Sample

JEEnius AI

PREVIOUS YEAR QUESTIONS · 2000–2026

NEET (UG)

Chapter-wise PYQs

Physics

2000–2026 Questions from 27 years

Chapter-wise previous year questions with full solutions · NEET (UG) and AIPMT

1,268	221	20
QUESTIONS	FIGURES	CHAPTERS

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NEET (UG) Chapter-wise PYQs · Physics

Chapter-wise previous year questions with full solutions · NEET (UG) and AIPMT
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How to use this book

- **Chapter-wise, newest first.** Every chapter opens with its questions, latest year first, followed by an answer key and then full solutions. Attempt the questions before turning to the key.
- **Source line.** Each question shows where it was asked — exam and year, and re-examination where it applies, and its type when it is not a single-correct MCQ.
- **Weightage table.** Physics opens with a table of how often every chapter was asked, overall and in the last five years. Use it to plan revision.
- **More than an answer.** Solutions carry a difficulty rating, a suggested time and the topic; many add a quick approach, the common traps students fall into, and what to revise.
- **Ref numbers.** Each solution carries a Ref number. Quote it to report an error.

Questions by year

2000 **42**	2001 **49**	2002 **47**	2003 **50**	2004 **49**	2005 **40**	2006 **50**	2007 **49**	2008 **48**	2009 **49**	2010 **48**	2011 **52**	2012 **50**
2013 **42**	2014 **33**	2015 **44**	2016 **45**	2017 **43**	2018 **41**	2019 **43**	2020 **45**	2021 **46**	2022 **51**	2023 **48**	2024 **32**	2025 **29**
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NEET (UG) and AIPMT 2000–2026

1,268 questions

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Physics

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PHYSICS · CHAPTER 1

Physics and Measurement

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1 NEET 2026 · NUMERICAL

The speed of light in vacuum is taken as unity. If light takes 6 min 40 s to reach the Earth from the Sun, the distance between the Sun and the Earth in new unit is:

(A) 3×10^8 (B) 500
(C) 3×10^{10} (D) 400

2 NEET 2026 · NUMERICAL

Each side of a metallic cube of mass 5.580 kg is measured to the 9.0 cm. Keeping the significant figures in view, the density of the material of the cube can be best expressed as $X \times 10^3$ kg m^{-3} where the value of X is:

(A) 7.654 (B) 7.6
(C) 7.65 (D) 7.7

3 NEET 2026

In a vernier calliper, 20 VSD coincide with 16 MSD (each division of length 1 mm). The least count of the vernier callipers is:

(A) 0.2 cm (B) 0.01 cm
(C) 0.02 cm (D) 0.1 cm

4 NEET 2026 · RE-EXAM

One main scale division of a Vernier calliper is equal to 1 mm and the number of divisions on the Vernier scale is 10. When both the jaws touch each other, the Vernier scale shifts to the left of zero of the main scale in such a way that 4th Vernier division coincides with a division of the main scale. If this Vernier calliper measures the length of the wire to be 1 cm, the actual length of the wire is:

(A) 0.60 cm (B) 0.96 cm
(C) 1.00 cm (D) 1.04 cm

5 NEET 2026 · RE-EXAM

Consider that σ_s, kB, b represents Stefan-Boltzmann constant, Boltzmann constant and Wien's displacement law constant, respectively. The dimension of $\sigma_s \times kB^{-1} \times b$ is

(A) $[L^{-1}T^{-1}K^{-2}]$ (B) $[L^{-1}K^{-2}]$
(C) $[L^{-1}T^{-1}K^{-3}]$ (D) $[L^{-1}T^{-1}K^{-4}]$

6 NEET 2025

Given below are two statements:

Statement I: In a vernier callipers, one vernier scale division is always smaller than one main scale division.

Statement II: The vernier constant is given by one main scale division multiplied by the number of vernier scale division.

In the light of the above statements, choose the correct answer from the options given below.

(A) Both Statement I and Statement II are false.
(B) Statement I is true but Statement II is false.
(C) Both Statement I and Statement II are true.
(D) Statement I is false but Statement II is true.

7 NEET 2025

If B is magnetic field and μo is permeability of free space, then the dimensions of (B/μo) is?

