PHYSICS

BOOKS - AAKASH SERIES

UNITS AND MEASUREMENTS

Problems

1. If the size of a nucleus (in the range of 10^{-15} to $10^{-14}m$) is scaled up to the tip of a sharp pin, what roughly is the size of an atom ? Assume tip of the pin to be in the range $10^{-5}m$ to $10^{-4}m$.

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2. The moon is observed from two diametrically opposite points A and B on Earth. The angle θ subtended at the moon by the two directions of

observation is $1^{\circ}54'$. Given the diameter of the Earth to be about $1.276 \times 10^{7} m$, compute the distance of the moon from the earth.

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3. A man wishes to estimate the distance of a nearby tower from him. He stands at a point A in front of the tower C and spots a very distant object O in line with AC. He then walks perpendicualr to AC upto B, a distaance of 100m and looks at O and C again. Since O is very distant, the direction of BO is practically the same as AO, but he finds the line of sight of C shifted from the original line of sight by an angle $\theta = 40^{\circ} (\theta \text{ is known as parallax})$. Estimate the distance fo the tower C from his original position A.

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4. Convert Newton into dyne.

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5. Convert the unit of work done from MKS system to CGS system (i.e. joule)

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6. If velocity , time and force were chosen as basic quantities , find the dimensions of mass and energy .

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7. Check the correctness of the formula $f = \frac{mv^2}{r^2}$ where f is force , m is mass , v is velocity and r is radius.

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8. Check the correctness of the formula $S = ut + \frac{1}{3}at^2$ where S is the distance , u is velocity , a is acceleration and t is time.

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9. State how does the time period of a simple pendulum depend on mass of bob.

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10. The period T_0 for a planet of mass 'm' above the sum in a circular orbit of radius R depends on m,R and G where G is the gravitational constant. Find expression for time period by dimensional methods.

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11. If energy E, velocity V and time T are taken as fundamental units, the dimensional formula for surface tension is

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12. If velocity of light c, planck's constant h and gravitational constnat G are taken as fundamental quantities then the dimensions of the length will be

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13. Suppose you system of units has one years as the unit of tiem , one light year as the unit of length and mass of earth as the unit of mass. How much 1 N be equal to the units of force in this system. Take 1 year = $3 \times 10^5 s$, 1 light year $= 9.5 \times 10^{15}$ m and mass and earth $= 6 \times 10^{24}$ kg .

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14. Write down 2302 m , 0.0034 m and 2.001 in the scientific way.

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15. The length of a straight line is measured a number of times by a number of observes . The following are the results of these measurements. Decide precision and accuracy.

Actual length = 3.785 cm ± 0.001 cm

1st set of measurement 3.8 cm , 3.9 cm , 3.7 cm

2nd set of measurements 3.478 cm , 3.479 cm , 3.478 cm , 3.478 cm , 3.479 cm

3 rd set of measurement 3.55 cm , 3.65 cm , 3.45 cm , 3.45 cm , 3.35 cm 4th set of measurements 3.784 cm , 3.785 cm , 3.784 cm , 3.785 cm , 3.784 cm

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16. Two clocks are being tested against a standard clock located in a national laboratory. At 12:00:00 noon by the standard clock, the readings of the two clocks are :

	Clock 1	Clock 2
Monday	12:00:06	10:15:08
Tuesday	12:01:25	10:14:59
Wednesday	11:59:06	10:15:28
Thursday	12:01:50	10:15:07
Friday	11:59:25	10:14:42
Saturday	12:01:40	10:15:14
Sunday	12:01:29	10:15:21

If you are doing an experiment that requires 'precision time interval' measurements , which of the two clocks will you prefer ?

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17. In an experiment the valno of refractive index of glass was found to be 1.54, 1.53, 1.44,1.54, 1.56 and 1.45 m in successive measurement. Calculate (i) the mean vlaue of refractive index (ii) absolute error of each measurement (iii) mean absolute error (iv) relative error and (v) percentage error.

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18. The readings of a length come out to be 2.63 m , 2.56 m , 2.42 m , 2.71 m and 2.80 m . Calculate the absolute errors and relative errors or percentage errors.

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19. If L = 2.06 cm $\pm 0.02cm$, $B = 1.11cm \pm 0.03cm$. What are (L+B) and (L-B) equal to ?

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20. If L = 2.01 m $\pm$ 0.01 m , what is 3 L ?

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21. If L = 20.04 m $\pm$ 0.01 m , B= 2.52 m $\pm$ 0.02 m . What are the values of $(L \times B)$ and $(L + B)$?

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22. If $L_1 = 2.02m \pm 0.01m$, $L_2 = 1.02m \pm 0.01m$, determine $L_1 + 2L_2$

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23. One side of a cube is measured as $a = 4.03 \pm 1\,\%$. What is its value?

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24. In the measurement of a physical quantity $X = A^2 \frac{B}{C^{1/3}} D^3$ The percentage errors introduced in the measurement of the quantities A, B, C and D are 2%, 2%, 4% and 5% respectively. Then, the minimum amount of percentage error in the measurement of X is contributed by

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25. In Poiseuille's method of determination of viscosity , what is the physical quantity that requires greater accuracy in measurement ? Formula $\eta = \frac{\pi P r^4}{8VI}$

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26. In an experiment of simple pendulum, the errors in the measurement of length of the pendulum (L) and time period (T) are $3\,\%$ and $2\,\%$ respectively. The maximum percentage error in the value of L/T^2 is

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27. The measured mass and volume of a body are 2.42 g and 4.7 cm^3 respectively with possible errors 0.01 g and 0.1 cm^3. Find the maximum error in density.

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28. If error in measurement of radius of a sphere is 1%, what will be the error in measurement of volume?

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29. Two resistors of resistances $R_1 = 100 \pm 3$ ohm and $R_2 = 200 \pm 4$ ohm are connected (a) in series , (b) in parrallel. Find the equivalent resistance of the (a) series combination , (b) parallel combination . Use for (a) the relation $R = R_1 + R_2$ and for (b) $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ and $\frac{\Delta R'}{R',^2} = \frac{\Delta R_1}{R_1^2} + \frac{\Delta R_2}{R_2^2}$

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30. In an experiment to determine the value of acceleration due to gravity g using a simple pendulum , the measured value of lenth of the pendulum is 31.4 cm known to 1 mm accuracy and the time period for 100 oscillations of pendulum is 112.0 s known to 0.01 s accuracy . find the accuracy in determining the value of g.

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31. If L = 20.04 m $\pm$ 0.01 m , B= 2.52 m $\pm$ 0.02 m . What are the values of $(L \times B)$ and $(L + B)$?

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32. The significant figures of 0.007 is

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33. Write down the number of significant figure in the 2.64×10^{34}

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34. State the number of significant figures in the following

(a)$0.007m^2$ (b)$2.64 \times 10^{24}kg$ (c) $0.2370g/cm^{-3}$

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35. The respective number of significant figures for thenumbers 6.320, 6.032, 0.0006032 are

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36. State the number of significant figures in the following

6.032

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37. The respective number of significant figures for thenumbers 6.320, 6.032, 0.0006032 are

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38. 20.96 rounded off to 3 significant figures is

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39. Round off to 3 significant figure.

0.0003125

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40. A stick has a length of 12.132 cm and another stick has a length of 12.4 cm.

If the two sticks are placed end to end , what is their total length ?

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41. A stick has a length of 12.132 cm and another stick has a length of 12.4 cm.

If the two sticks are placed side by side, what is the difference in their lengths ?

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42. Find the value of 2.2 + 4.08 + 3.125 + 6.3755.

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43. Solve with due regard to significant figure.

46.7 -10.04 =

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44. Solve with due regard to significant figure.

$\left(3.0 \times 10^{-8}\right) + \left(4.5 \times 10^{-6}\right) =$

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45. Find the number of significant figures in the following numbers.

(i) 6729 , (ii) 0.024 ,(iii) 6.0023 , (iv) 2.520×10^7 , (v) 0.08240

(vi) 4200 , (vii) 4.57×10^8 , (viii) 91.000

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46. The diameter of a sphere is 4.24 m . Calculate its surface area with due regard to significant figures.

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47. Find the value of the following addition with due consideration of signification figures 0.75 + 2.128 + 15.6 .

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48. If a circular piece of tin has a measured radius of 2.6 cm . What is circumference ?

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49. Find the value of 31.2 -12.125 with due consideration of significant figures.

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50. The length of a rod is 2.5 cm and diameter is 2.5 mm. The volume of the rod with due consideration to significant figures is

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Short Answer Type Questions

1. How do the random errors differ from systmetic errors?

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2. What is meant by rounding off?

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3. What are the rules for arithmetic operations with significant figures ?

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4. How do the random errors differ from systmetic errors?

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5. What do you mean by significant figures?

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6. What are the different types of errors that can occur in a measurement?

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7. Define the term mean absolute error . How is this calculate ?

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8. Define the term relative error . How is this calculate ?

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9. Define the term precentage error. How is this calculate ?

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10. Round off to 3 significant figures giving the rules followed (i) 25.87 (ii) 0.05134.

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11. What are the fundamental quantities and supplementary quantities is S.I.? Give their units.

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12. Explain the uses of dimensional analysis with one example for each.

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13. Is there any limit for the number of fundamental (base) quantities? What are supplementary fundamental quantities ? What are their units?

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14. Give the limitations of dimensional analysis.

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15. Using dimensional methods, verify the correctness of the following relations,

(i) $a = v^2/r, (ii) F = mr\omega^2, (iii) S.T.$ = rhdg/2

In the above formulae 'r' stands for radius, 'm' for mass , $'\omega'$ for angular velocity , 'v' for linear velocity , 'h' for height , 'd' for density and S.T. for surface tension.

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16. The velocity of a body is given by $v = At^2 + Bt + C$. If v and t are expressed in SI, what are the units of A,B and C?

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Very Short Answer Type Questions

1. We can reduce random errors by

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2. Why is that for both very small as well as very large (in addition to ordinary) quantities, the physical measurements are usually expressed in scientific notation, with powers of ten ?

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3. The unit of length, metre was originally defined as the distance between two fine lines engraved on gold plugs near the ends of a bar of platinum-iridium alloy that is kept 0° C. Then the unit was defined in October 1983 in terms of wavelength of kr. 86 radiation .

Now, the present unit is defined in terms of distance travelled by light .

In your opinion, which of the two essential requirements for a standard unit availability, invariability played the key role in this modification.

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4. Orginally the 'foot' of human being is taken as a unit of length. What condition prevents the use of human foot as a standard scientific fundamental (base) unit?

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5. As far as mechanics is concerned all systems of units are having the same dimensions for a given physical quantity. But for thermodynamics, electricity, magnetism and electromagnetics this is not the case. Why?

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

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7. Two physical quantities are having the same dimensions. Should their units be necessarily the same? Give an example supporting your answer.

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8. Why is the dimension of one fundamental (base) quantity interms of any other fundamental (base) quantity is always zero.

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9. Assertion: A dimensinoally wrong or inconsistent equation must be wrong.

Reason: A dimensionally consistent equation is an exact or a correct equation.

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10. State about the correctness or otherwise of the following two statements.

i) A physical quanity can have dimensions but no units.

ii) A physical quantity can have units but no dimensions.

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11. Can we derive the kinematic relations V= u+ at , S = ut = $\frac{1}{2}at^2$ and $V^2 = u^2 +$ 2as. Explain the reason for your answer.

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12. What is an error? What are constant errors?

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13. What is the convenience in using SI?

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14. Is dimensional analysis applicable to only SI ?

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15. What is meant by Unit? What is the importance of a unit?

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16. Define a coherent system of units.

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17. Name two coherent systems of units.

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18. What are the fundamental quantities and supplementary quantities is S.I.? Give their units.

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19. Define elementary physical quantities .

Watch Video Solution

20. What are the fundamental quantities and supplementary quantities is S.I.? Give their units.

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21. Define a compounded physical quantity .

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22. What is the importance of measurement?

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23. What are the derived units?

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24. What is meant by the principle of homogeneity of dimensions?

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Numerical Exercise Level 1

1. Derive the dimensions of Planck's constant. Which other quantity has similar dimensions?

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2. The dimensional formula of gravitational constant is

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3. Dimensional formula formula for thermal conductivity is (here K denotes the temperature) :

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4. Obtain the dimensional formula for the Angular impulse .

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5. Obtain the dimensional formula for the Poisson's ratio.

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6. Check the accurary of the relation $C = \frac{\pi \eta r^4}{2l}$ for couple per unit twist (C) of a wire of length (I), radius (r) and coefficient of rigidity (h).

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7. The kinetic energy of rotation (E_k) depends upon (i) angular momentum (J) : (ii) moment of inertia (i).

Find the relation by the method of dimensional analysis .

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8. The significant figures of 0.007 is

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9. State the number of significant figures in the following

(a)$0.007 m^2$ (b)$2.64 \times 10^{24} kg$ (c) $0.2370 g / cm^{-3}$

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(a)$0.007 m^2$ (b)$2.64 \times 10^{24} kg$ (c) $0.2370 g / cm^{-3}$

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11. State the numberof significant figures in the $6.320 J$

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12. Write down the number of significant figure in the 6.032

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13. What is the distance in km of quasar from whigh light takes 3 billion years to reach us? $c = 3 \times 10^5$ km/s.

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14. It is claimed that two atomic clocks if allowed to run for 100 years, free from any disturbance, may differ by only about 0.02 second. In measuring a time interval of second what is the accuracy?

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15. A substance having mass 5.74 g occupies a volume of $1.2cm^3$. Caluclate its density with due regard to significant digits.

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16. The diameter of a sphere is 4.24 m . Calculate its surface area with due regard to significant figures.

