CBSE

ELECTRICITY WS 4

Class 10 - Science

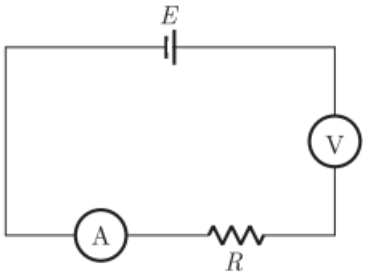
Section A

1. **Assertion (A):** Electric current flowing through a metallic wire is directly proportional to the potential difference across its ends. **[1]**

   Reason (R): Ohms law expression V = IR, where R (resistance) of the wire is always varying.

   a) Both A and R are true and R is the correct explanation of A.
   b) Both A and R are true but R is not the correct explanation of A.
   c) A is true but R is false.
   d) A is false but R is true.

2. **Assertion (A):** All electric devices shown in the circuit are ideal. The reading of each ammeter (a) and voltmeter (V) is zero. **[1]**



   Reason (R): An ideal voltmeter draws almost no current due to very large resistance, and hence (V) and (a) will read zero.

   a) Both A and R are true and R is the correct explanation of A.
   b) Both A and R are true but R is not the correct explanation of A.
   c) A is true but R is false.
   d) A is false but R is true.

3. **Assertion (A):** The equation V = Ri does not apply to those conducting. devices that do not obey Ohm's law. **[1]**

   Reason (R): V = RI is a statement of Ohm's law.

   a) Both A and R are true and R is the correct explanation of A.
   b) Both A and R are true but R is not the correct explanation of A.
   c) A is true but R is false.
   d) A is false but R is true.

4. **Assertion (A):** Insulators do not allow the flow of current through themselves. **[1]**

   Reason (R): They have no free-charge carriers.

   a) Both A and R are true and R is the correct explanation of A.
   b) Both A and R are true but R is not the correct explanation of A.
   c) A is true but R is false.
   d) A is false but R is true.

5. **Assertion (A):** If a graph is plotted between the potential difference and the current flowing, the graph is a straight line passing through the origin. **[1]**

   Reason (R): The current is directly proportional to the potential difference.

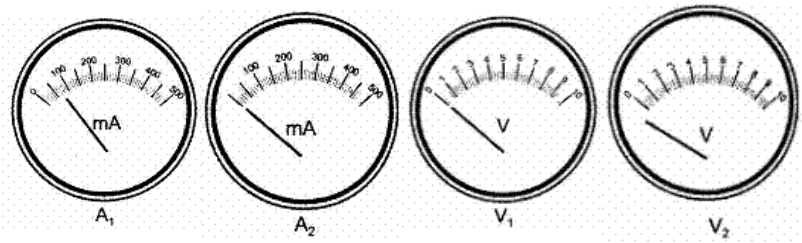
a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

6. The positions of the pointer of the two ammeters A_1 and A_2, and two voltmeters V_1 and V_2 available in the laboratory are shown in the given figure. For an experiment to study the dependence of the current on the potential difference across a resistor, the student would prefer **[1]**



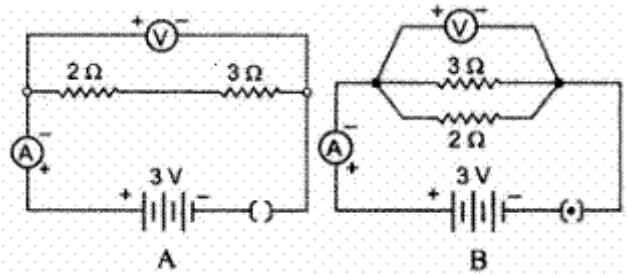
a) ammeter A_2 and voltmeter V_1

b) ammeter A_2 and voltmeter V_2

c) ammeter A_1 and voltmeter V_1

d) ammeter A_1 and voltmeter V_2

7. For the circuits A and B shown below, find the voltmeter readings would be **[1]**



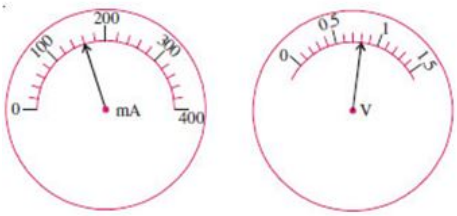
a) 5 V in both circuits

b) 0 V in both circuits

c) 0 V in circuit A and 3 V in circuit B

d) 0.6 V in circuit A and 2.5 V in circuit B

8. When performing the experiment on Ohm's law noted the milliammeter reading and voltmeter reading. From the obtained readings, the value of resistance calculated by him will be **[1]**



