DELHI PUBLIC SCHOOL, MIYAPUR

WORKSHEET
CHAPTER 12 - ELECTRICITY

CLASS: X (CBSE) **SUBJECT: PHYSICS**

NUMERICAL PROBLEMS

1. Find the charge if the number of electrons is 4×10^{-18}.

2. Find the number of electrons constituting one coulomb of charge.

3. How much work done in moving a charge of 3 coulombs from a point at 118 V to a point at 128volt?

4. How much work done in moving a charge of 2C across two points having a potential difference of12V?

5. Calculate the amount of work done to carry 4C from a point at 100 V to a point at 120volt?

6. How much work will be done in bringing a charge of 2×10^{-3} coulombs from infinity to a point P at which the potential is 5V?

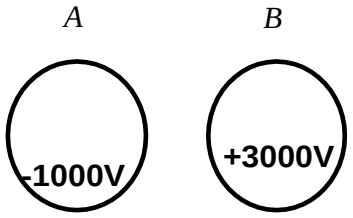
7. How much work will be done in bringing a charge of 3×10^{-2} coulombs from infinity to a point P at which the potential is 20V?

8. How much energy is given to each coulomb of charge passing through a 6V battery?

9. How much energy is transferred by a 12 V power supply to each coulomb of charge which it moves around acircuit?

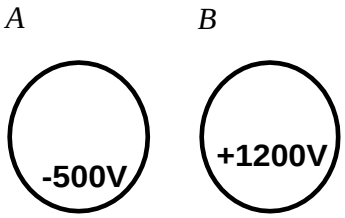
10. What is the potential difference between the terminals of a battery if 250 joules of work is required to transfer 20 coulombs of charge from one terminal of battery to the other?

11. What is the potential difference between the conductors A and B shown in below figure? If the conductors are connected by a length of wire, which way will electrons flow? When will this flow of electrons stop?



12. A particle of charge 2C is taken from a point at a potential of 100V to another point at a potential of 150V. Calculate the workdone.

13. What is the potential difference between the conductors A and B shown in below figure? If the conductors are connected by a length of wire, which way will electrons flow? When will this flow of electrons stop?



14. A particle of charge 5 x 10^{-2} C is taken from a point at a potential of 50V to another point at a potential of 250V. Calculate the workdone.

15. Three 2V cells are connected in series and used as a battery in acircuit.

(a) What is the potential difference at the terminals of thebattery?

(b) How many joules of electrical energy does 1 C gain on passing through (i)one cell (ii) all threecells.

NUMERICAL PROBLEMS

1. What current must flow if 0.24 coulombs is to be transferred in 15ms?

2. If a current of 10 A flows for four minutes, find the quantity of electricity transferred.

3. An electric bulb draws a current of 0.25A for 20 minutes. Calculate the electric charge that flows through thecircuit.

4. If the amount of electric charge passing through a conductor in 10min is 300C, find thecurrent.

5. How many electrons are flowing per second past a point in a circuit in which there is a current of4A?

6. A lamp of resistance 80Ω draw a current of 0.75A. Find the linevoltage.

7. A electric heater draw a current of 5A when connected to 220V mains. Calculate the resistance of its filament.

8. How much current will an electric bulb draw from a 200V source, if the resistance of the filament is1200Ω?

9. How much current will an electric heater draw from a 200V source, if the resistance of the filament is100Ω?

10. How much current does an electric heater draw from a 220V line, if the resistance of the heater (when hot) is 50Ω?

11. A bulb when cold has 1Ω resistance. It draws a current of 0.3A when glowing from a source of 3V. Calculate the resistance of the bulb when flowing and explain the reason for the difference inresistance.

12. Calculate the potential difference required across a conductor of resistance 5Ω to make a current of 1.5A flow through it.

13. What is the resistance of an electric are lamp when hot, if the lamp uses 20A when connected to a 220Vline?

14. Calculate the amount of work done to draw a current of 8A from a point at 100V to a point at 120V in 2seconds.

15. If 200C of charge pass a point in a circuit in 4 sec, what current is flowing?

16. A current of 4A flows around a circuit in 10 seconds. How much charge flows past a point in the circuit in this time? Also find the number of electrons passes in the circuit.

17. The current flowing through a resistor is 0.8 A when a p.d. of 20 V is applied. Determine the value of the resistance.

18. Determine the p.d. which must be applied to a 2 kΩ resistor in order that a current of 10 mA mayflow.

19. A coil has a current of 50 mA flowing through it when the applied voltage is 12 V. What is the resistance of thecoil?

20. A 100 V battery is connected across a resistor and causes a current of 5 mA to flow. Determine the resistance of the resistor. If the voltage is now reduced to 25 V, what will be the new value of the currentflowing?

21. What is the resistance of a coil which draws a current of (a) 50 mA and (b)200μA from a 120 V supply?

22. If a current of 5 A flows for 2 minutes, find the quantity of electricitytransferred.

23. A current of 0.5 A is drawn by a filament of an electric bulb for 10 minutes. Find the amount of electric charge that flows through thecircuit.

24. How much current will an electric bulbdraw from a 220 V source, ifthe resistance of the bulb filament is1200Ω?

25. How much current will an electric heater coil draw from a 220 V source, if the resistance of the heater coil is100Ω?

26. The potential difference between the terminals of an electric heater is 60 V when it draws a current of 4 A from the source. What current will the heater draw if the potential difference is increased to 120V?

27. When a 12 V batteryis connected across an unknown resistor, there is a current of2.5 mA in the circuit. Find the value of the resistance of the resistor.

28. An electric heater is connected to the 230 V mains supply. A current of 8A flows through the heater (a) How much charge flows around the circuit each second. (b)How much energy is transferred to the heater each second?

29. How many electrons are flowing per second past a point in a circuit in which there is a current of 5A?

30. An electric iron draws a current of 3.4A from the 220V supply line. What current will this electric iron draw when connected to 110V supply line?

31. A simple electric circuit has a 24V battery and a resistor of 60Ω. What will be the current in thecircuit?

32. When a 4Ω resistor is connected across the terminal of 12V battery, find the number of coulombs passing through the resistor per second.

33. An electric room heater draw a current of 2.4A from the 120V supply line. What current will this room heater draw when connected to 240V supply line?

34. A current of 200mA flows through a 4kΩ resistor. What is the p.d. across the resistor?

35. Ap.d.of10Vis needed to make a current of 0.02A flow through a wire.What p.d. is needed to make a current of 250mA flow through the same wire?

36. A TV draws a current of 5 A from the 240V supply line. What current will this TV draw when it is connected to 100V supplyline.

37. The potential difference between the terminals of an electric heater is 60V when it draw a current of 4A from the source. What current will the heater draw if the potential difference is increased to120V?

38. A bulb of resistance 400Ωis connected to 220V mains. Calculate the magnitude ofcurrent.

39. A battery of two cells is used to light a torch bulb of resistance 5Ω. The cells maintain a potential difference of 3V across the bulb. How much current will flow through the bulb?

