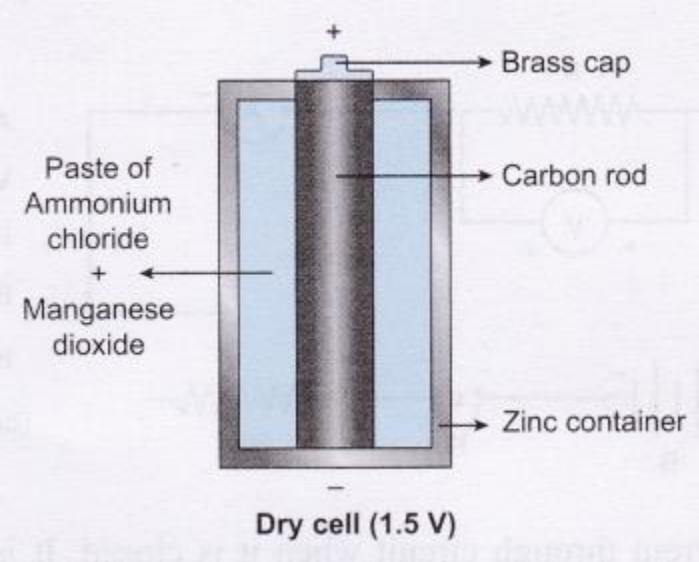
Ohm's Law

Introduction

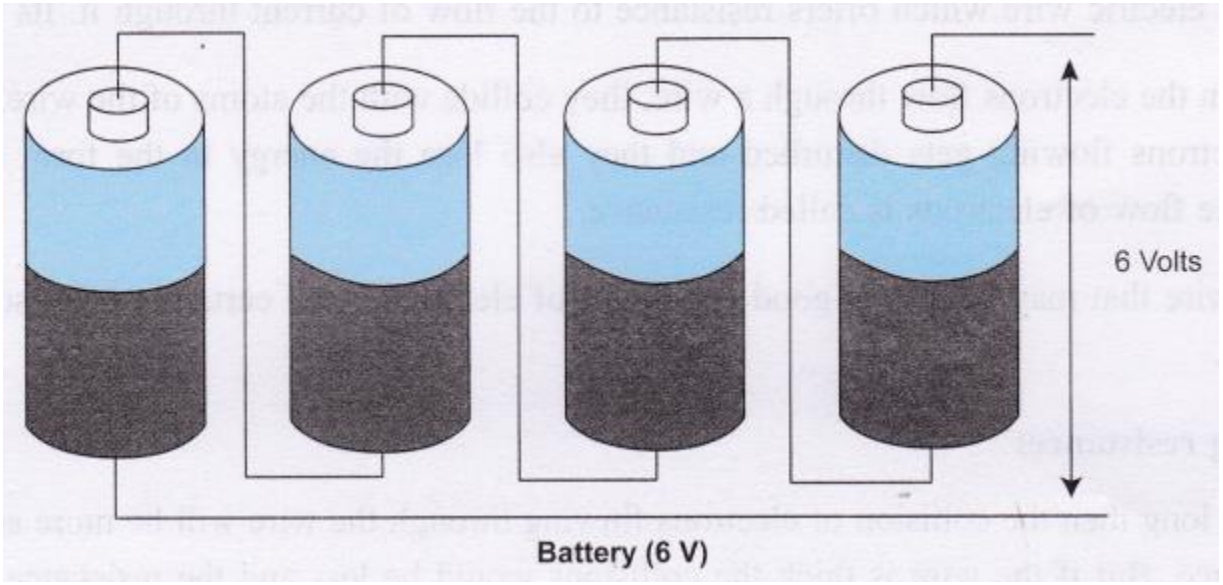
- **Charge:** There are two charges in nature i.e., positive and negative. The negative charge is due to electron. Its value is 1.6 x 10^{-19}C. It is measured in coulombs.
- **Coulomb:** One coulomb is the amount of charge present on 6.25 x 10^{18} electrons.
- **Electric Current:** It is the rate of flow of charge through a conductor. If a net charge Q flows across any cross-section of conductor in time t, then the current I, through the cross-section is
  $I = \frac{Q}{t}$
- The unit of current is ampere.
- **One Ampere:** One ampere is constituted by the flow of one coulomb of charge per second.
  $IA = \frac{1C}{1s}$
- It is measured by a device called ammeter which is always connected in series in a circuit.
- Potential difference In an electric circuit carrying current, the work done to move a unit charge from one point to the other is called potential difference.
  $V = \frac{W}{Q} = \frac{Work \quad done}{Charge}$
- The SI unit of potential difference is volt (V).
- **One Volt:** When 1 joule of work is done to move a charge of 1 Coulomb from one point to the other then potential difference is of 1 volt.
  $1Volt = \frac{1Joule}{1Coulomb}$
- It is measured by an instrument called the voltmeter. The voltmeter is always connected in parallel in a circuit.
- **e.m.f.:** Electro motive force, is the force which disturbs the equilibrium of free electrons flowing in the metal wire. The source of e.m.f. like cell or battery can develop a potential difference across the ends of the wire and the electrons can flow through the wire.
- **Ammeter:** The number of electrons flowing through a wire can be measured using ammeter. It is always connected in series in the circuit. The positive electrode of battery/cell is connected to the positive electrode of the ammeter and the negative end to the negative electrode of the battery.
- **Cell:** A cell is a device which produces potential difference in the wire and supplies the electrons to flow through the closed circuit. A primary cell produces 1.5 volts of potential difference.

Types of cells:



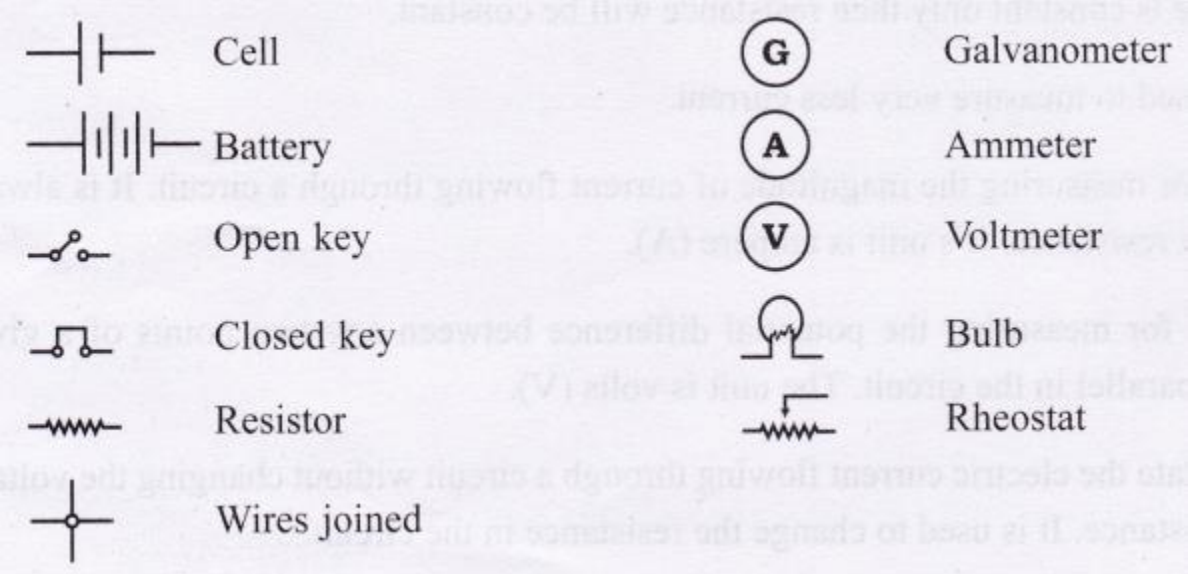
(a) Primary cell like dry cell, Lechlanche cell is used in torch, transistors etc. It produces 1.5 volts of p.d. (potential difference). For effective use should be used intermittently.
(b) Secondary cells can be recharged using a charger. The cell is connected to the charger and the electrons are stored in it which can be used later. Such cells are also called accumulators or storage cells.

