PHYSICS

BOOKS - PRADEEP PHYSICS (HINGLISH)

PHYSICAL WORLD AND MEASUREMENT

Sample Problem

1. The mass of a body is $5 \times 10^{-6} kg$. What is this mass in (α) gram (b) milligram (c) microgram?

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2. Calculate the number of astronomical units in one metre.

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3. The average wavelength of light from a sodium lamp is 5893Å. Express it in (i) metre (ii) nanometer.

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4. How many par sec are there in one ligth year?

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5. The mass of a proton is $1.67 \times 10^{-27} kg$. How may protons would make 1 gram?

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6. Calculate the angle of (a) 1° (degree) (b) 1' (minute of arc of are min) and (c) 1''(secondof arc of arc sec) in radian. Use $360^\circ = 2\pi rad.$, $1^\circ = 60'$ and 1' = 60''.

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7. The mass of an electron is $9.11 \times 10^{-31} kg.$ How many electrons would make 1kg?

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8. Calculate the number of light years in one kilometer.

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9. Express the average distance of earth from the sun in (i) light year (ii) per sec.

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10. (i) The density of a meterial is $0.8gcm^{-3}$. Its value in SI units is ....

(ii) The Young's modulus of steel is $1.9 \times 10^{11} N/m^2$. Its value in CGS units is ....

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11. The volume of a cube of side 10 cm. is ... m^3.

(ii) A vehicle moving with a speed of $36kgh^{-1}$ covers .... M in 1 sec.

(iii) The density of water at $4^{\circ} C is.....g /$ or $.....kg / m^3$.

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12. it is estimated that per minute, each cm^2 of earth recives about 2 calories of heat energy from the sun. This constant is called solar constant S. Express solar constant in SI units.

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13. The avarage distance from the earth to the sun is 1.49×10^{11} m. Find out the value of 1 par second in meter.

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14. The density of water in SI units is $10^3 kg/m^3$. What is its value in g//cc?

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15. A rock under water is 2900 m deep. Calculate the time in which an ultrasonic signal will return after reflection from the rock. Take velocity of ultrasonic waves in water = 1.45 km//s.

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16. The distance of nearest star from earth is $10^{13} km$. Calculate the time taken by a laser beam to return to earth after reflection from the star.

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17. The parallax of a heavenly body measured from tow points diametrically opposite on equator of earth is 2.0 minute. If radius of earth is 6400 km, calculate distance of heavenly body.

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18. The moon subtends an angle of 57 minutes at the base line equal to radius of earth. What is the distance of moon from earth. Given radius of earth is 6400 km.

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19. A drop of olive oil of diameter $0.6 \times 10^{-3} m$ spreads into a circular film of raius 12 cm. Estimate the molecular size of olive oil.

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20. Express 1 light year in terms of metre. What is its order of magnitude?

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21. The moon is observed from two diametrically opposite points A and B on earth. The angle θ substended at the moon by the two directions of observation is $1^{\circ} 54'$. Given the diameter of earth to be about $1.276 \times 10^{7} m$, calculate the distance of moon from earth.

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22. The sun's angular diameter is measured to be 1920''. The distance of the sun from the earth is $1.496 \times 10^{11} m$. What is the diameter of the sun?

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23. The distance of the sun from earth is $1.496 \times 10^{11} m$. If the angular diameter of the sun is 2000'', find the diameter of the sun.

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24. 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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25. The shadow of a tower standing on a level plane is found to be 50 m longer when the Sun's elevation is 30° than when it is 60°. The height of the tower is

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26. A rock under water is 1595 m deep. Find the time in which an ultrasonic signal returns after reflection from the rock. Speed of ultrasonic waves in water = $1450m/s$.

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27. Suppose there existed a planet that went around the sun twiche as fact as the earth. What would by its orbital size?

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28. A drop of olive oil of radius 0.25 mm spreads into a circular film of radius 10 cm on the water surface. Estimate the size of molecule of oleic acid.

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29. The radius of a muonic hydrogen atom is $2.5 \times 10^{-13} m$. What is the total atomic volume in m^3 of a mole of such hydrogen atom.

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30. Age of the universe is about 10^{10} years whereas the mankind has existed for 10^6 years. How many seconds would the man have existed if age of universe were one day.

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31. Two atomic clocks allowed to run for a average life of an indian (say 70 years) differ by 0.2 s only. Calculate the accuracy

of standard atomic clock in measuring a time interval of 1 sec.

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32. The mean life of an elementary particle pion is 2×10^{-7} ns. The age of the univers is about 4×10^{9} years. Identify a physically meaning time that is approximately half way between these two on a logarithmic scale.

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33. A 35 mm wide slide with 24 mm $\times$ 36 mm picture is projected ona screen placed 12 cm from the slide. The image of the slide picture on the screen measures $1.0m \times 1.5m$. What is the linear magnification of the arrangement ?

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34. If the size of a nucleus $\left(\approx 10^{-15}m\right)$ is scaled up to the tip of a sharp pin $\left(\approx 10^{-5}m\right)$, what roughly is the size of an atom?

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35. if the universe were shrunk to the size, of earth, how large would the earth be on this scale?

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36. Ten drops of olive of radius 0.20 mm spread into a circular film of radius 14.6 cm. on the surface of water. Estimate the size of an oil molecule.

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37. In case of venus, the angle of maximum elongation is found to be approximately 47°. Determine the distance between venus and sun $(r_{ve}$. and the distance between venus and earth $(r_{ve}$.

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38. By the use of dimensions, show that energy per unit volume is equal to pressure.

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39. Show that angular momentum has the same dimensions as the Planck's constant.

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40. Convert Newton into dyne.

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41. Surface tension of mercury is 540 $dyne/cm$. What will be its value when unit of mass of 1kg. Unit of length is 1m and unit of time is 1 minute?

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42. Given that T stands for time and l stands for the length of simple pendulum . If g is the acceleration due to gravity , then which of the following statements about the relation $T^2 = (l/g)$ is correct?

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43. Check the dimensional consistency of the relation $v = \frac{1}{I}\sqrt{\frac{P}{\rho}}$ where I is length, v is velocity, P is pressure and ρ is density,

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44. Derive an expression for time period (t) of a simple pendulem, which may depend upon : mass of bob (m), length of pendulum (l) and acceleration due to gravity(g).

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45. The velocity v of sound waves in a medium may depend upon modulus of elasticity (E), density (d) and wavelength (λ) of of the waves. Use method of dimensions to deerive the formula for v.

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46. The SI and CGS units of energy are joule and erg respectivel. How many ergs are equal to one joule.

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47. Find the value of 60 J per min on a system that has 100g, cm and 1 min. as the base units.

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48. If the unit of force energy and velocity are 20 N, 200J and 5m//s, find the units of mass, length and time.

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49. In a new system of units called star units, 1 kg* = 10 kg , 1m* = 1km and 1s*= 1minute, what will be the value of 1J of energy in the new system?

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50. When 1m, 1kg and 1min. Are taken as the fundamental units, the magnitude of force is 36 units. What will be the value of this force is CGS system?

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51. Find the value of 100 J of energy on a system whose fundamental units are 100 gram , 10cm and half minute.

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52. Out of the formulae y =a sin $2\pi t / T$ and y = a sin vt for the displacement y of particle undergoing a periodic motion, rule out the wrong formula on the basis of dimensions. Symbols have standard meaning.

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53. Time period of an oscillating drop of radius r, density ρ and surface tension S is $t = K\sqrt{\frac{\rho r^3}{S}}$. Check the correctness of this relation

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54. Check the correctness of the relation : $v = \frac{\pi P\left(a^2 - x^2\right)}{2\eta I}$,

Where$v$ is velocity, p is pressure difference, a is radius of tube, x is distance from the axis of tube, η is coeff. Of viscosity and I is length of the tube.

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55. By the method of dimensions, test the accuracy of the equation : $\delta = \dfrac{mgl^3}{4bd^3Y}$ where δ is depression in the middle of a bar of length l, breadth b, depth d, when it is loaded in the middle with mass m. Y is Young's modulus of meterial of the bar.

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56. Chek the correctness of the relation, $S_{n_{th}} = u + \dfrac{a}{2}(2n - 1)$, where u is initial velocity, a is acceleratin and $S_{n_{th}}$ is the distance travelled by the body in nth second.

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57. Let us consider an equation

$$\frac{1}{2}\mu\varepsilon^2 = mgh,$$

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

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58. The SI unit of energy is $J = kgm^2s^{-2}$, that of speed v is ms^{-1} and of acceleration a is ms^{-2} which of the formulae for kinetic energy (K) given below can you rule out on the basis of dimensional arguments (m stands for the mass of the body).

(a) $K = m^2v^3$ (b) $K = \frac{1}{2}mv^2$ (c) K= ma

(d) $K = \frac{3}{16}mv^2$ (e) $K = \frac{1}{2}mv^2 + ma$

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59. Find the dimensions of the quantity q from the expression

: $T = 2\pi\sqrt{\frac{ml^3q}{5Y}}$, Where T is tiem period of a bar of length l,

mass m and Young's modulus Y.

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60. Find the dimensions of K in the relation $T = 2\pi\sqrt{\frac{KI^2g}{mG}}$

where T is time period, I is length, m is mass, g is acceleration

due to gravity and G is gravitational constant.

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61. The refractive index μ of a medium is found to vary with wavelength λ as $\mu = A + \frac{B}{\lambda^2}$. What are the dimensions of A and B?

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62. Check the dimensional consistency of the following equations :

(i) $v = u + at$ (ii) $s = ut + \frac{1}{2}at^2$

(iii) $v^2 - u^2 = 2as$

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63. Find the dimensios of a/b in the relation $P = ax + bt^2$, where P is pressure, x is distance and t is time.

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64. In Vander Wall's equation $\left(P+\frac{a}{V^2}\right)(V-b)=RT$ What are the dimensions of a and b ? Here, P is pressure, V is volume, T is temperature and R is gas constant.

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65. Write the dimensions of a and b in the relation $P=\frac{(b-x)^2}{at}$ Where P is power, x is distance and t is time.

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66. Find the dimensions of a//b in the relation $P = \frac{a - x^2}{bt}$, where x is distance, t is time and P is pressure.

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67. Find the dimensions of $\frac{a \times b}{c}$ In the relation y= 4 sin at + 3 cos bt -ct, where t is time and y is distance.

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68. Find the dimenions of $\frac{c}{a \times b}$ in the relation : y = a cos $\omega t + b \times t - c\sqrt{t}$, where y is displacement, t is time and ω is agnular velocity.

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69. Experiments reveal that the velocity v of water waves may depend on their wavelength λ, density of water ρ, and acceleration due to gravity g. Establish a possible relation between v and λ, g, ρ.

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70. The period of revolution (T) of a planet around the sun depends upon (i) radius (r) of obit (ii) mass M of the sun and (iii) gravi-tational constant G. Prove that $T^2 \propto r^3$

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71. By the method of dimensions, obtain an expression for the surface tension S of a liquidk rising in a capillary tube. Assume that S depends on mass m of liquied, Pressure p of liquid and radius r of the capillary tube. Take $K = 1/2$.

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72. The frequency of vibration (v) of a string may depend upon length (l) of the string, tension (T) in the string and mass per unit length (m) of the string. Using the method of dimensions, derive the formula for v.

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73. The velocity of sound (v) in a gas depends upon coefficint of volume elesticity E of the gas and density d of the gas. Use method of dimensions to derive the formula for v.

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74. The period of vibration of a tunign fork depends on the length l of its prong, density d and Young's modulus Y of the meterial. Deduce an expression for the period of vibration (T) using dimensional analysis.

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75. The depth x to which a bullet penetrates a human body depends on (i) coeffeicint of elasticity, η and (ii) KE (E_k) of the bullet, By the method of dimensions, show that

$$x \propto \left(\frac{E_k}{\eta}\right)^{1/3}$$

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76. Consider a simple pendulum having a bob attached to a string that oscillates under the action of a force of gracity. Suppose that the period of oscillation of the simple pendulum depends on its length (I), mass of the bob (m) and acc. Due to gravity (g). Derive the expression for its time period using method of dimensions.

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77. Show dimensionally that the relation $t = 2\pi\left(\frac{I}{g}\right)$ is incorrect, where I is length and t is time period of a simple pendulum , g is acc. Due to gravity. Find the correct form of the relation, dimensionally

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78. The heat produced in a wire carrying an electric current depends on the current, the resistance and the time. Assuming that the dependuance is of the product of powers type, guress an eqn. between these quantites uning dimesional analysis. The dimensional formula of resistance is $ML^2A^{-2}T^{-3}$ and heat is a form of energy.

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79. Find the dimensions of the quantity q from the expression $T = 2\pi\sqrt{\frac{ml^3}{3Yq}}$, where T is time period of a bar of length l, mass m and Young's modulus Y.

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80. An artificial satellite of mass m is revolving in a circualr orbit around a planet of mass M and radius R. If the radius of the orbit of satellite be r, then period of satellite is

$$T = \frac{2\pi}{R}\sqrt{\frac{r^3}{g}}$$

Justify the relation using the method of dimensions.

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81. A large fluid star oscillates in shape under the influence of its own gravitational field. Using dimensional analysis, find the expression for period of oscillation (T) in terms of radius of star (R), mean density of fluid (ρ) and universal gravitational constant (G).

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82. In an experiment, two capacities measured are $(1.3 \pm 0.1)\mu F$ and $(2.4 \pm 0.2)\mu F$. Calculate the total capacity in parallel with percentage error.

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83. The lenghts of two cylinders are measured to be $i_1 = (5.62 \pm 0.01)$cm and $I_2 = (4.34 \pm 0.02)$cm. Calculate difference in lengths with error limtits.

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84. The length and breadth of a rectangular lamina are measured to be $(2.3 \pm 0.2)cm(1.6 \pm 0.1)cm$. Calculate area of the lamina with error limits.

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85. Calculate percentage error in the determination of $g = 4\pi^2 I / t^2$, when I and t are measured with $\pm 2\%$ and $\pm 3\%$ errors respectively.

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86. Write the results of the following with regard to significant figures. (i) 876 + 0.4382 (ii) 8.0 - 0.42

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87. Compute the following with regard to significant figures (i) 4.6xx0.128 (ii) $\frac{0.9995 \times 1.53}{1.592}$

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88. If the error involved in the measurement of mass and length of one side of a cube are 4% and 3% respectively. What is the maximum permissible relative error in calculation of density of meterail of the cube?

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Conceptual Problem

1. Why do we call Physis an exact science?

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2. Does imagination play any roal in Physics?

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3. What is electromagnetic force?

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4. Astrology is a science. Comment.

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5. List some key contemporary area of science and technology responsible for industrial revolution of the present age.

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6. Name some key scientific and technological advances which led to first industrial revolution in England and Europe.

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7. Should a scientific discovery which has nothing but dangerous consequences for manking be made public?

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8. The most incomprehensible thing about the world is that it is comprehensible. 'Who made these remarks? Given some evidence in support of it.

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9. Science is ever dynamic. There is no final theory in science and no unquestioned authority amongst scientists. As observation improve in detail / precison and experiments yield new result, theories are modified if necessary, to account for them. Thus, in science, approach is always 'open minded'. Read the above passage and answer the following questions :(i) What do you mean by 'open minded' approach ? (ii) What value of life do you learn from this?

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10. In difining the standerd of length, we have to specify the temperature at which the measurement should be made. Are we justified in calling length a fundamental quantity, if another physical quantity (temperature) has to be specified in choosing a standeard?

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11. What is the advantage in choosing the wavelength of light readination as a standard of length?

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12. Which type of phenomenon can be used as a measure of time ? Given three examples.

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13. Why has 'second' been defined in terms of periods of radiation from Cesium -133 ?

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14. Derive the SI unit of work or energy in terms of fundamental units.

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15. what is a choerent system of units?

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16. Do AU and A° represent the sakme unit of length?

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17. What is the difference between nm, mN, Nm ?

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18. Will five litres of benzene weigh more in summer of winter ? Comment.

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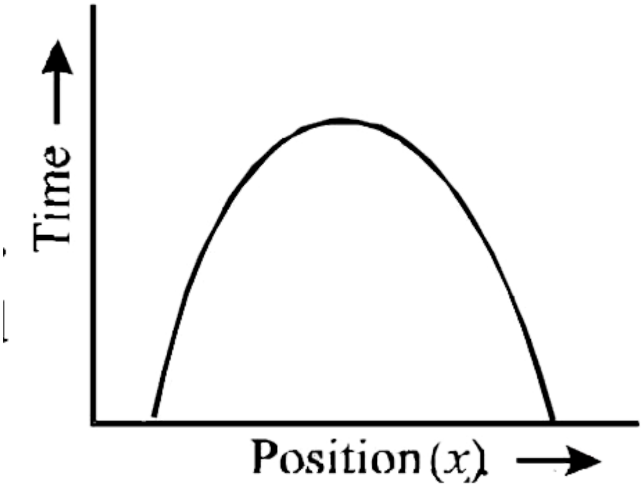
19. Answer the following giving reasons in brief :

Is the time variation of position , shown in the figure observed in nature ?



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20. why is it convenient to express the distancek of stars in terms of light year rather then in metre or kilometre ?

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21. Is the measure of and angle dependent on the unit of length?

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22. What is meant by angular diameter of moon ? What is its value?

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23. Suggest a distance corresponding to each of the following order of length :

(i) $10^7 m$ (ii) $10^4 m$

(iii) $10^3 m$ (iv)$10^2 m$

(v)$10^{-3}m$ (vi) $10^{-6}m$

(vii) $10^{-14}m$

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24. For a given base line, which will show a grater parallax - a distant star or a nearby star?

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25. Draw a schematic arrangement of the Geiger Marsden experiment. How did the scattering of α particles by a thin foil of gold provide an important way to determine an upper limit on the size of nucleus? Explain briefly.

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26. If the velocity of light is taken as the unit of velocity and one year is the unit of time, what must be the unit of length? What is it called?

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27. The screw of a spherometer moves by 4 mm. when its circular scale is given four complete rotations. If circular scale has 200 divisions, calculate pitch and least count of the spherometer.

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28. When circular scale of a screw gauge carrying 100 divisions is given four complete rotation, the head of the screw moves through 2mm. Calculate pitch and least count of the screw gauge.

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29. Mention some repetitive phenomena in nature which could serve as time standards. Which one is most suitable?

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30. Which is the world's most accurate clock ? What is its accuracy?

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

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32. Can a quantity having dimensions may have no units ?

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33. Can a quantity have units, but still be dimensionless?

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34. In different of systems of units, can a quantity have different dimensions?

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35. Can there be a physical quantity, which has no units and no dimensions?

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36. Energy density and pressure have the same dimensions. Comment.

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37. Match the physical quantities with dimehnsions expressed in disarray.