40. A steady current of 5A flows through a circuit for 30minutes. How much charge has circulated through the circuit in this time?

NUMERICAL PROBLEMS ON RESISTIVITY

1. Calculate the resistance of a copper wire of length 2m and area of cross section $10^{-6}m^2$. Resistivity of copper is $1.7 \times 10^{-8}\Omega m$

2. A copper wire of length 2m and area of cross section $1.7 \times 10^{-6}m^2$ has a resistance of 2×10^{-2}ohms. Calculate the resistivity of copper.

3. The amount of charge passing through a cell in 12 seconds is 3C. What is the current supplied by thecell?

4. A 12 V battery of a car is connected across a 4 Ω resistor. Calculate thecurrentpassing through the resistor.

5. Resistivity of a given copper wire of length 2m is $1.7 \times 10^{-8}\Omega m$. The wire is stretched so that its length becomes 4m. Find new resistivity of the copperwire.

6. Resistance of a given wire of length ' l ' is 3 Ω . The wire is stretched uniformly suchthatitslengthbecomes2l.Findthenewresistanceofthestretched wire.

7. Resistance of a given wire of length ' l ' is 4 Ω . The wire is stretched uniformly suchthatitslengthbecomes3l.Findthenewresistanceofthestretched wire.

8. Acopperwirehasadiameterof0.5mmandresistivityof1.6x10^{-}8Ωm.Whatwill be the length of this wire to make its resistance 10 Ω ? How much does the resistance change if the diameter is doubled?

9. A 6 Ω resistance wire is doubled up by folding. Calculate the new resistance of the wire.

10. Calculate the resistance of an aluminium cable of length 10km and diameter 20mm if the resistivity of aluminum is 2.7 x 10^{-8}Ωm.

11. Calculate the area of cross section of a wire if its length is 1.0m, its resistance is 23 Ω and the resistivity of the material of the wire is 1.84 x 10^{-6}Ωm.

12. A piece of wire of resistance 20 Ωis drawn out so that its length is increased to twice its original length. Calculate the resistance of the wire in the newsituation.

13. Two cylindrical wires of the same material have their lengths in the ratio of 4 : 9. What should be the ratio of their radii so that their resistances are in the ratio of 4 : 1?

14. Two wires of the same metal, have the same area of cross section but their lengths in the ratio of 3 : 1. What should be the ratio of current flowing through them respectively, when the same potential difference is applied across each of their length?

15. Two wires A and B of length 30m and 10m have radii 2cm and 1cm respectively. Compare the resistances of the two wires. Which will have less resistance?

16. Calculate the resistance of 1km long copper wire of radius 1mm. Resistivity of copper is 1.7x10^{-8}Ωm

17. A 4 Ωwire is doubled on it. Calculate the new resistance of the wire.

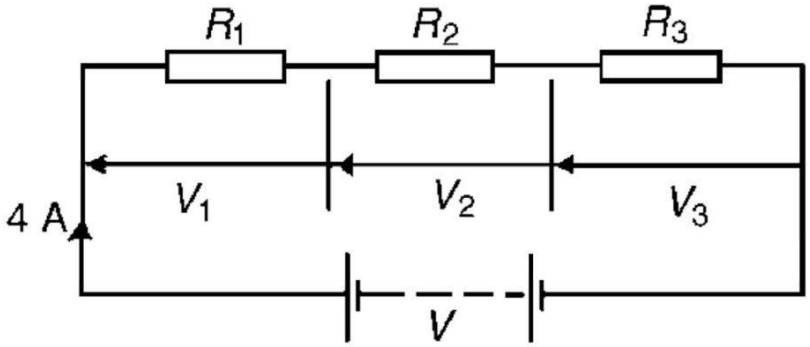
18. What should be the length of the nichrome wire of resistance 4.5 Ω , if the length of a similar wire is 60cm and resistance 2.5 Ω?

19. A metal wire of resistivity 64 x 10^{-6}Ω m and length 198cm has a resistance of 7 Ω. Calculate its radius.

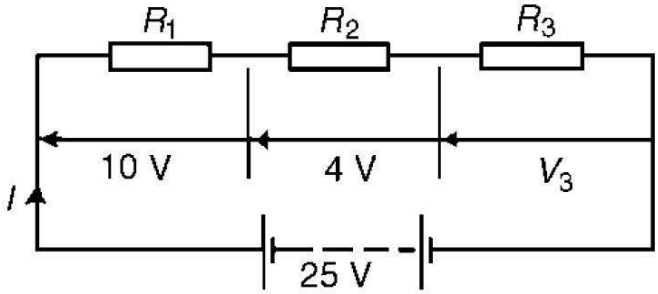
20. Calculate the resistivity of the material of a wire 1.0m long, 0.4mm in diameter and having a resistance of 2.0 Ω.

NUMERICAL PROBLEMS

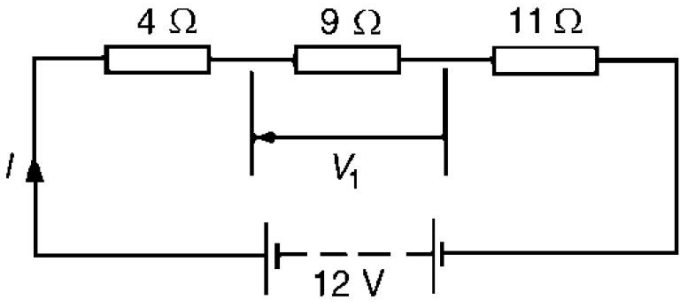
1. For the circuit shown in below Figure, determine (a) the battery voltage V, (b) the total resistance of the circuit, and (c) the values of resistance of resistors R1, R2 and R3, given that the p.d.'s across R1, R2 and R3 are 5 V, 2 V and 6 V respectively.



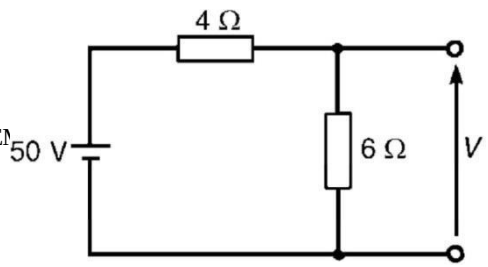
2. For the circuit shown in below Figure, determine the p.d. across resistor R_3. If the total resistance of the circuit is 100Ω, determine the current flowing through resistor R_1. Find also the value of resistorR_2



3. A 12 V battery is connected in a circuit having three series-connected resistors having resistances of 4Ω, 9Ω and 11Ω. Determine the current flowing through, and the p.d. across the 9Ωresistor.



