ELECTRIC CURRENT AND CIRCUIT

1. The filament of an electric lamp draws a current of 0.4A, which lights for 3 minutes. Calculate the charge that flows through the circuit. How many electrons will flow in this time interval?

2. A conductor carries a current of 0.2A. Find the amount of charge that will pass through the cross-section of the conductor in the 30s. How many electrons will flow in this time interval?

3. 6C charge flows through a point in the 20s. Calculate the current.

4. 120C charge flows through a point in 1 minute. What is the current?

5. A current of 1.6 mA flows from one point to another in 10s. What is the charge transferred?

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

ELECTRIC POTENTIAL AND POTENTIAL DIFFERENCE

7. How much work is done in moving a charge of 2C across two points having a potential difference of 12V?

8. Calculate the work done in moving a charge of 4C from a point at 220V to a point at 230V.

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

10. A charge of 1.6×10^{-9}C is moved between the two points. If the work done is 4.8×10^{6}J, what is the potential difference between the two points?

11. 100J of work is done in carrying a charge from one point at 120V to another at 130V. Calculate the charge transferred.

12. 48J of work is done in carrying a charge between two points having a potential difference of 8V. Calculate the charge transferred.

OHM'S LAW

13. Name a device that is used in an electric circuit to change the current in the circuit without changing the voltage source.

14. Draw a schematic circuit diagram for a circuit in which three resistors R_1, R_2, and R_3 a plug key under closed condition, and an ammeter are joined in series with a 5V battery. Also, a voltmeter is connected to measure the potential difference across the resistor R_1.

15. Name and state the law that gives the relationship between the current through a conductor and the potential difference across its two terminals. Also, express this law mathematically. Draw the V-I graph for this law.

16. The potential difference between two points of a wire carrying a current of 2A is 0.1V. Calculate the resistance between two points.

17. The potential difference between the terminals of an electric appliance is 240V and the current through it is 5A. What is the resistance of the wire?

18. A potential difference of 2V is applied across the ends of 0.5Ω resistance. What current flows through it?

19. A resistance of 20Ω has a current of 0.2A flowing through it. What is the potential difference across its ends?

20. How much current will an electric heater draw from a 220V line if the resistance of the heater is 50Ω?

21. What is the resistance of an electric arc lamp, if the lamp uses 20A when connected to a 220V line?

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

FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS

23. A piece of wire of length L is redrawn by pulling it, till its length becomes 2L. Compare the new resistance with the original value.

24. A given length of a wire is doubled on itself and this process is repeated once again. By what factor does the resistance of the wire change?

25. State the change in the ammeter reading observed when a resistance wire in a circuit is replaced by a wire of the same material and the same length but comparatively double cross-sectional area keeping the source of potential difference constant.

26. A thick wire and a thin wire made from the same material and of the same length are connected one by one to the same source. In which case a larger current will flow in the circuit? Justify your answer.

27. Keeping the potential difference constant the resistance of an electric circuit is doubled. State the change in the reading of an ammeter connected to the circuit.

28. State in brief the meaning of a variable resistor. Draw a circuit diagram to illustrate its function, especially in the study of variation in current with a potential difference across a resistor.


29. In the circuit diagram shown, the two resistance wires A and B are of the same area of cross section and the same material, but A is longer than B. Which ammeter A_1 or A_2 will indicate a higher reading for current? Give reason.

30. Electrical resistivity of some substances at 20°C are given below:

Silver	1.60×10^{-8} Ωm
Copper	1.62×10^{-8} Ωm
Tungsten	5.20×10^{-8} Ωm
Iron	10.0×10^{-8} Ωm
Mercury	94.0×10^{-8} Ωm
Nichrome	100×10^{-6} Ωm

Answer the following questions in relation to them:
a) Among silver and copper, which one is a better conductor? Why?
b) Which material would you advise to be used in electrical heating devices? Why?

31. The voltage-current (V-I) graph of a metallic conductor at two different temperatures T_1 and T_2 is shown below. At which temperature is the resistance higher?
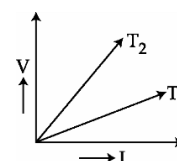
32. Resistance of a metal wire of length 1m is 26Ω at 20°C. If the diameter of the wire is 0.28mm, what will be the resistivity of the metal at that temperature?

