PHYSICS

BOOKS - CHETANA PHYSICS (MARATHI ENGLISH)

UNITS AND MEASUREMENTS

Exercise

1. Explain the need for making measurement.

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

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3. Define physical quantity and give a few examples.

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4. Define units and state the factors to be taken into consideration while selecting a unit

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5. Define unit and state the characteristics of a unit.

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6. Explain system of units and state and some system of units.

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7. Define physical quantities and give a few examples.

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8. Define fundamental quantity and state them with SI units.

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9. Define derived quantities and state examples.

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10. State the relation betwwen radian and degree and vice-versa.

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11. What are the conventions to be followed while writing S.I. units?

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

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13. What do A° and AU stand for?

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14. Does the magnitude of a physical quantity depend upon the system of units chosen?

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15. What is a light year?

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16. Star A is father than star B. Which star will have a large parallax angle?

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17. A large ball 2 m in radius is made up of a rope of square cross section with edge length 4 mm. Negleting the air gaps in the balol, what is total length of the rope to the nearest order of magnitude?

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18. Nuclear radius R has a dependemce on the mass number (A) as $R = 1.3 \times 10^{-6} A^{1/3}$m. For a nucleus of mass number A = 125. Obtain

the order of magnitude of R expressed in metre.

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19. Find the order of magnitude of the following quantities: Universal gravitional constant $G = 6.673 \times 10^{-11} N - m^2 / kg^2$

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20. Find the order of magnitude of the following quantities: Mass of electron= $9.1 \times 10^{31} kg$

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21. Find the order of magnitude of the following quantities: Speed of light in vaccum =299792458 m / s

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22. Find the order of magnitude of the following quantities: Acceleration due to gravity=9.80665 m/s^2

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23. Find the order of magnitude of the following quantities: Period of rotation of the Earth about its own axis = 24 h = $24 \times 60 \times 60s = 86,400$s.

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24. State the order of magnitude of duration of a day.

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25. What is order of magnitude? Explain with some examples.

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26. Why is parallax method not useful for measuring distance of stars more than 100 light years away?

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27. Fill in the blanks with suitable conventions.

(1) 1 micron =.....m

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28. Fill in the blanks with suitable conventions.

(2) 1 nanometer = ... = ...A°

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29. Fill in the blanks with suitable conventions.

(3) 5896 A° =.....cm

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30. Fill in the blanks with suitable conventions.

(4) 1 fermi =.....m

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31. Fill in the blanks with suitable conventions.

(5) 1 m =.....light year.

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32. Fill in the blanks with suitable conventions.

(6) 1 parsec =.....m =.....light year.

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33. Fill in the blanks with suitable conventions.

(7) 1 AU =.....m.

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34. Explain method of measurement of time.

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35. When the planet Jupiter is at a distance of 824.7 million kilometer from the earth, its angular diameter is measured to be 35.72" of arc. Calcutate the diameter of the Jupiter.

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36. Define dimensions and state uses of dimensional analysis.

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37. What are the dimensions of the quantity $l\sqrt{l/g}$ l - beng the length and the acceleration due to gravity.

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38. Explain with example how is dimensional analysis used to verify the correctness of physical equation.

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39. Name three physical quantities which are dimensionless.

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40. Explain with example, how is dimensional analysis used to convert the unit of a physical quantity from one system to another system of units.

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41. Explain with example, how dimensional analysis is used to derive the relation,

$n = \frac{1}{2L}\sqrt{\frac{T}{m}}$ where

n $\rightarrow$ Frequency, T $\rightarrow$ Tension, L $\rightarrow$ Length,

m $\rightarrow$ mass per unit length.

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42. Derive the formula for K.E of a particle having mass m and velocity v using dimensional analysis.

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43. List the limitation of analysis.

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44. Can two different physical quantities have same dimensions?

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45. A dimensionally correct equation need not be actually correct, but a dimensionally incorrect equation is necessarily wrong. Justify.

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46. If two physical quantities have the same dimensions, do they represent the same physical content?

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47. Show that production of pressure (P) and volume (V) has dimensions of energy.

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48. Force experienced by charge 'q' moving with velocity 'v' in a magnetic field 'B' is given by F = q v B. Find the dimensions of magnetic field.

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49. $v = at + \dfrac{b}{t+c} + v_0$ is dimensionally valid equation Obtain the dimensional formula for a,b,c where v is velocity, t is time and v_0 is initial velocity.

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50. Check weather the equation is dimensionally correct $v^2 = u^2 + 2as^2$.