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17. Find the value of the following addition with due consideration of signification figures 0.75 + 2.128 + 15.6 .

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Numerical Exercise Level 2

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

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2. The equation of state of a real gas is given by $\left(P+\frac{a}{V^2}\right)(V-b)=RT$ where P, V and T are pressure, volume and temperature resperature and R is the universal gas constant. The dimensions of the constant a in the above equation is

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3. The number of particles crossing a unit area perpendicular to the $x-a\xi s$ in a unit time is given by $n=-D\left(\frac{n_2-n_1}{x_2-x_1}\right)$, where n_1 and n_2 are the number of particles per unit volume at $x=x_1$ and x_2, respectively, and D is the diffusion constant. The dimensions of D are

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4. The density of a material in C.G.S. system is $8g/cm^3$. In a system of units in which unit of length is 5 cm and unit of mass is 20g. What is the

density of the material?

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5. In an experiment of simple pendulum the errors in the measurement of length of the pendulum L and time period T are 3% and 2% respectively. Find the maximum percentage error in the value of acceleration due to gravity.

A. 5%

B. 8%

C. 6%

D. 7%

Answer: D

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6. A scientist performs an experiment and takes 100 readings. He repeats the same experiment and now takes 500 readings, By doing this what is the advantage?

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7. Find the number of significant figures in the following numbers.

(i) 6729 , (ii) 0.024 ,(iii) 6.0023 , (iv) 2.520×10^7 , (v) 0.08240

(vi) 4200 , (vii) 4.57×10^8 , (viii) 91.000

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10. Find the number of significant figures in the 2.520×10^7

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11. State the number of significant figures in the following

0.08240

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12. Find the number of significant figures in the 4200

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13. Find the number of significant figures in the 4.51×10^8

Watch Video Solution

14. Find the number of significant figures in the 91.00

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18. A new unit of length is chosen such that the speed of light is 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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19. The dimensional formula for a physical quantity x is $\left[M^{-1}L^3T^{-2}\right]$. The errors in measuring the quantities $M, L,$ and $T,$ respectively are $2\%, 3\%,$ and 4%. The maximum percentage of error that occurs in measuring the quantity x is

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20. The measured mass the volume of a body are 2.42 and 4.7 cm^3 respectively with possible errors 0.01 g , and 0.1 cc. The find the maximum error in density.

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21. A substance having mass 5.74 g occupies a volume of $1.2cm^3$. Caluclate its density with due regard to significant digits.

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Questions For Descriptive Answers

1. In the formula $X = 3YZ^2$, X and Z have dimensions of capacitance and magnetic induction respectively . What are the dimensions of Y in MESQ system ?

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2. 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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3. A physical quantity P is related to four observably a,b,c and d as follows $P = a^3b^3/c^{1/2}$ d. 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 P calculated using the above relation turns out to be 3.763, to what value should you round off the result?

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4. A gas bubble from an explosion under water oscillates with a period T proportional to $p^a d^b E^c$where p is the static pressure d is the density of

water and E is the total energy of explosion. Find the value of a,b and c.

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5. If unit of mass is taken as 1 kg, of time a 1 minute and that acceleration due to gravity is taken as $9.81ms^{-2}$. What is the unit of energy?

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6. Each side of a cube is measured to be 7.203 m. what are the total surface area and the volume of the cube to appropriate significant figures ?

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7. The density of a cube is measured by measuring its mass and the length of its sides. If the maximum errors in the measurement of mass

and length are 3% and 2%, respectively, then find the maximum error in the measurement of the density of cube.

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Problem

1. From two diametrically opposite points A and B on earth, moon is observed. The angle θ subtended at the moon by the two directions of observation is $1^\circ 54^1$. If radius of earth is0.638×10^7 m, find the distance of the moon from the earth.

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2. Calculate the angular of (a) 1° (degree) (b) 1' (minute of arc or arcmin) and (c) 1" (second of arc or arc second) in radians. Use $360^\circ = 2\pi$ rad, $1^\circ = 60'$ and $1' = 60''$

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3. A man wishes to estimate the distance of a nearby tower from him. He stands at a point A in front of the tower C and spots a very distant object O in line with AC. He then walks perpendicualr to AC upto B, a distaance of 100m and looks at O and C again. Since O is very distant, the direction of BO is practically the same as AO, but he finds the line of sight of C shifted from the original line of sight by an angle $\theta = 40^\circ (\theta \text{ is known as parallax})$. Estimate the distance fo the tower C from his original position A.

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Actual length = 3.785 cm ± 0.001 cm

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2nd set of measurements 3.478 cm , 3.479 cm , 3.478 cm , 3.478 cm , 3.479 cm

3 rd set of measurement 3.55 cm , 3.65 cm , 3.45 cm , 3.45 cm , 3.35 cm 4th set of measurements 3.784 cm , 3.785 cm , 3.784 cm , 3.785 cm , 3.784 cm

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6. Two clocks are being tested against a standard clock located in a national laboratory. At 12:00:00 noon by the standard clock, the readings of the two clocks are :

	Clock 1	Clock 2
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Sunday	12:01:29	10:15:21

If you are doing an experiment that requires 'precision time interval' measurements , which of the two clocks will you prefer ?

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8. The readings of a length come out to be 2.63 m , 2.56 m , 2.42 m , 2.71 m and 2.80 m . Calculate the absolute errors and relative errors or percentage errors.

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9. If L = 2.06 cm $\pm 0.02cm$, $B = 1.11cm \pm 0.03cm$. What are (L+B) and (L-B) equal to ?

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10. Two objects A and B are of lengths 5 cm and 7cm determined with errors 0.1 cm and 0.2 cm respectively.What is the error in determing (a) the total length and (b) the difference in their lengths?

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11. If L = 2.01 m $\pm$ 0.01 m , what is 3 L ?

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12. If $L_1 = 2.02m \pm 0.01m$, $L_2 = 1.02m \pm 0.01m$, determine $L_1 + 2L_2$

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13. The length and breadth of a rectangular object are 25.2 cm and 16.8 cm respectively and have been measured to an accuracy of 0.1 cm. Find the relative error and percentage error in the area of the object.

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14. In an experiment to determine the value of acceleration due to gravity g using a simple pendulum , the measured value of lenth of the pendulum is 31.4 cm known to 1 mm accuracy and the time period for 100

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18. An experiment measured quantity a, b, c and then x is calculated from $x = ab^2/c^3$. If the percentage error in a, b, c are $\pm$ 1%, $\pm$ 3% and $\pm$ 2% respectively, the percentage error in x can be,

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19. If error in measurement of radius of a sphere is 1%, what will be the error in measurement of volume?

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20. A rectangular metal slab of mass 33.333 g has its length 8.0 cm, breadth 5.0 cm and thickness 1mm. The mass is measured with accuracy up to 1 mg with a senstitive balance. The length and breadth are measured with a vernier calipers having a least count of 0.01 cm. The

thickness is measured with a screwgauge of least count 0.01 mm. Calculate the percentage accuracy in density from above measurements.

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21. The percentage errors in the measurement of mass and speed are 2% and 3% respectively. The error in kinetic energy obtained by measuring mass and speed, will be

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22. The error in the measurement of the length of a simple pendulum is 0.1% and the error in the time period is 2%. What is the possible percentage of error in the physical quantity having the dimensional formula LT^{-2}?

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23. Two resistors of resistances $R_1 = 100 \pm 3$ ohm and $R_2 = 200 \pm 4$ ohm are connected (a) in series , (b) in parrallel. Find the equivalent resistance of the (a) series combination , (b) parallel combination . Use for (a) the relation $R = R_1 + R_2$ and for (b) $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ and $\frac{\Delta R'}{R^{,2}} = \frac{\Delta R_1}{R_1^2} + \frac{\Delta R_2}{R_2^2}$

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24. The heat dissipated in a resistance can be obtained by the measurement of resistance, current and time. If the maximum percentage error in the measurement of these quantities are $1\%, 2\%$ and 1% respectively. The maximum percentage error in the determination of the dissipated heat is -

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25. The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{\frac{L}{g}}$. Measured value of L is 20.0 cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 90 s using wrist watch of 1 s resolution. The accuracy in the determination of g is :

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26. Write down the number of significant figure in the 6.032

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27. 20.96 rounded off to 3 significant figures is

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28. A stick has a length of 12.132 cm and another stick has a length of 12.4 cm.

If the two sticks are placed end to end , what is their total length ?

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29. Find the value of 2.2 + 4.08 + 3.125 + 6.3755.

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30. Solve with due regard to significant figures.

(i) $46.7 - 10.4 =$ (ii) $\left(3.0 \times 10^{-8}\right) + \left(4.5 \times 10^{-6}\right) =$

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31. Find the product of 1.2, 2.54 and 3.257 with due regard to significant figures.

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32. Enthalpy change of a reaction with be equal to

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33. A substance having mass 5.74 g occupies a volume of $1.2cm^3$. Caluclate its density with due regard to significant digits.

Watch Video Solution

34. Find out the results of the following operations.

$(i)117.3 \times 0.0024$ $(ii)9.27 \div 41$

$(iii)42 \times 0.041$ $(iv)124.2 + 52.487$

$(v)124.2 - 52.487$ $(vi)\sqrt{58.97}$

$(vii)(17.5)^2$.

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35. If a circular piece of tin has a measured radius of 2.6 cm . What is circumference ?

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36. The diameter of a sphere is 4.24 m . Calculate its surface area with due regard to significant figures.

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37. Each side of a cube is measured to be 7.203 m. what are the total surface area and the volume of the cube to appropriate significant figures ?

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38. The length and breadth of a rectangular sheet are 16.2 cm and 10.1 cm, respectively. The area of the sheet in appropriate significant figures and error is

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39. Convert 1 newton (SI unit of force) into dyne (CGS unit of force)

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40. Convert the unit of work done from MKS system to CGS system (i.e. joule)

Watch Video Solution

41. Verify the correctness of the equations $v = u + at$.

Watch Video Solution

42. Check the correctness of the formula $S = ut + \frac{1}{3}at^2$ where S is the distance , u is velocity , a is acceleration and t is time.

Watch Video Solution

43. Show that the expression of the time period T of a simple pendulum of length l given by $T - 2\pi\sqrt{l/g}$ is dimensionally correct.

Watch Video Solution

44. The time period Of oscillation of a simple pendulum depends on the following quantities

Length of the pendulum (l),

Mass of the bob (m), and

Acceleration due to gravity (g)

Derive an expression for Using dimensional method.

Watch Video Solution

45. A gas bubble from an explosion under water oscillates with a period T proportional to $p^a d^b E^c$where p is the static pressure d is the density of water and E is the total energy of explosion. Find the value of a,b and c.

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46. The dimensional formula of product and quotient of two physical quantities A and B are given by $[AB] = \left[ML^2T^{-2}\right], \left[\frac{A}{B}\right] = \left[MT^{-2}\right]$. The quantites A and B respectively are

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47. If the equation of state of a gas is expressed as $\left(P + \frac{a}{V^2}\right)(V - b) = RT$ where P is the pressure, V is the volume and

T the absolute temperature and a, b , R are constants, then find the dimensions of 'a' and 'b' ?

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48. If E, M, L and G denote energy, mass, angular momentum and gravitational constant respectively, then the quantity $\left(E^2L^2/M^5G^2\right)$ has the dimensions of

Watch Video Solution

49. If pressure P, velocity V and time T are taken as fundamental physical quantities, the dimensional formula of force if

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50. If unit of mass is taken as 1 kg, of time a 1 minute and that acceleration due to gravity is taken as $9.81ms^{-2}$. What is the unit of

energy?

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Exercise 1 A

1. Atomic clock generally used in the national standards, is based on the periodic vibrations produced in a

A. cesium atom

B. carbon atom

C. hydrogen atom

D. krypton atom

Answer: A

Watch Video Solution

2. Atomic clock generally used in the national standards, is based on the periodic vibrations produced in a

A. $\pm 1 \times 10^{-13}$ s

B. $\pm 1 \times 10^{13}$ s

C. $\pm 1 \times 10^{-31}$ s

D. $\pm 1 \times 10^{-35}$ s

Answer: A

Watch Video Solution

3. Which one of the following methods is used to measure distance of a planet or a star from the earth?

A. the parallel method

B. the least count method

C. the null method

D. the parallax method

Answer: D

Watch Video Solution

4. Pascal is the S.I. unit of

A. Impulse

B. Coefficient of Viscosity

C. Surface Tension

D. Modulus of elasticity

Answer: D

Watch Video Solution

5. SI unit of coefficient of thermal conductivity

A. $Wm^{-1}K^{-1}$

B. $Wm^{-2}K^{-1}$

C. Wm K^{-1}

D. $Wm^{-1}K^{-2}$

Answer: A

Watch Video Solution

6. In the following which is not the unit of time

A. Leap year

B. Lunar month

C. Light year

D. sidereal year

Answer: C

Watch Video Solution

7. Candela is the unit of

A. Intensity of sound

B. Luminous intensity

C. Intensity of Electric field

D. Luminous flux

Answer: B

Watch Video Solution

8. Unit used to measure nuclear diameters is

A. formi

B. angstrom

C. micron

D. nanometre

Answer: A

Watch Video Solution

9. Parsec' is the unit of

A. Time

B. Impulse

C. Distance

D. Moment of inertia

Answer: B

Watch Video Solution

10. 1 kilowatt hour (kWh) is equal to

A. 36 kJ

B. 36×10^{-5} J

C. 360 J

D. 36×10^{5} J

Answer: D

Watch Video Solution

11. The dimensional formula of a pseudo force is

A. $M^{\circ}L^{\circ}T^{-1}$

B. $M^{\circ}L^{\circ}T^{\circ}$

C. $M^{\circ}LT^{\circ}$

D. MLT^{-2}

Answer: D

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12. 1 fermi is equal to

A. 10^{-7} micron

B. 10^{-5} angstrom unit

C. 10^{-3} nanomatre

D. none of the above

Answer: B

Watch Video Solution

13. One shake is equal to

A. 10^{-8} s

B. 10^{-9}s

C. 10^{-10}s

D. 10^9 S

Answer: A

Watch Video Solution

14. If P is X-ray unit and Q is micron, then $\frac{P}{Q}$=

A. 10^7

B. 10^{-7}

C. 10^5

D. 10^{-3}

Answer: B

Watch Video Solution

15. Which of the following is not expressed correctly with respect to units?

A. Specific heat $\rightarrow$ J $kg^{-1}K^{-1}$

B. Entropy $\rightarrow Jk^{-1}$

C. Thermal capacity $\rightarrow$ J Kg^{-1}

D. Temperature gradient $\rightarrow m^{-1}$ k

Answer: C

Watch Video Solution

16. Unit of Stefan's constant is : -

A. W $m^{-2}K^{-4}$

B. J $m^{-2}K^{-4}$

C. W $m^{-1}K^{-1}$

D. W $m^{-2}K^{-2}$

Answer: A

Watch Video Solution

17. A and B are the numerical values of a physical quantity and C and D are its units in two systems of mesurement . If C > D, then

A. $A > B$

B. $A < B$

C. A = B

D. A & B cannot be related

Answer: B

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18. Derived unit is

A. cnadela

B. steradian

C. ampere

D. volt

Answer: D

Watch Video Solution

19. $JKg^{-1}K^{-1}$ is the unit of

A. Boltzmann constant

B. PLANCK'S constant

C. Gas constant

D. All the above

Answer: C

Watch Video Solution

20. The ratio of SI Unit to CGS unit of Planck's constant is

A. 10^7

B. 10^{-7}

C. 10^3

D. 10^5

Answer: A

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21. Steradian is the solid angle subtended at the centre of the sphere by its surface whose area is equal to ___ of the sphere.