33. 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}Ω. Calculate the resistivity of copper.

34. A piece of wire, 15m long and of cross-sectional area $12 mm^2$ passes a current of 8A when connected to a 240V source. Calculate the resistivity of the wire.

35. Calculate the resistance of 100m length of wire of cross-sectional area of $0.01 mm^2$ and resistivity 5×10^{-6} ohm-cm.

36. Calculate the resistance of a wire of length 1km, cross-sectional area of $0.01 cm^2$, and resistivity of 1.6×10^{-8} ohm m.

2

37. A 10Ω coil is to be made from a copper wire of diameter 0.5 mm and resistivity 1.6×10^{-6} ohm cm. Calculate the length required.

38. Calculate the length of the wire of cross-sectional area $1mm^2$, resistance 340Ω, and resistivity 1.7×10^{-6} Ω cm.

39. A 4Ω resistance wire is doubled on it. Calculate the new resistance of the wire.

40. Aluminum wire has a radius of 0.25 mm and a length of 75 m. If the resistance of the wire is 10Ω, calculate the resistivity of aluminum.

41. A copper wire has a radius of 1mm and resistivity of 1.6×10^{-8} Ωm. What will be the length of this wire required to make its resistance 10Ω?

RESISTANCE OF A SYSTEM OF RESISTORS

42. 4Ω and 8Ω are connected in series and a potential difference of 12V is applied across their ends. Draw the circuit diagram and calculate the potential difference across the 4Ω resistor.

43. Two resistances of value 2Ω and 3Ω are connected in parallel. Draw the circuit diagram and calculate the total resistance.

44. 4Ω, 8Ω, and 12Ω are connected (a) in parallel and (b) in series. Calculate the total resistance in each case.

45. Three resistors of value 3Ω, 6Ω and 9Ω are connected in parallel. Calculate the total resistance and the total current in the circuit if a potential difference of 10V is applied across them.

46. Two resistances of 3 Ω and 6 Ω are to be connected to a battery of 9V to obtain (i) minimum current, and (ii) maximum current in the circuit. (a) How will you connect the resistances to the battery in each case? (b) Calculate the total current flowing in the circuit in both cases.

47. A wire of resistance R is cut into three equal parts. (i) Find the value of resistance of each part in terms of the original resistance R? (ii) If these three pieces are connected in parallel, what is the ratio of the equivalent resistance so obtained with the original resistance?

48. Two conducting wires of the same material, equal length, and equal diameter are first connected in series and then in parallel. Compare the equivalent resistance in two cases.

49. The resistance of a resistor is kept constant and the potential difference across its two ends is decreased to half of its former value. State the change that will occur in the current through it.
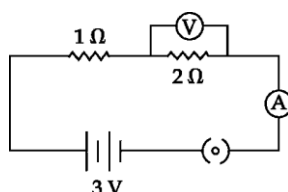
50. Study the following circuit: Answer the following questions.

(i) State the type of combination of the two resistors in the circuit.

(ii) How much current would flow through (a) 10Ω resistor and (b) 15Ω resistors?

(iii) What would be the ammeter reading?
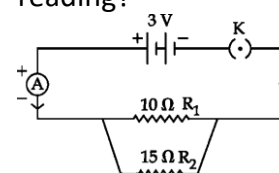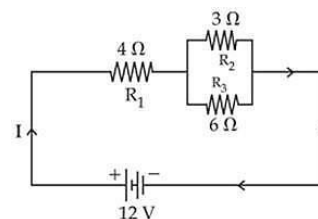

51. Find ammeter and voltmeter readings.

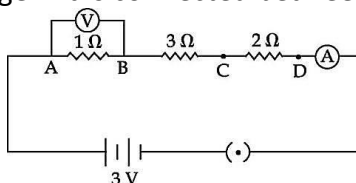52. The following circuit diagram shows the combination of three resistors R_1, R_2 and R_3.

