12 Advanced Physics 2023/24

English Version

Chapter 5

Current and Resistance

Scan for Solution

or visit www.manasra.academy

Done by Teacher Alaa Al Faqeh

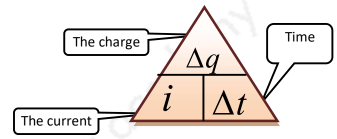
Manasra Academy

Ch5: Current and Resistance

5.1 (The electric current): i

"The electric current, i, is the net charge passing a given point in a given time, divided by that time."

$$i = \frac{dq}{dt}. \qquad q = \int dq = \int_0^t i\,dt'. \qquad i = \left|\frac{\Delta q}{\Delta t}\right|$$



Note: -The 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."

Example:

During lightning strikes from a cloud to the ground, currents as high as 25,000 A can occur and last for about 40 ms. How much charge is transferred from the cloud to the earth during such a strike?

Solution:

$$Q = i \cdot t \quad \Rightarrow \quad Q = 25000 \times 40 \times 10^{-3} \quad \Rightarrow \quad Q = 1.0\ C$$

Q1: How many electrons flow through a point in a wire in 3.00 s if there is a constant current of i = 4.00 A ?

A)7.5×10^{-19} electron B)7.5×10^{19} electron C)2.5×10^{19} electron D)2.5×10^{-19} electron

Q2: The quantity of charge through a conductor is modeled as:
$Q = (4.00\ C\ s^{-4})\,t^4 - (1.00 Cs^{-1})\,t + (6.00\ mC)$. What is the current at time t = 3.00 s

A) 231 A B) 431 A C) 623 A D) 765A

Q3: A current flows in a conducting wire whose strength changes with time according to the equation [$I(t)= 3.0 + 2.0t^3$] , where the time is measured in seconds, and the current is measured in amperes. How much charge does this current pass in 2 s?

A) 2C B) 1 4.9C C) 14C D) 2.7C

Q4: The electric current is defined as:

A) The net charge passing the cross-sectional area of a conductor in a certain time interval.

B) The net charge passing the cross-sectional area of a conductor in a certain time interval times this time interval.

C) The net charge passing the cross-sectional area of a conductor in a certain time interval divided by this time interval.

D) The current density through the conductor divided by the time interval taken to pass.

Q5: The electric current can be calculated from the

□ $i = q\Delta t$, $C.s$ □ $i = \frac{q}{\Delta t}$, $\frac{s}{C}$ □ $i = \frac{\Delta t}{q}$, $\frac{s}{C}$ □ $i = \frac{q}{\Delta t}$, $\frac{C}{s}$

5.2: (Current density): $\vec{J}$

-The current per unit area flowing through the conductor.

$$i = \int \vec{J} \cdot d\vec{A}$$

$$J = \frac{i}{A}$$

measured in A/m^2

Q6: A copper wire with a diameter of 1.02 mm, carries a constant current of 1.67 A. Find the current density.

$$J = \frac{i}{A} = \frac{1.67}{\pi(\frac{1.02 \times 10^{-3}}{2})^2} = 2.04 \times 10^6 \ \frac{A}{m^2}$$

Q7: The current density through a conductor is defined as:

A) The total current passing the cross-sectional area per unit time.

B) The cross-sectional area of a conductor times the current per unit cross- Sectional area.

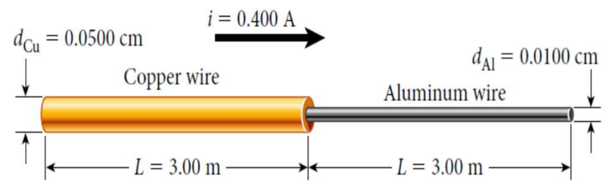
C) The charge per unit area passing through a conductor\`s cross- Sectional area.

D) The current passing per unit perpendicular cross-Sectional area of a conductor.

Q8: The current density of a conductor is given by:

A) $J = \rho E$ B) $J = i/A$ C) $J = A/i$ D) $J = \rho L/A$

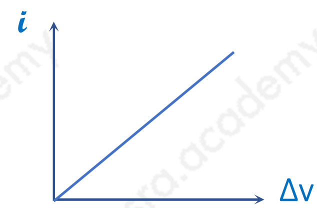
Q9: **A copper wire has a diameter $d_{Cu} = 0.0500$ cm, is 3.00 m long, and has a density of charge carriers of 8.50×10^{28} electrons/m³. As shown in the figure, the copper wire is attached to an equal length of aluminum wire with a diameter $d_{Al} = 0.0100$ cm and density of charge carriers of 6.02×10^{28} electrons/m³. 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}?**



5.3: (Resistivity and resistance):

Ohm`s Law:

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



The resistance: R

"The resistance is a material's opposition to the flow of electric current."

