CHAPTER **(7)**

ELECTRICITY

Electricity:

Static electricity: is a familiar electric phenomenon in which charged particles are transferred from one body to another. For example, if two objects are rubbed together, especially if the objects are insulators and the surrounding air is dry, the objects acquire equal and opposite charges.

- Static electricity is the result of an imbalance between negative and positive charges in an object. These charges can build up on the surface of an object until they find a way to be released or discharged. One way to discharge them is through a circuit.

- A Van de Graff generator pulls electrons from the Earth, moves them along a belt and stores them on the large sphere. These electrons repel each other and try to get as far away from each other as possible, spreading out on the surface of the sphere. ... It provides a conven-ient path for electrons to move to the ground.

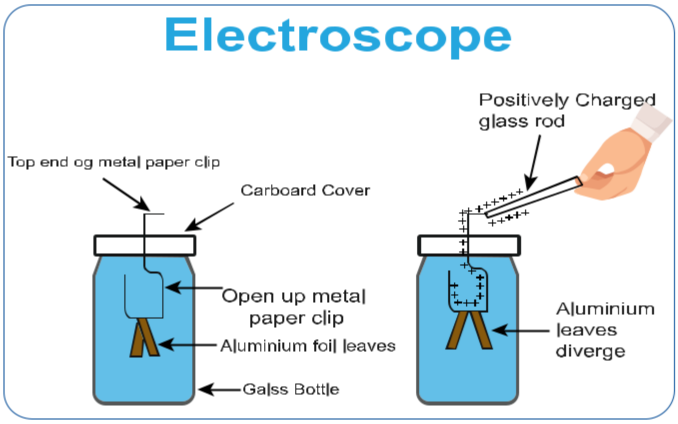
- Electric charging methods:
  1. Friction: (Rubbing) charge the neutral object by rub-bing it with other object, as rubbing plastic rod with piece of wool.
  2. Conduction: charge neutral object by contacting it with other charged object.
  3. Polarization or induction: charge neutral object with-out contact.
  4. The neutral atom: Number of electrons (-) = Number of protons (+).

Electroscope or charge detector:

- Used to detect the charged objects and estimate the type of charge.

- When the charged object carries the same type of the telescope's charge then the two leaves repel more and separation distance increases.

- When the charged object carries different type of the telescope's charge then the two leaves attract more and the separation distance decreases.



$q=ne$

The electric charge:

- The electric charge of any object is quantized and that means: the charge of the object is multiple of the elec-tron's charge $1.6x10^{-19}$C
- The charge of an object could be $3.2x10^{-19}$ or $4.8x10^{-19}$ C . And can be $6.4x10^{-19}$ C
- determined by using the equation: $q=ne$
- Q is the charge on an object [C], n is the number of electrons (integer number), and e is the electron 's charge [C].

7.1 The sound (bang) that we hear when we walk on a rug, due to .... Charging.

A Conduction
B Friction
C Grounding
D polarization

7.2 The charging of an object without contact is ....charging.

A Conduction
B Friction
C Grounding
D polarization

3. In the neutral atom

A Number of protons= Number of neutrons
B Number of electrons = Number of Neutrons
C Number of protons= Number of electrons
D Atomic number = Mass number

4. If the two leaves of charged electroscope repel more, then the object and the electroscope are

A Charged with the same charge
B Charged with two different charges
C Uncharged
D Only one of them is charged

5. A teacher asked his students to find out the amount of electric charge for an object, only one answer is correct.

A 10×10^{-19} B 5×10^{-19}
C 4.4×10^{-19} D 3.2×10^{-19}

Solution:

Any charge must be multiple of the charge of electron = 1.6 x 10^{-19} C 1.6 x 10^{-19} x 2 = 3.2 x10^{-19} C the answer is D.

6. How much is the charge of an electroscope, when the extra electrons are.

A 4.8×10^{10} B 7.7×10^{-9}
C 3.3×10^{-3} D 1.3×10^{-2}

7. If additional electrons gather on a neutral object, then the charge of this object is Coulomb

A $+6.4\times10^{-14}$ B $+0.4\times10^{-14}$
C -6.4×10^{-14} D -0.4×10^{-14}

Coulomb's law:

- The electrostatic force between two charges is directly proportional with the magnitude of the two charges and inversely proportional with the squared of the separation distance between two charges.

$$F = k\frac{q_1q_2}{r^2}$$

F is the electrostatic force [N], k is coulomb's constant [N.m/s2], q1 is the first charge [C], and q2 is the second charge [C], r is the distance between the two charges [m].

