PHYSICS

BOOKS - MAXIMUM PUBLICATION

UNITS AND MEASUREMENTS

Example

1. find the significant figure 263.25

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2. Find the significant figures in 2.05

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3. Find the significant figures in 302.005

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4. Find the significant figures in 2000145

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5. Find the significant figures in 0.002308

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6. Find the significant figures in 0.000135

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7. Find the significant figures in 12300

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8. Find the significant figures in 60700

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9. Find the significant figures in 3.500

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10. Find the significant figures in 0.06900

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11. Find the significant figures in 4.7000

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12. Check the correctness of the following equation by the method of dimensions. $s = ut + \frac{1}{2}at^2$

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13. Deduce an expression for the period of oscillation of a simple pendulum.

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14. Find the number of dynes in one Newton.

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Exercise

1. How many seconds are there in a light fermi?

A. a) 10^{-15}

B. b) 3.0×10^{8}

C. c) 3.33×10^{-24}

D. d) 3.3×10^{-7}

Answer: C

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2. Which of the following pairs have same dimentional formula for both the quantities?

$1)$Kinetic energy and torque $2)$ Resistance and inductance

$3)$ Young's modulus and pressure

A. a) (1)only

B. b) (2) only

C. c) $(1)$and (3) only

D. d) All of three

Answer: C

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3. Give the names of four dimensionless physical quantities.

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4. The dimensions of plank constant are the same as that of

.....

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5. A physical quantity $P = \frac{\sqrt{abc^2}}{d^3}$ is determined by measuring a,b,c and d seperately with the percentage error of 2%, 3%, 2% and 1% respectively. Minimum amount of error is contributed by the measurement of

A. a) b

B. b) a

C. c) d

D. d) c

Answer: B

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6. The number of significant figures in 11.118×10^{-6} is

A. a) 3

B. b) 6

C. c) 5

D. d) 4

Answer: C

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7. What is the number of significant figures in 0.06070?

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8. If $f = x^2$, What is the relative error in f?

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9. Which is the following measurement is more accurate?

A. $7000m$

B. $70 \times 10^2 m$

C. $7 \times 10^3 m$

D.

Answer: A

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10. Which of the following measurements is most accurate?

A. a) $5.0cm$

B. b) $0.005cm$

C. c) $5.00cm$

D.

Answer:

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11. Name three physical quantities having same dimension.

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12. Use your definition to explain how simple harmonic motion can be represented by the equation $y = a \sin \omega t$

Show that the above equation is dimensionally correct

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13. The curved surface area of a solid cylinder of radius $2cm$ and height $20cm$ is .....m^2 (Write answer in 3 significant digits)

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14. Fill in the blanks. 1m= .....ly

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15. Give a physical quantity with a unit and no dimension.

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16. Arrange the following in the descending order. 1light year, 1par sec, 1 astronomical unit.

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17. Magnitude of force F experienced by a certain object moving with speed V is given by $F = KV^2$. Where K is a constant. Find the dimensions of K.

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18. What is the maximum percentage error in the measurement of kinetic energy if percentage errors in mass and speed are $2\,\%$ and $3\,\%$ respectively?

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19. Solve the following with regard to significant figures.

$5.8 + 0.125$

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20. Solve the following with regard to significant figures.

$3.9 \times 10^5 - 2.5 \times 10^4$

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21. What is maximum fractional error in $(a+b)$

Given Δ a and Δb are absolute errors in measurements a and b.

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22. What is maximum fractional error in $a-b$

Given Δ a and Δb are absolute errors in measurements a and b.

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23. What is maximum fractional error in ab

Given Δ a and Δb are absolute errors in measurements a

and b.

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24. What is maximum fractional error in $\frac{a}{b}$

Given Δ a and Δb are absolute errors in measurements a and b.

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25. What is the maximum fractional error in a^n? (Given absolute error in a is Δa)

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26. What is absolute error in the measurement according to least count? $3.0kg$

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27. What is absolute error in the measurement according to least count? $25s$

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28. What is absolute error in the measurement according to least count? $5.62cm$

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29. A stone is thrown upwards from the ground with a velocity u. What is the maximum height attained by the stone?