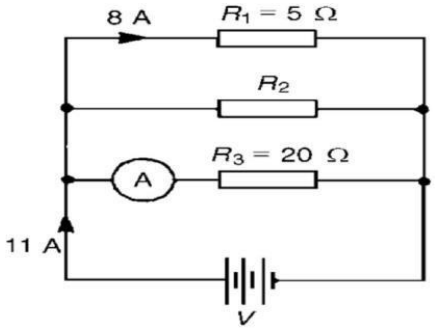
4. Find the voltage V in the givenfigure.



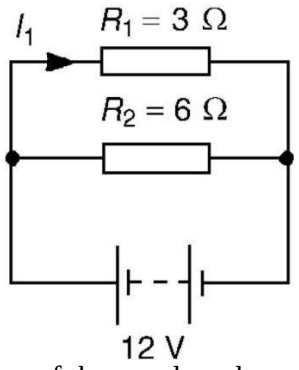
5. For the circuit shown in given Figure, determine (a) the reading on the ammeter, and (b) the value of resistorR_2

6. Two resistors are connected in series across a 24 V supply and a current of 3 A flows in the circuit. If one of the resistors has a resistance of 2Ωdetermine (a) the value of the other resistor, and (b) the p.d. across the 2Ωresistor. If the circuit is connected for 50 hours, how much energy isused?

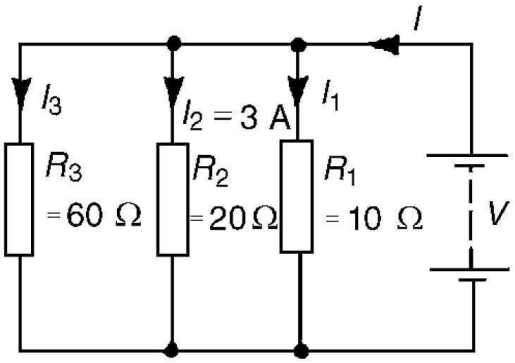
7. Two resistors, of resistance 3Ω and 6Ω, are connected in parallel across a battery having a voltage of 12



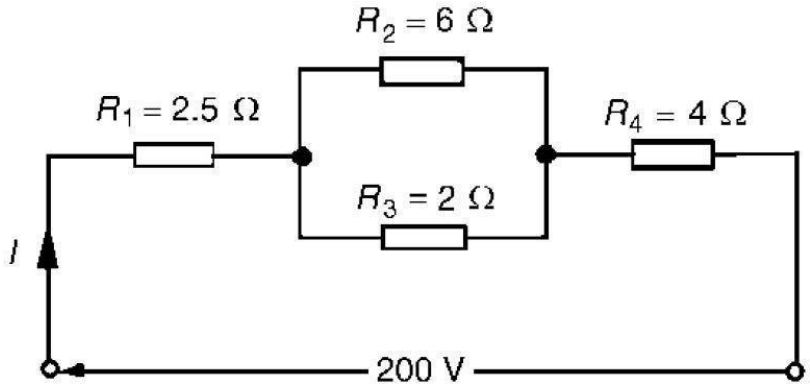
V. Determine (a) the total circuit resistance and (b) the current flowing in the 3Ωresistor.



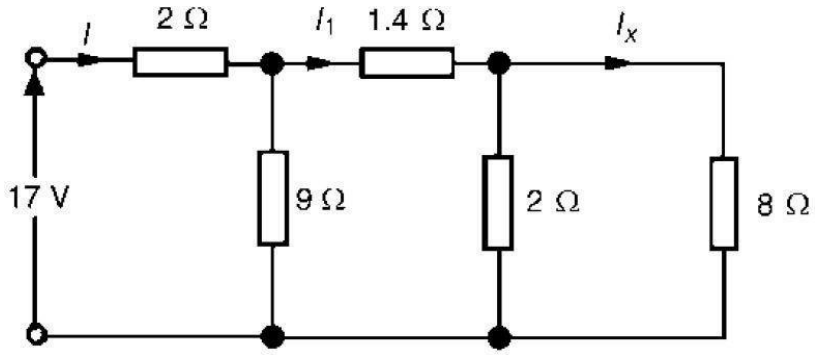
8. For the circuit shown in below Figure, find (a) the value of the supply voltage V and (b) the value of current I.



9. For the series-parallel arrangement shown in below Figure, find (a) the supply current, (b) the current flowing through each resistor and (c) the p.d. across each resistor.



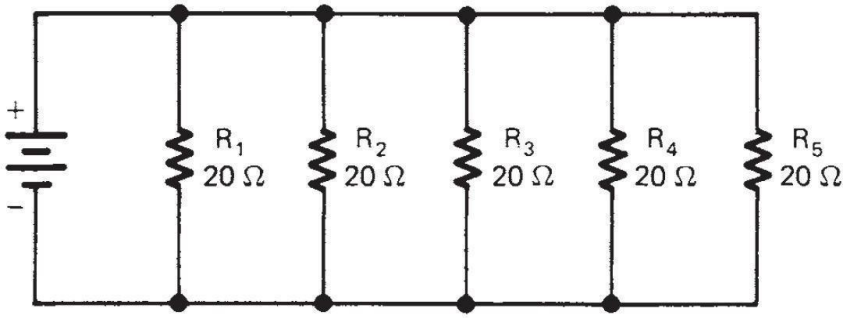
10. For the arrangement shown in below Figure, find the currentI_x.



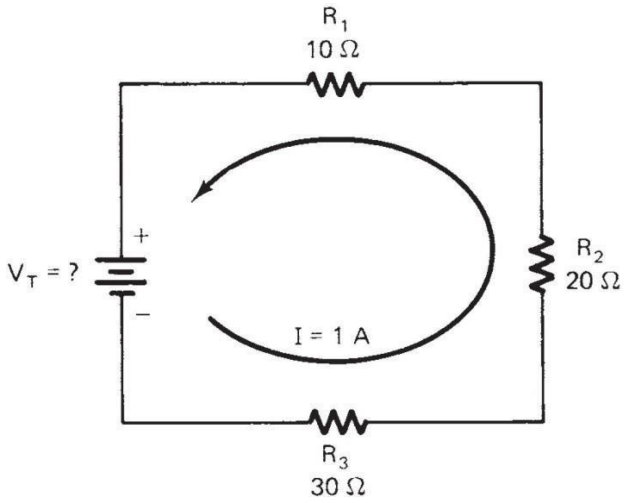
11. Four resistances of 16 Ω each are connected in parallel. Four such combinations are connected in series. What is the totalresistance?

12. Abatteryof9Visconnectedinseries withresistorsof0.2Ω,0.3Ω,0.4Ω,0.5Ωand 12 Ω . How much current would flow through the 12 Ω resistor?

13. An electric bulb of resistance 20 Ω and a resistance wire of 4 Ω are connected in series with a 6V battery. Draw the circuit diagram and calculate: (a) total resistance of the circuit (b) current through the circuit (c) potential difference across the electric bulb (d) potential difference across the resistancewire.