8. If the electrostatic force between two charges q 1, q2 is $F=k\frac{q_1q_2}{r^2}$ and the distance increased for doubles the original, the new force equals.

A $F=qvB$ B $\frac{F}{2}$
C $\frac{F}{4}$ D $2F$

9. The electrostatic force in Newton that is exerted by a charge of (4×10^{-9} C) on a test positive charge (1 C) and 1m far, the Coulomb constant is $9\times10^{9}\ N\cdot m^2/C^2$

A 4×10^{-9} B 4
C 36×10^{-9} D 36

Solution:

F = Kq_1q_2/r_2 = 9x10^9 x4x10^{-9}x1 / 1^2 = 36N , answer is D.

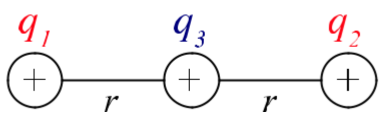
10. A positive charge(5 μC) is 30cm far from a negative charge $-4\mu C$ how much is the electrostatic between them $K=9\times10^9 Nm^2/C^2$

A 30 N B 20 N
C 3 N D 2 N

11. If the affected force on a 3x10^{-9} C charged object, and affected by another charged object 3 cm far away is 12x10^{-5}N, the charge of the second object equals $K=9\times10^9 Nm^2/C^2$

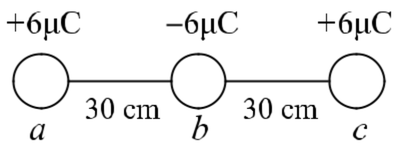
A 4×10^{-9} B 4×10^{-5}
C 4.5×10^{2} D 1.3×10^{3}

12. In the chart, the sum of forces that affected the charge q_3 which is in the middle between the two equal charges $q_1 q_2$



A 0 B Kq^2/r
C Kq^2/r^2 D $2Kq^2/r^2$

13. How much is the force that affects the charge b in the chart (N)?



A -3.6 B 0
C 3.6 D 0.036

The test charge:

The charge that is used to measure the electric field strength is referred to as a test charge since it is used to test the field strength. The test charge has a quantity of charge denoted by the symbol q. It is small and positive.

The electric field:

A region around a charged particle or object within which a force would be exerted on other charged particles or objects.

$$E = \frac{F}{q}$$

F is the electric force [N], E is the electric field [N/C], q is the electric charge [C].

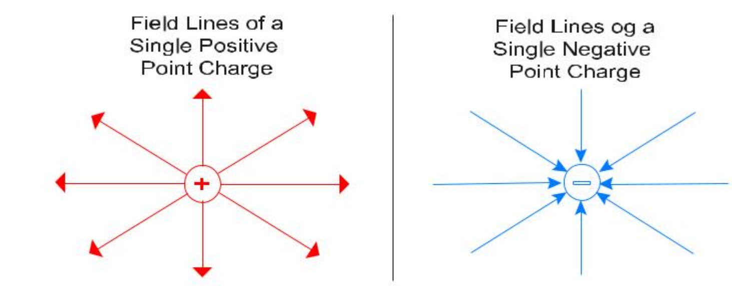
- To determine the electric field for the point charge at distance r from it:

$$E = k\frac{q}{r^2}$$

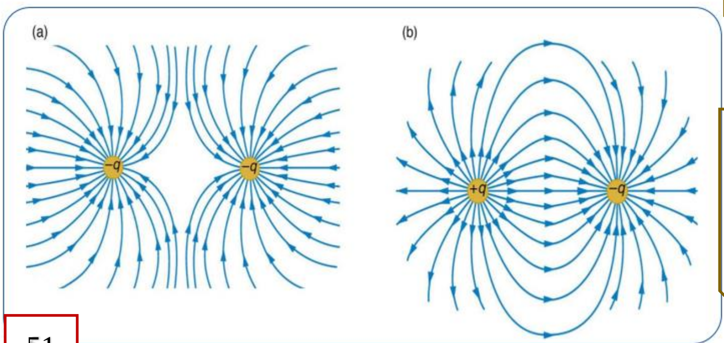
E is the electric field [N/C], k is coulomb's constant [N.m2/C2], q is the point charge [C] r is distance be-tween the charge and the point [m].