"The resistance is the ratio of the potential difference across a resistor to the resulting current."

$$R = \frac{\Delta V}{i}$$ measured in Ω

Factors affecting the resistance of a conductor:

-Length: L $R \alpha L$ (The longer the conductor the larger the number of collisions with ions and other electrons)

-Cross sectional area: A $R \alpha \frac{1}{A}$ (The wider the conductor the smaller the number of collisions with ions and other electrons)

-Type of material: R differs from a material to other depending on its atomic structure (atomic lattice).

$$R = \frac{\rho L}{A}$$

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:

$$\rho = \frac{E}{J}$$

$$\rho = \frac{RA}{L}$$

$$\rho = \frac{E}{J} = \frac{\Delta V/L}{i/A} = \frac{RA}{L}$$ (measured in Ωm)

The conductance: G

"The conductance is the reciprocal of the resistance."

$$G = \frac{1}{R} \quad \Rightarrow \quad G = \frac{i}{\Delta V}$$

(measured in Ω^{-1})

The conductivity: σ

"The conductivity is the reciprocal of the resistivity."

$$\sigma = \frac{1}{\rho} \quad \Rightarrow \quad \sigma = \frac{L}{RA}$$

(measured in $\Omega^{-1}m^{-1}$)

Example:

What is the resistance of the 100.0 m copper wire that is typically used in wiring household electrical outlets with diameter of 2.053 mm and resistivity of $1.72 \times 10^{-8} \Omega m$?

Solution:

$$R = \frac{\rho\, L}{A} \quad \Rightarrow \quad R = \frac{1.72\times10^{-8} \times 100}{(3.3112\times10^{-6})} \quad \Rightarrow \quad R = 0.520\ \Omega$$

Q10: Which of the following statements is true for the resistance of a copper wire at room temperature?

A) It increases as its length increases and its cross-sectional area decreases.
B) It increases with both its length and its cross-sectional area.
C) It increases as its cross-sectional area increases and its length decreases.
D) It increases by decreasing both its length and its cross-sectional area.

Q11: Calculate the effective resistance of a pocket calculator that has a 1.35-V battery and through which 0.200 mA flows.

A) 6750 Ω B) 2350 Ω C) 1245 Ω D) 1554Ω

Q12: A 10 V potential difference is applied across a 1000 Km conducting wire with a cross sectional area (5 cm^2). If a current of 3×10^{-3} A passes through the conductor, Find the resistivity and the conductivity of this wire?

$$\sigma = \frac{1}{\rho} \quad \Rightarrow \quad \sigma = \frac{L}{RA}$$

Q13: What current flows through a 2.54-cm-diameter rod of pure copper that is 20.0 cm long, when 1.00×10^3 V is applied to it? ($\rho = 1.72\times10^{-8}$ Ωm)

Q14: What is the resistance of a copper wire of length L =10.9 m and diameter d = 1.3 mm? The resistivity of copper is 1.72×10^{-8} Ω m.

Q15: What is the resistance of the 80.0 m standard copper wire with section area A = $5.2612 \times 10^{-6} m2$ $\quad \rho = 1.72 \times 10^{-8}\ \Omega m$

A) 0.26Ω B) 0.62Ω C) 0.88Ω D) 0.77Ω

Q16: The diameter of copper wire is 8.252 mm. Find the resistance of a 1.00-km length of such wire used for power transmission. $\rho = 1.72 \times 10^{-8}\ \Omega m$

A) 0.12Ω B) 0.22Ω C) 0.32Ω D) 0.52Ω

Q17: A voltage difference of (12.0 V) was applied between the two ends of a wire whose length is (1000 m) and its cross-sectional area is $4.5 mm^2$, a current of (3.20×10^{-3} A) flow through it , find the resistivity of the wire.

A) 1.72×10^{-8} Ωm B) 1.68×10^{-5} Ωm C) 7.12×10^{-8} Ωm D) 6.18×10^{-8} Ωm

Q18: What is the resistance of a copper wire that has length L = 70.0 m and diameter d = 2.60 mm? $\rho = 1.72 \times 10^{-8}\ \Omega m$

A) 0.119 Ω B) 0.139 Ω C) 0.163 Ω D) 0.22

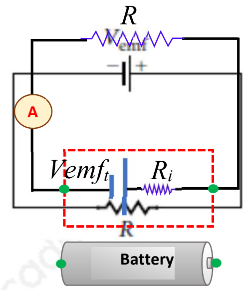
Q19: What is the resistance of the 100.0-m standard copper wire having a diameter of 2.053 mm that is typically used in wiring household electrical outlet

A) 0.52Ω B) 0.11 Ω C) 0.66 Ω D) 0.41 Ω

Q20: What is the resistance of a copper wire of length l = 10.9 m and diameter d = 1.3 mm? The resistivity of copper is 1.72×10^{-8} Ωm.

