Problem 1. The equation $\left(P+\frac{a}{V^2}\right)(V-b)$ = constant. The units of *a* is

(a) $Dyne \times cm^5$ (b) $Dyne \times cm^4$ (c) $Dyne\ / cm^3$ (d) $Dyne\ / cm^2$

Problem 2. If $x = at + bt^2$, where x is the distance travelled by the body in *kilometre* while t the time in seconds, then the units of b are

(a) *km/s* (b) *km-s* (c) *km/s*^{2} (d) *km-s*^{2}

Problem 3. The unit of absolute permittivity is

(a) *Farad - meter* (b) *Farad / meter* (c) *Farad/meter*^{2} (d) *Farad*

Problem 4. Unit of Stefan's constant is

(a) Js^{-1} (b) $Jm^{-2}s^{-1}K^{-4}$ (c) Jm^{-2} (d) Js

Problem 5. The unit of surface tension in SI system is

(a) $Dyne\ / cm^2$ (b) *Newton/m* (c) *Dyne/cm* (d) *Newton/m*^{2}

Problem 6. A suitable unit for gravitational constant is

(a) $kg\ metre\ \sec^{-1}$ (b) $Newton\ metre^{-1}\sec$ (c) $Newton\ metre^2 kg^{-2}$ (d) $kg\ metre\ \sec^{-1}$

Problem **7.** The SI unit of universal gas constant (*R*) is

(a) *Watt* $K^{-1}mol^{-1}$ (b) *Newton* $K^{-1}mol^{-1}$ (c) *Joule* $K^{-1}mol^{-1}$ (d) $Erg\,K^{-1}mol^{-1}$

Problem **8.** $X = 3YZ^2$ find dimension of Y in (MKSA) system, if X and Z are the dimension of capacity and magnetic **field respectively**

(a) $M^{-3}L^{-2}T^{-4}A^{-1}$ (b) ML^{-2} (c) $M^{-3}L^{-2}T^{4}A^{4}$ (d) $M^{-3}L^{-2}T^{8}A$

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Problem **9.** Dimensions of $\frac{1}{\mu_0 \varepsilon_0}$, where symbols have their usual meaning, are

(a) $[LT^{-1}]$ (b) $[L^{-1}T]$ (c) $[L^{-2}T^{2}]$ (d) $[L^{2}T^{-2}]$

Problem **10.** If *L*, *C* and *R* denote the inductance, capacitance and resistance respectively, the dimensional formula for C^2LR is

(a) $[ML^{-2}T^{-1}I^{0}]$ (b) $[M^{0}L^{0}T^{3}I^{0}]$ (c) $[M^{-1}L^{-2}T^{6}I^{2}]$ (d) $[M^{0}L^{0}T^{2}I^{0}]$

Problem **11.** A force *F* is given by $F = at + bt^2$, where t is time. What are the dimensions of *a* and *b*

(a) MLT^{-3} and $ML^{2}T^{-4}$ (b) MLT^{-3} and MLT^{-4} (c) MLT^{-1} and MLT^{0} (d) MLT^{-4} and MLT^{1}

Problem **12.** The position of a particle at time *t* is given by the relation $x(t) = \left(\frac{v_0}{\alpha}\right)(1 - c^{-\alpha t})$, where v_0 is a constant and $\alpha > 0$. The dimensions of v_0 and α are respectively

(a) $M^{0}L^{1}T^{-1}$ and T^{-1} (b) $M^{0}L^{1}T^{0}$ and T^{-1} (c) $M^{0}L^{1}T^{-1}$ and LT^{-2} (d) $M^{0}L^{1}T^{-1}$ and T

Problem **13.** The dimensions of physical quantity X in the equation Force $= \frac{X}{\text{Density}}$ is given by

(a) $M^{1}L^{4}T^{-2}$ (b) $M^{2}L^{-2}T^{-1}$ (c) $M^{2}L^{-2}T^{-2}$ (d) $M^{1}L^{-2}T^{-1}$

Problem **14.** **Number of particles is given by** $n = -D\dfrac{n_2 - n_1}{x_2 - x_1}$ **crossing a unit area perpendicular to *X*- axis in unit time, where** n_1 **and** n_2 **are number of particles per unit volume for the value of *x* meant to** x_2 **and** x_1. **Find dimensions of *D* called as diffusion constant**

