PHYSICS

BOOKS - KUMAR PRAKASHAN KENDRA

PHYSICS (GUJRATI ENGLISH)

UNITS AND MEASUREMENT

Section A Try Yourself Vsqs

1. What is physical quantity ?

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2. Weight is fundamental quantity. True / False

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3. What is derived quantity?

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4. What is unit ? Write its types.

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5. what is fundamental unit and derived unit ?

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6. What is unit system?


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7. Write different unit system ?


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8. Which is interational unit system?


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9. Which are supplementary quantities ?

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10. What is 1 radian?

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11. What is 1 steradian ?

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12. What is maximum value of plane angle and solid angle ?

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13. What is called a basis ?

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14. What is parallax ?

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15. Define angular diameter

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16. In optical microscope which electromagnetic waves are used ?

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17. Which microscope is used for nano technology ?

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18. Write dimension of molecule of oleic acid.

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19. Write size of observable universe and nucleus

Watch Video Solution

20. What is 1AU ? It represent which physical quantity ?

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21. Define light year. Is it unit of time?

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22. Which type of waves are used in electron microscope ?

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23. Define parsec.

Watch Video Solution

24. 1fm =..... Å

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25. Define mass.

Watch Video Solution

26. Write unit of mass in nuclear physics and write its unit.

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27. How mass of atom or nucleus is determined ?

Watch Video Solution

28. $1U = \ldots Kg$

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29. Write ratio of mass of observable universe and electron.

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30. In cesium clock time interval depend on which factors?

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31. How time is regulated in wristwatch?

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32. How time is regulated in cesium clock?

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33. Write uncertainty of time measured by cesium atomic clock.

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34. What is error in measurement ?

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35. What is error in measurement ?

Watch Video Solution

36. What is accuracy in measurement ? Accuracy depend on which factors ?

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37. What is least count?

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38. What is called least count error ?

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39. What is called as relative error ?

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40. Define fractional error.

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41. Out of absolute error, relative error and fractional error which has unit and which has no unit?

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42. Can error be completely eliminated ?

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43. Write rule for error produced in result due to addition and subtraction of error.

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44. Write rule for error in result due to multiplication and division

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45. What is error in measurement, done by any instrument?

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46. What is significant number? What is significant digit?

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47. Which is the best method to determine significant numbers ?

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48. Write no. of significant digits for number which do not represent measurement.

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49. What is dimension of a physical quantity ?

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50. What is dimensional formula ?

Watch Video Solution

51. What is dimensional equation ?

Watch Video Solution

52. Write dimensional formula and dimensional equation of density.

Watch Video Solution

53. What is dimensional analysis ?

Watch Video Solution

54. Why concept of dimension has basic importance ?

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55. Write principle of Homogeneity of dimension.

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Section A Questions Answers

1. What is unit ? Write its types.

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2. what is fundamental unit and derived unit ?

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3. What is unit ? Write its types.

Watch Video Solution

4. Write a note on SI (System International)

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5. Explain supplementary quantities and their unit of SI system.

Watch Video Solution

6. Write table for multiple and submultiple of various unit.

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7. Which devices are used for measurement of length of different order?

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8. What is parallax ?

Watch Video Solution

9. Explain parallax method to measure distance between the earth and planet.

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10. Explain method for measurement of dimension of a planet or star.

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11. Which type of waves are used in electron microscope ?

Watch Video Solution

12. Write a note on electron microscope.

Watch Video Solution

13. How tunneling microscope has become useful to estimate size of atom ?

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14. Explain method to determine size of molecule of oleic acid.

Watch Video Solution

15. Give range of length scale in physics.

Watch Video Solution

16. Define Astronomical unit, light year and parsec.

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17. What is mass? Write effect of external factor on mass.

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18. Write unit of mass in nuclear physics and write its unit.

Watch Video Solution

19. Explain measurement of mass of body.

Watch Video Solution

20. What is the range of masses we study in physics ?

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21. Explain how time was measured in ancient times. Also write note on cesium clock (atomic clock).

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22. Write ratio of maximum and minimum length in the universe.

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23. Write ratio of maximum and minimum time observed in universe.

Watch Video Solution

24. Write ratio of maximum and minimum mass in universe.

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25. Explain accuracy and precision in measurement.

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26. What is accuracy in measurement ? Accuracy depend on which factors ?

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27. Write difference between Mistake and Error.

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28. Write type or error in measurement of physical quantity and explain.

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29. Explain least count and least count error. Write a note on least count error.

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30. What is estimation of error ? Write method for estimation.

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31. Explain Absolute Error, Relative Error and Percentage Error.

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32. Write a note on combination of error.

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33. Explain error of a sum or a difference.

34. Write rule for error in result due to multiplication and division

35. What is significant number? What is significant digit?

36. Write and explain rules of determining significant digit with example.

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37. Write rules of "Round off" numbers.

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38. Explain : "By using significant digit we can prevent unnecessary long calculation.

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39. What points to be considered during addition.

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40. What points to be considered during multiplication and division of significant numbers ?

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41. Explain uncertainty or error in given asurement by suitable example.

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42. What is dimension of a physical quantity ?

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43. Define dimensional formula and dimensional equation by using sultable example.

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44. What is dimensional analysis ?

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45. Obtain the relation between the units of some physical quantity in two different systems o units.

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46. Obtain the relation between the MKS and CGS unit of work.

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47. Write principle of Homogeneity of dimension.

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48. Check dimensional consistency of given equation.

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49. Heat produced in a current carrying conducting wire depends on current I, resistance R of the wire and time t for which current is passed. Using these facts, obtain the formula for heat energy

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50. Write limitation of dimensional analysis.

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Section B Numericals Numerical Rom Textual Illustration

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

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Section B Numericals Numerical From Textual Illustration

1. A man wishes to estimate the distance of a nearby tower from him. He stands at a point A in fron of the tower C and spots a very distant objct O in line with AC.

He then walks pependicular to AC up to B, a distance of 100 m and look at O and C again. Since O is very distant the direction BO is practivally the same as AO, but he finds the line of slight by of C shifted fro the original line of slight by an angle $\theta = 30^\circ (\theta$ is known as parallax) estimate the distance of the tower C from his original position A.

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2. The moon is observed from two diametrically opposite points A and B on Earth. The angle θ subtended at the moon by the two directions of observation is $1^\circ 54'$. Given the diameter of the Earth

to be about 1.276×10^7 , compute the distance of the moon from the Earth.

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3. The Sun's angular diameter is measured to be 1920". The distance D of the Sun from the Earth is 1.496×109^{11} m. What is the diameter of the Sun ?

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4. If the size of a nucleus (in the range of 10^{-15} to 10^{-14}) is scaled up to the tip of a sharp pin, what

roughly is the size of an atom ? Assume tip of the pin to be in the range 10^{-5} m to $10^{-4}m$.