A) 0.141Ω B) 0.111 Ω C) 0.661 Ω D) 0.411 Ω

5.4: (Electromotive Force and Ohm's law):



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:

$$V_{emf} = i\,R_{eq}$$

*We will treat here **resistors as ohmic devices**; that is, devices that obey Ohm's Law.

*The **change in potential** is referred to as the **potential drop** across the resistor.

***Sources of emf** add potential difference to a circuit, and **potential drops** through resistors reduce potential in the circuit.

$\mathbf{V_t}$ is the **potential difference between the two terminals** of the emf source when the current is non zero (Note: $V_t \leq V_{emf}$)

Ther potential difference across a battery when no current flows is V_{emf}

*Ohm`s law for the simple circuit shown, where the battery has an internal resistance R_i is:

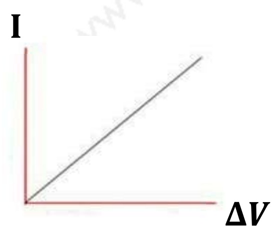
$$V_{emf} = i\,R_{eq} = i\,(R + R_i)$$

$i = V_t / R$

Types of resistors:

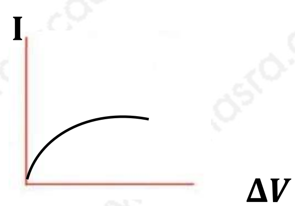
1- Ohomic resistor: (the current is directly proportional to the potential difference)

Like metallic conducting wire



2- Non- Ohomic resister: (The current has no direct proportionality with the potential difference.)

Like transistors and diodes



Rechargeable batteries also display a rating in mAh (milliampere-hour), which provides information on the total charge the battery can deliver when fully charged. The mAh is another unit of charge:

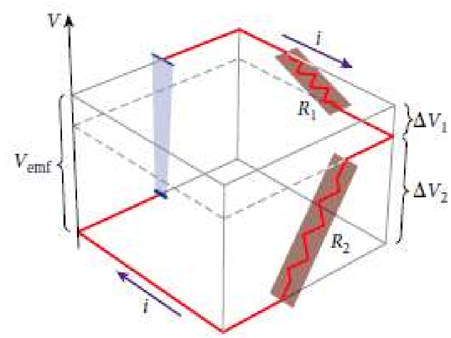
$1\,mAh = (10^{-3}\,A)(3600\,s) = 3.6\,As = 3.6\,C.$

Q21: A battery has a potential difference of 14.5 V when it is not connected in a circuit. When a 17.91 Ω resister is connected across the battery, the potential difference of the battery drops to 12.68 V . What is the internal resistance of the battery?

Q22: When a battery is connected to a 100 Ω resistor, the current is 4 A. When the same battery is connected to a 400 Ω resistor, the current is 1.01 A. Find the emf supplied by the battery and the internal resistance of the battery?

Q23: What are the relative values of the two resistances in the figure.

A) R1 < R2
B) R1 = R2
C) R1 > R2
D) Not enough information is given in the figure to compare the resistances.



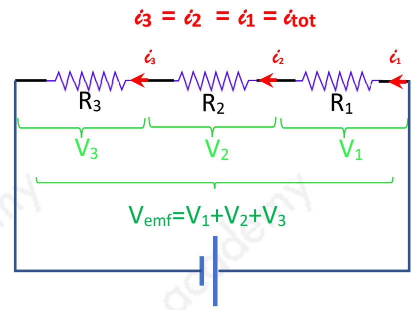
Resistance of the human body:

*For most people the human body resistance is in the range 500 kΩ < R_{body} < 2 MΩ. Most of this resistance comes from the skin, in particular, the layers of dead skin on the outside.

*However, if the skin is wet, its conductivity is increased, and, the body's resistance is lowered. *For a given potential difference, Ohm's Law implies that the current then increases.

*Handling electrical devices in wet environments or touching them with your tongue is thus a very bad idea.

5.5(Resistors in Series):



- Connection as shown in figure.

-All resistors in series group have the same current;

$$i_1 = i_2 = i_3 = \cdots \ldots . = i_{tot}$$

-The electric potential of each resistor is directly proportional to its resistance; $\Delta V \ \alpha \ R$

-The total potential equals the sum of the individual potentials;

$$\Delta V_{tot(seriesgroup)} = \Delta V_1 + \Delta V_2 + \Delta V_3 + \cdots \ldots \ldots$$

-The equivalent resistance equals the sum of the individual resistances;

$$R_{eq} = R_1 + R_2 + R_3 + \cdots \ldots$$

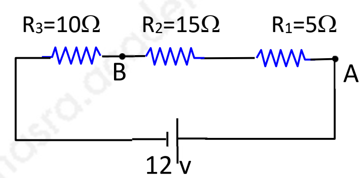
For identical resistance in series: $R_{eq} = nR$ (n: number of resistance)

Q24: In the figure shown three resistors are connected to a potential difference 12 V.

