PHYSICS

BOOKS - FULL MARKS PHYSICS (TAMIL ENGLISH)

NATURE OF PHYSICAL WORLD AND MEASUREMENT

In Text Solved Examples

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, 2.56s, 2.42, 2.71s and 2.80 s`. Calculate

(i) the mean value of the period of oscillation

(ii) the absolute error in eah measurement

(iii) The men absolute error (iv) the relative error (v) the percentage error. Expresss the results in proper form.

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5. 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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6. The temperatures of two bodies measured by a thermometer are $t_1 = (20 \pm 0.5)^\circ C, t_2 = (50 \pm 0.5)^\circ C.$

Calculate the temperature difference and the error therein.

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7. The length and breadth of a rectangle are (5.7 ± 0.1) cm and (3.4 ± 0.2) cm respectively. Calculate the area of the rectangle with error limits.

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

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

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10. State the number of significant figures in the following

(i) 600800 (ii) 400 (iii) 0.007 (iv) 5213.0

(v) $2.65 \times 10^{24} m$ (vi) 0.0006032

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11. Round off the following numbers as indicated

(i) 18.35 upto 3 digits (ii) 19.45 upto 3 digits (iii)

101.55×10^6 upto 4 digits (iv) 248337 upto digits 3 digits (v) 12.653 upto 3 digits.

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

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13. Suppose unknowingly you wrote the universal gravitational constant value as

$G = 6.67 \times 10^{11}$ Instead of the correct value $G = 6.67 \times 10^{-11}$, what is the acceleration due to this new acceleration due to gravity, what will be your weight W'?

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

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15. Obtain in expression for the time period T of a simple pendulun. The time period depend upon (i) mass 'm' of the bob (ii) length 'l' of the pendulum and (iii) acceieration due to gravity g at the place where the pendulum is suspended. (Constant k = 2π) i.e.

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16. Find the dimensions of a and b in the formula $\left[P + \frac{a}{V^2}[V - b]\right] = RT$ where P is pressure and V is the volume of the gas.

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17. Show that $\left(P^{-5/6}\rho^{1/2}E^{1/3}\right)$ is of the dimension of time. Here P is the pressure, ρ is the density and E is the energy of a bubble).

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18. Find the dimensions of mass in terms of Energy, length and time.

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19. A physical quantity Q is found to depend on quantities x,y,z obeying relation Q = $\frac{x^2y^3}{z^1}$. The percentage errors in x, y, and z are 2%, 3% and 1% respectively. Find the percentage error in Q.

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20. The mass and volume of a body and found to be 4 ± 0.03 kg and 5 $\pm$ 0.01 m^3

respectively. Then find the maximum possible percentage error in density.

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21. Using a Vernier Caliper, the length of a cylinder in different measurements is found to be 2.36 cm, 2.27 cm, 2.26 cm, 2.28 cm, 2.31 cm, 2.28 cm and 2.29 cm. Find the mean value, absolute error the relative error and the percentage error of the cylinder.

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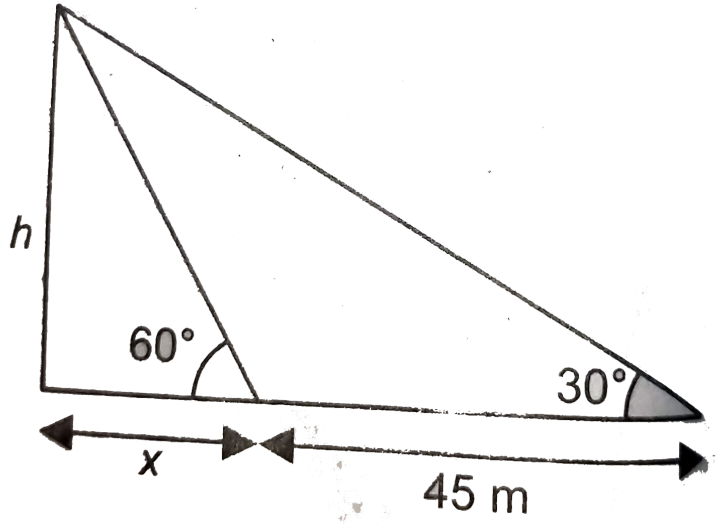
22. The shadow of a pole standing on a level around is found to be 45 m longer when the Sun's altitude is 30° than when it was 60°. Determine the height of the pole. [Given $\sqrt{3} = 1.73$]



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23. Calculate the number of times a human heari beats in the life of 100 years old man. Time of one heart beat = 0.8s

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24. The parallax of a heavenly body measured from two points diametrically opposite on equator of Earth is 2^1. Calculate the distance

of the heavenly body. [Given radius of the Earth = 6400 km][1" = 4.85×10^{-6} rad]

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25. Convert a velocity of 72 km h^{1-} into ms^{-1} with the help of dimensional analysis.

