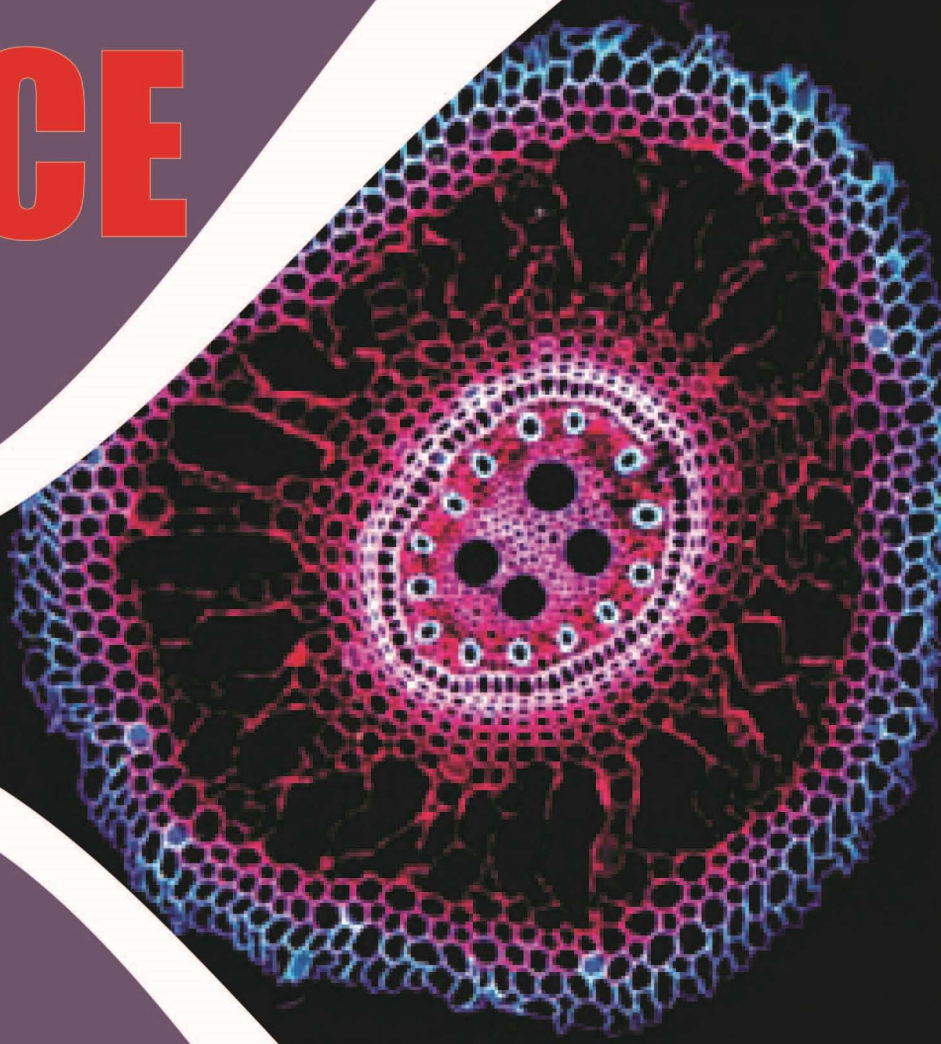
Saraswati

Lab Manual

SCIENCE

X



NEW SARASWATI HOUSE

Strictly in accordance with the latest CBSE syllabus

Saraswati

LAB MANUAL SCIENCE

(For Class X–First and Second Terms)

Based on CCE

R. Rangarajan
M.Sc., M.Ed.

R.P. Manchanda
M.Sc., M.Ed.

Rajesh Kumar
M.Sc., B.Ed.

