Serving Education for Last 40 Years

NEERAJ®

PHYSICS

N-312

Chapter wise Reference Book Including MCQ's & Many Solved Sample Papers

Based on

N.I.O.S. *Class* – XII

National Institute of Open Schooling

By:
Prieti Gupta, *M.Sc.*

NEERAJ PUBLICATIONS
(Publishers of Educational Books)

Mob.: 8510009872, 8510009878 E-mail: info@neerajbooks.com
Website: www.neerajbooks.com

MRP ₹ 520/-

CONTENTS

PHYSICS

Based on: **NATIONAL INSTITUTE OF OPEN SCHOOLING – XII**

■ ■

Sample Preview of the Solved Sample Question Papers

Published by:

NEERAJ PUBLICATIONS
www.neerajbooks.com

Solved Sample Paper - 1

Based on NIOS (National Institute of Open Schooling)

Physics - XII

N-312

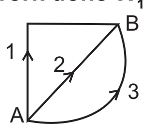
Time: 3 Hours] **[Maximum Marks: 100**

Note: *(i)* This Question Paper consists of 43 questions in all. *(ii)* All questions are compulsory. *(iii)* Marks are given against each question. *(iv)* Use log tables if required. *(v)* Section-A consists of: *(a)* Question Nos. 1 to 16 – Multiple Choice Type Questions (MCQs) carrying 1 mark each. Select and write the most appropriate option out of the four options given in each of these questions. An internal choice has been provided in some of these questions. You have to attempt only one of the given choices in such questions. *(b)* Question Nos. 17 to 28 – Objective Type Questions carrying 2 marks each (with 2 sub-parts of 1 mark each). Attempt these questions as per the instructions given for each. *(vi)* Section-B consists of *(a)* Question Nos. 29 to 37 – Very Short Answer Type Questions carrying 2 marks each and to be answered in the range of 30 to 50 words. *(b)* Question Nos. 38 to 41 – Short Answer Type Questions carrying 3 marks each and to be answered in the range of 50 to 80 words. *(c)* Question Nos. 42 and 43 – Long Answer Type Questions carrying 5 marks each and to be answered in the range of 80 to 120 words.

SECTION-A

Note: For Question Nos. 1 to 16, an internal choice has been provided in some of these questions. You have to attempt only *one* of the given choices in such questions.

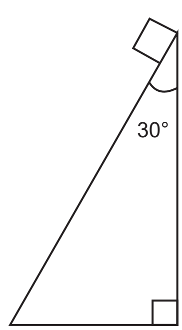
Q. 1. If a particle of mass *m* moves in the gravitational field of another particle of mass M from A to B along three different paths 1, 2 and 3 (as shown in the figure), the relation between the values of corresponding work done W_1, W_2 and W_3 will be:



(a) $W_1 = W_2 = W_3$ *(b)* $W_1 > W_2 > W_3$
(c) $W_1 < W_2 < W_3$ *(d)* $W_1 > W_2 > W_3$

Ans. *(a)* $W_1 = W_2 = W_3$.

Q. 2. A body of mass M is just at the verge of sliding down an inclined plane which makes an angle of 30° with the vertical as shown in the figure. The coefficient of friction between the body and the plane is:



(a) $\frac{1}{\sqrt{2}}$ *(b)* $\frac{1}{2}$
(c) $\frac{\sqrt{3}}{2}$ *(d)* $\sqrt{3}$

Ans. *(d)* $\sqrt{3}$.

Q. 3. A diode can be used as a/an:

(a) Switch *(b)* Oscillator
(c) Amplifier *(d)* Rectifier

Ans. *(d)* Rectifier.

Q. 4. Which one of the following substances is ferromagnetic in nature?

(a) Aluminium *(b)* Nickel
(c) Quartz *(d)* Copper

Ans. *(b)* Nickel.

Q. 5. Solenoids A and B have equal number of turns and equal area of cross-section. But the length of solenoid A is twice the length of solenoid B. The ratio of the self-inductance of solenoid A to the self-inductance of solenoid B will be:

(a) 1 : 1 *(b)* 1 : 2
(c) 2 : 1 *(d)* 1 : 4

Ans. *(b)* 1 : 2.

Q. 6. The wave front due to a point source in space at any instant *t* is a sphere of radius *ct*. The wave front at instant 2*t* will be a sphere of radius:

(a) *ct* *(b)* 2*ct*
(c) 3 *ct* *(d)* 4 *ct*

Ans. *(b)* 2*ct*.