A. the radius

B. square of the radius

C. cube of the radius

D. reciprocal of the radius

Answer: B

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22. The dimensional formula for coefficient of viscosity is

A. $ML^{-1}T$

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

C. MLT^{-1}

D. $M^{-1}L^{-1}$ T

Answer: B

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23. $\left[ML^{-1}T^{-2}\right]$ is the dimensional formula of

A. Modulus of Elasticity

B. Stress

C. pressure

D. All the above

Answer: D

Watch Video Solution

24. Heat and Thermal capacity differ in the dimensions of

A. Mass

B. Length

C. Time

D. Temperature

Answer: D

Watch Video Solution

25. Force constant and surface tension have the same dimensions in

A. Mass

B. Length

C. Time

D. All the above

Answer: D

Watch Video Solution

26. Assertion:Relative magnetic permeability has no units and no dimensions.

Reason:$\mu_r = \frac{\mu}{\mu_0}$, where the symbols have their standard meaning.

A. Intensity of sound

B. Solid angle

C. Strain

D. Relative density

Answer: B

Watch Video Solution

27. $\frac{x^2}{\text{mass}}$ has dimensions of kinetic energy. Then x has the dimensions of

A. Pressure

B. Torque

C. Moment of Inertia

D. Impulse

Answer: D

Watch Video Solution

28. The quantity having negative dimensions in mass is

A. Gravitational Potential

B. Gravitational constant

C. Acceleration due to gravity

D. none of the above

Answer: B

Watch Video Solution

29. h d G has the dimensions of (h = height , d = density , G = Gravitational constant)

A. Pressure

B. Power

C. Torque

D. Acceleration

Answer: D

Watch Video Solution

30. The quantity having dimensions only in temperature is

A. Letent heat

B. Entropy

C. Specific heat

D. Coefficient of linear expansion

Answer: D

Watch Video Solution

31. The dimensional formula for areal velocity is

A. $M^{\circ} L^{2}$ T

B. $M^{\circ}L^{-2}T^{-1}$

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

D. $M^{\circ}LT^{-2}$

Answer: B

Watch Video Solution

32. If R is the Rydberg constant , C is the velocity and h is the planck's constant , the RCh has the dimesions of

A. Power

B. Angular frequency

C. Wavelength

D. Energy

Answer: D

Watch Video Solution

33. If x times momentum is work , then the dimensions of x are

A. LT^{-1}

B. L^{-1} T

C. $ML^{-1}T^{-1}$

D. MLT

Answer: A

Watch Video Solution

34. The dimensional formula of magnetic induction B is

A. $MT^{-1}A^{-1}$

B. $MT^{-2}A^{-1}$

C. MTA^{-2}

D. MT^{-2} A

Answer: B

Watch Video Solution

35. The physical quantity which has dimensional formula as that of $\frac{\text{Energy}}{\text{mass} \times \text{length}}$ is

A. Force

B. Power

C. pressure

D. Acceleration

Answer: D

Watch Video Solution

36. The modulus of elasticity is dimensionally equivalent to

A. Stress

B. Surface tension

C. Strian

D. Coefficient of viscosity

Answer: A

Watch Video Solution

37. Planck constant has the same dimensions as

A. Energy

B. Power

C. Linear momentum

D. Angular momentum

Answer: D

Watch Video Solution

38. The fundamental unit which has same power in the dimenssional formula of surface tension and viscosity is

A. Mass

B. length

C. time

D. none

Answer: A

Watch Video Solution

39. The dimensions of thermal resistance are

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

B. $M^{0}L^{0}T^{-2}$

C. MLT^{-4}

D. MLT^{-1}

Answer: A

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40. The dimensional formula of velocity gradient is

A. $M^0L^0T^{-1}$

B. MLT^1

C. ML^0T^{-1}

D. M^0LT^{-2}

Answer: A

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41. Temperature can be expressed as a derived quantity in terms of any of the following

A. Length and mass

B. Mass and time

C. Length , mass and time

D. In terms of none of these

Answer: D

Watch Video Solution

42. The dimensional formula of coefficient of kinematic viscosity is

A. $M^0L^{-1}T^{-1}$

B. $M^0L^2T^{-1}$

C. ML^2T^{-1}

D. $ML^{-1}T^{-1}$

Answer: B

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43. The fundamental physical quantities that have same dimensions in the dimensional formulae of torque and angular momentum are

A. mass , time

B. time, length

C. mass , length

D. time, mole

Answer: C

Watch Video Solution

44. The dimensional formula for latent heat is

A. MLT^{-2}

B. ML^2T^{-2}

C. $M^0L^2T^{-2}$

D. MLT^{-1}

Answer: C

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45. $ML^{-1}T^2$ represents

A. Stress

B. Young's modulus

C. pressure

D. All the above

Answer: D

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46. The dimensional formula for angular momentum is

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

B. $ML^{3}T^{-1}$

C. MLT^{-1}

D. $ML^{-3}T^{-2}$

Answer: A

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47. The physical quantity that has no dimensions is

A. Angular velocity

B. Linear momentum

C. Angular momentum

D. Strain

Answer: D

Watch Video Solution

48. The energy density and pressure have

A. same dimensions

B. different dimensions

C. No dimensions

D. none

Answer: A

Watch Video Solution

49. $ML^{-1}T^2$ represents

A. Moment of a force

B. force

C. Acceleration

D. Momentum

Answer: A

Watch Video Solution

50. The dimensional formula of torque is

A. M^2LT^{-2}

B. ML^2T^{-2}

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

D. MLT^{-2}

Answer: B

Watch Video Solution

51. What is the dimensional formula of angular velocity?

A. $M^{-1}L^{1}T^{0}$

B. $M^{0}L^{-1}T^{-1}$

C. $M^{-1}L^{-1}T^{0}$

D. $M^{0}L^{0}T^{-1}$

Answer: D

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52. Solar constant and Stefan's constant have same dimensions in

A. mass

B. length

C. Time

D. All the above

Answer: A

Watch Video Solution

53. Which of the following is the most precise instrument for measuring length?

A. a vernier callipers with 20 divisions on the sliding scale

B. a screw gauge of pitch 1 mm and 100 divisions on the circular scale

C. an optical instrument that can measure length to within a wavelength of light

D. all the above

Answer: C

Watch Video Solution

54. For example , the true value of a certain length is near 3.678 cm. In one experiment , the measured value of found to be 3.5 cm, while in another experiment, the length is determined to be 3.38 cm. The first measurement has

A. more accuracy but less precision

B. Less accuracy but less precision

C. more accuracy but more precision

D. less accuracy but more precision

Answer: A

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55. For example , the true value of a certain length is near 3.678 cm. In one experiment , the measured value of found to be 3.5 cm, while in another experiment, the length is determined to be 3.38 cm. The first measurement has

A. more accuracy but less precision

B. less accuracy but less precision

C. more accuracy but more precision

D. less accuracy but more precision

Answer: D

Watch Video Solution

56. The errors due to imperfect design or calibration of the measuring instrument are

A. Random errors

B. Perfect errors

C. Personal errors

D. systematic errors

Answer: D

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57. For example, if you , by habit, always hold your head a bit too far to the right while reading the position of a needle on the scale, you will introdue an error called as

A. Random errors

B. Perfect errors

C. Parallax errors

D. Least count errors

Answer: C

Watch Video Solution

58. By improving experimental techniques, selecting better instruments and removing personal bias as far as possible, the erros can be minimised

A. Random errors

B. Perfect errors

C. Least count errors

D. systematic errors

Answer: D

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59. Unpredicatable fluctuations in temperature, voltage supply, mechanical vibrations of experimental set-ups , etc, lead to

A. Random errors

B. Perfect errors

C. Least count errors

D. systematic errors

Answer: A

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60. In a measurement, a choice of change of different units

A. does not change the number of significant figures

B. increase the number of significant figures

C. decrease the number of significant figures

D. may increase or may decrease the number of significant figures

Answer: A

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61. Zero error in an instrument introduces

A. Systematic error

B. Random error

C. 1 and 2 both

D. Gross error

Answer: A

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62. Which of the following is systematic error

A. least count error

B. parallax error

C. theoertical error

D. all

Answer: D

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63. What type of elements are found to occur in the combined state?

A. Proportional errors

B. Random error

C. determinate errors

D. systematic errors

Answer: B

Watch Video Solution

64. By repeating the same measurement several times, the errors that can be reduced are

A. determinate errors

B. instrumental errors

C. random errors

D. systematic errors

Answer: D

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65. In an experiment if the measured values of a physical quantity are highly concurrent, these measurements are said to be

A. accurate

B. precise

C. both precise and accurate

D. neither accurate or precise

Answer: B

Watch Video Solution

66. In an experiment if the measured values of a physical quantity have a high degree of closeness to the true value . These measurements are said to be

A. both precise and accurate

B. precise

C. accurate

D. neither accurate nor precise

Answer: C

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67. The measured value of physical quantity expressed to infinite number of decimals places is called

A. practical value

B. ideal value

C. absolute value

D. real value

Answer: B

Watch Video Solution

68. The arithmetic mean of several measurements is called

A. practical value

B. imaginary value

C. true value

D. ideal value

Answer: C

Watch Video Solution

69. Zero errors of measuring instruments are called

A. Indeterminate errors

B. Random errors

C. Disproportional emors

D. Instrumental errors

Answer: D

Watch Video Solution

70. The type of errors that can never be completely eliminated are

A. determinate error

B. instrumental errors

C. proportional errors

D. random errors

Answer: D

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71. Which of the following error is not systematic errors?

A. Least count error

B. Zero error

C. Backlash error

D. Theoretical error due to approximate

Answer: C

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72. Which of the following are intensive properties?

A. Systematic error

B. Gross error

C. random errors

D. Relative density

Answer: D

Watch Video Solution

73. An experimenter measured the diameter of a wire without noting zero error. This error is

A. Random errors

B. Systematic error

C. Gross error

D. Personal error

Answer: B

Watch Video Solution

74. Among the following the error that can be eliminated is

A. Systematic error

B. Random errors

C. Gross error

D. none

Answer: A

Watch Video Solution

75. Which of the following time measuring devices is most precise

A. A wall clock

B. A stop watch

C. A digital watch

D. An atomic clock

Answer: D

Watch Video Solution

76. In determing viscosity (η) by poiseuille's method for formula used $\eta = \frac{\pi p r^4}{8vl}$. Which of the quantities in the formula must be measured more accurately

A. p

B. r

C. v

D. 1

Answer: B

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77. The set of quantities which cannot form a group of fundamental qualntities in any system of measurement is

A. Length, mass and time

B. Length , mass and velocity

C. mass , time and velocity

D. Length, time and velocity

Answer: D

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78. The set of quantities which can form a group of fundamental quantities in any system of measurement is

A. Velocity, Acceleration and Force

B. Energy, Velocity and Time

C. Force, Power and Time

D. All the above

Answer: D

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79. Boltzman constant and Plank's constant differ in the dimensions of

A. Mass and Time

B. Length and Time

C. Length and Mass

D. Time and Temperature

Answer: D

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80. The pair of physical quantities having the same dimensions is

A. Power and Torque

B. Thermal capacity and specifie heat

C. Latent heat and gravitational potential

D. Angular momentum and Impulse

Answer: C

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81. A scalar quantity and a vector quantity haivng the same dimensions are

A. Gravitational potential and latent heat

B. Force and Tension

C. Specific heat and gas constant

D. Frequency and velocity gradient

Answer: D

Watch Video Solution

82. The pair of scalar quantities having the same dimensions is

A. Moment of force and Torque

B. Angular velocity and velocity gradient

C. Thermal capacity and Entropy

D. Planck's constant and Angular momentum

Answer: C

Watch Video Solution

83. The pair of vector quantities haivng the same dimensions is

A. Force and Impulse

B. Moment of inertia and Moment of the couple

C. Surface Tension and Force constant

D. Thrust and weight

Answer: D

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84. Intensity of Magnetization has the same dimensions as

A. Magnetic susceptibility

B. Magnetic moment

C. Intensity of magnetizing field

D. Magnetic permeability

Answer: C

Watch Video Solution

85. The product of Energy and moment of Inertia has the dimensions same as

A. The square of linear momentum

B. The square of angular momentum

C. Angular impulse

D. Planck's constant

Answer: B

Watch Video Solution

86. SI unit and CGS unit of certain quantity vary by 10^3 times.That quantity is

A. Boltzmann constant

B. Gravitational constant

C. Planck's constant

D. Angular momentum

Answer: B

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87. Choose the correct statement

A. The proportionality constant in an equation can be obtained by dimensional analysis

B. The equation V = u+at can be derived by dimensional method

C. The equation y = A sin wt can not be derived by dimensional method

D. The equation $\eta = \frac{A}{B}e^{-Br}$ can be derived with dimensional analysis

Answer: B

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88. The pair of physical quantities having the same dimensional formula are

A. Momentum, impulse

B. Momentum, energy

C. Energy, pressure

D. Force, power

Answer: A

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89. The pair of physical quantities having the same dimensional formula

A. force and work

B. Work and energy

C. Force and torque

D. Work and power

Answer: B

Watch Video Solution

90. When 45 g of an unknown compound was dissolved in 500 g of water, the solution has freezing point of $-0.93^{\circ}C$

(i) What is the molecular weight of compound ? $\left(K_f = 1.86\right)$

(ii) If empirical formula is CH_2O, what is the molecular formula of compound ?

