SAMPLE CONTENT

Precise PHYSICS

Std. XI Science

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Target Publications® Pvt. Ltd.

Written as per the latest textbook prescribed by the Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune.

PRECISE

PHYSICS

Std. XI Sci.

Salient Features

- Written as per the latest textbook
- Subtopic-wise segregation for powerful concept building
- Complete coverage of Textual Exercise Questions, Intext Questions, Activities and Textual Examples
- 'Solved Examples' provided to cover numerical aspect of the topic in detail.
- Each chapter contains:
  - 'Quick Review' and 'Important Formulae' for last-minute revision of concepts
  - 'Reading Between the Lines' creates a solid foundation through hands-on, discovery-based learning.
- Selected questions from NCERT textbook for practice
- Q.R. codes provide:
  - The Video links boosting conceptual retention

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PREFACE

"Everything should be made as simple as possible, but not simpler." - Albert Einstein.

With this vision in mind, we have created **"Precise Physics: Std. XI"** as per the new textbook of Maharashtra State board. It is a compact yet comprehensive guide designed to boost students' confidence and prepare them for the crucial Std. XI final exam. Each chapter is divided into subtopics and contains every important concept in a question and answer format, including all Textual Exercise and Intext questions. Key sections such as 'Can you tell' and 'Can you recall', which are important from an exam standpoint, are appropriately integrated with additional questions to match the flow of each subtopic. Numericals along with their step-wise solutions using log calculations (wherever necessary) are covered under the heading of '**Solved Examples'** at the end of each subtopic. Each question is assigned marks to help students gauge its importance and weightage.

Important Formulae and Quick **Review** are provided after the last subtopic of each chapter. The **'Exercise'** and **'Multiple Choice Question'** sections are added at the end of each chapter. **Notes** are included to cover additional relevant information on each topic as needed.

While ensuring concise coverage of the syllabus in an effortless and easy to grasp format, emphasis is also given on active learning. To achieve this, we have infused ***QR Codes.***

Precise Physics: Std. XI, adheres to our vision and achieves several goals: **concept-building**, **developing competence to solve numericals and self-study** —all while encouraging students toward cognitive thinking.

The flow chart on the adjacent page will walk you through the key features of the book and elucidate how they have been carefully designed to maximize the student learning.

We hope the book benefits the learner as we have envisioned.

Publisher
Edition: Fifth

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

KEY FEATURES

Reading between the lines

Reading between the lines provides elaboration or missing fragments of concept essential for complete understanding of the concept.

QR Codes

QR code provides:
Access to a video in order to boost understanding of a concept or activity

Solved Examples

Solved Examples offer complete solution to numerical including log (as seemed required).

Important Formulae

Important Formulae includes all of the key formulae in the chapter.

Quick Review

Quick review includes tables/ flow chart to summarize the key points in chapter.

Exercise

Exercise includes subtopic-wise additional questions and problems.

Multiple Choice Questions

Multiple Choice Questions include textual as well as additional MCQs.

CONTENTS

[Reference: Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04**]**

Note:
1. * mark represents Textual question.
2. # mark represents Intext question.
3. + mark represents Textual examples.
4. symbol represents textual questions that need external reference for an answer.

1 Units and Measurements

Contents and Concepts

1.1 Introduction

Q.1. What is a measurement? How is measured quantity expressed? [2 Marks]

Ans:

i. A measurement is a comparison with internationally accepted standard measuring unit.

ii. The measured quantity (M) is expressed in terms of a number (n) followed by a corresponding unit (u) i.e., M = nu.

Example:

Length of a wire when expressed as 2 m, it means value of length is 2 in the unit of m (metre).

iii. Different quantities are measured in different units.

Q.2. Can you recall? *(Textbook page no. 1)*

i. What is a unit? [1 Mark]

ii. Which units have you used in the laboratory for measuring [2 Marks]

a. length b. mass

c. time d. temperature?

iii. Which system of units have you used? [1 Mark]

Ans:

i. *The standard measure of any quantity is called the unit of that quantity.*

ii.

Physical quantity	Length	Mass	Time	Temperature
Units	millimetre, centimetre, metre	gram, kilogram	seconds minutes	Degree celsius degree fahrenheit

iii. I have used MKS or SI system mostly. At times, I have even CGS system is used.

1.2 System of Units

Q.3. Describe briefly different types of systems of units. [2 Marks]

Ans: System of units are classified mainly into four types:

i. C.G.S. system:

It stands for Centimetre-Gram-Second system. In this system, length, mass and time are measured in centimetre, gram and second respectively.

ii. M.K.S. system:

It stands for Metre-Kilogram-Second system. In this system, length, mass and time are measured in metre, kilogram and second respectively.