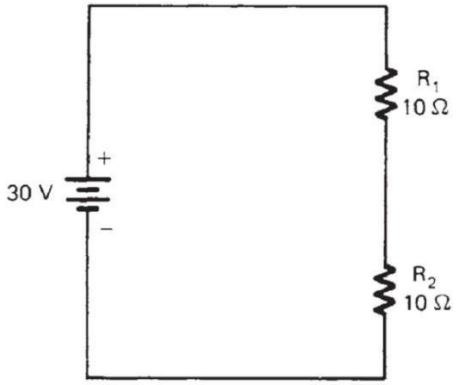


14. Find the equivalent resistance of the givencircuit.



15. Find the value of $V_T$in the givencircuit.

16. Find the voltage across each resistance in the givencircuit.

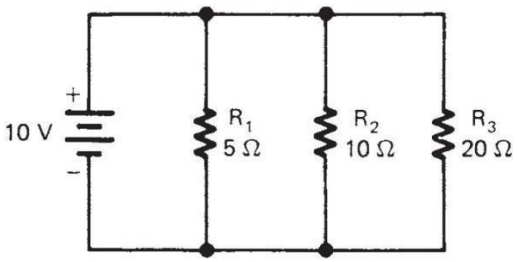


17. A potential difference of 4V is applied to two resistors of 6 Ω and 2 Ω connected in series. Calculate: (a) the combined resistance (b) the current flowing (c) the potential difference across the 6 Ωresistor

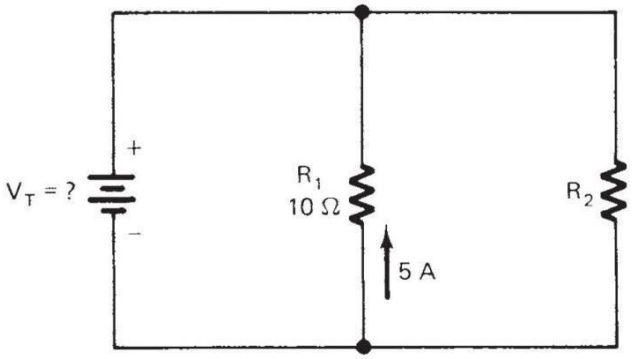
18. Resistors of 20Ω, 20Ω and 30Ω are connected in parallel. What resistance must be added in series with the combination to obtain a total resistance of10Ω.

19. If four identical lamps are connected in parallel and the combined resistance is 100Ω, find the resistance of onelamp.

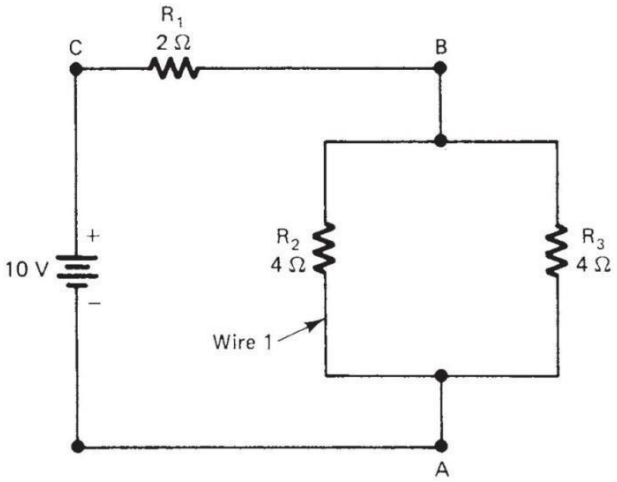
20. Find the current across the each resistance and total current flowing in the given circuit.



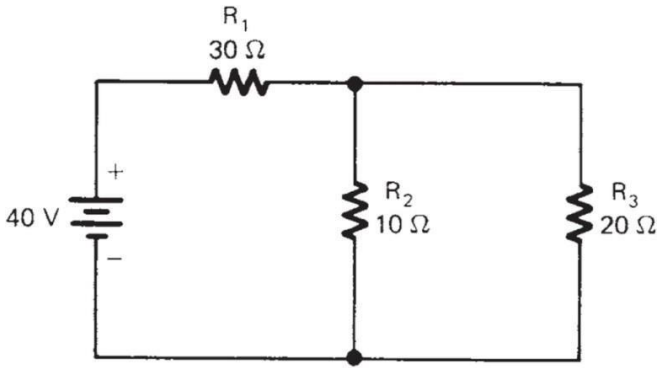
21. In the given circuit, the resistance R_1 and R_2 are connected in parallel. (i) Find the value of V_T. (ii) Find the total current and equivalent resistance in the circuit if resistance $R_2 = 10\Omega$



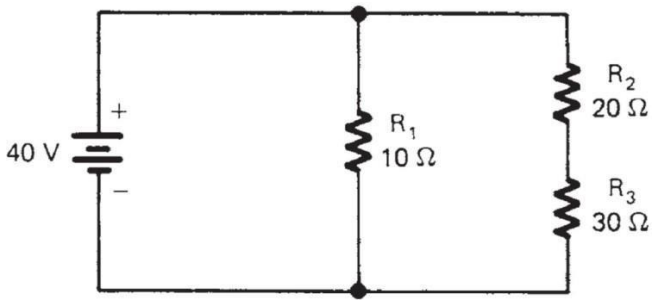
22. In the given circuit, (i) find the equivalent resistance of the circuit and total current flowing in the circuit. (ii) find the current flowing through $R_2$and R_3. (iii) find the voltage across eachresistance.



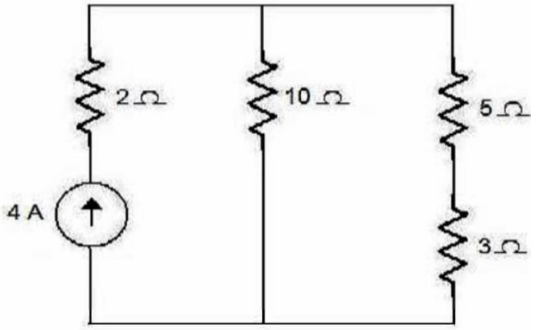
23. In the given circuit, (i) find the equivalent resistance and total current flowing in the circuit. (ii) find the voltage and current across each resistance in thecircuit.



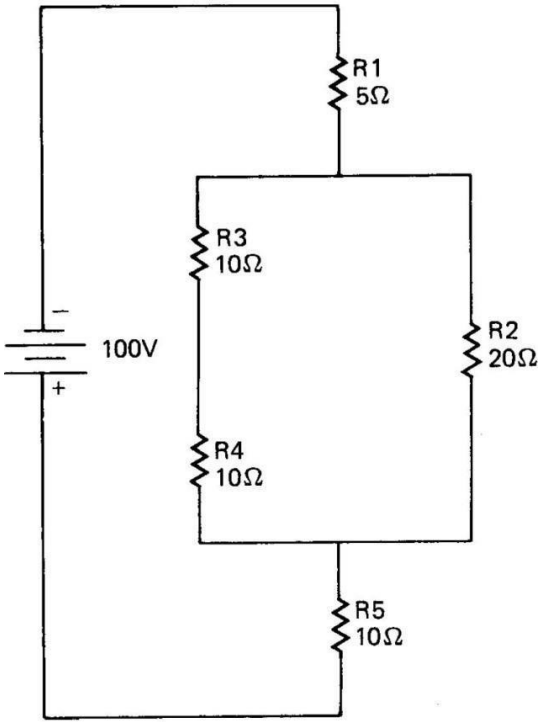
24. In the given circuit, (i) find the equivalent resistance and total current flowing in the circuit. (ii) find the voltage and current across each resistance in thecircuit.