The electric field:

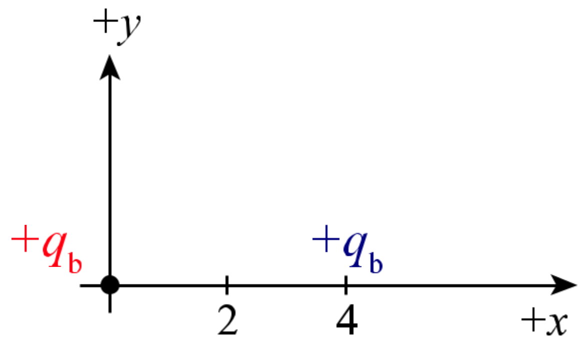
- The electric field lines are used to represent the actual electric field in the vacuum or any medium that surround the charge.
- Going out from the positive charge and coming in the negative charge.
- The electric field lines don't intersect.
- The electric field lines that produced form two charges or more are curved.



The above two charges are assumed in finitely far from each other



14. **In the chart, at which point on x axis we can put a third positive charge, so the sum of forces equals zero?** $q_b \neq q$



A $x > 4$ B $x < 0$
C $0 > x > 4$ D $X<0$ TO $X>4$

15. The test charge in the electric field must be

A Small and positive B Small and negative
C Large and positive D Large and negative

16. How much is the electric force that exerted on an electron (its charge is 1.6 x 10-19 C) and existed in electric field 200 N/C.

A $8\times10_{-22} N$ B $1.3\times10^{21} N$
C $3.2\times10_{-17} N$ D $3.2\times10^{17} N$

Solution:

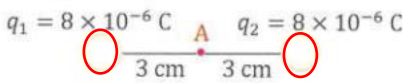
F = qE = 1.6x 10-19 x 200 = 320 x 10-19
= 3.2 x 10-17 C , Answer is C

17. A point is 0.002m far from a (4×10^{-6} C) charge in space, calculate the electric field
K = $9\times10^{9} N{\cdot}m^2 / C^2$

A 18×10^{6} N/C B 9×10^{9} N/C
C 18×10^{-6} N/C D 18×10^{-9} N/C

7.18 In the figure below, How much is the electric field affects at point A?

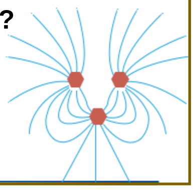
A 0 B 2×10^{6} N/C
C 21×10^{2} N/C D 8×10^{7} N/C



19. The electric field lines go from.

A Positive to positive charge
B Positive to negative charge
C Negative to positive charge
D Negative to negative charge

20. In the chart, there are three charges q1, q2, q3, what are their charges respectively?



A +,+,-
B -,-,+
C +,-,-
D +,-,+

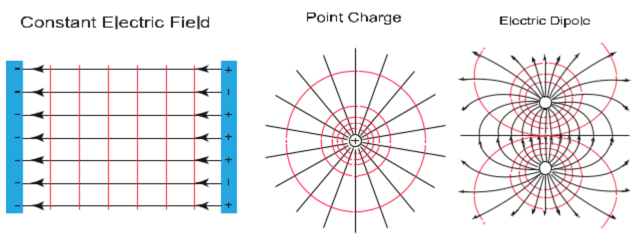
Applications of the electric field:

The electric potential difference: is the ratio of the work required to move a charge to the magnitude of this charge. And measured in volt [V].

$$\Delta V = \frac{W}{q}$$

ΔV is the electric potential difference [V], W is the work [J], q is the electric charge [C].

- Equipotential surface: is the collection of points in space that are all at the same potential.



Dashed lines are equipotential lines while solid lines are electric field lines.
Click on one of the diagrams for further detail

Example: The circular path around single point charge as shown above.

The electric potential in uniform electric field:

- The electric potential V near to the positive plate is greater than the potential neat the negative plate.
- The electric potential increases in the opposite direction of the electric field.
- To measure the electric potential in uniform electric field: $\Delta V = Ed$
- ΔV is the electric potential difference [V], E is the electric field [N/C] or [V/m], d is the separation distance between the two points or plates [m].