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

	Clock1	Clock 2
Monday	12:00:05:	10:15:06
Tuesday	12:01:15	10:14:18
Wednesday	11:59:08	10:15:18
Thursday	12:01:50	10:15:07
Friday	11:59:15	10:14:53
Saturday	12:01:30	10:15:24
Sunday	12:01:19	10:15:11
Sunday	12:01:19	10:15:11

If you are doing an experiment that requires precision

time interval measurements, which of the two clocks will you prefer? The range of variation in time of clock ?

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6. We measure the period of oscillation of a simple pendulum. In successive measurements, the readings turn out to be 2.63s, 2.56s, 2.42s , 2.71s and 2.80s. Calculate the absolute errors, relative error or percentage error.

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7. The temperature of two bodies measured by a thermometer are $t_1 = 20^\circ C \pm 0.5^\circ C$ and $t_2 = 50^\circ C \pm 0.5^\circ C$. Calculate the temperature difference and the error theirin.

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8. The resistance R=V/I where V=$(100 \pm 5)V$ and I= $(10 \pm 0.2)A$. Find the percentage error in R.

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

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10. Find the relative error in Z, if Z = $A^4 \frac{B^{\frac{1}{3}}}{C} D^{\frac{3}{2}}$.

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

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

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13. 5.74 g of a substance occupies $1.2cm^3$. Express its density by keeping the significant figures in view.

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

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

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15. The SI unit of energy is $J = kgm^2s^{-2}$, that of speed v is ms^{-1} and of acceleration a is ms^{-2}. What 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) $K = m^2v^2$

(b) $K = \left(\frac{1}{2}\right)mv^2$

(c) $K = ma$

(d) $K = \left(\frac{3}{16}\right)mv^2$

(e) $K = \left(\frac{1}{2}\right)mv^2 + ma$

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

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Section B Numericals Numerical From Textual Exercise

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

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2. The surface area of a solid cyclinder of radius 2.0 cm and height 10.0 cm is equal to ..... $(mm)^2$

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3. A vehicle moving with a speed of $18kmh^{-1}$ covers.....m in 1 s.

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4. The relative density of lead is 11.3. Its density is ..... gcm^{-3} or .....kgm^{-3}.

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5. $1 kgm^2 s^{-2} = \ldots\ldots\ldots\ldots gcm^2 s^{-2}$

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6. 1 m .....ly

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7. $3.0 ms^{-2} = \ldots\ldots\ldots\ldots Kmh^{-2}$

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8.

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

.

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

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10. Explain this statement clearly :

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

(a) 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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11. A new unit of length is chosen such that the speed of light in vacuum is unity. What is the distance between the Sun and the Earth in terms of the new unit if light takes 8 min and 20 s to cover this distance ?

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

(a) a vernier callipers with 20 divisions on the sliding scale

(b) a screw gauge of pitch 1 mm and 100 divisions on

the circular scale.

(c) an optical instrument that can measure length to within a wavelength of light ?

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

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

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

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

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17. The photograph of a house occupies an area of $1.75cm^2$ on a 35 mm side. The slide is projected on to a screen, and the area of the house on the screen is $1.55m^2$. What is the linear magnification of the projector-screen arrangement.

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18. State the number of significant

$0.007m^2$

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

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20. The mass of a box measured by a grocer's balance is 2.30 kg. Two gold pieces of masses 20.15 g and 20.17 g are added to the box. What is (a) the total mass of the box, (b) the difference in the masses of the pieces to correct significant figures ?

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

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

The percentage errors of measurement in a,b, c and d are 1%, 3% , 4% and 2% respectively. What is the

percentage error in the quantity P ? If the value of P calculated using the above relation turns out to be 3.763, to what value should you round off the result ?

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22. A book with many printing errors contains four different formulas for the displacement y of a particle undergoing a certain peroidic motion :

(a) $y = a \sin 2\pi t / T$

(b) y=asinvt

(c) $(a/T)\sin t/a$

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

(a = maximum displacement of the particle, v=speed of

the particle. T=time-period of motion). Rule out the wrong formulas on dimensional grounds)

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23. A famous relation in physics relates 'moving mass' m to the 'rest mass' m_0 of a particle in terms of its speed v and the speed of light,c. (This relation first arose as a consequence of special relativity due to Albert Einstein). 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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24. The unit of length conventent on the atomic scale is known as an angstrom and is denoted by Å: 1Å $= 10^{10}m$. The size of a hydrogen atom is about 0.5Å. What is the total atomic volume in m^{-3} of a mole of hydrogen atoms ?

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25. One mole of an ideal gas at standard temperature and pressure occupies 22.4 L (molar volume). What is the ratio of molar volume to the atomic volume of a

mole of hydrogen? (Take the size of hydrogen molecule to be about 1Å). Why is this ratio so large ?

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

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27. The principle of 'parallax' in section 2.3.1 is used in the determination of distances of very distant starts. The baseline AB is the line joining the Earth's two locations six months apart in its orbit around the Sun. That is, the baseline is about the diameter of the Earth's orbit $=3 \times 10^{11} m$. However, even the nearest stars are so distant that with such a long baseline, they show parallax only of the order of 1" (second) of arc or so. A parsec is a conventent unit of length on the astronomical scale. It is the distance of an object that will show a parallax of 1" (second of arc) from opposite ends of a baseline equal to the distance from the Earth to the Sun. How much is a parsec in terms of metres ?

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

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29. 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 you can, give a quantitative idea of the precision needed.

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30. 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 estimate is difficult to obtain, try to get an 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 strom

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

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

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31. The Sun is a hot plasma (ionized matter) with its inner core at a temperature exceeding $10^7 Kg$, and its outer surface at a temperature of about 6000K. At these high temperatures , no substance remains in a solid or liquid phase. In what range do you expect the mass density of the Sun to be, in the range of densities of solids and liquids or gases ? Check if your guess is

correct from the following data: mass of the Sun $= 2.0 \times 10^{30} Kg$, radius of the Sun $= 7.0 \times 10^{8} m$.

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

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Section B Numericals Additional Exercise

1. A man walking briskly in rain with speed v must slant his umbrella forward making an angle θ with the vertical. A student derives the following relation between θ and v: $\tan\theta$ = v and checks that the relation has a correct limit : as $v \to o, \theta \to 0$, as expected , (we are assuming there is no strong wind and that the rain falls vertically for a stationary man.) Do you think this relation can be correct ? If you, guess the correct relation.

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2. It is claimed that two cesium clocks, it allowed to run for 100 years, free from any distrubance, may differ by

only about 0.02 s. What does this imply for the accuracy of the standard cesium clock in measuring a time -interval of 1s ?

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

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4. The unit of length conventent on the nuclear scale is a fermi : $1f = 10^{-15}$m. Nuclear sized obey roughly the following empirical relation:

$r = r_0 A^{1/3}$

Where r is the radius of the nucleus, A its mass number, and r_0 is a constant equal to about, 1.2 f. Show that the rule implies that nuclear mass density is nearly constant for different nuclei. Estimate the mass density of sodium nucleus. Compare it with the average mass density of a sodium atom obtained in Exercise . 2.27.

