OSWAAL CBSE

Laboratory Manual

Physics

Class 12

Highlights

1. Strictly as per latest CBSE guidelines.
2. Includes all Activities / Experiments specified in latest CBSE curriculum.
3. Includes 'Viva Voce' Questions for each activity / experiment.
4. High Quality figures for overall understanding of the concepts.
5. Projects to facilitate collective efforts and extension of learning to real life situations.
6. Brief description of each Activity / Experiment given as 'Theoretical Concepts'.

OSWAAL

LABORATORY MANUAL

PHYSICS

Class 12

Name .....

School .....

Class..... Section .....

Roll No. .....

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PREFACE

CBSE always believe in Global Trends of Educational Transformation. The CBSE curriculum gets its lead from National Curriculum Framework – 2005 and Right to Free and Compulsory Education Act – 2009. As said by John Holt "We learn to do something by doing it. Laboratory work has special importance in the learning of science as scientific principles develop and grow on the basis of Laboratory work.

Lab Manuals for Classes XI & XII has been written so as to supplement the need of the students to prepare for lab work and improve practical skills among students.

This Lab Manual includes all activities and experiments as specified in latest CBSE curriculum. Each activity/experiment comprises of theoretical concepts which provides brief description about activities. At the end of every activity Viva Voce questions have been given for extra practice. Projects have been added to facilitate collective efforts and extension of learning to real life.

This book is strictly according to the latest CBSE guidelines, and contains more than sufficient viva voce questions and brief description of each activity/experiment, which help students in practicing and completing the lab work. All activities and experiments are always checked twice. Practically, this book provides students everything they need to learn during their lab work. Since we believe in continuous improvement, hence this book has been written with accuracy as well as updated as per CBSE guidelines and reviewed at different tiers by panel of experts.

We are sure that this book will serve as a perfect teaching guide for the teachers and good lab manual for the students. It is expected that they will take full advantage of our knowledge and experience.

At last we would like to thank our authors, editors, reviewers and specially students who regularly send us suggestions which helps in continuous improvement of this book and makes this book stand in the category of "One of the Best". Wish you all Happy Learning.

–Publisher

Activities

LIST OF EXPERIMENTS

Practicals should be conducted alongside the concepts taught in theory classes.

Sr. No.	Experiment	Date	Page	Remarks

Practicals

Evaluation Scheme for Examination	Marks
Two experiments one from each section	8+8
Practical record (experiment and activities)	6
Investigatory project	3
Viva on experiments, activities and project	5
Total	**30**

SECTION – A

Experiments

1. To determine resistance per cm of a given wire by plotting a graph for potential difference versus current.
2. To find resistance of a given wire using metre bridge and hence determine the resistivity (specific resistance) of its material.
3. To verify the laws of combination (series) of resistances using a metre bridge.
4. To verify the laws of combination (parallel) of resistances using a metre bridge.
5. To compare the EMF of two given primary cells using potentiometer.
6. To determine the internal resistance of given primary cell using potentiometer.
7. To determine resistance of a galvanometer by half-deflection method and to find its figure of merit.
8. To convert the given galvanometer (of known resistance and figure of merit) into a voltmeter of desired range and to verify the same.
9. To convert the given galvanometer (of known resistance and figure of merit) into an ammeter of desired range and to verify the same.
10. To find the frequency of AC mains with a sonometer.

Activities *(For the purpose of demonstration only)*

1. To measure the resistance and impedance of an inductor with or without iron core.
2. To measure resistance, voltage (AC/DC), current (AC) and check continuity of a given circuit using multimeter.
3. To assemble a household circuit comprising three bulbs, three (on/off) switches, a fuse and a power source.
4. To assemble the components of a given electrical circuit.
5. To study the variation in potential drop with length of a wire for a steady current.
6. To draw the diagram of a given open circuit comprising at least a battery, resistor/rheostat, key, ammeter and voltmeter. Mark the components that are not connected in proper order and correct the circuit and also the circuit diagram.

SECTION–B

Experiments

1. To find the value of *v* for different values of *u* in case of a concave mirror and to find the focal length.
2. To find the focal length of a convex mirror, using a convex lens.
3. To find the focal length of a convex lens by plotting graphs between *u* and *v* or between *1/u* and *1/v*.
4. To find the focal length of a concave lens, using a convex lens.
5. To determine angle of minimum deviation for a given prism by plotting a graph between angle of incidence and angle of deviation.
6. To determine refractive index of a glass slab using a travelling microscope.
7. To find refractive index of a liquid by using convex lens and plane mirror.

