PHYSICS

BOOKS - MBD

UNITS AND MEASUREMENTS

Example

1. What do you meant by length?

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2. What do you meant by a physical quantity?

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3. How will you define the mass?

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4. Name seven basic physical quantities.

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5. What is the ratio of size of atom and the sizeof the nucleus?

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6. Name three fundamental units.

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7. What are derived units?

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8. Comment on statement : "To define a physical quantity for which no method of measurment is given or known has no meaning."

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9. If $x = a + bt + ct^2$, where x is in metre and t in second, then wat ist he unit of c?

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10. Sometimes angular measurements are very helpful. Explain.

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11. What is the difference between Angstrom and A. U.?

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12. If the velocity of a radiowave be unity, find ithe distance of an aeroplane from the radar. If the

radio signal is received back by the radar in $8.4\mu s$.

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13. Write down the dimensional formula of gravitational constant (G).

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14. Name physical quantity having the dimensional formula.

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

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15. Name physical quantity having the dimensional formula.

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

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16. Name physical quantity having the dimensional formula.

$[M^1L^{-3}T^0]$

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17. Check the correctness of the equation s = vt.

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18. Give two examples of dimensional constants.

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19. Give two examples of dimensionless constants.

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20. Write physical quantity having dimensions $\left[M^1L^{-1}T^{-2}\right]$.

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21. Can a quantity have units but still be dimensinoless?

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22. Do all physical quantities have dimensions ? If no, name three physical quantities which are

dimensionless.

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23. What are significant figures?

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24. Underline the rules for significant figures.

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25. What do you mean by instrument error?

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26. What are various causes for errors in measurement?

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27. How many significant figures are there in the number 0.04500?

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28. what do you mean by least count error?

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29. What do you mean by absolute error?

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30. Solve with due regard to significant figures.

$\sqrt{6.5 - 6.32}$

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31. Which of the following length measurement is most accurate and why?

(a) 2.0 cm

(b) 2.00 cm

(c) 2.000 cm

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32. Which of the following length measurement is most accurate and why?

(a) 2.0 cm

(b) 2.00 cm

(c) 2.000 cm

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33. Which of the following length measurement is most accurate and why?

(a) 2.0 cm

(b) 2.00 cm

(c) 2.000 cm

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34. Round off 3.250 and 3.750 to one decimal place of decimal.

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35. What are personal errors?

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36. Add $6.75 \times 10^3 cm \rightarrow 4.52 \times 10^2$ cm

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37. Fill in the blanks:- The volume of a cube side 1 cm is equal to ....m^3

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38. Fill in the blanks:- The surface area of a solid cylinder of radius 2.0 cm and height 10.0 cm is equal to.....$(mm)^2$

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39. Fill in the blanks:- A vehicle moving with a speed of 18 km 'h^-1' covers.....m in 1 s

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40. Fill in the blanks:- The relative density of lead is 11.3. its density is ..... gcm^{-3} or ....kgm^{-3}

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41. Fill in the blanks by suitable conversion of units:- $1kgm^2s^{-2} = ...gcm^2s^{-2}$

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42. Fill in the blanks by suitable conversion of units:- $1m = \ldots\ldots 1y$

Watch Video Solution

43. Fill in the blanks by suitable conversion of units:- $3.0ms^{-2} = \ldots\ldots kmh^{-2}$

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44. Fill in the blanks by suitable conversion of units:-

$G = 6.67 \times 10^{-11} Nm^2 (kg)^{-2} = ...(cm)^3 s^{-2} g^{-1}$

.

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45. A calorie is a unit of heat or energy and it equal about 4.2 J where $1J = 1kgm^2 s^{-2}$. Suppose we employ a system of units in which the unit of mass equals α kg, the unit of length equals β m, the unit of time is γ s. Show that a calorie has a

magnitude 4.2 $\alpha^{-1}\ \beta^{-2}\ \gamma^{2}$ in terms of the new units.

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46. Explain this statement clearly :- "To call a dimensional quantity large' or 'small' is meaningless without specifying a standard for comparison". In view of this, reframe the following statements wherever necessary :- atoms are very small objects

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47. Explain this statement clearly :- “To call a dimensional quantity large’ or ‘small’ is meaningless without specifying a standard for comparison”. In view of this, reframe the following statements wherever necessary :- a jet plane moves with great speed

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48. Explain this statement clearly:

"To call a dimensional quantity 'large' or 'small' is meaningless without specifying a standard for comparision". In view of this, reframe the following

statements wherever necessary:

The mass of Jupiter is very large

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49. Explain this statement clearly :- " To call a dimensional quantity large' or 'small' is meaningless without specifying a standard for comparison". In view of this, reframe the following statements wherever necessary :- a proton is much more massive than an electron

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50. Explain this statement clearly :- " To call a dimensional quantity large' or 'small' is meaningless without specifying a standard for comparison". In view of this, reframe the following statements wherever necessary :- the speed of sound is much smaller than the speed of light.

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51. A new unit of length is chosen such that the speed of light in vacuum 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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52. Which of the following is the most precise device for measuring length :-

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53. Which of the following is the most precise device for measuring length :-

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54. Which of the following is the most precise device for measuring length :-

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55. A student measures the thickness of a human hair by looking at it through a microscope of magnification 100. He makes 20 observations and finds that the average width of the hair in the field of view of the microscope is 3.5 mm. What is the estimate on the thickness of hair ?

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56. Answer the following :- You are given a thread and a metre scale. How will you estimate the diameter of the thread ?

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57. Answer the following :- screw gauge has a pitch of 1.0 mm and 200 divisions on the circular scale. Do you think it is possible to increase the accuracy of the screw gauge arbitrarily by increasing the number of divisions on the circular scale ?