- **Battery:** A combination of two or more cells is called battery. It is commonly used in cars, invertors.

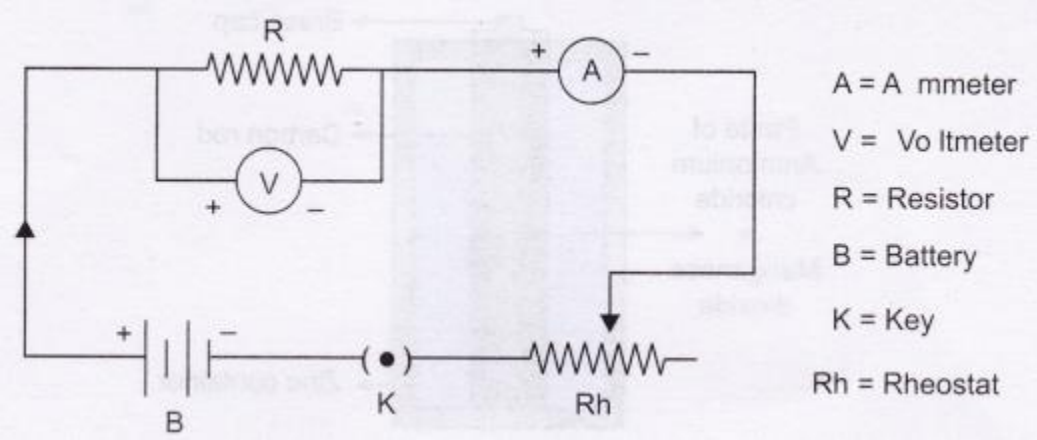


- **Conventional flow of current:** In the circuit diagram as shown below, the flow of electric current is always shown from positive end to a negative end of the battery. But we know that electrons in the circuit flow from negative terminal to positive terminal.

- When the flow of current was studied it was assumed that the positive electricity is flowing from higher potential to lower potential. The electrons were discovered much later.
- Symbols used in electric circuit:



- **Circuit diagram:**



- Key: It is used to pass the current through circuit when it is closed. It is also used to stop the current through circuit when it is open.
- **Ohm's law:** The current flowing through a metallic conductor held at constant temperature is directly proportional to the potential difference between the ends. V = IR
- **Resistor:** It is an electric wire which offers resistance to the flow of current through it. Its unit is Ohm (Ω).
- **Resistance:** When the electrons flow through a wire, they collide with the atoms of the wire, due to this collision the speed of electrons flowing gets disturbed and they also lose the energy in the form of heat energy. This obstruction for the flow of electrons is called resistance.
- Each and every wire that may be a very good conductor of electricity will certainly offer some resistance to the flow of electrons.

- **Factors affecting resistance:**
  (a) If the wire is long then the collision of electrons flowing through the wire will be more and hence it will offer more resistance. But if the wire is thick the collisions would be less and the resistance offer would be less. Hence, the resistance of the wire depends on the thickness, length material and the temperature of the wire.
  (b) If the wire is made up of same material and is thick the resistance will be less as compared the long wire of
  the same material at the constant temperature.
  (c) This law is not valid for semiconductors like diode, thermistor, diode, filament of lamp, light dependent resistor, LED etc. Therefore, all semiconductors are called non-ohmic materials.
- **Validity of Ohm's Law:** Ohm's law is valid only under the condition when temperature is kept constant. This is reasonable because when temperature is constant only then resistance will be constant.
- **Galvanometer:** It is an instrument used to measure very less current.
- **Ammeter:** It is an instrument used for measuring the magnitude of current flowing through a circuit. It is always connected in series, it offers very low resistance. It's unit is ampere (A).
- **Voltmeter:** It is an instrument used for measuring the potential difference between any two points of a given conductor. It is always connected in parallel in the circuit. The unit is volts (V).
- **Rheostat:** A component used to regulate the electric current flowing through a circuit without changing the voltage is called Rheostat. It has variable resistance. It is used to change the resistance in the circuit.

Science Lab Manual Class 10 Experiment – 1

Aim

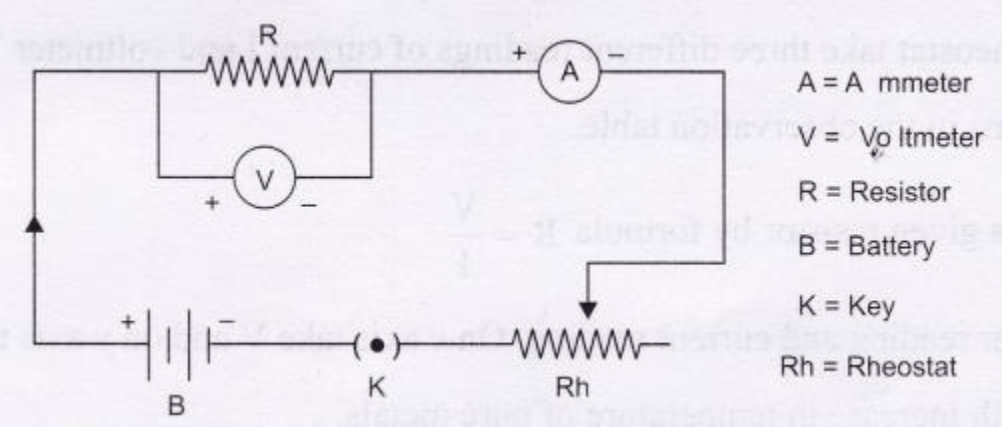
To study the dependence of potential difference (V) across a resistor on the current (I) passing through it and determine its resistance. Also plot a graph between V and I.