Activities

LIST OF EXPERIMENTS

Practicals should be conducted alongside the concepts taught in theory classes.

Sr. No.	Experiment	Date	Page	Remarks

8. To draw the I-V characteristic curve for a p-n junction in forward bias and reverse bias.
9. To draw the characteristic curve of a zener diode and to determine its reverse break down voltage.
10. To study the characteristic of a common - emitter *n-p-n* or *p-n-p* transistor and to find out the values of current and voltage gains.

Activities *(For the purpose of demonstration only)*

1. To identify a diode, an LED, a transistor, an IC, a resistor and a capacitor from a mixed collection of such items.
2. Use of multimeter to :
   (i) identify base of transistor,
   (ii) distinguish between *n-p-n* and *p-n-p* type transistors,
   (iii) see the unidirectional flow of current in case of a diode and an LED,
   (iv) check whether a given electronic component (e.g., diode, transistor or IC) is in working order.
3. To study effect of intensity of light (by varying distance of the source) on an LDR.
4. To observe refraction and lateral deviation of a beam of light incident obliquely on a glass slab.
5. To observe polarization of light using two Polaroids.
6. To observe diffraction of light due to a thin slit.
7. To study the nature and size of the image formed by a
   (i) convex lens,
   (ii) concave mirror, on a screen by using a candle and a screen (for different distances of the candle from the lens/mirror).
8. To obtain a lens combination with the specified focal length by using two lenses from the given set of lenses.

Suggested Investigatory Projects

1. To study various factors on which the internal resistance/EMF of a cell depends.
2. To study the variations in current flowing in a circuit containing an LDR because of a variation in
   (a) the power of the incandescent lamp, used to 'illuminate' the LDR (keeping all the lamps at a fixed distance).
   (b) the distance of a incandescent lamp (of fixed power) used to 'illuminate' the LDR.
3. To find the refractive indices of (a) water (b) oil (transparent) using a plane mirror, an equi convex lens (made from a glass of known refractive index) and an adjustable object needle.
4. To design an appropriate logic gate combination for a given truth table.
5. To investigate the relation between the ratio of
   (i) output and input voltage and
   (ii) number of turns in the secondary coil and primary coil of a self designed transformer.
6. To investigate the dependence of the angle of deviation on the angle of incidence using a hollow prism filled one by one, with different transparent fluids.
7. To estimate the charge induced on each one of the two identical styrofoam (or pith) balls suspended in a vertical plane by making use of Coulomb's law.
8. To set up a common base transistor circuit and to study its input and output characteristic and to calculate its current gain.
9. To study the factor on which the self inductance of a coil depends by observing the effect of this coil, when put in series with a resistor/(bulb) in a circuit fed up by an A.C. source of adjustable frequency.
10. To construct a switch using a transistor and to draw the graph between the input and output voltage and mark the cut-off, saturation and active regions.
11. To study the earth's magnetic field using a tangent galvanometer.

Record of the Activities/Projects performed

Sr. No.	Activity / Project	Date	Page No.	Remarks/ Signature

INTRODUCTION

COMMONLY USED APPARATUS IN PHYSICS LABORATORY

1. **Tuning Fork :** It is something that vibrates when we hit it. It's used to determine sound frequencies and variations. In other words, it is a sound resonator.
2. **Spectrometer :** It is an optical device used to analyze the light at different angles. *i.e.* to measure wavelength etc.
3. **Potentiometer :** It is an electrical equipment or a three terminal resistor which is used to calculate the emf and internal resistance of a battery.
4. **Magnetometer :** It is an instrument used to measure the strength and direction of the magnetic field around the instrument.
5. **Lens :** It is an optical device that causes light to either converge or to diverge.
6. **Thermometer :** It is an instrument used to measure the temperature or temperature gradient.
7. **Voltmeter :** It is a kind of Galvanometer that is used for measuring potential difference of an electric circuit between two points.
8. **Pulley :** It is a simple device consisting of a wheel having a groove along its edge, designed for holding a cable or rope.