(a) M^0LT^2 **(b)** $M^0L^2T^{-4}$ **(c)** M^0LT^{-3} **(d)** $M^0L^2T^{-1}$

0 0 0

Problem **15.** ***E*, *m*, *l* and *G* denote energy, mass, angular momentum and gravitational constant respectively, then the dimension of** $\dfrac{El^2}{m^5G^2}$ **are**

(a) Angle **(b) Length** **(c) Mass** **(d) Time**

Problem **16.** **The equation of a wave is given by** $Y = A\ \sin\omega\left(\dfrac{x}{v} - k\right)$ **where** ω **is the angular velocity and** v **is the linear velocity. The dimension of *k* is**

(a) LT **(b)** T **(c)** T^{-1} **(d)** T^2

Problem **17.** **The potential energy of a particle varies with distance *x* from a fixed origin as** $U = \dfrac{A\sqrt{x}}{x^2 + B}$, **where *A* and *B* are dimensional constants then dimensional formula for *AB* is**

(a) $ML^{7/2}T^{-2}$ **(b)** $ML^{11/2}T^{-2}$ **(c)** $M^2L^{9/2}T^{-2}$ **(d)** $ML^{13/2}T^{-3}$

Problem **18.** **The dimensions of** $\dfrac{1}{2}\varepsilon_0E^2$ **(** ε_0 **= permittivity of free space ; *E* = electric field) is**

(a) MLT^{-1} **(b)** ML^2T^{-2} **(c)** $ML^{-1}T^{-2}$ **(d)** ML^2T^{-1}

Problem **19.** **You may not know integration. But using dimensional analysis you can check on some results. In the integral** $\int \dfrac{dx}{(2ax - x^2)^{1/2}} = a^n \sin^{-1}\left(\dfrac{x}{a} - 1\right)$ **the value of *n* is**

(a) 1 **(b) – 1** **(c) 0** **(d)** $\dfrac{1}{2}$

Problem **20.** **A physical quantity** $P = \dfrac{B^2l^2}{m}$ **where *B*= magnetic induction, *l*= length and *m* = mass. The dimension of *P* is**

(a) MLT^{-3} **(b)** $ML^2T^{-4}I^{-2}$ **(c)** $M^2L^2T^{-4}I$ **(d)** $MLT^{-2}I^{-2}$

Problem **21.** **The equation of the stationary wave is *y*=** $2a\sin\left(\frac{2\pi ct}{\lambda}\right)\cos\left(\frac{2\pi x}{\lambda}\right)$**, which of the following statements is wrong**

(a) The unit of ct **is same as that of** λ

(b) The unit of x **is same as that of** λ

(c) The unit of $2\pi c/\lambda$ **is same as that of** $2\pi x/\lambda t$

(d) The unit of c/λ **is same as that of** x/λ

Problem **22.** **A physical quantity is measured and its value is found to be** nu **where** $n =$ **numerical value and** $u =$ **unit.**

Then which of the following relations is true

(a) $n \propto u^2$ **(b)** $n \propto u$ **(c)** $n \propto \sqrt{u}$ **(d)** $n \propto \frac{1}{u}$

Problem **23.** **In C.G.S. system the magnitude of the force is 100 *dynes*. In another system where the fundamental physical quantities are *kilogram*, *metre* and *minute*, the magnitude of the force is**

(a) 0.036 **(b) 0.36** **(c) 3.6** **(d) 36**

Problem **24.** **The temperature of a body on Kelvin scale is found to be *X K*. When it is measured by a Fahrenheit thermometer, it is found to be *X F*. Then *X* is**

(a) 301.25 **(b) 574.25** **(c) 313** **(d) 40**

Problem **25.** **Which relation is wrong**

(a) 1 *Calorie* = 4.18 *Joules*

(b) 1Å =10^{-10} ***m***

(c) 1 *MeV* = 1.6 × 10^{-13} ***Joules***

(d) 1 *Newton* =10^{-5} ***Dynes***

Problem **26.** **To determine the Young's modulus of a wire, the formula is** $Y = \frac{F}{A}.\frac{L}{\Delta l}$; **where *L*= length, A= area of cross- section of the wire,** $\Delta L =$ **Change in length of the wire when stretched with a force *F*. The conversion factor to change it from CGS to MKS system is**