Theory

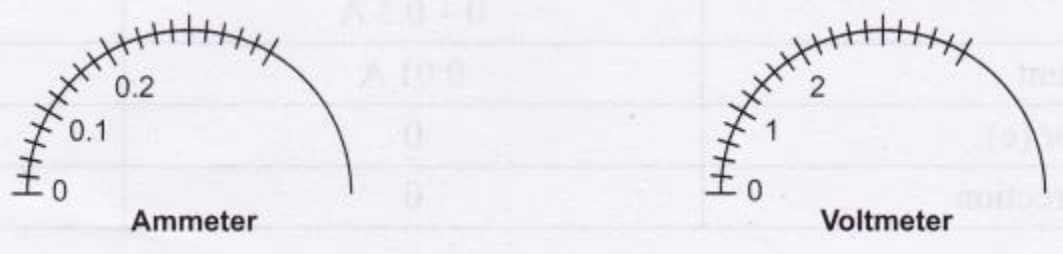
- **Ohm's Law:** The potential difference, V across the ends of a given metallic wire in an electric circuit is directly proportional to the current flowing through it, provided its temperature is the same. This is Ohm's law.
  $V \propto I$
  .'. $V = IR$, (Here R = Constant for the given metallic wire)
- The SI unit of resistance is Ohm (Ω).
  $R = \frac{V}{I}$
- **One Ohm:** If the potential difference across the ends of a conductor is 1 volt and the current flowing through it is 1 ampere, then the resistance of the conductor R is 1 ohm.

$$1 \text{ Ohm} = \frac{1 \text{ Volt}}{1 \text{ Ampere}}$$

- **Factors affecting resistance:**
- The nature of resistor (a conductor having some resistance.)
- The length of the resistance. ($R \propto l$)
  (Resistance increases as the length of the wire is increased)
- The area of cross-section of the resistor. $R \propto \frac{1}{A}$
  (Resistance decreases with the increase in the cross-section area of the wire)
- **Circuit Diagram:**



- In a circuit ammeter is always connected in series and voltmeter is connected in parallel across the points between which potential difference is to be measured.
- A straight line graph obtained between V and I verifies the Ohm's law.
- **Least Count:** It is very important to find the least count of ammeter and voltmeter before using them.



If in the ammeter, there are 10 divisions from 0 to 0.1 A then each division indicates 0.01 A.

A. To calculate the least count of ammeter.

Range of ammeter = A_R.....

Number of divisions in ammeter = A_N.....

.'. Least count of ammeter = $\frac{A_R}{A_N}$ = …….. ampere.

B. To calculate the least count of voltmeter.

Range of voltmeter = V_R……

Number of divisions in voltmeter = V_N

.'. Least count of voltmeter = $\frac{V_R}{V_N}$ = ……. volt.

Materials Required

A battery, an insulated copper wire (cut into 10 pieces), a key, an ammeter, a voltmeter,

a rheostat, a resistor and a piece of sand paper.

Procedure

1. Keep the devices as shown in the circuit diagram.
2. Connect them with the connecting wires and keep the key open.
3. Positive terminal of the battery is connected to the positive terminal of the ammeter.
4. Check the +ve and -ve terminals of voltmeter before connecting it in the circuit.
5. Once the circuit is connected, insert the key and check the rheostat, adjust its slider and see whether the ammeter and voltmeter readings are shown.
6. By using the slider of rheostat take three different readings of current 1 and voltmeter V.
7. Record your observations in the observation table.
8. Calculate resistance of a given resistor by formula $R = \frac{V}{I}$.
9. Plot a graph of voltmeter reading and current reading. On x axis take V and on y axis take I.
10. Resistance increases with increase in temperature of pure metals.

Observation Table

A. Least count of ammeter and voltmeter

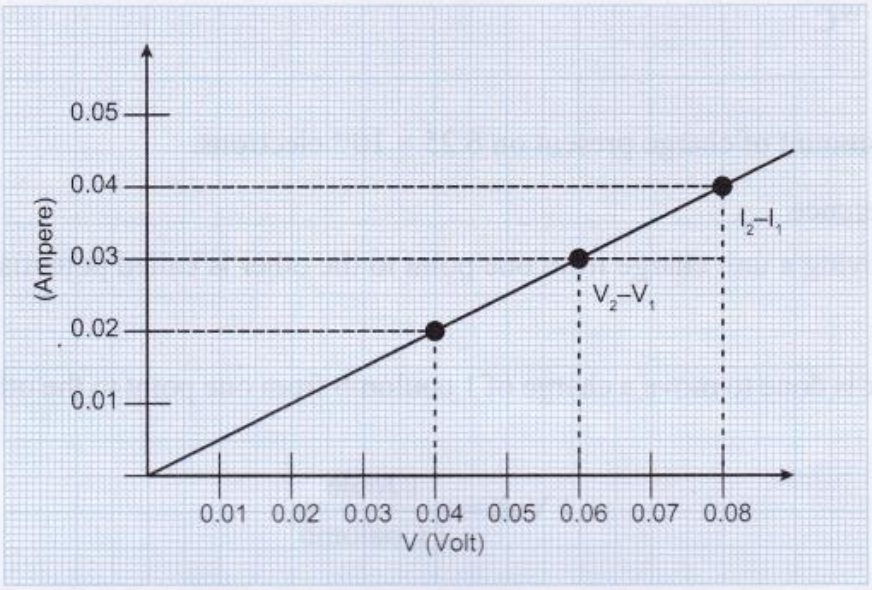
S. No.		Ammeter (A)	Voltmeter (V)
1.	Range	0 – 0.5 A	0-0.1 V
2.	Least Count	0.01 A	0.01 V
3.	Zero Error (e)	0	0
4.	Zero Correction	0	0

B. For reading of ammeter and voltmeter

S. No.	Current in Ampere (I) (Ammeter Reading)		Potential difference in Volts (V) (Voltmeter Reading)		Resistance in Ohms R = V/I(Ω)
	Observed	Corrected	Observed	Corrected	
1.	0	0.02	0	0.04	R1 =2 Ω
2.	0	0.03	0	0.06	R2 = 2 Ω

3.	0	0.04	0	0.08	R3 = 2Ω

$$\therefore \text{ Mean value of } R = \frac{R_1 + R_2 + R_3}{3} = \frac{2+2+2}{3} = 2\,\Omega$$



Graph between current and voltage

Conclusions

1. The value of R is found to be same and constant in all three readings.
2. The resistance of a resistor is ratio of potential difference V and current I.
3. The graph of V and I is a straight line. This shows that V∝I. This verifies Ohm's law.

Precautions

1. The connecting wires should be thick copper wires and the insulation of their ends should be removed using the sand paper.
2. Connections should be tight otherwise some external resistance may introduce in the circuit.
3. Connections should be made as per the circuit. Before closing the circuit show the connections to the teacher to take the readings.
4. The ammeter should be connected in series with the resister such that the current enters at the positive terminal and leaves at the negative terminal of the ammeter.
5. Voltmeter should always be connected in parallel to resistor.
6. Calculate the least count of voltmeter and ammeter correctly.
7. The pointers of the ammeter and voltmeter should be at zero mark when no current flows through the circuit.

8. Current should be passed through the circuit for a short time while taking observations; otherwise current would cause unnecessary heating in the circuit. Heating may change the resistance of resisters.

Science Lab Manual Viva Voce

Question 1:
Define electric current.
Answer:
The number of charges flowing through a given wire in unit time is called electric current.
OR
The rate of flow of charge in a conductor is called electric current.
$I = \frac{Q}{t}$

Question 2:
What is the value of charge in 1 electron?
Answer:
1 electron = 1.6×10^{-19}C

Question 3:
What is coulomb?
Answer:
One coulomb is the amount of charge present on 6.25×10^{18} electrons.

Question 4:
Define potential difference.
Answer:
The work done in moving a unit charge from one point to the other is called potential difference.