New Saraswati House (India) Pvt. Ltd.
New Delhi-110002 (INDIA)

NEW SARASWATI HOUSE

Second Floor, MGM Tower, 19 Ansari Road, Daryaganj, New Delhi-110002 (India)
Phone : +91-11-43556600
Fax : +91-11-43556688
E-mail : delhi@saraswatihouse.com
Website : www.saraswatihouse.com
CIN : U22110DL2013PTC262320
Import-Export Licence No. 0513086293

Branches:
• Ahmedabad (079) 22160722 • Bengaluru (080) 26619880, 26676396
• Chennai (044) 28416531 • Dehradun 09837452852 • Guwahati (0361) 2457198
• Hyderabad (040) 42615566 • Jaipur (0141) 4006022
• Jalandhar (0181) 4642600, 4643600 • Kochi (0484) 4033369 • Kolkata (033) 40042314
• Lucknow (0522) 4062517 • Mumbai (022) 28737050, 28737090
• Patna (0612) 2570403 • Ranchi (0651) 2244654

Reprint 2016

ISBN: 978-81-7335-548-6

Published by: New Saraswati House (India) Pvt. Ltd.
19 Ansari Road, Daryaganj, New Delhi-110002 (India)

Printed at: Vikas Publishing House Pvt. Ltd., Sahibabad (Uttar Pradesh)

SYLLABUS

General Instructions

1. The units specified for each term shall be assessed through both Formative and Summative assessments.
2. In each term, there will be two Formative assessments each carrying 10% weightage.
3. The Summative assessment in each term will carry 30% weightage.
4. One Formative assessment carrying 10% weightage in each term should include hands on practicals.
5. Assessment of Practical Skills through MCQ will carry 15% weightage of term marks in each Summative assessment.

FIRST TERM COURSE STRUCTURE

UNITS	MARKS
I Chemical Substances	33
II World of Living	21
III Effects of Current	29
IV Natural Resources	07
TOTAL	**90**

FIRST TERM PRACTICALS

Practical should be conducted alongside the concepts taught in theory classes

1. To find the pH of the following samples by using pH paper/universal indicator.
   (*a*) Dilute hydrochloric acid
   (*b*) Dilute NaOH solution
   (*c*) Dilute ethanoic acid solution
   (*d*) Lemon juice
   (*e*) Water
   (*f*) Dilute sodium bicarbonate solution.
2. To study the properties of acids and bases HCl & NaOH by their reaction with
   (*a*) Litmus solution (Blue/Red)
   (*b*) Zinc metal
   (*c*) Solid sodium carbonate
3. To perform and observe the following reactions and classify them into:
   (*a*) Combination reaction
   (*b*) Decomposition reaction
   (*c*) Displacement reaction
   (*d*) Double displacement reaction
      (*i*) Action of water on quick lime
      (*ii*) Action of heat on ferrous sulphate crystals
      (*iii*) Iron nails kept in copper sulphate solution
      (*iv*) Reaction between sodium sulphate and barium chloride solutions.

4. (*a*) To observe the action of Zn, Fe, Cu and Al metals on the following salt solutions.
   (*i*) $ZnSO_4$ (aq.)
   (*ii*) $FeSO_4$ (aq.)
   (*iii*) $CuSO_4$ (aq.)
   (*iv*) $Al_2(SO_4)_3$ (aq.)
   (*b*) Arrange Zn, Fe, Cu and Al metals in the decreasing order of reactivity based on the above result.
5. 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.
6. To determine the equivalent resistance of two resistors when connected in series.
7. To determine the equivalent resistance of two resistors when connected in parallel.
8. To prepare a temporary mount of a leaf peel to show stomata.
9. To show experimentally that light is necessary for photosynthesis.
10. To show experimentally that carbon dioxide is given out during respiration.

