

NEERAJ[®]

PHYSICS

N-312

**Chapter wise Reference Book
Including 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)

— Retail Sales Office: —

1507, First Floor, Nai Sarak, Delhi - 6 | Mob.: 8510009872, 8510009878
E-mail : info@neerajbooks.com Website : www.neerajbooks.com

MRP ₹ 500/-

Published by:



NEERAJ PUBLICATIONS

(Publishers of Educational Books)

Retail Sales Office: 1507, First Floor, Nai Sarak, Delhi - 6 | Mob.: 8510009872, 8510009878

E-mail : info@neerajbooks.com Website : www.neerajbooks.com

© Copyright Reserved with the Publishers only.

Reprint Edition with Updation of Sample Question Paper Only

Typesetting by: Competent Computers, Printed at: Novelty Printing Press

Disclaimer/T&C

1. For the best & up-to-date study & results, please prefer the recommended textbooks/study material only.
2. This book is just a Guide Book/Reference Book published by NEERAJ PUBLICATIONS based on the suggested syllabus by a particular Board/University.
3. These books are prepared by the author for the help, guidance and reference of the student to get an idea of how he/she can study easily in a short time duration. Content matter & Sample answers given in this Book may be Seen as the Guide/Reference Material only. Neither the publisher nor the author or seller will be responsible for any damage or loss due to any mistake, error or discrepancy as we do not claim the Accuracy of these Solutions/Answers. Any Omission or Error is highly regretted though every care has been taken while preparing, printing, composing and proofreading of these Books. As all the Composing, Printing, Publishing and Proof Reading, etc., are done by Human only and chances of Human Error could not be denied. Any mistake, error or discrepancy noted may be brought to the publishers notice which shall be taken care of in the next edition and thereafter as a good gesture by our company he/she would be provided the rectified Book free of cost. Please consult your Teacher/Tutor or refer to the prescribed & recommended study material of the university/board/institute/ Govt. of India Publication or notification if you have any doubts or confusions regarding any information, data, concept, results, etc. before you appear in the exam or Prepare your Assignments before submitting to the University/Board/Institute.
4. In case of any dispute whatsoever the maximum anybody can claim against NEERAJ PUBLICATIONS is just for the price of the Book.
5. The number of questions in NEERAJ study materials are indicative of general scope and design of the question paper.
6. Any type of ONLINE Sale/Resale of "NEERAJ BOOKS" published by "NEERAJ PUBLICATIONS" in Printed Book format (Hard Copy), Soft Copy, E-book on any Website, Web Portals, any Social Media Platforms – Youtube, Facebook, Twitter, Instagram, Telegram, LinkedIn etc. and also on any Online Shopping Sites, like – Amazon, Flipkart, eBay, Snapdeal, Meesho, Kindle, etc., is strictly not permitted without prior written permission from NEERAJ PUBLICATIONS. Any such online sale activity of any NEERAJ BOOK in Printed Book format (Hard Copy), Soft Copy, E-book format by an Individual, Company, Dealer, Bookseller, Book Trader or Distributor will be termed as ILLEGAL SALE of NEERAJ BOOKS and will invite legal action against the offenders.
7. The User agrees Not to reproduce, duplicate, copy, sell, resell or exploit for any commercial purposes, any portion of these Books without the written permission of the publisher. This book or part thereof cannot be translated or reproduced in any form (except for review or criticism) without the written permission of the publishers.
8. All material prewritten or custom written is intended for the sole purpose of research and exemplary purposes only. We encourage you to use our material as a research and study aid only. Plagiarism is a crime, and we condone such behaviour. Please use our material responsibly.
9. All matters, terms & disputes are subject to Delhi Jurisdiction only.

Get books by Post & Pay Cash on Delivery :

If you want to Buy NEERAJ BOOKS by post then please order your complete requirement at our Website www.neerajbooks.com where you can select your Required NEERAJ BOOKS after seeing the Details of the Course, Subject, Printed Price & the Cover-pages (Title) of NEERAJ BOOKS.

While placing your Order at our Website www.neerajbooks.com You may also avail the “Special Discount Schemes” being offered at our Official website www.neerajbooks.com.

No need to pay in advance as you may pay “Cash on Delivery” (All The Payment including the Price of the Book & the Postal Charges, etc.) are to be Paid to the Delivery Person at the time when You take the Delivery of the Books & they shall Pass the Value of the Goods to us. We usually dispatch the books Nearly within 2-3 days after we receive your order and it takes Nearly 3-4 days in the postal service to reach your Destination (In total it take nearly 6-7 days).