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26. Check The correctness of the following equation using dimensional analysis. Make a

comment on it.

$S = ut + 1/2at^2$ where s is the displacement, u is the initial velocily, t is the time and a is the acceleration produced,

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27. Round - off the following numbers as indicated.

(a) 17.234 to 3 digits (b) 3.996×10^5 to 3 digits (c) 3.6925×10^3 to 2 digits (d) 124783 to 5 digits.

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28. Solve the following with regard to significant figures.

(a) $\sqrt{4.5 - 3.31}$ (b) $5.9 \times 10^5 - 2.3 \times 10^4$

$(c) 7.18 + 4.3 (d) 6.5 + 0.0136$

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29. Arrive at Einstein's mass-energy relation by dimensional method (E = mc^2).

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30. The velocity of a body is given by the equation $v = b/t + ct^2 + dt^3$. Find the dimensional formula for b.

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31. The initial and final temperatures of a liquid in a container are observed to be $75.4 \pm 0.5^\circ C$ and $56.8 \pm 0.2^\circ C$. Find the fall in the temperature of the liquid.

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32. Two resistors of resistances $R_1 = 150 \pm 2$ Ohm and $R_2 = 220 \pm 6$ Ohm are connected in parallel combination. Calculate the equivalent resistance.

Hint: $\frac{1}{R'} = \frac{1}{R_1} + \frac{1}{R_2}$

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33. A capacitor of capacitance C = 3.0 $\pm 0.1 \mu F$ is charged to a voltage of V = 18 ± 0.4 Volt.

Calculate the charge Q[Use Q = CV].

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Textbook Questions Solved Multiple Choice Questions

1. One ofi the combinations from the fundamental physical constants is $\frac{hc}{G}$. The 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 pshere will be

A. 8%

B. 2%

C. 4%

D. 6%

Answer: D

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3. If the length and tiome period of an oscillating pendulum have errors of 1% and 3% respectgively then the error in

measurement of acceleratinon 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 3.51m, if the acuracy is 0.01 m, then the percentage errof 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 significant figures?

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 constand 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 a instant t is given by $v = at + bt^2$. The dimension 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. The dimensional formual for gravitational constnat G is

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: C

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11. The density of 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 gm, 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, the the dimensional of proportionality constant is

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

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

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

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

Answer: D

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13. The dimension of $\frac{1}{\mu_0 \varepsilon_0}$ is

A. length

B. time

C. velocity

D. force

Answer: C

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14. Plank'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 dimensions of length?

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

B. $\frac{\sqrt{hG}}{c^{\frac{5}{2}}}$

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

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

Answer: B

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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 pr unit volume (n) of certain charged paticles, and the charge (q) carried by each of the particles. Which of the following expression for l is dimensionally correct?

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

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

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

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

Answer: B

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Textbook Questions Solved Short Answer 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. Exp,ain with one example.

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Textbook Questions Solved Long Answer Questions

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

(ii) Write a note on triangultion method and radar method to measure larger distances.

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2. Explain in detail the various types of errors.

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

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4. Write short notes on the following:

a. Unit

b. Rounding -off

c. Dimensionless quantities

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5. Explain the principle of homogeneity of dimensions. What are its uses? Given example.

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Textbook Questions Solved 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 eneny

submarine is observed to be 80 sec. If the speed of sound in water is $1460ms^{-1}$. 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 circkle with regard to significant figures.

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3. Assuming that the frequency γ of a vibrating string may depend upon (i) applied force (F) (ii) length (l) (iii) mass per unit lengt (m), prove that $\gamma \propto \frac{1}{l}\sqrt{\frac{F}{m}}$ using dimensional analysis.

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4. 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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5. 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 1s resolution. Calculate the percentage accuracy in the determination of acceleration due to gravity g from the above measurement.

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Textbook Questions Solved 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 I 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 in more useful. Expalin.