Q. 7. In Young's double-slit experiment, the waves from S_2 reach at any point P on the screen T/2 seconds later than the waves from S_1. The phase difference between the waves at point P is:

Solved Sample Paper - 2

Based on NIOS (National Institute of Open Schooling)

Physics - XII

N-312

Time: 3 Hours] **[Maximum Marks: 100**

Note: *(i)* This Question Paper consists of 43 questions in all. *(ii)* All questions are compulsory. *(iii)* Marks are given against each question. *(iv)* Use log tables if required. *(v)* Section-A consists of: *(a)* Question Nos. 1 to 16 – Multiple Choice Type Questions (MCQs) carrying 1 mark each. Select and write the most appropriate option out of the four options given in each of these questions. An internal choice has been provided in some of these questions. You have to attempt only one of the given choices in such questions. *(b)* Question Nos. 17 to 28 – Objective Type Questions carrying 2 marks each (with 2 sub-parts of 1 mark each). Attempt these questions as per the instructions given for each. *(vi)* Section-B consists of *(a)* Question Nos. 29 to 37 – Very Short Answer Type Questions carrying 2 marks each and to be answered in the range of 30 to 50 words. *(b)* Question Nos. 38 to 41 – Short Answer Type Questions carrying 3 marks each and to be answered in the range of 50 to 80 words. *(c)* Question Nos. 42 and 43 – Long Answer Type Questions carrying 5 marks each and to be answered in the range of 80 to 120 words.

SECTION-A

Note: For Question Nos. 1 to 16, an internal choice has been provided in some of these questions. You have to attempt only *one* of the given choices in such questions.

Q. 1. Which of the following will always be in the direction of the net external force acting on the body?

(a) Velocity
(b) Acceleration
(c) Change in the momentum
(d) Displacement

Ans. *(c)* Change in the momentum.

Q. 2. In a transistor least doped region is:

(a) Emitter *(b)* Base
(c) Collector *(d)* None of these

Ans. *(b)* Base.

Q. 3. The retracting angle of a Prism is ½ and its refractive index is 1.5 for yellow colour. Deviation of yellow high passing through it is:

(a) 2° *(b)* 1°
(c) 1/2° *(d)* 1/4°

Ans. *(d)* 1/4°.

Q. 4. The length of a pipe open from both end is 1m. If speed of sound is 320m/s in air, fundamental frequency of standing wave in pipe is:

(a) 640Hz *(b)* 320Hz
(c) 160 Hz *(d)* 80 Hz

Ans. *(c)* 160 Hz.

Q. 5. Two light waves of wavelength (λ) each, reach a point having a path difference of λ /4. At this point, the phase difference between them is:

(a) $\pi / 4$ *(b)* $\pi / 2$
(c) π *(d)* 2π

Ans. *(b)* $\pi / 2$.

Q. 6. A transistor cannot act as:

(a) An LED *(b)* An amplifier
(c) An oscillator *(d)* A switch

Ans. *(a)* An LED.

Q. 7. According to Snell's law, what is constant for a given pair of media?

(a) The angle of incidence
(b) The angle of refraction
(c) The ratio of the sine of the angle of incidence to the sine of the angle of refraction
(d) The speed of light

Ans. *(c)* The ratio of the sine of the angle of incidence to the sine of the angle of refraction.

Q. 8. What is the relationship between electric field (E) and electric potential (V)?

(a) $E = \frac{1}{v}$ *(b)* $E = \frac{1}{\sqrt{v}}$

(c) $E = -\frac{dv}{dr}$ *(d)* $E = \frac{dv}{dr}$

Ans. *(c)* $E = -\frac{dv}{dr}$.

Q. 9 *(a)*. If Reynolds number of a liquid flow is 1200, the flow is:

(a) Laminar *(b)* Unsteady
(c) Turbulent *(d)* Not possible

Ans. *(a)* Laminar.

OR

***(b)* If the speed of a body is doubled, its kinetic energy will increase by:**

(a) 50% *(b)* 200%
(c) 100% *(d)* 300%

Ans. *(d)* 300%.

Sample Preview of The Chapter

Published by:

NEERAJ PUBLICATIONS

www.neerajbooks.com

PHYSICS

MODULE-I: MOTION, FORCE AND ENERGY

Units, Dimensions and Vectors

1

INTRODUCTION

In Physics, we study about nature and natural phenomena. To understand various natural phenomena e.g. if a ball is thrown from a certain height, with what speed it will touch the ground? Measurement of the quantities involved e.g. height, initial speed of the ball etc is essential. For every Measurement unit is assigned. In this chapter, you will learn about various fundamentals and derived quantities along with their SI units. Based on the basic unit, you will be likely to learn about dimensions. You will also study about uses of dimensions e.g. to check correctness of equation.