CONTENTS

PHYSICS

Based on: NATIONAL INSTITUTE OF OPEN SCHOOLING – XII

<i>S.No.</i>	<i>Chapters</i>	<i>Page</i>
	Solved Sample Paper - 1	1-7
	Solved Sample Paper - 2	1-6
	Solved Sample Paper - 3	1-4
	Solved Sample Paper - 4	1-7
	Solved Sample Paper - 5	1-6
<u>MOTION, FORCE AND ENERGY</u>		
1.	Units, Dimensions and Vectors	1
2.	Motion in a Straight Line	12
3.	Laws of Motion	23
4.	Motion in a Plane	35
5.	Gravitation	44
6.	Work, Energy and Power	57
7.	Motion of Rigid Body	70
<u>MECHANICS OF SOLIDS AND FLUIDS</u>		
8.	Elastic Properties of Solids	82
9.	Properties of fluids	93
<u>THERMAL PHYSICS</u>		
10.	Kinetic Theory of Gases	107
11.	Thermodynamics	120
12.	Heat Transfer and Solar Energy	131

<i>S.No.</i>	<i>Chapter</i>	<i>Page</i>
<u>OSCILLATIONS AND WAVES</u>		
13.	Simple Harmonic Motion	142
14.	Wave Phenomena	153
<u>ELECTRICITY AND MAGNETISM</u>		
15.	Electric Charge and Electric Field	176
16.	Electric Potential and Capacitors	186
17.	Electric Current	199
18.	Magnetism and Magnetic Effect of Electric Current	212
19.	Electromagnetic Induction and Alternating Current	228
<u>OPTICS AND OPTICAL INSTRUMENTS</u>		
20.	Reflection and Refraction of Light	251
21.	Dispersion and Scattering of light	270
22.	Wave Phenomena of Light	282
23.	Optical Instruments	295
<u>ATOMS AND NUCLEI</u>		
24.	Structure of Atom	302
25.	Dual Nature of Radiation and Matter	314
26.	Nuclei and Radioactivity	327
27.	Nuclear Fission and Fusion	339
<u>SEMICONDUCTOR DEVICES AND COMMUNICATION</u>		
28.	Semiconductors and Semiconducting Devices	348
29.	Applications of Semiconductor Devices	357
30.	Communication Systems	365
		■ ■

**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

Time : 3 Hours]

[Maximum Marks : 100

- Note :** (i) All questions are compulsory.
 (ii) Marks allotted are indicated against each question.
 (iii) Each question from Question Nos. 1 to 10 has four alternatives: (A), (B), (C) and (D) out of which one is most appropriate. Choose the correct answer among the four alternatives and write it in your answer-book against the number of the question. No separate time is allotted for attempting multiple choice questions.

Q. 1. The force of action and reaction are equal and opposite. Despite this, object moves on application of force because:

- (a) Both action and reaction act on the same object in same direction
 (b) Both action and reaction act on the same object in opposite direction.
 (c) Both action and reaction act on two different objects.
 (d) None of these

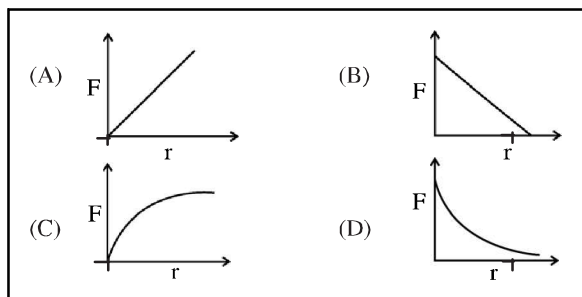
Ans. (c) Both action and reaction act on two different objects.

Q. 2. A horizontal force of 5N is required to maintain a velocity of 2m/s for a block of 10kg mass sliding over a rough horizontal surface. The work done by this force in one minute is:

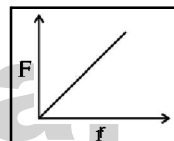
- (a) 600J (b) 60J
 (c) 6J (d) 6000J

Ans. (a) 600J.

Q. 3. Variation of viscous force (F) on a small sphere falling through a medium with the radius of the sphere, is represented as:



Ans. (a)



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) 160Hz (d) 80Hz

Ans. (c) 160Hz.

Q. 5. A parallel plate capacitor with air between the plates has a capacitance of 8pF. If the distance between the plates is reduced to half and the space between them is filled with a substance of dielectric constant 2, its capacitance will be:

- (a) 32pF (b) 16pF
 (c) 8pF (d) 4pF

Ans. (a) 32pF.