(i) Angular momentum (i) $[M^{-1}L^3T^{-2}]$

(ii) Latent heat (ii) $\left[M^1L^3T^{-3}A^{-2}\right]$

(iii) Specific heat (iii) $\left[M^0L^2T^{-2}\right]$

(iv) Joule's mechanical equivalent of heat (iv) $\left[M^0L^2T^{-2}K^{-1}\right]$

(v) Resistivity (v) $\left[M^0L^{\square})T^0\right]$

(vi) Gravitational Constant (vi) $\left[M^1L^2T^{-1}\right]$

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38. In the formula $X = 3YZ^2$, X and Z have dimensions of capacitance and magnetic induction respectively. The dimensions of Y in MKSQ system are ...., ...

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39. The units of Planck's constant are the same as those of ...., which is equal to moment of .... Fill in the blanks.

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40. IF $\in_0$ is electric permittivity of free space and E is electric field, then show that $\in_0 E^2$ has the dimensions of pressure.

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41. Identify the physical quantity x defined as $x = \frac{IFv^2}{WI^3}$, where I is moment of inertia, F is force, v is veloicty, W is work and I is length.

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42. Unit of $\frac{CV}{\rho\varepsilon_0}$ are of

$(C =$ capacitance, $V =$ potential, $\rho =$ specfic resistence and $\varepsilon_0 =$ permittivity of free space)`

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43. Finding dimensions of resistance R and inductance L, speculate what physical quantities (L/R) and $\frac{1}{2}LI^2$ represent, where I is current?

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44. Justify $L + L = L$and $L - L = L$

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45. How many ergs are there in 1 kilo watt hour?

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46. Let $x$and a stand for distance . Is $\int \frac{dx}{\sqrt{a^2 - x^2}} = \frac{1}{a}\sin^{-1}\left(\frac{a}{x}\right)$ dimensionally correct ?

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47. Use principle of homogenity of dimensions to find which one of the following relations is correct : (i) $T^2 = 4\pi^2 r^2$

(ii) $T^2 = \frac{4\pi^2 r^3}{G}$

(iii) $T^2 = \frac{4\pi^2 r^3}{GM}$

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48. If $x = 2at - 5bt^2$, where x is in metre and t is in seconds, find the dimensions of a//b.

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49. Which quantity in a given formula should be measured most accurately Why?

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50. Problesm with accuracy are due to errors'. Is the statement true?

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51. Precision describes the limitation of the measuring instrument' is the statement false?

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52. Poor accuracy involces errors that can often be correct, Do you agree?

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53. Precision describes the limitation of the measuring instrument' is the statement false?

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54. A physcial quantity $x = a^2 \frac{b^{-3/2}}{c^4}$ has a relative error $\frac{\Delta x}{x} = 2\frac{\Delta a}{a} - \frac{3}{2}\frac{\Delta b}{b} - 4\frac{\Delta c}{c}$ .is the statement correct?

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55. Can an instrument be called precise without being accurate? Can it be accurate without being precise?

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56. which of the following length measurement is most accurate and why? (i) 500.0cm (ii) 0.005cm (iii) 6.00cm

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57. Which of the following length measurement is (i) most precise and (ii) least precise?

(a) l= 5cm (b) l =5.00cm

(c) l= 5.000 cm (d) l = 5.0000cm.

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58. Distinguish between accuracy and precision.

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59. Of the following, which measurement is most accurate and which one is most precise ? (i) 5.00 mm (ii) 5.00cm

(iii) 5.00m (iv) 50.00 m.

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60. In a number without decimal, what is the significance of zeros on the right of non-zero digits ?

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61. What is the difference between 5.0 and 5.00?

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62. In the expression, surface area $= 4\pi r^2$ the factor 4 is an exact number. How many number of significant figures are there in the factor 4?

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63. The speed of light in air is $3.00 \times 10^8 m / s$ The distance travelled by light in one year $\left(i. e.365 days = 3.154 \times 10^7 s\right)$ is know as one light year. A student calculates one light year = 9.462×10^{15}m. Do you agree with the student ? If not what should be the correct value of one light year?

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64. If all measurements in an experiment are taken up to the same number of significant figures , then mention two possible reasons for maximum error.

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65. The mean value of period of oscillation of a simple pendulum in an expriement is 2.825 s. The arithmetic mean of all the absolute errors is 0.11 s. Round off the period of simple pendulum to approximate number of significant figures. Given resson.

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NCERT Exercises

1. Some of the most profound statements on the nature of science have come from Albert Einstein, one of the greatest scientist of all time. What do you think did Einstein mean when he said : "The most incomprehensible thing about the world is that it is comprehensible"?

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2. 'Every great physical theory starts as a heresy and ends as a dogma''. Give some examples from the history of science of the validity of this incisive remark.

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3. "Politics is the art of the possible . " Similarly, "Science is the art of the soluble." Explain this beautiful aphorism on the nature and practice of science .

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4. Though India now has large base in science and technology, which is fast expanding, it is still a long way from realising its potential of becoming a world leader in science . Name some important factors which in your view have hindered the advancement of science in India .

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5. No physicist has ever "seen" an electron, yet, all physicists believe in existence of electrons . An intelligent but superstitious man advances this analog to argure that 'ghosts' exist even though no one has "seen" one . How will you refute his argument ?

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6. The shells of crabs found around a particular coastal location in Japan seem mostly to resemble the legendary face of Samurai . Given below are two explanations of this observed fact . Which of these strikes you as a scientific explanation ?

(a) A tragic sea accident several centuries ago drowned a young Samurai . As a tribute to his bravery, nature through its inscrutable ways immortalised his face by imprinting it on the crab shells in that area .

(b) After the sea tragedy, fisherman in that area, in a gesture of honour to their dead hero, let free any crab shell caught by them which accidentally had a shape resembling the face of a Samurai . Consequently, the particular shape of the crab shell survived longer and therefore in corrse of time the shape was genetically propagated . This is an shape was genetically progagated . This is an example of evolution by artificial selection .

[Note : This interesting illustration taken from Carl Sagan's 'The Cosmos' highlights the fact that often strange and inexplicable facts which on the first sight appear supernatural actually turn out to have simple scientific explanations. Try to think out other examples of this kind .]

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7. The industrial revolution in England and Western Europe more than two centuries ago was triggered by some key scientific and technological advances . What were these advances ?

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8. List some key contemporary area of science and techonolgy responsible for industrial revolution of the present age.

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9. Write in about 1000 words a fiction piece based on your speculation on the science and techonology of the twenty-second century .

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10. Attempt to formulate your 'moral' views on the practice of science . Imagine yourself stumbling upon a discovery, which has great academic interest but is certain to have nothing but dangerous consequences for the human society . How , if at all will you resolve your dilemma ?

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11. Science, like any knowledge, can be put to good or bad use, depending on the user. Given below are some of the applications of science. Formulate your views on whether the particular application is good, bad or something that cannot be so clearly categorised :

Mass vaccination against small pox to curb and finally eradicate this disease from the population. (This has already been successfully done in India).

(b) Television for eradication of illiteracy and for mass communication of news and ideas.

(c) Prenatal sex determination

(d) Computers for increase in work efficiency

(e) Putting artificial satellites into orbits around the Earth

(f) Development of nuclear weapons

(g) Development of new and powerful techniques of chemical and biological warfare).

(h) Purification of water for drinking

(i) Plastic surgery

(f) Cloning

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12. India has had a long and unbroken tradition of great scholarship - in mathematics, astronomy, linguistics, logic ethics . Yet , in parallel with this, several superstitions and obscurantistic attitudes and practices flourished in our society and unfortunately continue even today-among many educated people too . How will you use your knowledge of science to develop strategies to counter these attitudes ?

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13. Though the law gives women equal status in India, many people hold unscientific views on a woman's innate nature, capacity and intelligence, and in practice give them a secondary status and role. Demolish this view using scientific arguments, and by quoting examples of great women in science and other spheres, and persuade yourself and others that, given equal opportunity, women are on par with men.

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14. It is more important to have beauty in the equations of physics than to have them agree with experiments . The great British physicist P.A.M. Dirac held this view. Criticise this statement. Look out for some equations and results in this book which strike you as beautiful .

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15. Though the statement quoted above may be disputed, most physicists do have a feeling that the great laws of physics are at once simple and beautiful . Some of the notable physicists .besides Dirac, who have articulated this feeling , are : Einstein, Bohr, Heisenberg , Chandrasekhar and Feynman . You are urged to make special efforts to get access to the general books and writings by these and other great masters of physics. these and other great masters of physics . Their writings are truly inspiring ?

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16. Textbooks on science may give you a wrong impression that studying science is dry and all too serious and that scientists are absent-minded introverts who never laugh or grin. This image of science and scientists is patently false. Scientists, like any other group of humans, have their share of humorists, and many have led their lives with a great sense of fun and adventure, even as they seriously pursued their scientific work. Two great physicists of this genre are Gamow and Feynman. You will enjoy reading their books listed in the Bibliography.

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17. Fill in the blanks

(a) The volume of a cube of side 1 cm isk equal to..... m^3

(b) the surface area fo a solid cylinder of radius 2.0 cm and height 10.0 cm is equal to .... $(mm)^2$

(c) A vehical moving with a speed of $18kmh^{-1}$ covers ....m in 1s.

(d) The relative density of lead is 11.3. its density is ......g cm^{-3} or $\ldots.\,kgm^{-3}$

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18. Fill in the blanks by suitable conversion of units :

(a) $1kgm^2s^{-2} = gcm^2s^{-2}$ (b) 1m = ... Light year (c)

$3ms^{-2} = \dots . Kmh^{-2}$

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

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19. A calorie is a unit of heat or energy and it equals about $4.2J, where 1J = 1kgm^2 s^{-2}$. Suppose we employ a system of units in which the unit of mass equals αkg, the unit of length equals is βm , the unit of time is γs. Show tthat a calorie has a magnitude $4.2\alpha^{-1}\beta^{-1}\gamma^2$ in terms of the new units.

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20. Explain this statement clearly :

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

(a) atoms are very small objects

(b) a jet plane moves with great speed

(c) the mass of Jupiter is very large

(d) the air inside this room contains a large number of molecules

(e) a proton is much more massive than an electron

(f) the speed of sound is much smaller than the speed of light.

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21. A new unit of length is chosen such that the speed of light in vecuum 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 sec. to cover the distance ?

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22. Which of the following is the most precise devise for measuring length ? (a) a Vernier callipers with 20 divisions on the sliding scals, coindiing with 19 main scale divions (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 wave length of light.

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

24. Answer the following :

(a) You are given a tread and a metre scale. How will you estimate the diameter of the thread ?

(b) A screw gauge has a pitch of 1.0 mm and 200 divisions on the circular scale. Do you think it is possible to increase the accuracy of the screw gauge arbitrarily by increasing the number of divisions on the circular scale ?

(c) The mean diameter of a thin brass rod is to be measured by vernier callipers. Why is a set of 100 measurements of the diameter expected to yield a more reliable estimate than a set of 5 measurement only ?

25. The photograph fo a house occupies an area of $1.7 cm^2$ on a 35 slide. The slide is projected on to a screen, and the area of the house on the screen is $1.55 m^2$ What is the liner magnification of the projector screen arrangement?

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26. State the number of significant figures in the following : (a) $0.007 m^2$ (b) $2.64 \times 10^{24} kg$ (c) $0.2370 gcm^{-3}$ (d) $6.320 J$ (e) $6.032 Nm^{-2}$ (f) $0.0006032 m^2$

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27. The length breadth and thickness of a metal sheet are 4.234 m, 1.005 m and 2.01 cm respectively. Given the area and volume of the sheet to correct number of significant figure.

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28. The mass of a box measured by a grocer's balance is 2.3 kg. Two gold pieces of masses 20.15 g and 20.17g are added to the box. What is (a) total mass of the box (b) the difference in masses of gold pieces to correct significant figures.

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29. The percentage errors of measurement in a, b, c and d are 1%. 3%, 4% and 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 2% the result? e resuuiit

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30. A book with many printing errors contains four different forumlae for the displacement y of a particle undergoing a certain periodic motion : (i) $y = a\frac{\sin(2\pi t)}{T}$ (ii) $y = a\sin vt$ (iii) $y = \frac{a}{T}\frac{\sin(t)}{a}$ (iv) $y = \frac{a}{\sqrt{2}}\left[\frac{\sin(2\pi t)}{T} + \frac{\cos(2\pi t)}{T}\right]$ Here, a is maximum displacement of particle, v is speed of particle, T is time period of motion. Rule out the wrong forumlae on dimensinal grounds.

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31. 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 sped of light c. (This relaiton first arose as a consequence of special theory of relativity due to Albert Einstein). A boy recalls the relation almost correctly but forgets where to put the constant c. He writes $m = \frac{m_0}{(1 - v^2)^{1/2}}$ Guess where to put the missing c?

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32. The unit of length convenint on the atomic scales is known as an angstrom and is denoted by $\text{Å}: 1\text{Å} = 10^{-10} m$. The size of a hydrogen atom is about 0.5Å What is the totall atomic volume in m^3 of a mole of hydrogen atoms?

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33. One mole of an ideal gas at NTP occupies 22.4 liters (molar volume). What is the ratio of molar volume to atomic volume

to atomic volume of a mole of hydrogen ? Take size of hydrogen molecule to be 1 Å. Why is this ratio so large?

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34. Explain this common observation clearly : If you look out of the window of a fast moving train, the nearby tress, houses etc. seem to move rapidly in a direction opposite to the train's motion, but the distant objects (hill tops, the Moon, the starts etc.) seem to be stationary. (In fact, since you are aware that you are moving, these distant objects seem to move with you).

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35. The principle of 'parallax' in Art. 1(c).4. is used in the determination of distacne of very distant stars. The baseline

AB in the line joining the Earth's two locations six months apart in its orbit around the sun. That is, the baseline is about the diameter of the Earth 's orbit $\approx 3 \times 10^{11} m.$ However, even the nearest stars are so distnat thet with such a long baseline, they show parallax only of the order of 1''(second) of arc or so . A parsec is a convenient unit of length on the astronomical scale. It is the distance of an objhect that will shown a parallax of 1'' (second) of arc fome oppsoite ends of a beasline equal to the distance from the Earth to the sun. How much is a parsec in terms of metres ?

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36. The nearest star to our solar system is 4.29 light years away. How mcuh is this distance in terms of par sec ? How mcuh parallax would this star show when viewed from two locations of the earth six months apart in its orbit around the sun?

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37. Precise measurements of physical quantities are a need of science. For example to ascertain the speed of an aircraft, one must have an accurate method to find its positions at closely separated instants of time. This was the actual motivation behind the discovery of radar in World War II. think of different examples in modern science where precise measurements of length, time, mass etc, arc needed. Also, where ever you can, give a quantitative idea of the precision needed.

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

(a) the total mass of rain-bearing clouds over India during the Monsoon

(b) the mass of an elephant

(c) the wind speed during a storm

(d) the number of strands of hair on your head

(e) the number of air molecules in your classroom.

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39. The sun is a hot plasma (ionised matter) with its linner core at a temperature excedding 10^7 K, and its outer surface at a temperature of about 6000K. At such high temps, no substance remains in a solid or liquid phase. In what range do you expect the mass density of the sun to be? In the range of densities of solids, liquieds or gases ? Check if your guess is correct from the following data : mass of sun $= 2.0 \times 10^{30} kg$, radius of the sun $= 7.0x10^8 m$

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40. when the planet Jupiter is at a distance of 824.7 million kilometers from the Earth, its angular diameter is mieaured to be 35.72'' of arc. Calculate the diameter of Jupiter ?

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Additional Exercises

1. A man wlaking briskly in rain with speed v must slant his umbrella forward making an angle θ with the vertical . A student derives the following relation between θ and v :

tan $\theta = v$

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

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

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3. Estimate the averaage atomic mass density of a sodium atom, assuming its size ot be 2.5 Å. Compare it with density of sodium in its crystalline phase $(970 kgm^{-3})$. Are the two denities of the same order of magnitude ? If so, why ?

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4. The unit of length convenient on nuclear scale is a fermi, $1f = 10^9 - 15)$m. Nuclear sizes obey rougholy the following empricial relation : $r = r_0 A^{1/3}$, where r is radius of the nucleus and r_0 is a constant equal to 1.2 f. show that the rule implies that nuclear mass density in nearly constant for different neclei. Estimate the mass density of sodium nucleus. Compare it with avarge mass density of sodium atom is Q. 27 $(4.67 \times 10^3 kg/m^3)$.

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5. A LASER is source of very intense, monochromatic, and unidirectional beam of light. These proparties of a laser light can be exploited to measure long distnae. The distance of the moon from the Earth hasl beenn already determine very precisely at the moon's surface. How much is the radius of the luuar orbit around the Earth?

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6. A SONAR (sound navigation and ranging) uses ultrasonic waves to detect and locate object under water. In a submarine equaipped with as SONAR, the time delay between genration of a probe wave and the recption of its echo after refection from an enemy submarine is found to be 77.0 s. What is the distance of the enemy submarine ? (speed of sound in water $= 1450 ms^{-1}$

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7. The farthest objects in out universe discovered by modern astronomeres are so distant that light emitted by them takes billions of year to reach the earth. These object (known as quasers) have may puzzling features, which have yet not been satisfactorily explained. What is the distance in km of a quasar form which light takes 3.0 billion years to reach us?

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8. It is a well known fact that during a total solar eclipes the disc of the moon almost completely covers the disc of the sun. From this fact and from the information you can gather from Solved Examples 3 and 4 on page 1//44, determine the approximate diameter of the moon.

Watch Video Solution

9. A great physicist of this century (P. A. M. Dirac) loved playing with numerical values of fundamental constant of nature. This led him to an instreasing observaion. Dirac found that form the basic constant of atomin physice (c,e, mass of electron mass of proton) and the gravitational constant G, he could arrive at a number with the dimension of time. Further, it was a very large number, its magnitude being close to the present estimate on the age of the universe $(\approx 15 billionyears)$. Form the table of fundamental constants in this book, try to see if you too can construct this number (or any other instresting number you can think of). if its coincidence with the age of the universe ware significant, what would this imply for the constancy of fundamental constants ?

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10. The radius of a sphere is measured to be (2.1 ± 0.5) cm. Calculate its surface area with error limits .

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11. The voltage across a lamp is $(6.0 \pm 0.1)V$ and the current passing through it is (4.0 ± 0.2) ampare. Find the power consumed by the lamp.

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12. The length and breadth of a rectangular block are 25.2 cm and 16.8 cm, which have both been measurd to an accurancy of 0.1 cm find the area of the rectangular block.

Watch Video Solution

13. A force of (2500 ± 5)N is applied over an area of $(0.32 \pm 0.02)m^2$ Calculate the pressure exerted over the area.

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14. To find the value of 'g' by using a simple pendulum, the following observations were made: Length of the thread, $I = (100 \pm 0.1)cm$ Time period of oscillation, $T = (2 \pm 0.1)s$ Calculate the maximum permissible in measurement of 'g' which quanitiy should be measured more accurately and why ?