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.

iv. S.I. system:

It stands for System International. This system has replaced all other systems mentioned above. It has been internationally accepted and is being used all over world. As the SI units use decimal system, conversion within the system is very simple and convenient.

Q.4. What are fundamental quantities? State two examples of fundamental quantities. Write their S.I. and C.G.S. units. [2 Marks]

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.5. What are fundamental units? State the S.I. units of seven fundamental quantities. **[3 Marks]**

Ans: Fundamental units:

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

S.I. Units of fundamental quantities:

Fundamental quantity	SI Units	
	Name	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

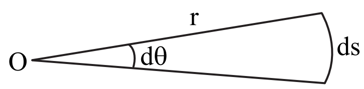
Q.6. State and describe the two supplementary units. **[2 Marks]**

Ans: The two supplementary units are:

i. Plane angle (dθ):

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

i.e., $d\theta = \frac{ds}{r}$



b. Thus, dθ is angle subtended by the arc at the centre of the circle.

c. Unit: radian (rad)

d. Denoted as θ^c

e. Length of arc of circle = Circumference of circle = $2\pi r$.

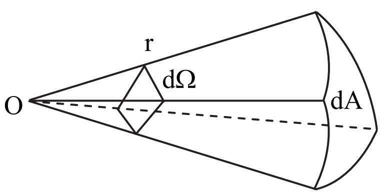
∴ plane angle subtended by entire circle at its centre is $\theta = \frac{2\pi r}{r} = 2\pi^c$

ii. Solid angle (dΩ):

a. solid angle is 3-dimensional analogue of plane angle.

b. *Solid angle is defined as area of a portion of surface of a sphere to the square of radius of the sphere.*

i.e., $d\Omega = \frac{dA}{r^2}$



c. Unit: Steradian (sr)

d. Denoted as (Ω)

e. Surface area of sphere = $4\pi r^2$

∴ solid angle subtended by entire sphere at its centre is $\Omega = \frac{4\pi r^2}{r^2} = 4\pi$ sr

Q.7. Derive the relation between radian and degree. Also find out 1″ and 1′ in terms of their respective values in radian. **[2 Marks]** **(Take π = 3.1416)**

Ans: We know that,

$2\pi^c = 360°$

∴ $\pi^c = 180°$

∴ $1^c = \frac{180}{\pi} = \frac{180}{3.1416} = 57.296°$

Similarly, $1° = \frac{\pi}{180} = \frac{3.1416}{180}$

$= 1.745 \times 10^{-2}$ rad

As, 1° = 60′

∴ $1' = \frac{1.745 \times 10^{-2}}{60} = 2.908 \times 10^{-4}$ rad.

As, 1′ = 60″

∴ $1'' = \frac{2.908 \times 10^{-4}}{60} \approx 4.847 \times 10^{-6}$ rad.

Students can scan the adjacent Q. R. Code in *Quill - The Padhai App* to get conceptual clarity about **degree and radian** with the aid of a linked video.

Q.8. What are derived quantities and derived units? State few examples. State the corresponding S.I. and C.G.S. units of the examples. **[3 Marks]**

Ans:

i. Derived quantities:

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

ii. Derived units:

The units of derived quantities which are expressed in terms of fundamental units for their measurements are called derived units.

iii. Examples and units:

Derived quantity	Formula	S.I. unit	C.G.S. unit
Velocity	$\frac{\text{Unit of displacement}}{\text{Unit of time}}$	m/s	cm/s
Acceleration	$\frac{\text{Unit of velocity}}{\text{Unit of time}}$	m/s^2	cm/s^2
Momentum	Unit of mass × Unit of velocity	kg m/s	g cm/s

Q.9. List the conventions followed while using SI units. [4 Marks]

Ans: Following conventions should be followed while writing S.I. units of physical quantities:

i. Unit of every physical quantity should be represented by its symbol.

ii. Full name of a unit always starts with smaller letter even if it is named after a person, eg.: 1 newton, 1 joule, etc. But symbol for unit named after a person should be in capital letter, eg.: N after scientist Newton, J after scientist Joule, etc.

iii. Symbols for units do not take plural form.

iv. Symbols for units do not contain any full stops at the end of recommended letter.

v. The units of physical quantities in numerator and denominator should be written as one ratio. For example the SI unit of acceleration is m/s^2 or $m\ s^{-2}$ but not m/s/s.

vi. Use of combination of units and symbols for units is avoided when physical quantity is expressed by combination of two. For example, The unit J/kg K is correct while joule/kg K is not correct.

vii. A prefix symbol is used before the symbol of the unit.

a. Prefix symbol and symbol of unit constitute a new symbol for the unit which can be raised to a positive or negative power of 10.
For example,
1 ms = 1 millisecond = 10^{-3} s
1 μs = 1 microsecond = 10^{-6} s
1 ns = 1 nanosecond = 10^{-9} s

b. Use of double prefixes is avoided when single prefix is available
10^{-6} s = 1 μs and not 1 mms
10^{-9} s = 1 ns and not 1 mμs

viii. Space or hyphen must be introduced while indicating multiplication of two units e.g., m/s should be written as $m\ s^{-1}$ or $m\text{-}s^{-1}$.