A. Angular momentum and torque

B. Torque and entropy

C. Power and angular momentum

D. None

Answer: D

Watch Video Solution

91. The pair of physical quantities not having the same dimensional formula is

A. Acceleration, gravitational field strength

B. Torque, angular momentum

C. Pressure, modulus of elasticity

D. All the above

Answer: B

Watch Video Solution

92. The time of oscillation of a small drop of liquid under surface tension depends upon density ρ, radius r and surface tension, s, as $T\alpha\rho^a s^b r^c$, then the decending order of a, b and c is

A. a $> b > c$

B. $a > c > b$

C. $b > a > c$

D. $c > a > b$

Answer: D

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93. With reference to magnetic dipole, match the tems of Column I with the tems of Column Ii and Choose the correct option from the codes given below.

Column I		Column II
(A) Dipole moment	(p)	$-M \cdot B$
(B) Equatiorial field for a short dipole	(q)	$M \times B$
(C) Axial field for a short dipole	(r)	$-\mu_0 m / 4\pi r^3$
(D) External field : Torque	(s)	**m**
(E) External field : Energy	(t)	$\mu_0 2m / 4\pi r^3$

A. Tesla

B. Am^2

C. $N(Am)^{-1}$

D. All the above

Answer: D

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94. S.I unit of Electric intensity is

A. Hm^{-1}

B. Nm^{-1}

C. Vm^{-1}

D. NC

Answer: C

Watch Video Solution

95. Which of the following is expressed correctly

A. Magnetic permeability $\rightarrow Fm^{-1}$

B. permittivity $\rightarrow Hm^{-1}$

C. Relative permittivity $\rightarrow Vm^{-1}$

D. Intensity of Magnetizing field $\rightarrow Am^{-1}$

Answer: D

Watch Video Solution

96. Find SI units of thermal resistance.

A. Wk^{-1}

B. $W^{-1}K$

C. $W^{-1}K^{-1}$

D. w $m^{-1}K^{-1}$

Answer: B

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97. Dimensional formula of Intensity of magnetization is

A. IL

B. IL^{-2}

C. IL^{-1}

D. I^{-1}L

Answer: C

Watch Video Solution

98. The dimensional formula of the physical quantity whose S.I. unit is farad is

A. $ML^2T^{-3}I^{-2}$

B. $M^{-1}L^{-3}T^4I^2$

C. $M^{-1}L^{-2}T^4I^2$

D. $M^{-1}L^{-2}L^2$

Answer: C

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99. The dimensional formula of the physical quantity whose S.I. unit is Hm^{-1} is

A. $ML^2T^{-2}I^{-2}$

B. $MLT^{-2}I^{-2}$

C. $M^2L^2T^{-2}I^{-2}$

D. $ML\,T^2I^2$

Answer: B

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100. The pair of quantities haivng neither units nor dimensions is

A. Plane angle and specific gravity

B. Magnetic permeability and Relative permittivity

C. Coefficient of friction and coefficient of restitution

D. Linear momentum and Angular momentum

Answer: C

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101. Dimensionless quantity is

A. Intensity level of sound

B. Magnetic susceptibility

C. Refractive Index

D. All the above

Answer: D

Watch Video Solution

102. Dielectric constant has the same dimensions

A. Stress

B. Strain

C. Electric capcity

D. Electric permittivity

Answer: B

Watch Video Solution

103. the dimensions of electric currect in electric conductivity are

A. 1

B. 2

C. 3

D. -2

Answer: B

Watch Video Solution

104. Choose the false statement

A. Relative permittivity is a dimensionless constant

B. Angular displacement has neither units nor dimensions

C. Refractive index is dimensionless variable

D. Permeability of vacuum is a dimensional constant

Answer: B

Watch Video Solution

105. The pair of quantities haivng same units and dimensions is

A. Focal power and Magnifying power

B. Tension and surface Tension

C. Force and Electromotive force

D. Power and electric power

Answer: D

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106. $\frac{he}{4\pi m}$ has the same dimensions as (h = Planck's constant , e = charge , m = mass.)

A. Magnetic moment

B. Magnetic induction

C. Angular momentum

D. Pole strength

Answer: A

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107. $\frac{M}{Vr}$ has the dimensions of (M = Magnetic moment, V = velocity , r = radius)

A. Pole strength

B. Electric charge

C. Electric potential

D. Force

Answer: B

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108. The dimensional formula for the capacitance of a capacitor is

A. $M^{-1}L^{-2}T^{-4}I^2$

B. $M^{-1}L^{-2}T^4I^2$

C. $ML^2T^{-4}I^{-2}$

D. $ML^{-2}T^4I^{-2}$

Answer: B

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109. The SI unit of magneitc flux is

A. $W\frac{b}{m^2}$

B. Am^2

C. Oersted

D. Weber

Answer: D

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110. The physical quantities not having same dimensions are

A. torque and work

B. momentum and planck's constant

C. stress and Young's modulus

D. speed and $\mu_0 \in_0^{-1/2}$

Answer: B

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111. Fundamental unit out of the following is

A. ampere

B. newton

C. ohm

D. weber

Answer: A

Watch Video Solution

112. The ratio of SI unit of CGS unit of a plysical constant is 10^7. That costant is

A. Universal gas constant

B. Universal gravitational constant

C. Magnetic induction

D. Impulse

Answer: A

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113. Electron volt is the unit of

A. Power

B. Potential

C. Electron charge

D. Energy

Answer: D

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114. The unit of reduction factor of tangent galvanometer

A. Ampere

B. Gauss

C. Radian

D. None

Answer: A

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115. The SI unit of magnetic permebility is

A. Am^{-1}

B. Am^{-2}

C. Hm^{-1}

D. Hm^{-2}

Answer: C

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116. $ML^2T^{-2}I^{-2}$ is the dimensional formula for

A. Self inductance

B. Magnetic induction

C. Magnetic moment

D. Electric conductance

Answer: A

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117. Magnetic induction and magnetic flux differ in the dimensions of

A. Mass

B. Electric current

C. Length

D. Time

Answer: C

Watch Video Solution

118. Electromotive force and Electric potential differ in the dimensions of

A. Mass

B. Length

C. Electric current

D. none of the above

Answer: D

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119. Let $[\varepsilon_0]$ denote the dimensional formula of the permittivity of vacuum. If M = mass, L = length, T = time and A = electric current, then:

A. $\in_0 = M^{-1}L^2T^{-1}$A

B. $\in_0 = M^{-1}L^{-3}T^2$A

C. $\in_0 = M^{-1}L^{-3}T^4A^2$

D. $\in_0 = M^{-1}L^2T^{-1}A^{-2}$

Answer: C

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120. Which of the following pairs is related as in work and force ?

A. Electric potential and electric intensity

B. Momentum and velocity

C. Impulse and force

D. Resistance and voltage

Answer: A

Watch Video Solution

121. The dimensional formula for magnetic flux is

A. $ML^2T^{-2}I^{-1}$

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

C. $ML^{-2}T^{-2}I^{-1}$

D. $ML^{-2}T^{-2}I^{-2}$

Answer: A

Watch Video Solution

122. The unit and dimensions of impedance in terms of charge Q are

A. ohm, $ML^2T^{-2}Q^{-2}$

B. ohm, $ML^2T^{-1}Q^{-2}$

C. ohm,$ML^{-2}T^{-2}Q^{-1}$

D. ohm, $MLT^{-1}Q^{-1}$

Answer: B

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123. The dimesions of $\frac{1}{2}\varepsilon_0 E^2$ (ε_0 is the permittivity of the space and E is electric field),is

A. ML^2T^{-2}

B. MLT^{-2}

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

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

Answer: C

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124. Using mass (M) , length (L) , time (T) , and electric current (A) as fundamental quantities , the dimensions of permitivity will be

A. $MLT^{-1}A^{-1}$

B. $MLT^{-2}A^{-2}$

C. $M^{-1}L^{-3}T^{+4}A^2$

D. $M^2L^{-2}T^{-2}A^2$

Answer: C

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125. Dimensions of $\frac{1}{\mu_0 \in_0}$, where symbols have their usual meaning are

A. $L^{-1}T$

B. L^2T^2

C. L^2T^{-2}

D. LT^{-1}

Answer: C

Watch Video Solution

126. If C and R denote capacitance and resistance respectively, then the dimensional formula of CR is

A. $[M^\circ L^\circ T]$

B. $[M^\circ L^\circ T^\circ]$

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

D. Not expressible in terms of [MLT]

Answer: A

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127. The dimensional formula for angular momentum is

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

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

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

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

Answer: B

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128. Of the following quantities, which one has dimensions different from the remaining three ?

A. Energy per unit volume

B. Force per unit area

C. Product of voltage and charge per unit volume

D. Angular momentum

Answer: D

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129. Dimensional formula of self-inductance is

A. $[MLT^{-2}A^{-2}]$

B. $[ML^2T^{-1}A^{-2}]$

C. $[ML^2T^{-2}A^{-2}]$

D. $[ML^2T^{-2}A^{-1}]$

Answer: C

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130. If $x = at + bt^2$, where x is the distance travelled by the body in kilometer while t is the time in second, then the unit of b is

A. km/s

B. km-s

C. km/s^2

D. km-s^2

Answer: C

Watch Video Solution

131. The dimensional formula of torque is

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

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

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

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

Answer: A

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132. Thd dimensional formula of pressure is

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

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

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

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

Answer: C

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133. Turpentine oil is flowing through a tube of length L and radius r. The pressure difference between the two ends of the tube is p , the viscosity of the coil is given by $\eta = \frac{p(r^2 - x^2)}{4vL}$, where v is the velocity of oil at a distance x from the axis of the tube. From this relation, the dimensions of viscosity η are

A. $[M^\circ L^\circ T^\circ]$

B. $[MLT^{-1}]$

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

D. $[ML^{-1}T^{-1}]$

Answer: D

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134. According to Newton, the viscous force acting between liquid layers of area A and velocity gradient $\frac{\Delta v}{\Delta z}$ is given by $F = -\eta A \frac{dv}{dz}$, where η is

constant called

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

B. $\left[M^{0}L^{\circ}T^{\circ}\right]$

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

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

Answer: D

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135. Which of the following is a dimensional constant ?

A. Refractive index

B. Poisson's ratio

C. Relative density

D. Gravitational constant

Answer: D

Watch Video Solution

136. Which of the following will have the dimensions of time ?

A. LC

B. $\frac{R}{L}$

C. $\frac{L}{R}$

D. $\frac{C}{L}$

Answer: C

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137. Which of the following is the most precise instrument for measuring length?

A. Vernier calipers

B. Screw guage

C. Optical instrument

D. All the above

Answer: C

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138. Which of the following sets cannot enter into the list of fundamental quantities in any system of units ?

A. length,mass and velocity

B. pressure,density and velocity

C. force,velocity and time

D. force momentum and length

Answer: B

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139. The dimensional formula for magnetic flux is

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

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

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

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

Answer: A

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140. A pair of physical quantities having same dimensional formula is

A. force and torque

B. work and energy

C. force and impulse

D. linear momcntum and angular momentum

Answer: A

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141. The value of Planck's constant in SI unit is

A. 6.63×10^{-31} J-s

B. 6.63×10^{-30} kg - m/s

C. 6.63×10^{-32} kg- m/s

D. 6.63×10^{-34} j-s

Answer: D

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142. SI unit of permittivity of free space is

A. coulomb/newton-metre

B. $\text{newton-metre}^2 / \text{coulomb}^2$

C. $\text{coulomb}^2 / \text{newton-metre}^2$

D. $\text{coulomb}^2 / \text{newton-metre}^2$

Answer: C

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143. The dimensions of universal gravitational constant are ____

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

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

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

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

Answer: A

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144. The ratio of the dimensions of Planck's constant and that of the moment of inertia has the dimensions of

A. velocity

B. angular momentum

C. time

D. frequency

Answer: D

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

A. LT^{-2}, L and T

B. L^2, T and LT^2

C. LT^2, LT and L

D. L , LT and T^2

Answer: A

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146. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be

A. $ML^2T^{-3}I^{-2}$

B. $ML^2T^{-3}I^{-1}$

C. ML^2T^{-2}

D. $ML^2T^{-1}I^{-1}$

Answer: A

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

A. 0.02

B. 0.04

C. 0.06

D. 0.08

Answer: C

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148. Which two of the following five physical paramenters have the same dimensions?