1- What is the equivalent resistance of the three resistors?

2- Calculate the current for each resistor.

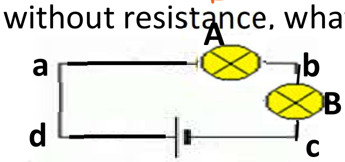
A) 50 Ω , 0.2A B) 30 Ω , 0.2A C) 30 Ω , 0.4A D) 50 Ω , 0.4A



Q25: A learner connected two lamps A and B as in the figure with a battery, and noticed that the brightness of lamp A is greater than the brightness of lamp B. Answer the following

1 **-**What does the difference in brightness of the two lamps indicate. $R_A > R_B$

2 **-**If the learner connects point b to point a with a connecting wire without resistance, what will happen to the brightness of each of the two lamps?



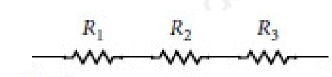
Q26: Three identical resistors, R_1, R_2, and R_3, are wired together as shown in the figure. An electric current is flowing through the three resistors. The current through R_2

A) is the same as the current through R_1 and R_3.

B) is a third of the current through R_1 and R_3.

C) is twice the sum of the current through R_1 and R_3.

D) is three times the current through R_1 and R_3.

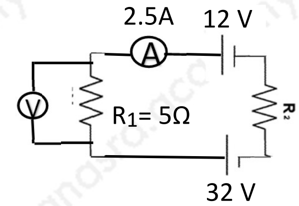


Q27: Which of the following is an incorrect statement?

A) The currents through electronic devices connected in series are equal.
B) The potential drops across electronic devices connected in parallel are equal.
C) More current flows across the smaller resistance when two resistors are in parallel connection.
D) More current flows across the smaller resistance when two resistors are in serial connection

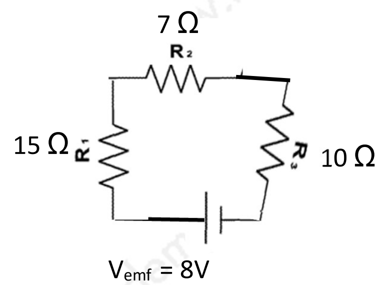
Q28: Depending to figure R_2 equal to:

A) 3Ω b- 5Ω C) 1Ω D) 2Ω



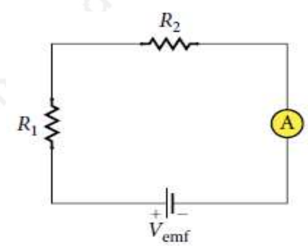
Q29: Depending to figure V_3 equal to:

A) 1.5V B) 2.5V C) 3.5V D) 4.5V



Q30: Two resistors, R1 = 3.00 Ωand R2 = 5.00Ω, are connected in series with a battery with Vemf = 8.00 V and an ammeter with RA = 1.00 Ω, as shown in the figure. What is the current measured by the ammeter

A) 0.5A B) 0.88A C) 1.5A D) 1A



Resistors in Parallel (5.6):

- Connection as shown in figure.

-All resistors in parallel group have the same electric potential (voltage);

$$V_1 = V_2 = V_3 = \dots\dots = V_{tot}$$

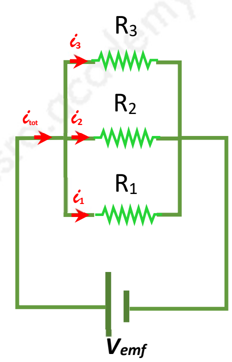
-The electric current in each resistor is inversely proportional to its resistance; $i \propto \frac{1}{R}$

-The total current equals the sum of the individual currents;

$$i_{tot(parallel\ group)} = i_1 + i_2 + i_3 + \dots\dots$$

-The reciprocal of the equivalent resistance equals the sum of reciprocals of the individual resistances;

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$$

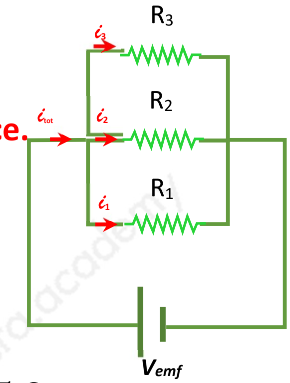


For identical resistance:

$R_{eq} = R / n$ (n: number of resistance)

Example:

Three resistors $R_1 = 1.00\ \Omega$, $R_2 = 2.00\ \Omega$, and $R_3 = 2.00\ \Omega$, are connected in parallel. The parallel connection is attached to a 3.00 V voltage source.



(a) What is the equivalent resistance?

(b) Find the current supplied by the source to the parallel circuit.

(c) Calculate the currents in each resistor and show that these add together to equal the current output of the source.