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

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Additional Questions Solved Multiple Choice Questions

1. The SI unit of surface tension is_____.

A. MT^{-2}

B. Nm^{-2}

C. Nm

D. Nm^{-1}

Answer: D

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2. One atomus equal to .....

A. 100 ms

B. $\frac{1}{6.25}$ ms

C. 160 ms

D. 160 μ s

Answer: C

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3. One lighi year is.....

A. 3.153×10^7 m

B. 1.496×10^7 m

C. 9.46×10^{12} km

D. 3.26×10^{15} m

Answer: C

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4. One Astronomical unit is.....

A. 3.153×10^7 m

B. 1.496×10^{11} m

C. 9.46×10^{12} km

D. 3.26×10^{15} m

Answer: B

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5. One parsec is .....

A. 3.153×10^7 m

B. 3.26×10^{15} m

C. 30.84×10^{15} m

D. 9.46×10^{15} m

Answer: C

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6. One Fermi is.....

A. 10^{-9} m

B. 10^{-10} m

C. 10^{-12} m

D. 10^{-15} m

Answer: D

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7. One Angstrom is.....

A. 10^{-9} m

B. 10^{-10} m

C. 10^{-12} m

D. 10^{-15} m

Answer: B

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8. One solar mass is .....

A. 2×10^{30} kg

B. 2×10^{30} g

C. 2×10^{30} mg

D. 2×10^{30} tonne

Answer: D

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9. $\frac{1}{12}$ of the mass of carbon 12 atom is.....

A. 1 TMC

B. mass of neutron

C. 1 amu

D. mass of hydrogen

Answer: D

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10. The word physics is derived from ..... Meaning nature.

A. scientist

B. fusis

C. fission

D. fusion

Answer: B

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11. The study of forces acting on bodies whether at rest or in motion is .....

A. classical mechanics

B. quantum mechanics

C. thermodynamics

D. condensed matter physics

Answer: A

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12. Mass of observable universe .....

A. 10^{31} kg

B. 10^{41} kg

C. 10^{55} kg

D. 9.11×10^{31} kg

Answer: C

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13. Mass of an electron .....

A. 10^{-31} kg

B. 9.11×10^{-31} kg

C. 1.6×10^{-31} kg

D. 1.6×10^{-27} kg

Answer: B

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14. The study of production and propagation of sound waves.....

A. Astrophysics

B. Acoustics

C. Relativity

D. Atomic physics

Answer: B

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15. The study of the discrete nature of phenomena at the atomic and subatomic levels.

A. Quantum mechanics

B. High energy physics

C. Acoustics

D. Classical mechanics

Answer: A

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16. The techniques used to study the crystal structure of various rocks are.....

A. x-ray diffraction

B. interference

C. total internal reflection

D. refraction

Answer: A

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17. The astronomers used to observe distant points of the universe by .....

A. Electron telescope

B. Astronomical telescope

C. Radio telescope

D. Radar

Answer: C

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18. The comparison of any physical quantity with its standard unit is known as .....

A. fundamental quantities

B. measurement

C. dualism

D. derived quantities

Answer: B

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19. Fundamental quantities can also be known as ..... quantities.

A. original

B. physical

C. negative

D. base

Answer: D

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20. Which one of the following is not a fundamental quantity?

A. length

B. luminous intensity

C. temperature

D. magnetic field

Answer: D

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21. The system of unit not only based on length, mass and time is

A. FPS

B. CGS

C. MKS

D. SI

Answer: D

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22. The coherent system of units .....

A. CGS

B. SI

C. FPS

D. MKS

Answer: B

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23. The triple point temperature of water is _____

A. $-273.16K$

B. 0 K

C. 273.16 K

D. 100 K

Answer: D

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24. Which of the following is a unit of distance?

A. Light year

B. Leap year

C. Dyne-sec

D. Parul

Answer: A

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25. The unit of moment of force.....

A. Nm^2

B. Nm

C. N

D. NJ rad

Answer: B

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26. I radian is.....

A. 2.91×10^{-4} m

B. 57.27°

C. 180°

D. $\frac{\pi}{180}$

Answer: B

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27. One degree of arc is equal to.....

A. 1"

B. 60"

C. 60'

D. 60°

Answer: C

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28. One degree of arc is equal to.....

A. 1.457×10^{2} rad

B. 1.457×10^{-2} rad

C. 1.745×10^{2} rad

D. 1.745×10^{-2} rad

Answer: B

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29. 1 minute of arc is equal to.....