Solved Examples

+Q.10. What is the solid angle subtended by the moon at any point of the Earth, given the diameter of the moon is 3474 km and its distance from the Earth 3.84×10^8 m?
(Example 1.1 of Textbook page no. 2)
[3 Marks]

Solution:

Given: Diameter (D) = 3474 km
∴ Radius of moon (R) = 1737 km $= 1.737 \times 10^6$ m
Distance from Earth $r = 3.84 \times 10^8$ m

To find: Solid angle (dΩ)

Formula: $d\Omega = \dfrac{dA}{r^2}$

Calculation:
From formula,

$$d\Omega = \frac{\pi R^2}{r^2} \quad \text{....(}\because \text{ cross-sectional area of disc of moon} = \pi R^2\text{)}$$

$$d\Omega = \frac{\pi \times (1.737 \times 10^6)^2}{(3.84 \times 10^8)^2}$$

$$= \frac{3.412 \times (1.737)^2 \times 10^{12}}{(3.84)^2 \times 10^{16}}$$

$$= \text{antilog}\{\log(3.142) + 2\log(1.737) - 2\log(3.84)\} \times 10^{-4}$$

$$= \text{antilog}\{0.4972 + 2(0.2397) - 2(0.5843)\} \times 10^{-4}$$

$$= \text{antilog}\{0.4972 + 0.4794 - 1.1686\} \times 10^{-4}$$

$$= \text{antilog}\{\bar{1}.8080\} \times 10^{-4}$$

$$= 6.428 \times 10^{-1} \times 10^{-4}$$

$$= \mathbf{6.43 \times 10^{-5}\ sr}$$

Ans: Solid angle subtended by moon at Earth is **6.43×10^{-5} sr**.

Q.11. Pluto has mean diameter of 2,300 km and very eccentric orbit (oval shaped) around the Sun, with a perihelion (nearest) distance of 4.4×10^9 km and an aphelion (farthest) distance of 7.3×10^9 km. What are the respective solid angles subtended by Pluto from Earth's perspective?
Assume that Earth's distance from the Sun can be neglected. [3 Marks]

Solution:

Given: Radius of Pluto, $R = \dfrac{2300}{2}$ km = 1150 km
Perihelion distance $r_p = 4.4 \times 10^9$ km
Aphelion distance $r_a = 7.3 \times 10^9$ km

To find: Solid angles ($d\Omega_p$ and $d\Omega_a$)

Formula: $d\Omega = \dfrac{dA}{r^2} = \dfrac{\pi R^2}{r^2}$

Calculation:
From formula,

$$\therefore \quad d\Omega_p = \frac{\pi(1150)^2}{(4.4 \times 10^9)^2} = \frac{3.142 \times (1150)^2}{(4.4 \times 10^9)^2}$$

$$= \mathbf{2.146 \times 10^{-13}\ sr}$$

$$\text{and } d\Omega_a = \frac{3.142 \times (1150)^2}{(7.3 \times 10^9)^2}$$

$$= \mathbf{7.798 \times 10^{-14}\ sr}$$

Ans: Solid angle at perihelion distance is **2.146×10^{-13} sr** and at aphelion distance is **7.798×10^{-14} sr**.

1.3 Measurement of Length

Q.12. Define a metre. **[1 Mark]**

Ans: *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.*

Q.13. What is parallax? **[2 Marks]**

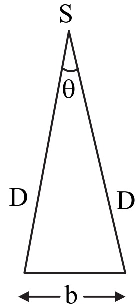
Ans:

i. *Parallax is defined as the apparent change in position of an object due to a change in position of an observer.*

ii. **Explanation:** When a pencil is held in front of our eyes and we look at it once with our left eye closed and then with our right eye closed, pencil appears to move against the background. This effect is called parallax effect.