SECOND TERM COURSE STRUCTURE

UNITS	MARKS
I Chemical Substances–Nature and Behaviour	23
II World of Living	30
III Natural Phenomena	29
IV Natural Resources	08
TOTAL	**90**

SECOND TERM PRACTICALS

Practical should be conducted alongside the concepts taught in theory classes

1. To study the following properties of acetic acid (ethanoic acid) :
   (*a*) odour
   (*b*) solubility in water
   (*c*) effect on litmus
   (*d*) reaction with sodium bicarbonate
2. To study saponification reaction for preparation of soap.
3. To study the comparative cleaning capacity of a sample of soap in soft and hard water.
4. To determine the focal length of
   (*a*) Concave mirror
   (*b*) Convex lens
   by obtaining the image of a distant object.
5. To trace the path of a ray of light passing through a rectangular glass slab for different angles of incidence. Measure the angle of incidence, angle of refraction, angle of emergence and interpret the result.
6. To study (*a*) binary fission in *Amoeba* and (*b*) budding in yeast with the help of prepared slides.
7. To trace the path of the rays of light through a glass prism.
8. To find the image distance for varying object distances in case of a convex lens and draw corresponding ray diagrams to show the nature of image formed.
9. To study homology and analogy with the help of models/charts of animals and models/charts/specimens of plants.
10. To identify the different parts of an embryo of a dicot seed (pea, gram or red kidney bean).

...CONTENTS...