Solution:

(a) $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R} + \frac{1}{R_3} \Rightarrow \frac{1}{R_{eq}} = \frac{1}{1} + \frac{1}{2} + \frac{1}{2} \Rightarrow R_{eq} = 0.5\ \Omega$

(b) $i_{tot} = \frac{V_{tot}}{R_{eq}} \Rightarrow i_{tot} = \frac{3}{0.5} \Rightarrow i_{tot} = 6\ A$

(c) $i_1 = \frac{V_1}{R_1} \Rightarrow i_1 = \frac{3}{1} \Rightarrow i_1 = 3\ A$

$i_2 = \frac{V_2}{R_2} \Rightarrow i_2 = \frac{3}{2} \Rightarrow i_1 = 1.5\ A$

$i_3 = \frac{V_3}{R_3} \Rightarrow i_3 = \frac{3}{2} \Rightarrow i_3 = 1.5\ A$

$i_1 + i_2 + i_3 = 3 + 1.5 + 1.5 = 6\ A = i_{tot}$

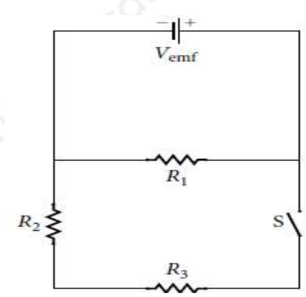
Note:

1- If one of the lamps burns out or is removed from its place, the brightness of the rest of the lamps will not be affected.

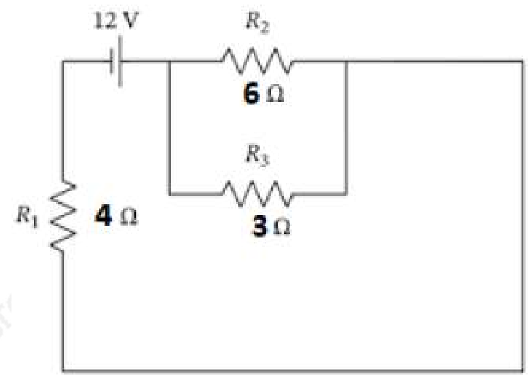
2- When adding a new lamp in parallel, the brightness of any lamp is not affected, and the value of the current passing through each lamp is not affected. However, the total current passing through the circuit increases because the equivalent resistance decreases:

Mixed connection circuitrs :

Q31: In the circuit in the figure, there are three identical resistors (R= 4 Ω). The switch, S, is initially open. When the switch is closed, find the current flowing in R_1, R_2 . V_{emf} = 12 V



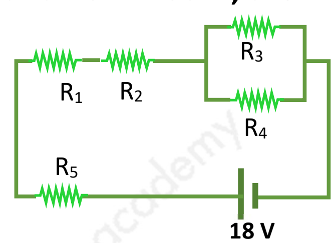
Q32: According to the circuit bellow:



A- Find the potential difference across R2.

B- Find the current in R3.

Q33: Five resistors R1 = 1.00 Ω, R2 = 2.00 Ω, R3 = 3.00 Ω, R4 = 6.00 Ω, and R5 = 4.00 Ω, are connected as shown in figure. 18.00 V battery is attached to group.



(a) What is the equivalent resistance?

(b) Find the current supplied by the source to the circuit.

(c) Calculate the voltage drop across each resistor.

Solution:

(a) $R_{34} = (\frac{1}{R_3} + \frac{1}{R_4})^{-1} \Rightarrow R_{34} = \left(\frac{1}{3} + \frac{1}{6}\right)^{-1} \Rightarrow R_{34} = 2\,\Omega$

$R_{eq} = R_1 + R_2 + R_{34} + R_5 \Rightarrow R_{eq} = 1 + 2 + 2 + 4 \Rightarrow R_{34} = 9\,\Omega$

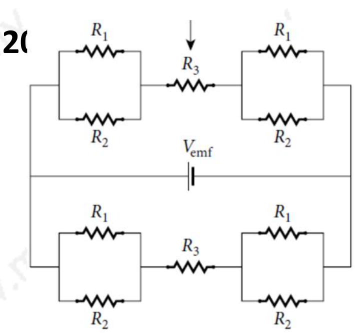
(b) $i_{tot} = \frac{V_{tot}}{R_{eq}} \Rightarrow i_{tot} = \frac{18}{9} \Rightarrow i_{tot} = 2\ A$

(c) $i_1 = i_2 = i_{34} = i_5 = i_{tot} = 2\ A$

$V_1 = i_1 R_1 \Longrightarrow V_1 = 2 \times 1 = 2\ V$ $\qquad V_2 = i_2 R_2 \Longrightarrow V_2 = 2 \times 2 = 4\ V$

$V_3 = V_4 = V_{34} = i_{34} R_{34} \Longrightarrow V_3 = V_4 = 2 \times 2 = 4\ V$ $\quad and \quad V_5 = i_5 R_5 \Longrightarrow V_5 = 2 \times 4 = 8\ V$

Q34: In the circuit shown in the figure, R₁ = 3.00 Ω, R₂ = 6.00 Ω, R₃ = 2(and V_{emf} = 12.0 V.