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

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6. A SONAR (sound navigation and ranging) uses ultrasonic waves to detect and locate objects under

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

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7. The farthest objects in our universe discovered by modern astronomers are so distant that light emitted by them takes billions of years to reach the Earth. These objects (known as quasars) have many puzzing features, which have not yet been satisfactorily

explained. What is the distance in km of a quasar from which light takes 3.0 billion years to reach us ?

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8. It is a well known fact that during a total solar eclipse the disk of the Moon almost completely covers the disk of the Sun. From this fact and from the information your can gather from examples 2.3 and 2.4 determine the approximate diameter of the Moon.

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9. A great physicist of this century (P.A.M. Dirac) loved playing with numerical values of Fundamental constants of nature. This led him to an interesting observation. Dirac found that from the basic constants of atomic physics(c,e, mass of electron, mass of proton) and the gravitational constant G, he could arrive at a number with the dimension of time. Further, it was a very large number, its magnitude being close to the present estimate on the age of the universe (~ 15 billion years). From the table of fundamental constants in this book, try to see if you too can construct this number (or any other interesting number you can think of). If its coincidence with the age of the universe were

significant , what would this imply for the constancy of fundamental constants ?

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10. In experiment to measure density of a subtance mass $m = (3 \pm 0.12)$ kg and volume $V = (10 \pm 1)m^3$ recorded. Find relative error in measurement of density $\left(\rho = \frac{m}{V}\right)$

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11. The period of oscillation of a simple pendulum is T = $2\pi\sqrt{\frac{L}{g}}$. Measuted value of L is 20.0 cm known to 1mm

accuracy and time for 100 oscillations of the pendulum is found to be 90s using a wrist watch of 1 s resolution. What is the accuracy in the determination of g ?

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12. An amount of heat passing through a metallic rod in time t is given by $Q = \frac{KA(T_1 - T_2)t}{I}$ where k= thermal conductivity

A= Cross sectional area, T_1 and T_2 are temeprature of hot and cold ends respectively and L= length. So the dimesional formula for k=.....

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13. If the length of a cylinder is $L = (4.00 \pm 0.01)cm$ radius $r = (0.250 \pm 0.001)cm$ and mass $m = (6.25 \pm 0.01)g$. Calculate the percentage error in determination of density.

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

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15. The electric force between two electric charges is given by $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$. where is a distance . between charges q_1 and q_2 . So, unit and dimensional formula of ε_0, is ..... and..... respectively.

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16. Which equation are dimensionally valid out of following equations

(i) Pressure $P = \rho gh$ where ρ= density of matter, g= acceleration due to gravity. H= height.

(ii) F.S $= \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$ where F= force ρ= displacement m= mass, v= final velocity and $v_0 =$ initial velocity

(iii) $s = v_0 t + \frac{1}{2}(at)^2$

s= dispacement $v_0 =$ initial velocity,

a= accelration and t= time

(iv) $F = \frac{m \times a \times s}{t}$

Where m= mass, a= acceleration, s= distance and t= time

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17. If the velocity of light, acceleration due to gravity and normal pressure are chosen as fundamental units, find the unit of mass, length and time. Given that velocity of light $c = 3 \times 10^8 ms^{-1} g = 10 ms^{-2}$ and the normal atmospheric pressure $P = 10^5 Nm^{-2}$

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18. An object is falling freely under the gravitational force. Its velocity after travelling a distance his v. If v depends on gravitational accelertation g and distance h, then with the help of dimensional analysis, formula of v is ..... (k is constant)

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19. A gas bubble from an explosion under water oscillates with a period T proportional to pap "E where P is the statie pressure, p is the density of water and E is the total energy of the explosion. So, values of a, b and care .... and ... respectively.

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20. If unit of a physical quantity is doubled, what will be its new value.

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21. If object distance $u = (50.1 \pm 10.2)$ cm and image distance $v = (20.1 \pm 0.2)$ cm, then find value of focal length with error.

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22. If an experiment to measure coefficient of viscosity radius of tube measured $r = (0.100 \pm 0.001)$ cm and length $1 = (50.0 \pm 0.1)$ cm and volume of fluid coming out of capillary in unit time is $V = (0.25 \pm 0.01) cm /^2$. If pressure difference between end of tube is $p = 10^6$ dyne/ cm^2, then by using Poeisullie's law $V = \frac{\pi p r^4}{8\eta l}$ Find coefficient of viscosity.

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Section B Numericals Numerical From Darpan Based On Textbook

1. In an experiment, refractive index of glass wavs observed to be $1.54, 1.53, 1.44, 1.54, 1.56 \& 1.45$, So, its absolute error, relative error & percentage error are .... & ..... Respectively.

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Section B Numericals Questions

1. (a) 1 rad = ... Degree

(b) 1 rad = ... Min

(c) 1 rad = ... Sec

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2. A man wishes to estimate the distance of a nearby tower from him. He stands at a point A in fron of the tower C and spots a very distant objct O in line with AC. He then walks pependicular to AC up to B, a distance of 100 m and look at O and C again. Since O is very distant the direction BO is practivally the same as AO, but he finds the line of slight by of C shifted fro the original line of slight by an angle $\theta = 30^\circ$ (θ is known as parallax) estimate the distance of the tower C from his original position A.

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3. The planet is observed from two diametrically opposite points A and B on Eath. The angle θ subtended at the planet by the two directions of observation is $1^\circ 30'$. Given the diameter of the Earth to be about $1.276 \times 10^7 m$, computer the distance of the moon from the Earth.

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4. The planet is observed from two diametrically opposite points A and B on Eath. The angle θ subtended at the planet by the two directions of observation is $1^\circ 8'$. Given the diameter of the Earth to be about $1.276 \times 10^7 m$, computer the distanc

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5. The Sun's angular diameter is 30''. The distance of Earth from Sun is $1.496 \times 10^{11} m$, then find the diameter of the Sun. $\left(1'' = 4.85 \times 10^{-6} \text{ rad}\right)$

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6. The Jupitar's angular diameter is $35.72''$. The distance of Earth from Jupiter is 82.27×10^{6} km then find diameter of the jupiter.

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7. The Sun's angular diameter is measured to be 1920". The distance D of the Sun from the Earth is 1.496×109^{11} m. What is the diameter of the Sun ?

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

	Clock1	Clock 2
Monday	12:00:05:	10:15:06
Tuesday	12:01:15	10:14:18
Wednesday	11:59:08	10:15:18
Thursday	12:01:50	10:15:07
Friday	11:59:15	10:14:53
Saturday	12:01:30	10:15:24
Sunday	12:01:19	10:15:11
Sunday	12:01:19	10:15:11

If you are doing an experiment that requires precision time interval measurements, which of the two clocks will you prefer? The range of variation in time of clock ?