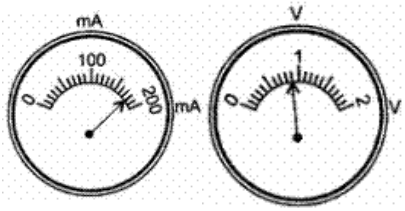
a) 5 Ω

b) 0.005 Ω

c) 0.5 Ω

d) 0.05 Ω

9. The current flowing through a resistor and the potential difference developed across its ends are shown in the given diagrams : **[1]**



The value of resistance of the resistor is

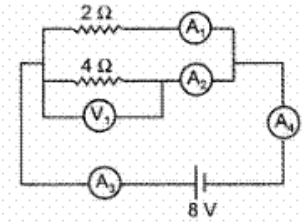
a) 500 ohm

b) 0.5 ohm

c) 50 ohm

d) 5.0 ohm

10. Using the given circuit with ammeter and voltmeter answer the question. **[1]**



The current indicated by A_3 is :

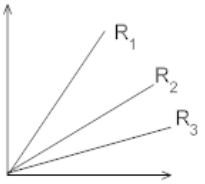
a) 6A

b) 2A

c) 1A

d) 4A

11. A student carries out an experiment and plots the V-I graph of three samples of nichrome wire with resistances R_1, R_2 and R_3 respectively figure. Which of the following is true? **[1]**



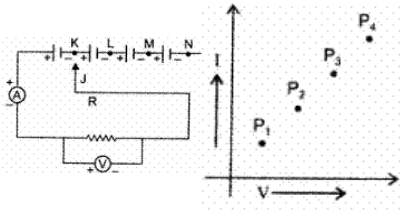
a) $R_3 > R_2 > R_1$

b) $R_1 > R_2 > R_3$

c) $\left(R \propto \frac{1}{\text{slope of V}-\text{I graph}}\right)$

d) $R_3 = R_2 = R_1$

12. A student performs an experiment on studying the dependence of the current (I) flowing through a conductor on the potential difference (V) applied across it by setting up his circuit as shown. He records four values of 'I' by keeping the sliding contact J, in the positions K, L, M and N, one by one. The corresponding points on his V-I graph are labelled as P_1, P_2, P_3 and P_4. The point P_3, would corresponding to the case when the sliding contact, J, is in the position **[1]**



a) N

b) L

c) K

d) M

13. Electrical resistivity of an alloy of copper and nickel is _____ when compared with the electrical resistivity of an alloy of copper, manganese and nickel. **[1]**

a) Double

b) Same

c) Less

d) More

14. Which of the following statements is/are incorrect? **[1]**

A. A neutron has a positive charge of $+1.6 \times 10^{-19}$ C

B. An ammeter is a low resistance device.

C. The resistance of semiconductors decreases with temperature.

D. One ampere is equal to 10^{-6} uA.

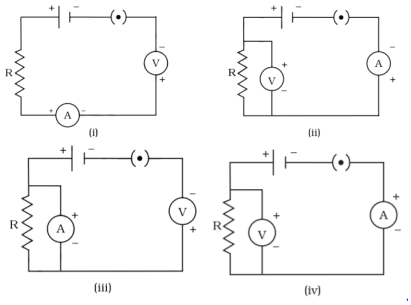
a) A and C

b) A and D

c) A and B

d) A, B and C

15. Identify the circuit (Figure) in which the electrical components have been properly connected. **[1]**



a) (iv)

b) (iii)

c) (i)

d) (ii)

16. The following precautions were listed by a student in the experiment on study of Dependence of current on potential difference. **[1]**

A. Use copper wires as thin as possible for making connections.

B. All the connections should be kept tight.

C. The positive and negative terminals of the voltmeter and the ammeter should be correctly connected.

D. The zero error in the ammeter and the voltmeter and the voltmeter should be noted and taken into consideration while recording the measurements.