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58. Answer the following :- The mean diameter of a thin brass rod is to be measured by vernier callipers. Why is a set of 100 measurements of the diameter expected to yield a more reliable estimate than a set of 5 measurements only ?

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59. The photograph of a house occupies an area of $1.75cm^2$ on a 35 mm slide. The slide is projected

on to a screen, and the area of the house on the screen is $1.55m^2$. What is the linear magnification of the projector-screen arrangement.

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60. State the number of significant figures in the following :- $0.007m^2$

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61. State the number of significant figures in the following :- $2.64 \times 10^{24}kg$

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62. State the number of significant figures in the following :- $0.2370 g cm^{-3}$

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63. State the number of significant figures in the following :-$6.320 J$

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64. State the number of significant figures in the following :- $6.032 Nm^{-2}$

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65. State the number of significant figures in the following :-$0.0006032 m^2$

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66. The length, breadth and thickness of a rectangular sheet of metal are 4.234 m, 1.005 m,

and 2.01 cm respectively. Give the area and volume of the sheet to correct significant figures.

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

What is the total mass of the box

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68. The mass of a box measured by a grocer's balance is 2.300 kg. Two gold pieces of masses 20.15 g and 20.17 g are added to the box. What is:- the difference in the masses of the pieces to correct significant figures ?

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69. A physical quantity P is related to four observables a, b, c and d as follows :- $P = a^3b^2 / \left(\left(\sqrt{c}\right)d\right)$ The percentage errors of measurement in a, b, c and d are 1%, 3%, 4% and

2%, respectively. What is the percentage error in the quantity P? If the value of Pcalculated using the above relation turns out to be 3.763, to what value should you round off the result ?

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70. A book with many printing errors contains four different formulas for the displacement y of a particle undergoing a certain periodic motion :- $y = a \sin 2\pi t / T$ (a = maximum displacement of the particle, v = speed of the particle. T= time-

period of motion). Rule out the wrong formulas on dimensional grounds.

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71. A book with many printing errors contains four different formulas for the displacement y of a particle undergoing a certain periodic motion :- $y = a \sin vt$ (a = maximum displacement of the particle, v = speed of the particle. T= time-period of motion). Rule out the wrong formulas on dimensional grounds.

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72. A book with many printing errors contains four different formulas for the displacement y of a particle undergoing a certain periodic motion :- $y = (a/T)\sin t/a$ (a = maximum displacement of the particle, v = speed of the particle. T= time-period of motion). Rule out the wrong formulas on dimensional grounds.

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73. A book with many printing errors contains four different formulas for the displacement y of a

particle undergoing a certain periodic motion :-

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

maximum displacement of the particle, v = speed of the particle. T= time-period of motion). Rule out the wrong formulas on dimensional grounds.

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74. A famous relation in physics relates 'moving mass' m to the 'rest mass' m_o of a particle in terms of its speed v and the speed of light, c. (This relation first arose as a consequence of special relativity due to Albert Einstein). A boy recalls the

relation almost correctly but forgets where to put the constant c. He writes :- $m = \frac{m_0}{(1 - v^2)^{\frac{1}{2}}}$ Guess where to put the missing c.

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75. The unit of length convenient on the atomic scale is known as an angstrom and is denoted by $\overset{\circ}{A}$: $1\overset{\circ}{A}$ = $10^{-10}m$. The size of a hydrogen atom is about $0.5\overset{\circ}{A}$. What is the total atomic volume in m^3 of a mole of hydrogen atoms ?

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76. One mole of an ideal gas at standard temperature and pressure occupies 22.4 L (molar volume). What is the ratio of molar volume to the atomic volume of a mole of hydrogen ? (Take the size of hydrogen molecule to be about $1\overset{\circ}{A}$). Why is this ratio so large ?

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77. Explain this common observation clearly : If you look out of the window of a fast moving train, the nearby trees, houses etc. seem to move rapidly in

a direction opposite to the train's motion, but the distant objects (hill tops, the Moon, the stars etc.) seem to be stationary. (In fact, since you are aware that you are moving, these distant objects seem to move with you).

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78. The principle of 'parallax' is used in the determination of distance of nearby stars. The role of distant object O there is now taken by nearby distant stars. The baseline AB is the line joining the Earth's two locations six months apart in its

orbit around the Sun. That is the baseline is about the disameter of the earth's orbit $= 3 \times 10^{11}$ m. However, even the nearest stars are so distant that with such a long baseline theyshow parallax only of the order 1 s of arc or so. A parsec is a convenient unit of length on the astronomical sxale. It is the distance of an object that will show a parallar of 1s of arc from opposite ends of a baseline equal to the distance from the Earth to the Sum How much is a parsec in terms of metre?

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79. The nearest star to our solar system is 4.29 light years away. How much is this distance in terms of parsecs? How much parallax would this star (named Alpha Centauri) show when viewed from two locations of the Earth six months apart in its orbit around the Sun ?

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80. Precise measurements of physical quantities are a need of science. For example, to ascertain the speed of an aircraft, one must have an

accurate method to find its positions at closely separated instants of time. This was the actual motivation behind the discovery of radar in World War II. Think of different examples in modern science where precise measurements of length, time, mass etc. are needed. Also, wherever you can, give a quantitative idea of the precision needed.