(i) Energy density

(ii) Refractive index

(iii) Dielectric constant

(iv) Young's modulus

(v) Magnetic field

A. b and d

B. c and e

C. a and d

D. a and e

Answer: C

Watch Video Solution

149. If the dimensions of a physical quantity are given by $\left[M^aL^bT^c\right]$, then the physical quantity will be

A. Force If a = 0, b = -1, c = -2

B. Pressure If a = 1, b = -1, c=-2

C. Velocity If a = 1, b =0, c= -1

D. Acceleration If a = 1, b = 1, c = -1

Answer: B

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150. The dimensions of $\frac{1}{2}\varepsilon_0 E^2$, where ε_0 is permittivity of free space and E is electric field, are

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

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

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

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

Answer: B

Watch Video Solution

151. A student measures the distance traversed in free fall of a body, initially at rest in a given time. He uses this data to estimate g, the accelration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e_1 and e_2 respectively, the percentage error in the estimation of g is -

A. $e_1 + 2e_2$

B. $e_1 + e_2$

C. $e_1 - 2e_2$

D. $e_2 - e_1$

Answer: A

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152. The density of material in CGS system of mass is $4gcm^3$ in a system of unit in which unit of length is $10cm$ and unit of mass is $100g$ the value of density of material will be

A. 0.04

B. 0.4

C. 40

D. 400

Answer: C

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153. The damping force on an oscillator is directly proportional to the velocity. The units of the constant to proportionality are

A. Kgs^{-1}

B. Kg s

C. Kg ms^{-1}

D. Kg ms^{-2}

Answer: A

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154. If force (F), velocity (v)and time (T) are taken as fundamental units,then find the dimension of mass.

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

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

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

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

Answer: B

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155. If energy (E), velocity (v) and time (T) are chosen as the fundamental quantities, the dimensional formula of surface tension will be

A. $\left[E^{-2}V^{-1}T^{-3}\right]$

B. $\left[EV^{-2}T^{-1}\right]$

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

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

Answer: D

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156. Planck 's constant (h) speed of length in vaccum (C) and newton 's gravitational constant (G) are three fundamental constant .Which of the following combinations of these has the dimension of length?

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

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

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

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

Answer: A

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157. A) Work and energy have the same units in any given system of measurement

B) Work and power have the same ratio of SI unit to C.G.S unit

A. Statement A is true and B is false

B. Statement A is false and B is true

C. Both A and B are true

D. Both A and B are false

Answer: C

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158. A standard unit should be

(a) consistent

(b) reproducible

(c) invariable

(d) easily available for usage

A. Only a& b are true

B. onlye a& c are ture

C. only a,c &d are true

D. a, b, c, d are true

Answer: D

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159. The correct order in which the ratio of SI unit to CGS unit increases is

(a) Power (b) Surface tension

(c) Pressure (d) force

A. c, b, d, a

B. c, a, b,d

C. d, a, b, c

D. a, c, d, b

Answer: A

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160. Write the ascending order of the units of length given below .

(a) Fermi (b) Micron

(c) Angstrom (d) Nanometre

A. a, b, d, c

B. a, c, d, b

C. a, c, b, d

D. a, b,c , d

Answer: B

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161. Out of the following the correct order of dimensions of mass increases is

(A) Velocity (B) Power

(C) Graviational Constant

A. A, B, C

B. C , A , B

C. A, C , B

D. B , C , A

Answer: B

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162. The correct order in which the dimensions of time decreases in the following physical quantities

A) Power

B) Modulus of elasticity

C) Moment of inertia

D) Angular momentum

A. A, B, D , C

B. C, D , A , B

C. A , C , D , B

D. C , D, B , A

Answer: D

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163. The time period of a seconds pendululm is measured repeatedly for three times by two stop watches A, B . If the readings are as follows $(\mathrm{S.NO.}, A, B)(1, 2.01\mathrm{sec}, 2.56\mathrm{sec}), (2, 2.10\mathrm{sec}, 2.55\mathrm{sec}), (3, 1.98\mathrm{sec}, 2.57\mathrm{sec}$

A. A is more accurate but B is more precise

B. B is more accurate but A is more precise

C. A, B are equally precise

D. A, B are equally accurate

Answer: A

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164. (A) All zeros to the right of the last nonzero digit after the decimal point are significant.

(B) If the number is less thant one, all the zeros to the right of the decimal point but to the left of the first nonzero digit are not significant.

A. Only A is correct

B. A, B are correct

C. Only B is correct

D. A, B are wrong

Answer: B

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165. If the immediate insignificant digit to be dropped is 5 then there will be two different cases

(A If the preceding digit is even , it is to be unchanged and 5 is dropped.

(B) If the preceding digit is odd, it is to be raised by 1,

A. Only A is correct

B. A, B are correct

C. Only B is correct

D. A, B are wrong

Answer: B

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166. A) In multiplication or division, the final result should retain only that many significant figures as are there in the original number with the least number of significant figures.

B) In addition or subtraction the final result should retain only that many

decimal places as are there in the number with the least number of decimal places.

A. Only A is correct

B. A, B are correct

C. Only B is correct

D. A, B are wrong

Answer: B

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167. The correct order in which the dimensions of 'Length" increases in the following physical quantities is

A) Permittivity

B) Resistance

C) Magnetic permeability

D) Stress

A. a, b, d, c

B. d, c, b, a,

C. A , C , D , B

D. c,b,d,a

Answer: C

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168. (A) : Plane angle has unit but no dimensional formula

(B) : All dimension less quantities are unit less

A. Both A & B are tue

B. Both A & B are false

C. Only A is true

D. Only B is true

Answer: C

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169. Dimensional formulae are used

A) to convert one system of units into another

(B) to find proportionality constants

C) to cheak the correctness of an equation

A. Onily A & B are true

B. Only C is true

C. A & C are true

D. All the true

Answer: C

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170. (A) The correctness of an equation is verified using the principle of homogeneity

(B) All unit less quantities are dimensional less.

A. Both A &B are true

B. Both A & B are false

C. Only A is true

D. Only B is true

Answer: A

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171. .(A): The value of dimensionless constants or proportionality constants cannot be found by dimensional methods.

(b) : The equations containing trigonometrical, exponential and logarithmic functions cannot be analysed by dimensional methods.

A. Both A &B are true

B. Both A & B are false

C. Only A is true

D. Only B is true

Answer: A

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172. Which of the following is not a unit of time

A) par sec B) light year C) micron D) sec

A. Only A

B. A and B

C. A, B & C

D. A, B , C , D

Answer: C

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173. Which of the following is dimensionless

(a) Boltzmann constant (b) Planks constant

(c) Poissons ratio (d) Relative density

A. Both A & B

B. Both B &C

C. Both C & D

D. Both D &A

Answer: C

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174. For a body in a uniformly accelerated motion, the distance of the body from a reference point at time 't' is given by $x = at + bt^2 + c$, where a, b , c are constants. The dimensions of 'c' are the same as those of

$(A)x \quad (B)at \quad (C)bt^2 \quad (D)a^2/b$

A. A

B. A & B

C. A, B & C

D. A, B , C & D

Answer: D

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175. Three of the quantities defined below has the same dimensional formula. Identify the

i) $\sqrt{\text{Energy}/\text{mass}}$

ii) $\sqrt{\text{Pressure}/\text{density}}$

iii) $\sqrt{\text{force}/\text{linear density}}$

iv) $\sqrt{\text{Angular frequency}/\text{radius}}$

A. ii only

B. ii and iii only

C. iii only

D. I, ii and iii only

Answer: D

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176. If e, E_0, h and C respectively represents electronic change, permittively of free space, planks constant and speed of light then $\frac{e^2}{E_0 hC}$ has the dimensions of

A) angle B) relative density

C) strain D) current

A. angle

B. relative density

C. strain

D. current

Answer: C

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177. 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. Only A

B. B and D

C. A, B, C, D

D. A and D

Answer: B

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178. The displacement of a particle executing simple harmonic motion is given by $y = 4\sin(2t + \phi)$. The period of oscillation is

A. ii only

B. ii and ii only

C. iii only

D. iii and iv only

Answer: C

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179. Match the following :

List - 1	List - 2
(a)second	(e)carbon -12
(b)mole	(f)Platinum iridium
(c)Metre	$(g)Cs - 133$
(d) Kilogram	$(h)Kr - 86$

A. a - h b -f c - g d - e

B. a - g b - h c - e d - f

C. a - g b - e c - h d - f

D. a - f b - g c - e d - h

Answer: B

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180. Match the following :

List - 1	List - 2
(a)second	(e)carbon -12
(b)mole	(f)Platinum iridium
(c)Metre	$(g)Cs-133$
(d) Kilogram	$(h)Kr-86$

A. a - e b - g c - h d - f

B. a - f b - h c - g d - e

C. a - e b - f c - h d - g

D. a - g b - e c - h d - f

Answer: D

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List-I	List - 2
$(a) m^{-1}$	(e) Surface tension
$(b) Pa$	(f) Thermal capacity
$(c) Jk^{-1}$	(g) Rydberg constant
$(d) Jm^{-2}$	(h) Energy density

181.

A. a - h b- f c -e d-g

B. a - g b- h c -e d-f

C. a - g b- h c -f d-e

D. a - f b- e c -g d-h

Answer: C

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List-I	List-2
(a)Electron volt	$(e)746W$
(b)kWH	$(f)10^{-15}m$
(c)Horse power	$(g)36 \times 10^5 J$
$(d)Fermi$	$(h)1.6 \times 10^{-19} J$

182.

A. a - h b- g c -e d-f

B. a - h b- f c -g d-e

C. a - g b- h c -e d-f

D. a - h b- g c -f d-e

Answer: A

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List-I	List-2
(a)Pressure	$(e)ML^2T^{-2}I^{-1}$
(b)Latent heat	$(f)M^0L^0T^{-1}$
(c)Velocity gradient	$(g)ML^{-1}T^{-2}$
(d)Magnetic flux	$(h)M^0L^2T^{-2}$

183.

A. a - h b- f c -g d-e

B. a - g b- h c -e d-f

C. a - g b- h c -f d-e

D. a - f b- g c -e d-h

Answer: C

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184. Match the following :

List - 1	List - 2
(a)second	(e)carbon -12
(b)mole	(f)Platinum iridium
(c)Metre	$(g)Cs-133$
(d) Kilogram	$(h)Kr-86$

A. a - e b- g c -h d-f

B. a - f b- h c -g d-e

C. a - g b- f c -h d-e

D. a - g b- e c -h d-f

Answer: D

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185. h d G has the dimensions of (h = height , d = density , G = Gravitational constant)

A. a - g b- e c -h d-f

B. a - g b- h c -e d-f

C. a - e b- f c -g d-h

D. a - f b- e c -h d-g

Answer: A

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186. Some physical constants are given in List-1 and their dimensional formulae are given in List-2. Match the correct pairs in the lists

List-I	List-2
(a)Planck's constant	$(e)ML^{-1}T^{-2}$
(b)Gravitational constant	$(f)ML^{-1}T^{-1}$
(c)Bulk modulus	$(g)ML^{-2}T^{-1}$
(d)Coefficient of viscosity	$(h)M^{-1}L^{3}T^{-2}$

A. a - h b- g c -f d-e

B. a - f b- e c -g d-h

C. a - g b- f c -e d-h

D. a - g b- h c -e d-f

Answer: D

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187. Dimensional formula formula for thermal conductivity is (here K denotes the temperature) :

A. $L^{2}T^{-2}K^{-1}$

B. $L^{2}T^{2}$

C. $ML^{2}T^{1}L^{-1}$

D. $MLT^{-3}K^{-1}$

Answer: D

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Exercise 1 B

1. Gibbs-Helmoholtz equation relates the free energy change to the enthalpy and entropy changes of the process as

$(\Delta G)_{PT} = \Delta H - T\Delta S$

The magnitude of ΔH does not change much with the change in temperature but the energy factor $T\Delta S$ changes appreciably. Thus, spontaneity of a process depends very much on temperature.

The dissolution of $CaCl_2.6H_2O$ in a large volume of water is endothermic to the extent of $3.5 kcal mol^{-1}$. For the reaction. $CaCl_2(s) + 6H_2O(l) \rightarrow CaCl_2.6H_2O(s) \Delta His - 23.2 kcal$. The heat of solution of anhydrous $CaCI_2$ in large quantity of water will be

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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2. (A) : Increasing the number of observations minimizes random errors.

(R) : Positive and negative random errors occur with equal probability.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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3. A buffer solution can be obtained from

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: D

Watch Video Solution

4. The physical quantities not having same dimensions are

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

5. A dimensionless quantity

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

6. If you lok 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 seem to be stationary. Why?

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

7. A : PARSEC and light year, both measure time

R : Both have dimension of time.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

8. A : A unitless physical quantity must be dimensionless.

R : A pure number is always dimensionless.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

9. A : Absolut error is unitless and dimensionless.

R : All type of errors are unitless and dimensionless.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: D

Watch Video Solution

10. A : Higher is the accuracy of measurement, if instrument have smaller least count.

R : Smaller the percentage error, higher is the accuracy of measurement.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

11. A : The maximum possible error in a reading is taken as least count of the measuring instrument.

R : Error in a measurement cannot be greater than least count of the measuring instrument.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

Watch Video Solution

12. A : In a measurement, two readings obtained are 20.004 and 20.0004. The second measurement is more precise.

R : Measurement having more decimal places is more precise.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

13. A : Out of the measurements A = 20.00 and B = 20.000, B is more accurate.

R : Percentage error in B is less than the percentage error in A.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

14. A : All physically correct equations are dimensionally correct.

R : All dimensionally correct equations are physically correct.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

Watch Video Solution

15. A : Physical relations involving addition and subtraction cannot be derived by dimensional analysis.

R : Numerical constants cannot be deduced by the methos of dimensions.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

16. A : An exact number has infinite number of significant digits.

R : A number, which is not a measured value has infinite number of significant digits.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

17. A : A dimensionless quantity may have unit.

R : Two physical quantities having same dimensions, may have different units.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

18. If $Q = \frac{x^n}{y^m}$ and $\Delta x, \Delta y$ are absolute errors in the measurement of x and y then absolute error ΔQ in Q is

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

Watch Video Solution

19. State true or false:

A point has no dimensions.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: D

Watch Video Solution

20. Ampere second is a unit of

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

 Watch Video Solution

21. (A): The distance of a star from earth can be measured by parallax method.

