PHYSICS

NCERT - FULL MARKS PHYSICS(TAMIL)

NATURE OF PHYSICAL WORLD AND MEASUREMENT

Example

1. From a point on the ground, the top of a tree is seen to have an angle of elevation 60°.

The distance between the tree and a point is 50 m. Calculate the height of the tree?

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2. The Moon subtends an angle of 1° 55' at the base line equal to the diameter of the Earth. What is the distance of the Moon from the Earth? (Radius of the Earth is 6.4×10^{6} m)

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3. A RADAR signal is beamed towards a planet and its echo is received 7 minutes later. If the distance between the planet and the Earth is 6.3×10^{10} m. Calculate the speed of the signal.

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4. In a series of successive measurements in an experiment, the readings of the period of oscillation of a simple pendulum were found

to be 2.63s, 2.56 s, 2.42s, 2.71s and 2.80s. Calculate

the mean value of the period of oscillation

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5. In s series of successive measurements in an experiment, the readings of the period of oscillation of a simple pendulum were found to be $2.63s, 2.56s, 2.42s, 2.71s$ and $2.80s$. Calculate

The mean absolute error in each measurement.

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6. In a series of successive measurements in an experiment, the readings of the period of oscillation of a simple pendulum were found to be 2.63s, 2.56 s, 2.42s, 2.71s and 2.80s. Calculate

the mean absolute error

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7. In s series of successive measurements in an experiment, the readings of the period of oscillation of a simple pendulum were found to be $2.63s, 2.56s, 2.42s, 2.71s$ and $2.80s$. Calculate

The relative error.

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8. In a series of successive measurements in an experiment, the readings of the period of

oscillation of a simple pendulum were found to be 2.63s, 2.56 s, 2.42s, 2.71s and 2.80s. Calculate

the percentage error. Express the result in proper form.

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9. Two resistances $R_1 = (100 \pm 3)\Omega, R_2 = (150 \pm 2)\Omega,$ are connected in series. What is their equivalent resistance?

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10. The temperatures of two bodies measured by a thermometer are $t_1 = (20 + 0.5)^\circ C, t_2 = (50 \pm 0.5)^\circ C.$ Calculate the temperature difference and the error therein.

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11. The length and breadth of a rectangle are $(5.7 \pm 0.1)cm$ and $(3.4 \pm 0.2)cm$ respectively.

Calculate the area of the rectangle with error limits.

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12. The voltage across a wire is (100 ± 5)V and the current passing through it is (10 ± 0.2) A. Find the resistance of the wire.

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13. A physical quantity x is given by $x = \frac{a^2 b^3}{c\sqrt{d}}$. If the percentage errors of measurement in a, b, c and d are 4%, 2%, 3% and 1% respectively then calculate the percentage error in the calculation of x.

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14. State the number of significant figures in the following

600800

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15. State the number of significant figures in the following

5213.0

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16. State the number of significant figures in the following

400

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17. State the number of significant figures in the following

$2.65 \times 10^{24} m$

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18. State the number of significant figures in the following

0.007

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19. State the number of significant figures in the following

0.0006032

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20. Round off the following numbers as indicated

18.35 up to 3 digits

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21. Round off the following numbers as indicated

19.45 up to 3 digits

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22. Round off the following numbers as indicated

101.55×10^6 up to 4 digits

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23. Round off the following numbers as indicated

248337 up to digits 3 digits

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24. Round off the following numbers as indicated

12.653 up to 3 digits.

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25. Convert 76 cm of mercury pressure into Nm^{-2} using the method of dimensions.

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26. If the value of universal gravitational constant in SI is $6.6 \times 10^{-11} Nm^2 kg^{-2}$ then find its value in CGS System?

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27. Check the correctness of the equation $\frac{1}{2}mv^2$ = mgh using dimensional analysis method.

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28. Obtain an expression for the time period T of a simple pendulum. The time period T depends on (i) mass 'm' of the bob (ii) length 'l' of the pendulum and (iii) acceleration due to

gravity g at the place where the pendulum is suspended. (Constant $k = 2\pi$) i.e

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29. The force F acting on a body moving in a circular path depends on mass of the body (m), velocity (v) and radius (r) of the circular path. Obtain the expression for the force by dimensional analysis method. (Take the value of k=1)

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Exercise I Multiple Choice Questions

1. One of the combinations from the fundamental physical constants is $\frac{hc}{G}$. Th e unit of this expression is

A. kg^2

B. m^3

C. s^{-1}

D. m

Answer: A

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

A. 8%

B. 2%

C. 4%

D. 6%

Answer: D

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3. If the length and time period of an oscillating pendulum have errors of 1% and 3% respectively then the error in measurement of acceleration due to gravity is

A. 4%

B. 5%

C. 6%

D. $7\ \%$

Answer: D

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4. The length of a body is measured as 3.51 m, if the accuracy is 0.01mm, then the percentage error in the measurement is

A. $351\ \%$

B. $1\ \%$

C. $0.28\ \%$

D. $0.035\ \%$

Answer: C

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5. Which of the following has the highest number of signifi cant fi gures?

A. $0.007m^2$

B. $2.64 \times 10^{24}kg$

C. $0.0006032m^2$

D. $6.3200J$

Answer: D

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6. If $\pi = 3.14$, then the value of π^2 is

A. 9.8596

B. 9.860

C. 9.86

D. 9.9

Answer: C

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7. Which of the following pairs of physical quantities have same dimension?