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15. For a glass prism of refracting, angle 60°, the minimum angle of deviation, D_m is fonud to be 36° with a maximum error of 1.05°, when a beam of parallel light is insident on the prism. Find the range of experimental value of refactive index μ. it is known that refractive index μ of material of prism is given by $\mu = \dfrac{\frac{\sin(A + D_m)}{2}}{\sin A/2}$

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16. The radius of curvature of a conave mirror, measured by a sphermoeter is given by $R = \dfrac{I^2}{6h} + \dfrac{h}{2}$ The values of I and h are 4.0 cm and 0.065 cm respectively, where I is measured by a metre scalel and h by a shpermoeter. Find the relative error in the measurement of R.

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17. In searle's experiment, the diameter of the wire, as measured by a screw gauge of least count 0.001 cm is 0.500 cm. The length, measured by a scale of least count 0.1cm is 110.0cm. When a weight of 40N is suspended from the wire, its extension is measured to be 0.125 cm by a micrometer of least count 0.001 cm. Find the Young's modulus of the meterial of the wire from this data.

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18. A small error in the measurement of the quantity having the highest power (in a given forumla) will contribute maximum percentage error in the value of the physcial quantity to whom it is related. Explain why.

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19. The two specific heat capacities of a gas measured as $C_p = (12.28 \pm 0.2)$ units and $(C_v = (3.97 \pm 0.3)$ units. Find the value of gas constant R.

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Questons Very short answer Questions 1 mark

1. What is Physics?

Watch Video Solution

2. What are the five main branches of Physics?

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3. Physics is more of a philosophy,nay more of a methematical science. Which is true ?

Watch Video Solution

4. What are the two principal thrusts in Physics?

Watch Video Solution

5. What is meso- scopic Physics?

Watch Video Solution

6. Name two Indian physicists who have won Noble Prize in Physics.

Watch Video Solution

7. Name the scientists responsible for the development for quantum mechanics.

Watch Video Solution

8. Who first gave the concept of antiparticle ?

Watch Video Solution

9. Name the scientist who won two Nobel Prizes.

Watch Video Solution

10. Name the scientist who won twice the Nobel Prize in Physics.

Watch Video Solution

11. what is the scientific principle of calculators and computers ?

Watch Video Solution

12. Which technology has trigerred the computer revolution in the last three decades of twentieth century ?

Watch Video Solution

13. Name the force responsible for the stability on nuclei. What is its range ?

Watch Video Solution

14. Which force governs the structure of atoms and molecules ?

Watch Video Solution

15. Which force governs the large scale motions in universe ?

Watch Video Solution

16. Among which type of elementary particles does the electromagnetic force act ?

Watch Video Solution

17. What are the exchange particles for the operation of (i) strong nuclear forces (ii) weak muclear forces ?

Watch Video Solution

18. What are conserved quantities in nature ? Name any two.

Watch Video Solution

19. Who discovered X-rays ?

Watch Video Solution

20. Fill in the blanks : (i) .... Discovered famous theory of relativity. (ii) Nuclear reactors are based on the phenomena of .... (iii) Genetic engineering helps us in finding the ....

Watch Video Solution

21. Arrange four types of basic forces in the order of increasing strength.

Watch Video Solution

22. What is the range of nuclear forces ?

Watch Video Solution

23. Mechanical energy is always constant. Is the statement ture ?

Watch Video Solution

24. How are science and arts similar ?

Watch Video Solution

25. What is the difference between science and technology?

Watch Video Solution

Short answer Questions 2 marks

1. What is the role of physics in your daily life?

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2. What is the basic difference between classical Physics and Quantum Mechanics ?

Watch Video Solution

3. What is the basic aim of science?

Watch Video Solution

4. What is the difference between physical and biological sciences?

Watch Video Solution

5. Who discovered the following (i) Absolute temperature (ii) Law of force of action between charges ?

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6. Fill in the blanks : (i) Lasers involve the process of .... (ii) Computers are based on........

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7. Which of the following statements are ture/ false ? (i) Keplar discovered famous theory of relativity. (ii) Nuclear reactors are based on controlled nuclear chain reaction. (iii) Einstein

explained photoemission on the basis of Planck's quantum theory.

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8. Why was science called natural philosophy in earlier days?

Watch Video Solution

9. Name three important discoveries of Physics, which have revolutionised modern chemistry.

Watch Video Solution

10. Comment on contribution of physics in the development of biological sciences.

Watch Video Solution

11. Which of these is largest : astronomical unit, light year and par sec ?

Watch Video Solution

12. Name three units which can be used for measuring large masses.

Watch Video Solution

13. which unit can be used for measurement of very small masses ?

Watch Video Solution

14. How many a.m.u make 1kg ?

Watch Video Solution

15. What is common between bar and torr ?

Watch Video Solution

16. Why are length, mass and time chosen as fundamental quantites in mechanics ?

Watch Video Solution

17. SI is reational system of units while MKS system is not rational. Why ?

Watch Video Solution

18. Why is platinum iridium alloy used in making prototype metre and kilogram ?

Watch Video Solution

19. The velocity v of a particle is given by $v = At^2 + Bt$. What are the dimensions of A and B ?

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20. Which of the following has the same dimension as Planck's constant : Torque, gravitational constant, angular momentum ?

Watch Video Solution

21. Given names of a scalar quantity and a vector quantity which have same dimensions.

Watch Video Solution

22. Write the dimensions of each of the following in terms of mass, length time. (i) Reynold number (ii) Rigidity modulus.

Watch Video Solution

Watch Video Solution

23. Give two examples each of dimensionless constants and dimensional variavles.

Watch Video Solution

24. Can a quantity have constant value and be dimensionless ?

Watch Video Solution

25. Give three examples of dimensionless varibles.

Watch Video Solution

26. Pressure is defined as momentum per unit volume. Is it true?

Watch Video Solution

27. Momentum per unit volume , divided by pressure represents reciprocal of velocity. Comment.

Watch Video Solution

28. Which physical quantity is represented by $\sqrt{\lambda g}, where \lambda$ is wavelength and g is acceleration due to gravity ?

Watch Video Solution

29. In the relation $C = v\lambda$ true dimensionally ?

Watch Video Solution

30. In the equation $y = A\sin(\omega t - kx)$, obtain the dimensional formula of ω and k. Given x is distnace and t is time.

Watch Video Solution

31. The rotational K.E. of a body is given by $\frac{1}{2}I\omega^2$. Use this equation to obtain the dimensions of I.

Watch Video Solution

32. Find the value of x in the relation

$$Y = \frac{T^x . \cos\theta . Tau}{L^3}, where$$

Y is Young's modulu. T is time period, τ is torque and L is length.

Watch Video Solution

Short answer Questions 3 marks

1. Briefly discuss the concept of frictional forces ?

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2. What is the origin of forces between two surfaces in contact ?

Watch Video Solution

3. What efforts have been made towards unification of forces ?

Watch Video Solution

4. Given three examples where Physics has been used in technology.

Watch Video Solution

5. What is the contribution of physics to our society ?

Watch Video Solution

6. What is a physical unit? Write the essential requirments that a physical unit/standard must meet.

Watch Video Solution

7. Why mks system had to be rationalised to obtain SI ? Define the unit of temperature on SI.

Watch Video Solution

8. Name and define all the basic and supplementary units of SI.

Watch Video Solution

9. State advantages of SI over other systems of units.

Watch Video Solution

10. Define Astronomical unit, light year and parscond. Establish relation between them.

Watch Video Solution

11. What is meant by giga, micro and femto ? Establish the relation between them.

Watch Video Solution

12. What is meant by order of magnitude ? Illustrate with atleast three examples ?

Watch Video Solution

13. What are the instruments used for the measurement of length from$10^{-5}m \rightarrow 10^2 m.$ Give the least count of each instrument.

Watch Video Solution

14. Name the quantites represented by the dimensional formula $[M^1L^2T^{-1}]$, $[M^1L^2T^{-2}]$ $[M^1L^{-3}T^0]$.

Watch Video Solution

15. Choose the pairs of quantities which have same dimensions : Impulse, force, work, momentum, moment of force, tension.

Watch Video Solution

16. Energy and yougn's modulus have the same dimensions, comment.

Watch Video Solution

17. The dimensions of quantites in one or more of the following pairs are the same. Identify the pair (S). (i) Torque and work (ii) Angular momentum and work (iii) Energy and Young's modulus (iv) Light year and wavelength.

Watch Video Solution

18. Show that is e is electronic charge, h is Planck's constant, c is velocity of light and $\in_0$ is electirc permittivity of free space, then e^2/(4$\pi\varepsilon_0$ hc) is dimensionless.

Watch Video Solution

19. Find the dimensions of Planck's constant. If its value in cgs system is 6.62×10^{-27} erg - sec, what will be its value on mks system?

Watch Video Solution

20. Calculate the dimensions of universal gravitational constant. If its value is SI units is 6.67×10^{11}, what will be its value is cgs system ?

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21. The rate flow (V) of a liquid through a pipe of radius (r) under a pressure gradient (P//I) is given by $V = \frac{\pi}{8}\frac{PR^4}{I\eta}$, Where η is coefficient of visocity of the liquied. Check whether the formula is correct or not.

Watch Video Solution

22. If the speed of light $c\left(= 3 \times 10^8 m/s\right)$, Planck's constant $h\left(= 6.6 \times 10^{-34} J - s\right)$ and gravitational constant $G\left(= 6.67 \times 10^{-11} mksunits\right)$ be chosen as fundamental units, find out the dimensions and value of unit of mass.

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23. Give limitations of dimensional analysis.

Watch Video Solution

Long Answer Questions 5 marks

1. According to Bohr, 'The task of science is both to extend the range of our experience and the reduce it to order.' Comment.

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2. Write a few lines about atleast three branches of science.

Watch Video Solution

3. Given briefly the scope and excitement of Physics.

Watch Video Solution

4. Mention a feq examples of Physics in relation to other sciences.

Watch Video Solution

5. Name the basic forces in nature. Given some examples of gravitational, electromagnetic and nucler forces from daily life experiences.

Watch Video Solution

6. Discuss some salient features of gravitational, electromagnetic and nuclear forces.

Watch Video Solution

7. State three important conservation laws used in Classical Physics.

Watch Video Solution

8. Explain the need for measurement in physics.

Watch Video Solution

9. Explain the concept of mass, length and time. Why mass, length and time are called fundamental quantites.

Watch Video Solution

10. Name and define all the basic and supplementary units of SI.

Watch Video Solution

11. Explain how will you measure (i) the size of astronomical object and (ii) the distance of a nearby star.

Watch Video Solution

12. Discuss briefly the methods used for the measurement of small and large time intervals.

Watch Video Solution

13. What is meant by dimensional formula and dimensional equation? Give examples.

Watch Video Solution

14. Derive the dimensional formulea for acc. Due to gravity, constant of gravitation, surface tension, coeffiecient of visocity, coefficient of elasticty, Planck's constant, gas constant, torque specific gravity and impulse.

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15. Explain the principle of homogeneity of dimensions. What are its uses ? Illustrate by giving one example of each.

Watch Video Solution

16. Explain the uses of dimensional equations giving atleast one example in each case.

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Very short Answer Questions

1. Does magnitude of a quantity change with change in the system of units ?

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2. Can a body have weight but no mass?

Watch Video Solution

3. Name two types of mass.

Watch Video Solution

4. Human heart is an inbulit clock. Comment

Watch Video Solution

5. How many times is a millisecond larger then a microsecond ?

Watch Video Solution

6. How many light years make 1 par sec ?

Watch Video Solution

7. What is the accuracy of the metre defined in terms of wavelength of light radiation ?

Watch Video Solution

8. Name two commonly used units for wavelength of light.

Watch Video Solution

9. Express 1 micron in metre.

Watch Video Solution

10. Which unit is used to measure size of a nucleus ?

Watch Video Solution

11. How many Angstrom are there in one metre ?

Watch Video Solution

12. How many times larger is a kg then an mg ?

Watch Video Solution

13. Which is the smalles prectical unit of time ?

Watch Video Solution

14. How many quintals are there in one metric ton ?

Watch Video Solution

15. What is one carat ?

Watch Video Solution

16. How many degress are there in one radian ?

Watch Video Solution

17. Write in ascending order : light year, astronomical unit, par sec.

Watch Video Solution

18. What is represented by 1 bar ? What is its value in SI units ?

Watch Video Solution

19. Is light year a unit of time ?

Watch Video Solution

20. Express the average distance of earth from the sun in (i) light year (ii) per sec.

Watch Video Solution

21. Which unit is used for measuring nuclear area of cross-section ?

Watch Video Solution

22. What is the order of magnitude of 499 and 0.050 ?

Watch Video Solution

23. What is the order of magnitude of radius of earth ?

Watch Video Solution

24. What is the estimated size of aboservable universe ?

Watch Video Solution

25. What is the average distance of moon from earth ?

Watch Video Solution

26. Which insturment is used for measuring distance upto $10^{-4}m$?

Watch Video Solution

Watch Video Solution

27. How far away is the nearst star alpha centuri from earth ?

Watch Video Solution

28. Name the device that can be used to measure the number of wavelengths of light in a given distance.

Watch Video Solution

29. What does the word LASER stand for ?

Watch Video Solution

30. What is the order of size of out galaxy ?

Watch Video Solution

31. What is the order of mean free path of an aire molecule ?

Watch Video Solution

32. What is the smallest mass measured indirectly so far?

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33. How are the pitch and least count of a spherometer related ?

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34. What is meant by angular diameter of moon ? What is its value?

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35. What is the order of mass fo uiverse.

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36. Which technique is used for measuring age of rocks, fossils etc.

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37. Are there more microseconds in a second than the number of seconds in a year ?

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38. Express in scientific notation : (i) 13780 kg (ii) 0.00000523 s

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39. What is the efficiency of time realisation in cesium atomic clocks ?

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40. What is the difference between inertial mass and gravitational mass of a body?

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41. Which is the world's most accurate clock ? What is its accuracy?

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42. What is the order of age of the earth ?

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43. Human life expectancy is of the order of

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44. What is the order of mass of universe ?

Watch Video Solution

45. What is the smallest mass measured indirectly so far?

Watch Video Solution

46. Wlidt is the shortest time interval measured indirectly so far ?

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47. Name the physical quantites having dimensions $[M^1L^2T^{-2}]$.

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48. Name two physical quantities which have dimesion $[M^1L^{-1}T^{-2}]$.

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49. How many times the unit of energy is affected when units of force and length are doubled ?

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50. What are the dimensions of rate of flow?

Watch Video Solution

51. Give two examples of non dimensional veriables.

Watch Video Solution

52. Name any three dimensional constants.

Watch Video Solution

53. Name any two non dimensional constant.

Watch Video Solution

54. The dimensional forumal of Hubble constant. Is same as that of frequency. Comment.

Watch Video Solution

55. Can there be a physical quantity which has no units and no dimensions.

Watch Video Solution

56. What is the dimension of time in power ?

Watch Video Solution

57. All constants are dimensionless. Comment.

Watch Video Solution

58. If 'slap' times speed equals power, what is the dimensional formula for 'slep' ?

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59. Can a quantity have units, but still be dimansionless?

Watch Video Solution

60. Does a quantity have different dimensions in different systems of units ?

Watch Video Solution

61. What are the dimensions of rate of flow?

Watch Video Solution

62. What are the dimensions of linear mass density ?

Watch Video Solution

63. What type of quantity is Avogadro's number ?

Watch Video Solution

64. What are the dimensions of a and b in the relation F = at + b x, whrer F is force and x is distance ?

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65. Calculate x in the equation :

$(velocity)^x = (pressired \Leftrightarrow .)^{3/2} \times (density)^{-3/2}$

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66. The dimensions of Boltzmann constant are the same as that of (i) pressure density (ii) Stefan's constant (iii) Planck's constant (iv) entropy

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67. Measuring process is essentially .... Fill in the blanks

Watch Video Solution

68. What is error of measurement ?

Watch Video Solution

69. What are personal errors ?

Watch Video Solution

70. What is the reliability of measurement of length using a metre scale ?

Watch Video Solution

71. Maximum absolute error in difference of two quantites is equal to ..... Of the absolute errors in the indinvidual quantites. Fill in the blanks.

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72. Fill in the blanks : (i) Maximum .... error in product of quantities is .... Of .... Errors in the individual quantities. (ii) Maximum...... error in a quantity raised to power (n) is .... The ...... error in the individual quantity.

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73. Which of the following length measurements is most precise and why?

(a) $2.0cm$, (b) $2.00cm$, (c) $2.000cm$

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74. What is precentage error in volume of a sphere, when error in measuring its radius is 2% ?

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75. What is error in density of a cube when its mass is uncertainl by $\pm 2\%$ and length of its edge is uncertain by $\pm 1\%$?

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76. Find the number of significant figures in 0.005.

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77. Round off to four significant figures in (i) 36.879 (ii) 1.0084

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78. Round off the following numbers as indicated : (ii) 25.653 ot 3 digits (ii) $4.996 \times 10^5 \rightarrow 3 digits$ (iii) 0.6995 to 1 digit (iv) 3.350 to 2 digits. (v) 3.450 to 2 digits.

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79. solve with due regard to significant figures: $\sqrt{6.5 - 6.32}$

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80. Change of units does not change the number of significant figure in a measurement. Is it true ?

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

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82. Subtract 10.5 from 10.587 and express the result with correct number of significant figures.

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83. Add 0.4382 to 876 and wirte the result with correct number of significant figures.

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

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85. The radius of atom is of the order of 1 Å and radius of nucleus is of the order of fermi. How many magnitudes higher is the volume of atom as compared to the volume of nucleus ?

Watch Video Solution

86. the device used for measuring the mass of atoms and molecules is

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87. Express unified atomic mass unit in kg.

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88. A function $f(\theta)$ is defined as : $f(\theta) = 1 - \theta + \frac{\theta^2}{2!} - \frac{\theta^3}{3!} + \frac{\theta^4}{4!} \ldots$ why is it necessary for θ to be a dimensionless quantity ?

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

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Short Answer Question 2 marks

1. What is meant by order of magnitude of a quantity ?

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2. Suggest a distance corresponding to each of the following order of length :

(i) $10^{7}m$ (ii) $10^{-6}m$

$10^{4}m$

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3. suggest some indirect method for measuring the height of a tree on a sunny day.

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4. Write the full name of the technique used in locating (a) position of an aeroplane in space, (b) position of an object under water.

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5. Assertion : Parallax method cannot be used for measuring distance of stars morer then 100 light year away.

Reason : Because parallax angle reduces so much that it cannot be measured accurately.

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6. who maintains indian Standard Time ?

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7. What is the basic difference between inertial mass, gravitational mass and weight of a body?

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8. Which technique is used for measuring age of rocks, fossils etc.

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Short Answer Questions

1. The mass of a body is measured by two persons is 10.2 kg and 10.23 kg. Which is more accurate and why ?

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2. In the measurement of g using a simple pendulum, which quantity should be measured which quantity should be measured with maximum accuracy and why ?

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3. when $y = s^4$, what is the relative error in y?