After being familiar with various physical quantities, their units as well as dimensions, you will learn about how the physical quantities can be grouped into scalars and vectors. Scalar quantity means having only magnitude while vectors quantities have magnitude as well as direction. You will learn about mathematical operations with vectors e.g. addition and subtraction of vectors, scalar and vector product, resolving a vector into its components, etc.

Measuring physical quantities will help us to understand natural phenomena while concept of scalar and vector will help us to understand physics that is lying behind different natural phenomenon.

CHAPTER AT A GLANCE

Physical Quantities

All the quantities in terms of which laws of physics can be described e.g. speed, distance, force, electric current etc. are called physical quantities.

Measuring Physical Quantities: Unit

For measuring any particular physical quantity, some standard of measurement must be chosen which has same nature as that of the quantity. This chosen standard of measurement is called a unit. For example, we choose meter or kilometer for measuring distance, second or hour for time and kilogram or gram for mass.

Thus meter, second and kilogram are units of length, time and mass respectively.

The SI Units

There are seven basic or fundamental units. The system of that unit is called SI system i.e. International system of units.

Quantity	***Unit***	***Symbol***
Length	Meter	m
Mass	Kilogram	kg
Time	Second	S
Electric Current	Ampere	A
Temperature	Kelvin	K
Luminous intensity	Candela	cd
Amount of substance	Mole	mol

Merits of SI System

(i) SI is an absolute system of units.

(ii) SI is a metric system i.e multiples and sub-multiples of units are expressed as powers of 10.

(iii) SI is a rational system of units i.e a particular physical quantity is assigned only one unit.

(iv) SI system is a coherent system of units.

Standards of Mass, Length and Time

***(i)* Mass:** The SI unit of mass is kilogram. It is the mass of a particular cylinder made of platinum-iridium alloy.

(ii) **Length:** The SI unit of length is meter. One meter is defined in terms of speed of light in a vacuum.

One meter is defined as the distance travelled by light in vacuum in a time interval 1/299792458 sec.

(iii) **Time:** Time is assigned second as its SI unit. One second is defined as the time required for a cesium-133 (^{133}Cs) atom to undergo 9192631770 vibrations between two hyperfine levels of its ground state.

Derived Units

The units which can be derived from three basic units i.e. kilogram, second and meter are called derived units. e.g. unit of velocity can be expressed in terms of meter and second *i.e* m/s., unit of force can be expressed *i.e.* N can be expressed as kg m/s^2.

Rules for Writing a Physical Quantity

(i) Symbols for various units e.g. kg, m etc. do not contain full stop e.g. 5 kg and not 5 kg. or 5 kgs.

(ii) Single prefixes are written if available e.g. pF and *ns*.

(iii) If a prefix is placed before the symbol of a unit, then the combination will act like a single symbol e.g. ns^{-1}will be written as ($10^{-9}s^{-1}$)

(iv) The first letter of symbol for a unit will not capital e.g. 6 cm and not 6 Cm.

(v) For writing large numbers, digits are written in groups but commas are avoided e.g 2345, 169780 etc.

Dimensions of Physical Quantity

Most of the derived units can be obtained from the fundamental units of mass, length and time. If mass is expressed as M, length L and time T, the velocity will be expressed as LT^{-1}, volume as L^3. Thus, physical quantities can be expressed in terms of M, L and T and known as dimensions of a physical quantity.

Uses of Dimensional Analysis

(i) For checking the accuracy of various formulae.

(ii) Derivation of formulae.

VECTORS AND SCALARS

Scalar Quantities

Physical quantities which have magnitude as well as direction are called scaler quantities e.g. mass, length etc.

Vector Quantities

Physical quantities which have magnitude as well as direction are called vector quantities e.g. displacement, velocity, etc.

Representation of Vectors

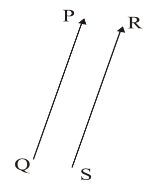
To represent a vector, draw a line with an arrow at its one end. The length of the line represent magnitude and arrow represent the direction.

$$A \longrightarrow B$$

Magnitude of vector $\overrightarrow{AB}$ $|\overrightarrow{AB}|$

Equal Vectors

If two vectors have same magnitude and they point in the same direction are said to be equal.



Here, $\overrightarrow{PQ} = \overrightarrow{RS}$

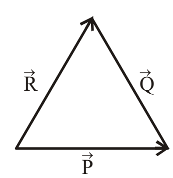
Negative of a Vector

Negative of a vector $\overrightarrow{PQ}$ has the same magnitude as $\overrightarrow{PQ}$ but has opposite direction to $\overrightarrow{PQ}$.