(R): The change in position of an object due to change in the point of observation is called parallax.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

22. A unitless quantity

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

Watch Video Solution

23. A more accurate measure of biomass will be in terms of

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

24. (A): Systametic errors are due to a definite cause and can be minimised.

(R): Random errors are due to unknown reasons and can be completely eliminated .

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

Watch Video Solution

25. Statement-I : When an algebraic equation has been derived, it is advisable to check it for dimensional consistency.

Statement-II : This guarantee that the equation is correct.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

Watch Video Solution

26. (A): The order of accuracy of a measurement depends on the least count of the instrument.

(R): The smaller the least count, more number of significant figures are in the measured value.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: B

Watch Video Solution

27. (A): The method of dimensions cannot be used to obtain the dependence of work done by a force when the force is inclined to the direction of displacement.

(R): All trigonometric functions are dimensionless.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

28. (A) : Mass, Volume and time may be taken as fundamental quantities in a system.

(R) : Quantities which are independent of one another are called fundamental quantities.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

Watch Video Solution

Exercise 2

1. The density of mercury is $13.6gcm^{-3}$ in CGS system. Its density in SI system is :

A. 136 kg/M^3

B. $1360kg/m^3$

C. 13600 kg/m^3

D. $1.36kg/m^3$

Answer: C

Watch Video Solution

2. A force of 40N acts on a body. If the units of mass and length are doubled and the unit of time is tripled, then the force in the new system becomes

A. 90 N

B. 90 new units

C. $\frac{160}{9}$ new units

D. $\frac{160}{9}$ N

Answer: B

Watch Video Solution

3. If the unit of force were 10N, that of power were 1 MW and that of time were 1 millisecond then the unit of length would be

A. 1 m

B. 100 m

C. 10^3 m

D. 10^{-2} m

Answer: B

Watch Video Solution

4. If the unit of power is million erg/minute, the unit of force is 1000 dyne and the unit of length is 5/3 cm then the unit of time is (in second).

A. 10

B. 1

C. $1/10$

D. $1/100$

Answer: C

Watch Video Solution

5. If the unit of length is doubled, unit of time is halved and unit of force is quadrupled, the unit of power would change by the factor

A. $1/4$

B. 16

C. $1/16$

D. 8

Answer: B

Watch Video Solution

6. The density of a material in CGS system is $2g/cm^3$. In a system of units in which unit of length is 2 cm and unit of mass is 4 g what is the numerical value of the density of the material?

A. 4

B. 2

C. 1

D. 0.5

Answer: A

Watch Video Solution

7. In CGS system the magnitude of the force is 100 dynes. In another system where the fundamental phyical quamtities are kilogram , meter , and minute, find the magnitude of the force.

A. 0.036

B. 0.36

C. 3.6

D. 36

Answer: C

Watch Video Solution

8. The volume V of a liquid crossing through a tube is related to the area of cross-section A, velocity v and time t as $V\alpha A^a v^b t^c$ which of the following is correct (given $a \neq 1$)

A. $a \neq b \neq c$

B. $a = b = c$

C. $a \neq b = c$

D. $a = b \neq c$

Answer: C

Watch Video Solution

9. The critical velocity v of a body depends on the coefficient of viscosity η the density d and radius of the drop r. If K is a dimensionless constant then v is equal to

A. $\frac{K\eta d}{r}$

B. $\frac{Kd}{\eta r}$

C. $\frac{K\eta}{dr}$

D. $\frac{Kr}{\eta r}$

Answer: C

Watch Video Solution

10. If density (D), acceleration (a) and force (F) are taken as basic quantities, then Time period has dimensions

A. $\frac{1}{6}$ in F

B. $-\frac{1}{6}$ in D

C. $-\frac{2}{3}$ in a

D. All the above are true

Answer: D

Watch Video Solution

11. The critical angular velocity w of a cylinder inside another cylinder containing a liquid at which its turbulence occurs depends on viscosity η, density d and the distance x between the walls of the cylinders. Then w is proportional to

A. $\frac{\eta}{x^2 d}$

B. $\frac{\eta}{d^2 x}$

C. $\frac{\eta^2}{xd}$

D. $\frac{xd}{\eta}$

Answer: A

Watch Video Solution

12. A liquid drop of density ρ , radius r, and surface tension σ oscillates with time period T . Which of the following expressions for T^2 is correct?

A. $\rho r^3 / \sigma$

B. $\rho\sigma / r^3$

C. $r^3\sigma / \rho$

D. None

Answer: A

Watch Video Solution

13. The volume of a liquid (V) flowing per second through a cylindrical tube depends upon the pressure gradient (p/l) radius of the tube (r) coefficient of viscosity (η) of the liquid by dimensional method the correct formula is

A. $V\alpha\frac{Pr^4}{\eta l}$

B. $V\infty\frac{Pr}{\eta l^4}$

C. $V\infty\frac{Pl^4}{\eta r}$

D. None

Answer: A

Watch Video Solution

14. The dimensions of resistivity in terms of M, L, T and Q, where Q stands for the dimensions of charge is

A. $ML^3T^{-1}Q^{-2}$

B. $ML^3T^{-2}Q^{-1}$

C. $ML^2T^{-1}Q^{-1}$

D. $MLT^{-1}Q^{-1}$

Answer: A

Watch Video Solution

15. The distance travelled by a particle in n^{th} second is $S_n = u + \frac{a}{2}(2n-1)$ where u is the velocity and a is the acceleration. The equation is

A. dimensionally true

B. dimensionally false

C. numerically may be true or false

D. 1 and 3 are correct

Answer: A

Watch Video Solution

16. The position of a particle at time 't' is given by the equation : $X(t)\frac{V_0}{A}\left(1-e^{At}\right)$

V_0 = constant and A > 0

Dimensions of V_0 and A respectively are :

A. $M^0LT^0$and T^{-1}

B. $M^0LT^{-1}$and LT^{-2}

C. $M^0LT^{-1}$and T

D. M^0LT^{-1} and T^{-1}

Answer: D

Watch Video Solution

17. If J is the angular momentum and E is the kinetic energy, then $\frac{J^2}{E}$ has the dimensions of

A. Moment of Inertia

B. Power

C. Angular velocity

D. Impulse

Answer: A

Watch Video Solution

18. If L is the inductance, C is the capacitance and R is the resistance, then $R\sqrt{\frac{C}{L}}$. has the dimension

A. $MLT^{-2}I^{-2}$

B. ML^2T^2I

C. $ML^{-1}T^{-2}I^{-1}$

D. $M^0L^0T^0I^0$

Answer: D

Watch Video Solution

19. If h is Planck's constant and λ is the wave length, $\frac{h}{\lambda}$ has the dimensions of

A. Energy

B. Momentum

C. Moment of Inertia

D. Frequency

Answer: B

Watch Video Solution

20. Which of the following combinations of three different physical quantities P, Q, R can never be a meaningful quantity?

A. $PQ - R$

B. $\frac{PQ}{R}$

C. $\frac{P - Q}{R}$

D. $\frac{PR - Q^2}{QR}$

Answer: C

Watch Video Solution

21. Which of the following physical quantities represent the dimensions of $\frac{b}{a}$ in the relaction $P = \frac{x^2 - b}{at}$, where p is power x is distance and t is time

A. power

B. Energy

C. Torsional constant

D. Force

Answer: B

Watch Video Solution

22. The radius of a sphere is measured as $(10 \pm 0.02\,\%)$ cm. The error in the measurement of its volume is

A. 25.1 cc

B. 25.12cc

C. 2.5 cc

D. 251.2 cc

Answer: C

Watch Video Solution

23. If length and breadth of a plane are $(40 + 0.2)$ and (30 ± 0.1) cm, the absolute error in measurement of area is

A. $10cm^2$

B. $8cm^2$

C. $9cm^2$

D. $7cm^2$

Answer: A

Watch Video Solution

24. When 10 observation are taken the random error is x when 100 observation are taken the random error becomes

A. $x/10$

B. x^2

C. 10 x

D. $\sqrt{x}$

Answer: A

Watch Video Solution

25. The diameter of a wire as measured by a screw gauge was found to be 1.002 cm, 1.000 cm, 1.006 cm .The absolute error in the second reading is

A. 0.002 cm

B. $0.004cm$

C. $0.006cm$

D. $0.003cm$

Answer: D

Watch Video Solution

26. The percentage error in the measurement of mass and speed are 2% and 3% respectively. Maximum estimate of percentage error of K.E

A. 0.11

B. 0.08

C. 0.05

D. 0.01

Answer: B

Watch Video Solution

27. The error in the measurement of the length of a simple pendulum is $0.1\,\%$ and the error in the time period is $2\,\%$. What is the possible percentage of error in the physical quantity having the dimensional formula LT^{-2}?

A. $1.1\,\%$

B. 2.1%

C. 4.1%

D. 6.1%

Answer: C

Watch Video Solution

28. Two identical satellites are moving around the Earth in circular orbits at heights 3R and R respectively where R is the radius of the Earth. The ratio of their kinetic energies is x. Find x.

A. 2.8%

B. 0.5%

C. 1.4%

D. 3%

Answer: C

Watch Video Solution

29. If the length of a cylinder is measured to be 4.28 cm with an error of 0.01 cm. The percentage error in the measured length is nearly

A. 0.4%

B. 0.5%

C. 0.2%

D. 0.1%

Answer: C

Watch Video Solution

30. The side of a cube, as measured with a vernier calipers of least count 0.01 cm is 3.00 cm. The maximum possible error in the measurement of volume is

A. $\pm 0.01 cm^3$

B. $\pm 0.06 cm^3$

C. $\pm 0.0 cm^3$

D. $\pm 0.27 cm^3$

Answer: D

Watch Video Solution

31. If $L = (20 \pm 0.01)m$ and $B = (10 \pm 0.02)m$ then L/B is

A. $(2 \pm 0.03)m$

B. $(2 \pm 0.015)m$

C. $(2 \pm 0.01)m$

D. $(2 \pm 0.005)m$

Answer: D

Watch Video Solution

32. The volume of a sphere is $1.76m^3$ What will be the volume of 25 such spheres taking into account the significant figures.

A. $0.44 \times 10^2 cm^3$

B. $44.0cm^3$

C. $44cm^3$

D. $44.00cm^3$

Answer: B

Watch Video Solution

33. A body of mass m = 3.513 kg is moving along the x-axis with a speed of $5.00ms^{-1}$. The magnitude of its momentum is recorded as

A. $17.6kgms^{-1}$

B. $17.565kgms^{-1}$

C. $17.56 kgms^{-1}$

D. $17.57 kgms^{-1}$

Answer: A

Watch Video Solution

34. If $\vec{a}$ and $\vec{b}$ are two unit vectors and θ is the angle between them, then the unit vector along the angular bisector of $\vec{a}$ and $\vec{b}$ will be given by

A.

B.

C.

D.

Answer: C

Watch Video Solution

35. Two full turns of the circular scale of a screw gauge cover a distance of 1 mm on its main scale. The total number of division on the circular scale is 50. Further, it is found that the screw gauge has a zero error of -0.03 mm while measuring the diameter of a thin wire, a student notes the main scale reading of 3 mm and the number of circular scale division in line with the main scale as 35. The diameter of the wire is

A. 3.32 mm

B. 3.73 mm

C. 3.67 mm

D. 3.38 mm

Answer: D

Watch Video Solution

36. In a vernier callipers, n divisions of its main scale match with (n+1) divisions on its vernier scale. Each division of the main scale is a units. Using the vernier principle, calculate its least count.

A. $d/(m-1)$

B. d/(m+1)

C. d/m

D. md/(m+1)

Answer: B

Watch Video Solution

37. A Vernier callipers has $1mm$ marks on the main scale . It has 20 equal divisions on the vernier scale , which match with 16 main scale divisions . For this vernier callipers, the least count is

A. 0.02 mm

B. 0.05 mm

C. 0.1 mm

D. 0.2 mm

Answer: D

Watch Video Solution

38. A screw gauge gives the following reading when used to mesure the diametre of a wire.

Main scale reading : 0mm

Circular scale reading : 52 divisions

Given that 1mm on main scale corresponds to 100 divisions of the circular scale. the diameter of wire from the above data is :

A. 0.52 cm

B. 0.052 cm

C. 0.026 cm

D. 0.005 cm

Answer: B

Watch Video Solution

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

A. 0.01mm

B. 0.1 nm

C. 0.001 mm

D. 1 cm

Answer: A

Watch Video Solution

40. Time for 20 oscillations of a pendulum is measured as $t_1 = 39.6 \quad s, \quad t_2 = 39.9 \quad s$ and $t_3 = 39.5s.$ What is the precision in the measurements?

What is the accuracy of the measurement?