SECOND TERM

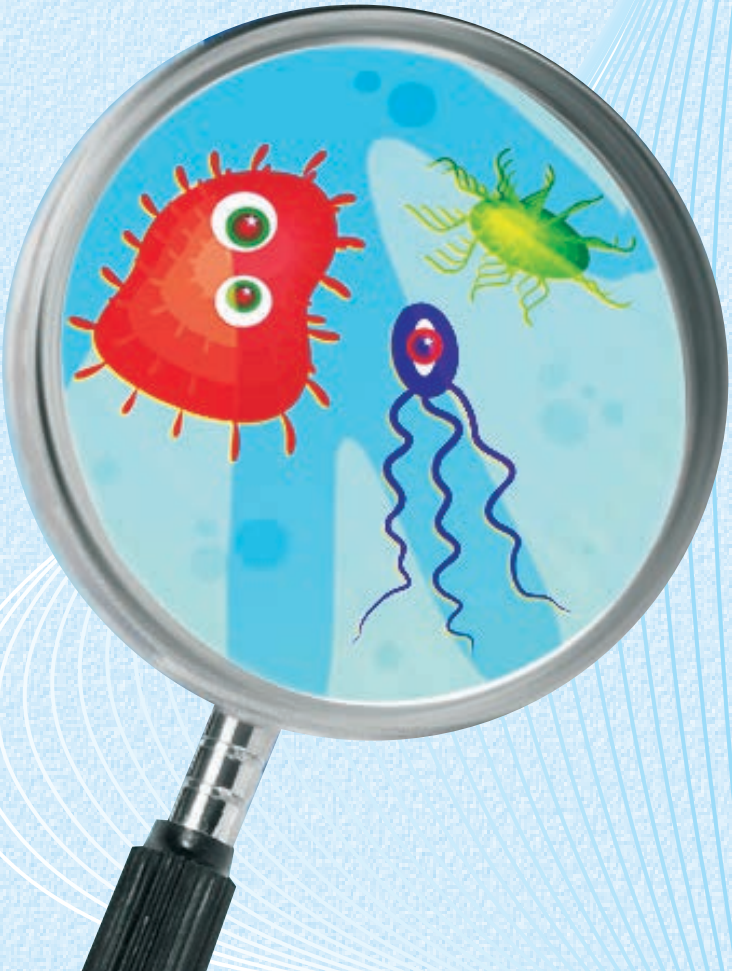
PHYSICS

CHEMISTRY

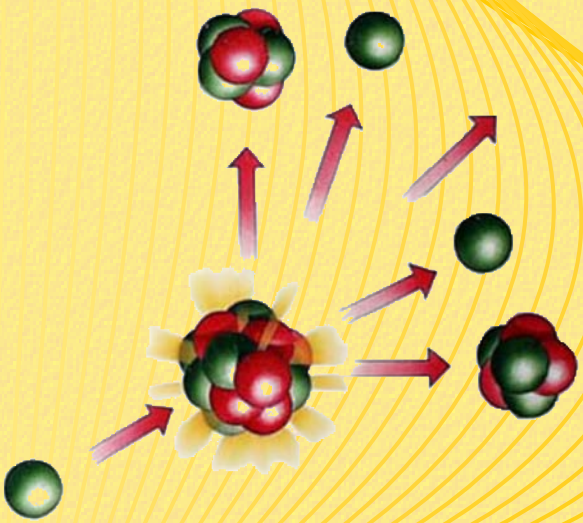
BIOLOGY

First Term

April to September



PHYSICS



1. EFFECTS OF CURRENT

Electric Current and Potential Difference

In general, atoms are neutral. But in conductors, the electrons in the outermost orbits are loosely bound and are free to move. The motion of these free electrons is said to constitute current. The amount of current flowing depends on the amount of charge flowing and the time.

Electric current is defined as the rate of flow of charges through any section of the conductor. If q is the charge flowing in time t then the current flowing is given by

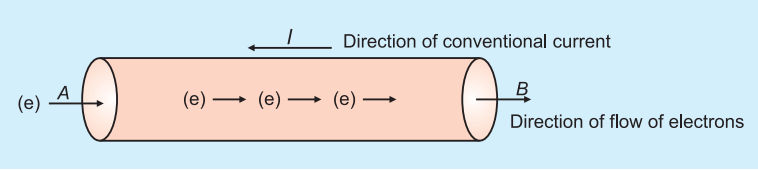
$$I = \frac{q}{t}$$

Charges are measured in coulomb, time in second so, the current is expressed in coulomb/sec or ampere.

The current flowing through a conductor is said to be one ampere when 1 coulomb of charge flows through the conductor for 1 second.

$$1 \text{ ampere} = \frac{1 \text{ coulomb}}{1 \text{ second}}$$

In the cross-section between A and B, the electrons flow from A to B. The conventional current is always taken opposite to the direction of electrons, *i.e.,* from B to A as shown by the arrow outside.

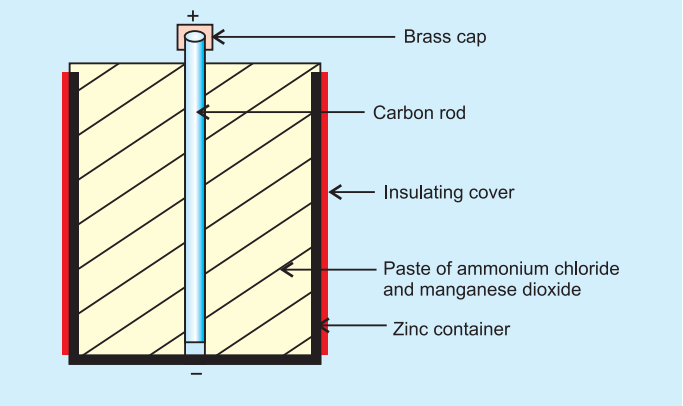


To maintain a steady current, two conditions are to be satisfied namely:

(*i*) Continuous loop or circuit, and

(*ii*) Development of potential difference.

Potential at a point is defined as the work done in bringing a unit (+ ve) charge from infinity to that point. Potential difference is the work done in carrying unit (+ ve) charge from one point to another. It is measured in volt. When potential difference is applied, there is an electric field created, which drives the electrons causing current. Application of potential difference can be done by using a cell or a battery. Primary cells which convert chemical energy to electrical energy and cannot be charged or re-used can be prepared in the laboratory. Dry cells are readily available in the market. Secondary cells or batteries of a car can be used. One can also use an eliminator using a.c. source to get a constant supply of current. A diagram of a dry cell is shown for a curious mind:



Dry cell produces 1.5 V potential difference between the carbon (+ ve) and zinc (– ve) terminals. Commercially these cells are produced by many companies and are used in torch, remote controls, etc., in day-to-day life.