E. The key in the circuit, once plugged in, should not be taken out till all the observations have been completed.

The precautions that need to be corrected and revised are:

a) B and E

b) A, C and E

c) A and E

d) C and E

17. An electric bulb of resistance 44 Ω draws a current of 5.0 A. Calculate the line voltage. **[1]**

18. State Ohm's law. **[1]**

19. What is SI unit of resistance ? **[1]**

20. 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 120 V? **[1]**

21. Should the resistance of a voltmeter be low or high? Give reason. **[1]**

22. Let the resistance of an electrical device remain constant, while the potential difference across its two ends decreases to one fourth of its initial value. What change will occur in the current through it? State the law which helps us in solving the above stated question. **[1]**

Section B

23. A student performed Ohm's law experiment, in which observed that the deflection on ammeter (or voltmeter) scale goes beyond the full scale. What will you infer from such an observation? What will you infer if the deflection takes place in opposite direction? **[2]**

24. Explain how we connect an ammeter and a voltmeter in a circuit while performing experiment for studying the dependence of current (I) on potential difference (V) across a resistor. **[2]**

25. While experimentally verifying ohm's law a student observed that pointer of the voltmeter coincide with 15^{th} division when the voltmeter has a least count of 0.05 V. Find the observed reading of voltmeter. **[2]**

26. If the resistor of a known resistance value is replaced with a nichrome wire of say 10 cm length in ohm's law **[2]**

experiment, how do the values of current through the nichrome wire and potential difference across the two ends of it change? How the values will change if the replaced wire is of manganin in place of nichrome?

27. Suppose the ammeter (or voltmeter) you are using in verifying ohm's law experiment does not have positive (+) and negative (-) terminal markings, how will you use such ammeter (or voltmeter) in the circuit? **[2]**

28. The values of current I flowing in a given resistor for the corresponding values of potential difference V across the resistor are given below- **[2]**

I (amperes)	0.5	1.0	2.0	3.0	4.0
V (volts)	1.6	3.4	6.7	10.2	13.2

Plot a graph between V and I and calculate the resistance of that resistor.

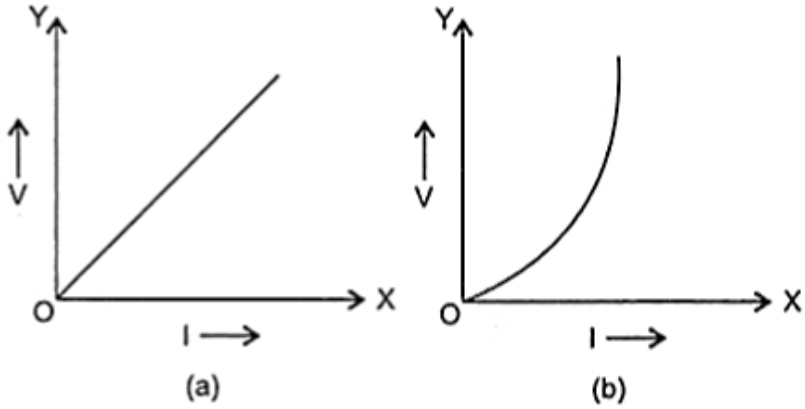
29. Draw a schematic diagram for a circuit in which three resistors R_1, R_2 and R_3 ,plug key, an ammeter are joined in series with a 5V battery. Also, a voltmeter is connected to measure the potential difference across the resistor R_1. **[2]**

30. The values of the current I flowing in a given resistor for corresponding values of potential difference V across the resistor are given below: **[2]**

I (amperes)	0.5	1.0	2.0	3.0	4.0
V (volts)	1.6	3.4	6.7	10.2	13.2

Plot a graph between V and I and calculate the resistance of that resistor.

31. The given figure shows the V-I graphs for two resistors. Identify the resistor that obeys ohm's law. Give a reason for your answer **[2]**

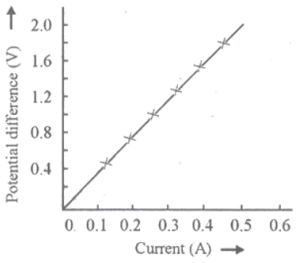


32. State Ohm’s law? How can it be verified experimentally? Does it hold good under all conditions? Comment. **[2]**

33. What is Ohm's law? How can it be verified? **[2]**

34. i. Identify the V-I graphs for ohmic and non-ohmic materials. **[2]**
ii. Give one example of each.