21. The ratio of the work required to move a charge to the magnitude of this charge is.

A Electric force
B Electric field
C electric potential
D Electrical capacity

22. The unit J/C equals.

A Volt (V)
B Tesla (T)
C Ampere (A)
D Newton (N)

23. The work that is needed to move a 4C charge in 200 V electric potential difference is.

A 25J
B 800J
C 8000J
D 80000J

Solution:

W = qV = 4 x 200 = 800 J , Answer is B

24. How much is the work done (Joule) to move a 5 C charge in 2.5V electric potential difference?

A 2
B 2.5
C 7.5
D 12.5

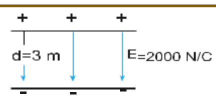
25. An example of equipotential surfaces around single point charge is the.

A Elliptical path
B Circular path
C Oval path
D Parabola path

26. If the distance between two parallel charged plates is 0.75 cm, and the electric field is 1200N/C, how much is the electric potential difference between the plates (Volte)?

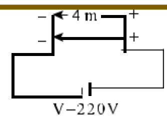
A 1600
B 900
C 16
D 9

27. Find out the electric potential difference in the chart



A 6000 V
B 3000 V
C 600V
D 300 V

28. Find out the electric field between the two plates in the chart.



A 55N/C
B 550 N/C
C 890 N/C
D 1300 N/C

Distribution of charges:

- When a conductor charged sphere just be in contact with other neutral sphere with same size, then the charges transfer from the charged sphere which has greater electric potential V to the neutral sphere which has less electric potential V until the charges distribut-ed equally on both spheres.
- When to charged spheres have the same charge but dif-ferent in volume be in contact, then the charges trans-fer from the smaller sphere which has greater electric potential to the bigger sphere which has less electric potential until the potential on two spheres become the same. Oblem:

Practice problem:

Two metal spheres are electrically charged. One of them carries +6 μC and the other −12 μC. The two spheres are carefully brought in contact and then separated. What is the new charge on each sphere if the spheres are the same size?

Solution:

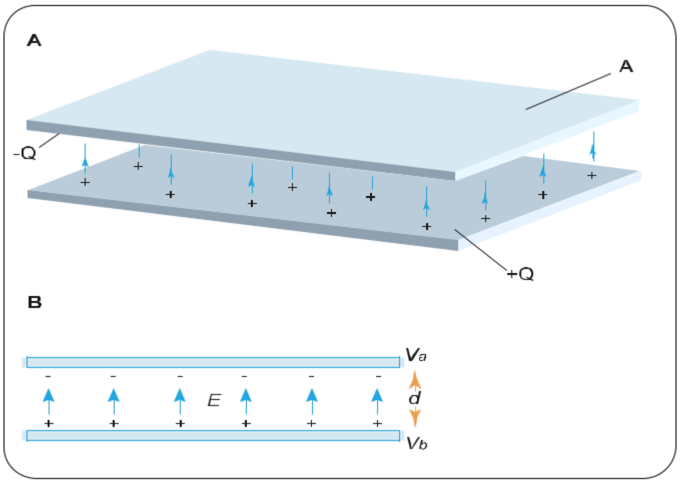
With two spheres of equal size, the total charge will try to distribute itself evenly between them. The positive charg-es are repelled by one another and try to get as far apart as possible. The negative charges behave the same way. They best strategy for maximizing separation is to send half your members to one sphere and half to the other. Since neither sphere is more "attractive" than the other, the separation should be an even one. On the whole, we have…
Qnet = (+6 μC) + (−12 μC) = −6 μC

of charge that will separate evenly into to batches of:

$$Q_1 = Q_2 = \frac{-6}{2} = -3\mu C$$

The electric charges storage:

The electric capacitor: Capacitor, device for storing elec-trical energy, consisting of two conductors in close prox-imity and insulated from each other. A simple example of such a storage device is the parallel-plate capacitor.



- Used to store the electric charges.
- It is represented in electric circuits as:

- The capacitance: is the ratio between the amounts of charge on one of the plates to the potential difference between the two plates. And depends on the geometri-cal dimensions of the capacitor.
- The capacitance increases as

1. The area of the plates increases.
2. The separation distance between the plates decreases.
3. The dielectric constant for the medium between the plates increases.

- To measure the capacitance:

$$C = \frac{q}{\Delta V}$$

C is the capacitance [Farad] [F], q is the charge in one plate [C], is the potential difference [V].