A. 1.745×10^{-2} rad

B. 2.91×10^{-4} rad

C. 2.91×10^{4} rad

D. 4.85×10^{-6} rad

Answer: B

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30. 1 second of arc is equal to.....

A. $\frac{1^\circ}{3600}$

B. 4.85×10^6 rad

C. $\frac{1}{4.85} \times 10^{-6}$ rad

D. 2.91×10^{-4} rad

Answer: A

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31. 1 second of arc is equal to.....

A. 57.27°

B. 1.745×10^{-2} rad

C. 2.91×10^{-4} rad

D. 4.85×10^{-6} rad

Answer: A

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32. Unit of impulse.....

A. NS^2

B. NS

C. Nm

D. Kgms^{-2}

Answer: B

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33. The ratio of energy and temperature is known as .....

A. Stefan's constant

B. Boltzmann constant

C. Planck's constant

D. Kinetic constant

Answer: B

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34. The range of distance can be measured by the direct method is.....

A. 102 to 10-5m`

B. 10-2 to 102 m`

C. 102 to 105 m`

D. 10-2 to 105 m`

Answer: C

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35. Which of the following is in increase order?

A. exa, tera, hecto

B. tera, exa, hecto

C. giga, tera, exa

D. hecto,exa,giga

Answer: C

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36. 10^{-18} is called as .....

A. nano

B. pico

C. femto

D. atto

Answer: D

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37. A radio signal sent towards the distant planet, returns after "t" s. If "c" is the speed of radio waves then the distance of the planet from the Earth is.....

A. $c\frac{t}{2}$

B. ct^2

C. 2ct

D. $c^2\frac{t^2}{2}$

Answer: A

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38. Find odd one out.....

A. Newton

B. Metre

C. Candela

D. Kelvin

Answer: A

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39. The shift in the position of an object when viewed with two eyes, keeping one eye closed at a time is known as .....

A. basis

B. fundamental

C. parallax

D. pendulum

Answer: C

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40. Chandrasekar limit is..... times the mass of the Sun.

A. 1.2

B. 1.4

C. 1.6

D. 1.8

Answer: B

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41. The smallest physical unit of time is.....

A. second

B. minute

C. hour

D. year

Answer: D

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42. Size of atomic nucleus is .....

A. 10^{-10} m

B. 10^{-12} m

C. 10^{-15} m

D. 10^{-18} m

Answer: C

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43. Time interval between two successive heart beat is in the order of .....

A. 10° s

B. 10 s

C. 10^{2} s

D. 10^{-3} s

Answer: A

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44. Half life time of a free neutron is in the order of.....

A. 10° s

B. 10^{1} s

C. 10^{2} s

D. 10^{3} s

Answer: D

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45. The uncertainty contained in any measurement is.....

A. rounding off

B. error

C. parallax

D. gross

Answer: B

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46. Zero error of an instrument is a.....

A. Systematic error

B. Random error

C. Gross crror

D. Both (a) and (b)

Answer: A

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47. Error in the measurement of radius of a sphere is 2%. Then error in the measurement of surface area is .....

A. 1%

B. 2%

C. 3%

D. 4%

Answer: D

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48. Imperfections in experimental procedure gives ..... error.

A. random

B. gross

C. Systematic

D. personal

Answer: C

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49. Random error can also be called as .....

A. personal error

B. chance error

C. gross error

D. unsystematic error

Answer: B

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50. To get the best possible true value of the quantity ..... has to be taken.

A. rms value

B. net value

C. arithmetic mean

D. Mode

Answer: C

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51. The error caused due to the shear carelessness of an observer is called as ..... error.

A. Systematic

B. Gross

C. Random

D. Personal

Answer: B

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52. The uncertainty in a measurement is called as.....

A. error

B. systematic

C. random error

D. gross error

Answer: A

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53. The difference between the true value and the measured value of a quantity is known as.....

A. Absolute error

B. Relative error

C. Percentage error

D. Systematic error

Answer: A

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54. If $a_1, a_2, a_3 \ldots\ldots a_n$ are the measured value of a physical quantity "a" and a_m is the true value then absolute error.....

A. $a_m = \Delta a_n + a_n$

B. $\Delta a_n = a_m + a_n$

C. $\Delta a_n = a_m - a_m$

D. $\Delta a_n = a_m - a_n$

Answer: D

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55. If ' a_m ' and' Δa_m are true value and mean absolute error respecively, then the magnitude of the quantity may lie between .....