   It reverses the direction of the force that one applies.
9. **Multimeter :** It is a versatile equipment for measurement of different electrical quantities in a circuit. In the course of lab work it is often required to measure voltage, current and resistance. Instead of using three different meters it is better to use a Multimeter.
10. **Barometer :** It is an engineering device used for measuring atmospheric pressure.
11. **Ruler :** It is used to make linear measurements like length, width and height.
12. **Vernier Caliper :** It is used in length measurements to gain an additional digit of accuracy compared to a simple ruler.
13. **Magnet :** It is commonly used for the experiments such as the changes in magnetic fields, magnetic force, etc.
14. **Spring Balance :** It is a weighing device that utilizes the relation between the applied load and the deformation of a spring.
15. **Weight Holder :** It is a metal, T-shaped bar that holds weights for traction.
16. **Self Retracting Tape Measure :** It provides both inside and outside measurements that are accurate. A tape measure of 25 or even 100 feet can wind into a relatively small container. The self-marking tape measure allows the user an accurate one hand measure and mark without an outside device.

GENERAL INSTRUCTIONS FOR PERFORMING EXPERIMENTS

(i) The students should thoroughly understand the principle of the experiment. The objective of the experiment and procedure to be followed should be clear before actually performing the experiment.

(ii) The apparatus should be arranged in proper order. To avoid any damage, all apparatus should be handled carefully and cautiously. Any accidental damage or breakage of the apparatus should be immediately brought to the notice of the concerned teacher.

(iii) Precautions meant for each experiment should be observed strictly while performing it.

(iv) Repeat every observation, a number of times, even if measured value is found to be the same. The student must bear in mind the proper plan for recording the observations. Recording in tabular form is essential in most of the experiments.

(v) Calculations should be neatly shown (using log tables wherever desired). The degree of accuracy of the measurement of each quantity should always be kept in mind, so that final results does not reflect any fictitious accuracy. The result obtained should be suitably rounded off.

(vi) Wherever possible, the observations should be represented with the help of a graph.

(vii) Always mention the result in proper SI unit, if any, along with experimental error.

SAFETY PRECAUTIONS IN THE PHYSICS LABORATORY

In the Physics laboratory, carelessness can lead to accidents causing injury to you or to your neighbouring person. Proper handling of apparatus and other materials can prevent majority of accidents. Following precautions should be kept in mind while working in the Physics laboratory.

(i) Put off the gas to extinguish the flame of a burner. Do not use any solid or liquid for this purpose (like putting a cap or pouring water as for extinguishing burning coal).

(ii) Do not throw any broken glass ware, etc. in the sink. Such things should be thrown into the waste basket.

(iii) Do not talk to other students in the laboratory while performing the experiment to maintain at most care and concentration.

(iv) Never test whether a wire is carrying current by touching it. Use a tester, screwdriver or a voltmeter of appropriate range. Try to keep your body slightly away from the circuit.

(v) Whenever a sharp instrument is used, be careful not to cut or puncher your skin, *e.g.,* while using a pair of blades to make a narrow slit.

(vi) While using a delicate instrument, *e.g.,* a sensitive galvanometer, be careful not to pass a high current in it, which may burn it out. While using it to find a null point, use a low resistance shunt or a high series resistance initially. When you approach the null point then remove it to make the instrument sensitive and make fine adjustment of the null point.

(vii) Take care not to wet any instrument, unless it is part of the experiment itself.

(viii) **Cuts and Burns :** (a) For wound caused by a broken glass or any sharp edge, remove the glass piece from the wound, control the bleeding by pressing a clean cloth or handkerchief or by a sterile surgical dressing. Apply a little dettol, or spirit, or savlon and cover it with bandage. (b) For wounds due to heat of a flame or due to touching a hot object, put the burnt portion under cold water for 15 minute to 30 minute. Then apply burnol.

(ix) Always try to keep your work area and bench clear of unnecessary items not to be used in performing the experiments.

(x) While unplugging a power cord, do not pull the cable.

(xi) The most important thing to be kept in mind is to read the instructions manual carefully before starting the experiment.

STUDY OF GRAPHS

(i) A graph is a line curved or straight, which represent the variation of one quantity with respect to other. It summarizes variation of one physical quantity known as dependent variable with another physical quantity known as independent variable. For example, consider the relation, Distance (s) = Speed (v) × Time (t). When speed is constant, distance travelled by a body is dependent on time. So to plot a graph, distance is taken as dependent variable and time as independent variable. The independent variable (the cause) is represented along x-axis while the dependent variable (the effect) is along y-axis.