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51. Consider a small sphere falling through a medium. The viscous force acting on the sphere depends upon the radius (r) of the sphere, velocity (V) of the sphere and the co-efficient of viscosity (η) of the medium. Use dimensional analysis and show that the viscous force is directly proportional to $\eta r v$.

(Given : Dimensions of $\eta = \left[M^1 L^{-1} T^{-1}\right]$).

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52. Assume that the speed (v) of sound in air depends upon the pressure (P) and density ρ of the air and use dimensional analysis to obtain an expression for the speed of sound.

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53. If length 'L', force 'F' and 'T' are taken as fundamental quantities, what would be the dimensional equation of (i)mass (ii) density?

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54. The density of mercury is 13.6 g/cm^3 using dimensional analysis express it in kg/m^3

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55. An object is falling freely under the gravitational force. Its velocity after travelling a distance h is v. If v depend upon gravitational acceleration g and distance h, prove with dimensional analysis $v = k$ sqrt(gh)`, where k is constant.

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56. Find dimensions of permittivity of vacuum, if $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$

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57. List the reasons for arising uncertainties in observations.

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58. What is an error explain types of error.

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59. What are the methods to minimise errors?

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60. Define.

(i) Most probable value. (ii) Absolute error.

(iii) Relative error.

(iv) percentage error.

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61. The masses of two bodies are measured to be 15.7 ± 0.2 kg and 27.3 ± 0.3 kg. What is the total mass of the two and error in it.

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62. The side of an object measured by means of a vernier callipers is 3.52 cm. If the least count of the vernier is 0.01 cm,estimate the percentage error in the measurement.

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63. The distance travelled by an object in time (100 ± 1)s is (5.2 ± 0.1)m. What is the speed and its error.

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64. In a workshop a worker measures the length of a steel plate with a Vernier callipers having a least count 0.01 cm. Four such measurements of the length yielded the following values 3.11 cm, 3.13 cm, 3.14 cm , 3.14 cm. Find the mean length, the mean absolute error and percentage error in the measured value of the length.

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65. If the measured values of two quantities are $A \pm \Delta A$ and $B \pm \Delta B$, and ΔA and ΔB being the mean absolute errors. What is the maximum possible error in $A + B$? Show that if $Z = \frac{A}{B}$ then $\frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$

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66. Find the percentage error in kinetic energy of a body having mass $60.0 \pm 0.3\text{g}$ moving with velocity $25.0 \pm 0.1 cm/s$.

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67. In ohm's experiment, the values of unknown resistances were found to be 6.12 Ω, 6.15 Ω, calculate the mean absolute error, relative error and percentage error in these measurements.

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68. If the length of a cylinder is $l = (4.00 \pm 0.001)$ cm, radius

$r = (0.025 \pm 0.001)$ cm and mass $m = (6.25 \pm 0.01)$ gm. Calculate the percentage error in the determination of density.

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69. State the rules for writing significant figures.

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70. If the formula for a physical quantity is $X = \frac{a^4 b^3}{c^{\frac{1}{3}} d^{\frac{1}{2}}}$ and if the percentage error in the measurements of a,b,c and d are 2%, 3%, 3 % and 4% respectively. Calculate percentage error in X.

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71. A dimensionally correct equation need not be actually correct, but a dimensionally incorrect equation is necessarily wrong. Justify.

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72. Can two different physical quantities have same dimensions?

Watch Video Solution

73. A dimensionally correct equation need not be actually correct, but a dimensionally incorrect equation is necessarily wrong. Justify.

Watch Video Solution

74. What is order of magnitude? Explain with some examples.

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75. Define significant figures and state the rules for determining significant figures.

Watch Video Solution

76. What is an error explain types of error.

Watch Video Solution

77. What are the methods to minimise errors?

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78. The length, breadth, and thickness of a rectangular sheet of metal are 4.234 m, 1.005 mand 2.01 cm respectively. Give the area and volumes of the sheet to correct significant figures.

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79. The diameter of a sphere is 2.14 cm. Calculate the volume of the sphere to the correct number of significant figures.

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80. Find the dimensions of Coefficient of viscosity (η)

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81. Find the dimensions of Resistance of a wire

$\frac{dv}{dx^2}$ = velocity gradient

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82. Using method of dimensional analysis show that $1J = 10^7$ erg.

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83. Express a pressure of 50 N/m^2 in terms of $dy \neq /cm^2$

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84. Density of water is 1 $gm/$ in the CGS units.

Express it in S.I units

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85. Show that the equation $V = u + at$ is dimensionally correct.