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9. In Ohm's experiment to experiment to measure resistance different observation of unkowwn resistance are $4.12\Omega 4.08\Omega$ and 4.41Ω. Find average absolute error, relative error and percentage error.

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10. If refractive measure of water are $1.32, 1.33, 1.34, 1.35$ and 1.36 then find of absolute error, relative error and percentage error.

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11. In Ohm's law potential difference between two end of a resistor are 15V, 14V, 10V, 12V and 13V. Find average absolute error, fractional (relative) error and pecentage error.

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12. The mass of empty beaker (50.3 ± 0.2) g and mass of hall water breaker $(59.4 + 0.2)g$. By keeping error in mind, the mass of water will be.....

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13. If $\theta_1 = (25.5 \pm 0.1)^\circ C$ and $\theta_2 = (35.3 \pm 0.1)^C$, then find $\theta_1 - \theta_2$.

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14. When current density of $(2.5 \pm 0.5)A$ is passed from wire, then there is a difference of $(20 \pm 1)V$ in

electric potential. The resistance of wire is

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15. Find the absolute error in the parallel combination of R_1 and R_2

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16. Two resistors $R_1 = (100 \pm 3)\Omega$ and $R_2 = (150 \pm 4.5)\Omega$, then how much maximum absolute error is there in theire series combination ?

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17. In $K = \frac{p^2}{2m}$ find the relative error. (Take mass m, constant)

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18. A physical quantity P is given by $P = \frac{A^3 B^{\frac{1}{2}}}{C^{-4} D^{\frac{3}{2}}}$. Due to which physical quantity produced the maximum percentage error in P ?

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19. In an experiment four quantities a,b,c and d are measured with percentage error 1% 2%, 3% and 4% respectively. Quantity P is calcualted as follows : $P = \frac{a^3 b^2}{cd}$ % error in P is

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20. The periodic time of simple pendulum is $T = 2\pi\sqrt{\frac{l}{g}}$. The length (l) of the pendulum is about 100 cm measured with 1mm accuracy. The periodic time is about 2s. When 100 oscillations are measured by a stop watch having the least count 0.1 second. Calcaulte the percentage error in measurement of g.

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21. The period of oscillation of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$. The length l of the pendulum is about 0.5s. The time of 100 oscillations is measured with a watch of 1 s resolution. Calcualte percentage error in measurment of g.

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22. Length breadth, thickness of a cuboid is $5.412m 0.021m$ and $1.23m$ respectively. Find total

surface area and volume of cuboid in view of significant digit.

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23. Length of side of cube is 1.1 cm and mass of cube is $10.38g$. Find its volume in view of significant digit.

Watch Video Solution

24. 25.852g of a substance occupies $6.31cm^3$ Express its density by keeping the significant Express its density by keeping the significant figures in view.

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25. $S = v_0 t + \frac{1}{2}(at)^s$. s = displacement, v_0= initial velocity, a= acceleration and t= time. Check the dimensional validity of the following equation.

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26. $F = \frac{mass}{t}$ where m= mass ,a= acceleration, s= distance and t= time. Check the dimensional validity of the following equation.

Watch Video Solution

27. If force F is reprsented in different, ways then which of the following is correct and which are not correct ? M= mass, a = acceleration r= radius, v= velocity d= distance t=time.

(a) $F = \frac{mv^2}{r}, (b) F = ma, (c) F = \frac{ma}{d}$

(d) $F = ma + \frac{1mv^2}{r} (e) F = \frac{md^2}{t^2}$

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28. An object is falling freely under the gravitational force. Its velocity after travelling a distance his v. If v depends on gravitational accelertation g and distance

h, then with the help of dimensional analysis, formula of v is ..... (k is constant)

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29. For object moving on circular path centripetal force (F) depend on mass (m), velocity (v) and radius (r). Derive equation of centripetal force F.

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Section C Objective Questions Vsqs

1. 1m equal to how many astronomical unit?

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2. Write difference between nm, miN and Nm.

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3. Which is the largest unit out of astronomical unit, light year and Parsec ?

Watch Video Solution

4. Parsec is how many light year?

Watch Video Solution

5. 1 pc is how many astronomical unit?

Watch Video Solution

6. Are AU and A are equal unit of length ?

Watch Video Solution

7. Are inertial mass and gravitational mass different ?

Watch Video Solution

8. What is the meaning of angular diameter of the Moon ?

Watch Video Solution

9. Which of the following measurement of length is more accurate ?

(i) $2.0cm$ $(ii)2.00cm$ $(iii)2.000cm$

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10. Solve $\sqrt{6.5-6.32}$ by using significant figure.

Watch Video Solution

11. Why parallax method is not used for distance between star and earth which are at distance of 100 light year?

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12. Explain accuracy and precision in measurement.

Watch Video Solution

13. State difference of mass and weight.

Watch Video Solution

14. Explain the statement, "The accuracy of the measurement, can be made not by absolute error but by percentage error only.

Watch Video Solution

15. It is advantageous to use the device having smaller value of least count". Explain the statement.

Watch Video Solution

16. Why are errors expressed as positive and negative?

Watch Video Solution

17. $1gcm^{-3}.... Kgm^{-3}$ (Fill the gaps)

Watch Video Solution

18. Why quantities appearing with higher (power) exponent should be measured with most accurately ?

Watch Video Solution

19. Write accuracy of atomic clock.

Watch Video Solution

20. If $f = x^2$ then what will be relative error in measurement of f ?

Watch Video Solution

21. Write six physical quantities which have dimension of $M^1L^2T^{-2}$

Watch Video Solution

22. Are dimension of mass and weight equal ?

Watch Video Solution

23. Write physical quantity having dimension of $Nm^{-1}s^2$.

Watch Video Solution

24. Is it possible that physical quantity has dimension but do not have mole?

Watch Video Solution

25. Explain supplementary quantities and their unit of SI system.

Watch Video Solution

26. Which are inferior planets ?

Watch Video Solution

27. What is elongation ?

Watch Video Solution

28. In modern times which method is used to measure the distance between the earth and planet?

Watch Video Solution

29. "Fundamental unit of length is kilometer and fundamental unit of mass is gram" - Agree or disagree?

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30. $x = a + bt + ct^2 = x$ in metre and tis in sec then write unit of a, b, c.

Watch Video Solution

31. Light year is unit of ..... .

Watch Video Solution

32. A physical quantity has unit $\frac{\text{Watt}}{m^2}$ write its dimension.

Watch Video Solution

33. $y = x^2 r + M^1 L^1 T^{-2}$ is dimensionally correct. If r represent displacement, then write dimension of x^2

Watch Video Solution

34. Pressure P = FK where F is force, obtain dimension of K.

Watch Video Solution

35. Obtain dimension of $\rho g v$

where, ρ = density, g = acceleration, v = velocity

Watch Video Solution

36. Explain supplementary quantities and their unit of SI system.

Watch Video Solution

37. The mass of an object is (225 ± 0.05) gm calculate percentage error in measurement.

Watch Video Solution

38. If $\theta_1 = (25.5 \pm 0.1)^\circ C$ and $\theta_2 = (35.3 \pm 0.1)^C$, then find $\theta_1 - \theta_2$.

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39. Subtract according to significant digit.

