Written as per the revised syllabus prescribed by the Maharashtra State Board of Secondary and Higher Secondary Education, Pune.

STD. XI Sci.
Perfect Physics

Salient Features

- Exhaustive coverage of syllabus in Question Answer Format.
- Covers answers to all Textual Questions, Intext Questions and relevant NCERT Questions.
- Includes Solved and Practice Numericals.
- Exercise, Multiple Choice Questions and Topic test at the end of each chapter for effective preparation.
- Important inclusions: NCERT Corner and Apply Your Knowledge

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Preface

In the case of good books, the point is not how many of them you can get through, but rather how many can get through to you.

"Std. XI Sci. : PERFECT PHYSICS" is a treasure house of knowledge that'd not only prepare you to face the conspicuous Std. XI final exam but also equip you up on parallel ground to face the prospective NEET and JEE exam. This book is specifically aimed at Maharashtra Board students. The content of the book is framed in accordance with Maharashtra State board syllabus splattered with additional snippets of information from the NCERT syllabus. This lethal combination of apt material from both the boards makes it the ultimate reference material for Std. XI.

This book has been developed on certain key features as detailed below:

- **Question and Answer** format of the book provides students with apropriate answers for all textual and intext questions. We've also included additional questions to ensure complete coverage of every concept.
- **Solved Examples** provide step-wise solution to various numerical problems. This helps students to understand the application of different concepts and formulae.
- **NCERT Corner** and **Notes** cover additional bits of relevant information on each topic.
- **Apply Your Knowledge and Brain Teasers** cover brain-storming questions to stengthen the students' conceptual understanding.
- **Quick Review** and **Formulae** sections facilitate instant revision at a glance.
- **Exercise** helps the students to gain insight on the various levels of theory and numercial-based questions.
- **Multiple Choice Questions** and **Topic Test** assess the students on their range of preparation and the amount of knowledge of each topic.

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

Please write to us on : mail@targetpublications.org

A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

Yours faithfully,
Publisher

Edition: Second

Contents

Note: All the Textual questions are represented by * mark
All the Intext questions are represented by # mark

01 Measurements

Syllabus

1.0 Introduction

Physics is the branch of science which deals with the study of nature and natural phenomena.
There are two domains in the scope of physics:

i. **Macroscopic domain:**
The macroscopic domain includes phenomena at the laboratory, terrestrial and astronomical scales.

ii. **Microscopic domain:**
The microscopic domain includes atomic, molecular and nuclear phenomena.

Q.1. What are physical quantities?

Ans: *Those quantities which can be measured i.e., subjected equally to all three elements of scientific study, namely : detailed analysis, precise measurement and mathematical treatment, are called physical quantities.*
Example: Mass, length, time, volume, pressure, force, etc.

1.1 Need for Measurement

***Q.2. What is the need for measurement of a physical quantity?**

Ans: i. To study phenomena in physics, scientists have performed different experiments.

ii. These experiments require measurement of physical quantities such as mass, length, time, volume, etc.

iii. Based on the observations of these experiments, scientists have developed various laws and theories.

iv. For the experimental verification of various theories, each physical quantity should be measured precisely.

v. Therefore, accurate measurement of physical quantities with appropriate instruments is necessary.

vi. Example: Consider the statement "The water boiled after some time." In the given statement, the physical quantity time is not defined precisely. A numerical value for time, which is measured on a watch is necessary.

1.2 Units for Measurements

The magnitude of a physical quantity 'x' is:
Magnitude of physical quantity
= Numerical value of physical quantity × Size of its unit.

i.e., x = nu

where, n = number of times the unit is taken.
u = size of unit of physical quantity.

Example:
If the length of a rod is 5 metre it means that the rod is 5 times as long as the standard unit of length (i.e., metre).

***Q.3. What is meant by unit of a physical quantity?**

Ans: i. *The reference standard used for the measurement of a physical quantity is called the unit of that physical quantity.*

ii. Example:

Physical Quantity	Standard (unit)
Length	metre, centimetre, inch, feet, etc.
Mass	kilogram, gram, pound etc.

Q.4. State the essential characteristics of a good unit.

Ans: Characteristics of a good unit:

i. It should be well-defined.
ii. It should be easily available and reproducible at all places.
iii. It should not be perishable.
iv. It should be invariable.
v. It should be universally accepted.
vi. It should be comparable to the size of the measured physical quantity.
vii. It must be easy to form multiples or sub multiples of the unit.

Note

Choice of unit depends upon its suitability for measuring the magnitude of a physical quantity under consideration. Hence, we choose different scales for same physical quantity.

Various units to express a physical quantity:

Prefix	Symbol	Power of 10	Prefix	Symbol	Power of 10
Exa	E	10^{18}	deci	d	10^{-1}
Peta	P	10^{15}	centi	c	10^{-2}
Tera	T	10^{12}	milli	m	10^{-3}
Giga	G	10^{9}	micro	μ	10^{-6}
Mega	M	10^{6}	nano	n	10^{-9}
Kilo	K	10^{3}	angstrom	Å	10^{-10}
Hecto	H	10^{2}	pico	p	10^{-12}
Deca	Da	10^{1}	femto	f	10^{-15}
			atto	a	10^{-18}

1.3 System of Units

Units are classified as fundamental units and derived units. In 1832, Gauss had suggested to select any three physical quantities as fundamental quantities. Accordingly, many systems of units came into existence.