(A) $MT^{-2}A^{-1}$ (B) $L^{-1}A$
(C) $LT^{-2}A^{-1}$ (D) $ML^2T^{-2}A^{-1}$

8 NEET 2023

A metal wire has mass (0.4 ± 0.002) g, radius (0.3 ± 0.001) mm and length (5 ± 0.02) cm. The maximum possible percentage error in the measurement of density will nearly be

(A) 1.2% (B) 1.3%
(C) 1.6% (D) 1.4%

9 NEET 2023

The errors in the measurement which arise due to unpredictable fluctuations in temperature and voltage supply are

(A) Instrumental errors (B) Personal errors
(C) Least count errors (D) Random errors

10 NEET 2022

Plane angle and solid angle have

(A) Both units and dimensions (B) Units but no dimensions
(C) Dimensions but no units (D) No units and no dimensions

11 NEET 2022

The dimensions $[MLT^{-2}A^{-2}]$ belong to the

(A) Electric permittivity (B) Magnetic flux
(C) Self inductance (D) Magnetic permeability

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12 NEET 2022

The area of a rectangular field (in m^2) of length 55.3 m and breadth 25 m after rounding off the value for correct significant digits is

(A) 14×10^2 (B) 138×10^1
(C) 1382 (D) 1382.5

13 NEET 2021

If E and G respectively denote energy and gravitational constant, then $\frac{E}{G}$ has the dimensions of

(A) $[M^2][L^{-2}][T^{-1}]$ (B) $[M^2][L^{-1}][T^0]$
(C) $[M][L^{-1}][T^{-1}]$ (D) $[M][L^0][T^0]$

14 NEET 2021

A screw gauge gives the following readings when used to measure the diameter of a wire: Main scale reading: 0 mm, Circular scale reading: 52 divisions. Given that 1 mm on main scale corresponds to 100 divisions on the circular scale. The diameter of the wire from the above data is

(A) 0.052 cm (B) 0.52 cm
(C) 0.026 cm (D) 0.26 cm

15 NEET 2021

If force [F], acceleration [A] and time [T] are chosen as the fundamental physical quantities. Find the dimensions of energy.

(A) $[F][A^{-1}][T]$ (B) $[F][A][T]$
(C) $[F][A][T^2]$ (D) $[F][A][T^{-1}]$

16 NEET 2020 · NUMERICAL

A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is:

(A) 0.01 mm (B) 0.25 mm
(C) 0.5 mm (D) 1.0 mm

17 NEET 2020

Taking into account of the significant figures, what is the value of 9.99 m − 0.0099 m?

(A) 9.9801 m (B) 9.98 m
(C) 9.980 m (D) 9.9 m

18 NEET 2019

In an experiment, the percentage of error occurred in the measurement of physical quantities A, B, C and D are 1%, 2%, 3% and 4% respectively. Then the maximum percentage of error in the measurement X, where $X = \frac{A^2B^{1/2}}{C^{1/3}D^3}$, will be

(A) 10% (B) $\left(\frac{3}{13}\right)$ %
(C) 16% (D) -10%

19 NEET 2018 · NUMERICAL

A student measured the diameter of a small steel ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and zero of circular scale division coincides with 25 divisions above the reference level. If screw gauge has a zero error of –0.004 cm, the correct diameter of the ball is

(A) 0.521 cm (B) 0.525 cm
(C) 0.529 cm (D) 0.053 cm

20 NEET 2017

A physical quantity of the dimensions of length that can be formed out of c, G and $\frac{e^2}{4\pi\varepsilon_0}$ is [c is velocity of light, G is universal constant of gravitation and e is charge]

(A) $\frac{1}{c}G\frac{e^2}{4\pi\varepsilon_0}$
(B) $\frac{1}{c^2}\left[G\frac{e^2}{4\pi\varepsilon_0}\right]^{\frac{1}{2}}$
(C) $c^2\left[G\frac{e^2}{4\pi\varepsilon_0}\right]^{\frac{1}{2}}$
(D) $\frac{1}{c^2}\left[\frac{e^2}{G4\pi\varepsilon_0}\right]^{\frac{1}{2}}$

21 AIPMT 2015

If dimensions of critical velocity v_c of a liquid flowing through a tube are expressed as $[\eta^x\rho^y r^z]$ where η, ρ and r are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values of x, y and z are given by

(A) 1, 1, 1 (B) 1, −1, −1
(C) −1, −1, 1 (D) −1, −1, −1

22 AIPMT 2014

If force (F), velocity (V) and time (T) are taken as fundamental units, then the dimensions of mass are

(A) $[FVT^{-1}]$ (B) $[FVT]$
(C) $[FV^{-1}T^{-1}]$ (D) $[FV^{-1}T]$

23 NEET 2013

In an experiment, four quantities a, b, c and d are measured with percentage errors 1%, 2%, 3% and 4% respectively. Quantity P is calculated as follows:

$$P = \frac{a^3b^2}{cd}$$

The percentage error in P is:

(A) 10% (B) 7%
(C) 4% (D) 14%

24 AIPMT 2009

If the dimensions of a physical quantity are given by $M^aL^bT^c$, then the physical quantity will be:

(A) Pressure if a = 1, b = -1, c = -2
(B) Velocity if a = 1, b = 0, c = -1
(C) Acceleration if a = 1, b = 1, c = -2
(D) Force if a = 0, b = -1, c = -2

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25 AIPMT 2008

If the error in the measurement of the radius of a sphere is 2%, then the error in the determination of the volume of the sphere will be:

(A) 4% **(B)** 6%
(C) 8% **(D)** 2%

26 AIPMT 2008

Which two of the following five physical parameters have the same dimensions?

(1) Energy density
(2) Refractive index
(3) Dielectric constant
(4) Young's modulus
(5) Magnetic field

(A) 2 and 4 **(B)** 3 and 5
(C) 1 and 4 **(D)** 1 and 5

27 AIPMT 2006

The velocity v of a particle at time t is given by $v = at + \frac{b}{t+c}$, where a, b and c are constants. The dimensions of a, b, and c are respectively:

(A) $[LT^{-2}]$, [L] and [T] **(B)** $[L^2]$, [T] and $[LT^2]$
(C) $[LT^2]$, [LT] and [L] **(D)** [L], [LT] and $[T^2]$

28 AIPMT 2004

The dimensions of universal gravitational constant are:

(A) ML^2T^{-1} **(B)** $M^{-2}L^3T^{-2}$
(C) $M^{-2}L^2T^{-1}$ **(D)** $M^{-1}L^3T^{-2}$

29 AIPMT 2002

The value of Planck's constant is:

(A) 6.63×10^{-34} J/s **(B)** 6.63×10^{-34} kg m²/s
(C) 6.63×10^{-34} kg m² **(D)** $6.63 \times 10^{-34} Js^{-1}$

30 AIPMT 2001

The dimension of Planck constant equals to that of:

(A) Energy **(B)** Momentum
(C) Angular momentum **(D)** Power

31 AIPMT 2000

Which pair have not equal dimensions?

(A) Energy and torque
(B) Force and impulse
(C) Angular momentum and Planck's constant
(D) Elastic modulus and pressure

Answer key · Physics and Measurement

1 D	2 D	3 C	4 –	5 A	6 B
7 B	8 C	9 D	10 B	11 D	12 A
13 B	14 A	15 C	16 C	17 B	18 C
19 C	20 B	21 B	22 D	23 D	24 A
25 B	26 C	27 A	28 D	29 B	30 C
31 B					

Solutions · Physics and Measurement

1 **Answer: D** Ref 6616

Easy ~0.5 min System of Units

QUICK APPROACH Start by converting the given time for light to reach Earth into seconds, then use the formula distance = speed × time, considering speed of light as unity in the new system.

Time taken by light to reach Earth from Sun is $t = 6$ min 40 s.

Convert time to seconds:
$t = 6 \times 60 + 40$
$t = 360 + 40$
$t = 400$ s

In the new system, speed of light in vacuum is taken as unity:
$v = 1$ unit/s

Distance between Sun and Earth in new unit:
$d = v \times t$
$d = 1 \times 400$
$d = 400$ units

2 **Answer: D** Ref 6632

Medium ~1.5 min Significant Figures and Density Calculation

QUICK APPROACH Start by recalling that density = mass ÷ volume, and apply the rules of significant figures carefully, especially noting the least number of significant figures among the given measurements.

Density = Mass / Volume

$$\text{Density} = \frac{5.580\ \text{kg}}{(9.0\ \text{cm})^3}$$

$$= \frac{5.580}{729} \times 10^6\ \frac{\text{kg}}{\text{m}^3}$$

$$= 0.007654321 \times 10^6\ \frac{\text{kg}}{\text{m}^3}$$

$$= 7.654 \times 10^3\ \frac{\text{kg}}{\text{m}^3}$$

Applying significant figure rules: mass has 4 significant figures, side length has 2 significant figures. The result must be expressed with the least number of significant figures, i.e., 2.

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$$= 7.7 \times 10^3 \frac{\text{kg}}{\text{m}^3}$$

Hence, $X = 7.7$.