Find :
(i)   Total resistance of the circuit,
(ii)   Total current (I) flowing in the circuit and the
(iii)   Potential difference across R_1.

53. How would the reading of (V) change if it is connected between C and D? Justify your answer.

HEATING EFFECT OF ELECTRIC CURRENT

54. An electric heater of resistance 8Ω draws 15 A from the service mains. Calculate the heat developed in the 60s.

55. 100 J of heat is produced each second in a 4 Ω resistor. Find the potential difference across the resistor.

56. A current of 4 A flows through a 12 V car headlight bulb for 10 min. Calculate the energy transfer taking place.

57. Two coils of resistances 3 Ω and 6 Ω are connected in series across a battery of potential difference 12V. Find the electrical energy consumed in 1 min in each resistance.

58. Calculate the energy consumed by a heater, which draws a current of 5 A at 220 V for 1 min.

59. An electric press consumes 120 kJ of energy in 5 min when 2 A of current flows through it. Calculate the electric potential at which the press operates.

60. Calculate the electrical energy flowing into the filament of an electric bulb in 20 s, when its resistance is 40 Ω and the potential difference across its terminals is 12 V.

61. (a)What is a fuse?
(b) State two properties of the material, which make it suitable for making fuse wire.
(c)Two fuse wires A & B of the same length one rated 15 A and 5 A. Which will be thicker? Why?
(d)An appliance of rating 1500 W – 220V is to be used. On which circuit it can be safely used, one with 15A fuse wire or the one with 5A fuse wire? Why?

62. Two identical immersion heaters are to be used to heat water, in a large container.
Which one of the following arrangements would heat the water faster: (i) connecting the heaters in series with the main supply, (ii) connecting the heaters in parallel with the main supply? Give reasons for your answer.

ELECTRIC POWER

63. An electric bulb is rated at 220V, 100W. What is its resistance? How much current does it draw?

64. A bulb draws 0. 4A current from 250V supply. Find its power and resistance.

65. A torch bulb is rated at 2.5V, 500mA. Find its power and resistance.

66. An appliance is marked 60W- 240V, what current it draws?

67. What is the maximum voltage that can be applied across a 10,000Ω resistance if it is rated for ¼W?

68. A 12V battery supplied a current of 35A. What is its power in kW?

69. How much electrical energy in kWh does an electric radiator consume in 2h if it draws a current of 5A from a 200V supply?

70. In how much time will a bulb of 100 W consume 2 kWh of energy?

71. The power of an appliance is 500W. Find the cost of using it for 6 hours if the price/unit is Rs4.

72. The power of an appliance is 1500W. Find the cost of using it for a month if it is used for 2 hours daily. Let the price per unit be Rs5.

4

73. A 60W bulb is used for 150h in a month. Find the cost of using it if the price/unit is Rs5.
74. A 60W bulb is used for 10h a day and a 500W iron is used for ½ h daily. Find the bill for a month if the price per unit is Rs 2.
75. Two heaters rated 750 W, 200 V, and 1000 W, 200 V are connected in parallel across a 200 V supply. Calculate the total power consumed.
76. A 100W fan is used for 10 hours and 3 bulbs of power 60W are used for 4 hours & 30min daily in an office. Calculate the cost of using them for a month at the rate of Rs.3.
77. In a house, a heater of power 2kW is used for 30min, 2 fans of power 150W for 10h and five bulbs of rating 60W, 40W, 40W, 100W and 200W for 6h in a day. Calculate the bill for a day at the rate of Rs.3/unit.
78. An electric bulb draws a current of 0.8A from 250 V mains. The bulb is used for an average of 8 hours a day, if energy costs Rs 3 per kWh; calculate the monthly bill for 30 days.
79. An appliance consumes 3 units of energy in 2 hours. what is its power rating?
80. An electric iron is marked 500W-200V. Find its (a) resistance, (b) current through it, and (c) cost of using it for 20h in a month if the price/unit is Rs 3.