A. $a_m + a_n \text{to} a_m - a_n$

B. $a_m - \Delta a_m \text{to} a_m + \Delta a_n$

C. $2a_m \text{to} \Delta a_m$

D. $0 \text{to} 2a_m$

Answer: B

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56. The ratio of the mean absolute error to the mean value is called as.....

A. absolute error

B. random error

C. relative error

D. percentage error

Answer: C

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57. Random error can also be called as .....

A. fractional error

B. absolute error

C. percentage error

D. systematic error

Answer: A

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58. A measured value to be close to targeted value, percentage error must be close to .....

A. 0

B. 10

C. 100

D. ∞

Answer: A

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59. The maximum possible error in the sum of two quantities is equal to .....

A. Z = A+B

B. $\Delta Z = \Delta A + \Delta B$

C. $\Delta Z = \Delta A / \Delta B$

D. $\Delta Z = \Delta A - \Delta B$

Answer: B

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60. The maximum possible error in the difference of two quantities is.....

A. DeltaZ = DeltaA +DeltaB`

B. $\Delta Z = \Delta A - \Delta B$

C. $\frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$

D. $\frac{\Delta Z}{Z} = \frac{\Delta A \Delta B}{AB}$

Answer: C

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61. The maximum fractional error in the difference of two quantities is.....

A. Z = A + B

B. $\Delta Z = \Delta A - \Delta B$

C. $\frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$

D. $\frac{\Delta Z}{Z} = \frac{\Delta A \Delta B}{AB}$

Answer: C

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62. The fractional error in the n^{th} power of a quantity is .....

A. $\frac{\Delta Z}{Z} = n\frac{\Delta A}{A}$

B. $\frac{Z}{\Delta Z} = n\frac{A}{\Delta A}$

C. $\frac{\Delta Z}{Z} = \frac{1}{n}\frac{\Delta A}{A}$

D. $\frac{Z}{\Delta Z} = \frac{1}{n}\frac{A}{\Delta A}$

Answer: A

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63. A physical quantity is given is $y = \frac{ab^3}{c^2}$. If Δa, Δb, Δc are absolute errors, the possible fractional error in y is .....

A. $\frac{\Delta y}{y} = \frac{\Delta a \Delta b}{2\Delta c}$

B. $\frac{\Delta y}{y} = \frac{\Delta a}{a} + 3\frac{\Delta b}{b} + 2\frac{\Delta c}{c}$

C. $\frac{\Delta y}{y} = \frac{\Delta a}{a} + \left(\frac{\Delta b}{a}\right)^3 + \left(\frac{\Delta c}{c}\right)^2$

D. $\frac{\Delta y}{y} = \frac{\Delta a}{a} + \frac{\Delta b}{a} + \frac{\Delta c}{c}$

Answer: B

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64. Number of significant digits in 3256.....

A. 1

B. 2

C. 3

D. 4

Answer: D

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65. Number of significant digits in 332005.....

A. 1

B. 6

C. 5

D. 2

Answer: C

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66. Number of significant digits in 20.00.....

A. 1

B. 2

C. 3

D. 4

Answer: D

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67. Number of significant digits in 2030.....

A. 1

B. 2

C. 3

D. 4

Answer: D

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68. Number of significant digits in 0.0342.....

A. 1

B. 2

C. 3

D. 4

Answer: C

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69. Number of significant digits in 20.00.....

A. 1

B. 2

C. 3

D. 4

Answer: D

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70. Number of significant digits in 0.030400.....

A. 6

B. 5

C. 4

D. 3

Answer: B

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71. The force acting on a body is mesured as 4.25 N. Round it off with two significant figure.....

A. 4.3

B. 4.2

C. both (a) or (b)

D. 4.25

Answer: B

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72. The quantities a, b, c are measured as 3.21, 4.253, 7.2346. The sum (a + b + c) with proper significant digits is.....

A. 14.6976

B. 14.697

C. 14.69

D. 14.6

Answer: C

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73. The dimensionis of universal gravitational constant is

A. ML^2T^{-2}

B. $M^{-1}L^3T^{-1}$

C. $M^3L^{-2}T^{-1}$

D. ML^2T^{-2}

Answer: B

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74. The ratio of one nanometer to one micron is.....