25. Find the current through 10 ohm resistor for the followingcircuit.

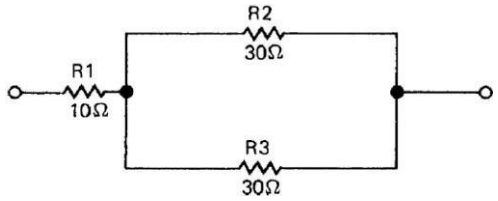


26. In the given circuit, (i) find the equivalent resistance and total current flowing in thecircuit.(ii) find the voltage and current across eachresistance in the circuit.

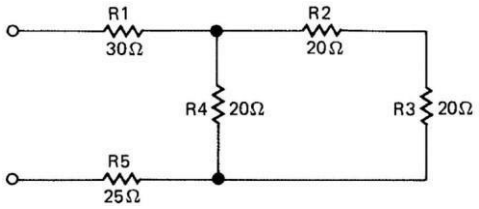


27. Find the equivalent resistance of the followingcircuits:

(i)



(ii)



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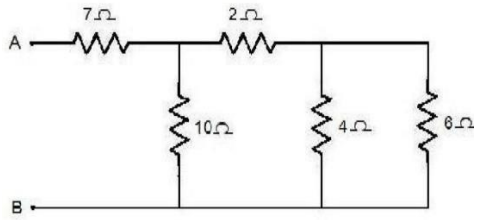
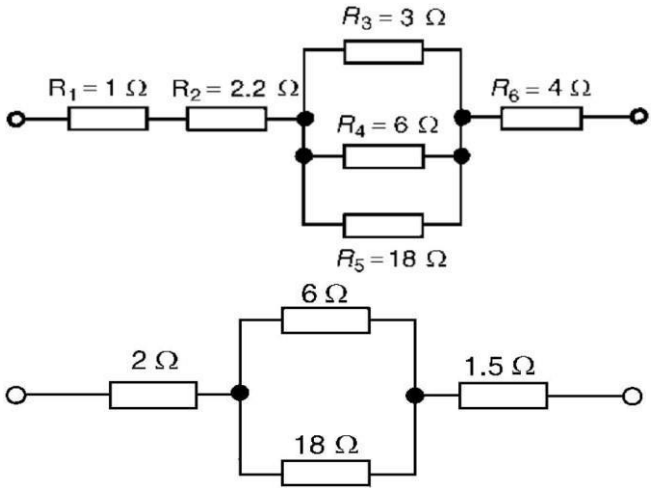


(iv)



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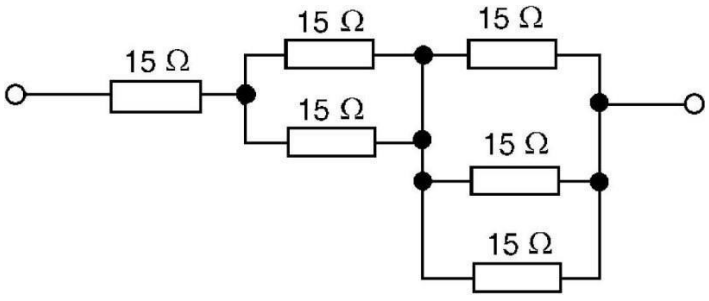
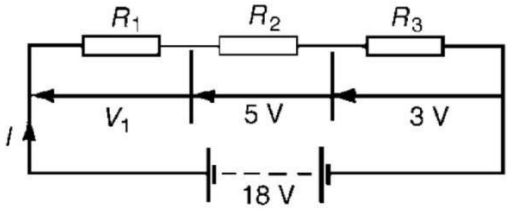
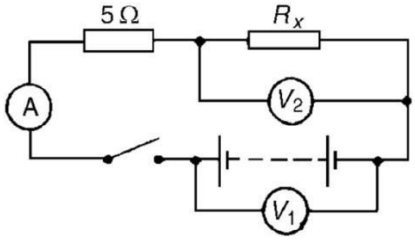


28. For the circuit shown in below Figure, determine the value of V1. If the total circuit resistance is 36Ω, determine the supply current and the value of resistors R1, R2 andR3.

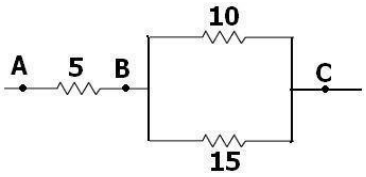


29. When the switch in the circuit in below Figure is closed the reading on voltmeter 1 is 30 V and that on voltmeter 2 is 10 V. Determine the reading on the ammeter and the value of resistorR_x.



30. A potential difference of 6V is applied to two resistors of 3 Ω and 6 Ω connected in parallel. Calculate: (a) the combined resistance (b) the current flowing in the main circuit (c) the current flowing in the 3 Ωresistor.

31. Three resistors are connected as shown in thediagram:



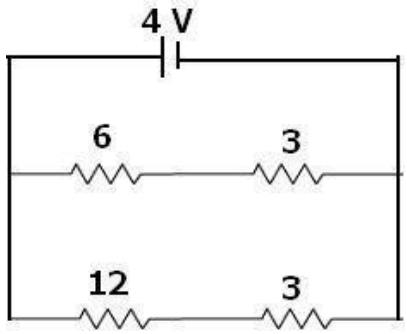
Through the resistor 5 Ω ohm, a current of 1A is flowing.

(i) What is the current through the other tworesistors?

(ii) What is the p.d. across AB and acrossAC?

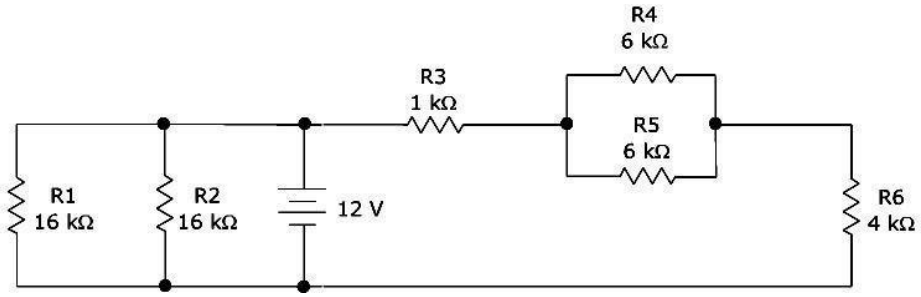
(iii) What is the totalresistance?