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

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40. Why 10^6 km cannot be represented by Mkm?

Watch Video Solution

41. Volume and total surface area of a cube is equal. Find volume of cube. Let I be length of cube.

Watch Video Solution

42. Write no. of significant digit in $(3204.80) \times 10^5$

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43. Which number is obtained by rounding off 96378 upto 2 significant digit?

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44. Explain "By changing unit zero are added. This will not change number of significant digits."

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45. By suitable example show that "Trailing zero in nonzero number are not significant".

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Section D Necert Exemplar Solutions Multiple Choice Questions Mcqs

1. The number of significant figures in 0.06900 is

A. 5

B. 4

C. 2

D. 3

Answer:

Watch Video Solution

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:

Watch Video Solution

3. The mass and volume of a body are $4.237g$ and $2.5cm^3$ respectively. The density of the material 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:

Watch Video Solution

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

A. $2.75 \text{ and } 2.74$

B. $2.74 \text{ and } 2.73$

C. $2.75 \text{ and } 2.73$

D. $2.74 \text{ and } 2.74$

Answer:

Watch Video Solution

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

A. $164 \pm 3cm^2$

B. $163.62 \pm 2.6cm^2$

C. $163.6 \pm 2.6cm^2$

D. $163.62 \pm 3cm^2$

Answer:

Watch Video Solution

6. Which of the following pairs of physical quantities 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:

Watch Video Solution

7. Measure of two quantities along with the precision of respective measuring instrument is $A = 2.5ms^{-1} + 0.5ms^{-1} B = 0.10s \pm 0.01s$. The value of AB will be

A. $(0.25 \pm 0.08)m$

B. $(0.25 \pm 0.5)m$

C. (0.25 ± 0.05)

D. (0.25 ± 0.135)

Answer:

Watch Video Solution

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. $1.4m \pm 0.04m$

B. $1.41m \pm 0.2m$

C. $1.4m \pm 0.2m$

D. $1.4m \pm 0.2m$

Answer:

Watch Video Solution

9. Which of the following measurement is most precise ?

A. $5.00mm$

B. $5.00cm$

C. $5.00m$

D. $5.00km$

Answer:

Watch Video Solution

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

A. $4.9cm$

B. $4.805cm$

C. $5.25cm$

D. $5.4cm$

Answer:

Watch Video Solution

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

A. 1.9×10^{10}

B. 1.9×10^{11}

C. 1.9×10^{12}

D. 1.9×10^{13}

Answer:

Watch Video Solution

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

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

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

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

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

Answer:

Watch Video Solution

Section D Necert Exemplar Solutions Multiple Choice Questions More Than One Options

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

A. $y = a \sin 2\pi \frac{t}{T}$

B. $y = a \sin vt$

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

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

Answer:

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

A. $\frac{(P-Q)}{R}$

B. $PQ-R$

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

D. $\frac{\left(PR-Q^2\right)}{R}$

Answer:

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3. Photon is quantum of radiation with energy E = hv, where v is frequency and his 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:

 Watch Video Solution

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

A. (A) Mass of electron (m_e)

B. (B) Universal gravitational constant (G)

C. (C) Charge of electron (e)

D. (D) Mass of proton (m)

Answer:

Watch Video Solution

5. Which of the following ratios express pressure?

A. $\frac{\text{Force}}{\text{Area}}$

B. $\frac{\text{Energy}}{\text{Volume}}$

C. $\frac{\text{Energy}}{\text{Area}}$

D. $\frac{\text{Force}}{\text{Volume}}$

Answer:

Watch Video Solution

6. Which of the following is not an example of a biomass energy source ?

A. Second

B. Parsec

C. Year

D. Light year

Answer:

Watch Video Solution

Section D Necert Exemplar Solutions Very Short Answer Type Questions

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

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Section D Necert Exemplar Solutions Multiple Choice Questions More Than One Options

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

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

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3. Express unified atomic mass unit in kg.

Watch Video Solution

4. 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 $f(\theta)$ to be a dimesnionless quantity ?

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

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Section D Necert Exemplar Solutions Short Answer Type Questions

1. The earth-moon distance is about 60 earth radius. What will be the diameter of the earth (approximately in degrees) as seen from the moon ?

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2. Moon is seen to be of $\left(\frac{1}{2}\right)^{\circ}$ diameter from the earth. What must be the relative size compared to the earth?

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3. 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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4. 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 your answer.

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

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7. During a total solar eclipse 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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8. If the unit of force is 100 N, unit of length is 10 m and unit of time is 100 s, what is the unit of mass in this system of units ?

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9. Give an example of

(a) a physical quantity which has a unit but no dimensions

(b) a physical quantity which has neither unit nor dimensions

(c) a constant which has a unit

(d) a constant which has no unit.

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Watch Video Solution

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

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

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12. 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) w and (ii) k.

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

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Section D Necert Exemplar Solutions Long Answer Type Questions

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

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2. The volume of a liquid flowing out per second of a pipe of length I and radius r is written by a student as $V = \frac{\pi}{8}\frac{pr^4}{\eta l}$ where p is the pressure difference between the two ends of the pipe and η is coefficent of viscosity of the liquid having dimensional formula

$(ML^{-1}T^{-1})$. Check whether the equation is dimensionally correct.

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3. A physical quantity X is related to four measurable quantities a, b, c and d as follows $X = a^2b^3c^{\frac{5}{2}}d^{-2}$. The percentange 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 $P = El^2m^{-5}G^{-2}$, Em, l 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 h and gravitational constant G are taken as fundamental quantities, then express mass, length and time in terms of dimensions of these quantities.

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6. An artificial satellite is revolving around a planet of mass M and radius R in a circular orbit of radius r. From Kepler'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 using dimensional analysis that $T = \frac{k}{R}\sqrt{\frac{r^3}{g}}$ where k is dimensionless RV g 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 1 mL of oleic acid is dissolved in 19 ml of

alcohol. Then I 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 through. 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 anstronomical units (AU) make 1 parsec ?

(b) Consider a sunlike star at a distance of 2 parsecs. 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) from the earth. Due to atmospheric fluctuations, eye cannot resolve objects

smaller than 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 AU from the earth. 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 very small. The energy at nuclear level is usually measured in MeV, where $IMeV = 1.6 \times 10^{-13} J$ the masses are

measured in unified atomic mass unit (u) where, $1u = 1.67 \times 10^{-27} kg$

. (a) Show that the energy equivalent of luis 931.5 MeV.

(b) A student writes the relation as lu = 931.5 MeV.

The teacher points out that the relation is dimensionally incorrect. Write the correct relation.