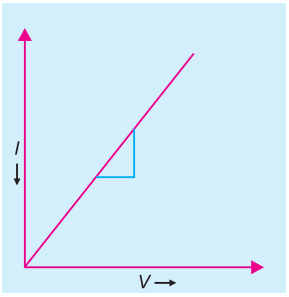
Ohm's law. According to this law, "When physical conditions remain the same, the electric current flowing through a conductor is directly proportional to the potential difference applied across the two ends."

$V \propto I$

i.e., $V = IR$, where I—Current in amperes

V—Potential difference in volts

R—Constant and is resistance of the conductor to the flow of charges.



Resistance of a conductor is defined as the opposition offered by the conductor to the flow of current through it.

The resistance of the conductor is directly proportional to its length and inversely proportional to its area of cross-section.

$$R \propto \frac{l}{A}$$

$\therefore\ R = \frac{\rho l}{A}$, where ρ is constant and called the resistivity of the material of the conductor. Resistance is measured in ohm and resistivity material constant is measured in ohm-m.

The resistance of a conductor is said to be one ohm if a current of one ampere flows through the conductor when a potential difference of 1 volt is applied across its ends.

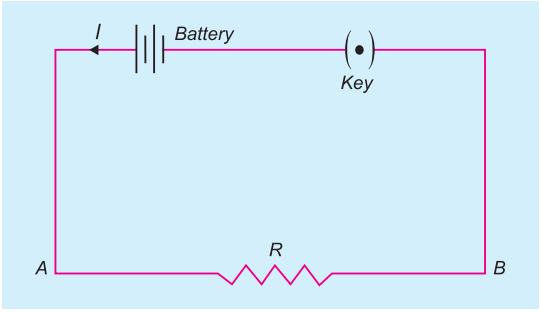
Since $V = IR$, the variation of I versus V should be a straight line, as shown in the above graph.

From the slope you can find the resistance. Since slope is $\frac{I}{V}$, the reciprocal of the slope exactly gives the resistance.

In any electric circuit, the resistance is indicated by the symbol 

.

A simple electric circuit is shown in following figure.



Battery is the source of energy or potential difference. Key is a safety device. The conductor carrying current is indicated by a resistance R. The direction of current indicated is that of conventional current. Instead of a battery, a dynamo or a battery eliminator can be used to create potential difference.

Resistance coil. In laboratory, resistance coils and boxes are available. Resistance coils are generally made of constantan or manganin materials. This is because they show less variation with any physical change. 1 Ω, 2 Ω and 10 Ω are some standard values of coil resistors.

Meters. The current flowing through a resistor is found by using an ammeter. It is always connected in series. When current flows, potential difference is created. It is measured by connecting a voltmeter. It is always to be connected in parallel. Whenever the ammeter and voltmeter are used, it is necessary to find their least count and one has to check whether there is zero error or not. If there is zero error, the pointer may not be at zero and so it needs to be adjusted for zero.

To find least count. Find the maximum reading (range R) in the instrument scale. Find the number (N) of divisions in the marked range. Least count = $\frac{R}{N}$ in the respective units.

Rheostat. It is a coil of a wire mounted in a frame. By the use of sliding contact in the rheostat, the number of turns in the circuit are varied and so the current can be varied.

Finding Resistance of a Coil

Experiment 1

AIM

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

APPARATUS REQUIRED

Resistance coil, connecting wires, key, battery eliminator, ammeter, voltmeter, etc.

SPECIFIC OBJECTIVE

1. To learn to define steady current.
2. To understand the need for a battery to have current.
3. To learn about the opposition to the flow of current.
4. To learn to use eliminator, rheostat, voltmeter and ammeter.
5. To learn to draw V–I graph to find resistance.

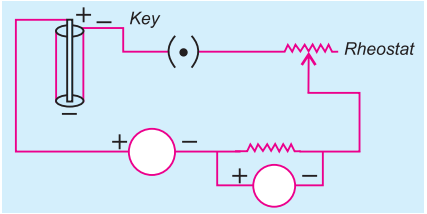
THEORY

Current flowing through a conductor depends on the potential difference applied across its ends, *i.e.*,

$I \propto V \Rightarrow V = IR$

Resistance can be found by taking the ratio between the potential applied and the current flowing as a result of it. Potential difference and current can be measured by using voltmeter and ammeter in volt and ampere respectively.