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81. Just as precise measurements are necessary in science, it is equally important to be able to make rough estimates of quantities using rudimentary

ideas and common observations. Think of ways by which you can estimate the following (where an estimate is difficult to obtain, try to get an upper bound on the quantity) :- the total mass of rain-bearing clouds over India during the Monsoon

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82. Just as precise measurements are necessary in science, it is equally important to be able to make rough estimates of quantities using rudimentary ideas and common observations. Think of ways by which you can estimate the following : (where an

estimate is difficult to obtain, try to get an upper bound on the quantity).

the mass of an elephant

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83. Just as precise measurements are necessary in science, it is equally important to be able to make rough estimates of quantities using rudimentary ideas and common observations. Think of ways by which you can estimate the following (where an estimate is difficult to obtain, try to get an upper

bound on the quantity) :- the wind speed during a storm

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84. Just as precise measurements are necessary in science, it is equally important to be able to make rough estimates of quantities using rudimentary ideas and common observations. Think of ways by which you can estimate the following (where an estimate is difficult to obtain, try to get an upper bound on the quantity) :- the number of air molecules in your classroom.

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85. The Sun is a hot plasma (ionized matter) with its inner core at a temperature exceeding 107 K, and its outer surface at a temperature of about 6000 K. At these high temperatures, no substance remains in a solid or liquid phase. In what range do you expect the mass density of the Sun to be, in the range of densities of solids and liquids or gases ? Check if your guess is correct from the following data : mass of the Sun = $2.0 \times 10^{30} kg$, radius of the Sun = $7.0 \times 10^{8} m$.

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86. When the planet Jupiter is at a distance of 824.7 million kilometers from the Earth, its angular diameter is measured to be 35.72" of arc. Calculate the diameter of Jupiter.

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87. A man walking briskly in rain with speed v must slant his umbrella forward making an angle θ with the vertical. A student derives the following relation between θ and v : $\tan \theta = v$ and checks

that the relation has a correct limit: as $v \to 0$, $\theta \to o$, as expected. (We are assuming there is no strong wind and that the rain falls vertically for a stationary man). Do you think this relation can be correct ? If not, guess the correct relation.

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88. It is claimed that two cesium clocks, if allowed to run for 100 years, free from any disturbance, may differ by only about 0.02 s. What does this imply for the accuracy of the standard cesium clock in measuring a time-interval of 1 s ?

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89. Estimate the average mass density of a sodium atom assuming its size to be about $2.5\overset{\circ}{A}$. (Use the known values of Avogadro's number and the atomic mass of sodium). Compare it with the density of sodium in its crystalline phase : $970kgm^{-3}$. Are the two densities of the same order of magnitude ? If so, why ?

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90. The unit of length convenient on the nuclear scale is a fermi : 1 f = $10^{-15}m$. Nuclear sizes obey roughly the following empirical relation :- $r = (r_0 A)^{\frac{1}{3}}$ where ris the radius of the nucleus, Aits mass number, and r_o is a constant equal to about, 1.2 f. Show that the rule implies that nuclear mass density is nearly constant for different nuclei. Estimate the mass density of sodium nucleus. Compare it with the average mass density of a sodium atom obtained in Exercise. 2.27.

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91. A LASER is a source of very intense, monochromatic, and unidirectional beam of light. These properties of a laser light can be exploited to measure long distances. The distance of the Moon from the Earth has been already determined very precisely using a laser as a source of light. A laser light beamed at the Moon takes 2.56 s to return after reflection at the Moon's surface. How much is the radius of the lunar orbit around the Earth ?

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92. A SONAR (sound navigation and ranging) uses ultrasonic waves to detect and locate objects under water. In a submarine equipped with a SONAR the time delay between generation of a probe wave and the reception of its echo after reflection from an enemy submarine is found to be 77.0 s. What is the distance of the enemy submarine? (Speed of sound in water = $1450ms^{-1}$).

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93. Hie farthest objects in our Universe discovered by modern astronomers are so distant that light emitted by them takes billions of years to reach the Earth. These objects (known as quasars) have many puzzling features, which have not yet been satisfactorily explained. What is the distance in km of a quasar from which light takes 3.0 billion years to reach us ?

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94. It is a well known fact that during a total solar eclipse the disc of the moon almost covers the disc of the sun. Find the approx. diameter of moon from the following data.

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95. Agreat physicist of this century (RA.M. Dirac) loved playing with numerical values of Fundamental constants of nature. This led him to an interesting observation. Dirac found that from the basic constants of atomic physics (c, e, mass of

electron, mass of proton) and the gravitational constant G, he could arrive at a number with the dimension of time. Further, it was a very large number, its magnitude being close to the present estimate on the age of the universe $(\sim 15 billion years)$. From the table of fundamental constants in this book, try to see if you too can construct this number (or any other interesting number you can think of). If its coincidence with the age of the universe were significant, what would this imply for the constancy of fundamental constants ?

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96. The number of significant figures in 0.06900 is :

A. 5

B. 4

C. 2

D. 3

Answer:

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97. The sum of numbers 436.32, 227.2 and 0.301 in aropriate significant figures is

A. 663.821

B. 664

C. 663.8

D. 663.82

Answer:

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98. The mass and volume of a body are 4.237 g and 2.5 cm^3, respectively. The density of the material of the body in correct significant figures is :

A. $1.6048 gcm^{-3}$

B. $1.69 gcm^{-3}$

C. $1.7 gcm^{-3}$

D. $1.695 gcm6 - 3$

Answer:

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99. The numbers 2.745 and 2.735 on rounding off to 3 significant figures will give

A. 2.75 and 2.74

B. 2.74 and 2.73

C. 2.75 and 2.73

D. 2.74 and 2.74

Answer:

100. Find the area of rectangle whose length and breadth are 12 cm and 4 cm respectively.

A. $164 \pm 3cm^3$

B. $163.62 \pm 2.6cm^2$

C. $163.6 \pm 2.6cm^2$

D. $163.62 \pm 3cm^2$

Answer:

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101. Which of the following pairs of physical quantities does not have same dimensional formula?