35. A V-I graph for a nichrome wire is given below. What do you infer from this graph? Draw a labelled circuit diagram to obtain such a graph. **[2]**

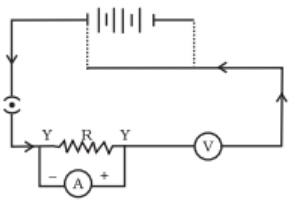


36. While studying the dependence of potential difference (V) across a resistor on the current (I) passing through it, **[2]**

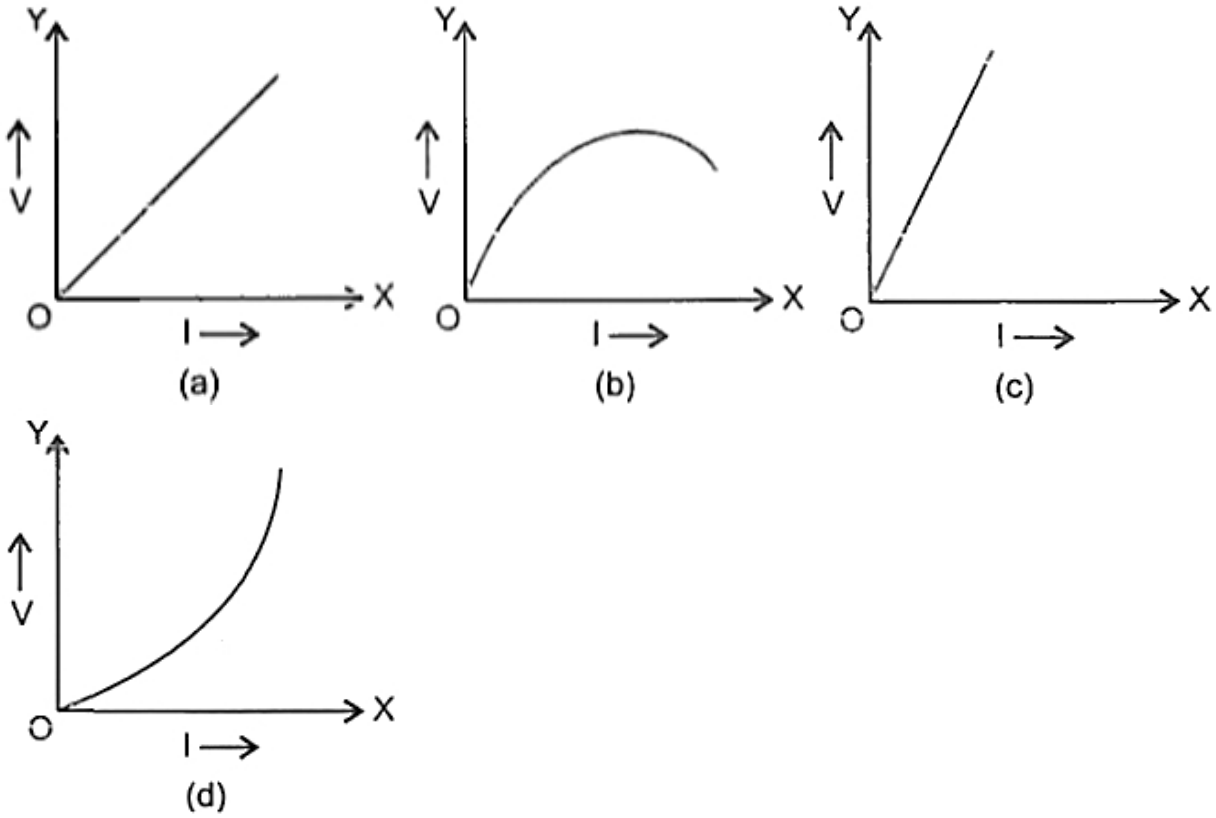
in order to determine the resistance of the resistor, a student took 5 readings for different values of current and plotted a graph between V and I. He got a straight line graph passing through the origin. What does the straight line signify? Write the method of determining resistance of the resistor using this graph.