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Section E Multiple Choice Questions Mcqs Mcqs Asked In Gujarat Board And Competitive Exams

1. Solid angle subtended by hemisphere at centre is ..... .

A. 1sr

B. $2\pi sr$

C. $4\pi sr$

D. πsr

Answer:

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2. $10^3 \frac{g}{cm^3} = , , \frac{kg}{m^3}$

A. 10^6

B. 10^{-6}

C. 10^3

D. 10^1

Answer:

Watch Video Solution

3. The dimensional formula of Stefan Boltzmann's constant is .....

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

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

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

D. $M^1L^0T^{-3}K^{-4}$

Answer:

Watch Video Solution

4. If error in measurement of a length of a cube is 3%, what is error in area of its one side ?

A. 0.03

B. 0.12

C. 0.09

D. 0.06

Answer:

Watch Video Solution

5. Round off 15.753 upto 3 significnt digits.

A. 15.753

B. 15.75

C. 15.8

D. 15.8

Answer:

Watch Video Solution

6. A heavenly body is observed from two diametrically opposite points A and B on the earth. The angle

substended at the heavenly body is 2.9×10^{-4} rad. Given the diameter of Earth to be about 1.28×10^{7} Compute the distance of the heavenly body from the earth.

A. $2.267 \times 10^{-11} m$

B. $4.413 \times 10^{7} m$

C. 4.413×10^{10}

D. $4.413 \times 10^{10} m$

Answer:

Watch Video Solution

7. The electric force between two electric charges is given by $F = k\frac{q_1 q_2}{r^2}$ where r is the distance between q_1 and q_2 . Give the dimensional formula of k.

A. $M^1L^2T^4A^2$

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

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

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

Answer:

Watch Video Solution

8. If the formula for a physical quantity is $W = \frac{a^4 b^3}{c^2 \sqrt{d}}$ and if percentage errors in the measurement of a, b, c and d are 1%, 2%, 3% and 4% respectively. Find the percentage error in W.

A. 1%

B. 16%

C. 18%

D. 12%

Answer:

Watch Video Solution

9. 1 MKS unit of power = ... CGS unit of power.

A. 10^2

B. 10^7

C. 10^5

D. 10^3

Answer:

Watch Video Solution

10. In the equation $b = a^2 \cos^2\left(\frac{2\pi\beta\gamma}{\alpha}\right)$. If the units of $a, \alpha,$ and β are m, s^{-1} and $\left(ms^{-1}\right)^{-1}$. respectively. The unit of b and Y.....

A. m and ms^{-2}

B. m^2 and ms^{-2}

C. m^2 and $\left(ms^{-2}\right)$

D. m and $\left(ms^{-2}\right)^{-1}$

Answer:

Watch Video Solution

11. When a current of $(5 \pm 0.5)A$ flows through a wire, it develops a potential difference of $(40 \pm 1)V$. The resistance of the wire is .....

A. $(8 \pm 1.5)\Omega$

B. $(8 \pm 0.5)\Omega$

C. $(8 \pm 1)\Omega$

D. $(8 \pm 2)\Omega$

Answer:

Watch Video Solution

12. 1 fm=... nm

A. 10^{-3}

B. 10^{-6}

C. 10^{-9}

D. 10^{+6}

Answer:

Watch Video Solution

13. The dimensional formula of energy propagated per unit area at a given point in unit time is.....

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

B. $M^1L^0T^{-3}$

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

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

Answer:

Watch Video Solution

14. Numbers of significant figures in 4.033 and 0.004033 are ..... respectively.

A. 3 and 3

B. 4 and 4

C. 3 and 4

D. 4 and 6

Answer:

Watch Video Solution

15. If frequency (F), velocity (v) and density (D) are considered as fundamental units the dimensional formula for momentum will be.....

A. $D^2v^2F^2$

B. $D^1v^4F^{-3}$

C. $D^{-1}v^{-4}F^{-3}$

D. $D^1v^1F^{-2}$

Answer:

Watch Video Solution

16. Dimensional formula of thermal resistance R_H.....

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

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

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

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

Answer:

Watch Video Solution

17. In $\left(P+\frac{a}{V^2}\right)(V-b)=RT$ equation the, a,b will be ..... Where P= Pressure V= Volume and T= Temperature

.

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

B. $M^1L^8T^{-2}$

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

D. $M^1L^8T^{-2}K^{-1}$

Answer:

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18. 1g=.... Amu

A. 1.66×10^{-24}

B. 6.024×10^{23}

C. 1.66×10^{-30}

D. 6.024×10^{-29}

Answer:

Watch Video Solution

19. If $Z = A^4$ then relatie error in Z is .....

A. $(\Delta A)^4$

B. $4\left(\frac{\Delta A}{A}\right)$

C. $\frac{(\Delta A)^4}{A}$

D. $\left(\frac{\Delta A}{A}\right)^{\frac{1}{4}}$

Answer:

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20. ..... is the dimensional formula fo Gravitational potential energy.

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

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

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

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

Answer:

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21. The electric force between two electric charges is given by $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$. where is a distance . between charges q_1 and q_2 . So, unit and dimensional formula of ε_0, is ..... and..... respectively.

A. $N^1C^2m^{-2}, M^{-1}L^{-3}T^4A^2$

B. $N^{-1}Cm^{-2}, M^{-1}L^{-1}T^{-1}A$

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

D. $NCm^{-2}, MLTA$

Answer:

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22. Light propagates rectilinearly, due to

A. wave nature

B. wavelengths

C. velocity

D. frequency

Answer:

Watch Video Solution

23. Unit of thermal resistane is .... And its dimensional formula is ....

A. $J^{-1}sK$, $M^{-1}L^{-2}KT^{3}$

B. Kelvin Watt, $ML^{-2}T^{-3}K$

C. J/sK, $ML^{-1}T^{-1}KA$

D. Kelvin Ohm, $ML^{-2}T^{-3}A^{-2}K$

Answer:

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24. Formula $W = \frac{a^4 b^3}{\frac{c^1}{3}\sqrt{d}}$ and if percentage error in the measurement of a, b, c d are 2%, 1%, 6% and 4% respectively, then calculate the percentage error in W.

A. 0.15

B. 0.14

C. 0.21

D. 0.16

Answer:

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25. $100gcms^{-1} = xNs$ then x=....

A. 3.6×10^{-3}

B. 1×10^{-3}

C. 6×10^{-4}

D. 1×10^{-5}

Answer:

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26. Which of the following is not a fundamental physical quantity ?

A. Mass of electron (m_e)

B. Weight

C. Time

D. Length

Answer:

Watch Video Solution

27. Write down the number of significant figures in $0.003m^2$

A. Two

B. Three

C. Four

D. One

Answer:

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

A. $[\varepsilon_0] = [M^{-1}L^{-3}T^2A]$

B. $[\varepsilon_0] = [M^{-1}L^{-3}T^4A^2]$

C. $[\varepsilon_0] = [M^{-1}L^2T^{-1}A^{-2}]$

D. $[\varepsilon_0] = [M^{-1}L^2T^{-1}A]$

Answer:

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29. The current voltage relation of diode is given by $I = \left(e^{1000V/T} - 1\right)$ mA, where the applied voltage V is in volts and the temperature T is in degree Kelvin. If a student makes an error measuring ± 0.01 V while measuring the current of 5mA at 300K, what will be the error in the value of current in.