PROCEDURE



1. Get a battery eliminator or battery, key, ammeter, voltmeter and a rheostat and connect them as shown in the adjacent diagram.
2. Plug in the key and switch on the eliminator after adjusting it for 2 volts.
3. Position the rheostat such that a fixed value of current flows in the circuit.
4. Note down the voltmeter reading for a particular value of current sent in the resistor.
5. Change the position of slider in rheostat such that the current flowing is changed.
6. Note down the voltmeter reading again and similarly take 5–6 observations.
7. Record the current and voltage in each case and find the ratio between V and I to get resistance of the coil.
8. Draw a graph between V and I choosing proper scales. (V on X-axis, I on Y-axis)
9. Find the slope of the graph.
10. Take the reciprocal of the slope.
11. The straight line nature of the graph and the value of the reciprocal of slope gives confirmation of the resistance (being a constant).

OBSERVATION

Range of voltmeter = R_V = ...

Number of divisions in voltmeter N_V = ...

Range of ammeter = R_A = ...

Number of divisions in ammeter N_A = ...

Least count of voltmeter = $m = \dfrac{R_V}{N_V}$ = ... volt.

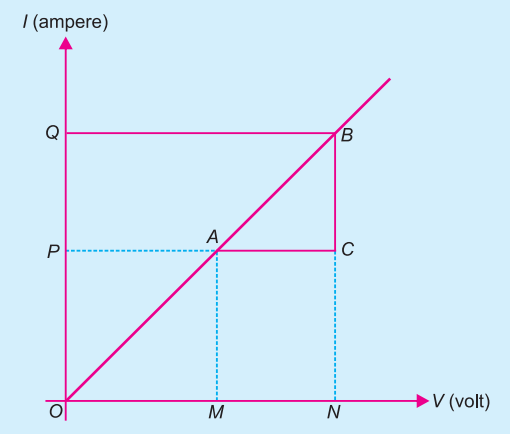
Least count of ammeter = $n = \dfrac{R_A}{N_A}$ = ... ampere.

TABULATION

S.No.	No. of divisions in		Voltage	Current	$R = \frac{V}{I}$
	Voltmeter x	Ammeter y	$V = m \times x$	$I = n \times y$	
1.					
2.					
3.					
4.					
5.					

Mean value of R = _____ Ω

GRAPH



Scale:

x-axis: 1 cm = ... volt

y-axis: 1 cm = ... ampere

Slope = $Z = \frac{BC}{AC}$ = ...

Resistance = $\frac{1}{\text{Slope}} = \frac{1}{Z}$ ohm = ... ohm.

INFERENCE

(*i*) The current through the resistor is seen to vary directly with the potential difference applied.

(*ii*) The value of resistance of the given resistor is found to be ..... ohm.

PRECAUTIONS / SOURCES OF ERROR

1. Rub and remove any dust using sand paper from the tips of the wires before connecting.
2. After connecting before switching on, get the circuit checked by the teacher.
3. When not in use, switch off the supply of current.
4. Use a rheostat of low resistance so that better variation can be brought in current.
5. Note down the zero errors in voltmeter and ammeter and do proper correction.
6. Avoid touching any wire by hand, when there is a supply of current.
7. If the wire is heated, switch off the supply for a while and then do the experiment.
8. Note down the reading from the scales of metres used, by placing your eye exactly in line with it (Removes parallax).

VIVA VOCE QUESTIONS

Q1. Is atom charged?

Ans. No, it is neutral.

Q2. Define current.

Ans. Rate of flow of charges in a conductor is called current. $I = \frac{q}{t}$

Q3. Write the SI unit of current.

Ans. Ampere is the SI unit of current.

Q4. What is coulomb?

Ans. Coulomb is the SI unit of charge.