A. 10^{-3}

B. 10^{3}

C. 10^{-9}

D. 10^{-6}

Answer: A

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75. Which of the following physical quantities have same dimensional formula?

A. Moment of inertia and moment of force

B. Work and torque

C. Impulse and momentum

D. Angular momentum and Planck's constant

Answer: A

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76. Two quantities A and B have different dimensions. Which of the following is physically meaningful?

A. A+B

B. A-B

C. A/B

D. None

Answer: C

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77. The dimensional formula for moment of inertia.....

A. ML^0T^{-2}

B. $ML^{-1}T^2$

C. $ML^{-2}T^0$

D. ML^2T^0

Answer: D

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78. Which of the following is having same dimensional formula?

A. tension and surface tension

B. strain and angle

C. year and light

D. none of this

Answer: B

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79. Which of the following quantities is expressed as force per unit area?

A. Pressure

B. Stress

C. Both (a) and (b)

D. None

Answer: C

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80. In equation of motion $S = ut + \frac{1}{2}kt^2$, the dimensional formula for K is.....

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

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

C. [T]

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

Answer: B

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81. The dimensional formula for heat capacity.....

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

B. $\left[ML^2K^{-1}\right]$

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

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

Answer: D

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82. The product of Avogadro constant and elementary charge is known as ..... constant.

A. Planck's

B. Avogadro

C. Boltzmann

D. Faraday

Answer: D

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83. Force F is given by $F = at + bt^2$. Where "t" is time. What are the dimensions of "a" and "cb"?

A. $\left[MLT^{-3}\right]$ and $\left[MLT^{-4}\right]$

B. $\left[MLT^{-4}\right]$ and $\left[MLT^{-3}\right]$

C. $\left[MLT^{-1}\right]$ and $\left[MLT^{-2}\right]$

D. $\left[MLT^{-2}\right]$ and $\left[MLT^{-0}\right]$

Answer: D

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84. Dimensions of impulse are :

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

B. $\left[MLT^{-2}\right]$

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

D. $\left[ML^2T^0\right]$

Answer: C

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85. If speed of light (c), acceleration due to gravity (g) and pressure (P) are taken as fundamental units, the possible relation to gravitational constant (G) is.....

A. $c^0 gp^{-3}$

B. $c^2 g^3 p^{-2}$

C. $c^0 g^2 p^{-1}$

D. $c^2 g^2 p^{-2}$

Answer: C

Watch Video Solution

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86. Equivalent of one joule is.....

A. Nm

B. kg $m^2 s^{-2}$

C. kg m s^{-1}

D. N kg m^2

Answer: B

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87. Pick out the dimensionless quantity.....

A. vapour density

B. specific gravity

C. molality

D. mass fraction

Answer: B

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88. Odd one out.....

A. strain

B. refractive index

C. numbers

D. stress

Answer: D

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89. A wire has a mass $0.3 \pm 0.003g$ radius $0.5 \pm 0.005mm$ and length $6 \pm 0.06cm$. The

maximum percentage error in the measurement of its density is :

A. 1%

B. 2%

C. 3%

D. 4%

Answer: D

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90. The dimensions of Planck's constant are same as

A. energy

B. momentum

C. angular momentum

D. power

Answer: C

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91. Given that y = A $\sin\left(\frac{2\pi}{\lambda}(ct - x)\right)$. Where y and x are measured in metres. Which of the following statements is true?

A. The unit of λ is same as that of x and A

B. The unit of λ is same as that of x but not of A

C. The unit of c is same as that of $2\pi / \lambda$

D. The unit of (ct - x) is same as that $2\pi / \lambda$

Answer: A

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92. The number of significant figures in 0.06900 is .....

A. 1

B. 2

C. 4

D. 5

Answer: C

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93. The numbers 3.665 and 3.635 on rounding off to 3 significant figures will give .....

A. 3.66 and 3.63

B. 3.66 and 3.64

C. 3.67 and 3.63

D. 3.67 and 3.64

Answer: B

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94. Which of the following measurements is most precise?

A. 4.00 mm

B. 4.00 cm

C. 4.00 m

D. 4.00 km

Answer: A

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95. The mean radius of a wire is 2 mm. Which of the following measurements is most accurate?

A. 1.9 mm

B. 2.25 mm

C. 2.3 mm

D. 1.83 mm

Answer: A

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96. If error in measurement of radius of sphere is 1%. What will be the error in measurement of volume?