PRACTICAL BASED QUESTIONS

81. In an ammeter, there are 20 divisions between the 400 mA mark and the 500 mA mark. What is the least count of the ammeter?
82. Which of the following devices would you use to maintain the potential difference between two points of a conductor? (a) A rheostat (b) A cell (c) A voltmeter (d) An ammeter
83. How will you connect various components in a circuit (i) to verify Ohm's Law, (ii) to find equivalent resistance when 2 resistors are connected in series and (iii) to find equivalent resistance when 2 resistors are connected in parallel
84. In the experiment to study the dependence of current on potential difference across a resistor, a student obtained a graph as shown in the diagram. What is the value of the resistance of the resistor?
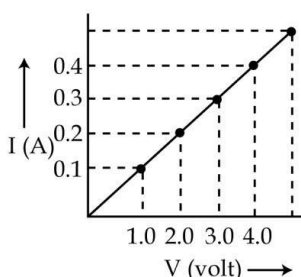

85. The current flowing through a conductor and the potential difference across its two ends is as per readings of the ammeter and the voltmeter shown below.
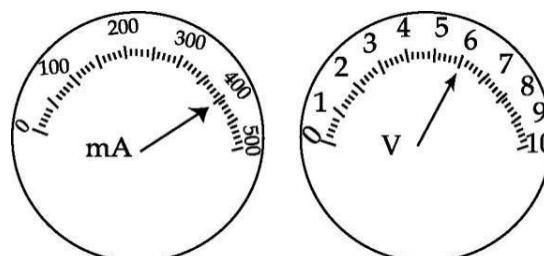
What would be the resistance of the conductor?
86. Study the two circuits circuit I and circuit II shown below. In circuit I, the ammeter reads current I_1 and the voltmeter reads voltage V_1. In circuit II, the ammeter reads current I_2 and the voltmeter reads voltage V_2.

Circuit I   Circuit II
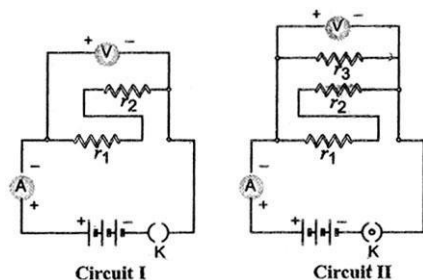
Which one of the following is the correct statement about the ammeter and voltmeter readings?

(a) $I_1>I_2$; $V_1=V_2$ (b) $I_1<I_2$; $V_1=V_2$ (c) $I_1>I_2$; $V_1>V_2$ (d) $I_1<I_2$; $V_1<V_2$

87. The number of divisions in the ammeter of range 2A is 10 and the voltmeter of range 5 V is 20. When the switch of the circuit for Ohm's law is closed, the ammeter reading is at the 8th division and the voltmeter reading is at the 8th division. The value of the resistance of the resistor is –

(a) 1.25 Ω   (b) 2 Ω   (c) 0.75 Ω   (d) 1.5 Ω

88. The diagram shows a network of four resistors which is connected to an electric source. Identify the resistors which are connected in series in this network.
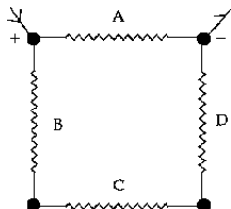

89. Ohm's law experiment is performed separately with individual resistors R_1, R_2 [$R_1>R_2$] and a series combination of R_1, R_2. The graph is plotted between the potential difference (V) and current (I) as shown in the figure for each case: Identify which one is for R_1, R_2, and a combination of resistors.
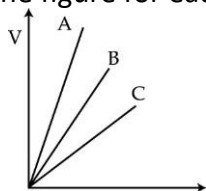
90. The readings of current flowing through a conductor and the potential difference across its two ends are shown in the ammeter and voltmeter given below. Calculate the resistance of the conductor.
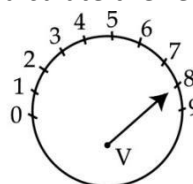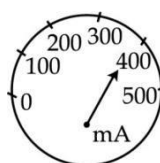

91. To determine the equivalent resistance of three resistors arranged in parallel four students connected the resistors as shown in figures A, B, C, and D.