Q5. Give two essential conditions for current flow.

Ans. (*i*) Continuous loop (*ii*) Potential difference.

Q6. What is conventional current direction?

Ans. Conventional current direction is opposite to the direction of flow of electrons.

Q7. Define potential at a point.

Ans. Potential at a point is defined as the work done in carrying unit positive charge from infinity to that point.

Q8. State Ohm's law.

Ans. When physical conditions remain same, the current flowing through a conductor is directly proportional to the potential difference applied across its ends.

Q9. What is resistance?

Ans. The opposition offered to the flow of current in a conductor is called resistance.

Q10. Write the SI unit of resistance, potential and current.

Ans. ohm (Ω), volt and ampere.

Q11. What are the factors affecting the resistance?

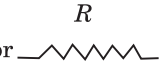
Ans. Nature of material—resistivity.

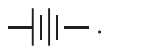
Length and area of cross-section.

Q12. How do you create potential difference?

Ans. By using a battery or electrochemical cell.

Q13. Draw the symbol for resistor and a battery.

Ans. Resistor 

Battery  .

Q14. What is the use of (*i*) voltmeter (*ii*) ammeter?

Ans. Voltmeter—used to find potential difference.

Ammeter—used to find current.

Q15. How do you connect a (*i*) voltmeter (*ii*) ammeter?

Ans. (*i*) Voltmeter is connected in parallel, and (*ii*) Ammeter is always connected in series.

Q16. What is the use of a rheostat?

Ans. It is used to vary current in a circuit.

Q17. What is the use of battery eliminator?

Ans. It creates potential difference.

Q18. What is the use of key in electric circuit?

Ans. It is a device used for safety and make or break a circuit according to the requirement.

Q19. In the absence of electricity supply, how can you do the experiments on electricity?

Ans. By using dry cell or battery.

Q20. From where does a dry cell get its energy?

Ans. Energy of dry cell comes from the energy of the chemicals in the form of electrolyte.

Q21. If you increase the value of resistance in this experiment, how will the value of current change?

Ans. Current decreases.

Q22. Why is it advised to take out the key when the observations are not being taken?

Ans. To avoid continuous flow of current causing heat in the resistor.

Q23. Why is it advised to clean the ends of connecting wires before connecting them?

Ans. To avoid loose contact or insulators like dust stopping closed circuit.

Practical Based Questions

Multiple Choice Questions (1 Mark)

1. Current will flow when potential difference
(*a*) is applied (*b*) is zero (*c*) is constant (*d*) is reversed.

2. Potential difference can be created by
(*a*) Plug key (*b*) Two-way key (*c*) Batteries (*d*) Connecting wires.

3. An electrical circuit essentially consists of
(*a*) a source of potential (*b*) a resistor (*c*) a key (*d*) both (*a*) and (*b*).

4. In series connection, the number of common points with the devices is
(*a*) one (*b*) two (*c*) more than two (*d*) dependent on the circuit.

5. In household connections, we use
(*a*) series (*b*) parallel (*c*) both (*a*) and (*b*) (*d*) none of these.

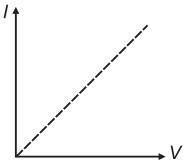
6. The meter to be connected in parallel for measurement is
(*a*) voltmeter (*b*) ammeter (*c*) both (*a*) and (*b*) (*d*) none of these.

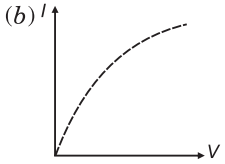
7. Ammeters should be connected in
(*a*) series (*b*) parallel (*c*) may be (*a*) or (*b*) (*d*) always parallel.

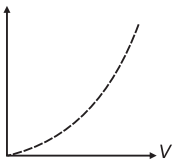
8. Use of battery eliminator
(*a*) ensures a steady potential supply (*b*) allows varying current
(*c*) both (*a*) and (*b*) (*d*) none of these.