Question 5:
Define 1 volt.
Answer:
When 1 joule of work is done to move a charge of 1 coulomb from one point to the other, then potential difference
is of 1 volt.

$$1 \text{ Volt} = \frac{1 \text{ Joule}}{1 \text{ Coulomb}}$$

Question 6:
What is resistance? Give its SI unit.
Answer:

It is the property of a conductor to resist the flow of charges through it.
Its SI units is ohm(Ω). $R = \frac{V}{I}$

Question 7:
Define 1 ohm.
Answer:
If the potential difference across the ends of a conductor is 1 volt and the current flowing through it is 1 ampere, then resistance of the conductor is 1 ohm.

$$1\ \text{Ohm} = \frac{1\ \text{Volt}}{1\ \text{Ampere}}$$

Question 8:
What are the factors that affect resistance?
Answer:

1. The nature of resistor, i.e., material of a conductor.
2. The length of the resistor (R∝ l).
3. The area of cross-section of the resistor $\left(R \propto \frac{1}{A}\right)$
4. Temperature of wire.

Question 9:
What is Ohm's law?
Answer:
The potential difference V across the ends of a given metallic wire in an electric circuit is directly proportional to the current flowing through it, provided its temperature remains same.

Question 10:
How many electrons are present in 1 coulomb?
Answer:
In 1 coulomb 6.25 x 10^{18} electrons are present.

Science Lab Manual Practical Based Questions

Question 1:
What is the unit of current and how do we measure current flowing through a wire?
Answer:
The unit of current is ampere. It is measured by the device called ammeter.

Question 2:
What is the unit of potential difference and how do we measure potential difference?

Answer:
Its unit is volt and is measured by a device called voltmeter.

Question 3:
In an electric circuit containing resistance, ammeter, key and battery, where will you connect voltmeter to verify Ohm's law?
Answer:
Voltmeter will be connected parallel to the resistance.

Question 4:
If the length of a given resistor is increased, what will happen to the overall resistance?
Answer:
On increasing the length of the resistor its resistance increases.

Question 5:
To make electric heater what type of wire should be used?
Answer:
To make electric heater the wire used should be offering high resistance.

Question 6:
What is the nature of graph obtained for V and I?
Answer:
The graph is a straight line.

Question 7:
What does the straight line of a graph indicate?
Answer:
The straight line of the graph indicates that current I is directly proportional to voltage V.

Question 8:
What is the formula used to calculate the resistivity of a given wire?
Answer:
To calculate resistivity

$$R = \frac{\rho l}{A} \quad \therefore \quad \rho = \frac{RA}{l}$$

ρ = resistivity, R = resistance

A = Cross-section area of wire (resistance), l = length of wire (resistance)

Question 9:
What is meant by least count of an instrument?
Answer:

The least value that an instrument can measure is called its least count. It should be non-zero number.

Science lab manual NCERT Lab Manual Questions

Question 1:
In this experiment it is advised to take out the key from the plug when the observations are not being taken. Why?
Answer:
This helps in taking accurate readings. The unnecessary current flows through the circuit causes the heating effect and changes the resistance.

Question 2:
Suppose the ammeter (or voltmeter) you are using in this experiment do not have positive (+) and negative (-) terminal markings. How will you use such ammeter (or voltmeter) in the circuit?
Answer:
We need to identify the positive and negative terminal of the device by connecting it to the battery. Connect the ammeter in series and check for the deflection and connect voltmeter in parallel to the resistor in the circuit and check for the deflection.

Question 3:
If the resistor of a known resistance value is replaced with a nichrome wire of 10 cm length (say). How do the values of current through the nichrome wire and potential difference across the two ends of it may change? How the values will change if the replaced wire is of manganin in place of nichrome?
Answer:
The resistance of nichrome is more as compared to manganin. If the known resistor is replaced by the nichrome wire than the current will decrease and the potential difference will decrease. On replacing nichrome wire with manganin the current will increase and the potential difference will increase.

Question 4:
Suppose in this experiment you see 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?
Answer:
In the experiment if the deflection on ammeter or voltmeter scale goes beyond the full scale than the device needs to be replaced with the one which can measure higher current and voltage.
If the deflection takes place in opposite direction than the connections need to be checked and the terminals need to be interchanged.

Question 5:
Why is it advised to clean the ends of connecting wires before connecting them?
Answer:
The ends of the wire may get corroded or some impurities may be deposited on it hence to remove the same and get correct readings the ends of the wire should be cleaned.

Science lab activities - Multiple Choice Questions (MCQs)

Questions based on Procedural and Manipulative Skills
Question 1:
The instrument used to measure electric current is
(a) voltmeter
(b) ammeter
(c) resistor
(d) none of these

Question 2:
The instrument used to measure the potential difference is
(a) voltmeter
(b) ammeter
(c) rheostat
(d) galvanometer

Question 3:
The unit of electric current is
(a) volt
(b) ampere
(c) ohm
(d) joule

Question 4:
The SI unit of resistance of a wire is
(a) volt
(b) ampere
(c) ohm
(d) joule

Question 5:
The unit of charge is
(a) volt
(b) ampere
(c) joule
(d) coulomb

Question 6:
The resistance of a wire depends on
(a) material of wire
(b) length of wire
(c) cross-sectional area of wire
(d) all of these

Question 7:
According to Ohm's law, the relationship between V, I and R is

$(a)\ V = \frac{I}{R}$ $(b)\ V = IR$
$(c)\ R = VI$ $(d)\ V = \frac{R}{I}$

Question 8:
An ammeter has 20 divisions between mark 0 and mark 2 on its scale. The least count of the ammeter is
(a) 0.02 A
(b) 0.01 A
(c) 0.2 A
(d) 0.1 A

Question 9:
In a voltmeter there are 20 divisions between the 0 mark and 0.5 V mark. The least count of the voltmeter is
(a) 0.020 V
(b) 0.025 V
(c) 0.050 V
(d) 0.250 V.

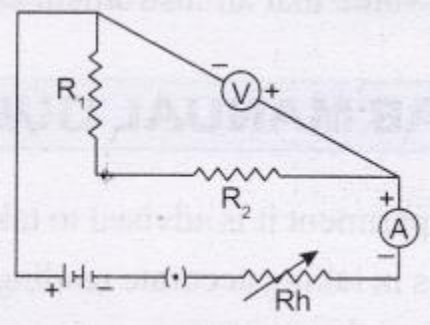
Question 10:
An ammeter has a range of (0-3) ampere and there are 30 divisions on its scale. What is the least count?
(a) 10
(b) 27
(c) 0.1
(d) 0.01

Question 11:
The resistance of an alloy
(a) increases with temperature
(b) decreases with temperature

(c) is constant with rise in temperature
(d) is zero.

Question 12:
What will happen to current passing through a conductor if potential difference across it is doubled and the resistance is halved?
(a) remains unchanged
(b) becomes double
(c) becomes halved
(d) becomes four times

Question 13:
For the experiment “to find the equivalent resistance of the two given resistors connected in parallel” the following circuit was drawn by a student.



The teacher pointed out the possibility of the following faults:
A. the ammeter was not correctly connected in the circuit
B. the voltmeter was not correctly connected in the circuit
C. the resistors IT and R2 were not correctly connected in parallel.
D. the rheostat and the key were not correctly connected in the circuit
The two faults pointed out correctly by the teacher, are
(a) A and B
(b) B and C
(c) C and D
(d) D and A

Question 14:
A voltmeter should have:
(a) high resistance
(b) low resistance
(c) moderate resistance
(d) variable resistance.