A. 0.1 sec

B. 0.01 sec

C. 1 sec

D. 2 sec

Answer: A

Watch Video Solution

41. The measured mass and volume of a body are 53.63 g and $5.8cm^3$ respectively, with possible errors of 0.01 g and 0.1 cm^3 . The maximum percentage error in density is about

A. $0.2\ \%$

B. 2%

C. 5%

D. 10%

Answer: B

Watch Video Solution

42. A Vernier callipers has $1mm$ marks on the main scale . It has 20 equal divisions on the vernier scale , which match with 16 main scale divisions . For this vernier callipers, the least count is

A. 0.02 mm

B. 0.05 mm

C. 0.1 mm

D. 0.2 mm

Answer: D

Watch Video Solution

43. Which of the following numbers has least number of significant figures?

A. 0.80760

B. 0.80200

C. 0.08076

D. 80.267

Answer: C

Watch Video Solution

44. The number of significant figures in 0.0006032 is

A. 7

B. 2

C. 5

D. 2

Answer: B

Watch Video Solution

45. The number of significant figures in 6.320 is

A. 4

B. 2

C. 3

D. 1

Answer: A

Watch Video Solution

46. The radius of a circle is 2.12 metre. Its area according to the rule of significant figures is

A. $4.5216cm^2$

B. $4.521cm^2$

C. $4.52cm^2$

D. $4.5cm^2$

Answer: D

Watch Video Solution

47. Epistasis and dominance are respectively

A. 5 and 6

B. 5 and 7

C. 2 and 7

D. 2 and 6

Answer: B

Watch Video Solution

48. The mass of a block is 87.2 g and its volume is $25cm^3$. What is its density up to correct significant figures?

A. $3.488gcm^{-3}$

B. $3.5gcm^{-3}$

C. $3.48gcm^{-3}$

D. $3.4gcm^{-3}$

Answer: B

Watch Video Solution

49. The length of a rod is measured by different instruments. Of the following the accurate result is

A. 500 mm

B. 500.00 mm

C. 500.0 mm

D. 0.5 m

Answer: B

Watch Video Solution

50. 2.34 is obtained by rounding of the number

A. 2.346

B. 2.355

C. 2.335

D. 2.334

Answer: C

Watch Video Solution

51. When 0.0003125 is reduced to 3 significant figures its value is

A. 0.00312

B. 3.125

C. 0.000312

D. 0.000313

Answer: C

Watch Video Solution

52. Gibbs-Helmoholtz equation relates the free energy change to the enthalpy and entropy changes of the process as

$(\Delta G)_{PT} = \Delta H - T\Delta S$

The magnitude of ΔH does not change much with the change in temperature but the energy factor $T\Delta S$ changes appreciably. Thus, spontaneity of a process depends very much on temperature.

A reaction has value of $\Delta H = 20kcal$ at $200K$, the reaction is spontaneous, below this temperature, it is not. the values ΔG and ΔS at $200K$ are, respectively

A. 15.78 cm

B. 15.7805 cm

C. 15.780 cm

D. 15.8 cm

Answer: D

Watch Video Solution

53. $9765 \div 14.39 = 678.59625$. This quotient on rounding off to two significant figures is

A. 680

B. 70

C. 678.6

D. 679

Answer: A

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54. The value of $124.2 - 52.487$ with due regard to significant places is

A. 71.7

B. 71.71

C. 72

D. 71

Answer: A

Watch Video Solution

55. The value of 42×0.041 with due regard to significant figures is

A. 1.722

B. 1.72

C. 1.7

D. 1.8

Answer: C

Watch Video Solution

56. $\sqrt{58.97}$=

A. 7.679

B. 7.68

C. 7.6

D. 7.7

Answer: A

Watch Video Solution

Exercise 3

1. The length of a rectangular plate is measured as 10 cm by a vernier scale of least count 0.01 cm and its breadth as 5 cm by the same scale. The percentage error in area is

A. 0.1%

B. 0.3%

C. 0.01%

D. 0.05%

Answer: B

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2. The length of a metallic sheet is measured as 10.0 cm using a metre scale of L.C. 0.1cm and its breadth is, measured as 1.00 cm using a vernier

callipers of L.C. 0.01 cm, the error in area is

A. $\pm 0.01 cm^2$

B. $\pm 0.1 cm^2$

C. $\pm 0.11 cm^2$

D. $\pm 0.2 cm^2$

Answer: D

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3. The mass of a beaker is (10.1 ± 0.1)g when empty and (17.3 ± 0.1)g when filled with a liquid. The mass of the liquid with possible limits of accuracy is

A. $(7.2 \pm 0.2) g$

B. (7.2 ± 0.1) g

C. $(7.1 \pm 0.2) g$

D. $(7.2 \pm 0.3)g$

Answer: A

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4. The measured mass the volume of a body are 2.42 and 4.7 cm^3 respectively with possible errors 0.01 g , and 0.1 cc. The find the maximum error in density.

A. $0.2\ \%$

B. $2\ \%$

C. $5\ \%$

D. $2.17\ \%$

Answer: D

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5. When two resistors of (600 ± 3) ohm and (300 ± 6) ohm are connected in parallel, value of the equivalent resistance is

A. $200 ohm \pm 1.5\ \%$

B. 200 ohm $\pm 3.5\ \%$

C. 200 ohm $\pm 9\ \%$

D. 200 ohm

Answer: A

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6. A parabolic wire as shown in the figure is located in x-y plane and carries a current I=10 amp. A unifrom magnetic field of intensity $2\sqrt{2T}$, making an angle of 45° with x-axis exists throughout the plane. If the coordinates of end point 'P' of wire are $(2m, 1.5m)$ then the total force acting on the wire is:

A. 1.49

B. 1.52

C. 1.51

D. 0.151

Answer: C

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7. Two resistors of 10KΩ and 20KΩ are conne cted in series. If tolerance of each resistor is 10% then tolerance of the combination will be

A. 0.05

B. 0.1

C. 0.15

D. 0.2

Answer: B

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8. Imagine a light planet revolving around a very massive star in a circular orbit of radius r with direction T. On what power of r, will the square of time period depends if the gravitational force of attraction between the planet and the star is proportional to $r^{-5/2}$.

A. 10

B. 20

C. 5

D. 80

Answer: C

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9. A man in a lift ascending with an upward acceleration a throws a ball vertically upwards with a velocity v with respect to himself and catches it

after t_1 seconds. After wards when the lift is descending with the same acceleration a acting downwards the man again throws the ball vertically upwards with the same velocity with respect to him and catches it after t_2 seconds?

A. remains the same

B. is four times

C. is halved

D. is reduced by a factor of 1/4

Answer: D

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10. While measuring the acceleration due to gravity by a simple pendulum, a student makes a positive error of 1% in the length of the pendulum and a negative error of 3% in the value and a of time period. His percentage error in the measurement of g by the relation $g = 4\pi^2(l/T^2)$ will be

A. 0.02

B. 0.04

C. 0.07

D. 0.1

Answer: C

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11. The value of escape speed from the surface of earth is

A. 0.02

B. 0.09

C. 0.03

D. 0.12

Answer: B

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12. In the measurement of volume of solid sphere using the formula $V = \frac{4}{3}\pi r^3$ if the error committed in the measurement of the radius r is 2%, the percentage error in the volume measurement is

A. 0.03

B. $1.5\ \%$

C. $4.5\ \%$

D. $6\ \%$

Answer: C

Watch Video Solution

13. A uniform round object of mass M, radius R and moment of inertia about its centre of mass I_{cm} has a light, thin string wrapped several times around its circumference. The free end of string is attaced to the celling

and the object is released from rest. Find the acceleration of centre of the object and tension n the string. [Take $\frac{I_{cm}}{MR^2} = k$]

A. 0.34 ± 0.01 cm

B. 0.34 ± 0.02 cm

C. 0.34 ± 0.04 cm

D. 0.17 ± 0.01 cm

Answer: D

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14. Resistance of a given wire is obtained by measuring the current flowing in it and the voltage difference applied across it. If the percentage errors in the measurement of the current and the voltage difference are 3% each, then error in the value of resistance of the wire is

A. zero

B. $1\ \%$

C. 3%

D. 6%

Answer: D

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15. In an experiment the valno of refractive index of glass was found to be 1.54, 1.53, 1.44,1.54, 1.56 and 1.45 m in successive measurement. Calculate (i) the mean vlaue of refractive index (ii) absolute error of each measurement (iii) mean absolute error (iv) relative error and (v) percentage error.

A. $0.04, 4\%$

B. $0.03, 3\%$

C. $0.02, 2\%$

D. $0.02, 2\%$

Answer: B

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16. A physical quantity is represented by $X = M^a L^b T^{-c}$.If the percentage error in the measurement of M,L and T are $\alpha\,\%$, $\beta\,\%$ and $\gamma\,\%$ to respectively, what is the total percentage error in X?

A. $(a\alpha + b\beta - c\gamma)\,\%$

B. $(2a\alpha + b\beta + 3c\gamma)\,\%$

C. $(a\alpha - b\beta + c\gamma)\,\%$

D. $(a\alpha - b\beta - c\gamma)\,\%$

Answer: B

Watch Video Solution

17. In a simple pendulum experiment, length is measured as 31.4 cm with an accuracy of Imm. The time for 100 oscillations of pendulum is 112.0s with an accuracy of 0.1s. The percentage accuracy in g is

A. 1

B. 1.2

C. 1.8

D. 2.1

Answer: D

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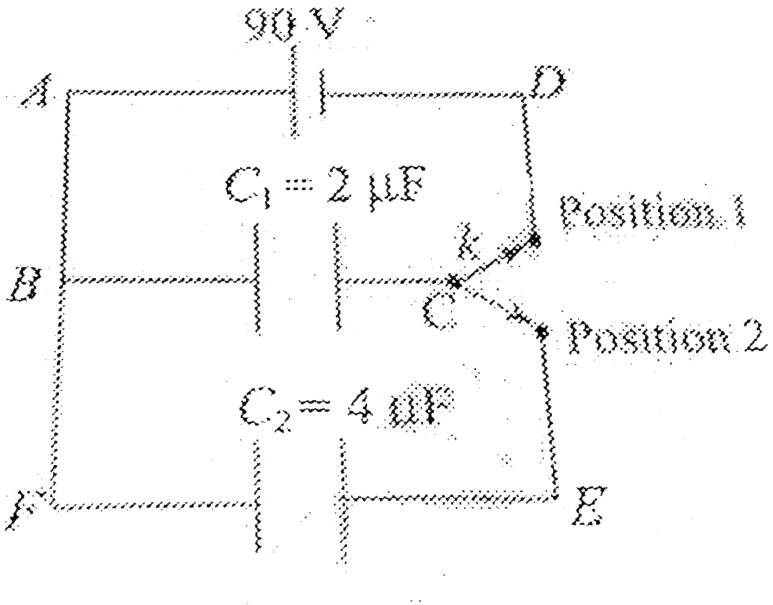
18. Figure shows two capacitors of capacitance $2\mu F$ and $4\mu F$ and a cell of 90 V. The switch 'k' is such that when it is in position 1, the circuit ABCD is closed and when it is in position 2, the circuit BCEF is closed.the resistance of both the circuits is negligible os that the capacitor gets fully charged instantly. Initially the switch is in position1. then it is turned in position 2 and then in position 1. Now two cycles are completed. Find the

charge $(\text{in}\mu C)$ after two cycles.



A. $(2 \pm 0.13)\mu$ F

B. $(9 \pm 0.18)\mu$ F

C. $(2 \pm 0.09)\mu F$

D. $(9 \pm 0.09)\mu$ F

Answer: B

Watch Video Solution

19. In an experiment the valno of refractive index of glass was found to be 1.54, 1.53, 1.44,1.54, 1.56 and 1.45 m in successive measurement. Calculate (i) the mean vlaue of refractive index (ii) absolute error of each measurement (iii) mean absolute error (iv) relative error and (v) percentage error.

A. $1.51, 0.04, 0.03, 3\ \%$

B. $1.51, 0.4, 0.03, 3\ \%$

C. $15.1, 0.04, 0.03\ \%\ , 3\ \%$

D. $15.1, 0.04, 0.3, 3\ \%$

Answer: A

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20. A rectangular metal slab of mass 33.333 g has its length 8.0 cm, breadth 5.0 cm and thickness 1mm. The mass is measured with accuracy up to 1 mg with a senstitive balance. The length and breadth are

measured with a vernier calipers having a least count of 0.01 cm. The thickness is measured with a screwgauge of least count 0.01 mm. Calculate the percentage accuracy in density from above measurements.

A. 0.13

B. 1.3

C. $1.3\,\%$

D. 0.16

Answer: C

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21. The distance covered by a body in time (30.0 ± 0.4)m is (6.0 ± 0.6)s. Calculate the speed of the body. The percentage error in the speed is

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22. The measured mass and volume of a body are 53.63 g and $5.8cm^3$ respectively, with possible errors of 0.01 g and 0.1 cm^3. The maximum percentage error in density is about

A. $0.2\,\%$

B. $2\,\%$

C. $5\,\%$

D. $10\,\%$

Answer: B

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23. A student performs an experiment for determination of $g = \frac{4\pi^2 l}{T^2} l \approx 1m$ and the commits an error of "Deltal' For T he takes the time of n osciilations with the stop watch of least count Δt For which of the following data the measurement of g will be most accurate ?

(a) $\Delta L = 0.5\Delta L = 0.1, n = 20$

(B) $\Delta L = 0.5 \Delta t = 0.1, n = 50$

(C) $\Delta L = 0.5, \Delta t = 0.02 n = 20$ (D) $\Delta L = 0.1 \Delta t = 0.05 n = 50$.