(a) 1 **(b) 10** **(c) 0.1** **(d) 0.01**

Problem **27.** **Conversion of 1 MW power on a new system having basic units of mass, length and time as 10*kg*, 1*dm* and 1 *minute* respectively is**

(a) $2.16\times10^{12}\,unit$ **(b)** $1.26\times10^{12}\,unit$ **(c)** $2.16\times10^{10}\,unit$ **(d)** $2\times10^{14}\,unit$

***Problem* 28.** **In two systems of relations among velocity, acceleration and force are respectively** $v_2 = \frac{\alpha^2}{\beta} v_1, \;\; a_2 = \alpha\beta a_1$ **and** $F_2 = \frac{F_1}{\alpha\beta}$. **If** α **and** β **are constants then relations among mass, length and time in two systems are**

(a) $M_2 = \frac{\alpha}{\beta} M_1, L_2 = \frac{\alpha^2}{\beta^2} L_1, T_2 = \frac{\alpha^3 T_1}{\beta}$

(b) $M_2 = \frac{1}{\alpha^2\beta^2} M_1, L_2 = \frac{\alpha^3}{\beta^3} L_1, T_2 = T_1 \frac{\alpha}{\beta^2}$

(c) $M_2 = \frac{\alpha^3}{\beta^3} M_1, L_2 = \frac{\alpha^2}{\beta^2} L_1, T_2 = \frac{\alpha}{\beta} T_1$

(d) $M_2 = \frac{\alpha^2}{\beta^2} M_1, L_2 = \frac{\alpha}{\beta^2} L_1, T_2 = \frac{\alpha^3}{\beta^3} T_1$

***Problem* 29.** **If the present units of length, time and mass (*m*, *s*, *kg*) are changed to 100*m*, 100*s*, and** $\frac{1}{10}$ ***kg* then**

(a) The new unit of velocity is increased 10 times

(b) The new unit of force is decreased $\frac{1}{1000}$ **times**

(c) The new unit of energy is increased 10 times

(d) The new unit of pressure is increased 1000 times

***Problem* 30.** **Suppose we employ a system in which the unit of mass equals 100 *kg*, the unit of length equals 1 *km* and the unit of time 100 *s* and call the unit of energy *eluoj* (*joule* written in reverse order), then**

(a) 1 *eluoj* = 10^4 ***joule***

(b) 1 *eluoj* = 10^{-3} ***joule***

(c) 1 *eluoj* = 10^{-4} ***joule***

(d) 1 *joule* = 10^3 ***eluoj***

***Problem* 31.** **If 1*gm cms*$^{-1}$ = *x Ns*, then number *x* is equivalent to**

(a) 1×10^{-1}

(b) 3×10^{-2}

(c) 6×10^{-4}

(d) 1×10^{-5}

***Problem* 32.** **From the dimensional consideration, which of the following equation is correct**

(a) $T = 2\pi\sqrt{\frac{R^3}{GM}}$

(b) $T = 2\pi\sqrt{\frac{GM}{R^3}}$

(c) $T = 2\pi\sqrt{\frac{GM}{R^2}}$

(d) $T = 2\pi\sqrt{\frac{R^2}{GM}}$

***Problem* 33.** **A highly rigid cubical block *A* of small mass *M* and side *L* is fixed rigidly onto another cubical block *B* of the same dimensions and of low modulus of rigidity** η **such that the lower face of A completely covers the upper face of *B*. The lower face of B is rigidly held on a horizontal surface. A small force *F* is applied perpendicular to one of the side faces of *A*. After the force is withdrawn block *A* executes small oscillations. The time period of which is given by**

(a) $2\pi\sqrt{\frac{M\eta}{L}}$

(b) $2\pi\sqrt{\frac{L}{M\eta}}$

(c) $2\pi\sqrt{\frac{ML}{\eta}}$

(d) $2\pi\sqrt{\frac{M}{\eta L}}$

Problem 34. A small steel ball of radius r is allowed to fall under gravity through a column of a viscous liquid of coefficient of viscosity. After some time the velocity of the ball attains a constant value known as terminal velocity v_T. The terminal velocity depends on (i) the mass of the ball. (ii) η (iii) *r* and (iv) acceleration due to gravity *g*. which of the following relations is dimensionally correct