(ii) A graph gives precise and complete explanation of cause and effect of a phenomenon. In order to plot a graph, a set of values of independent variable and corresponding values of dependent variable is required. This data can be obtained either theoretically or experimentally in controlled manner. The theoretical data is obtained by using theoretical relationship of dependent and independent variables.

Plotting a graph :

To plot a graph showing variation between two physical quantity, generally, a graph paper is needed which is ruled in millimeter or centimeter square. Following steps should be taken while plotting a graph :

(i) First identify the independent variable and dependent variable and take them along X-axis and Y-axis respectively. The horizontal line represents X-axis (abscissa) while the vertical line represents Y-axis (ordinate) with orgin 'O' at which both the axis intersect.

(ii) Take a suitable scale as per range of data obtained through experiment and mark the respective axes.

(iii) Mark the points on the graph paper corresponding to dependent and independent variable data.

(iv) Now join the points marked on the graph paper and draw a free hand smooth curve so that maximum number of points lie on it.

(v) In case of straight line extrapolate the graph so that this intersect the axis.

Uses of graph :

(i) A graph is very useful to study an event or phenomenon which relates two physical quantities. It gives complete information about whole episode at a glance. For example, graph between distance and time, or force and acceleration.

(ii) Graph also gives the corresponding data of dependent and independent variable by extrapolation, which can not be determined experimentally. For example, graph between temperature and volume of gas in Charles law determines absolute zero temperature on extrapolation.

(iii) It also help us in identifying the accuracy in experimental data and determine the unknown physical quantity indirectly. For example, Resistance of wire can be determined by slope of line, in graph between potential and electric current, in Ohm's experiment.

(iv) With the help of graph, mean value of a physical quantity can be easily determined from various observation data.

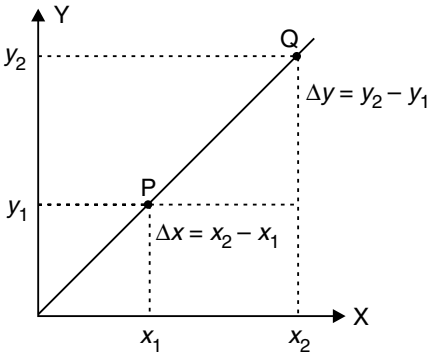
Applications of the graph

Determination of the slope of a straight line.

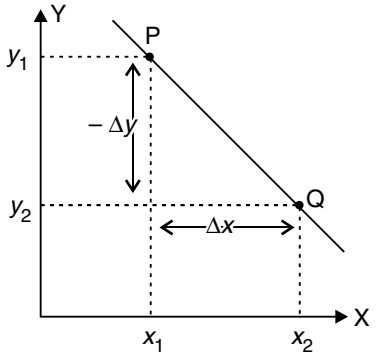
To calculate the slope, take two points on the line *e.g.*, P(x_1, y_1) and Q(x_2, y_2) and draw the abscissa and ordinate. Determine $\Delta x = x_2 - x_1$ and $\Delta y = y_2 - y_1$ (*i.e.* the change in the values of x and y respectively). The slope of the straight line will, thus

be given as, Slope $m = \dfrac{\Delta y}{\Delta x}$.

Slope m is positive when y increases with increase in x and m is negative if y decreases with increase in x.



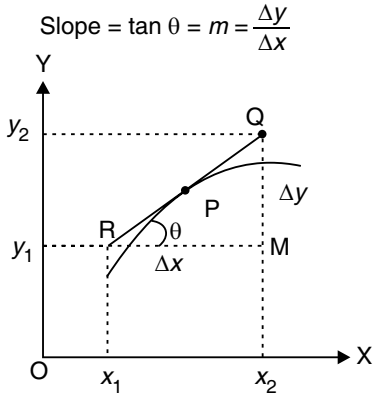
(a) Positive Slope



(b) Negative Slope

Determination of the slope of a curve :

Slope of the curve have different values at different points on the curve. It is determined by drawing tangent at the desired point and thereby constructing right angle triangle while tangent to curve as hypoteneous of triangle as shown.



Importance:

(i) Slope of graph on a curve at a point gives instantaneous rate of change of *y* w.r.t. *x*.