37. Let the resistance of an electrical component remains constant while the potential difference across the two ends of the component decreases to half of its former value. What change will occur in the current through it? **[2]**

38. A Child has drawn the electric circuit to study Ohm's law as shown in Figure. His teacher told that the circuit diagram needs correction. Study the circuit diagram and redraw it after making all corrections. **[2]**



39. The given figures show V-I graphs experimentally obtained for different resistors. Select the graphs for resistors that do not obey Ohm's law. **[2]**

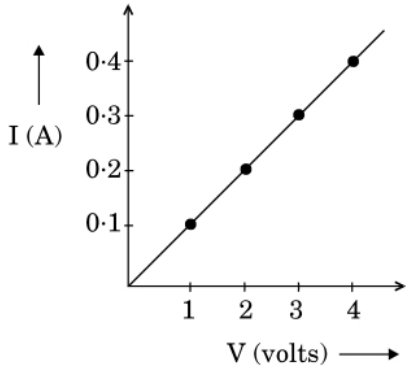


40. Calculate the resistance of an electric bulb which allows a 10A current when connected to a 220V power source? **[2]**

41. In the experiment to study the dependence of current (I) on the potential difference (V) across a resistor, a student obtained a graph as shown. **[2]**

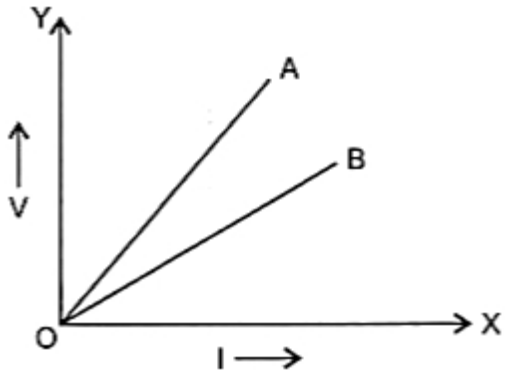
    i. What does the graph depict about the dependence of current on the potential difference?

ii. Find the current that flows through the resistor when the potential difference across it is 2.5 V.



42. Write three points of difference between an ohmic resistor and non-ohmic resistor. **[2]**

43. The given figure represents V-I graph for a series combination and for a parallel combination of two resistors. **[2]**
Which of the two, A or B, represents the series combination. Give a reason for your answer.



44. When a 12 V battery is connected across an unknown resistor, there is a current of 2.5 mA in the circuit. Find the value of the resistance of the resistor. **[2]**

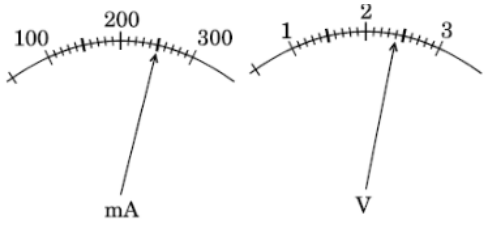
45. a. State the relation correlating the electric current flowing in a conductor and the voltage applied across it. Also draw a graph to show this relationship. **[2]**
b. Find the resistance of a conductor if the electric current flowing through it is 0.35 A when the potential difference across it is 1.4 V.

46. What is the limitation of Ohm's law? **[2]**

47. A current of 30 mA is flowing through a wire of resistance of 50Ω. what is the potential difference between two ends of the wire ? **[2]**

Section C

48. The current flowing through a resistor connected in a circuit and the potential difference developed across its ends are as shown in the diagram by milliammeter and voltmeter readings respectively: **[3]**
a. What are the least counts of these meters?
b. What is the resistance of the resistor?



49. a. How much current will an electric bulb draw from a 220 V source, if the resistance of the bulb filament is 1200 Ω? **[3]**
b. How much current will an electric heater coil draw from a 220 V source, if the resistance of the heater coil is 100 Ω?