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30. A stone is thrown upwards from the ground with a velocity u. What is the maximum height attained by the ball? Check the correctness of the equation thus obtained using the method of dimensional analysis.

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31. Derive an empirical relationship for the force experienced on the car in terms of mass of the car m,

velocity v, and radius of the track r using dimensional analysis.

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32. What is the dimensional formula of coefficient of viscosity?

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33. Write any two drawbacks of dimensional analysis.

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34. Principle of homogeneity is based on the fact that two quantities of same nature can be added. What do you mean by principal of homogeneity?

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35. Principle of homogeneity is based on the fact that two quantities of same nature can be added. Velocity V depends on the time t as $V = at^2 + bt + c$. find dimension of constants a, b, and c.

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36. if $x = a + bt + ct^2$ where x is in metre and t in second. if error in the measurement of time is 2%. what will be the error in x?

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37. Rahul measure the height of Ramesh in different trials as $1.67m$, 1.65m, 1.64m, and 1.63m`. find the mean absolute error?

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38. Rahul measure the height of Ramesh in different trials as $1.67m$, 1.65m, 1.64m, and 1.63m`. find the percentage

error?

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39. in a particular experiment Ramu use the relation $F = AB + (P + Q)Y$ to calculate force. which principle is used to check the correctness of the equation.

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40. in a particular experiment Ramu use the relation $F = AB + (P + Q)Y$ to calculate force. in the dimensional formula of Y is `M^0L^1T^(-1). then find the dimensional formula of P.

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41. Which of the following is the most precise device for measuring length ? (a) a vernier calliper with 20 divisions on the sliding scale, coinciding with 19 main scale divisions (b) a screw gauge of pitch 1mm and 100 divisions on the circular scale (c) an optical instrument that can measure length to within a wavelength of light.

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42. is it possible to increase the accuracy of screw gauge by increasing the number of divisions on the head scale?

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43. in an experiment with a common balance the mass of a ring found to be 2.52g, 2.5g, 2.51g, 2.49g and 2.54g in successive measurements. calculate the mean value of the mass of the ring.

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44. in an experiment with a common balance the mass of a ring found to be 2.52g, 2.5g, 2.51g, 2.49g and 2.54g in successive measurements. calculate the absolute error in each measurement.

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45. In the experiment with common balance the mass of a body is found to $2.52g$, $2.53g$, $2.51g$, $2.49g$ and $2.54g$ in successive measurement. Calculate relative error and relative percentage error.

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46. while discussing the period of a pendulum one of the student argued that period depends on the mass of the bob. what is your opinion?

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47. while discussing the period of a pendulum one of the student argued that period depends on the mass of the bob. how will you prove your argument dimensionally?

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48. in an experiment with a common balance the mass of a ring found to be 2.52g, 2.5g, 2.51g, 2.49g and 2.54g in successive measurements. calculate the mean value of the mass of the ring.

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49. in an experiment with a common balance the mass of a ring found to be 2.52g, 2.5g, 2.51g, 2.49g and 2.54g in successive measurements. calculate the absolute error in each measurement.

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50. in an experiment with a common balance the mass of a ring found to be 2.52g, 2.5g, 2.51g, 2.49g and 2.54g in successive measurements. calculate the absolute error in each measurement.

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51. The volume of a cube of side 1 cm is equal to .....m^3.

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

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53. Fill in the blanks: A vehicles moving with speed of $18kmh^{-1}$ covers _____m in 1s.

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54. Fill in blanks: the relative density of lead is 11.3. its density is _____ g cm^{-3} or _____ kgm^{-3}.