(A)   (B)

(C)   (D)
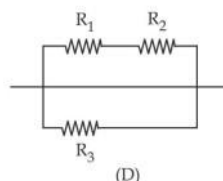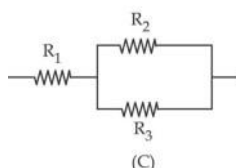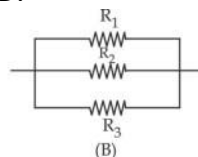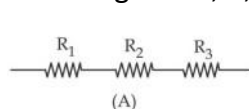
The correct setup is of which student?
The correct result will be obtained by which student?

6

92. While performing the experiment on studying the dependence of current (I) on the potential difference (V) across a resistor, four students I, II, III, and IV set up the circuit as shown.
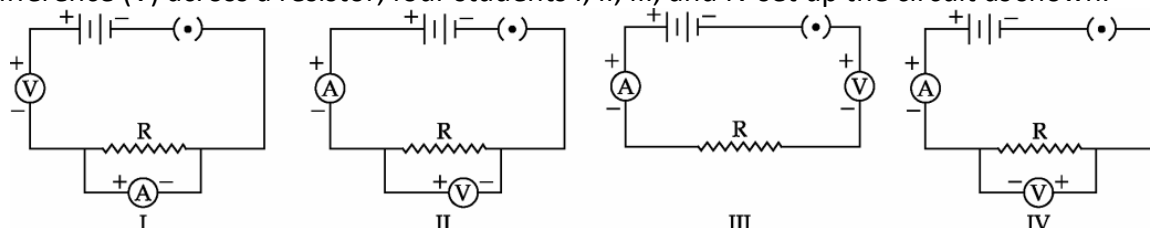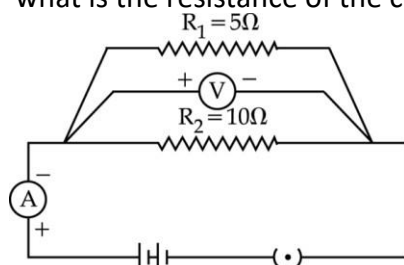

93. Four students plot graphs between V and I, showing dependence of current I on potential difference, V across a resistor, as shown
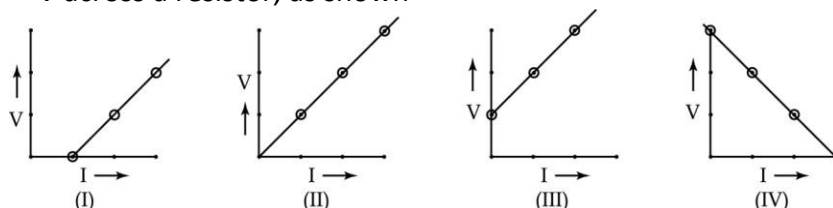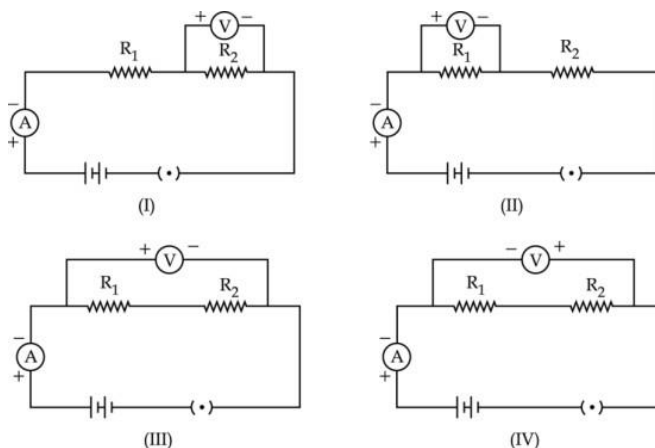

Which one is the correct graph?

94. In the circuit given below, on plugging the key, the voltmeter reads 2.0 V but ammeter reads 0.6 A. what is the resistance of the combination?

95. In an experiment to find the equivalent resistance of two resistors connected in series, four circuits were set – up as shown.

The voltmeter has been correctly connected in which arrangement?