Q. 6. S.I. unit of self-inductance of a solenoid is:

- (a) Volt/second (b) Ohm-second
 (c) Volt-second (d) Ohm/second

Ans. (b) Ohm-second.

Q. 7. The refracting angle of a Prism is $\frac{1}{2}$ and its refractive index is 1.5 for yellow colour. Deviation of yellow light passing through it is:

- (a) 2° (b) 1°
 (c) $\frac{1}{2}^\circ$ (d) $\frac{1}{4}^\circ$

Ans. (d) $\frac{1}{4}^\circ$.

Q. 8. Balmer series of spectral lines is obtained when an electron in hydrogen atom jumps from higher orbits to the:

- (a) First orbit (b) Second orbit
 (c) Third orbit (d) Fourth orbit

Ans. (b) Second orbit.

Q. 9. An electron is accelerated through a potential V , its de-Broglie wavelength is λ . If accelerating voltage is increased to $4V$, its de-Broglie wavelength will become:

- (a) 4λ (b) 2λ
(c) λ (d) $\lambda/2$

Ans. (d) $\lambda/2$.

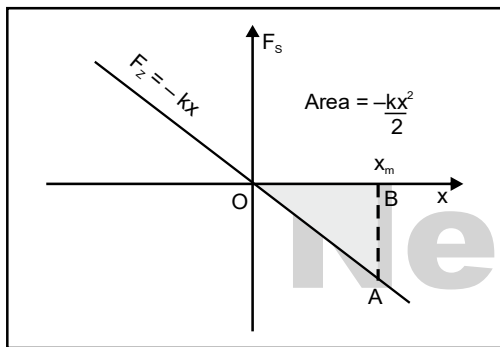
Q. 10. In a transistor least doped region is:

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

Ans. (b) Base.

Q. 11. Draw a graph showing variation of spring force (F) with extension (X) of an ideal spring. Write S.I. unit of spring constant.

Ans. The plot of spring force vs. displacement is shown below:



According to the Hooke's law, the spring force for an extension X_m is $F_s = -kX_m$

Q. 12. Using dimensional analysis, derive Stoke's law for the viscous force acting on a spherical body of radius (r), falling freely with a velocity (v) through a fluid of viscosity η .

Ans. Ref.: See Chapter-9, Page No. 94, 'Stoke's Law'.

Q. 13. Two bodies initially at temperature T_1 and T_2 when kept in thermal contact, do not necessarily settle to mean temperature $(T_1 + T_2)/2$ always. Why is it so?

Ans. Law of Conservation of Energy says that the energy is transferred from one body to another and from one format to another.

If we consider ideal conditions for heat transfer, when two bodies of temperature T_1 and T_2 come in thermal contact, heat transfer takes place from a body of higher temperature to a body of lower temperature. The quantity thermal energy is the function of mass and temperature. Hence, the mean temperature of the bodies in contact will be given by the weighted average not normal average.

$$\therefore T_{\text{avg}} = \frac{m_1 T_1 + m_2 T_2}{m_1 + m_2}$$

$$\text{Hence only when } m_1 = m_2, \text{ then } T_{\text{avg}} = \frac{T_1 + T_2}{2}$$

Q. 14. A battery of e.m.f. $10V$ and internal resistance 3Ω is connected to a external resistor. If the current in the circuit is $0.5A$. Calculate the:

(i) External resistor, and

Ans. Emf of the battery, $E = 10V$

Internal resistance of the battery, $r = 3\Omega$

Current in the circuit, $I = 0.5A$

Resistance of the resistor = R

The relation for current using Ohm's law is,

$$I = \frac{E}{R + r}$$

$$\Rightarrow R + r = \frac{E}{I}$$

$$\Rightarrow R + r = \frac{10}{0.5}$$

$$\Rightarrow R = 20 - 3 = 17\Omega.$$

(ii) Terminal voltage of the battery

Ans. Terminal voltage of the resistor = V

According to Ohm's Law,

$$V = IR$$

$$V = 0.5 \times 17$$

$$V = 8.5V$$

Therefore, the resistance of the resistor is 17Ω and the terminal voltage is $8.5V$.

Q. 15. An electron is projected at right angle to a uniform magnetic field (B) with velocity v . Derive the expression for the radius of circular path described by the electron. Take ' m ' as mass of electron and ' e ' its electric charge.