A. Work and torque

B. Angular momentum and Planek's constant

C. Tension and surface tension

D. Impulse and linear momentum.

Answer:

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102. Measure of two quantities along w2ith te precision of respective measuring instrument is `A = 2.5 ms^-1 +- 0.5 ms^-1, B = 0.10 s +- 0.01 s. The value of AB will be

A. (0.25 ± 0.08)m

B. (0.25 ± 0.5) m

C. (0.25 ± 0.05) m

D. (0.25 ± 0.135) m

Answer:

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103. You measure two quantities as $A = 1.0m \pm 0.2m, B = 2.0m \pm 0.2m.$ We should report correct value for $\sqrt{AB}$ as

A. $1.4m \pm 0.4m$

B. $1.41m - 0.15m$

C. $1.4m \pm 0.3m$

D. $1.4m \pm 0.2m$

Answer:

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104. Which of the following measurements is most precise?

A. 5.00 mm

B. 5.00 cm

C. 5.00 m

D. 5.00 km

Answer:

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105. The mean length of an object is 5 cm. Which of the following measurements is most accurate?

A. 4.9 cm

B. 4.805 cm

C. 5.25 cm

D. 5.4 cm.

Answer:

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106. Young's modulus of steel is $1.9 \times 10^{11} N/m^2$. When expressed in CGS units of dyne $/cm^2$, it will be equal to $\left(1N = 10^5 dy \neq , 1m^2 = 10^4 cm^2\right)$

A. 1.9×10^{10}

B. 1.9×10^{11}

C. 1.9×10^{12}

D. $1.9x10^{13}$

Answer:

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107. If momentum (p), area (A) and time (T) are taken to be fundamental quantities, then energy has the dimensional formula

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

B. $\left[p^{2}AT\right]$

C. $\left[pA^{-1/2}T\right]$

D. $\left[pA^{1/2}T^{-1}\right]$

Answer:

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108. On the basis of dimensions, decide which of the following relations for the displacement of a particle undergoing simple harmonic motion is not correct?

A. $y = a \sin 2\pi t / T$

B. $y = a \sin vt$

C. $v = \frac{a}{T} \sin\left(\frac{t}{a}\right)$

D. $y = a\sqrt{2}\left(\frac{\sin(2\pi t)}{T} - \frac{\cos(2\pi t)}{T}\right.$

Answer:

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109. If P,Q,R are physical quantities, having different dimensions, which of the following combinations can never be a meaningful quantity?

A. (P-Q)R

B. PQ-R

C. PQ/R

D. (R+Q)P

Answer:

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110. Photon is quantum of radiation with energy E = hv, where v is frequency and h is Planck's constant. The dimensions of h are the same as that of

A. linear impulse

B. angular impulse

C. linear momentum

D. angular momentum.

Answer:

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111. If Planck's cosntant (h) and speed of light in vaccum (c) are taken as two fundamental quantities, which one of the following can, in addition, be taken to express length, mass and time in terms of the three chosen fundamental quantities?

A. Mass of electron (m_e)

B. Universal gravitsational constant (G)

C. Charge of electron (e)

D. Mass of proton (m_p)

Answer:

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112. Which of the following ratios express pressure?

A. Force/Area

B. Energy/Volume

C. Energy/Area

D. Force/Volume.

Answer:

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113. Which of the following are not a unit of time?

A. Second

B. Parsec

C. Year

D. Light year.

Answer:

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114. Why do we have different units for the same physical quantity?

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115. The radius of atom is of the order of $1\overset{\circ}{A}$ and radius of nucleus is of the order of fermi. How many magnitudes higher is the volume of atom as compared to the volume of nucleus?

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116. Name the device used for measuring the mass of atoms and molecules.

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117. Express unified atomic mass unit in kg.

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118. A function $f(\theta)$ is defined as $f(\theta) = 1 - \theta + \frac{\theta^2}{2!} + \frac{\theta^3}{3!} + \frac{\theta^4}{4!} + \ldots\ldots$ Why is

it necessary for $f(\theta)$ to be dimensionless quantity?

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119. Why length, mass and time are chosen as base quantities in mechanics?

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120. The earth-moon distance is about 60 earth radius. What will be the diameter of the earth

(approximately in degrees) as seen from the moon?

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121. The earth- moon distance is about 60 earth radius. Moon is seen to be of $(1/2)^\circ$ diameter from the earth. What must be the relative size compared to the earth?

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122. The earth- moon distance is about 60 earth radius. Moon is seen to be of $(1/2)^{\circ}$ diameter from the earth. From parallax measurement, the sun is found to be at a distance of about 400 times the earth-moon distance. Estimate the ratio of sun earth diameters.

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123. Which of the following time measuring device is most precise? Give reasons for your answers.

A. A wall clock

B. A stop watch

C. A digital watch

D. An atmic clock.

Answer:

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124. The distance of a galaxy is of the order of 10^{25} m. Calculate the order of magnitude of time taken by light to reach us from the galaxy.

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125. The vector 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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126. During a total solar eclips the moon almost entirely covers the sphere of the sun. Write the relation between the distances and sizes of the sun and moon.

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127. If the unit of force is 100 N, unit of length is 10 m and unit of time is 100 s, what isw the unit of mass in this system of units?

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128. Give an example of a physical quantity which has a unit but no dimensions.

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129. Give an example of a physical quantity which has neither unit nor dimensions.

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130. Give an example of a constant which has a unit.

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131. Give an example of a constant which has no unit.