Q.14. What is parallax angle? **[2 Marks]**

Ans:



i. *Angle between the two directions along which a star or planet is viewed at the two points of observation is called parallax angle (parallactic angle).*

ii. It is given by,

$\theta = \frac{b}{D}$

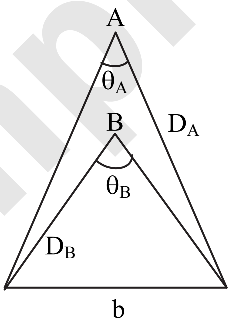
where,

b = Separation between two points of observation,

D = Distance of source from any point of observation.

***Q.15. Star A is farther than star B. Which star will have a large parallax angle?** **[2 Marks]**

Ans:



i. Parallax angle is given by, $\theta = \frac{b}{D}$

ii. Here, 'b' is constant for the two stars.

∴ $\theta \propto \frac{1}{D}$

iii. As star A is farther i.e., $D_A > D_B \Rightarrow \theta_A < \theta_B$.

Hence, star B will have larger parallax angle than star A.

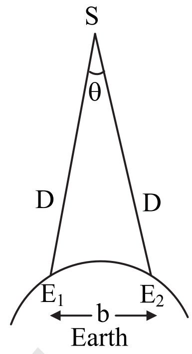
Q.16. Explain the method to determine the distance of a planet from the Earth. **[3 Marks]**

Ans:

i. Parallax method is used to determine distance of different planets from the Earth.

ii. To measure the distance 'D' of a far distant planet S, select two different observatories (E_1 and E_2).

iii. The planet should be visible from E_1 and E_2 observatories simultaneously i.e. at the same time.



iv. E_1 and E_2 are separated by distance 'b' as shown in figure.

∴ $E_1E_2 = b$

v. The angle between the two directions along which the planet is viewed, can be measured. It is parallax angle, which in this case is $\angle E_1SE_2 = \theta$

vi. The planet is far away from the (Earth) observers, hence

$b << D$

∴ $\frac{b}{D} << 1$ and 'θ' is also very small.

Hence, $E_1 E_2$ can be considered as arc of length b of circle with S as centre and D as radius.

∴ $E_1S = E_2S = D$

∴ $\theta = \frac{b}{D}$ ….(θ is taken in radian)

∴ $D = \frac{b}{\theta}$

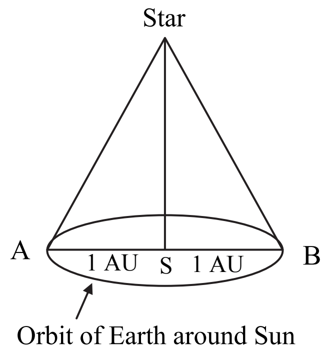
Thus, the distance 'D' of a far away planet 'S' can be determined using the parallax method.

Q.17. Explain how parallax method is used to measure distance of a star from Earth. **[2 Marks]**

Ans:

i. The parallax measured from two farthest distance points on Earth for stars will be too small and hence cannot be measured.

ii. Instead, parallax between two farthest points (i.e., 2 AU apart) along the orbit of Earth around the Sun (s) is measured.



Q.18. Explain how size of a planet or star is measured. **[2 Marks]**

Ans:

i. To determine the diameter (d) of a planet or star, two diametrically opposite points of the planet are viewed from the same observatory.

ii. If d is diameter of planet or star, angle subtended by it at any single point on the Earth is called angular diameter of planet.

iii. Let angle α be angle between these two directions as shown in the figure below.

Q.34. Explain the use of dimensional analysis to check the correctness of a physical equation. **[2 Marks]**

Ans: Correctness of a physical equation by dimensional analysis:

i. A physical equation is correct only if the dimensions of all the terms on both sides of that equations are the same.

ii. For example, consider the equation of motion.
$v = u + at$ ....(1)

iii. Writing the dimensional formula of every term, we get
Dimensions of L.H.S. $[v] = [L^1 M^0 T^{-1}]$,
Dimensions of R.H.S. = [u] + [at]
$= [L^1 M^0 T^{-1}] + [L^1 M^0 T^{-2}]\,[L^0 M^0 T^1]$
$= [L^1M^0T^{-1}] + [L^1M^0T^{-1}]$
$\Rightarrow$ [L.H.S.] = [R.H.S.]

iv. As dimensions of both side of equation are same, physical equation is dimensionally correct.

Q.35. State the limitations of dimensional analysis. **[2 Marks]**

Ans: Limitations of dimensional analysis:

i. The value of dimensionless constant can be obtained with the help of experiments only.

ii. Dimensional analysis cannot be used to derive relations involving trigonometric (sin θ, cos θ, etc.), exponential (e^x, e^{x^2}, etc.), and logarithmic functions (log x, log x^3, etc) as these quantities are dimensionless.

iii. This method is not useful if constant of proportionality is not a dimensionless quantity.

iv. If the correct equation contains some more terms of the same dimension, it is not possible to know about their presence using dimensional equation.

