 \times 10^{-6}m$ ⓒ $1.436 \times 10^{-3}m$ ⓑ $1.198 \times 10^{-3}m$ ⓐ

7. *Two cylindrical wires, 1 and 2, made of the same material, have the same resistance. If the length of wire 2 is twice that of wire 1, what is the ratio of their cross-sectional areas, A_1/A_2?*

A1/A2 = 2 ⓓ A1/A2 = 4 ⓒ A1/A2 = 0.5 ⓑ A1/A2 = 0.25 ⓐ

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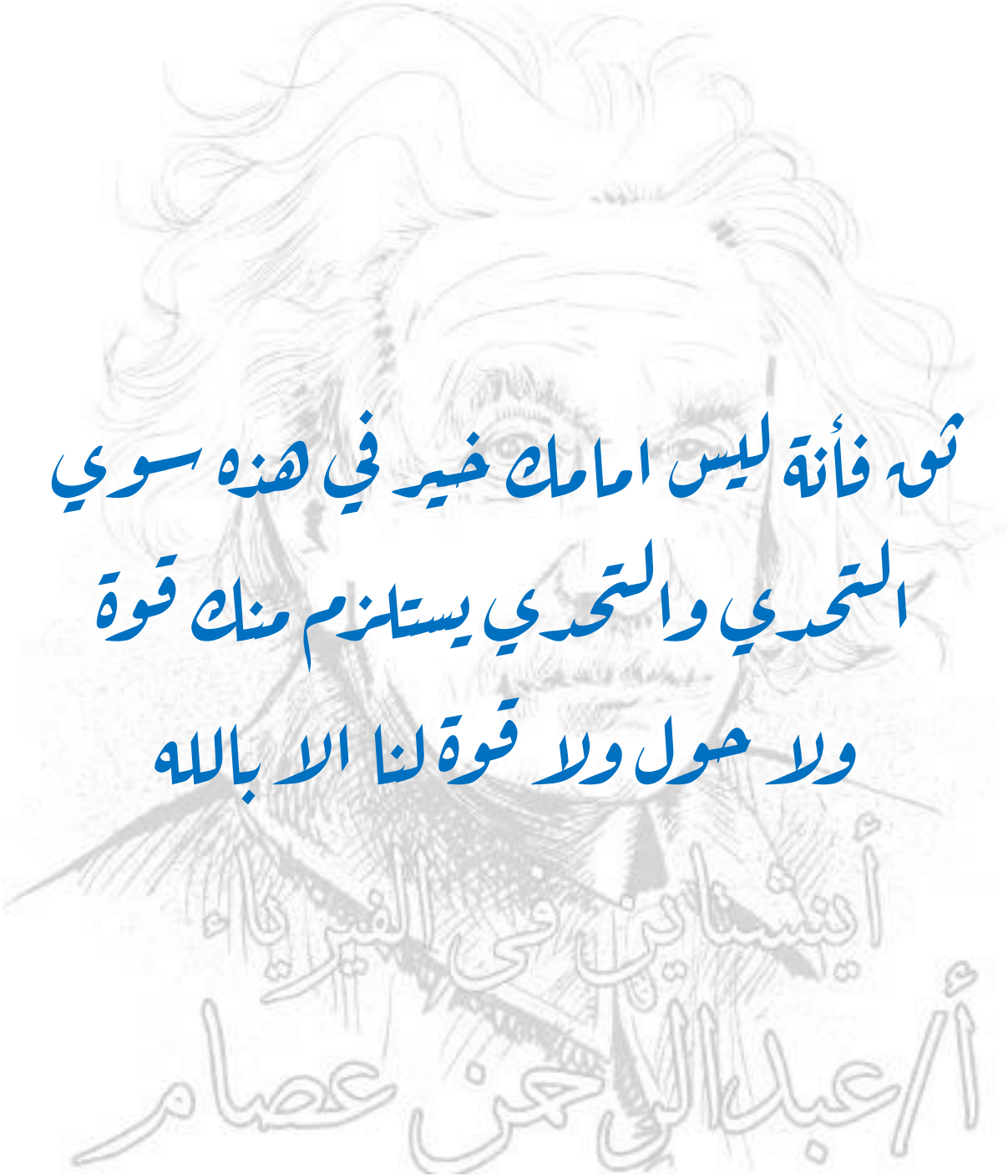
Check your understanding:

If the Conductance of the wire is 0.9S, and there is another wire of the same material and the same length, and the radius of the second wire is 3 times that of the first wire, what is the Conductance of the second wire?

ⓐ 2.7*S* ⓑ 8.1*S* ⓒ 0.3S ⓓ 0.1S



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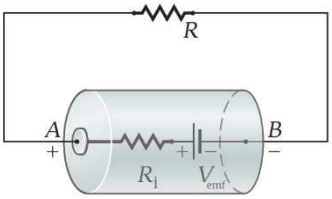
Electromotive Force 4

for a circuit like the one shown in Figure, the emf device provides the potential difference that creates the current flowing through the resistor. Therefore, in this case, Ohm's Law can be written in terms of the external emf as:

$$V_{emf} = \Delta V + IR_i \text{ or } V_{emf} = I(R + R_i)$$



Notes :

(V_{emf}) *potential difference of when it is not connected in a circuit.*

(ΔV) *the battery connected in a circuit.*

$$(\text{I})\text{current} = \frac{\Delta V}{R}$$

$$\text{the internal resistance } R_i = \frac{V_{emf} - \Delta V}{I}$$

Example :

1. *Consider a battery that has V_{emf} = 12.0 V when it is not connected to a circuit. When a10.0Ω resistor is connected with the battery, the potential difference across the battery's. Terminals drop to 10.9 V. What is the internal resistance of the battery?*

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2. *A battery has a potential difference of 14.50 V when it is not connected in a circuit. When a 17.91 Ω resistor is connected across the battery, the potential difference of the battery drops to 12.68 V. What is the internal resistance of the battery?*

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3. *When a battery is connected to a 100. Ω resistor, the current is 4.00 A. When the same battery is connected to a 400. Ω resistor, the current is 1.01 A.*

Find the internal resistance of the battery.
Find the emf supplied by the battery.

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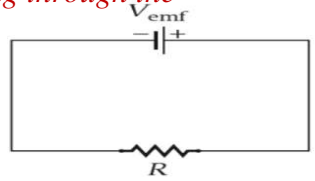
4. *For the electric circuit shown in the figure: if the battery's electromotive force is (12V), the resistance is (R=2.4Ω), what is the electric current flowing through the circuit?*



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