3 **Answer: C** Ref 6642

Medium ~1 min Vernier Callipers

Least count of vernier callipers

$L.C. = 1$ MSD $- 1$ VSD ...(i)

Given: 20 VSD $=$ 16 MSD

$$1 \text{ VSD} = \frac{16}{20} \text{ MSD}$$

From (i)

$$L.C. = 1 \text{ MSD} - \frac{16}{20} \text{ MSD}$$

$$L.C. = \frac{4}{20} \text{ MSD}$$

$L.C. = \frac{1}{5}$ mm = 0.2 mm

$L.C. = 0.02$ cm

4 **Answer: –** Ref 6821

Medium Vernier Callipers

QUICK APPROACH Work out the least count first. Then find how far the Vernier zero sits to the left of the main scale zero when the jaws touch, and remember that a negative zero error is subtracted with its sign.

Find the least count, then the negative zero error, and correct the reading.

Step 1. Ten Vernier divisions equal nine main scale divisions, so 1 VSD $= 0.9$ mm and the least count is $1 - 0.9 = 0.1$ mm $= 0.01$ cm.

Step 2. With the jaws closed, the Vernier zero lies a distance x to the left of the main scale zero. The 4th Vernier mark sits at $-x + 4(0.9) = 3.6 - x$ mm, and this must fall on a main scale mark. With $x < 1$ mm, that mark is at 3 mm, so $x = 0.6$ mm. Equivalently, $x = (10 - 4) \times 0.1$ mm.

Step 3. The zero error is negative: $e = -0.6$ mm $= -0.06$ cm.

Step 4. Actual length $=$ observed reading $-$ zero error $= 1 - (-0.06) = 1.06$ cm.

Step 5. None of the four options gives 1.06 cm. Option (D), 1.04 cm, comes from wrongly taking the error as -4×0.01 cm. NTA dropped this question in its final answers and accepted no option.

Answer: 1.06 cm, which matches no option (question dropped by NTA)

COMMON TRAPS

- **Taking the coinciding division as the size of a negative zero error.** When the Vernier zero lies left of the main scale zero and the nth Vernier division coincides, the zero error is $-(N - n) \times$ LC, not $-n \times$ LC. Here that is $-(10 - 4) \times 0.1$ mm $= -0.6$ mm. *Avoid it:* Locate the Vernier zero with a quick sketch: place the nth Vernier mark on a main scale mark and measure back to the Vernier zero.
- **Adding a negative zero error instead of subtracting it.** True reading $=$ observed reading $-$ zero error, always with the error's sign. A negative error makes the true value larger than the reading. *Avoid it:* Write the error with its sign before correcting, and check that a negative error increases the reading.

REVISE Practise Vernier calliper zero-error questions where the Vernier zero is on each side of the main scale zero. · The least count formula LC $=$ 1 MSD $-$1 VSD and its use in correcting readings.

5 **Answer: A** Ref 6832

Easy Dimensions of Physical Quantities

Stefan-Boltzmann law states that the total energy radiated per unit surface area per unit time is proportional to T^4, so $[\sigma_s] = [MT^{-3}K^{-4}]$ (NCERT Class 11, Physics, Chapter 2, Table 2.2 and dimensional analysis examples). Boltzmann constant appears in $pV = Nk_BT$, yielding $[k_B] = [ML^2T^{-2}K^{-1}]$. Wien's displacement law is $\lambda_m T = b$, so $[b] = [LK]$ (NCERT mentions Wien's constant in thermal radiation context).

Thus, dimension of $\sigma_s \cdot k_B^{-1} \cdot b$ is obtained as:

$$[MT^{-3}K^{-4}] \times [M^{-1}L^{-2}T^2K] \times [LK] = [M^0L^{-1}T^{-1}K^{-2}]$$

This is exactly option [A]. Option [B] omits $[T^{-1}]$ by confusing power with energy. Options [C] and [D] stem from common errors like taking Stefan's exponent as T^3 or mishandling the sign of K in k_B^{-1}. The calculation aligns with NCERT's emphasis on deriving dimensions from fundamental relations without needing separate experiments.

6 **Answer: B** Ref 4810

Medium ~1 min Vernier Callipers

Statement I is generally true because in a normal vernier calliper, one vernier scale division is smaller than one main scale division to allow precise measurement. However, in some modified vernier callipers, this may not hold. Statement II is false because the vernier constant (least count) is given by one main scale division divided by the number of vernier scale divisions, not multiplied. Hence, Statement I is true and Statement II is false.

7 **Answer: B** Ref 4821

Medium ~1 min Dimensional Analysis

Magnetic field B is given by B = μoni, where n is number of turns per unit length and i is current. The dimension of n is L^{-1} and dimension of current i is A. Therefore, the dimension of B/μo is [n][i] = L^{-1} A.