Reading between the lines

Explanation for point (iii):

Gravitational force between two point masses is directly proportional to product of the two masses and inversely proportional to square of the distance between the two

i.e., $F \propto \frac{m_1 m_2}{r^2}$

$\Rightarrow F = G\frac{m_1 m_2}{r^2}$

The constant of proportionality 'G' is NOT dimensionless. Thus, method of dimensional analysis will not work.

Explanation for point (iv):

With standard symbols, the equation $s = \frac{1}{2}at^2$ *is dimensionally correct. However, the complete equation is,* $s = ut + \frac{1}{2}at^2$

Solved Examples

Q.36. If length 'L', force 'F' and time 'T' are taken as fundamental quantities, what would be the dimensional equation of mass and density? **[2 Marks]**

Solution:

i. Force = Mass × Acceleration

$\therefore$ Mass = $\frac{\text{Force}}{\text{Acceleration}}$

$\therefore$ Dimensional equation of mass

$$\frac{\text{Dimensions of force}}{\text{Dimensions of acceleration}} = \frac{[F^1]}{[L^1T^{-2}]}$$

$$= \mathbf{[F^1L^{-1}T^2]}$$

ii. Density = $\frac{\text{Mass}}{\text{Volume}}$

Dimensional equation of density

$$= \frac{\text{Dimensions of mass}}{\text{Dimensions of volume}} = \frac{[F^1L^{-1}T^2]}{[L^3]}$$

$$= \mathbf{[F^1L^{-4}T^2]}$$

Ans: i. The dimensional equation of mass is $\mathbf{[F^1L^{-1}T^2]}$.

ii. The dimensional equation of density is $\mathbf{[F^1L^{-4}T^2]}$.

***Q.37. An electron with charge e enters a uniform magnetic field $\vec{B}$ with a velocity $\vec{v}$. The velocity is perpendicular to the magnetic field. The force on the charge e is given by $|\vec{F}|$ = B e v. Obtain the dimensions of $\vec{B}$.** **[2 Marks]**

Solution: Given: $|\vec{F}| = B\,e\,v$

Considering only magnitude, given equation is simplified to,

F = B e v

$\therefore$ $B = \frac{F}{ev}$

but, $F = ma = m \times \frac{\text{distance}}{\text{time}^2}$

$\therefore$ $[F] = [M^1] \times \left[\frac{L^1}{T^2}\right] = [L^1M^1T^{-2}]$

Electric charge, e = current × time

$\therefore$ $[e] = [I^1T^1]$

Velocity v = $\frac{\text{distance}}{\text{time}}$

$\therefore$ $[v] = \left[\frac{L}{T}\right] = [L^1T^{-1}]$

Now, $[B] = \left[\frac{F}{ev}\right] = \frac{[L^1M^1T^{-2}]}{[T^1I^1][L^1T^{-1}]}$