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4. When you take 500 obseravations instead of 100 observations of a measurement, by what factor is probable error reduced ?

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5. What is a systematic error ? How can it be removed ?

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6. Which of the following lengths measured is most accurate and why ? (a) 500.0cm (b) 0.0005 cm (c) 6.00 cm

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7. Subtraction of two nearly equal quantites destroy the accuracy. Comment.

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

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9. A substance weighing 5.74 g occupies a volume of $1.2cm^3$.

Caluclate its density with due regard to significant digits.

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10. What is the differecne between the measurements 4.0 cm and 4.000 cm ?

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11. In a number without decimal , what is the significant of zeros on the right of non - zero digits?

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12. State the number of significant figures in (i) 0.007m (ii) $2.67 \times 10^{-24} kg$

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13. Add 8.2 and 10.163 and round off the sum to proper number of significant figures.

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14. The mean value of period of oscillation of a simple pendulum in an expreiment is 2.825 s. The arithmetic mean of all the absolute errors is 0.11 s. Round off the period of simple pendulum to approximate number of significant figures. Given resson.

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15. (a) The earth- moon distance is about 60 earth radius. What wil be the diameter of the earth (approximately in degress) as seen from the moon ? (b) Moon is seen to be of $(1/2)^{\circ}$ diameter from the earth. What must be the relative size compared to the earth ? (c) From parallax measurement, the sun is found to be at a distance of about 400 times the earth. moon distance. Estimate the ratio of sun-earth diameters.

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16. 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. Give reason for you answer.

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

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

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19. During a total solar ecilpse the moon almost entirely covers the sphere of the sun. Write the relation between the distances and sizes of the sun and moon.

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

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21. Give an example of (a) a physical quantiy which has a unit but no dimensions. (b) a physical quantity which has neither unit no dimensions. (c) a constant which has a unit. (d) a constant which has no unit.

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22. Calculate the length of the arc of a circle of radius 31.0 cm which subtands and angle of $\frac{\pi}{6}$ at the centre.

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

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

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

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Shor Answer Question 3 marks

1. The resistance $R = \frac{V}{I}$, where $V = (100 \pm 5.0)V$ and $I = (10 \pm 0.2)A$. Find the percentage error in R.

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2. A capacitor $C = (2.0 \pm 0.1)\mu F$ is charged to a voltage $V = (20 \pm 0.5)$ volt. Calculate the charge Q with error limits.

Watch Video Solution

3. Which of the following length measurment is most accurate and why ? (i) 4.00 cm (ii) 0.004 mm (iii) 40.00 cm.

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4. How is accuracy in measurement different from precision ?

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5. What is meant by significant figures ? Given any four rules for counting significant figures.

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6. Can we reduce the permissible error in a result using same instrument?

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Long Answer Question 5 marks

1. What do you udnderstand by errors measurement ? Discuss briefly the verious types of erros.

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2. Discuss how errors propagate in sum, difference, product and division of quantites.

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Long Answer Questions

1. A new system of units is proposed in which unit of mass is αkg, unit of length β m and unit of time λs. How much will 5 J measure in this new system ?

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2. The volume of a liquied flowing out per second of a pipe of length l and radius r is written by a student as $v = \frac{\pi}{8}\frac{Pr^4}{\eta I}$ where P is the pressure difference between the two ends of the pipe and η is coefficient of viscosity of the liquid having dimensioal formula $ML^{-1}T^{-1}$. Check whether the equation is dimensionally correct.

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3. A physcial quantity X is related to four measurable quantites a, b, c and d as follows : $X = a^2b^3c^{5/2}d^{-2}$ The percentage error in the measurement of a, b, c and d are 1% , 2%, 3% and 4%, respectively. What is the percentage error in quantity X ? if the value of X calculated on the basis of the above relation is 2.763, to what value should you round off the result ?

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4. In the expression $P = EI^2 m^{-5} G^9 (-2)$, E, m, I and G denote energy, mass, angular momentum and gravitational constant, respectively. Show that P is a dimensionless quantity.

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5. If velocity of light c, Planck's constant G are taken as fundamental quantites, then express mass, length and time in terms of dimensions of these quantites.

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6. An artificial satellite is revolving around a planet of mass M and radius R, in a circular orbit of radius r. From Kelper's Third law about the period of a satellite around a common central body, square of the period of revolution T is proportional to the cube of the radius of the orbit r. Show usnig dimensional analysis, that $T = \frac{k}{R}\sqrt{\frac{r^3}{g}}$, Where k is a dimensionless constant and g is acceleration due to gravity.

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7. In an experiment to estimate the size of a molecule of oleic acid 1mL of oleic acid is dissolved in 19 mL of alcohol. Then 1 mL of this solution is diluted to 20 mL by adding alcohol. Now 1 drop of this diluted solution is placed on water in a shallow

trough. The solution spreads over the surface of water forming one molecule thick layer. Now, lycopodium powder is sprinkled evenly over the film and its diameter is measured. Knowing the volume of the drop and area of the film we can calculate the thickness of the film which will give us the size of oleic acid molecule. Read the passage carefully and answer the following questions : (a) why do we dissolve oleic acid in alcohol ? (b) What is the role of lycopodium powder ? (c) What would be the volume of oleic acid in each mL of solution prepared ? (d) How will you calculate the volume of n drops of this solution of oleic acid ? (e) What will be the volume of oleic acid in one drop of this solution ?

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8. (a) How many astronomical units (A.U) make 1 parsec ? (b) Consider a sunlike star at a distance of 1 parsec.When it is seen through a telescope with 100 magnification, what should be the angular size of the star ? Sun appears to be $(1/2)^{\circ}$ from the earth. Due to atmospheric fluctuations, eye can't resolve object smallar then 1 arc minute. (c) Mars has approximately half of the earth's diameter. When it is closest to the earth it is at about 1//2 A.U. from the erath. Calculate what size it will appear when seen through the same telescope.

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9. Einstein's mass - energy relation emerging out of his famous theory of relativity relates mass (m) to energy

$(E) as E = mc^2$, where c is speed of light in vacuum. At the nuclear level, the magnitudes of energy are vary small. The energy at nuclear level is usually measured in MeV, where $1 MeV = 1.6 \times 10^{-13} J$, the masses are measured in unified mass unit (u) where $1u = 1.67 \times 10^{-27} kg$. (a) Show that the energy equivalent of 1u is 931.5 MeV. (b) A student writes the relation as 1 u = 931.5 MeV. The teacher points out that the relation is dimensionally incorrect. Write the correct relation.

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Advanced Problems for Competitions

1. Light emitted by Krypton 86 is 6057.8021 Å. Calculate number of wavelengths of Krypton 86 in one metre. What is the order of magnitude ?

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2. The weather bureau determines the height of cloud layer by measuring the angle of elevation to the point, where the light of a vertical beam is reflected by clouds. The angle is measured at any observation station sapeerated from the foot of the light beam by a base lline. If the base line is 500 m in length, what is the altiude of cloud layer observed at 41° ?

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3. Deduce the dimensional formula of thermal conducitvity (k).

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4. If velocity of light (c), gravitational constant (G) and Planck's constant (h) are chosen as fundamental units. What would be the dimensions of acceleration due to gravity ?

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5. $LetR = K\rho^a v^b \eta^c D^1 \dots (i)$

where a, b, c are the dimensions and K is dimensionless constant. Writing the dimensions in(i) we get

$$\left[M^0L^0T^0\right] = \left[ML^{-3}\right]^1 \left(LT^{-1}\,\hat{}\,b\left(ML^{-1}\right)^c L^1\right.$$

$$= M^{a+c}L^{-3a+b+1-c}T^{-b} - c$$

Applying the principle of homogeneity of dimensions, we get

a +c = 0, c= -a

-3a +b +1 -c =0 .... (ii)

-b-c = 0 or b= -c

From (ii) -3a - c+1 -c = 0

-3a - 2c =-1 or -3a +2a = -1 or a= 1

c = -a =-1, b=-c =1

Putting these values in (i) we get

$$R = K\rho^1 \upsilon^1 \eta^{-1} D^1$$

$$R = K\frac{\rho \upsilon D}{\eta}$$

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6. The radius of a proton is about 10^{-9} micron and the radius of universe is about 10^{28} cm. Name a physical object whose size is approximately halfl way between these two extermes on a logarithmin scale.

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7. Identify the physical quantity x defined as $x = \frac{IFv^2}{WI^3}$, where I is moment of inertia, F is force, v is veloicty, W is work and I is length.

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8. Finding dimensions of resistance R and indcutance L, speculate what physcial quantities (L/R) and $\frac{1}{2}LI^2$ represent, where I is current?

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9. The pitch of a screw gauge is 1mm and there are 100 divisions on circular scale. While measuring the diameter of a wire, the linear scale reads 1 mm and 47th division on circular scale coincides with reference line. The length of the wire is 5.6 cm. Find the curved surface area of the wire in cm^2 to correct number of significant figures.

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10. The diameter of a brass metal bob is measured as $1.92 \times 10^{-2} m$ using a vernier callipers. The mass of the bob is measured to be $29.150 \times 10^{-3} kg$ using a physical balance. Find density of the meterial to correct number of significant figures.

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11. Construct a new physical quantity having dimensions of length in terms of universal constant : G (gravitational

constant), h (Planck's constant) and c (velocity of light). What is the order of its value?

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12. Calculate the dimensions of impulse in terms of velocity (v) denity (ρ) and frequeny (v) as fundamental units.

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Curiosity Questions

1. What is a discovery ?

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2. Can you visualize the growth and development of useful scientific tool ?

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3. Why is the use of common units throughout the world desirable ?

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4. Give one example where precise measurement of length is important.

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5. From where do we get highly accurate time signals in U.S?

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6. Principle of homogeneity of dimensios is the consistency test for any equation. If an equation fails this test, it is proved wrong. But if the equation passes this consistency test, it is not neacessarliy proved right. Why ?

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7. Differentiate between precision and accuracy with an example.

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Higher Order Thinking Skills

1. If the velocity of light c, the constant of gravitation G and Planck's constant h be chosen as fundamental units, find the value of a gram, a centimeter and a second in terms of new units of mass, length and time respectively. Given $c = 3 \times 10^{10} cms^{-1}, G = 6.67 \times 10^{-8}$ dyne $cm^2 g^{-2}, h = 6.6 \times 10^{-27}$ erg sec.

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2. If P represents radiation pressure , C represents the speed of light , and Q represents radiation energy striking a unit area per second , then non - zero integers x, y, z such that $P^x Q^y C^z$ is dimensionless , find the values of $x, y, \text{ and } z$.

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3. A voltmeter having least count 0.1 V and an ammeter having least count 0.2 A are used to measure the potentail difference across the ends of a wire and current flowing through the wire respectively. If the reading of voltmeter is 4.4 V and reading of ammeter is 2.2 A, then find (i) the resistance of wire with maximum permissible error and (ii) maximum percentage error.

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4. Two resistances $R_1 = (16 \pm 0.3) ohm$ and $R_2 = (48 \pm 0.5) ohm$ are connected in parallel. Find the total resistance of the combination and maximum percentage error.

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5. To study the flow of a liquied through a narrow tube, the following formula is used $:\eta = \frac{\pi}{8}\frac{Pr^4}{VI}$, where letters have their usual meaning. The value of P, r, V and I are 76 cm of Hg col. $0.28cm, 1.2cm^3s^{-1}$ and $18.2cm$ respectively. If these quantities are measured to the accuracy of $0.1cmofHgcol.$, $0.01cm, 0.1cm^3s^{-1}$ and 0.1 cm respectively, find the percentage error in the value of η.

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6. A large fluid star oscillates in shape under the influence of its own gravitational field. Using dimensional analysis, find the expression for period of oscillation (T) in terms of radius of

star (R), mean density of fluid (ρ) and universal gravitational constant (G).

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7. Calculate focal length of a spherical mirror from the following observations : object distance, $u = (50.1 \pm 0.5)cm$ and image distance , $v = (20.1 \pm 0.2)cm.$

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8. If C represents capacitance and R represents resistance, then the unit of CR^2 are

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9. Let I = current through a conductor, R =its resistance and V = potential difference across its ends. According to Ohm's law, product of two of these quantites equals the third. Obtain Ohm's law from dimensional analysis. Dimensional formula for R and V are $\left[ML^2T^{-3}A^{-2}\right]$ and $\left[ML^2T^{-2}A^{-1}\right]$ respectively.

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10. Check the correctness of the relation $c = \dfrac{1}{\sqrt{\mu_0 \in_0}}$ where the symbols have their usual meaning.

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Value Based Questions

1. Science is ever dynamic. There is no final theory in science and no unquestioned authority amongst scientists. As observation improve in detail / precison and experiments yield new result, theories are modified if necessary, to account for them. Thus, in science, approach is always 'open minded'. Read the above passage and answer the following questions :(i) What do you mean by 'open minded' approach ? (ii) What value of life do you learn from this?

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2. Fundamental forces in nature have been classified as : Gravitational forces, weak forces, electromagnetic forces and nuclaer forces. Gravitational forces are weakest of all forces and nuclear forces are the stronges of all. Whereas gravitational forces operate over very long distance, the nuclear forces are confined only within the nucleus. Read the above passage and answer the following questions : (i) Which forces are central forces ? (ii) Which forces are non conservative forces ? (iii) What value of life do you learn from this study ?

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3. Albert Einstein, the greastest scientist of all times once remarked : 'The most incomprehensible thing about the world is that it is comprehensible.' Another famous philosopher Bertrand Russel once commented 'We know very little and yet it is astonsihing that we know so much, and still more astonishing that so little knowledge (of science) can give us so much power.' Read the above paragraph and answer the following questions : (i) Are the two remarks identical ? What is the underlying basis of the two remarks ? (ii) How do these remarks apply in day to day life ?

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4. The process of measurement is basically a process of comparison. The chosen standard of measurement of a quantity, which has essentially the same nature as that of the quantity is called unit of the quantity. Magnitude of a quantity (Q) = size of its unit $(u) \times$ number of times (n) this unit is contained in the quantity. i.e. Q = nu As magnitude of a quantity remains the same, whatever be its units of measurement, therefore, $Q = n_1 u_1 = n_2 u_2$ Read the above passage and answer the following questions : (i) The value of acceleration due to gravity $(g) = 9.8 m / s^2$ How do you express it in km/hr^2 ? (ii) Our world is a game of numbers. Do you agree ? Justify.

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5. As is known, the result of an experiment is calculated by performing mathematical operation (like addition, subtraction, multiplication, division, etc.) on several measurements, which have different degrees of accuracy. It has been established that (a) When $x = a + b, \Delta x = \pm (\Delta a + \Delta b)$

(b) When $x = a - b, \Delta x = \pm (\Delta a + \Delta b)$

(c) When $x = a \times b, \frac{\Delta x}{x} = \pm \left(\frac{\Delta a}{a} + \frac{\Delta b}{b}\right)$

(d) When $x = \frac{a}{b}, \frac{\Delta x}{x} = \pm \left(\frac{\Delta a}{a} + \frac{\Delta b}{b}\right)$

Read the above paragraph and answer the following questions : (i) Why is absolute error in $x = (a - b)$, sun of the absolute error in a and b ? (ii) Why is fractional error in $x = \frac{a}{b}$, sun of fractional error in a and b ? (iii) What do you learn from this ?

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Problems for Practice

1. How many light years are there in 1 metre?

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2. The radius of gold nucleus is 41.3. fermi. Express its volume in m^3

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3. How may metric tone are there in a teragrm?

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4. How much longer then a microsecond is a millisecond ?

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5. The density of wood is $0.5g/$ what is its value is SI?

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6. Calculate surface area of a solid cylinder of diameter 4 cm and height 20 cm in mm^2

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7. Express an acceleration of $10ms^{-2}$ in km h^{-2}

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8. Find the value of one light year in giga meter.

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9. How much longer is a per sec from a light year?

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10. Convert an acceleration of $2kmh^{-2}$ into cm s^{-2}

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11. The relative density of lead is 11.3. its density $= \ldots \ldots gcm^{-3} = \ldots \ldots \ldots kgm^{-3}$. Fill in the blanks.

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12. fill in the blanks by suitable conversion of units :

(i) $5ms^{-2} = \ldots \ldots \ldots Kmh^{-2}$

(ii) $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$

$= \ldots \ldots Cm^3 s^{-2} g^{-1}$

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13. 76 cm of mercury column is a measure of atmospheric pressure. Express it is N/m^2 Given density of mercury is $13.6 \times 10^3 kg/m^3$

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14. How many amu would make up 1 kg?

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15. How many astronomical units make up one light year?

Watch Video Solution

16. The value of universal gravitational constant is 6.67×10^{-8}dyne$g^{-2}cm^2$. What is its value in Mks system?

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17. The acceleration of a body is $2km/h^2$. Express it in cm/s^2

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18. Estimate the order of magnitude of surface area of earth.

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19. Estimate the order of number of seconds in a century.

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20. From a quasar, light takes about 3 billion years to reach the surface of earth. Calculate the distance of quasar from the earth in light years.

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21. When planet Jupiter is at a distance of 824.7 million km from earth, its angular diameter is measured to be 35.72'' of arc. Calculate the diameter of Jupiter.

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22. A star is located 9 ly away from us. What is its distance in par sec ? What is the parallax shown by this star when viewed from two locations $3 \times 10^{11} m$ apart. Given 1 par sec $= 3.084 \times 10^{16} m, \text{ and } 1 ly = 9.46 \times 10^{15} m.$

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23. When the observations are taken at an interval of 6 months, the angle of parallax for a star is 0.4". Find the distance of star in par sec.

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24. A drop of olive oil of radius 0.25 mm spreads into a circular film of diameter 20cm on the water surface. Estimate the size of the oil molecule.

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25. The shadow of a pole standing on a level ground is found to be 45 m longer when the sun's altitude is 30° then when it was 60° Determine the height of the pole.

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26. A radar signal is beamed towards a planet and its echo is recived 7 minutes later. If the distance between the planet and earth is $6.3 \times 10^{10} m,$ calculate the speed of the signal.

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27. Find the period of revoluition of planet Mars about the sun if mean distance of the Mars from the sun is 1.52AU.

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28. A drop of olive oil of radius 0.3 mm spreads into a rectangular film of $30cm \times 15cm$ on the water surface. Calculate the size of the oil molecule.

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29. Total time taken by a laser beam to return to the earth after reflection from the moon is 2.56 s. Calculate the distance of moon from the earth. Take velocity of light in vacuum $= 3 \times 10^8 m / s$.

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30. Human heart beats one in 0.8s. Calculate how many times the human heart beats in the life of a person of 60 years.

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31. An air moleculle spins once in 10^{-12}s. How many times (order of mangitude) would an air molecule spin around its asixs, while the earth revolves once around the sun?

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32. If two atomic clocks, allowed to run for 60 years differ from eachother by 0.2s only, calculate the accuracy of standerd atomic clock measuring a time interval of 1 sec.