A. $0.5mA$

B. $0.05mA$

C. $0.2mA$

D. $0.02mA$

Answer:

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30. 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 divisions in the circular scale and pitch as 1 mm.

B. A screw gauge having 50 divisions in the circular scale and pitch as 1 mm.

C. A meter scale.

D. A vernier calliper where the 10 divisions in vemier scale matches with 9 division in main scale and main scale has 10 division in 1 cm.

Answer:

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31. The period of oscillation of a simple pendulum is T = $2\pi\sqrt{\frac{L}{g}}$. Measuted value of L is 20.0 cm known to 1mm

accuracy and time for 100 oscillations of the pendulum is found to be 90s using a wrist watch of 1 s resolution. What is the accuracy in the determination of g ?

A. 0.02

B. 0.03

C. 0.01

D. 0.05

Answer:

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32. A student measures the time period of 100 oscillations of a simple pendulum four times. The data set is 90 s, 91 s, 95 s and 92 s. If the minimum division in the measuring clock is Is, then the reported mean time should be :

A. $92 \pm 3s$

B. $92 \pm 2s$

C. $92 \pm 2s$

D. $92 \pm 1.8s$

Answer:

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33. A screw gauge with a pitch of 0.5 mm and a circular scale with 50 divisions is used to measure the thickness of a thin sheet of Aluminium. Before starting the measurement, it is found that when the two laws of the screw gauge are brought in contact, the 45^{th} division coincides with the main scale is barely visible. What is the thickness of the sheet is the main scale reading is 0.5 mm and the 25^{th} division coincides with the main scale line ?

A. $0.50mm$

B. $0.75mm$

C. $0.80mm$

D. $0.70mm$

Answer:

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34. Dimensional formula of angular momentum is....

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

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

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

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

Answer:

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35. If C and R represent capacitance and resistance respectively, then write dimensional formula of RC

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

B. $M^0L^0T^0$

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

D. None of these

Answer:

 Watch Video Solution

36. Write dimensional formula of self inductance.

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

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

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

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

Answer:

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37. Which of the following physical quantities has different dimensional formula ?

A. Energy per unit volume

B. Product of voltage and charge per unit volume.

C. Force acting per unit area

D. Angular momentum

Answer:

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38. Viscous force acting between two layers of liquid having area A and velocity gradient $\frac{\Delta v}{\Delta z}$ is given by $F = \eta A \frac{\Delta v}{\Delta z}$. Find dimension of η.

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

B. $M^0 L^0 T^0$

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

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

Answer:

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39. The frequency of oscillation of a mass m suspended from a spring having force constant k is given by $f = Cm^x k^g$, where C is a dimensionless quantity. The value of x and y

A. $x = \frac{1}{2}, y = \frac{1}{2}$

B. $x = -\frac{1}{2}, y = -\frac{1}{2}$

C. $x = \frac{1}{2}, y = -\frac{1}{2}$

D. $x = -\frac{1}{2}, y = \frac{1}{2}$

Answer:

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40. Write dimension of permeability of vacuum.

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

B. $M^0L^1T^1$

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

D. None of these

Answer:

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41. In a new system, if units for length mass and time are chosen to be 10 cm 10g and 0.1 s respectively, then new unit of force in this system will be.....

A. 1

B. 0.1

C. 0.01

D. 0.001

Answer:

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42. Value of N divison on a vernier scale is equal to (N-1) scale on main scale of vernier. If value of 1 scale on main scale is 1 mm then leas count will be....

A. N

B. $N-1$

C. $\frac{1}{10N}$

D. $\frac{1}{N-1}$

Answer:

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43. Which of the following constant has dimension?

A. refractive indeed

B. Poission's ratio

C. relative density

D. universal constant of gravitation

Answer:

Watch Video Solution

44. In equation $\left(P+\frac{a}{V^2}\right)=b\frac{\theta A}{V}$ pressure, V = volume, Q = absolute temp. a, b are constant. Find dimension of a

A. $M^1L^5T^{-2}$

B. $M^{-1}L^5T^2$

C. $M^1L^{-5}T^{-2}$

D. $M^1L^5T^1$

Answer:

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45. Which of the following have same dimension ?

A. LC

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

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

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

Answer:

Watch Video Solution

46. Write dimension of magnetic flux.

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

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

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

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

Answer:

Watch Video Solution

47. Which of the following pair do not have same dimension?

A. pressure - stress

B. velocity - speed

C. force - impulse of force

D. work - energy

Answer:

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48. A cylindrical rod having temperature T_1 and T_2 at its end. The rate of flow of heat is $Q_1 \frac{\text{Cal}}{s}$ If all linear dimensions are doubled keeping temperature constant, then the rate of flow of heat Q_2 in $\frac{\text{Cal}}{s}$ will be .....

A. $4Q_1$

B. $2Q_1$

C. $\frac{Q_1}{4}$

D. $\frac{Q_1}{2}$

Answer:

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49. SI unit of Stefan-Boltzmaan constant is . . ..

A. $Wm^{-2}K^{-4}$

B. Wm^{-2}

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

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

Answer:

Watch Video Solution

50. Which of the following is unit of permitivity of vaccum ?

A. $\frac{C^2}{(Nm)^2}$

B. $\frac{C}{Nm}$

C. $\frac{Nm^2}{C}$

D. $\frac{C^2}{Nm^2}$

Answer:

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51. Ratio of unit of Planck's constant and moment of inertia will give which physical quantity ?

A. time

B. frequency

C. angular momentum

D. velocity

Answer:

Watch Video Solution

52. Velocity of a particle at time t is given by $v = at + \frac{b}{t+c}$ a, b, care constant. The dimension of a b, c will be .....

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

B. LT^2, LT and L

C. L, LT and T^2

D. LT^2, L and T

Answer:

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53. If mass, length, time and electric current is represented as M, L, T, I respectively, then dimension of resistance will be .....

A. ML^2T^{-2}

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

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

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

Answer:

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

A. 0.04

B. 0.06

C. 0.08

D. 0.02

Answer:

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55. Which of the following two parameter have same dimension?

(a) energy density (b) refractive index

(c) dielectric constant (d) Young's modulus

(e) electric field.

A. (b) and (d)

B. (c) and (e)

C. (a) and (d)

D. (a) and (e)

Answer:

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56. Dimension of a physical quantity is $M^aL^bT^c$, then it is .....