$\therefore$ $[B] = \mathbf{[L^0M^1T^{-2}\,I^{-1}]}$

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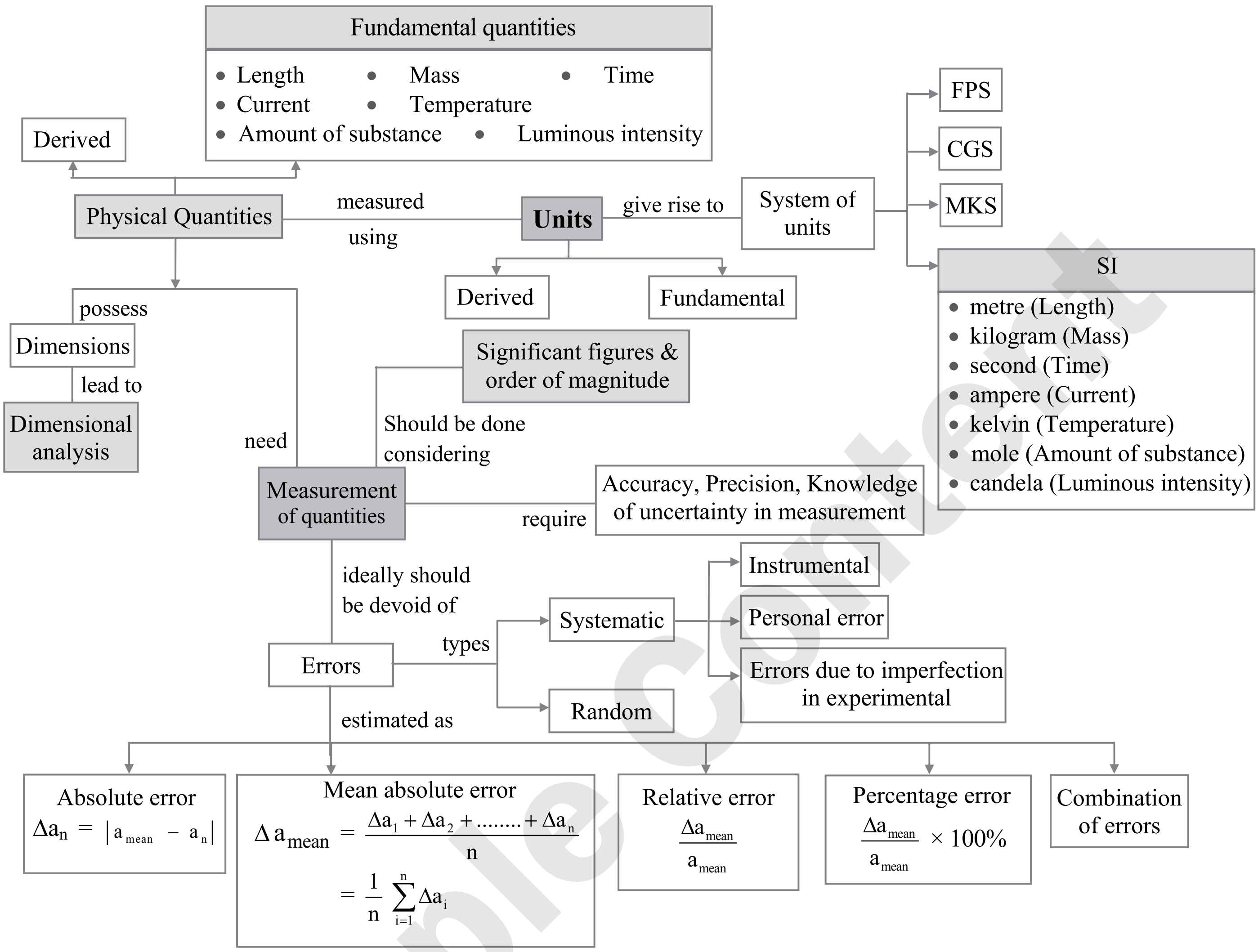
To see complete chapter buy **Target Notes** or **Target E-Notes**

Quick Review



Important Formulae

1. **Measure of physical quantity:**
   M = nu
   where, n = numerical value, u = unit

2. **Relation between numerical value and size of unit:** $n_1u_1 = n_2u_2$

3. **Conversion factor of a unit in two system of units:** $n = \left[\frac{M_1}{M_2}\right]^a \left[\frac{L_1}{L_2}\right]^b \left[\frac{T_1}{T_2}\right]^c$

4. **Plane angle:** $d\theta = \frac{ds}{r}$

5. **Solid angle:** $d\Omega = \frac{dA}{r^2}$

6. **Parallax angle:** $\theta = \frac{b}{D}$

7. **Diameter of planet/star:** $d = \alpha D$.

8. **Average value or mean value:**
   $$a_{mean} = \frac{a_1 + a_2 + a_3 + .. + a_n}{n} = \frac{1}{n}\sum_{i=1}^{n} a_i$$

9. **Absolute error:**
   = |Average value – Measured value|
   $|\Delta a_n| = |a_{mean} - a_n|$

10. **Mean absolute error:**
    $$\Delta a_{mean} = \frac{\Delta a_1 + \Delta a_2 + ... + \Delta a_n}{n} = \frac{1}{n}\sum_{i=1}^{n} \Delta a_i$$

11. **Relative (fractional) error:** $= \frac{\Delta a_{mean}}{a_{mean}}$

12. **Percentage error:** $= \frac{\Delta a_{mean}}{a_{mean}} \times 100\,\%$

13. If $Z = A \pm B$, then maximum error:
    $\Delta Z = \pm(\Delta A + \Delta B)$

14. If Z = AB or $Z = \frac{A}{B}$ then,

$$\frac{\Delta Z}{Z} = \pm\left(\frac{\Delta A}{A} + \frac{\Delta B}{B}\right)$$

15. If $Z = A^m \times B^n$, then error in measurement:

$$\frac{\Delta Z}{Z} = \frac{m\Delta A}{A} + \frac{n\Delta B}{B}$$

Various prefixes to express a physical quantity:

Prefix	Symbol	Power of 10	Prefix	Symbol	Power of 10
Tera	T	10^{12}	micro	μ	10^{-6}
Giga	G	10^{9}	nano	n	10^{-9}
Mega	M	10^{6}	angstrom	Å	10^{-10}
Kilo	k	10^{3}	pico	p	10^{-12}
milli	m	10^{-3}	femto	f	10^{-15}

Exercise

1.1 Introduction

1. Define unit of physical quantity. **[1 Mark]**
Ans: *Refer Q.2. (i).*

1.2 System of Units

2. Describe F.P.S and M.K.S. system. **[1 Mark]**
Ans: *Refer Q.3.(iii) and (ii)*

3. Describe C.G.S and SI system. **[1 Mark]**
Ans: *Refer Q.3.(i) and (iv).*

4. Compare plane angle and solid angle. **[2 Marks]**
Ans: *Refer Q.6.*

1.3 Measurement of Length

5. Explain the method to determine the distance of a planet from the Earth. **[3 Marks]**
Ans: *Refer Q.16.*

1.4 Measurement of Mass

6. What is atomic mass unit (amu)? **[1 Mark]**
Ans: *Refer Q.26.*

1.5 Measurement of time

7. Why was solar day rejected as a unit of time? **[2 Marks]**
Ans: *Refer Q.28.*

1.6 Dimensions and Dimensional Analysis

8. What are the dimensions of power? **[1 Mark]**
Ans: $[L^2M^1T^{-3}]$

9. What are the dimensions of frequency? **[1 Mark]**
Ans: $[L^0M^0T^{-1}]$

10. State the conversion factor between S.I. and CGS units of force using dimensional analysis. **[1 Mark]**
Ans: Conversion factor = 10^5 i.e., 1 N = 10^5 dyne.

11. Find the dimensional correctness of kinematical equations: **[2 Marks]**
v = u + at
Ans: *Refer Q.34.*

12. The value of G in C.G.S system is 6.67×10^{-8} dyne cm^2 g^{-2}. Calculate its value in S.I. system. **[2 Marks]**
Ans: 6.67×10^{-11} N m^2/kg^2

1.7 Accuracy, Precision and Uncertainty in Measurements

13. What are the reasons that may introduce possible uncertainties in an observation? **[2 Marks]**
Ans: *Refer Q.46.*

1.8 Errors in Measurements

14. Explain:
i. absolute error
ii. relative error
iii. percentage error **[1 Mark Each]**
Ans: *Refer Q. 54 (ii), (iv), (v).*

15. Error in the measurement of radius of a sphere is 1%. Then error in the measurement of volume will be? **[1 Mark]**
Ans: 3%

16. The length of a rod as measured in an experiment was found to be 2.48 m, 2.46 m, 2.49 m, 2.50 m and 2.48 m. Find the mean absolute error, relative error and percentage error. **[3 Marks]**
Ans: i. 0.01 m ii. 0.004 m
iii. 0.4%

17. The length of a metal plate was measured using Vernier callipers of least count 0.01 cm. The measurement made were 4.11 cm,4.13 cm, 4.21 cm and 4.09 cm. Find the mean length, the mean absolute error, relative error and the percentage error in the measurement of length. **[3 Marks]**
Ans: i. 4.135 cm ii. 0.0375 cm
iii. 9.068×10^{-3} iv. 0.906%

1.9 Significant figures

18. Define significant figures. **[1 Mark]**
Ans: *Refer Q.72. (only definition)*

19. What are the rules for determining significant figures? **[2 Marks]**
Ans: *Refer Q.72. (only rules)*

20. What is order of magnitude? Explain with two examples. **[2 Marks]**

Ans: *Refer Q.75.*

21. Add 3.8×10^{-6} and 4.2×10^{-5} with due regards to significant figures. **[1 Mark]**

Ans: 4.6×10^{-5}

22. Two different masses are determined as (23.7 ± 0.5) g and (17.6 ± 0.3) g. What is the sum of their masses? **[1 Mark]**

Ans: 41.3 ± 0.8 g

23. The length, breadth and thickness of a rectangular sheet of metal are 4.658 m, 1.356 m and 2.04 cm respectively. Give the area and volume of the sheet to correct significant figures. **[3 Marks]**

Ans: i. $12.88\ m^2$ ii. $0.1288\ m^3$

24. The acceleration due to gravity at a place is $9.8\ ms^{-2}$. Find its value in km h^{-2} and its order of magnitude for that value. **[2 Marks]**

Ans: i. $127008\ km/h^2$ ii. 5

25. Find the order of magnitude of following data.
    i. Height of a tower 4325 m
    ii. Weight of a car 789 kg
    iii. Charge on electron 1.6×10^{-19} C **[3 Marks]**

Ans: i. 3 ii. 3 iii. −19

26. What will be the kinetic energy of body if its mass is 2 kg and moving with a velocity of 2 m/s? Write its order of magnitude and significant figures. **[2 Marks]**

Ans: i. 4 J ii. 0 iii. 1

Multiple Choice Questions

[1 Mark Each]

1. A physical quantity may be defined as
   (A) the one having dimension.
   (B) that which is immeasurable.
   (C) that which has weight.
   (D) that which has mass.