Question 15:
The ammeter connected in a circuit reads 0.01 A when battery is switched off. It means there is:
(a) wrong connections

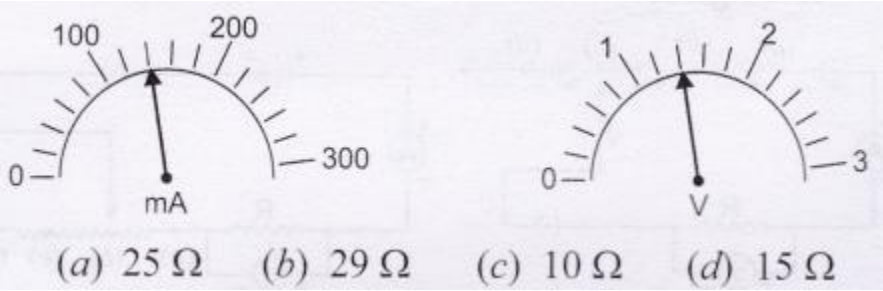
(b) zero error
(c) positive error
(d) negative error.

Question 16:
In an electric circuit the key should be kept off to avoid:
(a) damage of instrument
(b) damage of resistor
(c) incorrect readings
(d) none of these.

Question 17:
In Ohm's circuit which of the following does not have © and © terminals?
(a) Voltmeter
(b) Ammeter
(c) Battery
(d) Resistor

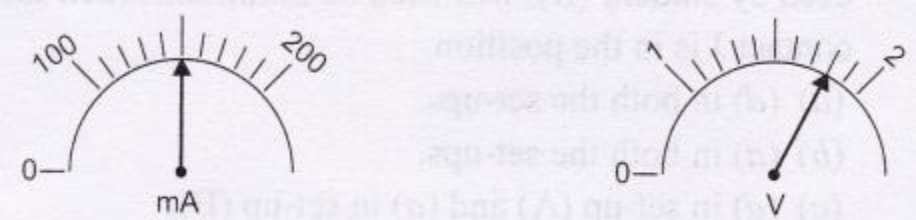
Question 18:
The resistance of a wire depends on:
(a) material of the wire
(b) length of the wire
(c) temperature of the wire
(d) all of these

Questions based on Observational Skills
Question 19:
The current flowing through a resistor connected in an electric circuit and potential difference developed across its ends are shown in the diagram.
Find the value of the resistance of the resistor is



Question 20:
The current flowing through a resistor connected in a circuit and the potential difference developed across its ends are as shown in the diagram. The approximate value of the

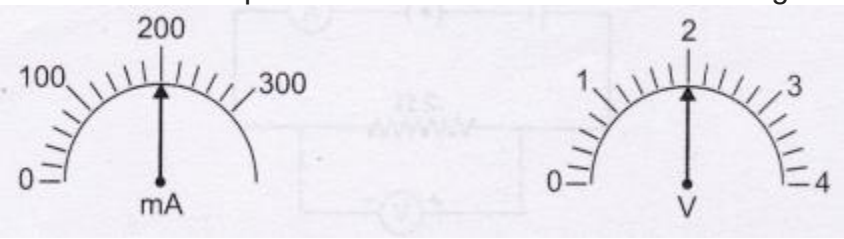
resistor is:



(a) 2 Ω (b) 6 Ω (c) 12 Ω (d) 15 Ω

Question 21:

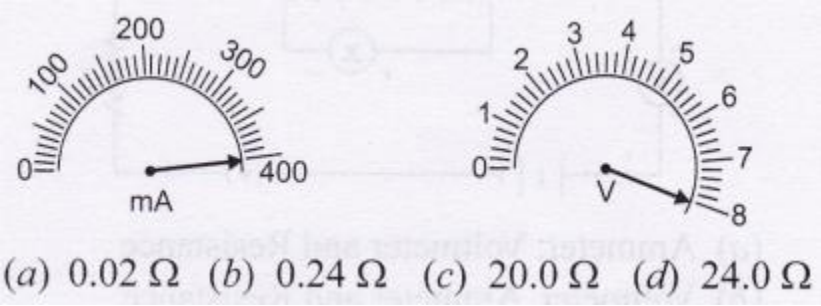
The current flowing through a resistor connected in an electrical circuit and the potential difference developed across its ends are shown in the given diagram.



The value of resistance of the resistor in Ohm is
(a) 25 (b) 20 (c) 15 (d) 10

Question 22:

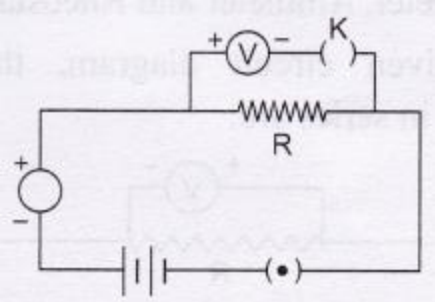
The current flowing through a conductor and the potential difference across its two ends are as per reading of the ammeter and the voltmeter shown below. The resistance of the conductor would be:



(a) 0.02 Ω (b) 0.24 Ω (c) 20.0 Ω (d) 24.0 Ω

Question 23:

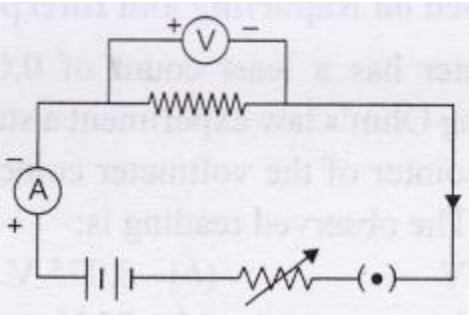
For the circuit diagram shown below, the student would observe



(a) same reading in both the ammeter and the voltmeter
(b) no reading in either the ammeter or the voltmeter
(c) some reading in the ammeter but no reading in the voltmeter.
(d) some reading in the voltmeter but no reading in ammeter.

Question 24:

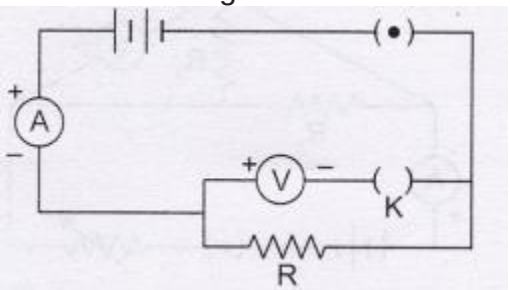
The following circuit diagram shows the experimental set-up for the study of dependence of current on potential-difference. Which two components are connected in the series?



(a) battery and Voltmeter
(b) ammeter and voltmeter
(c) ammeter and rheostat
(d) resistor and voltmeter

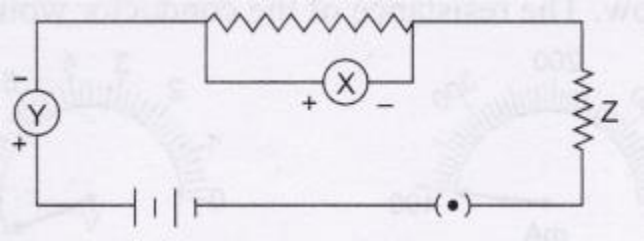
Question 25:

A student arranged an electric circuit as shown below:



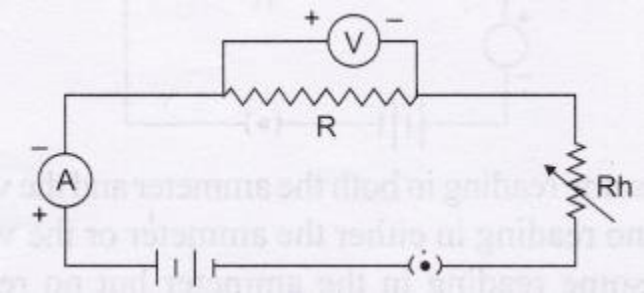
He would observe
(a) no reading in either the ammeter or the voltmeter.
(b) no reading in the voltmeter but a finite reading in the ammeter.
(c) no reading in the ammeter but a finite reading in the voltmeter.
(d) a finite reading in both the ammeter and the voltmeter.