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

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56. Fill in the blanks by suitable conversion of units: $1m =$_ _ ly

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

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58. fill in the blanks by suitable conversion of units: $G = 6.67 \times 10^{-11} Nm^2(kg)^{-2} = \ldots\ldots\ldots\ldots\ldots (cm)^3 s^{-2} g^{-1}$

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59. a calorie is a unit of heat or energy and it equals about 4.2J, where $1J = 1kgm^2s^{-2}$. suppose we employ a system of units in which the unit of mass equals αkg, the unit of length equals β meter, the unit of time is second. show that

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

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60. Which of the following is the most precise device for measuring length - An optical instrument, a vernier calliper, or a screw gauge?

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61. state the number of significant figures in $0.007m^{2}$

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62. state the number of significant figure? $2.64 \times 10^{24} kg$

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63. state the number of significant figure? $0.2370 gcm^{-3}$

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64. state the number of significant figure? $6.320 J$

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65. state the number of significant figure? $6.032 Nm^{-2}$

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66. state the number of significant figure? $0.0006032m^2$

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67. The length breadth and thickness of a rectangular sheet of metal are $4.234m$, $1.005m$ and $2.01cm$ respectively. give the area and volume of the sheet to correct significant figures.

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

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

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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69. A famous relation in physics relates 'moving mass' m to the 'rest mass' m_0 of a particle in terms of its speed v and the speed of light c. (This relation first arose as a consequence of special relativity due to Albert Einstein). Boy recalls the relation almost correctly but forgets where to put the constant c. He writes:

$$\frac{m_0}{(1-v^2)^{\frac{1}{2}}}$$

Guess where to put the missing c.

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70. Mechanical power is represented by $P = Fv + Av^3p$ where, F is the force ,v is the velocity, A is the area and rho is the density.

The dimensional formula of power is .....

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71. Mechanical power is represented by $P = Fv + Av^3p$ where, F is the force ,v is the velocity, A is the area and rho

is the density.

Check the dimensional validity of the above equation.

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72. Which of the following equations can't be obtained by the dimensional method? (k is a constant)

A. $T = k\sqrt{\frac{l}{g}}$

B. $E = kmv^2$

C. $P = hpg$

D. $N = N(o)e^{-\lambda t}$

Answer: D

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73. Give examples for the following: A dimensionless, unitless physical quantity.

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74. Give examples for the following: A dimensionless physical quantity but having unit in SI system.

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75. Give examples for the following: Two physical quantities which have the same dimensions.

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76. A company manufacturing PVC pipes claims in an advertisement that the volume of water flowing out through the pipe in a given time is as per the equation $V = KA^2ut$ where A is the area of cross section of the pipe, u is the speed of flow, t is the time and K is a dimensionless constant.

Name the principle that can be used to check the dimensional correctness of this equation.

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77. A company manufacturing PVC pipes claims in an advertisement that the volume of water flowing out through the pipe in a given time is as per the equation

$V = KA^2ut$ where A is the area of cross section of the pipe, u is the speed of flow, t is the time and K is a dimensionless constant.

Check the equation and state whether the claimis correct.

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78. A student was asked to write the equation for displacement at any instant in a simple harmonic motion of amplitude'a'. He wrote the equation as

$$y = a\sin\left(\frac{2\pi vt}{k}\right)$$

Where 'v' is the velocity at instant 't'. For the equation to be dimensionally correct. what should be the dimensions of k?

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79. What is the area of a square of side $1.4cm$ in proper significant figures?

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80. To measure distance we use different units. Which of the following is the largest unit of length?

A. Kilometer

B. Astronomical unit

C. Light year

D. Parsec

Answer: D

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81. Which of the following measurment is more accurate? Why?

A. $500.00kg$

B. $0.0005kg$

C. $6.00kg$

D.

Answer: A

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82. All Physical quantities can be expressed in terms of dimension.

Write the physical quantities of the following dimensions: $\left[M^1L^1T^{-1}\right]$

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83. All Physical quantities can be expressed in terms of dimension.

Write the physical quantities of the following dimensions: $\left[M^1L^2T^{-2}\right]$

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84. Check whether the equation

$T = 2\pi\sqrt{\frac{m}{g}}$ is dimensionally correct.Where T is the Time period of a simple pendulum , m is the mass of the bob and g is the acceleration due to gravity

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85. Which measurement is most precise?