8 **Answer: C** Ref 6433

Medium ~1.5 min Error Analysis

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We know, $\rho = \frac{\text{Mass}}{\text{Volume}} = \frac{M}{\pi r^2 \ell}$

Using the concept of errors we know,

$$\frac{\Delta\rho}{\rho} = \frac{\Delta M}{M} + \frac{2\Delta r}{r} + \frac{\Delta \ell}{\ell} = \left(\frac{0.002}{0.4} + \frac{2\times 0.001}{0.3} + \frac{0.02}{5}\right)$$

$$\frac{\Delta\rho}{\rho} = 0.0156$$

$$\frac{\Delta\rho}{\rho}\% = 1.56\% \approx 1.6\%$$

9 **Answer: D** Ref 6438

Easy ~0.5 min Errors in Measurement

The errors which cannot be associated with any systematic or constant cause are called random errors. These errors can arise due to unpredictable fluctuations in experimental conditions, e.g., random change in pressure, temperature, voltage supply, etc.

10 **Answer: B** Ref 6237

Easy ~0.5 min Supplementary Units

Plane angle (radian) and solid angle (steradian) are supplementary quantities. They have units (rad and sr) but are dimensionless because they are defined as ratios of two lengths and two areas respectively. Hence, they have units but no dimensions.

11 **Answer: D** Ref 6238

Medium ~1 min Dimensional Analysis

We need to find which physical quantity has the dimensional formula $[MLT^{-2}A^{-2}]$.

Let's check each option:

(1) Electric permittivity (ϵ_0):
From Coulomb's law, $F = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}$

$$\epsilon_0 = \frac{q_1 q_2}{4\pi F r^2}$$

Dimensions: $\frac{[AT]^2}{[MLT^{-2}][L^2]} = [M^{-1}L^{-3}T^4A^2]$

(2) Magnetic flux (Φ):
$\Phi = B \cdot A$
From $F = BIL$, $B = \frac{F}{IL}$
Dimensions of B: $\frac{[MLT^{-2}]}{[A][L]} = [MT^{-2}A^{-1}]$
Dimensions of Φ: $[MT^{-2}A^{-1}] \times [L^2] = [ML^2T^{-2}A^{-1}]$

(3) Self inductance (L):

$$emf = L\frac{dI}{dt}$$

$$L = \frac{emf \cdot dt}{dI}$$

Dimensions: $\frac{[ML^2T^{-3}A^{-1}]\times[T]}{[A]} = [ML^2T^{-2}A^{-2}]$

(4) Magnetic permeability (μ_0):
From $F = \frac{\mu_0}{4\pi}\frac{I_1 I_2 l}{r}$

$$\mu_0 = \frac{4\pi F r}{I_1 I_2 l}$$

Dimensions: $\frac{[MLT^{-2}]\times[L]}{[A]^2\times[L]} = [MLT^{-2}A^{-2}]$

Therefore, the dimensions $[MLT^{-2}A^{-2}]$ belong to magnetic permeability.

12 **Answer: A** Ref 6255

Medium ~1 min Significant Figures and Rounding Off

Step 1: Calculate the area of the rectangular field.

Area = Length × Breadth

Area = 55.3×25

Area = $1382.5\ m^2$

Step 2: Determine the number of significant figures in the given measurements.

Length = 55.3 m has 3 significant figures.

Breadth = 25 m has 2 significant figures.

Step 3: Apply the rule for multiplication. The result should have the same number of significant figures as the measurement with the least number of significant figures.

The least number of significant figures is 2.

Step 4: Round off the calculated area to 2 significant figures.

1382.5 rounded to 2 significant figures is 1400.

Step 5: Express the rounded value in scientific notation.

$1400 = 14 \times 10^2\ m^2$

13 **Answer: B** Ref 6012

Medium ~1 min Dimensional Analysis

Dimensional formula of energy

$[E] = [M^1L^2T^{-2}]$ ... (I)

Dimensional formula of gravitational constant

$[G] = [M^{-1}L^3T^{-2}]$ ... (II)

From (I) & (II)

$\frac{[E]}{[G]} = \frac{[M^1L^2T^{-2}]}{[M^{-1}L^3T^{-2}]} = [M^2L^{-1}T^0]$

Hence, dimensions of $\left[\frac{E}{G}\right] = [M^2L^{-1}T^0]$

So, correct option is (2).