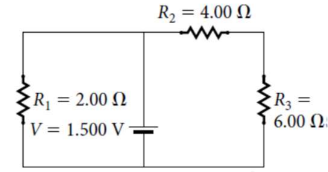
(a) Determine a value for the equivalent resistance.

(b) Calculate the magnitude of the current flowing through R₃ on the top branch of the circuit (marked with a vertical arrow)

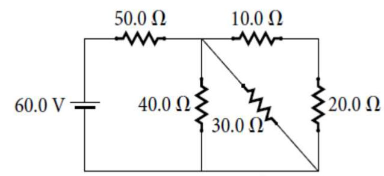
Q35: A battery with V = 1.500 V is connected to three resistors as shown in the figure.

(a) Find the potential drop across each resistor.

(b) Find the current in each resistor.



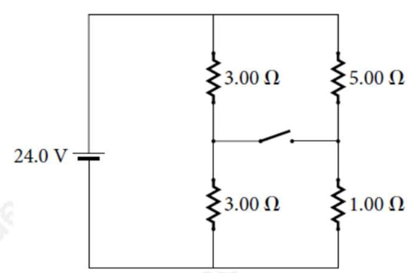
Q36: What is the equivalent resistance of the five resistors in the circuit in the figure?



Q37: What is the current in the circuit shown in the figure when the switch is

(a) open?

(b) closed?



5.7(Energy and Power in electric Circuits):

A battery must do work to drive charges dq, from the negative terminal to the positive terminal (within the emf device) equal to the increase in electric potential energy of that charge, d*U*.

$$dU = dq\Delta V = idt\Delta V$$

Using the definition of power:

$P = \frac{dU}{dt} = \frac{idt\Delta V}{dt} = i\Delta V$ (The power is the rate of dissipated or produced energy)

This work is stored as electric potential energy:

P = U/ t . the unit of power is W (J/S)

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

Electrical Energy cost :

Cost = P(KW) × t(h) × Rate

(**1 KW.h=3.6×106 J)**

Q38: A DC winch motor is rated at 20 A with a voltage of 115 V. What is the power consumed by the motor?

A) 2300W B) 1300W C) 3300W D) 200W

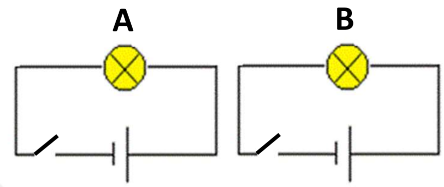
Q39: A flashlight has a light bulb filament resistance of 8 Ω and a battery voltage of 6 V. Calculate the power that the lamp puts out when it is turned on.

A) 4.5W B) 8W C) 1.5W D) 10W

Q40: A flashlight has a light bulb filament resistance of 8 Ω and a battery voltage of 6 V. Calculate:

1- The power that the lamp puts out when it is turned on.
2- If you were asked to replace the device's light bulb with another so that the device lights up for a longer period without changing the battery, would you replace it with a lamp whose filament resistance is greater or less than 8 Ω, and mention the reason.

Q41: Using the figure, when the two switches are closed at the same moment, lamp A lights up for a period of time less than B before it goes out. If the two batteries are the same, compare the resistance of the two lamps with the explanation.



Q42: How much money will a homeowner owe an electric company if he turns on a 100 W incandescent light bulb and leaves it on for a hole year. Assume that the cost of electricity is 0.12AED /Kwh.?

Q43: A TV is used to watch a football game for 1.5 h. If the device resistance 20Ω and operates at 220 V, suppose the cost of electricity is 25 fils per Kw.h . How much money will be paid to watch the game?

Choose the correct answer:

1)If the current through a resistor is increased by a factor of 2, how does this affect the power that is dissipated?

□ It decreases by a factor of 4. □ It increases by a factor of 2.
□ It decreases by a factor of 8. □ It increases by a factor of 4.

2)You make a parallel combination of resistors consisting of resistor A having a very large resistance and resistor B having a very small resistance. The equivalent resistance for this combination will be:

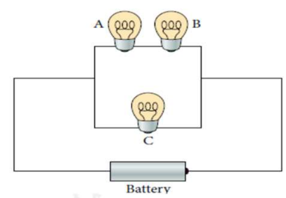
□ slightly greater than the resistance of the resistor A.
□ slightly less than the resistance of the resistor A.
□ slightly greater than the resistance of the resistor B.
□ slightly less than the resistance of the resistor B.

3)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 and A_2?