- Farad [F] = [C/V]

29. The charges transfer between two contacts objects if they have.

A. Equal spaces
B. Different spaces
C. Equal electric potentials
D. Different electric potentials

30. If two spheres have the same charge and differ-ent volume, get in contact, so.

A. each sphere keeps its charge, because they are equal
B. The charge transfers from the bigger sphere to the smaller one, because they have the same electric potential
C. The charge transfers from the smaller sphere to the bigger one, because they have different electric potential
D. All the charge transfers to the bigger sphere

31. The electric capacitor is used for:

A Storing electric charges
B Decreasing the potential
C determine the potential
D Storing power

32. The electric capacitor is represent as.

A 
B 
C 
D 

33. The capacitance represents.

A The amount of electric charge that is saved at specific electric potential
B The current intensity that flows through the resistance
C The ability of an electric instrument
D The number of electrons in power packs

34. The capacitance in the capacitor depends on.

A The geometric dimensions of capacitor
B The electric potential between the two plates of capacitor
C The charge of the capacitor
D All the above

35. How much is the charge of a capacitor (its capacity is 6 μF, electric potential between the plates 30 V)?

A 5 μC
B 180 μC
C 5 C
D 180 C

Solution:

Q= CV = 6 x 10^{6} x 30 = 180 X 10^{6} = 180 μC, Answer is B

36. The Farad equals.

A C-V
B C/V
C C-V²
D C/V²

The current electricity:

- Electric current: any movement of electric charge car-riers, such as subatomic charged particles.
- Conventional current: Physicists consider current to flow from relatively positive points to relatively negative points. Or the flow of the positive charges.
- Current: is the rate of electric charge flow and given as:

$$I = \frac{q}{t}$$

Electric power and energy:

Electric power: is the rate of converting energy

$$P = IV$$

$$P = I^2V$$

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

Where I is the electric current [A], V is the voltage or elec-tric potential [V], P is the power [W], and R is the resist-ance [ ].

- The dissipated power in conductor is directly propor-tional with the squared current and resistance,
- Kilowatt . hour is amount of power 1000 watt continued for 1 hour [3600 s] and it is equivalent to 3.6×10^6

37. The flows of positive charges from the positive plate to the negative plate is.

A voltage
B Conventional current
C Electric force
D Electric potential energy

38. Calculate the electric current in a wire, if a 3 C charge flows in it in 6 s.

A 0.5 A
B 2 A
C 9 A
D 18 A

Solution:

I = Q/t = 3/6 = 0.5 A, Answer is A

39. **The Amber equals.**

A C·s
B C/s
C C·V
D C/V

40. **The rate of converting energy is.**

A Energy
B Electric Power
C Electric current
D Voltage

41. **The dissipated power in conductor is proportional**

A Inversely with resistance and directly with squared current
B Directly with resistance and inversely with squared current
C Inversely with both resistance and squared current
D Directly with both resistance and squared current

42. **A lamp is 5 W power and 20 V voltage, so the electric current is …… Amper.**

A 0.025
B 0.25
C 25
D 2.5

43. **A lamp is 5.5 W power and 220 V voltage, so the electric current is …… Amper.**

A 0.025
B 0.25
C 100
D 1000

Electrical energy:

Depends on: the electric charge and the potential difference between the two points.

$$E = Pt$$
$$E = IVt$$
$$E = I^2Rt$$
$$E = \frac{V^2}{R}t$$

Where E is the electric energy [J], P is the power [W], t is the time [s], I is the current [A], V is the voltage [V], and R is the resistance [ ].

44. **Calculate the electric potential in a 1100 watt power, if the current is 5 A.**

A 44 V
B 110 V
C 220 V
D 5500 V

45. **An electric lamp has 4Ω resistance, flows in it 2 A current, so its electric power is.**

A 1 W
B 4 W
C 16 W
D 64 W

46. **Calculate the electric current in a 16 W power and 4 Ω resistance.**

A 2 A
B 4 A
C 20 A
D 64 A

Solution:

$P=I^2R$

$16 = I^2 \times 4$

$I^2 = 16/4 = 4$, $I = 2$ A , Answer is A

47. **If a 5 mA electric current flows in 50 Ω resistance, so the dissipated power equals Watt.**