$\overrightarrow{\mathbf{PQ}} = -\overrightarrow{\mathbf{RS}}$

Addition of Vectors

(a) **Triangle Law of Vectors:** Consider two vectors $\vec{P}$ and $\vec{Q}$ represented in magnitude and direction by the two sides of a triangle taken in order, then the resultant $\vec{R}$ will be represented by the third side of triangle taken in reverse direction. This is called triangle law of vectors.

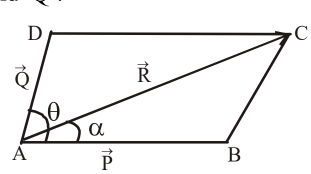


Here $\vec{R} = \vec{P} + \vec{Q}$

and $\vec{P} + \vec{Q} = \vec{Q} + \vec{P}$

Note: If more than two vectors are added, then the resultant vectors can be obtained by joining the tail of the first vectors to the tip of the last vector.

(b) **Parallelogram Law of Vector Addition:** Consider two vectors $\vec{P}$ and $\vec{Q}$ represented by sides of a parrallelogram AB and AD, let θ be the angle between $\vec{P}$ and $\vec{Q}$ .Then diagonal AC represent the resultant the vectors $\vec{P}$ and $\vec{Q}$.



$$\vec{R} = \vec{P} + \vec{Q}$$

$$|R| = \sqrt{P^2 + Q^2 + 2PQ \cos\theta}$$

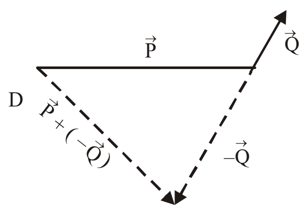
If resultant $\vec{R}$ makes an angle α with vector $\vec{P}$, then

$$\tan\alpha = \frac{Q\sin\theta}{P + Q\cos\theta}$$

Subtraction of Vectors

Subtraction of vector $\vec{Q}$ from a vector $\vec{P}$ is same as the addition of vector $-\vec{Q}$ to the vector $\vec{P}$ i.e.

$$\vec{P} - \vec{Q} = \vec{P} + (-\vec{Q})$$

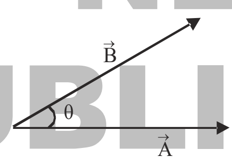


Multiplication of Vectors

***(a)* Scalar Product**

Scalar product of two vectors is defined as:

$$\vec{A}.\vec{B} = |A||B|\cos\theta$$



Properties of Scalar Product

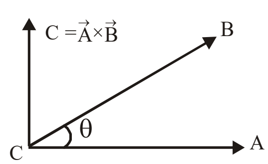
(i) A.B = B.A

(ii) A. (B+C) = A.B+A.C

(iii) A.B = X, where X is a scalar quantity.

***(b)* Vector Product:** Vector product of two vectors is defined as:

$$\vec{A} \times \vec{B} = |A||B|\sin\theta$$



Direction of $\vec{A}\times\vec{B}$ is given by right hand rule which states that if fingers of right hand are curled from A to B, then direction of thumb gives the direction of the vector $\vec{C} = \vec{A}\times\vec{B}$

Properties

(i) A× B = –B × A

(ii) A × (B + C) = A × B + A × C

(iii) A × B, is a vector quantity.

Resolution of Vectors

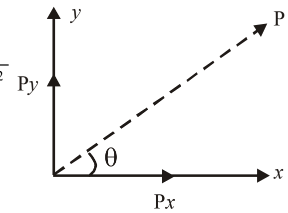
A given vector P can be resolved along x and y axis. Component of a vector P are given by:

$Px = P\cos\theta$

and $Py = P\sin\theta$

$|\vec{P}| = \sqrt{Px^2 + Py^2}$

$\tan\theta = Py/Px$



Unit Vector

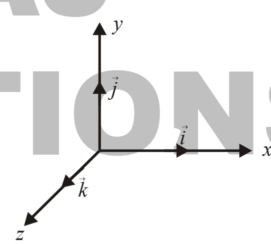
A vector having unit magnitude and having a specified direction is called unit vector. Unit vectors along x-axis, y-axis and z-axis are written as $\hat{i}$, $\hat{j}$ and $\hat{k}$ respectively.