Ans. It is given that, an electron is projected at right angle to a uniform magnetic field (B) with velocity v . The magnetic force acting on it is given by:

$$F_m = qvB \sin \theta \quad \dots(1)$$

On the circular path, the centripetal force is also acting on it as:

$$F_c = \frac{mv^2}{r} \quad \dots(2)$$

From equation (1) and (2):

$$qvB = \frac{mv^2}{r}$$

$$r = \frac{mv}{qB}$$

Q. 16. Draw a graph showing variation of angle of deviation (D) with angle of incidence (i) of rays passing through a prism. Name the two factors on which angle of minimum deviation (δ) depends.

Ans. If we vary the angle of incidence i , the angle of deviation δ also changes; it becomes minimum for a certain value of i and again starts increasing as i increases further.

Sample Preview of The Chapter

Published by:



**NEERAJ
PUBLICATIONS**

www.neerajbooks.com

PHYSICS

MODULE-I: MOTION, FORCE AND ENERGY

1

Units, Dimensions and Vectors

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.

2 / NEERAJ : PHYSICS (N.I.O.S.-XII)

(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. ms^{-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 scalar 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

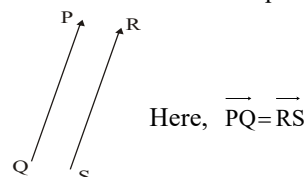
To represent a vector, draw a line with an arrow at its one end. The length of the line represent magnitude and arrow represent the direction.



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

Equal Vectors

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



Negative of a Vector

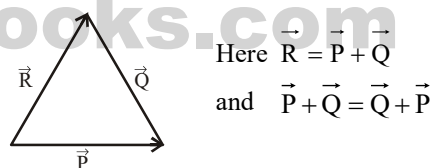
Negative of a vector \vec{PQ} has the same magnitude as \vec{PQ} but has opposite direction to \vec{PQ} .



Addition of Vectors

(a) **Triangle Law of Vectors:** Consider two vectors

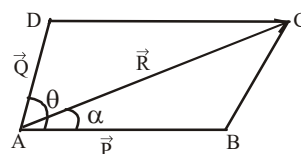
\vec{P} and \vec{Q} represented in magnitude and direction by the two sides of a triangle taken in order, then the resultant \vec{R} will be represented by the third side of triangle taken in reverse direction. This is called triangle law of vectors.



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} .



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

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

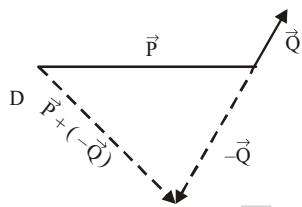
If resultant \vec{R} makes an angle α with vector \vec{P} , then

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

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.

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

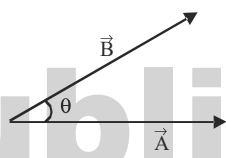


Multiplication of Vectors

(a) Scalar Product

Scalar product of two vectors is defined as:

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



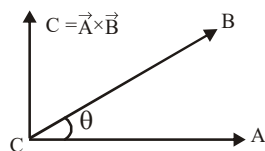
Properties of Scalar Product

- (i) $A \cdot B = B \cdot A$
- (ii) $A \cdot (B + C) = A \cdot B + A \cdot C$
- (iii) $A \cdot B = X$, 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) $A \times B = -B \times A$
- (ii) $A \times (B + C) = A \times B + A \times C$
- (iii) $A \times B$, is a vector quantity.

Resolution of Vectors

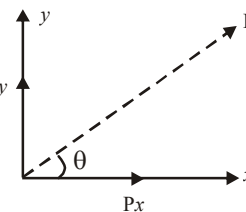
A given vector P can be resolved along x and y axis. Component of a vector P are given by:

$$P_x = P \cos \theta$$

and $P_y = P \sin \theta$

$$|\vec{P}| = \sqrt{P_x^2 + P_y^2}$$

$$\tan \theta = P_y / P_x$$



Unit Vector

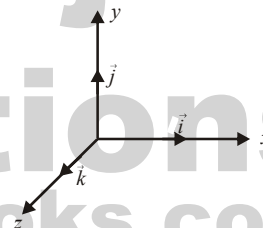
A vector having unit magnitude and having a specified direction is called unit vector. Unit vectors along x-axis, y-axis and z-axis are written as \hat{i} , \hat{j} and \hat{k} respectively.

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

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?

4 / NEERAJ : PHYSICS (N.I.O.S.-XII)

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 certainty 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.