A. $1\,\%$

B. $\frac{1}{3}\,\%$

C. $3\,\%$

D. $10\,\%$

Answer: C

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97. Dimensions $\left[ML^{-1}T^{-1}\right]$ are related to .....

A. torque

B. work

C. energy

D. Coefficient of viscosity

Answer: D

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98. Heat produced by a current is obtained a relation H = I^2RT. If the errors in measuring these quantities current, resistance, time are 1% 2% and 1% respectively then total error in calculating the energy produced is.....

A. $2\,\%$

B. $4\,\%$

C. $5\,\%$

D. $6\,\%$

Answer: C

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99. Length cannot be measured by .....

A. fermi

B. angstrom

C. parsec

D. debye

Answer: D

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100. The pressure on a square plate is measured by measuring the force on the plate and the length of the sides of the plate by using the formula $p = \frac{F}{l^2}$. If the maximum errors in the measurement of force and length are 4% and 2% respectively, then the maximum error in the measurement of pressure is .....

A. $1\,\%$

B. $2\,\%$

C. $8\,\%$

D. $10\ \%$

Answer: C

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101. Which of the following cannot be verified by using dimensional analysis?

A. $s = ut + \frac{1}{2}at$

B. y = a sin ωt

C. $F = \frac{mv^2}{r}$

D. F =ma

Answer: B

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102. Percentage errors in the measurement of mass and speed are 3% and 2% respectively. The error in the calculation of kinetic energy is .....

A. 2 %

B. 3%

C. 5%

D. 7%

Answer: D

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103. More number of readings will reduce .....

A. random error

B. systematic error

C. both (a) and (b)

D. neither (a) nor (b)

Answer: A

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104. If the percentage error in the measurement of mass and momentum of a body are 3% and 2% respectively, then

maximum possible error in kinetic energy is .....

A. 2%

B. 3%

C. 5%

D. 7%

Answer: D

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105. In a vernier cliper, n divisions of vernier scale coincides with (n - 1) divisions of main scale. The least count of the instrument is.....

A. $\frac{1}{n}MSD$

B. $\frac{n}{n+1}MSD$

C. $\frac{n+1}{n}MSD$

D. $\frac{n+1}{n-1}MSD$

Answer: A

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106. The period of 0scillation of a simple pendulum is recorded as 2.63s, 2.56s, 2.42s ,2.71s and 2.80s respectively. The average absolute error is .....

A. 0.1 s

B. 0.2s

C. 1.0s

D. 0.11s

Answer: D

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107. In a system of units, if force (F), acceleration (a) and time (T) are taken as fundamental units then the dimensional formula of energy is .....

A. $\left[FA^2T\right]$

B. $\left[FAT^2\right]$

C. $\left[F^2AT\right]$

D. [FAT]

Answer: B

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108. The random error in the arithmetic mean of 50 observations is 'a', then the random error in the arithmetic mean of 200 observations would be .....

A. $4a$

B. $16a^2$

C. $\frac{a}{4}$

D. $\frac{a}{2}$

Answer: C

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109. Which of the following is not dimensionless?

A. Relative permittivity

B. Relative index

C. Relative density

D. Relative velocity

Answer: D

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110. If V-velocity. K - kinetic energy and T - time are chosen as the fundamental units, then what is the dimensional formula for surface tension?

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

B. $\left[K^2VT^{-2}\right]$

C. $\left[KV^2T^2\right]$

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

Answer: A

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Additional Questions Solved Short Answer Questions 1 Mark

1. A new unit of length is chosen such that the speed of light in vscuum is unity. What is the distance between the sun and the Earth in terms of the new unit if light takes 8 min and 20 s to cover this distance.

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2. If x = a + bt + ct^2, where x is in metre and t in seconds, what is the unit of c?

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3. What is the difference between mN,Nm and nm?

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4. The radius of atom is of the ordar of 1Å & radius of nucleus is of the order of fermi. How many magnitudes higher is the volume of the atom as compared to the volume of uncleus?

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5. How many kg make 1 unified atomic mass unit?

6. Name some physical quantities that have same dimension.

7. Name the physical quantities that have dimensional formuls $\left[ML^{-1}T^{-2}\right]$

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8. Give two examples of dimensionless variables.