Question 26:
To verify Ohm's law the given circuit diagram was drawn by a student. What does X, Y and Z in the circuit stand for respectively?



(a) Ammeter, Voltmeter and Resistance
(b) Voltmeter, Ammeter and Resistance
(c) Ammeter, Voltmeter and Rheostat
(d) Voltmeter, Ammeter and Rheostat.

Question 27:
In the given circuit diagram, the components connected in series are:

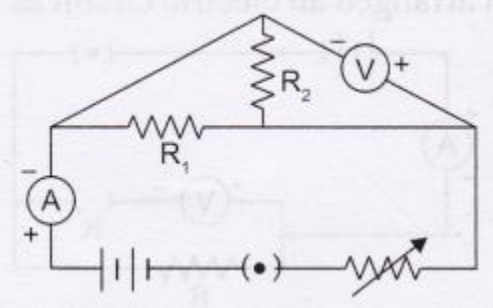


(a) battery and ammeter
(b) ammeter and resistor
(c) ammeter and rheostat
(d) all of the above.

Question 28:
In the above circuit diagram, the components connected in parallel are:
(a) battery and ammeter
(b) resistor and voltmeter
(c) rheostat and ammeter
(d) ammeter and voltmeter.

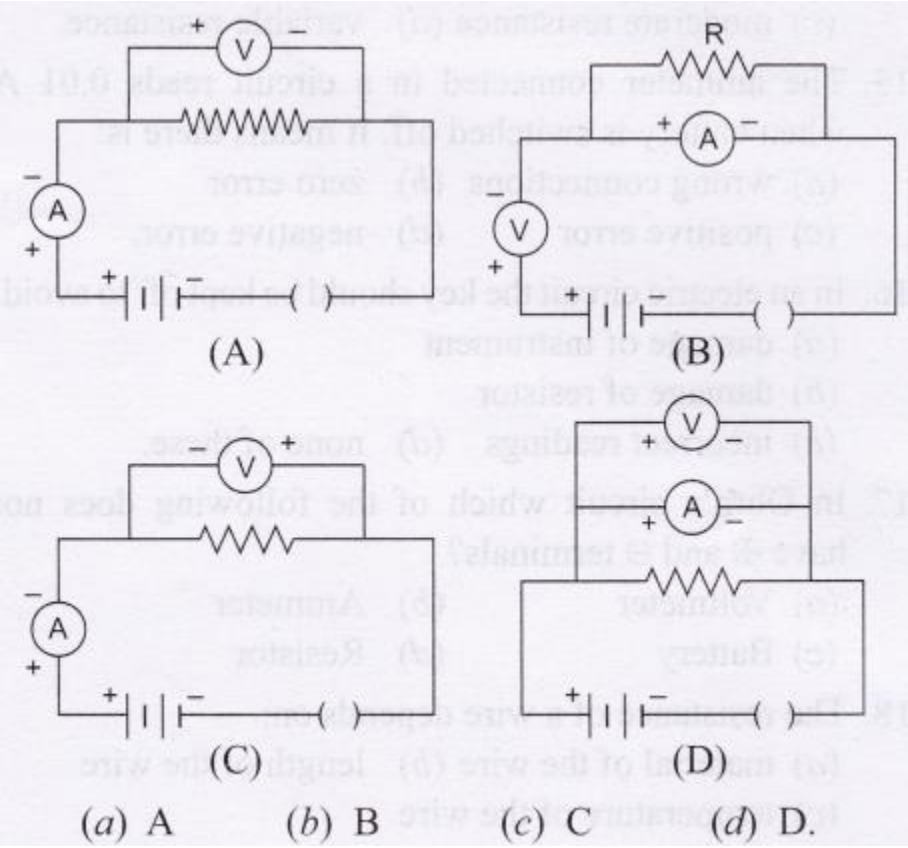
Questions based on Reporting and Interpretation Skills
Question 29:
A voltmeter has a least count of 0.05 volt. While performing Ohm's law experiment a student observed that the pointer of the voltmeter coincides with 15th division. The observed reading is:
(a) 0.75 V
(b) 0.075 V
(c) 7.5 V
(d) 75 V

Question 30:
The only correct statement for the following electric circuit is



(a) The voltmeter has been correctly connected in the circuit.
(b) The ammeter has been correctly connected in the circuit.
(c) The resistors R_1 and R_2 have been correctly connected in series.
(d) The resistors R_1 and R_2 have been correctly connected in parallel.

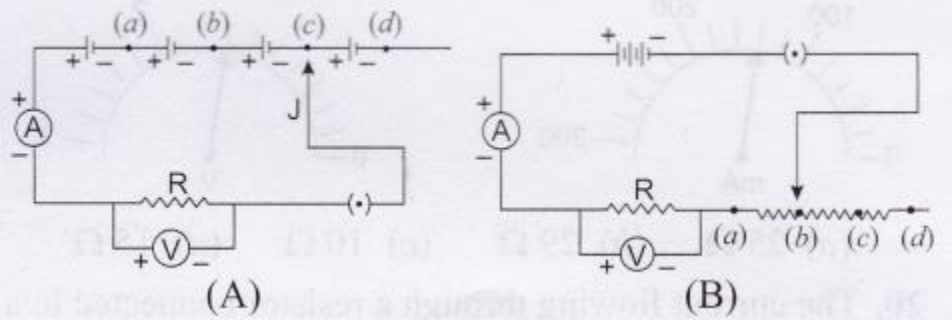
Question 31:
The correct set-up for studying the dependence of the current on the potential difference across a resistor is



(a) A (b) B (c) C (d) D.

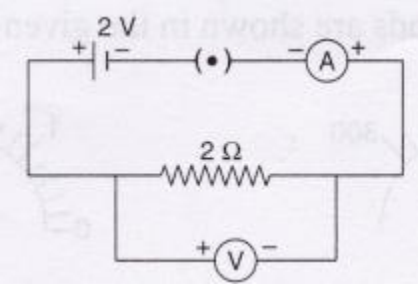
Question 32:
To study the dependence of the current (I) on the potential difference (V), across a resistor, two students used two set-ups shown in figures (A) and (B) respectively. They

kept the contact J in four different positions, marked (a), (b), (c) and (d) in the two figures.
For the two students, the value of the emf used by student (A) and the resistance due to the rheostat



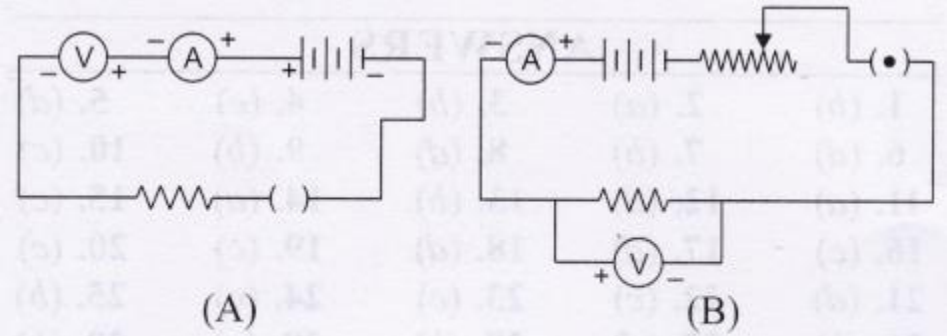
used by student (B), will each be minimum when the contact J is in the position.
(a) (d) in both the set-ups.
(b) (a) in both the set-ups.
(c) (d) in set-up (A) and (a) in set-up (B).
(d) (a) in set-up (A) and (d) in set-up (B).