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33. If the distance of vanus from sun is 0.73 AU, find out the orbital period of the venus in days.

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34. IF the size of an atom (= 1Å) were enlarged to the tip of a sharp pin $\left(\cong 10^{-5}m\right)$, how large would the height of mout everest $\left(\cong 10^{4}m\right)$ be?

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35. If an atom of size 10^{-10}m were enlarged to the size of the earth $(\cong 10^7 m)$, how large would its nucleus be ? Take size of nucleus $= 10^{-14}$m.

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36. If size of an atom $(\approx 10^{-10} m)$ is scaled up to 1m, what would be the size of nucleus $(\approx 10^{-14} m)$?

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37. A neutron starj has a density equal to theat of nuclear matter $(\cong 2.8 \times 10^{17} kg/m^3)$. Assuming the star to be spherical, find the radius of the neutron star whose mass is $4.0 \times 10^{30} kg$.

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38. An object 1 mm square is projected and its image on the screen is 1cm square. Calcullate the linear magnificaiton.

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39. Rad corpuscles of human blood stream are known to be flattened discs. Blood count shows RBC_s of sdhte order of 5×10^6 in each cubic millimeter of blood. If the adult body contains 5 litres of blood, what is the order of total number of red corpuscles it contains?

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40. Find the percentage empty space in one mole of nitrogen gas at STP. Given, radius of nitrogen molecule is 2 Å.

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41. Assuming that the orbit of the planet Mercury around the sun to be a circle, Copernicus detrmined the orbital radius to be $0.38AU$. From this determine the angle of maximum elongation for Mercury and its distance from the earth when the elongation is maximum .

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42. If the unit of force is 1 kN, unit of length 1 km and unit of time is 100s, what will be the unit of mass?

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43. Find the value of 100 J on a system which has 20 cm, 250g and half minute as fundamental units of length, mass and time.

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44. If the value of universal gravitational constant is $6.67 \times 10^{11} Nm^2 kg^{-2}$, then find its value in CGS system.

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45. The value of Stefan's constant is $\sigma = 5.76 \times 10^{-8} Js^{-1} m^{-2} K^{-4}$. Find its value in cgs system.

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46. Convert a power of one mage watt on a system whose fundamental units are 10kg, 1 dm and 1 minte.

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47. When one metre, one kg and one minute are taken as fundamental units, the magnitude of a foce is 36 units. What is the value of this force on cgs system?

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48. If velocity of light is taken as the unit of velocity and an year is taken as the unit of time, what is the unit of length?

What is it called?

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49. If the unit of force ware kilonewton, that of time millisecond and that of power kilowatt, what would be the units of mass and length?

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50. The surface tension of water is 72 dyne//cm. Express is in SI units.

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51. Check the correctness of the relation $\pi = I\alpha$ whare π is torque acting on the body, I is moment of inertia and α is angular acceleration.

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52. Chack the correctness of the relations. (i) escape velocity, $v = \sqrt{\frac{2GM}{R}}$ (ii) $v = \frac{1}{2l}\sqrt{\frac{T}{m}}$, where l is length, T is tension and m is mass per unit length of the string.

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53. On the basis of dimensional arguments, rule out the wrong relation for Kinetic Energy. (i) $\frac{3}{16}mv^2$ (ii) $\frac{1}{2}mv^2 + ma$

Watch Video Solution

54. Cheak the correctness of the equation $FS = \frac{1}{2}mv^2 - (1)\mu^2$

Watch Video Solution

55. The rate of flow (V) of a liquid flowing through a pipe of radius r and pressure gradient (P//I) is given by Poiseuille's equation$V = \frac{\pi}{8}\frac{Pr^4}{\eta I}$ Chack the dimensional correctness of this relation.

Watch Video Solution

56. Using dimensional analysis, check the correctness of the following relations : (i) $S_{nth} = u + \frac{a}{2}(2n - 1)$ (ii) $\lambda = h/mv$

(ii) $= mc^2$ where the symbole have their usual menaings.]

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57. Check the correctness of the relation $h = \frac{2\sigma\cos\theta}{r^2 dg}$, where h is height , $sigam$ is surface tension, θ is angle of contact, r is radius, d is density and g in acceleration due to gravity.

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58. Check by the method of dimensions, the formula $u\psi lo = \frac{1}{\lambda}\sqrt{\frac{K}{d}}$, where v is velocity of longitudinal waves, λs is wavelength of wave, K is coefficient of volume elasticity and d is density of the medium.

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59. The cirtical velocity (v) of flow of a liquied through a pipe of radius (r) is given by $v = \frac{\eta}{\rho r}$ where ρ is density of liquid and η is coefficient of visocity of the liquied. Check if the relaiton is correct dimensinally.

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60. The dimension of (angular momentum/ magnetic moment) are $\left[MA^{-1}T^{-1}\right]$. is it correct?

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61. The dimension of σb^4 (where σ is Stefan's constant and b is Wien's constant) are $\left[ML^4T^{-3}\right]$ is it true.

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62. Check by the method of dimensions, whether the folllowing relation are dimensionally correct or not. (i) $v = \sqrt{P / \rho}$, where v is velocity. P is perrssure and ρ is density. (ii) $v = 2\pi\sqrt{\frac{I}{g}}$, where I is length, g is acceleration due to gravity and v is frequency.

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63. The distnac e (x) covered by a particel in time t is given by $x = a + bt - ct^2 + dt^3$. Find the dimesniosn of a,b,c,d.

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64. Find the dimensions of axxb in the relation $P = \frac{a - t^2}{b\sqrt{x}}$, wher x is distance t is time and P is power.

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65. In the equation y= a sin $(\omega t + kx)$ t and x stand for time and distance respectively. What are the dimensions of ω / k?

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66. The position of a particle moving along x-axis depends on time according to the equation $x = at^2 + bt^3$, where x is in metre and t is in sec. What are the units and dimensions of a and b : what do they represent?

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67. The velocity v of a particle depends upon time t, according to the equation $v = a + bt + \frac{c}{d+t}$ Write the dimensions of a,b,c, and d.

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68. Write the dimensions of a/b in the relation $F = a\sqrt{x} + bt^2$ where F is force x is distance and t is time.

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69. Write the dimensions ofa/b in the relation $P = \frac{a - t^2}{bx}$ where P is pressure, x is distance and t is time.

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Watch Video Solution

70. Find the dimensions of a/b in the relation $P = \frac{b - x^2}{at}$ where P is pressure. X is distance and t is time.

Watch Video Solution

71. Find the dimensions of $a \times b$ in the relation $p = a\sqrt{t} - bx^2$, where x is distance, t is time and P is power.

Watch Video Solution

72. Find the dimensions of $\frac{a \times b}{c}$ in the relation $F = \frac{a}{\sqrt{x}} + bx = cx^2$ where F is force and x is distance.

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73. A small spherical ball of radius r falls with velocity v through a liquid having coeffiecinet of viscosity η. find viscous darg F on the wall if it depends or $r, v, \eta. Take K = 6\pi$

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74. The cirtical angular velocity ω_c of a cylinder inside another cylinder containing a liquied at which its turbulance occurs depends on visocisity η density ρ and disntac d between wall of the cylinder. Obtain an expression for ω_c using method of dimensios.

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75. Expermients show that frequency (n) of a tuning fork depends on lentght (I) fo the prong, density (d) and the Young's modulus (Y) of its meterial. On the basis of dimensional analysis, dericve an expression for frequency of tunnig fork.

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76. Calculate the dimensions of linear momentum and surface tension in terms of velocity (v), density (ρ) and frequency (V) as fundamental units.

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77. The wavalenght (λ) of matter waves may depends upon Planck's constant (h) mass (m) and velocity (v) of the particle. Use the method of dimensions to derive the formula

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78. The speed of transverse wave v in a stretched string depend on length tension T in the string and liner mass density (mass per unit length). μ. Find the relation using method of dimensions.

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79. Assuming that the mass m of the largest stone that can be moved by a flowing river depends upon the velocity v, of water, its density ρ and acceleration due to gravity g, then m is directly proportional to

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80. The frequency (V) of an oscillatingj drop may depends upon radius (r) of the drop density (ρ) of liquid and the surface tension (S) of the liquid. Deduce of formula dimensionally.

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81. Using the method of dimensions, derive an expression for rate of flow (v) of a liquied through a pipe of radius (r) under a pressure gradient (P/I) Given that V also depends on coefficient of viscosity (η) of the liquied.

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82. The eacape velocity of a body depend upon (i) acceleration due to gravity (g) (ii) radius of the plate (R) Obtain the formula for escape velcoity using the mehtod of dimensions.

Watch Video Solution

83. A small spherical ball of radius r falls with velocity v through a liquid having coeffiecinet of viscosity η. find viscous darg F on the wall if it depends or $r, v, \eta. TakeK = 6\pi$

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84. By the method of dimensions, obtain an expression for the surface tension S of a liquid rising in a capillary tube. Assume that S depends on mass m of liquied, Pressure p of liquid and radius r of the capillary tube. Take $K = 1/2$.

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85. Find the dimensional formula of $\frac{1}{4\pi \text{in}_0}\frac{e^2}{hc}$, where symbols have their usual menaing.

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86. If the fundamental quantites are velocity (v), mass (M), time (T), what will be the dimensions of η in the equaiton $V = \frac{\pi pr^4}{8I\eta}$ where the symbosl have their usual meaning?

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87. The number of particles is given by $n = -D\frac{n_2 - n_1}{x_2 - x_1}$ crossing a unit area perpendicular to X - axis in unit time , where n_1 and n_2 are particles per unit volume for the value of x meant to x_2 and x_1 . Find the dimensions of D called diffusion constant.

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88. In dimension of circal velocity v_0 liquid following through a take are expressed as $(\eta^x \rho^y r^z)$ where η, ρ and $r$are the coefficient of viscosity of liquid density of liquid and radius of the tube respectively then the value of x, y and z are given by

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89. Reynold number N_R a dimensionless quantity determines the condition of laminar flow of a viscous liquied through a pipe. N_R is a function of density ρ of liquid, average speed υ and coeff. Of viscosity η. Given that $N_R \propto D$, diameter of pipe. Show by the method of dimensions that $N_R \propto \frac{\rho \upsilon D}{\eta}$

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90. The period of vibration of a tunign fork depends on the length l of its prong, density d and Young's modulus Y of the meterial. Deduce an expression for the period of vibration (T) using dimensional analysis.

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91. A U - tube of uniform cross section contains mercury upto a height h in either limb. The mercury in one limbe is depressed a little and then relased. Obtain an expression for time period (T) of oscillation, assuming that T depends on h,ρ and g, where ρ is density of mercury.

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92. The length of a rod as measured in an experiment is found to be 2.48 m, 2.46 m , 2.49 m , 2.49 m and 2.46 m. Find the average length , the absolute error in each observation and the percentage error.

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93. If $I_1 = (12.0 \pm 0.1)$ cm and $I_2 = (8.5 \pm 0.5)cm$ find $(l_1 + l_2)$ and $(l_1 + l_2)$ with proper error limits.

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94. The lengths of the sides of a rectangle are $(5.7 \pm 0.2)cm$ and (3.2 ± 0.1) cm. Calculate the perimeter of rectangular with error limits.

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95. In an experiment the refractive index of glass was observed to be $1.45, 1.56, 1.54, 1.44, 1.54,$ and 1.53. Calculate

(a). Mean value of refractive index

(b). Mean absolute error

(c) Fractional error

(d) Percentage error

(e) Express the result in terms of absolute error and percentage error

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96. The initial and final temperatures of a liquied are measured to be $(67.7 \pm 0.2)^{\circ} C$ and $(76.3 \pm 0.3)^{\circ} C$. Calculate the rise in temperature.

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97. Two resistance $r_1 = (100.0 \pm 0.3) ohm$ and $r_2 = (150.0 \pm 0.5)$ ohm are connected in series. Calculate the combined resistance with error limits.

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98. The diameter of a wire as measured by a screw gauge was found to be 0.026 cm, 0.028 cm, 0.029 cm, 0.027cm, 0.024cm and 0.027 cm. Calculate

(i) mean value of diameter

(ii) mean absoulte error

(iii) relative error (iv) percentage error. Also express the result in terms of absolute error and percentage error.

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99. The lengths of the two pieces of wire are $l_1 = (35.2 \pm 0.1) cm$ and $l_2 = (47.4 \pm 0.2)$ cm. what is the total length of wire with error limits ?

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100. In the above question, what is the difference in lengths of the two pieses of wire ?

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101. The specific heats of a gas are measured as $C_p = (12.28 \pm 0.2)$ units and C_(upsilon =(3.97 +- 03)` units. Find the value of gas constant R and percentage error in R.

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102. The lengths and breadth of a rectangle are $(5.7 \pm 0.1) cm$ and (2.4 ± 0.2) cm. Calculate area of the rectangle with error limits.

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103. Time taken by a body in (20 ± 0.2) second in undergoing a displacement of (200 ± 5)m. Calculate the percentage error in calculation of velcoity.

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104. The voltage across a lamp is $(6.0 \pm 0.1) V$ and the current passing through it is (4.0 ± 0.2) ampare. Find the

power consumed by the lamp.

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105. If percentage error in a, b, c, d are 1% 2% 3% and 4% respectively. What will be the percentage error in

$$X = \frac{a^{1/3}b^4}{cd^{2/3}}$$

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106. The specific resistance ρ of a thin wire of radius r cm, resistance R ohm and length L is given by $\rho = \frac{\pi r^2 R}{L}$. $If L = 78 \pm 0.01 cm$ $r = 0.26 \pm 0.02$ and $R = 32 \pm 1 \Omega$, What is the percentage error in ρ?

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107. A potentail difference of $V=(20 \pm 1)$ volt is applied across a resistance of (8.0 ± 2) ohm. Calculate the current with error limits.

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108. The radius of a sphere is measured to be (2.1 ± 0.5) cm. Calculate its surface area with error limits .

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109. A physical quantity x is calculated from $x=ab^2/\sqrt{c}$. Calculate the percentage error in measuring x when the percentage errors in measuring a , b , and c are 4 , 2 , and 3%, respectively .

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110. To measure radus of curvature of a convex mirror unsing a spherometer, it was found that $I = (4.4 \pm 0.1)$ cm and h = (0.085 +- 0.001)` cm. Calculate the maximum possible error in the radius of curvature.

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111. The error in the measurement of radius of a sphere in $\pm 4\,\%$ What would be the error in volume of the sphere?

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112. The percentage error in the measurement of mass and speed of a body are 2% and 3% respectively. What will bek the maximum percentage error in the estimation of kinetic energy of the body?

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113. The heat generated in a circuit is given by $Q = I^2 Rt$, where I is current, R is resistance, and t is time. If the percentage errors in measuring $I, R,$ and $tare2\%, 1\%,$ and 1%, respectively, then the maximum error in measuring heat will be

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114. State the number of significant figures in the following :

(i) 0.0070300 m (ii) $2.73 \times 10^{-4} kg$

(iii) 1.0850m (iv) $5.097 \times 10^{3} s$

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115. Add $2.384 \times 10^{-4} \rightarrow 1.7 \times 10^{-5}$ and express the result to correct number of significant figures.

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116. Subtract 2.5×10^{4} form 3.8×10^{5} with due regard to significant figures.

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117. The diameter of circle is 1.06m. Calculate the area enclosed by the circle in correct number of significant figures.

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118. The mass of a body is 179.84 g and its volume is $32.2cm^3$ Express its density with correct number of significant figures.

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119. Write down the number of significant figures in the following :

(i) 0.039 (ii) 2.000 (iii) 0.050 (iv) 3.08×10^6

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120. Round off to three significant digits

(i) 0.03927kg (ii) $4.085 \times 10^8 s$

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121. A jeweller puts a diamond weighing 5.42g in a box weighing 1.2kg. Find the total weight of the box and the diamond to correct number of significant figures.

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122. (a).Add $3.8 \times 10^{-6} \rightarrow 4.2 \times 10^{-5}$ with due regard to significant figures.

(b). Subtract $3.2 \times 10^{-6} \text{ ơ} m 4.7 \times 10^{-4}$ with regard to significant figures.

(c). Subtract $1.5 \times 10^3 \mathfrak{o} m 4.8 \times 10^4$ with due regard to significant figures.

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123. (a).Add $3.8 \times 10^{-6} \rightarrow 4.2 \times 10^{-5}$ with due regard to significant figures.

(b). Subtract $3.2 \times 10^{-6} \mathfrak{o} m 4.7 \times 10^{-4}$ with regard to significant figures.

(c). Subtract $1.5 \times 10^3 \mathfrak{o} m 4.8 \times 10^4$ with due regard to significant figures.

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124. Solve with due regard to significant figurers.

$$\frac{2.91 \times 0.3842}{0.080}$$

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125. Solve the following and express the result to appropriate number of significant figures : (i) $\frac{2.51 \times 10^{-4} \times 1.81 \times 10^{7}}{0.4463}$

(ii) 1.567 + 0.958 - 0.27

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126. The time period of oscillation of simple pendulum is given by $t = 2\pi\sqrt{I/g}$ What is the accurancy in the determination of 'g' if 10cm length is knownj to 1mm accuracy and 0.5 s time period is measured form time of 100 oscillations with a wastch of 1 sec. resolution.

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127. The nth division of main scale coincides with (n +1) th division of vernier scale. Given one main division is equal to 'a' units. Find the least count of the vernier.

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128. The pitch of a screw gauge is a mm and there are 100 division on the circular scale. While measuring the diameter of a wire, the linear scale reads 1mm and 47th division on circular scale coincides with the reference line. The length of the wire is 5.6 cm. Find the curved surface area $\left(\in cm^2\right)$ of the wire in proper significant figures.

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129. In a vernier callipers, 10 vernier scale divisions coincide with 9MSD each of value 1mm. While measuring length of a cylinder using this calliper, main scale reading is 5.1 cm and 7th vernier division coincides with any main scale division. Whenm diameter of cylinder is measured, main scale reading is 1.7 cm and 3rd vernier division coincides with any main scale division. Calculate curved surface area of the cylinder with correct number of significant figures.

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130. How many parsec make up 1 metre ? What is the order of magnitude?

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Test Your Grip

1. Physics involves the study of

A. humans

B. birds and animals

C. plants

D. nature and natural phenomena

Answer: (d)

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2. Classial Physics doen not include subjects like

A. Mechanics

B. Heat

C. Elementary particles

D. Sound

Answer: (c)

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3. The range of masses we study in Physics is

A. $10^{-30}kg \rightarrow 10^{55}kg$

B. $10^{-30}kg \rightarrow 10^{60}kg$

C. $10^{-27}kg \rightarrow 10^{55}kg$

D. $10^{-27}g \rightarrow 10^{60}g$

Answer: (a)

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4. The estimated size of observable universe is ....