14 **Answer: A** Ref 6022

Medium ~1 min Screw Gauge

Pitch of the screw gauge, $P = 1$ mm

Number of circular divisions, $n = 100$

Least count $LC = \frac{P}{n} = \frac{1}{100} = 0.01$ mm

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$LC = 0.001$ cm

Diameter of the wire $= MSR + (CSR \times LC)$

$= 0 + (52 \times 0.001$ cm$)$

$= 0.052$ cm

15 **Answer: C** Ref 6036

Medium ~1.5 min Dimensional Analysis

Energy, $E \propto F^a A^b T^c$

$[E] = [F^a][A^b][T^c]$

$\Rightarrow [ML^2T^{-2}] = [MLT^{-2}]^a[LT^{-2}]^b[T]^c$

$[ML^2T^{-2}] = [M^a L^{a+b} T^{-2a-2b+c}]$

Comparing dimensions on both sides.

$\Rightarrow a = 1;\ a + b = 2$ and $-2 = -2a - 2b + c$

$\Rightarrow b = 1 \quad \Rightarrow -2 = -2 - 2 + c$

$\Rightarrow c = 2$

$[E] = [FAT^2]$

16 **Answer: C** Ref 5972

Easy ~0.5 min Screw Gauge

The least count (LC) of a screw gauge is given by the formula:

$$LC = \frac{\text{Pitch}}{\text{Number of divisions on circular scale}}$$

Given:
$LC = 0.01$ mm
Number of divisions $= 50$

Rearranging the formula to find the pitch:
Pitch $= LC \times$ Number of divisions

Pitch $= 0.01 \times 50$

Pitch $= 0.5$ mm

Therefore, the pitch of the screw gauge is 0.5 mm.

17 **Answer: B** Ref 6002

Medium ~1 min Significant Figures

Step 1: Perform the subtraction.

$9.99 - 0.0099 = 9.9801$ m

Step 2: Apply the rule for significant figures in subtraction. The result should have the same number of decimal places as the measurement with the fewest decimal places.

9.99 has 2 decimal places.
0.0099 has 4 decimal places.

Therefore, the result must be rounded to 2 decimal places.

Step 3: Round 9.9801 to 2 decimal places.

$9.9801 \approx 9.98$ m

Answer: 9.98 m

18 **Answer: C** Ref 5742

Medium ~1 min Error Analysis

Given $X = \frac{A^2 B^{1/2}}{C^{1/3} D^3}$.

The maximum percentage error in X is given by:

$\frac{\Delta X}{X} \times 100 = 2\frac{\Delta A}{A} \times 100 + \frac{1}{2}\frac{\Delta B}{B} \times 100 + \frac{1}{3}\frac{\Delta C}{C} \times 100 + 3\frac{\Delta D}{D} \times 100$

Substituting the given percentage errors:

$= 2 \times 1\% + \frac{1}{2} \times 2\% + \frac{1}{3} \times 3\% + 3 \times 4\%$

$= 2\% + 1\% + 1\% + 12\%$

$= 16\%$

19 **Answer: C** Ref 5293

Medium ~1 min Screw Gauge and Zero Error

Diameter of the ball

$=$ MSR $+$ CSR $\times$ (Least count) $-$ Zero error

$= 0.5$ cm $+ 25 \times 0.001 - (-0.004)$

$= 0.5 + 0.025 + 0.004$

$= 0.529$ cm

20 **Answer: B** Ref 5192

Hard ~2 min Dimensional Analysis

Let $\frac{e^2}{4\pi\varepsilon_0} = A = ML^3T^{-2}$

$I = C^x G^y (A)^z$

$L = [LT^{-1}]^x [M^{-1}L^3T^{-2}]^y [ML^3T^{-2}]^z$

$-y + z = 0 \Rightarrow y = z \quad \ldots$ (i)

$x + 3y + 3z = 1 \quad \ldots$ (ii)

$-x - 4z = 0 \quad \ldots$ (iii)

From (i), (ii) & (iii)

$$z = y = \frac{1}{2}, \quad x = -2$$

Thus the expression is $\frac{1}{c^2}\left[G\frac{e^2}{4\pi\varepsilon_0}\right]^{\frac{1}{2}}$

21 **Answer: B** Ref 5028

Medium ~1 min Dimensional Analysis

Critical velocity v_c is given by $v_c = \frac{R\eta}{\rho D}$, where D is the diameter of the tube. Since $D \propto r$, we have $v_c \propto \eta^1 \rho^{-1} r^{-1}$. Comparing with $[\eta^x \rho^y r^z]$, we get $x = 1$, $y = -1$, $z = -1$.