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132. Calculate the length of the arc of a circle of radius 31.0 cm which subtends an angle of $\frac{\pi}{6}$ at the centre.

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133. Calculate the solid angle subtended by the periphery of an area of $1cm^2$ at a point situated symmetrically at a distance of 5 cm from the area.

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134. The displacement of a progressive wave is represented by y = A sin $(\omega t - kx)$, where x is distance and t is time. Write the dimensional formula of ω

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135. The displacement of a progressive wave is represented by y = A sin $(\omega t - kx)$, where x is distance and t is time. Write the dimensional formula of k

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136. Time for 20 oscillations of a pendulum is measured as $t_1 = 39.6s, t_2 = 39.9s, t_3 = 39.5s,$ What is the precision in the measurements ? What is the accuracy of the measurement ?

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137. A new system of units is proposed in which unit of mass is α kg, unit of length β m and unt of time γs. How much will 5 J measure in this new system?

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138. The volume of a liquid flowing out per second of pipe of length l and radeius r is wrteen by a student as

$v = \frac{\pi P r^4}{8\eta l}$ where P is the pressure difference between the two ends of the pipe and η is coefficent of viscosity of the liquid having dimensional formula $ML^{-1}T^{-1}$ Check whether the equation is dimensionally correct.

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139. A physical quantity X is related to four measurable quantities a, b, c and d as follows. $X = a^2 b^3 c^{5/2} d^{-2}$ The percentage error in the measurement of a,b,c and d are 1%,2%, 3% and 4%, respectively. What is the perecentage error in quantity X? If the value of X calculated on the bais of the above relation is 2.7 63, to what value should you round off the result?

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140. In the expression $P = El^2m^{-5}G^{-2}$, E,m,l and G denote energy, mass, angular momentum and gravitational constant, respectively. Show that P is a dimensionless quantity.

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141. If velocity of light c, Plank's constant h and gravitational ontant G are taken as fundamental quantities then express mass, length and time in terms of dimensions of these quantities.

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142. An artificial satellite is revolving around a planet fo mass M and radius R, in a circular orbit of radius r. From Kepler's third law about te period fo a satellite around a common central bdy, square of the period of revolution T is proportional to the cube of the radius of the orbit r. Show usingn dimensional analysis, that $T = \frac{k}{R}\sqrt{\frac{r^3}{g}}$, where k is a dimensionless constant and g is acceleration due to gravity.

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143. In an experiment to estimate the size of a molecule of oleic acid 1mL of oleic acid is dissolved in 19 mL of alcohol. Then 1 mL of this solution is diluted to 20 mL by adding alcohol. Now 1 drop of this diluted solution is placed on water in a shallow trough. The solution spreads over the surface of water forming one molecule thick layer. Now, lycopodium powder is sprinkled evenly over the film and its diameter is measured. Knowing the volume of the drop and area of the film we can calculate the thickness of the film which will give us the size of oleic acid molecule. Read the passage carefully and answer the following

questions : why do we dissolve oleic acid in alcohol ?

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144. In an experiment to estimate the size of a molecule of oleic acid 1mL of oleic acid is dissolved in 19 mL of alcohol. Then 1 mL of this solution is diluted to 20 mL by adding alcohol. Now 1 drop of this diluted solution is placed on water in a shallow trough. The solution spreads over the surface of water forming one molecule thick layer. Now, lycopodium powder is sprinkled evenly over

the film and its diameter is measured. Knowing the volume of the drop and area fo the film we can calculate the thickness of the film which will give us the size of oleic acid molecule. Read the passage carefully and answer the following questions : What is the role of lycopodium powder?

Watch Video Solution

145. In an experiment to estimate the size of a molecule of oleic acid 1mL of oleic acid is dissolved in 19 mL of alcohol. Then 1 mL of this solution is

diluted to 20 mL by adding alcohol. Now 1 drop of this diluted solution is placed on water in a shallow trough. The solution spreads over the surface of water forming one molecule thick layer. Now, lycopodium powder is sprinkled evenly over the film and its diameter is measured. Knowing the volume of the drop and area of the film we can calculate the thickness of the film which will give us the size of oleic acid molecule. Read the passage carefully and answer the following questions : What would be the volume of oleic acid in each mL of solution prepared?

Watch Video Solution

146. In an experiment to estimate the size of a molecule of oleic acid 1mL of oleic acid is dissolved in 19 mL of alcohol. Then 1 mL of this solution is diluted to 20 mL by adding alcohol. Now 1 drop of this diluted solution is placed on water in a shallow trough. The solution spreads over the surface of water forming one molecule thick layer. Now, lycopodium powder is sprinkled evenly over the film and its diameter is measured. Knowing the volume of the drop and area of the film we can calculate the thickness of the film which will give us the size of oleic acid molecule. Read the passage carefully and answer the following

questions : How will you calculate the volume of n drops of this solution of oleic acid ?

Watch Video Solution

147. In an experiment to estimate the size of a molecule of oleic acid 1mL of oleic acid is dissolved in 19 mL of alochol. Then 1 mL of this solution is diluted to 20 mL by adding alcohol. Now 1 drop of this diluted solution is placed on water in a shallow trough. The solution spreads over the surface of water forming one molecule thick layer. Now, lycopodium powder is sprinkled evenly over

the film and its diameter is measured. Knowing the volume of the drop and area of the film we can calculate the thickness of the film which will give us the size of oleic acid molecule. Read the passage carefully and answer the following questions : What will be the volume of oleic acid in one drop of this solution?