If $P = P_x\hat{i} + P_y\hat{j} + P = \hat{k}$

and $Q = Q_x\hat{i} + Q_y\hat{j} + Q_z\hat{k}$

then $P + Q = (P_x + Q_x)\hat{i} + (P_y + Q_y)\hat{j} + (P_z + Q_z)\hat{k}$

$P \cdot Q = P_x + Q_x + P_y + Q_y + P_z + Q_z$



INTEXT QUESTIONS 1.1

Q. 1. Discuss the nature of laws of physics.

Ans. Laws of physics are conclusion based on repeated scientific experiments and observations over many years. These laws are accepted universally within the scientific community. Nature of laws of physics are:

(i) True: At least within their regime of validity.

(ii) Universal: Apply everywhere in the universe.

(iii) Simple: Expressed in terms of a single mathematical equation.

(iv) Absolute: Nothing in the universe appears to affect them.

(v) Stable: Unchanged since discovered.

(vi) Omnipotent: Everything in the universe apparently must comply with them.

Q. 2. How has the application of the laws of physics led to better quality of life?

Ans. The application of the laws of physics for the manufacture of machines, gadgets, etc. and improvement in them which led to better quality of our physical life. e.g.

(i) Different types of engines based on the laws of thermodynamics.

(ii) Means of communication (radio, telephone, T.V.) based on the propagation of electromagnetic waves.

(iii) Generation of electricity based on the principle of electromagnetic induction.

(iv) Nuclear reactors based on the phenomenon of controlled nuclear fission.

(v) Jet aeroplanes and rockets based on Newton's second and third law of motion.

(vi) X-rays ultra violet rays and infrared rays which are used in medical science for diagnostic and healing purposes.

(vii) Mobile phones, calculators and computers based on the principles of electronics.

(viii) Laser-based on the phenomenon of population inversion.

Q. 3. What is meant by significant figures in measurement?

Ans. Those digits in measurement that are known with certainly plus the first uncertain digit, are called significant figures. e.g. when a student measure the length of a line as 2.4 cm, the digit 2 is certain which 4 is uncertain as a little less or more than 0.4 cm is reported as 0.4 cm.

Q. 4. Find the number of significant figures in the following quantity, quoting the relevant laws:

***(i)* 426.69**

Ans. Significant figures are = 5

As all non-zero digits are significant.

***(ii)* 4200304.002**

Ans. Significant figures are = 10

As all zeros between two non-zero digits are significant.

***(iii)* 0.3040**

Ans. Significant figures are = 4

As all non-zero digits to the right of a decimal point are significant.

***(iv)* 4050 m**

Ans. Significant figures are = 4

As all zero to the right of last of non-zero are significant.

***(v)* 5000**

Ans. Significant figure is 1

As in a whole number all zeros to the right of the last non-zero number is not significant.

Q. 5. The length of the object is 3.486 m, if it is expressed in centimetre (i.e. 348.6 cm) will there be any change in the number of significant figures in the two cases.

Ans. No, in both cases the number of significant figures is 4 as all non-zero digits are significant.

Q. 6. What are the four applications of the principles of dimension? On what principles are the above based.

Ans. There are four applications of the principles of dimension:

(i) Derivation of a relationship between different physical quantities or formula.

(ii) Checking up of accuracy of a formula or relationship between different physical quantities.

(iii) Conversion of one system of units into another, and

(iv) Derivation of units of a physical quantity.

These applications are based on the principle that the dimensions of physical quantities on the two sides of a equation or formula must be the same. This principle is known as 'The Principle of Homogeneity of Dimensions'.

Q. 7. The mass of the sun is 2×10^{30} kg. The mass of proton is 2×10^{-27} kg. If the sun was made only of protons, how many protons would be in the sun?

Sol. Give, Mass of the sun = 2×10^{30} kg

Mass of proton = 2×10^{-27} kg

$\therefore$ Number of protons in the sun

$$= \frac{\text{Mass of the sun}}{\text{Mass of proton}}$$

$$= \frac{2 \times 10^{30} \text{ kg}}{2 \times 10^{-27} \text{ kg}} = 10^{57}.$$

Q. 8. The wavelength of light used to be expressed in Angstroms. One angstrom equals 10^{-8} cm. Now the wavelength is expressed in nanometers. How many angstroms are there in one nanometer?

Sol. 1 Angstrom = 10^{-8} cm = 10^{-10} m

1 nanometer (nm) = 10^{-9} m

(1 nm/1 Angstrom) = 10^{-9} m/10^{-10} m = 10

$\Rightarrow$ (1 nm/1 Angstrom) = 10A°

$\Rightarrow$ 1 nanometer = 10 Angstrom.

Q. 9. A radio station operates at a frequency of 1370 KHZ. Express this frequency in GHz.