□ $A_1/A_2 = 2$ □ $A_1/A_2 = 4$ □ $A_1/A_2 = 0.5$ □ $A_1/A_2 = 0.25$

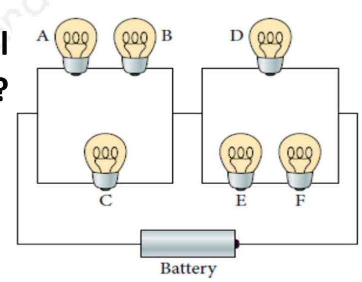
4)All three light bulbs in the circuit shown in the figure are identical. Which of the three shines the brightest?

□ A and B □ A □ B □ C

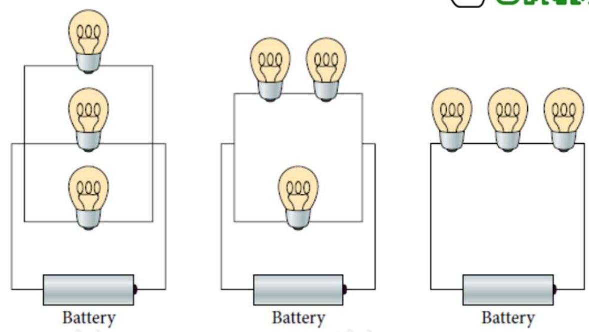


5) All of the six light bulbs in the circuit shown in the figure are identical Which ordering correctly expresses the relative brightness of the bulbs? (Hint: The more current flowing through a light bulb, the brighter it is!)

□ A = B > C = D > E = F □ C = D > A = B = E = F
□ A = B = E = F > C = D □ A = B = C = D = E = F

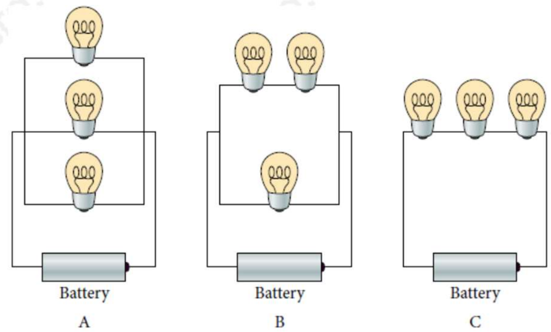


6) Which of the arrangements of three identical light bulbs shown in the figure draws most current from the battery?



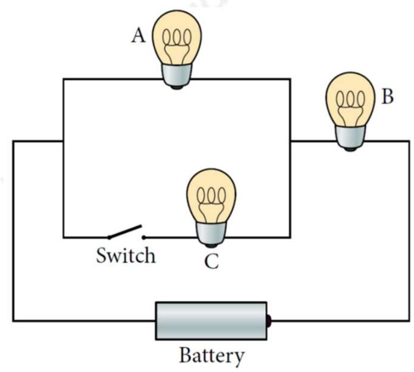
□ A □ B
□ C □ A and C

7) Which of the arrangements of three identical light bulbs shown in the figure has the highest resistance?



□ A □ B
□ C □ A and C

8) Three identical light bulbs are connected as shown in the figure. Initially the switch is closed. When the switch is opened (as shown in the figure), bulb C goes off. What happens to bulbs A and B?



□ Both bulbs A and B get brighter.
□ Both bulbs A and B get dimmer.
□ Bulb A gets dimmer, and bulb B gets brighter.
□ Bulb A gets brighter, and bulb B gets dimmer.

9) Which of the following wires has the largest current flowing through it?

□ a 1-m-long copper wire of diameter 1 mm connected to a 10-V battery
□ a 0.5-m-long copper wire of diameter 0.5 mm connected to a 5-V battery
□ a 2-m-long copper wire of diameter 2 mm connected to a 20-V battery
□ a 1-m-long copper wire of diameter 0.5 mm connected to a 5-V battery
□ All of the wires have the same current flowing through them.

10) Ohm's Law states that the potential difference across a device is equal to

□ the current flowing through the device times the resistance of the device.
□ the current flowing through the device divided by the resistance of the device.
□ the resistance of the device divided by the current flowing through the device.
□ the current flowing through the device times the cross-sectional area of the device.
□ the current flowing through the device times the length of the device.

11) Which of the following is an incorrect statement?

□ The currents through electronic devices connected in series are equal.

□ The potential drops across electronic devices connected in parallel are equal.

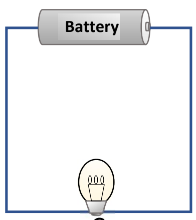
□ More current flows across the smaller resistance when two resistors are in parallel connection.

□ More current flows across the smaller resistance when two resistors are in serial connection.

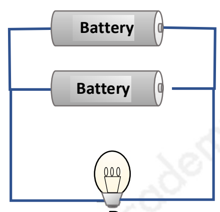
12) Identical batteries are connected in three different arrangements to the same light bulb as shown in the figure. Assume that the batteries have no internal resistance. In which arrangement will the bulb shine the brightest?