Watch Video Solution

148. How many astronomical units (A.U.) make 1 parsec?

Watch Video Solution

149. Consider a sunlike start at a distance of 2 parsecsWhen it is seen through a telescope with 100 magnification, what should be the angular size of the star? Sun appears to be $(1/2)^{\circ}$ from the earth. Due to atmospheric fluctuationsw, eye can't resolve objects smaller than 1 arc minute.

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150. Mars has approximately half of the earth's diameter. When it is closest to the earth it is at abot 1/2 A.U. from the earth. Calculate what size it

will appear when seen through the same telescope.

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151. Express unified atomic mass unit in kg.

Watch Video Solution

152. Einstein's mass-energy relation emerging out of his famous theory of relativity relates mass (m) to energy (E) as E=mc^2 , where c is the speed of light in vacuum. At the nuclear level, the

magnitudes of energy are very small. The energy at nuclear level is usually measured in MeV, where 1MeV=$1.6 \times 10^{-}13J$, the masses are measured in unified atomic mass unit (u) where, $1u = 6 \times 10^{-}27kg$.

A student writes the relation as 1 u = 931.5 MeV. The teacher points out that the relation is dimensionally incorrent. Write the correct relation.

Watch Video Solution

153. The difference in the elngth of a mean solar day and a sidereal day is about

A. 1 min

B. 4 min

C. 15 min

D. 4 sec

Answer:

154. The physical quantities not having same dimensions are:

A. momentum and Planck's constant

B. speed and $(\mu_0 \varepsilon_0)^{-\left(\frac{1}{2}\right)}$

C. speed and $\sqrt{P/\rho}$

D. Surface tension and spring constant.

Answer:

Watch Video Solution

155. Proper symbol for kilo watt hour is

A. k wh

B. k WH

C. k Wh

D. k WH

Answer:

Watch Video Solution

156. Candela is the unit of

A. acoustic intensity

B. electric intensity

C. luminous intensity

D. magnetic intensity

Answer:

Watch Video Solution

157. Electron volt is a unit of

A. potential difference

B. charge

C. energy

D. capacity

Answer:

Watch Video Solution

158. If the unit of length and force are increased four times each, the unit of energy is increased.

A. 4 times

B. 16 times

C. 8 times

D. no increase

Answer:

Watch Video Solution

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

A. Work

B. Pressure

C. Volume

D. Area

Answer:

Watch Video Solution

160. The fundamental unit which has same power in the dimensional furmulae of surface tension and viscosity is

A. Mass

B. time

C. length

D. force

Answer:

Watch Video Solution

161. The physical quantity strain has:

A. no units

B. basic unit

C. derived units

D. fundamental unit

Answer:

Watch Video Solution

162. A time increased of 3.1 seond is recorded with the help of a stop watch whose least count is 0.1s.

The limits between which the time interval lies is

A. (3.1 ± 0.1) second

B. (3.100 ± 0.01)second

C. (3.100 ± 0.01) second

D. (3.1 ± 0.2) second

Answer:

Watch Video Solution

163. What is the decimal equivalent of $\frac{1}{40}$ upto four significant figures?

A. 0.02

B. 0.025

C. 0.025

D. 0.02500

Answer:

Watch Video Solution

164. Parsec is the unit of

A. time

B. distance

C. frequency

D. angular acceleration

Answer:

Watch Video Solution

165. Three measurements are made as 18.425 cm, 7.21 cm and 5.0 cm. The addition should be written as

A. 30.635 cm

B. 30.64 cm

C. 30.6 cm

D. 30.63 cm

Answer:

Watch Video Solution

166. Which of the following is most accurate measurement?

A. $3 \times 10^{-3} m$

B. $30 \times 10^{-4} m$

C. $300 \times 10^{-5} m$

D. 0.0030 m

Answer:

Watch Video Solution

167. A student measured the dimater of a wire usign a screw gauge with least count 0.001 cm and listed the measurements. The correct measurement is :

A. 5.3 cm

B. 5.32 cm

C. 5.320 cm

D. 5.3200 cm

Answer:

Watch Video Solution

168. If P = x-y, then the maximum percentage error in the measurement of P is :

A. $\frac{\Delta x - \Delta y}{x - y} \times 100\,\%$

B. $\frac{\Delta x + \Delta y}{x - y} \times 100\,\%$

C. $\frac{\Delta x}{x - y} + \frac{\Delta y}{x - y} \times 100\,\%$

D. $\frac{\Delta x - \Delta y}{\Delta x + \Delta y} \times 100\,\%$

Answer:

Watch Video Solution

169. The number of significant figures in $0.0006m^2$ are

A. 1

B. 3

C. 2

D. 4

Answer:

Watch Video Solution

170. The dimensional formula of velocity gradient is

A. $\left[M^0LT^{-1}\right]$

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

C. $\left[M^0L^0T^{-1}\right]$

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

Answer:

Watch Video Solution

171. The number of significant figures in 0.00430 are

A. 5

B. 4

C. 3

D. None

Answer:

Watch Video Solution

172. The unit of power of lens is..... .

A. watt

B. horse power

C. dioptre

D. lux.

Answer:

Watch Video Solution

173. The length, breadth and thickness of a rectangular block are 137.2 cm, 7.1 cm and 0.43 cm respectively. Which of these measurements is the most accurate?

A. Measurement of length

B. Measurement of breadth

C. Measurement of thickness

D. All are equally accurate.

Answer:

Watch Video Solution

174. Three measurements are made as 18.425 cm, 7.21 cm and 5.0 cm. The addition should be written as

A. 30.635 cm

B. 30.64 cm

C. 30.6 cm

D. 30.63 cm.

Answer:

Watch Video Solution

175. Fill in the blanks:

These are ___ basic and _____ supplementary units.