A. force and power

B. torque and energy

C. torque and power

D. force and torque

Answer: B

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8. The dimensional formula of Planck's constant h is

A. $\left[ML^2T^{-1}\right]$

B. $\left[ML^2T^{-3}\right]$

C. $\left[MLT^{-1}\right]$

D. $\left[ML^3T^{-3}\right]$

Answer: A

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9. The velocity of a particle v at an instant t is given by $v = at + bt^2$. Th e dimensions of b is

A. [L]

B. $\left[LT^{-1}\right]$

C. $\left[LT^{-2}\right]$

D. $\left[LT^{-3}\right]$

Answer: D

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10. Th e dimensional formula for gravitational constant G is [Related to

A. $\left[ML^3T^{-2}\right]$

B. $\left[M^{-1}L^3T^{-2}\right]$

C. $\left[M^{-1}L^{-3}T^{-2}\right]$

D. $\left[ML^{-3}T^{2}\right]$

Answer: B

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11. Th e density of a material in CGS system of units is $4gcm^{-3}$. In a system of units in which unit of length is 10 cm and unit of mass is 100 g, then the value of density of material will be

A. 0.04

B. 0.4

C. 40

D. 400

Answer: C

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12. If the force is proportional to square of velocity, then the dimension of proportionality constant is

A. $\left[MLT^0\right]$

B. $\left[MLT^{-1}\right]$

C. $\left[ML^{-2}T\right]$

D. $\left[ML^{-1}T^0\right]$

Answer: D

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13. The dimension of $(\mu_0\varepsilon_0)^{-\frac{1}{2}}$ is

A. length

B. time

C. velocity

D. force

Answer: C

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14. Planck's constant (h), speed of light in vacuum (c) and Newton's gravitational constant (G) are taken as three fundamental constants. Which of the following

combinations of these has the dimension of length?

A. $\frac{\sqrt{hG}}{c^{\frac{3}{2}}}$

B. $\frac{\sqrt{hG}}{c^{\frac{3}{2}}}$

C. $\sqrt{\frac{hc}{G}}$

D. $\sqrt{\frac{Gc}{h^{\frac{3}{2}}}}$

Answer: A

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15. A length-scale (l) depends on the permittivity (ε) of a dielectric material, Boltzmann constant (k_B), the absolute temperature (T), the number per unit volume (n) of certain charged particles, and the charge (q) carried by each of the particles. Which of the following expression for l is dimensionally correct?

A. $l = \sqrt{\dfrac{nq^2}{\varepsilon k_B T}}$

B. $l = \sqrt{\dfrac{\varepsilon k_B T}{nq^2}}$

C. $l = \sqrt{\frac{q^2}{\varepsilon n^{\frac{2}{3}} k_B T}}$

D. $l = \sqrt{\frac{q^2}{\varepsilon k_B T}}$

Answer: B

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Exercise Ii Short Answer Type Questions

1. Briefly explain the types of physical quantities.

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2. How will you measure the diameter of the Moon using parallax method?

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3. Write the rules for determining significant figures.

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4. What are the limitations of dimensional analysis?

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5. Define precision and accuracy. Explain with one example.

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Exercise Iii Long Answer Type Questions

1. Explain the use of screw gauge and vernier caliper in measuring smaller distances.

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2. Write a note on triangulation method and radar method to measure larger distances.

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3. Explain in detail the various types of errors.

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4. What do you mean by propagation of errors? Explain the propagation of errors in addition and multiplication.

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5. Write short notes on the following.

Unit

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6. Write short notes on the following.

Rounding - of

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7. Write short notes on the following.

Dimensionless quantities

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8. Explain the principle of homogeniety of dimensions. What are its uses? Give example.

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Exercise Iii Numerical Problems

1. In a submarine equipped with sonar, the time delay between the generation of a pulse and its echo after reflection from an enemy submarine is observed to be 80 s. If the speed

of sound in water is $1460 ms^{-1}$. What is the distance of enemy submarine?

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2. The radius of the circle is 3.12 m. Calculate the area of the circle with regard to significant figures.

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3. Assuming that the frequency γ of a vibrating string may depend upon applied force (F) , prove that $\gamma \alpha \frac{1}{l} \sqrt{\frac{F}{m}}$ using dimensional analysis.

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4. Assuming that the frequency γ of a vibrating string may depend upon length (A) , prove that $\gamma \alpha \frac{1}{l} \sqrt{\frac{F}{m}}$ using dimensional analysis.

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5. Assuming that the frequency γ of a vibrating string may depend upon mass per unit length (m), prove that $\gamma \alpha \frac{1}{l}\sqrt{\frac{F}{m}}$ using dimensional analysis.

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6. Jupiter is at a distance of 824.7 million km from the Earth. Its angular diameter is

measured to be 35.72″. Calculate the diameter of Jupiter.

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7. The measurement value of length of a simple pendulum is 20 cm known with 2 mm accuracy. The time for 50 oscillations was measured to be 40 s within 1 s resolution. Calculate the percentage accuracy in the determination of acceleration due to gravity 'g' from the above measurement.

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Exercise V Conceptual Questions

1. Why is it convenient to express the distance of stars in terms of light year (or) parsec rather than in km?

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2. Show that a screw gauge of pitch 1 mm and 100 divisions is more precise than a vernier

caliper with 20 divisions on the sliding scale.

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3. If humans were to settle on other planets which of the fundamental quantities will be in trouble? Why?

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4. Having all units in atomic standards is more useful. Explain.

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5. Why dimensional methods are applicable only up to three quantities?

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