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9. State the number of significant figures in

(i) 0.007 m^2 (ii) 2.64×10^{24} kg (iii) 0.2370 g cm^{-3}

(iv) 0.2300m (v) 86400 (vi) 86400 m

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10. Given relative error in the measurement of length is 0.02, what is the percentage error?

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11. A physical quantity P is related to four observables a, b, c and d as follows:

$$P = \frac{a^3 b^2}{d\sqrt{c}}$$

The percentage errors of measurement in a, b, c and d are 1%, 3%, 4% and 2% respectively. What is the percentage errors in the quantity P?

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12. A boy recalls the relation for relativistic mass (m) in terms of rest mass (m_0) velocity

of particle v, but forgets to put the constant c (velocity of light). He writes m= $\frac{m_0}{(1-v^2)^{1/2}}$ correct the equation by putting the missing 'c'.

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13. Name the technique used in locating.

(a) an under water obstacle

(b) position of an aeroplane in space.

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14. Deduce dimensional formulae of -

(i) Boltzmann's constant (ii) mechanical equivalent of heat.

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15. Give examples of dimensional constants and dimensionless constants.

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Additional Questions Solved Short Answer Questions 2 Mark

1. The vernier scale of a travelling microscope has 50 divisions which coincide with 49 main scale divisions. If each main scale division is 0.5 mm. Calculate the minimum inaccuracy in the measurement of distance.

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2. If the unit of force is 100N, unit of length is 10m and unit of time is 100s. What is the unit of Mass in this system of units?

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3. State the principle of homogeneity. Test the dimensional homogeneity of equations -

(i) $s = ut + \frac{1}{2}at^2$ (ii) $S_n = u + \frac{a}{2}(2n - 1)$

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4. In Vander Waal's gas equation $\left(P+\frac{2}{V^2}\right)$ (V-b) = RT. Determine the dimensions of a and b.

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5. Magnitude of force experienced by an object moving with speed v is given by F = kv^2 . Find dimensions of k

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6. A book with printing error contains four different formulae for displacement. Choose the correct formula/formulae

(a) $y = a \sin \frac{2\pi}{T} t$ (b) $y = a \sin vt$ (c) $y = \frac{a}{T} \sin\left(\frac{t}{a}\right)$

(d) $y = \frac{a}{T}\left(\frac{\sin(2\pi)}{T} t + \frac{\cos(2\pi)}{T} t\right)$

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7. Determine the number of light years in one metre.

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8. The mass of a box measured by a grocer's balance is 2.3 kg. Two gold pieces 20.15 g and 20.17 g are added to the box.

(i) What is the total mass of the box?

(ii) The difference in masses of the pieces to correct significant figures.

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9. 5.74 g of a substance occupies 1.2 cm^3 Express its density to correct significant figures.

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10. If displacement of a body $s = (200 \pm 5)$ m and time taken by it t = (20 ± 0.2) s, then find the percentage error in the calculation of velocity.

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11. If the error in measurement of mass of a body be 3% and in the measurement of miss of a body be 3% and in the measurement of velocity he 2%. What will be maximum possible error in calculation of kinetic energy?

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12. 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 average

length, absolute error and percentage error. Express the result with error limit.

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13. A physical quantity is measured as Q = (2.1 ± 0.5) units. Calculate the percentage error in (1) $Q^2(2)2Q$

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14. 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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15. A laser light beamed at the Moon takes 2.56s and to return after reflection at the Moon's surface. What will be the radius of lunar orbit?

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16. Convert

3 ms^{-2} to $\mathrm{km}h^{-2}$ (ii) G = 6.67×10^{-11} N m^2kg^{-2} to $cm^3g^{-1}s^{-2}$

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17. A calorie is a unit of heat or energy and it equals 4.2 J where 1J = 1 kg m^2s^{-2} . Suppose we employ a system of units in which unit of mass is α kg. unit of length is β m, unit of time

is γ . What will be magnitude of calorie in terms of this new system?

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18. The escape velocity v of a body depends upon (i) the acceleration due to gravity of the planet and (ii) the radius of the planet R. Establish dimensionally the relationship between v, g and R.

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19. The frequency of vibration of a string depends on, (i) tension in the string (ii) mass per unit length of string, (iii) vibrating length of the string. Establish dimension the relation for frequency.

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20. One mole of an ideal gas at STP occupies 22.4 L. What is the ratio of molar volume to atomic volume of a mole of hydrogen? Why is

the ratio so large? Take size of hydrogen molecule to be 1 Å.

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