32. For the circuit shown in the diagrambelow:

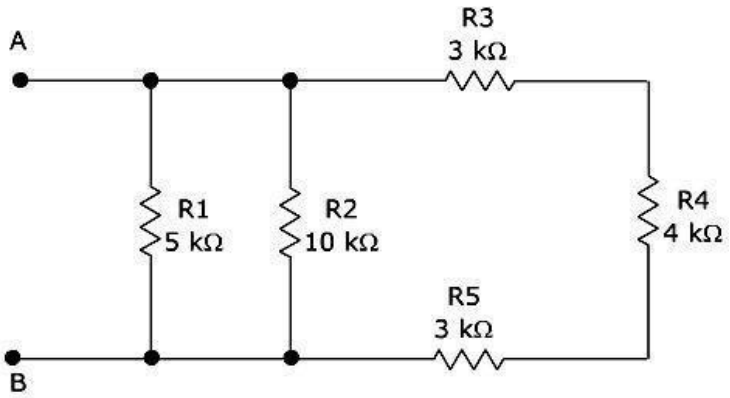


What is the value of: (i) current through 6 Ω resistor? (ii) p.d. across 12 Ω resistor?

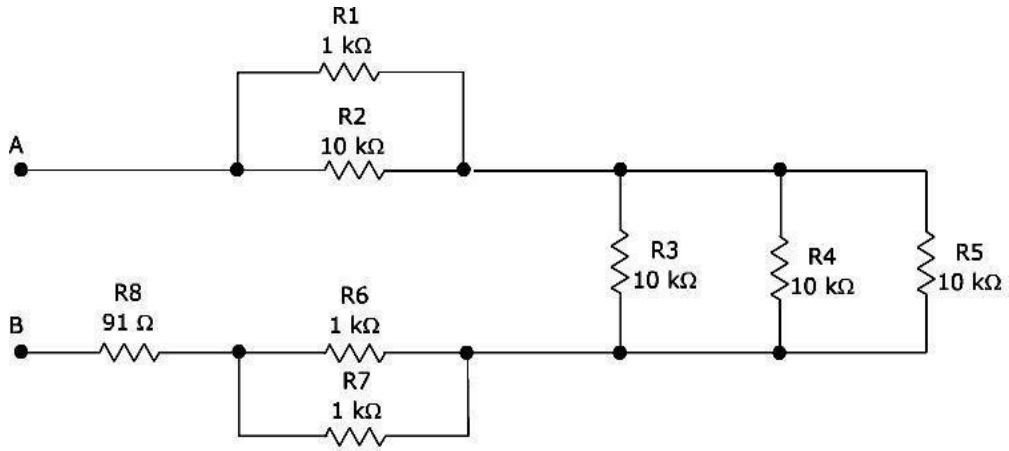
33. Calculate the total resistance of the circuit below, as seen by the voltagesource.



34. What is the resistance between A and B in the given figure givenbelow?



35. What is the resistance between A and B in the given figure givenbelow?



36. Resistances of 4Ω and 12Ω are connected in parallel across a 9 V battery. Determine (a) the equivalent circuit resistance, (b) the supply current, and (c) the current in each resistor.

37. Three identical lamps A, B and C are connected in series across a 150 V supply. State (a) the voltage across each lamp, and (b) the effect of lamp C failing.

38. The p.d's measured across three resistors connected in series are 5 V, 7 V and 10 V, and the supply current is 2 A. Determine (a) the supply voltage, (b) the total circuit resistance and (c) the values of the three resistors.

39. If three identical lamps are connected in parallel and the combined resistance is 150Ω, find the resistance of one lamp.

NUMERICAL PROBLEMS

1. What will be the current drawn by an electric bulb of 40 W when it is connected to a source of220V?

2. A bulb is rated as 250V;0.4A. Find its power and resistance.

3. An electric bulb is connected to a 220V power supply line. If the bulb draw a current of 0.5A, calculate the power of the bulb.

4. An electric bulb is connected to a 250 V generator. The current is 0.50 A. What is the power of the bulb?

5. What current will be taken by a 920W appliance if the supply voltage is230V?

6. When an electric lamp is connected to 12V battery, it draws a current 0.5A. Find the power of the lamp.

7. Calculate the power used in 2Ω resistor in each (i) a 6V battery in series with 1Ω and 2Ω resistor (ii) a 4V battery in parallel with 12Ω and 2Ωresistor.

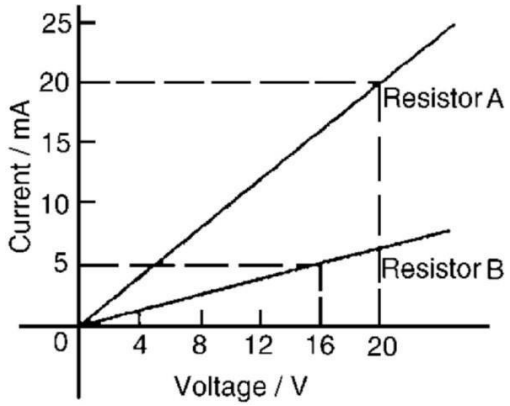
8. A 100 W electric light bulb is connected to a 250 V supply. Determine (a) the current flowing in the bulb, and (b) the resistance of the bulb.

9. Calculate the power dissipated when a current of 4 mA flows through a resistance of 5kΩ

10. An electric kettle has a resistance of 30Ω. What current will flow when it is connected to a 240 V supply? Find also the power rating of thekettle.

11. A current of 5 A flows in the winding of an electric motor, the resistance of the winding being 100 . Determine (a) the p.d. across the winding, and (b) the power dissipated by the coil.

12. The current/voltage relationship for two resistors A and B is as shown in below Figure. Determine the value of the resistance of each resistor and also find the power dissipated through each resistor.



13. The hot resistance of a 240 V filament lamp is 960Ω. Find the current taken by the lamp and its power rating.

14. A 12 V battery is connected across a load having a resistance of 40Ω. Determine the current flowing in the load, the power consumed and the energy dissipated in 2 minutes.

15. A source of e.m.f. of 15 V supplies a current of 2 A for six minutes. How much energy is provided in this time?

16. Electrical equipment in an office takes a current of 13 A from a 240 V supply. Estimate the cost per week of electricity if the equipment is used for 30 hours each week and 1 kWh of energy costs7p

17. An electric heater consumes 3.6 MJ when connected to a 250 V supply for 40 minutes. Find the power rating of the heater and the current taken from the supply.

18. Determine the power dissipated by the element of an electric fire of resistance 20Ω when a current of 10 A flows through it. If the fire is on for 6 hours determine the energy used and the cost if 1 unit of electricity costs7p.

19. A business uses two 3 kW fires for an average of 20 hours each per week, and six150 W lights for 30 hours each per week. If the cost of electricity is 7p per unit, determine the weekly cost of electricity to the business.