Watch Video Solution

176. Fill in the blanks:

One fermi = _____

Watch Video Solution

177. Fill in the blanks:

$1\mathring{A}$= _____

Watch Video Solution

178. Fill in the blanks:

Spring balance is used to find the _____ of a body.

Watch Video Solution

179. Fill in the blanks:

Displacement has units of _____

Watch Video Solution

180. Fill in the blanks:

Vectors can be added only if they have same ____.

Watch Video Solution

181. Fill in the blanks:

Horizontal range is same for angle of porjection θ

and _____

Watch Video Solution

182. Name the fundamental units of measurement.

Watch Video Solution

183. What is 1 A.U.?

Watch Video Solution

184. What is the unit shake?

Watch Video Solution

185. What is the order of magnitude of the following

Velocity of light.

Watch Video Solution

186. What is the order of magnitude of the following

Size of nulceus of hydrogen atom.

Watch Video Solution

187. What is the order of magnitude of the following

Size of the atom of hydrogen atom.

Watch Video Solution

188. What is the order of magnitude of the following

Size of observable universe .

Watch Video Solution

189. What is micron?

Watch Video Solution

190. The dimensional analysis fails to derive the relation involving more than three independent factors. Explain why.

Watch Video Solution

191. Express one parsec second in terms of light years.

Watch Video Solution

192. Can a body have zero mass and zero weight?

Watch Video Solution

193. The mass of a body as measured by two students is given as 1.2 kg and 1.23 kg. Which of the two is more accurate and why?

Watch Video Solution

194. 1 quintal = _____ kg.

Watch Video Solution

195. 1 amu = _____ kg.

Watch Video Solution

196. What is the difference between the mass of an object and its weight ?

Watch Video Solution

197. Define a light year.

Watch Video Solution

198. What do you mean by least count?

Watch Video Solution

199. Underline the rules for significant figures.

Watch Video Solution

200. What do you understand by absolute error.

Watch Video Solution

201. What is a unit?

Watch Video Solution

202. What is the concept of length in physics?

Watch Video Solution

203. Why do we have different units for the same physical quantity?

Watch Video Solution

204. Name the device used for measuring the mass of atoms and molecules.

Watch Video Solution

205. Express unified atomic mass unit in kg.

Watch Video Solution

206. Why length, mass and time are chosen as base quantities in mechanics?

Watch Video Solution

207. If the universe was to shrink to the size of earth, how large would be the Earth on this scale?

Watch Video Solution

208. Are inertial mass and gravitational mass of a body different?

Watch Video Solution

209. Which is the most accurate clock?

Watch Video Solution

210. Name two types of masses.

Watch Video Solution

211. What are dimensions of Angular momentum?

Watch Video Solution

212. Of which quantity watt is SI unit?

Watch Video Solution

213. Of which quantity joule is SI unit?

Watch Video Solution

214. Name physical quantity having the dimensional formula.

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

Watch Video Solution

215. What is velocity of radiowave?

Watch Video Solution

216. What is range of wavelength for visisble light?

Watch Video Solution

217. The length has ____ dimensions.

Watch Video Solution

218. An echo is the phenomenon of repetition of sound on ____ from an obstace.

Watch Video Solution

219. The inertial mass of a body is measured using an _____.

Watch Video Solution

220. Derived units can be obtained from the _____ units.

Watch Video Solution

221. Relative velocity has dimensions of _____.

Watch Video Solution

222. What is measurement of a physical quantity?

Watch Video Solution

223. What is the need of measurement?

Watch Video Solution

224. The SI unit of length is-

Watch Video Solution

225. What are the characteristics of physical standard?

Watch Video Solution

226. Check the correctness of the relation S = ut + $\frac{1}{2}at^2$ using dimensional analysis.

Watch Video Solution

227. What do you mean by dimensions of a physical quantity ? Give examples to show how the dimensions of a physical quantity are determined.

Watch Video Solution

228. Though the number of physical quantities is very large yet we do not have as many different units, why?

Watch Video Solution

229. In defining the standard of length we have to specify the temperature at which the measurement should be made. Are we justified in calling length a fundamental quantity if an other physical quantity, temperature has to be specified in choosing a standard?

Watch Video Solution

230. What is the advantage of expressing metre in terms of krypton-86 wavelength?

Watch Video Solution

231. What type of phenomean can be used as measure of time? Give two examples of it.

Watch Video Solution

232. What is a coherent system of units? Give an example of coherent system of units.

Watch Video Solution

233. What is a coherent system of units? Give an example of coherent system of units.

Watch Video Solution

234. Sometimes angular measurements are very helpful. Explain.

Watch Video Solution

235. What is the advantage in choosing the wavelength of light radiation as a standard of length?

Watch Video Solution

236. What is the difference between accurate and precise measurement?

Watch Video Solution

237. Given below is an equation of a wave: $y = r \sin \omega(x / v - k\pi)$. What are the dimensions of x and k? Here ω is angular velocity and v linear velocity.

Watch Video Solution

238. Find the dimensions of a' and 'b' in the following equation:

$\left(P + a/V^2\right)(V - b) = RT$

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239. If $x = a + bt + ct^2$, where x is in metre and t in second, what are the units of a, and b?