Vernier Callipers having 5 divisions on sliding scale, or Vernier Callipers having 10 divisions on sliding scale.

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86. Which measurement is most precise?

Vernier Callipers having 10 divisions on sliding scale or Vernier Callipers having 20 divisions on sliding scale.

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87. Which measurement is most precise?

Vernier Callipers having 20 divisions on sliding scale, or Vernier Callipers having 25 divisions on sliding scale.

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88. What happens to the accuracy when the least count is decreased?

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89. A boy recalls the relativistic mass wrongly as $m = \frac{m_0}{\sqrt{1 - V^2}}$

Using dimensional method put the missing 'C' at proper place.

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90. Pick out the fundamental unit from the following:

A. Second

B. m/s

C. Newton

D. Joule

Answer:

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91. Velocity of sound depends on density (rho) and modulus of elasticity (E). (The dimensional formula of E is $\left(MI^{-1}T^{-2}\right)$.

State the principle of homogeneity.

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92. Velocity of sound depends on density (rho) and modulus of elasticity (E). (The dimensional formula of E is

$(MI^{-1}T^{-2})$.

Using the above principle , arrive at an expression for the velocity of sound.(Take$K = 1$)

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93. The correctness of an equation is checked using the principle of homogeneity.

For an equation, $x = a + bt + ct^2$, where x is in metre and t in second. What will be the dimension of b?

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94. Significant figures determine the accuracy of the measurement of a physical quantity.

The radius of a sphere is given by $R = 1.03m$. How many significant figures are there in it?

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95. Significant figures determine the accuracy of the measurement of a physical quantity.

If the percentage error in calculating the radius of the sphere is 2%, what will be the percentage error in calculating the volume?

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96. Choose the correct alternative.

Gravitational force/weak nuclear force is the weakest

fundamental force.

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97. The centripetal force on a body in circular motion is given by $F = \frac{mv^2}{r}$.

Write the dimension of force.

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98. The centripetal force on a body in circular motion is given by $F = \frac{mv^2}{r}$.

Using the above formula, write an equation to find $\%$ error in centripetal force.

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99. The centripetal force on a body in circular motion is given by $F = \frac{mv^2}{r}$.

What is the number of significant figures in $0.050N$?

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100. Dimension method helps in converting the units from one system into another. Name the principle used for the above purpose.

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101. Dimension method helps in converting the units from one system into another. Using dimension, prove 1 Newton= 10^5 dynes.

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102. Suggest a method to measure the diameter of the Moon.

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103. Length, breadth and thickness of a block is measured using vemier calipers. The percentage errors in the

measurements are $2\%, 1\%$ and 3%` respectively. Estimate the percentage error in its volume.

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104. A physical quantity is given by $h = \frac{Fv^2}{L}$. F is the force, v is the velocity and L is the angular momentum. Find the dimensions of h.

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105. The correctness of equations can be checked using the principle of homogeneity. State the principle of homogeneity.

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106. Let us consider an equation $\frac{1}{2}mv^2 = mgh$

Where m is the mass of the body. V its velocity , g is the acceleration due to gravity and h is the height . Check whether this equation is dimensionally correct.

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107. The correctness of equations can be checked using the principle of homogeneity. If percentage errors of measurement in velocity and mass are $2\% \text{ and } 4\%$ respectively, what is the percentage error in kinetic energy?

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108. The error in the measurement of radius of a circle is 0.6%`. Find the percentage error in the calculation of the area of the circle.

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109. Name the principle used to check the correctness of an equation.

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110. What is the number of significant figures in 0.00820J` ?

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111. Length of a sheet is $17.3 \pm 0.3cm$ and breadth is $3.12 \pm 0.08cm$. Calculate the percentage error in the area.

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112. Using the principle of homogeneity of equations, check whether the equation is correct. $T = 2\pi\sqrt{\frac{g}{l}}$ (Trarrtime, grarracceleration, lrarrlength)

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113. Check whether the equation $mv^2 = mgh$ is dimensionally correct or not.

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