A. velocity if $a = 1, b = 0, c = -1$

B. accceleration if $a = 1, b = 1, c = -2$

C. force if $a = 0, b = -1, c = -2$

D. pressure if $a = 1, b = -1, c = -2$

Answer:

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57. Dimension of $\frac{1}{2}\varepsilon_0 E^2$ is..... ε_0 permittive of vaccum

E= electric field

A. ML^1T^{-2}

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

C. ML^2T^{-1}

D. MLT^{-1}

Answer:

Watch Video Solution

58. Dimension of $[\mu_0\varepsilon_0]^{-\frac{1}{2}}$....

A. $L^{\frac{1}{2}}T^{-\frac{1}{2}}$

B. $L^{-1}T$

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

D. $L^{-\frac{1}{2}}T^{\frac{1}{2}}$

Answer:

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

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

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

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

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

Answer:

Watch Video Solution

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

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

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

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

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

Answer:

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61. In dimension of critical velocity v_c of liquid following through a tube are expressed as $\left[\eta^x \rho^y r^z\right]$ where η, ρ and r are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values 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:

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62. If Plank constant (h) speed of free space light (c) and Newton gravitation constant (G) are chosen as the fundamental quantities, then dimensional formula of length will be .....

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

B. $\sqrt{\frac{G_c}{h^{\frac{3}{2}}}}$

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

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

Answer:

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63. A student perform experiment to measure thickness of slab by using vernier caliper. 50 scale of vernier is equal to 49 scale of main scale. He observes that zero of vernier is between 7.00 cm and 7.05 cm 23rd division of vernier coincide with main scale. What will be thickness of slab measured by student?

A. $7.73cm$

B. $7.23cm$

C. $7.023cm$

D. $70.73cm$

Answer:

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64. In an experiment four quantities a,b,c and d are measured with percentage error 1% 2%, 3% and 4% respectively. Quantity P is calcualted as follows : $P = \frac{a^3b^2}{cd}$ % error in P is

A. 0.04

B. 0.14

C. 0.1

D. 0.07

Answer:

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65. The density of a material in the shape of a cube is determined by measuring three sides of the cube and its mass. If the relative errors in measuring the mass and length are respectively 1.5% and 1 % the maximum error in determining the density is

A. 2.5%

B. 3.5%

C. 4.5%

D. 0.06

Answer:

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66. A student measured the diameter of a small steel ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and zero of circular scale division coincides with 25 divisions above the reference

level. If screw gauge has a zero error of - 0.004 cm, the correct diameter of the ball is

A. $0.529cm$

B. $0.521cm$

C. $0.053cm$

D. $0.525cm$

Answer:

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Section F Questions From Module

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

A. 0.04

B. 0.06

C. 0.08

D. 0.02

Answer:

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2. If $V = \sqrt{\frac{\gamma P}{\rho}}$, V =velocity, P= pressure ρ= density, then dimension of γ will be .....

A. $M^0L^0T^0$

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

C. $M^1L^0T^0$

D. $M^0L^1T_0$

Answer:

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3. If energy (E), velocity (V) and force (F) are taken as fundamental quantity, then dimension of mass will be .....

A. $E^1v^2F^0$

B. $E^1v^{-2}F^0$

C. $E^1v^{-1}F^1$

D. $E^1v^{-2}F^1$

Answer: A::B

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4. The periodic time of simple pendulum is $T = 2\pi\sqrt{\frac{l}{g}}$. The length (l) of the pendulum is about 100 cm measured with 1mm accuracy. The periodic time is about 2s. When 100 oscillations are measured by a stop watch having the least count 0.1 second. Calcaulte the percentage error in measurement of g.

A. $0.1\,\%$

B. 0.01

C. $0.2\,\%$

D. $0.8\,\%$

Answer: B

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5. Which of the following physical quantity is dimensionless?

A. Specific heat

B. Strain

C. Quantity of heat

D. Stress

Answer: A

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6. Which of following is not unit of length ?

A. fermi

B. micron

C. debye

D. light year

Answer: B::D

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7. When current passes through resistor due to its resistive property heat is produced. Error in

measurement of resistance, current and time is 1%, 2% and 1% respectively, then what will be percentage error in measurement of heat energy ?

A. 4

B. 6

C. 5

D. 8

Answer:

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8. Percentage error in measurement of (125 ± 0.5) cm will be.....

A. $0.1\,\%$

B. $0.04\,\%$

C. $0.4\,\%$

D. 0.4

Answer: D

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9. Parsec is unit of which physical quantity ?

A. Time

B. Distance

C. Frequency

D. Angular velocity

Answer: A::C::D

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10. The potential energy of a particle from a distance x from an origin, changes according to the formula $U = \frac{A\sqrt{x}}{x + B}$ where A and B are constant so the dimension of AB=.....

A. $M^1L^{\frac{5}{2}}T^{-2}$

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

C. $M^{\frac{3}{2}}L^{\frac{3}{2}}T^{-2}$

D. $M^1L^{\frac{7}{2}}T^{-2}$

Answer: A::B

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11. Write significant digit in 7.900 and 0.07900

A. 2

B. 3

C. 4

D. 5

Answer: D

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12. In an experiment to measure density of object mass and volume are measured as 22.42 gram and $4.7cm^3$ respectively. Error in measurement of mass and volume is 0.1 gram and $0.1cm^3$ respectively. Find maximum error in measurement of density.

A. 0.22

B. 0.02

C. 2%

D. 0.02%

Answer: B

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13. From length of square plate and force acting on it pressure on plate is measured. If error in force and length is 4% and 2% respectively, then maximum relative error in measurement of pressure will be .....

A. 0.01

B. 0.02

C. 0.06

D. 0.08

Answer:

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14. Which of the following have same dimension ?

A. Torque and work

B. Stress and energy

C. Force and stress

D. Force and work

Answer: A::D

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15. In an experiment to measure density of a cube percentage error in measurement of mass and length of sphere is 0.26% and 0.38% respectively, then find % error in measurement of density.

A. 14%

B. 1.40%

C. 1.04%

D. 1.44%

Answer: A::D

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16. To measure gravitational acceleration by using simple pendulum, length of pendulum (0.8 ± 0.01) m and periodic time (2.5 ± 0.12) s. Find percentage error in measurement of g.

A. 10.85

B. 12.75

C. 15.85

D. 21.12

Answer: A

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17. Length and breadth of a metal plate are 3.124 m and 3.002 m respectively. Area of plate upto 4 significant digit will be ..... m^2.

A. 9.37

B. 9.378

C. 9.3782

D. 9.378248

Answer: C

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18. Density of a material in GGS system is $4g/cm^3$. If length 10 cm and mass 10g are accepted as new system of unit, then density, in new unit system will be.....

A. 0.4

B. 40

C. 400

D. 0.04

Answer: D

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19. Write dimensional formula of universal constant of gravitation (G).

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

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

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

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

Answer: A::B::C

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20. In relation $y = a\sin(\omega t - kx)$ dimension of k will be.....

A. $M^0L^1T^1$

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

C. ML^0T^{-1}

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

Answer: A

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