Watch Video Solution

240. What is the concept of length in physics?

Watch Video Solution

241. Bring out the difference between 2.0 and 2.000.

Watch Video Solution

242. How is systematic error eliminated?

Watch Video Solution

243. Mention some of the time intervals of importance in physics.

Watch Video Solution

244. State principle of hmogenity of dimensio and its use in dimensional analysis.

Watch Video Solution

245. Define and explain dimensional formula and dimensional equation.

 Watch Video Solution

246. Define Dimensional variables

 Watch Video Solution

247. Give two examples of dimensional constants.

 Watch Video Solution

248. Define Non-dimensional variables.

 Watch Video Solution

249. Give two examples of dimensionless constants.

Watch Video Solution

250. What is the difference between the mass of an object and its weight ?

Watch Video Solution

251. What are the limitations of dimensional analysis?

Watch Video Solution

252. What are the limitations of dimensional analysis?

Watch Video Solution

253. What do you meant by a physical quantity?

Watch Video Solution

254. What is measurement of a physical quantity?

Watch Video Solution

255. What is the need of measurement?

Watch Video Solution

256. Define and explain unit of a physical quantity.

Watch Video Solution

257. Name the various prefixes and their symbols for expressing power of 10.

Watch Video Solution

258. What is the necessity of such like prefixes?

Watch Video Solution

259. What is the concept of length in physics?

Watch Video Solution

260. The SI unit of length is-

Watch Video Solution

261. What are the orders of the sizes of the objects one come across within physics ? Give examples.

Watch Video Solution

262. Define 1 fermi, 1 angstrom, 1 light year, astronomical unit, parsec in terms of metre.

Watch Video Solution

263. How will you measure the distance of a hill by echo method?

Watch Video Solution

264. How will you measure the height of an accessible object.

Watch Video Solution

265. How will you measure the height of an inaccessible object using triangulation method?

Watch Video Solution

266. What do you understand by elevation and angular distance between two stars ? How does angular measurement help us to determine. Size of astronomical objects and distances.

Watch Video Solution

267. What do you understand by elevation and angular distance between two stars ? How does angular measurement help us to determine. Size of astronomical objects and distances.

Watch Video Solution

268. Explain Reflection methods (Radar and Sonar) for measruing distances.

Watch Video Solution

269. How will you measure very small size like size of an atom of a substance

Watch Video Solution

270. How will you measure very small size like size of an atom of a substance

Watch Video Solution

271. Define and explain dimensional formula and dimensional equation.

Watch Video Solution

272. Discuss uses of dimensional equation with suitable examples.

Watch Video Solution

273. What do you mean by significant figures? Give examples.

Watch Video Solution

274. State and explain the rules for finding the significant figures in the sum, difference, product and quotient of two numbers.

Watch Video Solution

275. What are different types of errors measurements made by instruments?

Watch Video Solution

276. What is an error? How are they classified and how do the errors combine?

Watch Video Solution

277. Find the value of 10 J in a system which has 100 cm, 10 g and 30 s as fundamental unit.

Watch Video Solution

278. The velocity v of sound waves, through a medium may be assumed to depend on density of

the medium, d and Modulus of elasticity (E) . Modulus of elasticity is a ratio of stress to strain and stress is force per unit area. Deduce by the method of dimensions the formula for the velocity of sound.

Watch Video Solution

279. The velocity v of sound waves, through a medium may be assumed to depend on density of the medium, d and Modulus of elasticity (E) . Modulus of elasticity is a ratio of stress to strain and stress is force per unit area. Deduce by the

method of dimensions the formula for the velocity of sound.

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280. The time of oscillation of t of a small drop of a liquid under surface tension depends upon the density d, the radius r and the surface tensions s. Prove dimensionally that $t \propto \sqrt{dr^3 / s}$

Watch Video Solution

281. Assuming that mass M of the largest stone that can be moved by a flowing river , ρ the density of water and 'g' the acceleration due to gravity, show that mass M varies as the sixth power of velocity.

Watch Video Solution

282. If a composite physical quantity in terms of moment of inertia I, force F, velocity v, work W and length L is defined as $Q = \frac{iFv^2}{WL^3}$, find dimensions of Q and identify it.

Watch Video Solution

283. The Sun is a hot plasma (ionized matter) with its inner core at a temperature exceeding 107 K, and its outer surface at a temperature of about 6000 K. At these high temperatures, no substance remains in a solid or liquid phase. In what range do you expect the mass density of the Sun to be, in the range of densities of solids and liquids or gases ? Check if your guess is correct from the following data : mass of the Sun = $2.0 \times 10^{30} kg$, radius of the Sun = $7.0 \times 10^{8} m$.

Watch Video Solution

284. If $F = x^2$, relative error in f would be how many times the relative error in x?

Watch Video Solution

285. The length and breadth of a rectangular block are 25.2 cm and 1.68 cm, which have both been measured to an accuracy of 0.1 cm. Find the area of the rectangular block.

Watch Video Solution

286. Check the correctness of the relation $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$ dimensionally and numerically.

Watch Video Solution

Exercise

1. Define unit

Watch Video Solution

2. Why length, mass and time are chosen as base quantities in mechanics?

Watch Video Solution

3. Name the fundamental units of measurement.

Watch Video Solution

4. Do all physical quantities have dimensions ? If no, name three physical quantities which are dimensionless.

Watch Video Solution

5. Are the dimensions of coefficient of viscosity and coefficient of friction same?

Watch Video Solution

6. Does the ratio of same quantity depend upon system of unit used?

Watch Video Solution

7. What are the advatages of S.I units?

Watch Video Solution

8. What do you mean by the term measurement?

Watch Video Solution

9. What are the uses of dimensional analysis?

Watch Video Solution

10. What are order of magnitude? Give two examples.

Watch Video Solution

11. Describe the method to measure the height of a big tree.

Watch Video Solution

12. Underline the rules for significant figures.

Watch Video Solution

13. Discuss in detail different types of errors arising in the measurement of the physical quantities. State the general method for estimating the error in a combined caldculation.

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14. Show that errors combine in a similar way in addition and subtraction operations.

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