50. You are provided with a resistor, a key, an ammeter, a voltmeter, four cells of 1.5 V each and few connecting wires. Using these circuit components, draw a labelled circuit diagram to show the setup to study the Ohm's law. State the relationship between potential difference (V) across the resistor and the current (I) flowing through it. Also draw V-I graph, taking V on the X-axis. **[3]**

51. Three students X, Y and Z while performing the experiment to study the dependence of current on the potential difference across a resistor, connect the ammeter (A), the battery (B), the key (k) and the resistor (R) in series, in the following three different orders. **[3]**

i. X→ B, K, R, A, B

ii. Y→ B, A, K, R, B

iii. Z→B, R, K, A, B

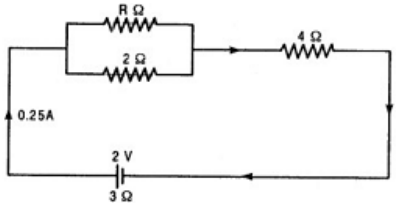
Who has connected them in the correct order?

52. What kind of graph is obtained by plotting values of V and I? Why? **[3]**

53. The following circuit diagram shows three resistors 2Ω, 4Ω, RΩconnected to a battery of e.m.f. 2V and internal resistance 3Ω. A main current of 0.25 A flows through the circuit. **[3]**

a. What is the P.D. across 4 Ω resistor.

b. Calculate P.D. across the internal resistance of the cell.



54. The values of current I flowing through a resistor for the corresponding values of potential difference V across it are given below: **[3]**

V(volts)	1.5	3.0	6.0	9.0
I(amperes)	0.5	1.0	2.0	3.0

a. Plot a graph between V and I.

b. Why should this graph pass through the origin?

c. Name and state the law which is represented by the graph.

Section D

Question No. 55 to 58 are based on the given text. Read the text carefully and answer the questions: **[4]**

In 1827, a German physicist Georg Simon Ohm (1787-1854) found out the relationship between the current I, flowing in metallic wire and the potential difference across its terminals. He stated that the electric current flowing through a metallic wire is directly proportional to the potential difference V, across its ends provided its temperature remains the same.

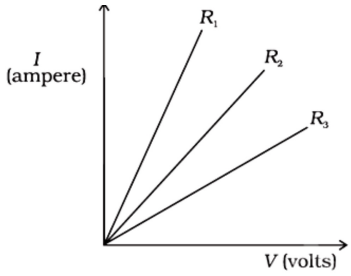
The resistance of a circuit is defined as the ratio between the voltage applied to the current flowing through it.

Rearranging the above relation,

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

Electric charge flows easily through some materials than others. The electrical resistance measures how much the flow

of this electric charge is restricted within the circuit.



55. What is the unit of electrical resistance?

56. Define Ohm's law.

57. From graph which resistance have high resistance?

58. What does the slope of V-I graph at any point represent?

59. **State True or False:** **[4]**

(a) A conductor having some appreciable resistance is called a resistor. **[1]**

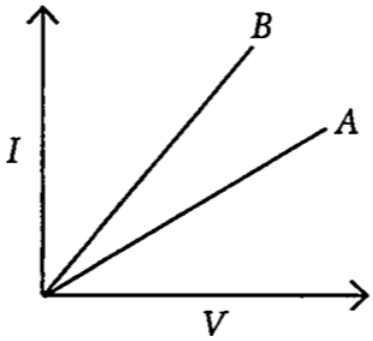
(b) A component used to regulate current without changing the voltage source is called variable resistance. **[1]**

(c) In an electric circuit, a device called rheostat is often used to change the resistance in the circuit. **[1]**

(d) The property of the conduct due to which it opposes the flow of current through it is called resistance of the conductor. **[1]**

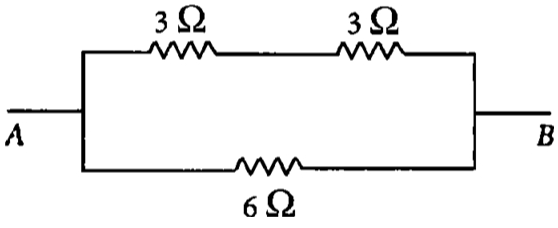
60. Several resistors may be combined to form a network. The combination should have two end points to connect it with a battery or other circuit elements. When the resistances are connected in series, the current in each resistance is same but the potential difference is different in each resistor. When the resistances are connected in parallel, the voltage drop across each resistance is same but the current is different in each resistor. **[4]**

i. The two wires of each of resistance R, initially connected in series and then in parallel. In the graph it shows the resistance in series and in parallel. Which one is correct?