A. $10^{18}m$

B. $10^{26}m$

C. $10^{40}m$

D. $10^{-18}m$

Answer: (b)

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5. Time taken by light to cross nuclear diameter is of the order of

A. $10^{22}s$

B. $10^{-6}s$

C. $10^{-14}s$

D. $10^{-22}s$

Answer: (d)

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6. Optical fibers are based on the phenomenon of

A. total internal reflection

B. refraction

C. dispersion

D. none of these

Answer: (a)

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7. Generation, propagation and detection of electromagnetic waves is the basis of

A. Computers

B. Reactors

C. Radio and Television

D. Lasers

Answer: (c)

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8. Force of friction and tension in a string are

A. gravitational forces

B. weak forces

C. electromagnetic forces

D. nuclear forces

Answer: (c)

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9. Inverse square law of distance is followed by

A. gravitational forces

B. electromagnetic forces

C. both (a) and (b) above

D. neither (a) not (b)

Answer: (c)

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10. Albert Einstein was awarded Nobel Prize for his work on

A. Theory of relativity

B. Law of gravitation

C. Uncerainty Principle

D. Photo electricity

Answer: (d)

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11. The measurement of a physical quantity is basically the process of __________.

A. a process of comparison

B. a proces of estimation

C. a process of ease

D. none of these

Answer: (a)

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12. Who made these remarks : 'time is what a clock read'.

A. Newton

B. Einstein

C. CV Raman

D. none of these

Answer: (b)

Watch Video Solution

13. Choose the quatity whose unit is not treated as a fundamental unit.

A. length

B. velocity

C. mass

D. time

Answer: (b)

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14. The SI unit of luminous intensity is

A. watt candela

B. newton

C. lux

D.

Answer: (b)

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15. Waber is derived unit of

A. magnetic moment

B. luminous flux

C. magnetic flux

D. none of these

Answer: (c)

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16. A standard metre is equal to k wavelengths in vacuum, energy of photon is 2.047eV of the radiation from Krypton 86, where k is

A. 165076.37

B. 16507637.3

C. 1650763.73

D. none of these

Answer: (c)

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17. Which of the following relations is not correct ?

A. $1A. U = 1.496 \times 10^{11} m$

B. $1ly = 9.46 \times 10^{15} m$

C. $1par\sec = 3.084 \times 10^{16} m$

D. `1 ly = 6.3xx10^(-4) A.U.

Answer: (d)

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18. Prefix zepto and femto stands for which multiples ?

A. 10^{15}

B. 10^{-15}

C. 10^{5}

D. 10^{-5}

Answer: (b)

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19. How many disintegrations per second make up 1 curie ?

A. 3.7×10^{10}

B. 3.7×10^{13}

C. 3.7×10^{7}

D. none of these

Answer: (a)

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20. Which of the following relations is not correct ?

A. 1 millibar = $10^2 Pa$

B. 1 bar = 760 torr

C. 1 bar = $10^4 Pa$

D. none of these

Answer: (c)

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21. The order of magnitude of height of man is

A. zero

B. 1

C. -1

D. none of these

Answer: (a)

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22. The radius of proton in of the order of

A. $10^{15}m$

B. $10^{-15}m$

C. $10^{-14}m$

D. $10^{-31}m$

Answer: (b)

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23. A screw gauge and a sphermoeter can measure distances upto

A. $10^{-3}m$

B. $10^{-4}m$

C. $10^{-5}m$

D. $10^{-6}m$

Answer: (c)

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24. The parallax method has been used for measuring distances of stars, which are

A. lass then 100 light years away

B. more the 100 light years away

C. neither less nor more then 100 light years away

D. none of above

Answer: (a)

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25. The mass of sun is of the order of

A. $10^{55} kg$

B. $10^{42} kg$

C. $10^{-30} kg$

D. $10^{30} kg$

Answer: (d)

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26. The time of heart beat is of the order of

A. 10 s

B. $10^{-2}s$

C. $10^{0}s$

D. $10^{-1}s$

Answer: (c)

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27. Radioactive dating is used for measuring long time intervals of the order of

A. $10^{17}s$

B. $10^7 s$

C. $10^{17} years$

D. $10^7 years$

Answer: (a)

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28. Accuracy of cesium clock is

A. 1 part in 10^7

B. 1 part in 10^{13}

C. 1 part in 10^{-7}

D. 1 part in 10^{-13}

Answer: (b)

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29. Quartz crystal clocks have an accuracy of 1 sec in every

A. $10^{-9}s$

B. $10^{9}s$

C. $10^{-13}s$

D. $10^{13}s$

Answer: (b)

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30. Human life expectancy is of the order of

A. $10^{7}s$

B. $10^{-7}s$

C. $10^{9}s$

D. $10^{-9}s$

Answer: (c)

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31. Which of the following is not a dimensional constant ?

A. gravitational constant G

B. π

C. Planck's constant h

D. gas constant R

Answer: (b)

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32. Which of the following is a dimensional variable ?

A. force

B. exponential e

C. angle

D. velocity of light in vacuum

Answer: (a)

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33. Which of the following is not a dimensional variable ?

A. density

B. specific gravity

C. angle

D. strain

Answer: (a)

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34. The dimensionas of universal gravitational constant are

____

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

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

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

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

Answer: (c)

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

A. Reynold Number

B. instensity of wave

C. angular impulse

D. torque

Answer: (c)

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36. Which one of the following has the same dimension in length as Planck's constant ?

A. coefficient of viscosity

B. rate of flow

C. pressure gradient

D. torque

Answer: (d)

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37. The dimensions of $\frac{a}{b}$ in the relatin F = ax + bt are

A. LT^{-1}

B. $L^{-1}T$

C. LT

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

Answer: (b)

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38. Name the quantity represented by the dimensional formula $[M^1l^{-3}T^0]$.

A. specific gravity

B. linear mass density

C. impulse

D. density

Answer: (d)

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39. Momentum per unit volume has the dimensions :

A. MLT^{-1}

B. MLT^{-2}

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

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

Answer: (c)

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40. The dimensional formula for conductance is

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

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

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

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

Answer: (d)

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41. If random error in the arithmetic mean of 100 observations is x, then the randow error in the arithmetic mean of 500 observations would be

A. 5x

B. $x/5$

C. 25x

D. $x/25$

Answer: (b)

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42. In the difference of two quantites

A. maximum absolute error is equal to sum of absolute errors in individual quantites

B. maximum absoulte error is equal to difference in absolute errors in individual quantities

C. Either (a) or (b)

D. neither (a) nor (b)

Answer: (a)

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43. In the division of two quantities, the maximum value of fractional error is equal to

A. difference of fractional errors in the individual quantities

B. sum of fractional errors in the individual quantities

C. Either (a) or (b)

D. Neither (a) not (b)

Answer: (b)

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44. The percentage error in determination fo $g = 4\pi^2 \frac{I}{t^2}$, when I and t are measured with $\pm 1\%$ and $\pm 2\%$ errors is

A. 0.01

B. 0.02

C. 0.05

D. 0.09

Answer: (c)

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45. Precision in measurement depends on

A. least count of measuring instrument

B. temperature of the surroundings

C. carefulness of observer

D. all of the above

Answer: (a)

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46. The number of significant figures in 0.008403 is

A. 6

B. 4

C. 3

D. 2

Answer: (b)

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47. In the measured length x = 7.304 cm = 73.04 mm = 0.07304m = 0.00007304 km, number of significant figures is

A. 7

B. 3

C. 4

D. 8

Answer: (c)

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48. When we add 0.9825 ot 3.04, the correct result with regard to significant figures is

A. 4.0225

B. 4.022

C. 4.02

D. 4

Answer: (c)

Watch Video Solution

49. Each side of a cube is measured to be 3.784 m. Its total surface area with appropriate significant figures is

A. $85.911936m^2$

B. $85.9119m^2$

C. $85.911m^2$

D. $89.91m^2$

Answer: (d)

Watch Video Solution

50. 7.893 gram of a substance occupies a volume of $1.1cm^3$ The density of substance with appropriate significant figures is

A. $7.175gcm^{-3}$

B. $7.2gcm^{-3}$

C. $7.18gcm^{-3}$

D. $7.1754gcm^{-3}$

Answer: (b)

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Fill in the blanks

1. Science is .... Which humans have gained through ....

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2. The sciences which deal with .... Are called physical sciences.

Watch Video Solution

3. The sciences which deal with .... Are called ....

Watch Video Solution

4. Physics is a branch of .... Which deals with the study of ....

Watch Video Solution

5. Techonology is .... For...............

Watch Video Solution

6. The principle used in optical fibre is ____

Watch Video Solution

Watch Video Solution

7. Radio and television are based on..............

Watch Video Solution

8. Magnetic confinement of plasma is the basis of ....

Watch Video Solution

9. Role of DNA in heredity is the basis of ....

Watch Video Solution

10. Computers are based on............

Watch Video Solution

11. The process of measurement is basically a ....

Watch Video Solution

12. A bigger unit is contained .... Of times in the quantity.

Watch Video Solution

13. Mass of a body is defined as the .... Which can ....

Watch Video Solution

14. According to Einstein, time is ....

Watch Video Solution

15. The units of measurement of .... And .... Are called ....

Watch Video Solution

16. The SI unit of luminous intensity is

Watch Video Solution

17. One radian is the angle subtended at .... By an arc ....

Watch Video Solution

18. One light year is .... In vacuum in................. .

Watch Video Solution

19. The year in which there is total solar eclipes is called a ....

Watch Video Solution

20. An area of $10^4\ m^2$ is called ....

Watch Video Solution

21. Order of magnitude of a quantity is the ...., which gives us a value............. .

Watch Video Solution

22. The estimated size of observable universe is of the order of.........

Watch Video Solution

23. The parallax method has been used for measuring distances of stars, which are

Watch Video Solution

24. The smallest mass is that of .... Of the order of .... kg.

Watch Video Solution

25. Masses of atomic / subatomic particles are measured using a ....

Watch Video Solution

26. Time taken by light to cross a distance of nuclear size is of the order of......... .

Watch Video Solution

27. Age of universe is of the order of .... Second.

Watch Video Solution

28. .... is used for measurig long time intervals of the order of .... Sec.

Watch Video Solution

29. Any phenomenon that............ Can serve as a ....

Watch Video Solution

30. An optical microscope uses visible light of wavelength ranging from .... To ....

Watch Video Solution

31. Universal gravitational constant, universal gas constant and .... Are some of the .... constant.

Watch Video Solution

32. Methematical constants, π, $etc.$ are called ....

Watch Video Solution

33. Angle, ... And .... Are some of the .... Variables.

Watch Video Solution

34. Some of the dimensional veriables are .... , ... , ...

Watch Video Solution

35. Which of the following physical quantities has a unit but no dimensions?

Watch Video Solution

36. The dimensional formula of Hubble constant. Is same as that of frequency. Comment.

Watch Video Solution

37. Can there be a physical quantity, which has no units and no dimensions?

Watch Video Solution

38. The dimension of length in pressure gradient is ....

Watch Video Solution

39. The dimension formula of Stefan's constant is............ .

Watch Video Solution

40. $\left[M^{1}L^{2}T^{-3}A^{-2}\right]$ is the .... formula of ....

Watch Video Solution

Watch Video Solution

41. The .... In the .... Value and .... Value of a quantity is called ....

Watch Video Solution

42. The .... Of systematic error are.............. . Therefore, such errors can be.................

Watch Video Solution

43. The .... Value that can be measured by a .... Is called .... Of the instrument.

Watch Video Solution

44. The .... Error are those which occur .... by ....

Watch Video Solution

45. .... Errors arise on account of shear................. of the ....

Watch Video Solution

46. .... Error or .... Error is the ratio of .... To .... of the quantity measured.

Watch Video Solution

47. Maximum .... error in sum of difference of two quantites is .... of absolute errors in ....

Watch Video Solution

48. Maximum .... error in sum of difference of two quantites is .... of absolute errors in ....

Watch Video Solution

49. The .... Of a measurement is a measure of .... the .... Value is to the .... Of the quantity.

Watch Video Solution

50. .... Tells us to what .... the quantity is measured by a.............. .

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Multiple choice questions - 1 NCRT

1. The number of significant figures in 0.06900 is

A. 5

B. 4

C. 2

D. 3

Answer: (b)

2. The sum of the numbers 436.32, 227.2 and 0.301 in appropriate significant figures is

A. 663.821

B. 664

C. 663.8

D. 663.82

Answer: (c)

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

A. $1.6048gcm^3$

B. $1.69gcm^{-3}$

C. $1.7gcm^{-3}$

D. $1.695gcm^{-3}$

Answer: (c)

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

A. 2.75 and 2.74

B. 2.74 and 2.73

C. 2.75 and 2.73

D. 2.74 and 2.74

Answer: (d)

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

A. $164 \pm 3cm^2$

B. $163.62 \pm 2.6cm^2$

C. $163.6 \pm 2.6 cm^2$

D. $163.62 \pm 3 cm^2$

Answer: (a)

Watch Video Solution

6. Which of the following pairs of physical quantites does not have same dimensional formula ?

A. work and torque

B. Angular momentum and Planck's constant

C. Tension and surface tension

D. Impulse and linear momentum

Answer: (c)

Watch Video Solution

7. Measure of two quantites along with the precision of respective measuring instrument is

$A = 2.5ms^{-1} \pm 0.5ms^{-1}$

$B = 0.10s \pm 0.01s$ The value of AB will be

A. $(0.25 \pm 0.08)m$

B. (0.25 ± 0.5)

C. $0.25 \pm 0.05)m$

D. $(0.25 \pm 0.135)m$

Answer: (a)

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

A. $1.4 \pm 0.4m$

B. $1.41m \pm 0.15m$

C. $1.4m \pm 0.3m$

D. $1.41m \pm 0.2m$

Answer: (d)

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9. which of the following measurements is most precise ?

A. 5.00 mm,

B. 5.00 cm

C. 5.00 m

D. 5.00 km

Answer: (a)

Watch Video Solution

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

A. 4.9 cm

B. 4.805 cm

C. 5.25 cm

D. 5.4 cm

Answer: (a)

Watch Video Solution

11. Young's modulu of steel is $1.9 \times 10^{11} N / m^2$ When expressed is CGS units of $dy\text{nes} / cm^2$ it will be equal to $(1N = 10^5 dy\text{ne}, 1m^2 = 10^4 cm^2)$

A. 1.9×10^{10}

B. 1.9×10^{11}

C. 1.9×10^{12}

D. 1.9×10^{13}

Answer: (c)

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

A. $(P^1 A^{-1} T^1)$

B. $(P^2 A^1 T^1)$

C. $\left(P^1 A^{1/2} T^1\right)$

D. $\left(P^1 A^{1/2} T^{-1}\right)$

Answer: (d)

Watch Video Solution

13. On the basis of dimensional, decide which of the following relation for the displacement of a particle undergoing simple harmonic motion is not correct :

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

B. $y = a \sin vt$

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

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

Answer: (b,c)

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

A. $(P - Q) / R$

B. PQ - R

C. $P + Q / R$

D. $(PR - Q^2) / R$

Answer: (a,e)

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

A. Linear impulse

B. Angular impulse

C. Linear momentum

D. Angular momentum

Answer: (b,d)

Watch Video Solution

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

A. Mass of electron (m_e)

B. Universal gravitational constant (G)

C. charge of electron (e)

D. Mass of proton (m_p)

Answer: (a,b,d)

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17. Which of the following rations express pressure ?

A. Force / Area

B. Energy /Volume

C. Energy / Area

D. Force / Volume

Answer: (a,b)

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

A. second

B. Parsec

C. Year

D. Light year

Answer: (b,d)

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Competiton Focus Jee Medical Entrance I. Multiple choice Questions

1. One kilo - watt hout is equal to

A. 3.6×10^6 Joule

B. 3.6×10^5 Jole

C. 10^3 Joule

D. 10^7Joule

Answer: (a)

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2. A new unit of length is chosen such that the speed of light in vacuum is unity. What is the distance between the sun and the earth in terms of the new unit, if light takes 8 min and 20 sec. to cover the distance ?

A. 300

B. 500

C. 400

D. 600

Answer: (b)

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3. Given that $y = a\cos\left(\frac{t}{P} - qx\right)$, where t represents distance is metre. Which of the following statements is true ?

A. unit of t is same as that of p

B. unit of t is same as that of q

C. unit of x is same as that of q

D. unit of x is same as that of P

Answer: (a)

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4. Which of the following in not the unit of surface tension ?

A. N/m

B. J/m^2

C. kg/s^2

D. none of these

Answer: (d)

Watch Video Solution

5. Which two of the following five physical paremeters have the same dimensions ? 1. energy density 2. refractive index 3.

dielectric constant 4. Young's modulus 5. magnetic field.

A. 2 and 4

B. 3 and 5

C. 1 and 4

D. 1 and 5

Answer: (c)

Watch Video Solution

6. If energy (E) , velocity (V) and time (T) are chosen as the fundamental quantities , the dimensions formula of surface tension will be

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

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

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

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

Answer: (b)

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7. If $E, M, J, \text{ and } G$, respectively , denote energy , mass , angular momentum , and gravitational constant , then EJ^2 / M^5G^2 has the dimensions of

A. Length

B. Mass

C. Time

D. Angle

Answer: (d)

Watch Video Solution

8. A physical energy of the dimension of length that can be formula cut of c, G and $\frac{e^2}{4\pi\varepsilon_0}$ is [c is velocity of light G is universal constant of gravilation e is change

A. $\frac{1}{c^2}\left[\frac{Ge^2}{4\pi in_o}\right]^{1/2}$

B. $c^2\left[\frac{Ge^2}{4\pi \text{in}_0}\right]^{1/2}$

C. $\frac{1}{c^2}\left[\frac{Ge^2}{4\pi \text{in}_0}\right]^{1/2}$

D. $\frac{1}{c}\left[\frac{Ge^2}{4\pi in_0}\right]$

Answer: (a)

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9. 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 visocity of oil at a distance x from the axis of tube from this relation, the dimensions of viscosity are :

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

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

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

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

Answer: (d)

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10. Given $F = (a/t) + bt^2$ where F denotes force and t time.

The diamensions of a and b are respectively :

A. $[MLT^{-1}]$ and $[MLT^{-4}]$

B. $[LT^{-1}]$ and $[T^{-2}]$

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

D. $[LT^{-2}]$ and $[T^{-2}]$

Answer: (a)

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11. The dimensional formula for molar thermal capacity is same as that of

A. gas constant

B. stefan's constant

C. Boltzamann constant

D. specific heat

Answer: (c)

Watch Video Solution

12. The dimensional forumla for thermal resistance is

A. $[ML^2T^{-3}K^{-1}]$

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

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

D. $[ML^2T^{-3}K^{-2}]$

Answer: (c)

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13. If force (F) velocity (V) and time (T) are taken as fundamental units, then the dimensions of mass are

A. $[FVT^{-1}]$

B. $[FVT^{-2}]$

C. $[FV^{-1}T^{-1}]$

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

Answer: (d)

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14. Which of the following units denots the dimensions ML^2 / Q^2 where Q denots the electric charge ?