□ A □ B □ C

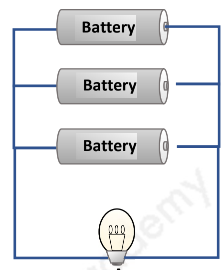
□ The bulb will have the same brightness in all three arrangements.



C



B

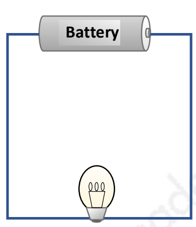


A

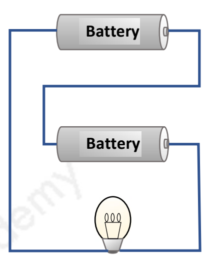
13) Identical batteries are connected in three different arrangements to the same light bulb as shown in the figure. Assume that the batteries have no internal resistance. In which arrangement will the bulb shine the brightest?

□ A □ B □ C

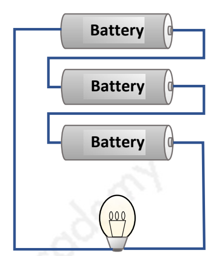
□ The bulb will have the same brightness in all three arrangements.



C



B



A

14) The electric resistance of the human body is very high:

□ when the body is wet

□ if the skin is dry

□ when touch electric wires with tongue

□ if sharp electric wire penetrates the skin

15)For resistors in series, which of the following is always true?

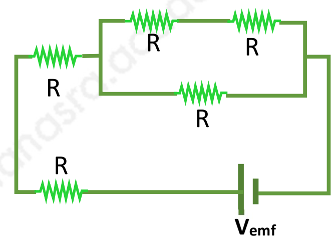
□ potential difference is the same for each one of the resistors in series.

□ the equivalent resistance is less than that of any individual resistance.

□ the total current is distributed in inverse ratios between resistors in series.

□ the total potential difference is distributed in direct ratios between resistors in series.

16) In the figure shown, the equivalent resistance for the group is:



□ $\frac{21\,R}{8}$ □ $\frac{8\,R}{3}$

□ $\frac{R}{2}$ □ $\frac{6\,R}{5}$

17) Filament bulb whose resistance is 8.0 Ω operating under a potential difference of 4.5 V. What is the intensity of the current passing through the lamp?

□ 0.56 A □ 9.4 A □ 1.8 A □ 36 A

18) What is the potential difference between the two terminals of a 5.0 Ω resistor with a current 5.0 A?

□1.0 V □ 10.0 V □ 25.0 V □ 1.0×10^{2} V

19) Which of the following affects the resistance of a wire?

□ Length □ Temperature □ Type □ All of the above

20) The rated power recorded on light bulbs measures:

□ rate of energy released in the form of heat and light

□ the density of the charge carriers

□ the potential difference that they need

□ the amount of negative charge passing through it

21) What is the current flowing in a 75 W filament bulb that operates at 120 V?

□ 9.0×10^{3} A □ 1.6 A □ 1.95×10^{2} A □ 0.63 A

22) When the current passing through a circuit -with a constant resistance- is tripled, by which factor does the power change?

□ $\frac{1}{9}$ □ $\frac{1}{3}$ □ 3 □ 9

23) In a cathode ray tube, the electron beam current is 7.5 x 10^{-5} A. What is the amount of charge that hits the screen during 5.0 s?

□ 5.3×10^{-6} C □ 5.6×10^{-2} C □ 3.8×10^{-4} C □ 2.8×10^{-3} C

24) Filament bulb with 240 Ω resistance operates at a potential difference of 120 V. How strong is the current passing through it?

□ 0.20 A □ 0.50 A □ 1.0 A □ 2.0 A

25) Which of the following wires have the largest resistance?

□ aluminum wire 10 cm length, 3 cm radius

□ aluminum wire 10 cm length, 5 cm radius

□ aluminum wire 5 cm length, 3 cm radius

□ aluminum wire 5 cm length, 5 cm radius

26) A current of 4.00 A passes through a 5.00 × 10^2 W heater. What is the potential difference between the two ends of the heater?

□ 8.00×10^{-3} V □ 2.50×10^{1} V □ 1.25×10^{2} V □ 2.00×10^{3} V

27) A current of 6.0 A passes through a 325 W heater. What is the resistance of the heater?

□ 4.5Ω □ 9.0 Ω □54 Ω □ 88 Ω

28) What is the potential difference between the two ends of the lamp whose resistance is 136Ω when operating at the power of 1.00 × 10^2 W?

□ 220 V □ 136 V □ 125 V □ 117 V

29) An 80.0 W power filament bulb whose resistance is 45 Ω. what is the current passing through the filament bulb?

□ 0.56 A □ 0.75 A □ 1.3 A □ 1.8 A