2. Which of the following is the fundamental unit?
   (A) Length, force, time
   (B) Length, mass, time
   (C) Mass, volume, height
   (D) Mass, velocity, pressure

3. Which of the following is NOT a fundamental quantity?
   (A) Temperature
   (B) Electric charge
   (C) Mass
   (D) Electric current

*4. Which of the following is not a fundamental unit?
   (A) cm (B) kg
   (C) centigrade (D) volt

5. The distance of the planet from the earth is measured by _______.
   (A) direct method
   (B) directly by metre scale
   (C) spherometer method
   (D) parallax method

6. The two stars S_1 and S_2 are located at distances d_1 and d_2 respectively. Also if $d_1 > d_2$ then following statement is true.
   (A) The parallax of S_1 and S_2 are same.
   (B) The parallax of S_1 is twice as that of S_2
   (C) The parallax of S_1 is greater than parallax of S_2
   (D) The parallax of S_2 is greater than parallax of S_1

7. Which of the following is NOT a unit of time?
   (A) Hour (B) Nano second
   (C) Microsecond (D) parsec

*8. Light year is a unit of
   (A) time (B) mass
   (C) distance (D) luminosity

9. An atomic clock makes use of _______.
   (A) cesium-133 atom
   (B) cesium-132 atom
   (C) cesium-123 atom
   (D) cesium-131 atom

10. S.I. unit of energy is joule and it is equivalent to
   (A) 10^6 erg (B) 10^{-7} erg
   (C) 10^7 erg (D) 10^5 erg

11. $[L^1M^1T^{-1}]$ is an expression for _______.
   (A) force (B) energy
   (C) pressure (D) momentum

12. Dimensions of $\sin \theta$ is
   (A) $[L^2]$ (B) $[M]$
   (C) $[ML]$ (D) $[M^0L^0T^0]$

*13. $[L^1M^1T^{-2}]$ is the dimensional formula for
   (A) velocity (B) acceleration
   (C) force (D) work

*14 Dimensions of kinetic energy are the same as that of
   (A) force (B) acceleration
   (C) work (D) pressure

15. Accuracy of measurement is determined by
   (A) absolute error
   (B) percentage error
   (C) human error
   (D) personal error

16. Zero error of an instrument introduces ________.
(A) systematic error
(B) random error
(C) personal error
(D) decimal error

17. The diameter of the paper pin is measured accurately by using ________.
(A) Vernier callipers
(B) micrometer screw gauge
(C) metre scale
(D) a measuring tape

*18. The error in the measurement of the sides of a rectangle is 1%. The error in the measurement of its area is
(A) 1%
(B) 1/2%
(C) 2%
(D) None of the above.

19. The number of significant figures in 11.118×10^{-6} is
(A) 3 (B) 4
(C) 5 (D) 6

20. 0.00849 contains ______ significant figures.
(A) 6 (B) 5
(C) 3 (D) 2

21. 3.310×10^2 has ______ significant figures.
(A) 6 (B) 4
(C) 2 (D) 1

22. The Earth's radius is 6371 km. The order of magnitude of the Earth's radius is
(A) 10^3 m (B) 10^9 m
(C) 10^7 m (D) 10^2 m

23. ________ is the smallest measurement that can be made using the given instrument
(A) Significant number
(B) Least count
(C) Order of magnitude
(D) Relative error

Answers to Multiple Choice Questions

1.	(A)	2.	(B)	3.	(B)	4.	(D)
5.	(D)	6.	(D)	7.	(D)	8.	(C)
9.	(A)	10.	(C)	11.	(D)	12.	(D)
13.	(C)	14.	(C)	15.	(B)	16.	(A)
17.	(B)	18.	(C)	19.	(C)	20.	(C)
21.	(B)	22.	(C)	23.	(B)		

Hints to Multiple Choice Questions

18. $A = l \times b$

$$\therefore \frac{\Delta A}{A} = \frac{\Delta l}{l} + \frac{\Delta b}{b} = 1\% + 1\% = 2\%$$

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