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86. The pressure (P) of a liquid column dependsonits height h, the densityρ, acceleration due to gravity g. Show that P = hρ g by dimensional method. (Given: constant k = 1)

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87. What is order of magnitude of one year in terms of seconds?

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88. The radius of a nucleus of mass number 'A' is given by $R = 1.3 \times 10^{-16} \times A^{1/3}$.

Find the order of magnitude of radius for a nucleus with A = 216.

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89. State the order of magnitude of radius of the earth. Given R = 6400 km

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90. The thickness of a glass sheet is measured at six different places and the following readings are obtained : 1.21 mm, 1.24 mm, 1.19 mm, 1.15 mm, 1.22 mm, 1.25 mm. Find the most probable value of the thickness and percentage error in measurement.

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91. The volume of a solid cylinder of length 10 cm and radius 4 cm is measured using a vernier calliper which has a least count 0.01 cm. Find the percentage error in the measurement.

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92. The radius of a sphere measured is 4.68 ± 0.01 cm. Estimate the percentage error

in the measurement of the volume of the sphere.

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93. Successive measurements of the period of oscillation of a simple pendulum come out to be 2.63 s, 2.56 s, 2.71 s and 2.81 s. Calculate Mean absolute error and Percentage error

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94. Two resistors have resistances $R_1 = (37 \pm 3)\Omega$ and $R_2 = (54 \pm 5)\Omega$. Find the equivalent resistance of their series combination.

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95. Choose the correct option.

$\left[L^1 M^1 T^{-2}\right]$ is dimensional formula for

A. Velocity

B. Acceleration

C. Force

D. Work

Answer:

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96. Choose the correct option.

Light year is a unit of

A. Time

B. Mass

C. Distance

D. Luminosity

Answer:

Watch Video Solution

97. Choose the correct option.

Distance travelled by a particle at any instant 't' can be represented as $S = A(t + B) + Ct^2$ Dimension of B are.

A. [M^0L^1T^-1]`

B. [M^0L^0T^1]

C. [M^0L^1T^-2]

D. [M^0L^2T^-2]

Answer:

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98. Choose the correct option.

$\left[L^{-1}M^{1}T^{-2}\right]$ is the dimensional formula for

A. joules constant

B. gravitational constant

C. pressure

D. force

Answer:

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99. Choose the correct option.

Whiceh of the following equation is dimensionally correct?

A. pressure =energy per unit volume

B. pressure= energy per unit area

C. pressure= momentum xx volume xx time

D. pressure= force xx area

Answer:

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100. Choose the correct option.

If the unit of length and force are increased to

four times,How many times the unit of energy will increase?

A. 2 times

B. 4 times

C. 8 times

D. 16 times

Answer:

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101. Choose the correct option.

The dimensional formula for impulse is the same as dimensional formula for

A. acceleration

B. force

C. momentum

D. rate of change in momentum

Answer:

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102. Choose the correct option.

A unitless quantity

A. always has a non-zero dimension

B. may have a non-zero dimension

C. never has a zero dimension

D. has no dimensions

Answer:

Watch Video Solution

103. Choose the correct option.

Which of the following is NOT a dimensionless quantity?

A. angle

B. strain

C. specific gravity

D. density

Answer:

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104. Choose the correct option.

Dimensional analysis CANNOT be used

A. to check the correctness of a physical quantity

B. to derive the relation between different physical quantities

C. to find out constant of proportionality which may be pure number

D. to change from one sustem of units to another

Answer:

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105. Choose the correct option.

The value of acceleration due to gravity is 980 cms^{-2}. If the unit of length is kilometer and that of time is in minute. the value of acceleration due to gravity is

A. 980 km $\min^{-2}$

B. 98 km $\min^{-2}$

C. 35.28 km min^{-2}

D. 28.35 km min^{-2}

Answer:

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106. Choose the correct option.

Using the principle of homogeneity of dimensions, find which of the following relation is correct?

A. $T^2 = \frac{4\pi^2 - a^3}{G}$

B. $T^2 = \frac{4\pi^2 a^3}{GM}$

C. $T^2 = 4\pi^2 a^3$

D. $T^2 = \frac{4\pi^2 a^3}{GM^3}$

Answer:

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107. The value of the magnitude rounded off to the nearest integral power of 10 is called

A. significant figure

B. special way of writing

C. significant figure

D. order of magnitude

Answer:

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108. Choose the correct option.

The magnitude of any physical quantity can be

expressed as $A \times 10^n$ where n is a number called order of magnitude and A is

A. $0.1 \leq A < 1$

B. $0.5 \leq A < 5$

C. $5 \leq A < A$

D. $1 \leq A > 9$

Answer:

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109. Choose the correct option.