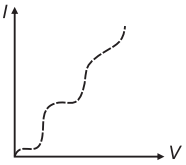
9. By using an ammeter and voltmeter, the physical quantity that cannot be measured directly is
(*a*) current (*b*) voltage (*c*) resistance (*d*) none of these.

10. Which of the following graphs shows the variation of voltage *V* with current *I*?

(*a*) 

(*b*) 

(*c*) 

(*d*) 

11. The slope *V–I* graph is
(*a*) Voltage (*b*) Power (*c*) Current (*d*) Resistance.

12. The ratio *I/V* is called
(*a*) Resistance (*b*) Power (*c*) Conductance (*d*) Voltage.

13. The current flow can be varied by the use of
(*a*) a rheostat (*b*) variable source of energy (*c*) battery eliminator (*d*) all of these.

14. What is the use of plane mirror in voltmeter and ammeter?
(*a*) It helps to make the measurement accurate (*b*) It gives resistance directly
(*c*) It makes the meter good looking (*d*) It gives light to take reading.

15. Connecting wires are made of
(*a*) Aluminium (*b*) Copper (*c*) Germanium (*d*) Constantan.

16. While taking the reading in meter, the eye should be held
(*a*) from left of the pointer (*b*) from right of the pointer
(*c*) directly above the pointer (*d*) any of these.

17. The source of energy used by you is indicated by
(*a*)  (*b*) (*c*) (*d*)

18. The voltmeter should be connected in parallel to
(*a*) the ammeter (*b*) the resistor (*c*) the battery (*d*) none of these.

19. To vary the current in a circuit, the most preferred device is
(*a*) a variable resistor (*b*) a rheostat (*c*) a variable source (*d*) all of these.

20. When current is not switched on and the ammeter shows a reading of 0.1 ampere, then there is
(*a*) zero error (*b*) positive error (*c*) negative error (*d*) both (*b*) and (*c*).

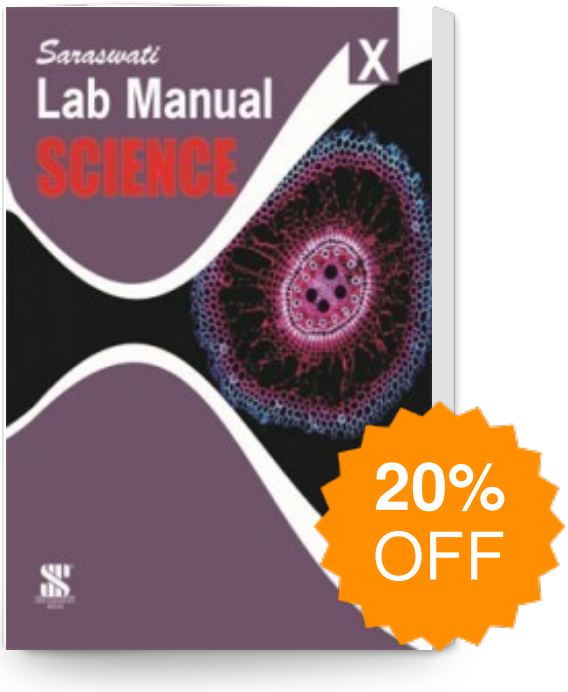
21. During the time you do not take reading, it is advisable to put off the battery since
(*a*) heat will be produced in wire (*b*) resistance of the wire will vary with temperature
(*c*) ohm's law may not be applicable if (*b*) happens (*d*) both (*b*) and (*c*)

22. Rheostat is used to vary
(*a*) Resistance (*b*) Current (*c*) Potential (*d*) Power.

23. Rate of change of charge in a circuit is called
(*a*) Resistance (*b*) Current (*c*) Potential (*d*) Power.

24. For current to flow in a circuit, one needs
(*a*) Resistance (*b*) Current (*c*) Potential (*d*) Power.

Saraswati Lab Manual Science Class-X Term-I & II



Publisher : SChand Publications ISBN : 9788173355486

Author : R. P. Manchanda, R. Rangarajan, Rajesh Kumar