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22 **Answer: D** Ref 2774

Medium ~1 min Dimensional Analysis

We need to express mass in terms of force, velocity and time.

Let the dimension of mass be:

$[M] = [F^a V^b T^c]$

Now use standard dimensions:

$[F] = [MLT^{-2}]$

$[V] = [LT^{-1}]$

Substitute these:

$[M] = [MLT^{-2}]^a [LT^{-1}]^b [T]^c$

Comparing powers of M, L and T:

For mass:

$a = 1$

For length:

$a + b = 0$

$b = -1$

For time:

$-2a - b + c = 0$

Substitute values:

$-2(1) - (-1) + c = 0$

$c = 1$

So,

$[M] = [F^1 V^{-1} T^1]$

Therefore, the dimensions of mass are:

$[FV^{-1}T]$

23 **Answer: D** Ref 2653

Medium ~1 min Propagation of Errors

For multiplication, division, and powers, the maximum percentage error is found by adding the percentage errors after multiplying each by its power.

Given:

$$P = \frac{a^3 b^2}{cd}$$

So,

$\frac{\Delta P}{P} \times 100 = 3\left(\frac{\Delta a}{a} \times 100\right) + 2\left(\frac{\Delta b}{b} \times 100\right) + \left(\frac{\Delta c}{c} \times 100\right) + \left(\frac{\Delta d}{d} \times 100\right)$

Substitute the given percentage errors:

$$\frac{\Delta P}{P} \times 100 = 3(1) + 2(2) + 3 + 4$$

$$\frac{\Delta P}{P} \times 100 = 3 + 4 + 3 + 4$$

$$\frac{\Delta P}{P} \times 100 = 14$$

Therefore, percentage error in P is 14%.

24 **Answer: A** Ref 1848

Easy ~1 min Dimensional Analysis

Pressure is force per unit area.

Dimension of force:

$[F] = MLT^{-2}$

Dimension of pressure:

$$[P] = \frac{[F]}{[A]}$$

$$[P] = \frac{MLT^{-2}}{L^2}$$

$[P] = ML^{-1}T^{-2}$

So,

$a = 1$

$b = -1$

$c = -2$

Hence, the correct option is A.

25 **Answer: B** Ref 1649

Easy ~1 min Propagation of Errors

Volume of a sphere is:

$$V = \frac{4}{3}\pi r^3$$

For powers, percentage error gets multiplied by the power.

$\frac{\Delta V}{V} \times 100 = 3 \times \frac{\Delta r}{r} \times 100$

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Given percentage error in radius is 2%.

$$\frac{\Delta V}{V} \times 100 = 3 \times 2$$

$$\frac{\Delta V}{V} \times 100 = 6$$

So, the percentage error in volume is 6%.

26 **Answer: C** Ref 1706

Medium ~1 min Dimensional Analysis

Energy density is energy per unit volume.

$[Energy] = ML^2T^{-2}$

$[Volume] = L^3$

$[Energy\ density] = ML^{-1}T^{-2}$

Young's modulus is stress per strain. Strain is dimensionless, so Young's modulus has the same dimensions as stress.

$$[Stress] = \frac{[Force]}{[Area]}$$

$[Force] = MLT^{-2}$

$[Area] = L^2$

$[Young's\ modulus] = ML^{-1}T^{-2}$

So, energy density and Young's modulus have the same dimensions. Hence, the correct option is 1 and 4.

27 **Answer: A** Ref 1292

Medium ~1 min Dimensional Analysis

Velocity has dimensions:

$[v] = [LT^{-1}]$

Given:

$$v = at + \frac{b}{t+c}$$

By dimensional homogeneity, each term must have the dimensions of velocity.

For the first term:

$[at] = [LT^{-1}]$

Since:

$[t] = [T]$

So:

$[a][T] = [LT^{-1}]$

$[a] = [LT^{-2}]$

Now, in the denominator $t + c$, both terms must have the same dimensions. Therefore:

$[c] = [T]$

For the second term:

$$\left[\frac{b}{t+c}\right] = [LT^{-1}]$$

Since:

$[t + c] = [T]$

So:

$$\frac{[b]}{[T]} = [LT^{-1}]$$

$[b] = [L]$

Therefore, the dimensions of a, b and c are respectively $[LT^{-2}]$, [L] and [T].