The number of significant figures in 0.400 is

A. 1

B. 2

C. 3

D. 4

Answer:

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110. Choose the correct option.

Which of the following is NOT a fundamental unit?

A. cm

B. kg

C. centigrade

D. volt

Answer:

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111. Choose the correct option.

Dimensions of kinetic energy are the same as that of

A. Force

B. Acceleration

C. Work

D. Pressure

Answer:

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112. Choose the correct option.

Which is following relations is correct?

A. 1 light year =9.46×10^{15}m

B. 1 astronomical unit (AV) =1.496×10^{10} m

C. 1 parsec =2.26 light years

D. All of above

Answer:

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113. Choose the correct option.

SI unit of energy, the joule is equivalent to

A. N.m

B. W / s

C. $N - m^2 / s^2$

D. N / m

Answer:

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114. Choose the correct option.

The error in the measurement of sides of a rectangle is 1%. The error in measurement of its area is

A. [1%

B. $1/2\%$

C. 0.02

D. None of the above

Answer:

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115. Choose the correct option.

Dimensions of electric potential are

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

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

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

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

Answer:

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116. Choose the correct option.

Which of the following is supplementary unit?

A. kelvin

B. ampere

C. radian

D. joule

Answer:

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117. Choose the correct option.

If the pointer of the voltmeter shows reading of 0.2 V when no curent flows in the circuit, the error in voltmeter is

A. Instrumental error

B. Personal error

C. Random error

D. None of these

Answer:

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118. Choose the correct option.

The number of seconds in a day has order of magnitude as

A. 5

B. 4

C. -4

D. -5

Answer:

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119. Choose the correct option.

N/m^2 is a unit of

A. Energy

B. Momentum

C. Pressure

D. Force

Answer:

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120. Choose the correct option.

If $x = at + bt^2$, where x is distance travelled by body in km while t is second, then unit of b are

A. km / s

B. km-s

C. $km - s^2$

D. km / s^2

Answer:

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121. Choose the correct option.

Select the pair whose dimensions are same

A. Force-Pressure

B. Work-Torque

C. Velocity- Velocity gradient

D. Energy-omentum

Answer:

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122. Choose the correct option.

Which of the following units is NOT written correctly

A. Meter

B. kelvin

C. newton

D. kilogram

Answer:

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123. Choose the correct option.

Which of the following is dimensionaless

A. Planck's constant

B. gravitational constant

C. Power of a lens

D. Refractive index

Answer:

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124. Choose the correct option.

The sum of 7.21, 12.141 and 0.0028 can be expressed upto appropriate number of significant figures as

A. 19.3

B. 19.35

C. 19.353

D. 19.358

Answer:

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125. The diference between the true value and measured value is called

A. mistake

B. error

C. significant figures

D. fault

Answer:

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126. If the pointer of the voltmetre is not exactly at the zero of the scale, then the error is called

A. instrumental error

B. systematic error

C. personal error

D. random error

Answer:

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127. The value of the magnitude rounded off to the nearest integral power of 10 is called

A. significant figures

B. uncertain number

C. significant number

D. order of magnitude

Answer:

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128. The reference standard used for the measurement of a physical quantity is called

A. standard quality

B. dimension

C. constant

D. unit

Answer:

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129. Define fundamental quantity and state them with SI units.

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130. Explain system of units and state and some system of units.

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131. Explain with example, how is dimensional analysis used to convert the unit of a physical quantity from one system to another system of units.

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132. Find the dimension of : work

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133. Find the dimension of : Refractive index

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134. Show that the equation $s = ut + \frac{1}{2}at^2$ is dimensionally correct.

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135. Determine the number of significant figures in the following measurements.

0.05718

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136. Determine the number of significant figures in the following measurements.

9300

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137. Determine the number of significant figures in the following measurements.

2.35×10^{-19}

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138. Determine the number of significant figures in the following measurements.

1.3725×10^{9}

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139. What is an error explain types of error.

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140. Period of simple pendulam is given as $T = 2\pi\sqrt{\frac{1}{g}}$.Verify this formula using dimensional method.

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141. The side of a cube is measured to be 20.44 ± 0.02 m. Find the percentage error in the measurement of area.

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142. For measuring large distances, which units are used by astronomers ? In detail.

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143. Why is only carbon is used and not only other element for defining atomic mass unit?

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144. List the reasons for arising uncertainties in observations.

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145. State limitation of dimensional Analysis

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