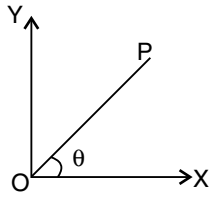
(ii) Slope of graph gives the average value of *dy*/*dx* between two point.

(iii) Intercepts of graph on *x* and *y* axes give values of important physical constants.

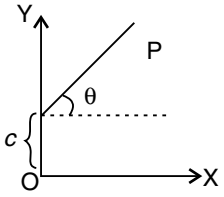
(iv) The area under the graph and *x*-axis give values of various physical quantity.

Some Graphs with Equations:

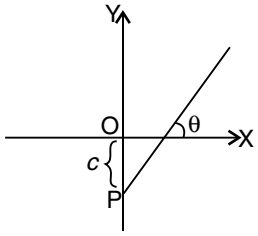
(i) $y = mx$: the graph between *x* and *y* is a straight line passing through origin with slope $m = \tan\theta$, where θ angle which line make with X-axis while the intercept is O.



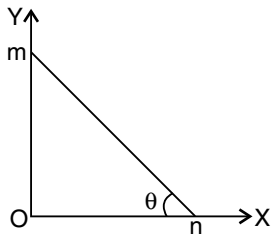
(ii) $y = mx + c$: This is equation of graph of straight line with positive interception on *y*-axis equal to C. Slope of line is $m = \tan\theta$, with C as the intercept.



(iii) $y = mx - c$: This is equation of graph of straight line showing variation of *y* with *x* straight line intercept on negative *y*-axis at distance *c* from origin. Slope of line is *m*.

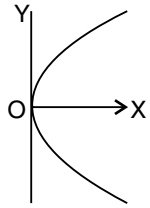


(iv) $y = -mx + c$: Equation is also of a straight line graph showing variation of *y* with *x* having slope negative and positive interception on *y*-axis.

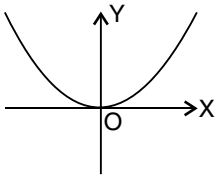


(v) **Parabolic graphs :**

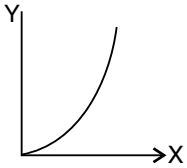
(a) $y^2 = kx$, the graph will be symmetric parabolic curve about x-axis.



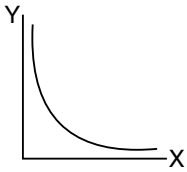
(b) $x^2 = ky$, the graph will be symmetric parabolic curve about y-axis.



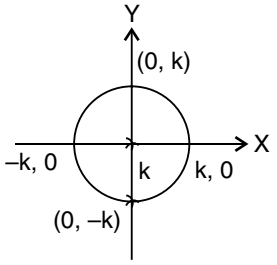
(c) $y = ax + bx^2$, a and b are positive constant.



(vi) $xy = k$, the graph between x and y is a rectangular hyperbola.



(vii) $x^2 + y^2 = k^2$, the graph between x and y is a circle with radius k.



(viii) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, the graph between x and y is an ellipse.

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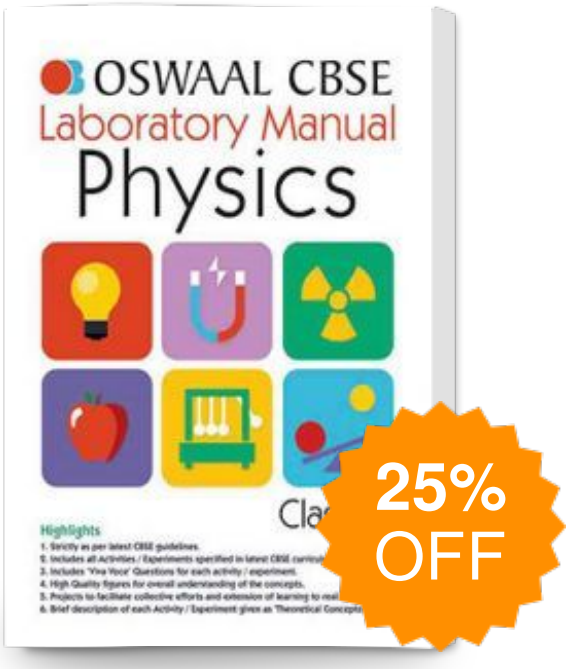

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