20. If 5 A, 10 A and 13 A fuses are available, state which is most appropriate for the following appliances which are both connected to a 240 V supply (a) Electric toaster having a power rating of 1 kW (b) Electric fire having a power rating of 3 kW

21. The hot resistance of a 250 V filament lamp is 625Ω . Determine the current taken by the lamp and its power rating.

22. Determinetheresistanceofacoilconnectedtoa150Vsupplywhenacurrentof

(a) 75 mA (b) 300 mA flows through it. Determine the power dissipated through it.

23. Determine the resistance of an electric fire which takes a current of 12A from a 240 V supply. Find also the power rating of the fire and the energy used in 20h.

24. Determine the power dissipated when a current of 10 mA flows through an appliance having a resistance of 8k.

25. 85.5 J of energy are converted into heat in nine seconds. What power is dissipated?

26. A current of 4 A flows through a conductor and 10 W is dissipated. What p.d. exists across the ends of the conductor?

27. Find the power dissipated when:

(a) a current of 5 mA flows through a resistance of 20k

(b) a voltage of 400 V is applied across a 120 kresistor

(c) a voltage applied to a resistor is 10 kV and the current flow is 4mA.

28. A battery of e.m.f. 15 V supplies a current of 2 A for 5 min. How much energy is supplied in thistime?

29. In a household during a particular week three 2 kW fires are used on average 25 h each and eight 100 W light bulbs are used on average 35 h each. Determine the cost of electricity for the week if 1 unit of electricity costs7p.

30. Calculate the power dissipated by the element of an electric fire of resistance 30 when a current of 10 A flows in it. If the fire is on for 30 hours in a week determine the energy used. Determine also the weekly cost of energy if electricity costs 7.2p perunit.

31. A television set having a power rating of 120 W and electric lawnmower of power rating 1 kW are both connected to a 240 V supply. If 3 A, 5 A and 10 A fuses are available state which is the most appropriate for eachappliance.

32. For a heater rated at 4kW and 220V, calculate: (a) the current (b) the resistance of the heater (c) the energy consumed in 2 hours and (d) the cost if 1kWh is priced at Rs.4.60

33. A radio set of 60W runs for 50hrs. How much electrical energyconsumed?

34. A current of 4A flows through a 12V can headlight bulb for 10min. How much energy transfer occurs during this time?

35. Calculate the energy transferred by a 5A current flowing through a resistor of 2Ωfor30min.

36. A bulb is rated at 200V-100W. What is its resistance? 5 such bulbs burn for 4 hrs. What is the electrical energy consumed? Calculate the cost if the rate is Rs. 4.60 per unit.

37. A refrigerator having a power rating of 350W operates for 10hours a day. Calculate the cost of electrical energy to operate it for a month of 30days. The rate of electrical energy is Rs. 3.40 per KWh.

38. What will be the current drawn by an electric bulb of 40W when it is converted to a source of220V?

39. An electric bulb is rated 220V and 100W. When it is operated on 110V, find the power consumed.

40. An electric heater draws a current of 10A from a 220V supply. What is the cost of using the heater for 5 hrs everyday for 30days if the cost of 1 unit is Rs.5.20?

41. In house two 60W electric bulbs are lighted for 4 hrs and three 100W bulbs for 5 hrs everyday. Calculate the electrical energy consumed in30days.

42. An electric motor takes 5A current from a 220V supply line. Calculate the power of the motor and electrical energy consumed by it in 2hrs.

43. An electric iron consumes energy at a rate of 840 W when heating is at the maximumrateand360Wwhentheheatingisattheminimum.Thevoltageis220V. What are the current and the resistance in each case?

44. An electric refrigerator rated 400 W operates 8 hour/day. What is the cost of the energy to operate it for 30 days at Rs 3.00 per kWh?

45. An electric motor takes 5 A from a 220 V line. Determine the power of the motor and the energy consumed in 2 h.

46. Two lamps, one rated 100 W at 220 V, and the other 60 W at 220 V, are connected in parallel to electric mains supply. What current is drawn from the line if the supply voltage is 220V?

47. Which uses more energy, a 250 W TV set in 1 hr, or a 1200 W toaster in 10 minutes?

48. Two bulbs A and B are rated 100W – 120V and 10W – 120V respectively. They are connected across a 120V source in series. Which will consume more energy.

49. Two bulbs A and B are rated 100W – 120V and 10W – 120V respectively. They are connected across a 120V source in series. Find the current in each bulb. Which will consume moreenergy.

50. An electric kettle is rated at 230V, 1000W. What is the resistance of its element? What maximum current can pass through itselement?

51. An electric geyser has the rating 1000W, 220V marked on it. What should be the minimum rating in whole number of a fuse wire that may be required for safe use with thisgeyser?

52. The mains power supply of a house is through a 5A fuse. How many 100W, 220V bulbs can be used in this house at the correctvoltage?

53. An electrician puts a fuse of rating 5A in that part of domestic electrical circuit in which an electrical heater of rating 1.5kW, 220V is operating. What is likely to happen in this case and why? What change if any needs to bemade/

54. Two bulbs of ratings 40W-220V and 60W-220V are connected in series and this combination is connected with a supply of 220V. Calculate the current from the supplyline.

55. Two bulbs have the ratings 40W-200V and 20W-110V. What is the ratio of their resistances?

56. I can spend Rs. 9 per month (30days) on electric light. If power is 30paise per kWh and I use 5 identical bulbs for 5 hours a day, what should be the power of each bulb?

57. Compute the number of electrons passing through per minute through an electric bulb of 60W,220V.

58. If electrical energy costs Rs.3 per unit, what is the total cost of leaving 4 light bulb rated at 100W each switched on for 8hours.

59. An electric heater of resistance 8Ω draws 15 A from the service mains 2hours.
Calculate the rate at which heat is developed in the heater.

60. 100 J of heat are produced each second in a 4 Ω resistance. Findthe potentialdifference across the resistor.

61. Compute the heat generated while transferring 96000 coulomb of charge in one hour through a potential difference of 50V.

62. An electric iron of resistance 20 Ω takes a current of 5 A. Calculate theheatdeveloped in 30 s.

63. Ap.d.of 250Visappliedacrossaresistanceof 500Ωinanelectriciron.
Calculate (i) current (ii) heat energy produced in joules in 10s.

64. Calculate the heat produced when 96000C of charge is transferred in 1 hour through a p.d. of50V.

65. A resistance of 40 Ω and one of 60 Ω are arranged in series across 220V supply7. Find the heat in joules produced by this combination of resistances in half a minute?

66. When a current of 4A passes through a certain resistor for 10min, 2.88 x 10^4 J of heat are produced. Calculate (a) power of the resistor (b) the voltage across the resistor.

67. A heating coil has a resistance of 200 Ω. At what rate will heat be produced in it when a current of 2.5 Ω flows throughit.

68. An electric heater of resistance 8Ω takes a current of 15Afrom the mains supplyline. Calculate the rate at which heat is developed in the heater.