ii. The equivalent resistance of r_1 and r_2, when connected in series is R_1 and when they are connected in parallel is R_2. Then the ratio is

iii. The equivalent resistance between A and B is



OR

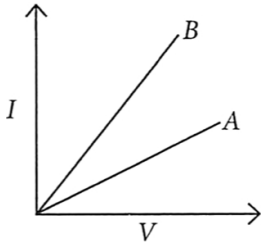
Two resistances 10 Ω and 3 Ω are connected in parallel across a battery. If there is a current of 0.2 A in 10 Ω resistor, the voltage supplied by battery is

61. The obstruction offered by a conductor in the path of flow of current is called resistance. The SI unit of **[4]**

resistance is ohm (Ω). It has been found that the resistance of a conductor depends on the temperature of the conductor. As the temperature increases the resistance also increases. But the resistance of alloys like mangnin, constantan and nichrome is almost unaffected by temperature. The resistance of a conductor also depends on the length of conductor and the area of cross-section of the conductor. More be the length, more will be the resistance, more be the area of cross-section, lesser will be the resistance.

i. Which of the following is not will desired in material being used for making electrical wires?

ii. The V - I graph for two metallic wires A and B is given. What is the correct relationship between their temperatures?



iii. Two wires of same material one of length L and area of cross-section A, other is of length 2L and area $\frac{A}{2}$,what is the relation between their resistance?

OR

A wire of resistance 20 Ω is cut into 5 equal pieces. The resistance of each part is

62. **Read the Case study followed by 3 questions Part (i) and (ii) are compulsory. However, an internal choice has been provided in part (iii):** **[4]**

The rate of flow of charge is called electric current. The SI unit of electric current is Ampere (A). The direction of flow of current is always opposite to the direction of flow of electrons in the current.

The electric potential is defined as the amount of work done in bringing a unit positive test charge from infinity to a point in the electric field. The amount of work done in bringing a unit positive test charge from one point to another point in an electric field is defined as potential difference.

$V_{AB} = V_B - V_A = \frac{W_{BA}}{q}$

The SI unit of potential and potential difference is volt.

i. The 2 C of charge is flowing through a conductor in 100 ms, then what would be the current in the circuit?

ii. What would be the potential difference between the two terminals of a battery, if 100 joules of work is required to transfer 20 coulombs of charge from one terminal of the battery to other?

iii. What is the number of electrons flowing per second in a conductor if 1 A current is passing through it?

OR

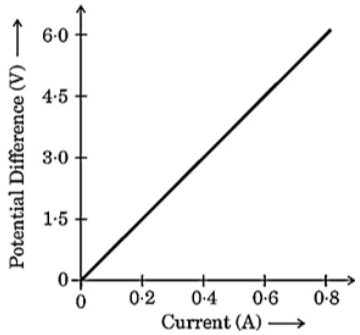
Write the formula of voltage in terms of work done, current, time and charge.

Section E

63. **[5]**

a. State Ohm's Law.

b. Name and define the physical quantity determined by the slope of V - I curve given in the diagram. Use this graph to find the value of this physical quantity in SI units.



c. Establish the relationship between 1 kWh and 1 joule.

64. 1. What is meant by the statement, The resistance of a conductor is one ohm? **[5]**

2. Define electric power. Write an expression relating electric power, potential difference and resistance.

3. How many 132 Ω resistors in parallel are required to carry 5 A on a 220 V line?

65. a. Derive the relation for the equivalent resistance when three resistors of resistances R_1, R_2 and R_3 are connected in parallel. **[5]**

b. Find the minimum resistance that can be made using four resistors, each of 20 Ω.

66. What is meant by resistance of a conductor? Name and define its SI unit. List the factors on Which the resistance of a wire affected, if (i) its length is doubled, (ii) its radius is doubled? **[5]**

Section F

67. **Fill in the blanks:** **[6]**

(a) Those substances through which electricity cannot flow are known as _____. **[1]**

(b) _____ states that at a constant temperature, the current flowing through a conductor is directly proportional to the potential difference across its ends. **[1]**

(c) A conductor having some appreciable resistance is called a _____. **[1]**

(d) In an electric circuit, a device called _____ is often used to change the resistance in the circuit. **[1]**

(e) A component used to regulate the current without changing the voltage source is called _____. **[1]**

(f) A component of identical size that offers a _____ resistance is a poor conductor. **[1]**