A. Henry (H)

B. H / m^2

C. Weber (Wb)

D. Wb / m^2

Answer: (a)

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15. Time dependence of a physical quantity P is given by $P = P_0 \exp(-\alpha t^2)$, where α is a constant and t is time. The constant α is

A. dimensionless

B. $has \dim ensionsT^{-2}$

C. has dimensions of P.

D. $has \dim ensionsT^{2}$

Answer: (b)

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16. Given that $\int \frac{dx}{\sqrt{2ax - x^2}} = a^n \sin^{-1}\left(\frac{x-a}{a}\right)$ where a is a constant. Using dimensional analysis. The value of n is

A. 1

B. -1

C. 0

D. none of the above.

Answer: (c)

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17. Assuming that the mass m of the largest stone that can be moved by a flowing river depends upon the velocity v, of water, its density ρ and acceleration due to gravity g, then m is directly proportional to

A. v^4

B. v^6

C. v^5

D. v

Answer: (b)

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18. a quantity X is given by $\varepsilon_0 L \frac{\Delta V}{\Delta t}$ where $\in_0$ is the permittivity of the free space, L is a length, ΔV is a potential difference and Δt is a time interval. The dimensinal formula for X is the same as that of

A. resistance

B. voltage

C. charge

D. current

Answer: (d)

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19. A liquid of coefficient of viscosity η is flowing steadily through a capillary tube of radius r and length I. If V is volume of liquid flowing per sec. the pressure difference P at the end of tube is given by

A. $P = \frac{8\pi IV}{\eta r^4}$

B. $P = \frac{8\eta r^4 I}{\pi V}$

C. $P = \frac{8\eta IV}{\pi r^4}$

D. $P = \frac{8\eta r^4 V}{\pi I}$

Answer: (c)

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20. If the dimensions of a physical quantity are given by $M^a L^b T^c$, 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= -2

Answer: (b)

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21. The position x of a partical at time t is given by $x = \frac{V_0}{a}\left(1 - e^{9 - at}\right)$ where V_0 is a constant and a gt 0. The dimensions of V_0 and a are.

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

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

C. M^0LT^{-1} and LT^{-2}

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

Answer: (a)

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22. In dimension of circal velocity v_0 liquid following through a take are expressed as $(\eta^x\rho^y r^z)$ where η, ρ and $r$are the coefficient of viscosity of liquid density of liquid and radius of the tube respectively then the value of x, y and z are given by

A. 1, 1,1

B. 1,-1,-1

C. $-1, -1, 1$

D. $-1, -1, -1$

Answer: (b)

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23. In terms of basic units of mass (M), length (L), time (T), and charge (Q), the dimensions of magnetic permeability of vacuum (μ_0) would be

A. (MLQ^{-2})

B. $(LT^{-1}Q^{-1})$

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

D. (LTQ^{-1})

Answer: (a)

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24. If units of length, mass and force are chosen as fundamental units, the dimensions of time would be :

A. $M^{1/2}L^{-1/2}F^{1/2}$

B. $M^{1/2}L^{1/2}F^{1/2}$

C. $M^{1/2}L^{1/2}F^{-1/2}$

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

Answer: (c)

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25. The dimensions of intensity of wave are

A. $L^0 M^1 T^{-3}$

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

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

D. $L^2 M^2 T^{-3}$

Answer: (a)

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26. Given : force $= \dfrac{\alpha}{\text{density} + \beta^3}$. What are the dimensions of α, β?

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

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

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

D. M^2L^{-2}, ML^{-3}

Answer: (c)

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27. If the speed of light c, acceleration due to gravity (g) and pressure (p) are taken as the fundamental quantities then the dimension of gravitational constant is

A. c^0gp^{-3}

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

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

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

Answer: (c)

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28. Dimensions of ohm are same as that of (where h is Planck's constant and e is charge)

A. h/e

B. h^2/e

C. h/e^2

D. h^2/e^2

Answer: (c)

Watch Video Solution

29. Experiments reveal that the velocity v of water waves may depend on their wavelength λ, density of water ρ, and acceleration due to gravity g. Establish a possible relation between v and λ, g, ρ.

A. $v^2 = k\lambda^{-1}g^{-1}d^{-1}$

B. $v^2 = k\lambda g$

C. $v^2 = k\lambda dg$

D. $v^2 = k\lambda^3 g^{-1}d^{-1}$

Answer: (b)

Watch Video Solution

30. If the energy, $E = G^p h^q c^r$, where G is the universal gravitational constant, h is the Planck's constant and c is the velocity of light, then the values of p are q and r are, respectively

A. $-1/2, 1/2$ and $5/2$

B. $1/2, \ -1/2$ and $-5/2$

C. $-1/2, 1/2$ and $3/2$

D. $1/2, \ -1/2$ and $-3/2$

Answer: (a)

Watch Video Solution

31. The physical quantites not having same dimensions are

A. momentum and planck's constant

B. speed and $(\mu_0 \lambda_0)^{-1/2}$

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

D. surface tension and spring constant

Answer: (a)

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32. A dence collection of equal number of electrona and positive ions is called netural plasma. Certain solids contianing fixed positive ions surroundedby free electrons can be treated as neytral plasma. Let 'N' be the numbrer density of free electrons, each of mass 'm'. When the elctrons are subjected to an eletric field, they are displaced relatively away from the heavy positive ions. if the electric field becomes zero, the electrons begin to oscillate about the positive ions with a natural angular frequency 'ω_P' which is called the plasma frequency. to sustain the oscillations, a time varying electric field needs to be applied that has an angular frequrncy ω, where a part of the energy is absorbed and a part of it is reflected. As ω approaches ω_p all the free electrons are set to resonance together and all the energy is reflected. this is the explaination of high reflectivity of metals.

(1) Taking the electronic charge as 'e' and the permittivity as 'ε_0'. use dimensional analysis to determine the correct expression for ω_p.

A. $\sqrt{\frac{Ne}{mI\mathrm{n}_0}}$

B. $\sqrt{\frac{mI\mathrm{n}_0}{Ne}}$

C. $\sqrt{\frac{Ne^2}{m\mathrm{in}_0}}$

D. $\sqrt{\frac{mI\mathrm{n}_0}{Ne^2}}$

Answer: (c)

Watch Video Solution

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

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

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

C. $[\in_0] = MLT^{-2}A(-2)$

D. $[\in_0] = ML^2T^{-1}A$

Answer: (b)

Watch Video Solution

34. The energy of a system as a function of time t is given as $E(t) = A^2 \exp(-\alpha t)$, $\alpha = 0.2s^{-1}$. The measurement of A has an error of $1.25\,\%$. If the error In the measurement of time is $1.50\,\%$, the percentage error in the value of $E(t)$ at t = 5 s` is

A. 0.01

B. 0.02

C. 0.03

D. 0.04

Answer: (d)

Watch Video Solution

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

A. 0.02

B. 0.03

C. 0.01

D. 0.05

Answer: (b)

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36. The density of a cube is measured by measuring its mass and length of its side. If the maximum errors in the measurements of mass and length are 3% and 2% respectively. Then the maximum error in the measurement of density is :

A. 0.07

B. 0.05

C. 0.09

D. 0.03

Answer: (c)

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37. The volume of a sphere is $.176m^3$ What will be the volume of 25 such spheres taking into account the significant figures.

A. $44.0m^3$

B. $44m^3$

C. $404.0m^3$

D. $0.404m^3$

Answer: (a)

Watch Video Solution

38. The diameter of a circle is 2.486 m. Calculate the area with due regard to significant figures.

A. $4.85m^3$

B. $4.85454m^3$

C. $4.854m^3$

D. $4.8545m^3$

Answer: (c)

Watch Video Solution

39. The length breadth and thickness of a rectangular object are 4.576 m, 1.243 , and 1.22 cm respectively. Find the area of its face and its volume to correct significant figures.

A. $5.688m^3, 6.94 \times 10^{-3}m^3$

B. $5.062m^2, 6.94 \times 10^{-2}m^3$

C. $5.688m^2, 10^{-2}m^3$

D. $5.6m^2, 6.9 \times 10^{-1}m^3$

Answer: (c)

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40. The length of a cylinder is measured with a meter rod having least count $0.1cm$. Its diameter is measured with Vernier calipers having least count $0.01cm$. Given that length is $5.0cm$ and radius is $2cm$. Find the percentage error in the calculated value of the volume.

A. 0.04

B. 0.03

C. 0.02

D. 0.01

Answer: (b)

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41. When a copper sphere is heated, maximum percentage change will be observed in :

A. radius

B. area

C. volume

D. none of these

Answer: (c)

Watch Video Solution

42. A student performs an experiment to determine the Young's modulus of a wire, exactly$2m$ long, by Searle's method. In a partcular reading, the student measures the extension in the length of the wire to be $0.8mmwithanuncerta \int yof$+- 0.05mm$ataloadofexactly$1.0kg $, thestudentalsomeasuresthediameterofthewire \rightarrow be$ 04mm$withanuncerta \int yof$+-0.01mm. $Take$g=9.8m//s^(2)` (exact). the Young's modulus obtained from the reading is

A. $(2.0 \pm 0.3) \times 10^{11} N/m^2$

B. $(2.0 \pm 0.2) \times 10^{11} N/m^2)$

C. $(2.0 \pm 0.2 \times 10^{11} N/m^2)$

D. $(2.0 \pm 0.05) \times 10^{11} N/m^2$

Answer: (b)

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43. If voltage across a bulb rated 220 volt-100 watt drops by $2.5\ \%$ of its value, the percentage of the rated value by which the power would decrease is

A. 0.2

B. 0.025

C. 0.05

D. 0.1

Answer: (c)

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44. The percentage errors in the measurement of mass and speed are 2% and 3% , respectively . How much will be the maximum error in the estimation of KE obtained by measuring mass and speed?

A. 0.08

B. 0.07

C. 0.09

D. 0.05

Answer: (a)

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45. What is the value of $(5.0 \times 10^{-6}(5.0 \times 10^{-8}$ with due regards to significant figures ?

A. 2.50×10^{-13}

B. 25.0×10^{-14}

C. 25×10^{-14}

D. 250×10^{-15}

Answer: (c)

Watch Video Solution

46. In an experiment to measure the height of a bridge by dropping stone into water underneath, if the error in measurement of time of 0.1 s at the end of 2s, then the error in estimation of height of bridge will be

A. 0.49 m

B. 0.98 m

C. 1.96 m

D. 2.12 m

Answer: (c)

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47. The pressure on a square plate is measured by measuring the force on the plate and the length of the sides of the plate. If the maximum error in measurement of force and length are respectively 4% and 2%, the maximum error in the measurement of pressure is

A. 0.01

B. 0.02

C. 0.06

D. 0.08

Answer: D

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48. The following observations were taken for dtermining the surface tension of water by capillary tube method: diameter of capillary , $D = 1.25 \times 10^{-2} m$ and rise of water in capillary , $h = 1.45 \times 10^{-2} m$. Taking $g = 9.80 ms^{-2}$ and using the relation $T = (rgh/2) \times 10^3 Nm^{-1}$, what is the possible error in measurement of surface tension T?

(a) $2.4\,\%$ (b) $15\,\%$ (c) $1.6\,\%$ (d) 0.15%`

A. 0.024

B. 0.1

C. 0.0015

D. 0.015

Answer: (d)

Watch Video Solution

49. The relative density of material of a body is found by weighting it first in air and then in water . If the weight in air is $(5.00 \pm 0.05)N$ and the weight in water is $(4.00 \pm 0.05)N$.

Find the relative density along with the maximum permissible percentage error.

A. $(5.00 + 0.05)$

B. $5.00 \pm 11\,\%$

C. 5.00 ± 0.10

D. $5.00 \pm 6\,\%$

Answer: (b)

Watch Video Solution

50. $1cm$ on the main scale of a vernier callipers is divided into $10 equal$ parts. If 10 divisions of vernier coincide with 8 small divisions of main scale, then the least count of the calliper is.

A. 0.01 cm

B. 0.02 cm

C. 0.05 cm

D. 0.005 cm

Answer: (b)

Watch Video Solution

51. Two full turns of the circular scale of a screw gauge cover a distance of $1mm$ on its main scale. The total number of divisions on the circular scale is 50. Further, it is found that the screw gauge has a zero error of $-0.03mm$. While main scale reading of $3mm$ and the number of circular scale divisions in line with the main scale as 35. the dimeter of the wire is

A. 3.32 mm

B. 3.73mm

C. 3.67mm

D. 3.38mm

Answer: (d)

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52. A student uses a simple pendulum of exactly $1m$ length to determine g, the acceleration due ti gravity. He uses a stop watch with the least count of $1 \sec$ for this and record

$40 \sec onds$ for 20 oscillations for this observation, which of the following statement $(s) is (are)$ true?

A. Error ΔT in measuring T, the time period, is 0.05 seconds

B. Error ΔT in measuring T, the time period, is 1 second

C. Percentage error in the determination of g is 5%

D. Percentage error in the detremination of g is 2.5%

Answer: (c)

Watch Video Solution

53. A student measures that distance traversed in free fall of a body, initially at rest in given time. He uses this data to estimated g, the acceleration due to gravity. If the maximum percentage error 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. $e_2 - e_1$

B. $e_1 + 2e_2$

C. $e_1 + e_2$

D. $e_1 - 2e_2$

Answer: (d)

Watch Video Solution

54. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is $0.5mm$ and there are 50 divisions on the circular scale. The reading on the main scale is $2.5mm$ and that on circular scale is 20 divisions. if the measured mass of the ball has a relative error of 2%, the relative percentage error in the density is

A. 0.009

B. 0.024

C. 0.0311

D. 0.042

Answer: (c)

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55. A spectrometer gives the following reading when used to measure the angle of a prism.

Main scale reading : $58.5 degree$

Vernier scale reading : 09 divisions

Given that 1 division on main scale correspods to 0.5 degree. Total divisions on the vernier scale is 30 and match with 29 divisions of the main scale. the angle of the prism from the above data:

A. 58.59°

B. 58.77°

C. 58.65°

D. 59°

Answer: (c)

Watch Video Solution

56. In an experiment four quantities a,b,c and d are measure with percentage error 1%, 2%, 3%,and 4% respectively quantity is P is calculate as follow

$P = \frac{a^3b^2}{cd}\%$ error in P is

A. 0.04

B. 0.14

C. 0.1

D. 0.07

Answer: (b)

Watch Video Solution

57. The pressure on a square plate is measured by measuring the force on the plate and the length of the sides of the plate . If the maximum error in the measurement of force and length are , respectively , 4% and 2% . Find the maximum error in the measurement of pressure.

A. 0.01

B. 0.02

C. 0.08

D. 0.1

Answer: (c)

Watch Video Solution

58. A student measured the length of a rod and wrote it as $3.50 cm$. Which instrument did he use to measure it?

A. A screw gauge having 100 division in the circular scale and pitch as 1mm

B. A screw gauge having 50 division in the circular scale and pitch as 1mm.

C. A meter scale.

D. A vernier calliper where 10 division in vernier scale match with 9 division in main scale and main scale has 10 division in 1 cm.

Answer: (d)

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

A. 0.02

B. 0.03

C. 0.01

D. 0.05

Answer: (b)

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60. The energy of a system as a function of time t is given as $E(t) = A^2 \exp(-\alpha t)$, $\alpha = 0.2 s^{-1}$. The measurement of A has an error of 1.25%. If the error In the measurement of time is 1.50%, the percentage error in the value of $E(t)$ at t = 5 s` is

A. 0.01

B. 0.02

C. 0.03

D. 0.04

Answer: (d)

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61. A student measures the time period of 100 ocillations of a simple pendulum four times. The data set is $90s$, 91 s, 95 s, and 92 s. $If the \min i\mu m \div ision \in themeasur \in gclockis$1 s`, then the reported men time should be:

A. $(92 \pm 2)s$

B. $(92 \pm 5)s$

C. $(92 \pm 1.8)s$

D. $(92 \pm 3)s$

Answer: (a)

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62. A screw gauge with a pitch of 0.5 mm and a circular scale with 50 division is used to measure the thickness of a thin sheet of aluminium. Before starting the measurement, it is found that when the two jaws of the screw are brought in constant, 45th division coincides with the main scale line and that the zero of main scale line and that the zero of main scale is barely visible. What is the thickness of the sheet, if the main scale reading is 0.5 mm and 25th division coincides with the main scalel line ?

A. 0.75 mm

B. 0.80mm

C. 0.70 mm

D. 0.50mm

Answer: (b)

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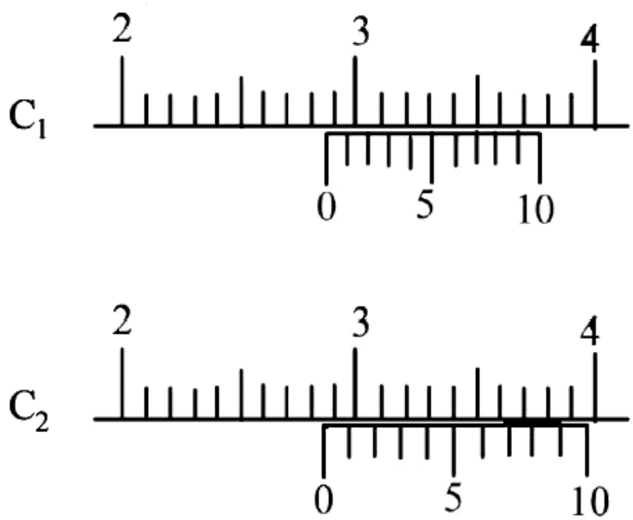
63. There are two Vernier calipers both of which have $1cm$ divided into 10 equal divisions on the main scale. The vernier scale of the calipers (c_1) has 10 equal divisions that correspond to 9 main scale divisions. The Vernier scale of the other calipers (C_2) has 10 equal divisions tgat correspond to 11 main scale divisions. the reading of the two calipers are shown in the figure. the measured values (in cm) by calipers C_1 and C_2 respectively, are



A. 2.87 and 2.87

B. 2.87 and 2.83

C. 2.85 and 2.82

D. 2.87 and 2.86

Answer: (b)

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Competiton Focus Jee Medical Entrance II. Multiple choice Questions

1. Planck's constant h, speed of light c and gravitational constant G are used to from a unit of length L and a unit of mass M. Then the correct option (s) is / (are)

A. $M \propto \sqrt{c}$

B. $M \propto \sqrt{G}$

C. $L \propto \sqrt{h}$

D. $L \propto \sqrt{G}$

Answer: (a,c,d)

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2. In terms of potential difference C, electric current I, permittivity ε_0, permeability μ_0 and speed of light c, the dimensionally correct equation (s) is (are)

A. $\mu_0 I^2 = \varepsilon_0 V^2$

B. $\varepsilon_0 I = \mu_0 V$

C. $I = \varepsilon_0 c V$

D. $\mu_0 c I = \varepsilon_0 V$

Answer: (a,c)

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3. Which of the following pairs have same dimensions ?