A 2.5×10^{3}
B 2.5×10^{-3}
C 1.25×10^{-3}
D 1×10^{-3}

48. **A 5 kilo Watt.Hour equals a power of.**

A 1 Watt for 5 hours
B 1000 Watt for 1 hour
C 5000 Watt for 5 hours
D 5000 Watt for 1 hour

49. **An electric lamp has 60 W power, 12 V voltage, so the resistance of it is.**

A 24 ohm
B 7.2 ohm
C 2.4 ohm
D 0.2 ohm

50. **Saad used an electric lamp its power is 0.1 kW for 12 h, calculate the dissipated power (kW·h).**

A 120
B 12
C 1.2
D 0.12

51. **A battery (12 V voltage), How much time does it need to produce 600J energy in a circuit flows in it 0.5A current ?**

A 0.01
B 6
C 100
D 3600

52. A house of five rooms, each room has 5 lamps, each lamp is 100 W power, if all the lamps light-ed for one minute, how much is the dissipated power (Joule)?

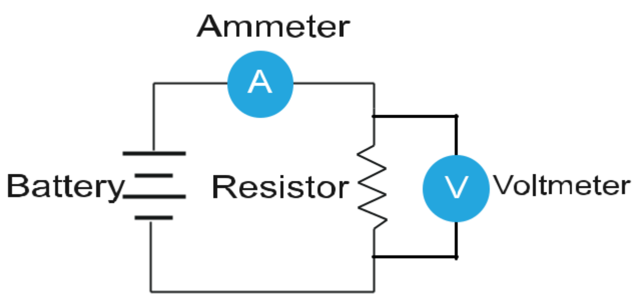
A 0.3 k   B 3 k
C 30 k   D 300 k

Ammeter and voltmeter:

- Ammeter: is a device that used to measure the current intensity in the circuits.
- Voltmeter: is a device that used to measure the poten-tial difference (voltage).

Ohm's law:

- The strength of a direct current is directly proportional to the potential difference and inversely proportional to the resistance of the circuit. (At constant temperature).
- The simple electric circuit that used to satisfy Ohm's law:



- Represented by the formula:

$$V \alpha I$$

$$R = \frac{V}{I}$$

Where R is the resistance [ ], V is the voltage [V], I is the current [A].

- To increase the current intensity in a resistance, the potential difference must be increased and reduce the resistance.

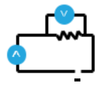
53. A device that used to measure the potential difference (voltage).

A Ammeter   B Voltmeter
C Ohmmeter   D Galvanometer

54. The strength of a direct current is directly pro-portional to the potential difference at constant temperature.

A Joule's Low   B Ohm's Low
C Hook's Low   D Boyle's Low

55. Which circuit satisfies Ohm's Low?

A 
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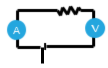
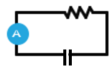
C 
D 

56. Ohm's Low states that.

A Vα1/R   B V α t
C V α I   D Vα1/I

57. If you connect a battery (voltage 40 V) with a resistance (20 Ω), so the current that flows in the circuit is……… Amper.

A 2   B 8
C 20   D 0.5

Solution:

V=IR
40=20I
I = 40/20 = 2 A , Answer is A

58. A resistance 2 Ω , its potential difference is 9 V, the current flows in it is.

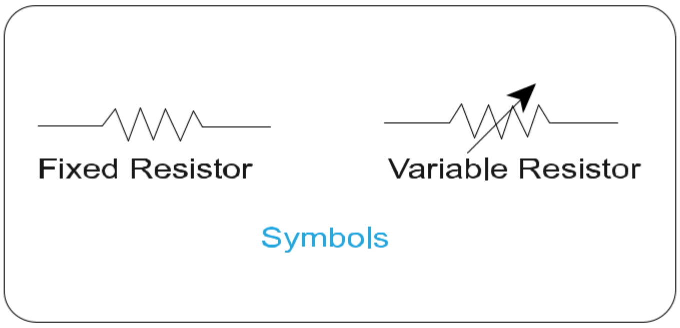
A 2 A   B 4.5 A
C 11 A   D 18 A

59. To increase the electric current in a circuit.

A Increase voltage and resistance together
B Increase voltage, decrease resistance
C Decrease voltage and resistance together
D Decrease voltage, increase resistance

The electrical resistance:

- Resistance is a measure of the opposition to current flow in an electrical circuit. Resistance is measured in ohms, symbolized by the Greek letter omega (Ω).
- Types of resistance:
- Fixed Resistors and Variable Resistors.