69. A resistance of 25Ω is connected to a 12Vbattery.Calculate the heat energy in joule generated per minute.

70. How much heat will an instrument of 12W produce in one minute if its is connected to a battery of12V?

GIST OF THE LESSON

1. **Positive and negative charges:** The charge acquired by a glass rod when rubbed with silkis called positive charge and the charge acquired by an ebonite rod when rubbed with wool is called negativecharge.

2. **Coulomb:** It is the S.I. unit of charge. One coulomb is defined as that amount of chargewhich repels an equal and similar charge with a force of 9 x 10^9 N when placed in vacuum at a distance of 1 meterfrom it. Charge on an electron = -1.6 x 10^{-19} coulomb.

3. **Static and current electricities:** Static electricity deals with the electric charges at restwhile the current electricity deals with the electric charges inmotion.

4. **Conductor:** A substance which allows passage of electric charges through it easily is calledaconductor‘. A conductor offers very low resistance to the flow of current. For example copper, silver, aluminium etc.

5. **Insulator:** A substance that has infinitely high resistance does not allow electric current to flowthroughit.Itiscalledan_insulator‘.Forexamplerubber,glass,plastic,eboniteetc.

6. **Electric current:** The flow of electric charges across a cross-section of a conductorconstitutes an electric current. It is defined as the rate of flow of the electric charge through any section of aconductor.

Electric current = Charge/Timeor

$I = Q/t$

Electric current is a scalar quantity.

7. **Ampere:** It is the S.I. unit of current. If one coulomb of charge flows through any section ofa conductor in one second, then current through it is said to be oneampere.

   1 ampere = 1coulomb/1second or

   1 A = 1C/1s = $1Cs^{-1}$ 1 milliampere = 1 mA = 10^{-3}A

   1 microampere = 1μA = 10^{-6} A

8. **Electriccircuit:**Theclosedpathalongwhichelectriccurrentflowsiscalledanelectric circuit'.

9. **Conventional current:** Conventionally, the direction of motion of positive charges is takenas the direction of current. The direction of conventional current is opposite to that of the negatively chargedelectrons.

10. **Electric field:** It is the region around a charged body within which its influence can be experienced.

11. **Electrostatic potential:** Electrostatic potential at any point in an electric field is defined as the amount of work done in bringing a unit positive charge from infinity to that point. Its unit is volt. Positive charges move from higher to lower potential regions. Electrons, being negatively charged, move from lower to higher potential regions.

12. **Potential difference between two points:** The Potential difference between two points in an electric field is the amount of work done in bringing a unit positive charge from one toanother. Potential difference = Work done/Charge or V =W/Q

13. **One volt potential difference:** The Potential difference between two points in an electricfield is said to one volt if one joule of work has to be done in bringing a positive charge of one coulomb from one point to another. 1 volt = 1 joule/1 coulomb or 1 V =1J/1C

14. **Galvanometer:** It is device to detect current in an electriccircuit.

15. **Ammeter:** It is device to measure current in a circuit. It is always connected in series in a circuit.

16. **Voltmeter:** It is a device to measure potential difference. It is always connected in parallel to the component across which the potential difference is to bemeasured.

17. **Ohm's law:** This law states that the current passing through a conductor is directly proportional to the potential difference cross its ends, provided the physical conditions like temperature, density etc. remains unchanged.

$$V \alpha I \text{ or } V = RI$$

The proportionality constant R is called resistance of conductor.

18. **Resistance:** It is a property of a conductor by virtue of which it opposes the flow of current through it.

It is equal to the ratio of the potential difference applied across its ends and the current flowing through it.

Resistance =Potential difference/Current or R =V/I

19. Ohm: It is the S.I. unit of resistance. A conductor has a resistance of one ohm if a currentof one ampere flows through it on applying a potential difference of one volt across itsends.

1 ohm = 1volt/1ampere or 1Ω = 1V/1A

20. Factors on which resistance of a conductor depends: The resistance R of a conductor depends

i) Directly on its length L i.e. R αL.

ii) inversely on its area of cross-section A i.e. R α1/A

iii) on the nature of material of the conductor on. On combining the above factors, weget

R α L/A

R = ρ * L/A The proportionality constant ρ is called resistivity of conductor.

21. Resistivity: It is defined as the resistance offered by a cube of a material of side 1 mwhen current flows perpendicular to its opposite faces. Its S.I. unit is ohm-meter (Ωm). Resistivity, ρ =RA/L

22. Equivalent resistance: If a single resistance can replace the combination of resistances insuch a manner that the current in the circuit remains unchanged, then that single resistance is called the equivalentresistance.

23. Laws of resistances inseries:

i) Current through each resistance issame.

ii) Total voltage across the combination = Sum of the voltagedrops.

$V= V_1 + V_2 + V_3$

iii) Voltage drops across any resistor is proportional to itsresistance.

$V_1 = IR_1$, $V_2 = IR_2$, $V_3 = IR_3$

iv) Equivalent resistance = Sum of the individualresistances.

$R_s = R_1 + R_2 + R_3$

v) Equivalent resistance is larger than the largest individualresistance.

24. Laws of resistances inparallel:

i) Voltage across each resistance is same and is equal to the appliedvoltage.

ii) Total current = Sum of the currents through the individualresistances.

$I = I_1 + I_2 + I_3$

iii) Currents through various resistances are inversely proportional to the individualresistances.

$I_1 = V/R_1$, $I_2 = V/R_2$, $I_3 = V/R_3$

iv) Reciprocal of equivalent resistance = Sum of reciprocals of individualresistances. $1/R_p = 1/R_1 + 1/R_2 + 1/R_3$

v) Equivalent resistance is less than the smallest individualresistance.

25. Joule's law of heating: It states that the heat produced in a conductor is directlyproportional to (i) the square of the current I through it (ii) proportional to its resistances Rand (iii) the time t for which current is passed. Mathematically, it can be expressedas $H=I^2Rt$ joule = $I^2Rt/4.18$ cal

or

$H=VIt$ joule = $VIt/4.18$cal

26. Electric energy: It is the total work done in maintaining an electric current in an electric circuit for given time.

Electric energy, $W = VIt = I^2Rt$ joule

27. Electrical power: Electrical power is the rate at which electric energy is consumed byan appliance.

$P = W/t = VI = I^2R = V^2/R$

28. Watt: It is the S.I. unit of power. The power of an appliance is 1 watt if one ampere ofcurrent flows through it on applying a potential differences of 1 volt across itsends.

1 watt = 1 joule/1 second =1 volt x 1 ampere

or $1\ W = 1\ Js^{-1} = 1\ VA$

1 kilowatt = 1000 W

29. Kilowatt hour: It is the commercial unit of electrical energy. One kilowatt hour is the electric energy consumed by an appliance of 1000 watts when used for one hour.

1 kilowatt hour (kWh) = 3.6×10^6 J

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