A. Torque and Work

B. Angular momentum and work

C. Energy and young's modulus

D. Light year and Wavelength

Answer: (a,d)

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4. Let $[\in_0]$ denote the dimensional formula of the permittivity of vacuum. If $M = mass, L = \leq n > h, T = time$ and $A = elctriccurrent$, then :

A. $[In_0] = [M^{-1}l^{-3}T^2I]$

B. $[\in_0] = [M^{-1}L^{-3}T^4I^2]$

C. $[\mu_0] = [MLT^{-2}I^{-2}]$

D. $[\mu_0] = [ML^2T^{-2}I]$

Answer: (b,c)

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5. The dimensions of $\left[ML^{-1}T^{-2}\right]$ may correspond to

A. Work done by force

B. Linear momentum

C. Pressure

D. Energy per unit volume

Answer: (c,d)

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6. A student uses a simple pendulum of exactly $1m$ length to determine g, the acceleration due ti gravity. He uses a stop watch with the least count of $1\sec$ for this and record

$40 \sec onds$ for 20 oscillations for this observation, which of the following statement $(s) is (are)$ true?

A. Error ΔT in measuring T, the time period, is 0.05 seconds

B. Error ΔT in measuring T, the time period, is 1 second

C. Percentage error in the determination of g is 5%

D. Percentage error in the detremination of g is 2.5%

Answer: (a,c)

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7. If C represents capacitance and R represents resistance, then the unit of CR^2 are

A. Henry

B. $\frac{\text{volt-second}}{\text{ampere}}$

C. $\text{volt} / \text{ampere}$

D. $\text{joule} / \text{ampere}^2$

Answer: (a,b,d)

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8. Pressure is defined as :

A. Momentum per unit are

B. Momentum per unit area per unit time

C. Momentum per unit volume

D. Energy per unit volume

Answer: (b,d)

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9. Which of the following is a unit of permeability ?

A. H / m

B. Wb / Am

C. $ohm \times s / m$

D. $V \times s / m^2$

Answer: (a,b,c)

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10. The pairs of physical quantities that have the same dimensions is (are):

A. Reynold Number and coefficient of frication

B. Latent heat and gravitational potentail

C. Curie and frequency of light waver

D. Planck's constant and torque.

Answer: (a,b,c)

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11. Consider a Vernier callipers in which each $1cm$ on the main scale is divided into 8 equal divisions and a screw gauge with 100 divisions in its circular scale. In the Vernier callipers, 5

divisions of the Vernier scale coincide with 4 divisions on the scale and in the screw gauge, one complete rotation of the circular scale moves it by two divisions on the linear scale. Then :

A. If the pitch of the screw gauge is twice the least count of the vernier callipers, the least count of screw gauge is 0.01 mm.

B. If the patich of the screw gauge is twice the least count of the vernier callipers, the least count of screw gauge is 0.005 mm.

C. If the least conunt of the linear scale of the screw gauge is twice the least count of screw gauge is 0.01 mm.

D. If the least count of the linear scale of the screw gauge is twice the least count of the vernier callipers, the least count of screw gauge is 0.005mm.

Answer: (b,c)

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12. The dimensions of Planck's constant are the same as thet of

A. Momentum

B. Angular momentum

C. Energy

D. Pressure

Answer: (b)

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13. A length - scale (l) depends on the permittivity (ε) of a dielctric material. Boltzmann constant (k_B), the absolute tempreture (T), the number per unit volume (n) of certain charged particles, and the charge (q) carried by each of the partcles. which of the following expression (s) for I is (are) dimensionally correct?

A. $I = \sqrt{\frac{nq^2}{\text{I}nk_BT}}$

B. $I = \sqrt{\frac{\text{in}k_BT}{nq^2}}$

C. $I = \sqrt{\frac{q^2}{\text{in}n^2 / 3k_BT}}$

D. $I = \sqrt{q^2 / \text{in}n^{1/3}k_BT}$

Answer: (b,d)

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Comprehension 1.

1. Whether a given relation / formula is correct or not can be checked on the basis of the principle of homogeneity of dimensions. According to this principle, only that formula is correct, in which the dimensions of the various terms on one side of the relation are equal to the respective dimensions of these terms on the other side of the relation. With the help of the compreshension given above, choose the most appropriate alternative for each of the following questions :

The distance travelledl by a body in nth second is given by $S_{nth} = u + \frac{a}{2}(2n - 1)$ where u is initial velocity and a is acceleration. The dimensions of S_{nth} are

A. L

B. LT^{-1}

C. LT^{-2}

D. $L^{-1}T$

Answer: (b)

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2. Write the dimensions of a and b in the relation ,

$P = \dfrac{b - x^2}{at}$, where P

is power ,x is distance and t is time

A. $\left[M^0 lT^{-2}\right]$

B. $\left[M^0 L^2 T^2\right]$

C. $\left[M^0 L^2 T^{-2}\right]$

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

Answer: (d)

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3. Whether a given relation / formula is correct or not can be checked on the basis of the principle of homogeneity of dimensions. According to this principle, only that formula is correct, in which the dimensions of the various terms on one side of the relation are equal to the respective dimensions of these terms on the other side of the relation. With the help of the comprehension given above, choose the most appropriate alternative for each of the following questions :

In the same equation, the dimensional formula of a is

A. $\left[M^{-1} L^0 T^2\right]$

B. $[ML^{0}T^{2}]$

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

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

Answer: (a)

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Comprehension 2.

1. Significant figures in the meaured value of a physical quantity tell the number of digits in which we have confidence. Larger the number of significant figures obtained in a measurement, greater is the accuracy of measurement and vice-verse, In addition or subtraction, the number of decimal places in the result should equal the smallest number of decimal places in any term in the operation. In multiplication and division, the number of significant figures in the product or in the quatient is the same as the smallest number of significant figures in any of the factors. With the help of the compreshension given above, choose the most appropriate alternative for each of the following questions :

The area enclosed by a circle of diameter 1.06 m with correct number of significant figures is

A. $0.88m^2$

B. $0.883m^2$

C. $1.88m^2$

D. $0.882026m^2$

Answer: (b)

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2. Significant figures in the meaured value of a physical quantity tell the number of digits in which we have confidence. Larger the number of significant figures obtained in a measurement, greater is the accuracy of measurement and vice-verse, In addition or subtraction, the number of decimal places in the result should equal the smallest number of decimal places in any term in the operation. In multiplication and division, the number of significant figures in the product or in the quatient is the same as the smallest number of significant figures in any of the factors. With the help of the compreshension given above, choose the most appropriate alternative for each of the following questions :

The circumference of the circle of diameter 1.06 m with correct number of significant figures is

A. 3.33 m

B. 3.33142 m

C. 3.3 m

D. 3m

Answer: (a)

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3. Significant figures in the meaured value of a physical quantity tell the number of digits in which we have confidence. Larger the number of significant figures obtained in a measurement, greater is the accuracy of measurement and vice-verse, In addition or subtraction, the number of decimal places in the result should equal the smallest number of decimal places in any term in the operation. In multiplication and division, the number of significant figures in the product or in the quatient is the same as the smallest number of significant figures in any of the factors. With the help of the compreshension given above, choose the most appropriate alternative for each of the following questions :

Subtract 2.6×10^4 from 3.9×10^5 with due regard to significant figures

A. 3.64×10^5

B. 3.7×10^5

C. 3.6×10^5

D. 3.65×10^6

Answer: (c)

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4. Significant figures in the measured value of a physical quantity tell the number of digits in which we have confidence. Larger the number of significant figures obtained in a measurement, greater is the accuracy of measurement and vice-verse, In addition or subtraction, the number of decimal places in the result should equal the smallest number of decimal places in any term in the operation. In multiplication and division, the number of significant figures in the product or in the quotient is the same as the smallest number of significant figures in any of the factors. With the help of the comprehension given above, choose the most appropriate alternative for each of the following questions :

Add $3.8 \times 10^{-6} \rightarrow 4.2x10^{-5}$ with due regard to significant figures

A. 4.6×10^{-5}

B. 4.6×10^{-6}

C. 4.58×10^{-5}

D. 4.580×10^{-5}

Answer: (a)

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Interger type Questions

1. Light from the sun reaches the earth approximately in $x \times 10^{2}$ sec, where x is :

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2. If units of measurement of two system are in the ratio 2 : 1, then the ratio of units of angular momentum in the two system willl be :

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3. To find the distance d over which a signal can be seen clearly in foggy conditions, a railways-engineer uses dimensions and assumes that the distance depends on the mass density ρ of the fog, intensity (power/area) S of the light from the signal and its frequency f. the engineer finds that d is proportional to $S^{1/n}$. the value of n is

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4. The dimensions of T in the dimensional formula for mobilitty are :

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5. Unit of $\frac{CV}{\rho\varepsilon_0}$ are of

$(C =$ capacitance, $V =$ potential, $\rho =$ specfic resistence and $\varepsilon_0 =$ permittivity of free space)`

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6. If σ is Stefan's constant and b is Wien's constant, then the dimensions of length in $\sin gmab^4$ are :

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7. Heat generated in a circuit is given by $H = I^2$ Rt. If error in measuring current I, resistance R and time t are 2%, 1% and 3% respectively, then percentage error in calculating heat is :

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8. To find the distance d over which a signal can be seen clearly in foggy conditions, a railways-engineer uses dimensions and assumes that the distance depends on the mass density ρ of the fog, intensity (power/area) S of the light from the signal and its frequency f. the engineer finds that d is proportional to $S^{1/n}$. the value of n is

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Assertion Reason Type Questions

1. Assertion : if the units of force and length are doubled, the unit of energy will be 4 times.

Reason : The unit of energy is independent of the units of force and length

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (c)

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2. Assertion: The error in the measurement of radius of sphere is 0.3%. The permissible error in its surface area is 0.6%.

Reason: The permissible error is calculated by the formula $\frac{\Delta A}{A} = \frac{4\Delta r}{r}$.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (c)

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3. Assertion : Distance travelled by the particle in the nth second has dimensios of length.

Reason :It is the distance travelled by the partical in the given time.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (d)

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4. Assertion : 'Light year' and 'Wavelength' both measure distance.

Reason : Both have dimensions of time.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (c)

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5. Assertion : Light year and year, both measure time.

Reason : Because light year is the time light takes to reach the earth from the sun.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (d)

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6. Assertion : Force cannot be added to pressure.

Reason : Because their dimensons are different.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (a)

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7. Assertion : Rate of flow of a liquid represents velocity of flow

Reason : The dimensions of rate of flow are $[M^0 L^1 T^{-1}]$

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (d)

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8. Assertion : Planck's constant (h) represents angular momentum.

Reason : Because, both have the same dimension , $[M^1L^2T^{-1}]$

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (a)

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9. Assertion : Units of Rydberge constant R are m^{-1}.

Reason : It follows from Bohr's formula $\left[\overline{V}=R\left(\frac{1}{n_1^2}-\frac{1}{n_2^2}\right)\right]$, where the symbole have their usual meaning.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (a)

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10. Assertion : Pressure can be subracted from pressure gradient.

Reason : Because both have the same dimensions.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (d)

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11. Assertion : Parallax method cannot be used for measuring distance of stars morer then 100 light year away.

Reason : Because parallax angle reduces so much that it cannot be measured accurately.

A. If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

B. If both , Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is true but the Reason is false.

D. If both, Assertion and Reason are false.

Answer: (a)

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1. Assertion : Number of significant figure in 0.005 is one and that is 0.500 is three

Reason : This is became zeros are not significant

A. Statement -1 is true, Statement -2 is true , and Statement -2 is correct explanation of Statement -1.

B. Statement -1 is true , Statement -2 is true, but Statement -2 is not a correct explanation of Statement -1.

C. Statement-1 is true, but Statement -2 is false.

D. Statement-1 is false, but Statement -2 is true.

Answer: (c)

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2. Assersion : Out of three meansurements $l = 0.7m, l = 0.70m$ and $l = 0.700m$ the last one is most accurate.

Reason: In every meansurements only the last significant digit is not accurately known.

A. Statement -1 is true, Statement -2 is true , and Statement -2 is correct explanation of Statement -1.

B. Statement -1 is true , Statement -2 is true, but Statement -2 is not a correct explanation of Statement -1.

C. Statement-1 is true, but Statement -2 is false.

D. Statement-1 is false, but Statement -2 is true.

Answer: (a)

3. Statement-1 : nm is not same as m N

Statement -2 : $1nm = 10^{-9}m$ and $1mN = 10^{-3}N$

A. Statement -1 is true, Statement -2 is true , and Statement -2 is correct explanation of Statement -1.

B. Statement -1 is true , Statement -2 is true, but Statement -2 is not a correct explanation of Statement -1.

C. Statement-1 is true, but Statement -2 is false.

D. Statement-1 is false, but Statement -2 is true.

Answer: (a)

4. Assertion: The dimensional formula of surface energy is $[M^0L^2T^{-2}]$.

Reason: surface energy has same dimensions as that of potential energy.

A. Statement -1 is true, Statement -2 is true , and Statement -2 is correct explanation of Statement -1.

B. Statement -1 is true , Statement -2 is true, but Statement -2 is not a correct explanation of Statement -1.

C. Statement-1 is true, but Statement -2 is false.

D. Statement-1 is false, but Statement -2 is true.

Answer: (a)

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5. Statement -1 : Distance travelled in nth second has the dimensions of velocity.

Statement -2 : Because it is the distancce travelled in one (particular) second.

A. Statement -1 is true, Statement -2 is true , and Statement -2 is correct explanation of Statement -1.

B. Statement -1 is true , Statement -2 is true, but Statement -2 is not a correct explanation of Statement -1.

C. Statement-1 is true, but Statement -2 is false.

D. Statement-1 is false, but Statement -2 is true.

Answer: (a)

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6. Statement-1 : Velocity gradient has the dimensions of frequency.

Statement -2 : Velocity gradient is rate of change of velocity with distance.

A. Statement -1 is true, Statement -2 is true , and Statement -2 is correct explanation of Statement -1.

B. Statement -1 is true , Statement -2 is true, but Statement -2 is not a correct explanation of Statement -1.

C. Statement-1 is true, but Statement -2 is false.

D. Statement-1 is false, but Statement -2 is true.

Answer: (a)

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7. Statement-1 If error in measurement of distance and time are 3% and 2% respectively, error in calculation of velocity is 5%

Statement-2 : Velocity $= \frac{dis\tan ce}{time}$

A. Statement -1 is true, Statement -2 is true , and Statement -2 is correct explanation of Statement -1.

B. Statement -1 is true , Statement -2 is true, but Statement -2 is not a correct explanation of Statement -1.

C. Statement-1 is true, but Statement -2 is false.

D. Statement-1 is false, but Statement -2 is true.

Answer: (b)

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8. Statement-1 : The dimensional formula of electric potential is $[ML^2T^{-3}A^{-1}]$.

Statement-2 : Electric potential is equal to work done.

A. Statement -1 is true, Statement -2 is true , and Statement -2 is correct explanation of Statement -1.

B. Statement -1 is true , Statement -2 is true, but Statement -2 is not a correct explanation of Statement -1.

C. Statement-1 is true, but Statement -2 is false.

D. Statement-1 is false, but Statement -2 is true.

Answer: (c)

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9. Consider a Vernier callipers in which each $1 cm$ on the main scale is divided into 8 equal divisions and a screw gauge with 100 divisions in its circular scale. In the Vernier callipers, 5 divisions of the Vernier scale coincide with 4 divisions on the scale and in the screw gauge, one complete rotation of the circular scale moves it by two divisions on the linear scale. Then :

A. If the pitch of the screw gauge is twice the least count of the vernier callipers, the least count of screw gauge is 0.01 mm.

B. if the pitch of the screw gauge is twice the least count of the vernier callipers, the least count of screw gauge is 0.005 mm.

C. If the least count of the linear scale of the screw gauge is twice the least count of the vernier callipers, the least count of screw gauge is 0.01 mm.

D. If the least count of the linear scale of the screw gauge is twice the least count of the vernier calliper, the least count of screw gauge is 0.005 mm.

Answer: (b,c)

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10. The vernier constant of a vernier callipers is $0.1mm$ and it has a positive zero error of $0.04cm$. While measuring diameter of a rod, the main scale reading is $1.2cm$ and $5th$ vernier division is coinciding with any scale division. The correct diameter of the rod is

A. 1.21 cm

B. 1.21mm

C. 1.29 mm

D. 1.29 cm

Answer: (a)

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11. What is the use of thin strip at the back of vernier calliper ?

A. for measuring internal diameter of a beacker

B. for measuring depth of a cylinder

C. for measurig dimeter of a hollow cylinder

D. none of these

Answer: (b)

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12. When the two jaws of a vernier callipers are in touch, zero of vernier scale lies to the right of zero of main scale and coinciding with vernier division 3. If vernier constant is $0.1mm$, the zero correction is

A. $-0.03cm$

B. $+0.03cm$

C. $= 0.03mm$

D. $+0.03mm$

Answer: (a)

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13. The circular scale of a screw gauge has 200 divisions. When it is given 4 complete rotations, it moves through $2mm$. The least count of the screw gauge is

A. $0.25 \times 10^{-2} cm$

B. $0.25 \times 10^{-3} cm$

C. 0.001 cm

D. 0.001 mm

Answer: (b)

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14. While measuring diameter of a wire using a screw gauge the main scale reading is $7mm$ and zero of circular scale is 35 divisions above the reference line. If the screw gauge has a zero error of $-0.003cm$, the correct diameter of the wire is (given least count $= 0.001cm$)

A. 0.735 cm

B. 0.732 cm

C. 0.738 cm

D. 7.38 cm

Answer: (c)

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15. When a screw gauge is completely closed, zero of circular scale is 4 division below the reference line of graduation. If least count of screw gauge is 0.001 cm, the zero correction is

A. $-0.004cm$

B. $+0.004cm$

C. $-0.004mm$

D. $+0.004mm$

Answer: (a)

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16. Two spherometers A and B have the same pitch. A has 100 division on periphery of its circular disc and B has 200 division on periphery of its circular disc. Then

A. Both A and B have same least count

B. L.C. of A is twice the L.C. of B

C. L.C. of A is half the L.C. of B

D. Nothing can be said

Answer: (b)

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17. If h is the height or depth (sagitta) of a spherical surfacce and I is the mean distance between the legs of sphermoeter, then radius of curvature R of the surface is

A. $R = \frac{I^2}{h} + \frac{h}{2}$

B. $R = \frac{I^2}{6h} + \frac{h}{2}$

C. $R = \frac{I^2}{6h} - \frac{h}{2}$

D. $R = \frac{h^2}{6I} + \frac{I}{2}$

Answer: (b)

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18. A student measured the length of a rod and wrote it as 3.50 cm. Which instrument did he use to measure it ?

A. A screw gauge having 100 division in the circular scale and pitch as 1mm

B. A screw gauge having 50 division in the circular scale and pitch as 1mm.

C. A meter scale.

D. A vernier calliper where 10 division in vernier scale match with 9 division in main scale and main scale has 10 division in 1 cm.

Answer: (d)

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