COMMON TRAPS

- **Treating b/(t+c) as if only b must have velocity dimensions.** Each additive term must have dimensions of velocity: [at] = $[LT^{-1}]$ and $[b/(t+c)] = [LT^{-1}]$. Since [t+c] = [T], [b]/[T] = $[LT^{-1}]$, so [b] = [L]. *Avoid it:* Box the complete term before assigning dimensions: [b/(t+c)], not just [b].
- **Not enforcing equal dimensions inside the sum t+c.** In "t+c", the terms t and c are added, so [c] must equal [t] = [T]. *Avoid it:* Circle every plus/minus sign. For each addition/subtraction, write the rule: left term dimension = right term dimension.

REVISE Before solving, split equations into additive terms and require each complete term to match the LHS dimension. · For every bracket or denominator containing + or −, first equate dimensions of the quantities being added/subtracted.

28 **Answer: D** Ref 932

Easy ~0.5 min Dimensional analysis of gravitational constant

Using Newton's law of gravitation:

$$F = \frac{Gm_1m_2}{r^2}$$

Rearrange for G:

$$G = \frac{Fr^2}{m_1m_2}$$

Dimensions of force:

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$[F] = MLT^{-2}$

Dimensions of distance squared:

$[r^2] = L^2$

Dimensions of product of masses:

$[m_1 m_2] = M^2$

So,

$$[G] = \frac{MLT^{-2} \times L^2}{M^2}$$

$[G] = M^{-1}L^3T^{-2}$

Therefore, the correct answer is option D.

COMMON TRAPS

- **Writing G proportional form instead of isolating G.** Correct rearrangement is "$G = \frac{Fr^2}{m_1 m_2}$". *Avoid it:* Before substituting dimensions, algebraically isolate the required constant and box it.
- **Forgetting that r is squared.** The inverse-square law has distance squared, so when isolating G, the factor is r^2, contributing L^2. *Avoid it:* Circle powers in formulas before replacing variables by dimensions.

REVISE Memorize and derive $[G] = M^{-1}L^3T^{-2}$ from $F = Gm_1m_2/r^2$. · Practice isolating target variables before dimensional substitution.

29 **Answer: B** Ref 557

Easy ~0.5 min SI Units and Dimensions of Planck's Constant

Planck's constant has the unit of action or angular momentum.

$h = 6.63 \times 10^{-34}$ J s

Now, joule can be written as:

$1J = 1kgm^2s^{-2}$

So:

$Js = kgm^2s^{-1}$

Therefore, Planck's constant can also be written as:

6.63×10^{-34} kg m²/s

Hence, option B is correct.

30 **Answer: C** Ref 213

Easy ~0.5 min Dimensions of Physical Quantities

Planck constant appears in the relation:

$E = h\nu$

So,

$$h = \frac{E}{\nu}$$

Dimension of energy is:

$[E] = ML^2T^{-2}$

Dimension of frequency is:

$[\nu] = T^{-1}$

Therefore,

$$[h] = \frac{ML^2T^{-2}}{T^{-1}}$$

$[h] = ML^2T^{-1}$

Angular momentum has dimension:

$[L] = [mvr]$

$[L] = MLT^{-1} \times L$

$[L] = ML^2T^{-1}$

Hence, Planck constant has the same dimensions as angular momentum.

COMMON TRAPS

- **Choosing Energy because Planck constant appears with E in E = hν.** Dimensions must be obtained after algebraic isolation: from "$h = \frac{E}{\nu}$", h has dimension energy divided by frequency, not energy itself. *Avoid it:* Always rearrange the formula for the required quantity before substituting dimensions.
- **Dividing by T^{-1} incorrectly.** When dividing powers of the same base, subtract exponents: $T^{-2} / T^{-1} = T^{(} - 2 - (-1)) = T^{-1}$. *Avoid it:* Write the exponent operation explicitly whenever the denominator has a negative power.

REVISE Dimensions of energy, frequency, momentum, angular momentum, and power side by side. · Practice exponent division with negative powers, especially T^{-2}/T^{-1}.

31 **Answer: B** Ref 153

Easy ~1 min Dimensional Analysis

Check dimensions of each pair.

Energy:

$[E] = ML^2T^{-2}$

Torque:

$[\tau] = ML^2T^{-2}$

So energy and torque have equal dimensions.

Force:

$[F] = MLT^{-2}$

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Impulse:

$[J] = [F \times t]$

$[J] = MLT^{-1}$

So force and impulse do not have equal dimensions.

Angular momentum:

$[L] = ML^2T^{-1}$

Planck's constant:

$[h] = ML^2T^{-1}$

So they have equal dimensions.

Elastic modulus and pressure both have dimensions:

$[P] = ML^{-1}T^{-2}$

Therefore, the pair with not equal dimensions is Force and impulse.

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Sample



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