A. $\Delta = 0.5, \Delta T = 0.1, n = 20$

B. $\Delta L = 0.5, \Delta T = 0.1, n = 50$

C. $\Delta L = 0.5, \Delta T = 0.01, n = 20$

D. $\Delta L = 0.5, \Delta T = 0.05, n = 20$

Answer: D

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24. An experiment is performed to obtain the value of acceleration due to gravity g by using a simple pendulum of length L. In this experiment time for 100 oscillations is measured by using a watch of 1 second least count and the value is 90.0 seconds. The length L is measured by using a meter scale of least count 1 mm and the value is 20.0 cm. The error in the determination of g would be:

A. 1.7%

B. 4.4%

C. 2.7%

D. 2.27%

Answer: C

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25. A student measured the diameter of a wire using a screw gauge with least count 0.001 cm and listed the measurements. The correct measurement is -

A. 5.320 cm

B. 5.3 cm

C. 5.32 cm

D. 5.3200 cm

Answer: A

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26. A physical quantity P is related to four observably a,b,c and d as follows $P = a^3 b^3 / c^{1/2}$ d. 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 P calculated using the above relation turns out to be 3.763, to what value should you round off the result?

A. 13%, 3.763

B. 13%, 3.76

C. 13%, 3.8

D. 15%, 3.76

Answer: C

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27. The radius of a sphere is 6.01 cm. Its volume to four significant figures is

A. $909.7cm^3$

B. $909cm^3$

C. $916cm^3$

D. $909.67cm^3$

Answer: A

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28. The length of a rod is 22.4 m out of it 2.543m is cut out. The remaining length of the rod according to the idea of significant figures is

A. 19.8 m

B. 19.9m

C. 20.0 mn

D. 19.86 m

Answer: B

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29. The value of 117.4×0.0025 is

A. 0.2935

B. 0.294

C. 0.3

D. 0.29

Answer: D

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30. The sum of the given two numbers with regard to significant figures is $\left(5.0 \times 10^{-8}\right) + \left(4.5 \times 10^{-6}\right)$ =

A. $4.55x10^{-6}$

B. 4.5×10^{-6}

C. 4.6×10^{-6}

D. 4×10^{-6}

Answer: C

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31. Find the product of 1.2, 2.54 and 3.257 with due regard to significant figures.

A. 9.934

B. 9.93

C. 9.9

D. 9.9346

Answer: C

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32. A stick has a length of 12.132 cm and another stick has a length of 12.4 cm.

If the two sticks are placed side by side, what is the difference in their lengths ?

A. 2.02 cm

B. 2.0 cm

C. 2 cm

D. 2.055 cm

Answer: B

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33. The length of a rectangular sheet is $1.5cm$ and breadth is $1.023cm$. Find the area of the face of a rectangular sheet to the correct number of significant figures.

A. $1.8045cm^2$

B. $1.804cm^2$

C. $1.805cm^2$

D. $1.8cm^2$

Answer: D

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34. The numbers $2.745 \text{ and } 2.735$ 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: D

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35. One metre how many light years

A. 1.057×10^{-15} ly

B. 1.05×10^{-16} ly

C. 1.05×10^{-14} ly

D. 1.057×10^{-17} ly

Answer: B

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36. The power of a motor is 200W. If the unit of length is halved, that of mass is doubled and that of time is aiso doubled, then the power of the motor in the new system is

A. 3200 W

B. 3200 new units

C. 12.5 new units

D. 12.5 W

Answer: B

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37. In CGS system the magnitude of the force is 100 dynes. In another system where the fundamental phyical quamtities are kilogram , meter , and minute, find the magnitude of the force.

A. 0.036

B. 0.36

C. 3.6

D. 36

Answer: C

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38. The calorie is a unit of heat or energy and it equals about 4.2 J where $1J = 1kgm^2s^{-2}$. Suppose we employ a system of units in which the unit of mass equals α kg, the unit of length equals β m and the unit of time is γ s. Show that the calorie has a magnitude of $4.2\alpha^{-1}\beta^{-2}\gamma^2$ in terms of the new units.

A. $4.2\alpha^2\beta^2\gamma^2$ new unis

B. $4.2\alpha^{-1}\beta^{-2}\gamma^2$ new units

C. $\alpha^{-1}\beta^{-2}\gamma^2$ new units

D. $\frac{1}{4.2}\alpha^{-1}\beta^{-2}\gamma^2$ new units

Answer: B

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39. If the mass of the electron $\left(9 \times 10^{-31}\right.$ kg) is taken as unit of mass, the radius of the first Bohr orbit $\left(0.5 \times 10^{-10}\right.$m) as unit of length and 500 newton as the unit of force, then the unit of time in the new system would be

A. 3×10^{-22} s

B. 15×10^{-12} s

C. 15×10^{-20} s

D. 45×10^{-20} s

Answer: A

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40. If pressure P, velocity of light c and acceleration due to gravity g are chosen as fundamental units, then dimensional formula of mass is

A. Pc^3g^{-4}

B. $Pc^{-4}g^3$

C. Pc^4g^{-3}

D. Pc^4g^3

Answer: C

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41. If young's modulus y, surface tension s and time T are the fundamental quantities then the dimensional formula of density is

A. $s^2y^3t^{-2}$

B. $s^3y^3T^{-2}$

C. $s^{-2}y^3T^2$

D. $s^{-2}y^2T^3$

Answer: C

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42. Dimcnsional analysis of the relation (Energy) = $(\text{Pressure difference})^{3/2}(\text{Volume})^{3/2}$ gives the value of n as

A. 3

B. 2

C. $3/2$

D. $1/2$

Answer: C

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43. If P represents radiation pressure, C speed of light, and Q radiation energy striking unit area per second and x,y,z are non zero integers, then P^x Q^y C^z is dimensionless. The values of X,y and z are respectively

A. 1,1,-1

B. 1,-1,1

C. -1,1,1

D. 1,1,1

Answer: B

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44. If the time period $(T)$of vibration of a liquid drop depends on surface tension (S) , radius(r) of the drop , and density (ρ) of the liquid , then find the expression of T.

A. $T = K\frac{\sqrt{\rho r^3}}{S}$

B. $T = K\frac{\sqrt{\rho^{1/2}r^3}}{S}$

C. $T = K\frac{\sqrt{\rho r^3}}{S^{1/2}}$

D. $T = K\sqrt{\frac{\rho^{1/2}r^3}{S}}$

Answer: C

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45. Suppose, the torque acting on a body, is given by $\tau = KL + \frac{MI}{\omega}$

Where L = angular momentum, I = moment of inertia & ω= angular speed

What is the dimensional formula for K & M?

A. time^2

B. time^4

C. time^4

D. time^{-4}

Answer: D

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46. A force F is given by $F = at + bt^2$, where t is time. The dimensions of a and b are

A. MLT^{-3} and ML^2T^4

B. MLT^{-3} and MLT^{-4}

C. MLT^{-1} and MLT^0

D. MLT^{-4} and MLT^1

Answer: B

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47. The number of particles crossing a unit area perpendicular to the $x - a\xi s$ in a unit time is given by $n = -D\left(\frac{n_2 - n_1}{x_2 - x_1}\right)$, where n_1 and n_2 are the number of particles per unit volume at

$x = x_1$ and x_2 , respectively , and D is the diffusion constant. The dimensions of D are

A. $M^\circ LT^3$

B. $M^\circ L^2T^{-4}$

C. M^0LT^{-2}

D. $M^0L^2T^{-1}$

Answer: D

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48. Turpentine oil is flowing through a tube of length L and radius r. The pressure difference between the two ends of the tube is p , the viscosity of the coil is given by $\eta = \frac{p(r^2 - x^2)}{4vL}$, where v is the velocity of oil at a distance x from the axis of the tube. From this relation, the dimensions of viscosity η are

A. $[ML^{-1}T^{-1}]$

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

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

D. $\left[M^0L^0T^0\right]$

Answer: A

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49. The dimensional formula of the product of two physical quantities P and Q is ML^2T^{-2}. The dimensional formula of P/Q is ML^0T^{-2}. Then what are the units of physical quantities P and Q.

A. Force, velocity

B. Momentum, displacement

C. Force, displacement

D. Work, velocity

Answer: C

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50. The potential energy of a particle varies with distance x from a fixed origin as $V = \frac{A\sqrt{X}}{X+B}$ where A and B are constants . The dimension of AB are

A. $M^1L^{5/2}T^{-2}$

B. $M^1L^2T^{-2}$

C. $M^{3/2}L^{5/2}T^{-2}$

D. $M^1L^{7/2}T^{-2}$

Answer: D

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51. If the displacement y of a particle is y = A sin (pt + qx), then

A. the dimensions of p are $M^\circ L^\circ T$

B. the dimensions of q are $M^{\circ}LT^{\circ}$

C. the dimensions of p/q are $M^{\circ}LT^{-1}$

D. the dimensions of pq are $M^{\circ}LT^{-1}$

Answer: C

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52. If the displacement y of a particle is y =A sin (pt+qx) then dimensional formula of pq is

A. L

B. LT^{-1}

C. T^{-1}

D. $L^{-1}T^{-1}$

Answer: C

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53. The vander waal's equation for a gas is $\left(p+\frac{a}{V^2}\right)(V-b)=nRT$ where p, V, R, T and n represent the Pressure, Volume, universal gas constant, absolute temperature and number of moles of a gas respectively, where a and b are constants. The ratio $\frac{b}{a}$ will have the following dimensional formula

A. $M^{-1}L^{-2}T^2$

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

C. ML^2T^2

D. MLT^{-2}

Answer: A

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54. If h is the Planck's constant, m = mass of the electron, e = charge of the electron and $\in_0$ = permittivity of vacuum, then $\frac{h^2\in_0}{me^2}$ has the unit

A. newton

B. joule

C. watt

D. metre

Answer: D

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55. A circular railway track of radius r is banked at angle θ so that a train moving with speed v can safely go round the track. A student writes: $\tan\theta = rg/v^2$. Why this relation is not correct?

(i) Equality of dimensions does not guarantee correctness of the relation .

(ii) Dimensionally correct relation may not be numerically correct.

iii) The relation is dimensionally incorrect.

A. (i)& (ii)

B. (ii) & (iii)

C. (iii) & (i)

D. (i) , (ii) & (iii)

Answer: A

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56. The parameter $\frac{mQ^4}{\varepsilon_0^2 h^2}$ has the dimensions of (m = mass Q = charge $\in_0$ = Permittivity and h = Planck's constant)

A. Wavelength

B. Power

C. Angular momentum

D. Energy

Answer: D

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57. The dimesions of $\frac{1}{2}\varepsilon_0 E^2$ (ε_0 is the permittivity of the space and E is electric field),is

A. ML^2T^{-2}

B. MLT^{-2}

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

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

Answer: C

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58. If M is the magnetic moment, B is the magnetic induction and T is the time then MBT^2 has the dimensions of

A. Intensity of magnetization

B. Intensity of magnetic field

C. Moment of Inertia

D. Magnetic permeability

Answer: C

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59. A quantity X is given by $\varepsilon_0 L \frac{\Delta V}{\Delta T}$ where ε_0 is the permittivity of the free space, L is a length ΔV is a potential difference nad Δt is a time interval. The dimensional formula for X is the same as that of

A. resistance

B. charge

C. voltage

D. current

Answer: D

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60. In the relation: $P = \frac{\alpha}{\beta} e^{-\frac{\alpha Z}{k\theta}}$, P is pressure Z is distance k is Boltzmann constant and θ is the temperature. The dimensional formula of β will be

A. $M^{\circ} L^{\circ} T^{\circ}$

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

C. $M^{\circ} L^{2} T^{\circ}$

D. $M^{-1} L^{1} T^{2}$

Answer: C

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61. The length of a pendulum is measuredas 1,01 m and time for 30 oscillation is measured as one minute 3 s. Error length is 0.01 m and error in the 3 s. The percentage error in the measurement of acceleration due to gravity id,

A. 1

B. 5

C. 10

D. 15

Answer: C

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62. Resistance of a given wire is obtained by measuring the current flowing in it and the voltage difference applied across it. If the percentage errors in the measurement of the current and the voltage difference are 3% each, then error in the value of resistance of the wire is

A. zero

B. 0.01

C. 0.03

D. 0.06

Answer: D

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63. In the equation $\left(\frac{1}{p\beta}\right) = \frac{y}{k_B T}$, where p is the pressure, y is the distance, k_B is Boltzmann constant and T is the tempreture. Dimensions of β are

A. $M^{-1}L^{1}T^{2}$

B. $M^{0}L^{2}T^{0}$

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

D. $M^{\circ}L^{\circ}T^{\circ}$

Answer: B

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64. If the time period t of the oscillation of a drop of liquid of density d, radius r, vibrating under surface tension s is given by the formula $t = \sqrt{r^{2b}s^{c}d^{a/2}}$. It is observed that the time period is directly proportional to $\sqrt{\frac{d}{s}}$. The value of b should therefore be :

A. $3/4$

B. $\sqrt{3}$

C. $3/2$

D. $2/3$

Answer: C

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65. A student measures the thickness of a human hair using a microscope of magnification 100. He makes 20 observations and find that the average thickness (as viewed in the microscope) is 3.5 mm. What is the estimate of the thickness of hair?

A. $0.5cm$

B. 0.035 cm

C. 0.035 mm

D. 3.5 cm

Answer: C

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

A. $\frac{1}{c}G\frac{e^2}{4\pi\in_0}$

B. $\frac{1}{c^2}\left[G\frac{e^2}{4\pi\in_0}\right]^{1/2}$

C. $c^2\left[G\frac{e^2}{4\pi\in_0}\right]^{1/2}$

D. $\frac{1}{c^2}\left[\frac{e^2}{G4\pi\in_0}\right]^{1/2}$

Answer: B

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