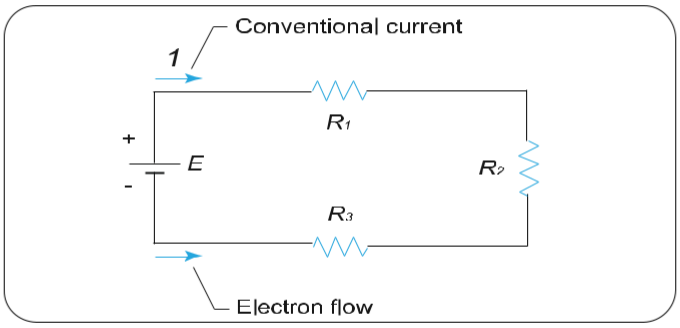


- The resistance of a conductor depends on:
  1- The length of the conductor: resistance increases as length increased.
  2- The cross sectional area: resistance decreases as the cross sectional area of the conductor increased. 3- Temperature: resistance increases as the temper ature of the conductor increased. Because the num ber of collision between the electrons in the conduc tor increased.
  4- The type of conductor's matter.

Resistance is used to control in the current intensity that passes through the electric circuits or any specific part of it.

Series electric circuit:

- Series circuit: a path along which the whole current flows through each component.



- The equivalent resistance or (Resultant resistance) for series is given as:
  $R = R_1 + R_2 + R_3 + ... + R_n$
- R is the resultant resistance [Ω], R1, R2, and R3 are resistors of the circuit [Ω].
- In series: the equivalent resistance is greater than the any single resistance in the circuit.

60. The ratio of potential to electric current is.

A Electric capacity
B Electric power
C ctric resistance
D ctric energy

61. This  **symbols.**

A Fixed resistor
B Variable resistor
C Capacitor
D Prompt

62. The electric resistance of a conductor is inversely proportional with its

A Length
B Cross sectional area
C Temperature
D Type of matter

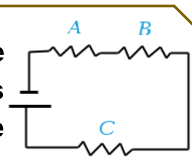
63. The resistance of the conductors increases as the temperature increases because of:

A The mobility of atoms decreases
B The number of atoms increases
C The collisions of electrons increase
D The number of electron decreases.

64. The variation resistance is used in electric circuits to control

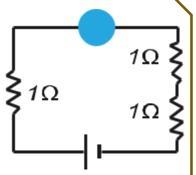
A Current
B Potential difference
C Time of current flow
D Electromotive force.

65. Three resistors A, B, and C are connected in electric circuit as shown in the figure, what is the type of this connection?



A All connected in series
B A and B on series and C on parallel
C All connected on parallel
D A and B on parallel and C on series.

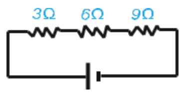
66. A student connected three resistors with lump as shown in the figure, but his partner told him that " I can connect the lump with one resistor to get the same illumination but the resistance must be equal to:



A 1 Ω B 2 Ω
C 3 Ω D 0.3 Ω

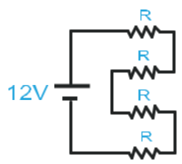
67. The equivalent resistance in the given circuit is:

A 18 Ω B 9 Ω
C 3 Ω D 1.63 Ω



68. The equivalent resistance in the given circuit is:

A R/4 B 48/R
C 4/R D 4R



69. Three resistors are connected on series, the smallest one is 1 Ω and the biggest one is 5 Ω, then the equivalent resistance is

A Less than 1 Ω B Equals to 1Ω
C Equals to 5 Ω D Greater than 5 Ω

70. When 5 different resistors are connected in series, then the current in each is:

A The same and the voltage of each resistor is the same.

B Not the same but the voltage of each resistance is the same.

C The same but the voltage of each resistance is not the same.

D Not the same and the voltage of each resistance is not the same.

Electric potential drop in series circuit:

- To measure the potential drop, use the relation

  $V = IR$

  V is the potential drop [V], I is the current [A], and R is the resistance [Ω].

- The voltage drop or potential drop for the equivalent resistance in series circuit equals to the sum of poten-tials of resistors in the circuit.

  $V=V_1+V_2+V_3+ \ldots$

  V is the potential drop in the equivalent resistance [V], V1, V2 and V3are the drop in potential for each single resistance in the circuit [V].