Question 33:
In the circuit given below the voltmeter and ammeter readings are respectively



(a) 2 V and 2 A
(b) 1 V and 2 A
(c) 2 V and 1 A
(d) 1 V and 1 A.

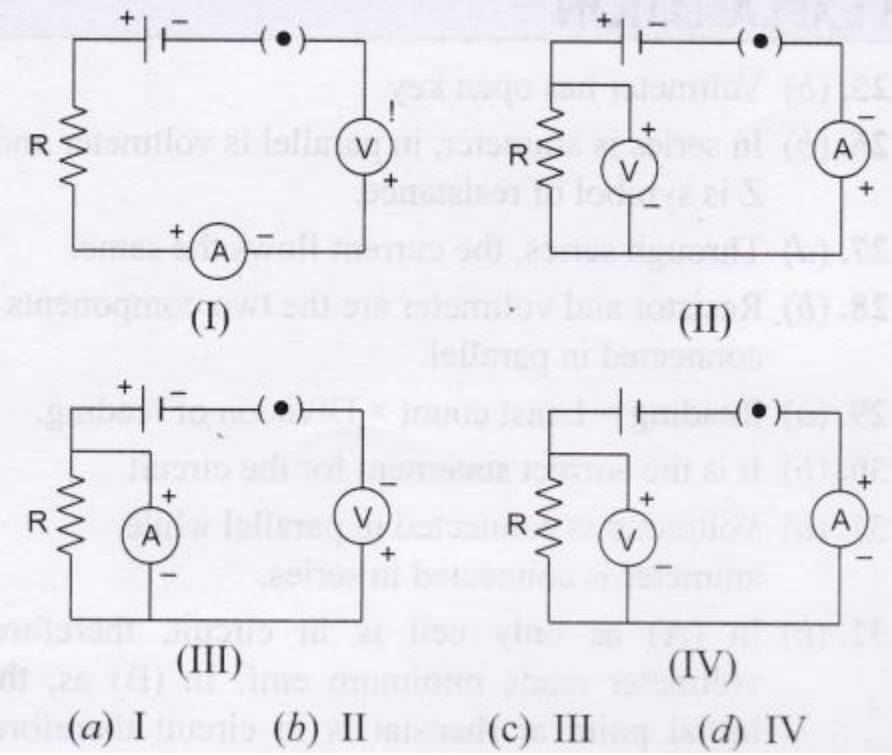
Question 34:
Which of the following set-up is correct for the verification of Ohm's law.



(A) (B)

(*a*) A (*b*) B
(*c*) both A and B (*d*) neither A nor B.

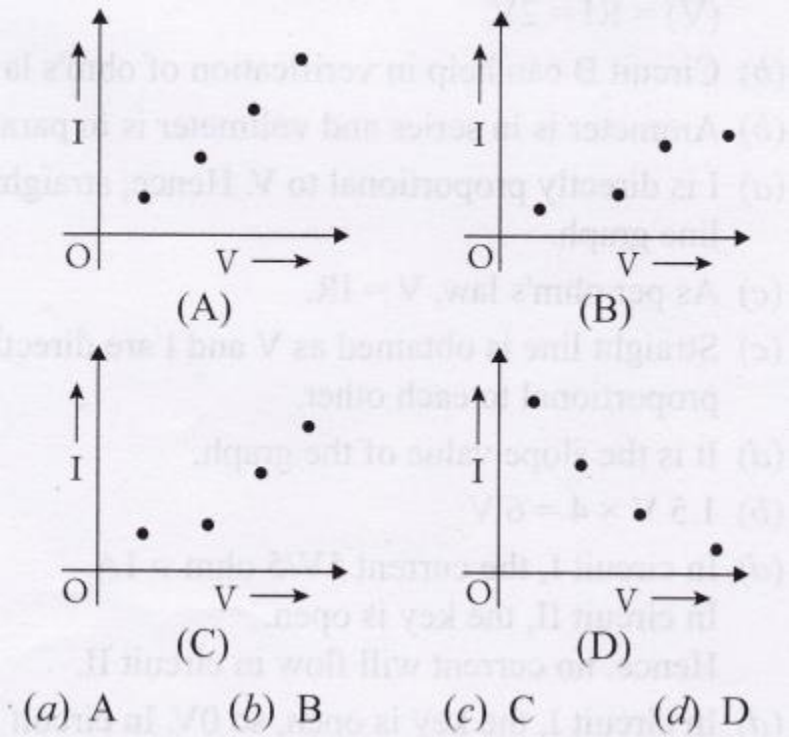
Question 35:
Identify the circuit in which the electrical components have been properly connected.



(*a*) I (*b*) II (c) III (*d*) IV

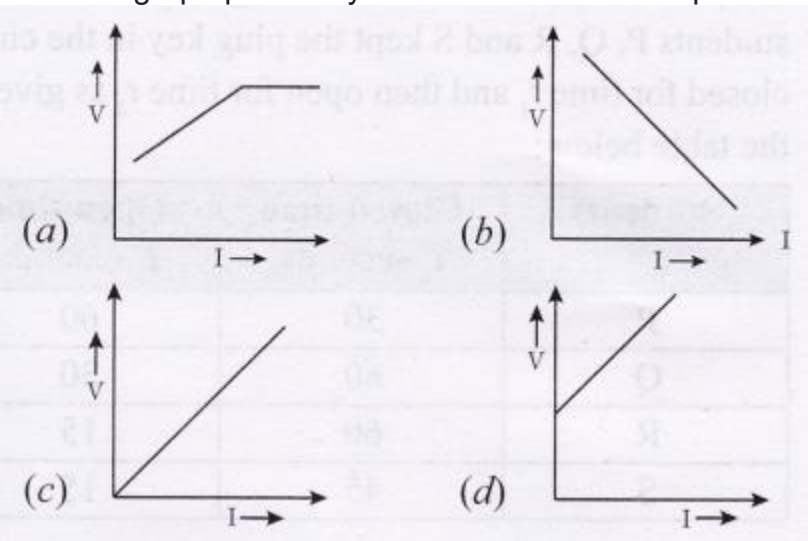
Question 36:
The plot correctly showing the dependence of the current 1 on the potential difference V

across a resistor R is

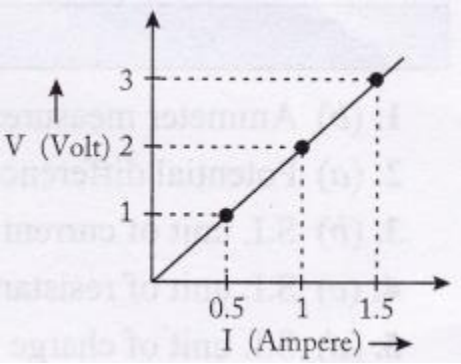


Question 37:
The graph of V-I is a straight line. The slope of this straight line graph gives:
(a) potential difference
(b) power
(c) resistance
(d) rheostat.