Q.5. A. What is a system of units?
***B. Briefly describe different types of systems of units.**

Ans: A. *The whole set of units i.e., all the basic and derived units taken together forms a system of units.*

B. System of units are classified mainly into four types:

i. C.G.S. system:
It stands for Centimetre-Gram-Second system. In this system, fundamental quantities i.e., length, mass and time are measured in centimetre, gram and second respectively. It is a French metric system of unit.

ii. M.K.S. system:
It stands for Metre-Kilogram-Second system. In this system, fundamental quantities i.e. length, mass and time are measured in metre, kilogram and second respectively. It is a French metric system of unit.

iii. F.P.S. system:
It stands for Foot-Pound-Second system. In this system, length, mass and time are measured in foot, pound and second respectively. It is a British imperial system.

iv. S.I. system:
It stands for Standard International system. This system has replaced all other systems mentioned above. It has been internationally accepted and is being used all over world.

#Q.6. Can you call a physical quantity large or small without specifying a standard for comparison?

Ans: No, we cannot call a physical quantity large or small without specifying a standard for comparison.

1.4 S.I. units

Q.7. *What is S.I. system of units? Explain its need. OR
Write a short note on S.I. units.

Ans: S.I. system of units:

i. Use of different systems of units became very inconvenient for exchanging scientific information between different parts of the world.

ii. To overcome this difficulty, it became necessary to develop a common system of units.

iii. In October 1960, at the Eleventh International General Conference of weights and measures in Paris, a common system of units was accepted. This system of units called "Systeme Internationale d′Units" is the modern metric system of unit measurement. It is abbreviated as S.I. units.

iv. S.I. units consist of seven fundamental units, two supplementary units and a large number of derived units.

v. Nowadays, S.I. system has replaced all the other systems of units and is greatly used to exchange scientific data between different parts of the world.

1.5 Fundamental and derived units

***Q.8. What are fundamental quantities?**
State two examples of fundamental quantities. Write their S.I. and C.G.S. units.

Ans: Fundamental quantities:

The physical quantities which do not depend on any other physical quantity for their measurements i.e., they can be directly measured are called fundamental quantities.

Examples: mass, length etc.

Fundamental quantities	S.I. unit	C.G.S. unit
Mass	kilogram (kg)	gram (g)
Length	metre (m)	centimetre (cm)

Q.9. *A. What are fundamental units?
B. State the S.I. units of seven basic fundamental quantities.

Ans: A. Fundamental units:

The units used to measure fundamental quantities are called fundamental units.

B. Units of fundamental quantities:

i. There are seven fundamental quantities accepted in S.I. system.

ii. Fundamental quantities with their corresponding units are given in following table.

Base Quantities and Units:

Base quantity	SI Units		
	Name	Symbol	Definition
Length	metre	M	The metre is the length of the path travelled by light in vacuum during a time interval of 1/299,792,458 of a second. (1983)
Mass	kilogram	Kg	The kilogram is equal to the mass of the international prototype of the kilogram (a platinum-iridium alloy cylinder) kept at international Bureau of Weights and Measures, at Serves, near Paris, France. (1889)
Time	second	S	The second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom. (1967)
Electric current	ampere	A	The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 metre apart in vacuum, would produce between these conductors a force equal to 210^{-7} newton per metre of length. (1948)
Thermo dynamic Temperature	kelvin	K	The kelvin, is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water. (1967)

Amount of substance	mole	mol	The mole is the amount of substance of a system, which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon-12 (1971)
Luminous intensity	candela	cd	The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 54010^{12} hertz and that has a radiant intensity in that direction of 1/683 watt per steradian. (1979)

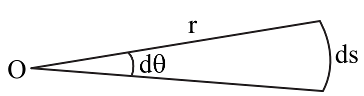
Supplementary Units		
Plane angle	radian	rad
Solid angle	steradian	sr

NCERT Corner

- **Supplementary Units**

i. Plane angle (dθ):

The ratio of length of arc (ds) to the radius (r) is called as Plane angle (dθ).

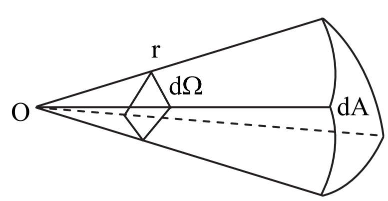


$d\theta = \frac{ds}{r}$

Unit: radian (rad)
Dimensions: dimensionless quantity

ii. Solid angle (dΩ):

The ratio of the intercepted area (dA) of the spherical surface described about the apex O as the centre, to the square of its radius r is called Solid angle (dΩ)



Unit: Steradian (sr)
Dimensions: dimensionless quantity.

- **Some units retained for general use (Though outside SI)**

Name	Symbol	Value in SI Unit
minute	min	60 s
hour	h	60 min = 3600 s
day	d	24 h = 86400 s
year	y	365.25 d = 3.156×10^7 s
degree	°	1° = (π/ 180) rad
litre	L	I $dm^3 = 10^{-3}$ m^3
tonne	t	10^3 kg
carat	c	200 mg
bar	bar	0.1 MPa = 10^5 Pa
curie	Ci	3.7×10^{10} s^{-1}
roentgen	R	2.58×10^{-4} C/kg
quintal	q	100 kg
barn	b	100 $fm^2 = 10^{-28}$ m^2
are	a	1 $dam^2 = 10^2$ m^2
hectare	ha	1 $hm^2 = 10^4$ m^2

Q.10. *A. What are derived quantities and derived units? State two examples.

B. State the corresponding S.I. and C.G.S. units of the examples.

Ans: A.

i. Derived quantities:

Physical quantities other than fundamental quantities which depend on one or more fundamental quantities for their measurements are called derived quantities.

Examples: speed, acceleration, momentum, force, etc.

ii. Derived units:

The units of derived quantities which depend on fundamental units for their measurements are called derived units.

B. Examples and units:

Derived quantity	S.I. unit	C.G.S. unit
Speed	m/s	cm/s
Force	N	dyne
Density	kg/m^3	g/cm^3
Acceleration	m/s^2	cm/s^2