71. What is the voltage of battery in the shown circuit?

A 6 V B 9 V
C 12 V D 24 V

Solution:

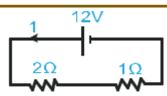
$R_{eq} = R_1 + R_2 + R_3 = 2 + 3 + 3 = 8\ \Omega$

$V = IR_{eq} = 3 \times 8 = 24$ V , Answer is D.

72. Two resistors R1 and R2 are connected in series, then the current that passes in the cir-cuit can be determined as:

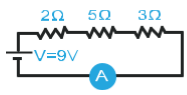
A $I = V(R_1 + R_2)$ B $I = R_1R_2/V$
C $I = V/R_1R_2$ D $I = V/(R_1 + R_2)$

73. The current that passes in the following circuit equals:



A 18 A B 15 A
C 9 A D 4 A

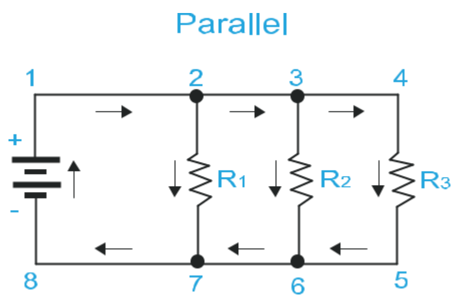
74. Determine the voltage of 5 Ω resistance in the following circuit.



A 0.9 V B 1.8 V
C 2.7 V D 4.5 V

The parallel circuit:

- A circuit in which the electric current passes through two or more branches or connected parts at the same time before it combines again.



The equivalent resistance for parallel circuit is given as:

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}+.......+\frac{1}{R_n}$$

R is the equivalent resistance [Ω], R1, R2,R3 and Rn are the resistors of the circuits [Ω].

- The equivalent resistance in the parallel circuit is less than any single resistance in the circuit.
- The total current circuit equals in the sum of the current in each branch in the circuit.

$$I = I_1 + I_2 + I_3 + ... + I_n$$

I is the total current [A], I1,I2, and I3are the currents in the branches of the circuit [A].

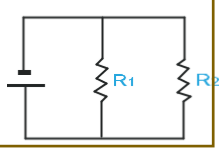
- If one branch in the electric parallel circuit is breaking of, the other branch's current remains the same (constant) but the equivalent current becomes less.

75. A circuit with battery and two resistors R1, R2 (different values), when calculating the current and the voltage we find out that…

A Different currents, same voltages
B Same currents, different voltages
C Different currents and voltages
D Same currents and voltages

76. The equivalent resistance in the circuit is.

A 18 Ω
B 9 Ω
C 2 Ω
D 0.5 Ω



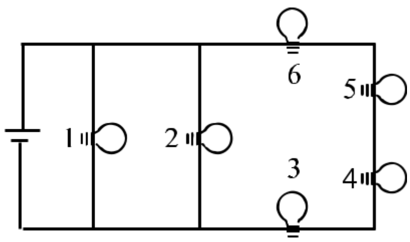
77. Eight resistors, each one is 24 Ω in a parallel circuit, the equivalent resistance is.

A 8 Ω
B 32 Ω
C 3 Ω
D 16 Ω

78. The equivalent resistance for a parallel different resistors is .

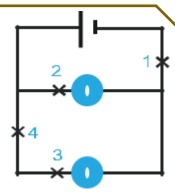
A Bigger than the highest resistance
B Less than the least resistance
C Equals to the highest resistance
D Equals to the least resistance

79. In the chart, 6 lamps in a circuit, if lamp 1 burnt out, what will happen to the other lamps' glow?



A lamp 2 glows less
B Lamps (3,4,5,6) glow less
C All lamps glow the same
D Lamp 2 glows more

80. The next circuit has a battery and two lamps, if you only have one chance to neither of the lamps lights, at which point will you cut the circuit?



A 1
B 2
C 3
D 4

Chapter 7: Electricity

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
D	D	C	A	D	B	C	A	D	D	A	A	B	D	A	C	B	A	B	D
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
C	A	B	D	B	D	A	A	D	C	A	D	A	A	B	B	B	A	B	B
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
D	B	A	C	C	A	C	D	C	C	C	D	B	B	A	C	A	B	B	C
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
A	B	C	A	A	C	A	D	D	C	D	D	D	D	A	C	C	B	C	A