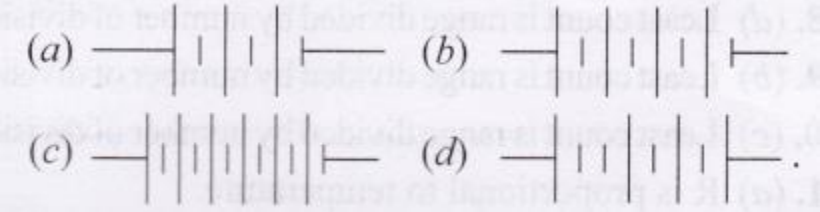
Question 38:
The best graph plotted by a student for Ohm's experiment is:



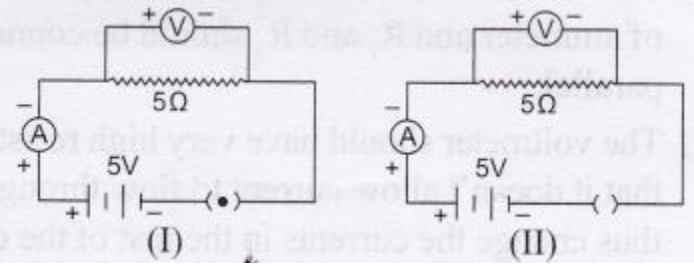
Question 39:
The given graph, is plotted for V-I to verify Ohm's law.
The resistance of the conductor used in the experiment is:
(a) 1 Ω
(b) 1.5 Ω
(c) 3 Ω
(d) 2 Ω



Question 40:
A student wanted to make a battery of 6 V of cells with e.m.f 1.5 V each. The correct arrangement is:

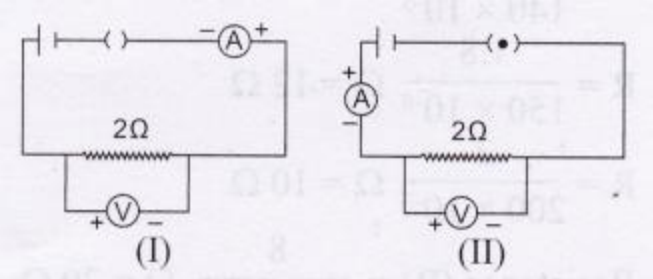


Question 41:
For the circuits shown in figures I and II, the ammeter readings would be:



(a) 0 A in circuit I and 1 A in circuit II
(b) 0 A in both the cases
(c) 1 A in both the cases
(d) 1 A in circuit I and 1 A in circuit II.

Question 42:
For the circuits shown in figures I and II given below, the ammeter reading is 1A so the voltmeter reading would be:



(a) 0 V in both the circuits
(b) 2 V in both the circuits
(c) 2 V in circuit I and 0 V in circuit II
(d) 0 V in circuit I and 2 V in circuit II.

Question 43:
In an experiment to study dependence of current on the potential difference across a given resistor, four students P, Q, R and S kept the plug key in the circuit closed for time t{ and then open for time t2 as given in the table below:

Students	Closed time t_1 seconds	Open time t_2 seconds
P	30	60
Q	60	30
R	60	15
S	45	15

The best choice of open and closed time is that of student
(a) P (b) Q (c) R (d) S

CBSE Class 10 Science Practicals Lab Manual MCQ Answers:

1. (b)	2. (a)	3. (b)	4. (c)	5. (d)
6. (d)	7. (b)	8. (d)	9. (b)	10. (c)
11. (a)	12. (d)	13. (b)	14. (a)	15. (c)
16. (c)	17. (d)	18. (d)	19. (c)	20. (c)
21. (d)	22. (c)	23. (c)	24. (c)	25. (b)
26. (b)	27. (d)	28. (b)	29. (a)	30. (b)
31. (a)	32. (b)	33. (c)	34. (b)	35. (b)
36. (a)	37. (c)	38. (c)	39. (d)	40. (b)
41. (d)	42. (d)	43. (a)		

Physics Lab Manual Scoring Key With Explanation

1. (b) Ammeter measures current.
2. (a) Potential difference is measured by voltmeter. S.I. unit of current is ampere.
3. (b) S.I. unit of resistance is ohm.
4. (c) S.I. unit of charge is coulomb.
5. (d) S.I. unit of charge is coulomb.
6. (d) R depends on all the given factors.
7. (b) Ohm's Law.
8. (d) Least count is range divided by number of divisions.
9. (b) Least count is range divided by number of divisions.
10. (c) Least count is range divided by number of divisions.
11. (a) R is proportional to temperature.
12. (d) As per Ohm's law of formula calculation.
13. (b) The -ve of voltmeter should be connected to +ve of ammeter and R(and R, should be connected in parallel.
14. (a) The voltmeter should have very high resistance so that it doesn't allow current to flow through it and thus change the currents in the rest of the circuit.
15. (c) The reading is shown on switched off circuit.
16. (c) The ON switch will interfere in correct readings as some current will keep flowing.
17. (d) Resistor is just a piece of wire.
18. (d) Resistance depends on all the given factors.
19. $(c)\ R = \frac{1.4}{140 \times 10^{-3}}\ \Omega = 10\ \Omega$
20. $(c)\ R = \frac{1.8}{150 \times 10^{-3}}\ \Omega = 12\ \Omega$
21. $(d)\ R = \frac{2}{200 \times 10^{-3}}\ \Omega = 10\ \Omega$

22. (c) Resistance $(R) = \frac{8}{400 \times 10^{-3}}\ \Omega = 20\ \Omega$
23. (c) Current will not flow through voltmeter as the key is open.
24. (c) They are in series.
25. (b) Voltmeter has open key.
26. (b) In series is ammeter, in parallel is voltmeter and Z is symbol of resistance.
27. (d) Through series, the current flows the same.
28. (b) Resistor and voltmeter are the two components connected in parallel.
29. (a) Reading = Least count x Division of reading.
30. (b) It is the correct statement for the circuit.
31. (a) Voltmeter is connected in parallel while ammeter is connected in series.
32. (b) In (A) as only cell is in circuit, therefore, voltmeter reads minimum emf. In (B) as, the initial point at rheostat is in circuit therefore, minimum resistance is in circuit.
33. (c) Current (I) =V/R= 1 A and potential difference (V) = RI = 2V.
34. (b) Circuit B can help in verification of ohm's law.
35. (b) Ammeter is in series and voltmeter is in parallel.
36. (a) I is directly proportional to V. Hence, straight line graph.
37. (c) As per ohm's law, V = IR.
38. (c) Straight line is obtained as V and I are directly proportional to each other.
39. (d) It is the slope value of the graph.
40. (b) 1.5 V x 4 = 6 V
41. (d) In circuit I, the current 5V/5 ohm = 1 A.
    In circuit II, the key is open.
    Hence, no current will flow in circuit II.
42. (d) In circuit I, the key is open, so 0V. In circuit II, the current flows and hence 2V.
43. (a) We must keep the circuit closed for a relatively shorter time and open for a relatively longer time