(a) $v_T \propto \frac{mg}{\eta r}$ (b) $v_T \propto \frac{\eta r}{mg}$ (c) $v_T \propto \eta r m g$ (d) $v_T \propto \frac{mgr}{\eta}$

Problem 35. A dimensionally consistent relation for the volume *V* of a liquid of coefficient of viscosity η flowing per second through a tube of radius r and length *l* and having a pressure difference p across its end, is

(a) $V = \frac{\pi p r^4}{8\eta l}$ (b) $V = \frac{\pi \eta l}{8pr^4}$ (c) $V = \frac{8p\eta l}{\pi r^4}$ (d) $V = \frac{\pi p \eta}{8lr^4}$

Problem 36. With the usual notations, the following equation $S_t = u + \frac{1}{2}a(2t-1)$ is

(a) Only numerically correct (b) Only dimensionally correct
(c) Both numerically and dimensionally correct (d) Neither numerically nor dimensionally correct

Problem 37. If velocity v, acceleration *A* and force *F* are chosen as fundamental quantities, then the dimensional formula of angular momentum in terms of v, A and F would be

(a) $FA^{-1}v$ (b) Fv^3A^{-2} (c) Fv^2A^{-1} (d) $F^2v^2A^{-1}$

Problem 38. The largest mass (*m*) that can be moved by a flowing river depends on velocity (*v*), density (ρ) of river water and acceleration due to gravity (*g*). The correct relation is

(a) $m \propto \frac{\rho^2 v^4}{g^2}$ (b) $m \propto \frac{\rho v^6}{g^2}$ (c) $m \propto \frac{\rho v^4}{g^3}$ (d) $m \propto \frac{\rho v^6}{g^3}$

Problem 39. If the velocity of light (*c*), gravitational constant (*G*) and Planck's constant (*h*) are chosen as fundamental units, then the dimensions of mass in new system is

(a) $c^{1/2}G^{1/2}h^{1/2}$ (b) $c^{1/2}G^{1/2}h^{-1/2}$ (c) $c^{1/2}G^{-1/2}h^{1/2}$ (d) $c^{-1/2}G^{1/2}h^{1/2}$

Problem 40. If the time period (*T*) of vibration of a liquid drop depends on surface tension (*S*), radius (*r*) of the drop and density (ρ) of the liquid, then the expression of *T* is

(a) $T = K\sqrt{\rho r^3 / S}$ (b) $T = K\sqrt{\rho^{1/2} r^3 / S}$ (c) $T = K\sqrt{\rho r^3 / S^{1/2}}$ (d) None of these

Problem **41.** **If *P* represents radiation pressure, *C* represents speed of light and *Q* represents radiation energy striking a unit area per second, then non-zero integers *x, y* and *z* such that $P^x Q^y C^z$ is dimensionless, are**

(a) $x = 1, y = 1, z - = 1$ **(b)** $x = 1, y - = 1, z = 1$ **(c)** $x - = 1, y = 1, z = 1$ **(d)** $x = 1, y = 1, z = 1$

Problem **42.** **The volume *V* of water passing through a point of a uniform tube during *t* seconds is related to the cross-sectional area *A* of the tube and velocity *u* of water by the relation $V \propto A^{\alpha} u^{\beta} t^{\gamma}$, which one of the following will be true**

(a) $\alpha = \beta = \gamma$ **(b)** $\alpha \neq \beta = \gamma$ **(c)** $\alpha = \beta \neq \gamma$ **(d)** $\alpha \neq \beta \neq \gamma$

Problem **43.** **If velocity (*V*), force (*F*) and energy (*E*) are taken as fundamental units, then dimensional formula for mass will be**

(a) $V^{-2}F^{0}E$ **(b)** $V^{0}FE^{2}$ **(c)** $VF^{-2}E^{0}$ **(d)** $V^{-2}F^{0}E$

Problem **44.** **Given that the amplitude A of scattered light is :**

(i) Directly proportional to the amplitude (A_0) of incident light.

(ii) Directly proportional to the volume (*V*) of the scattering particle

(iii) Inversely proportional to the distance (r) from the scattered particle

(iv) Depend upon the wavelength (λ) of the scattered light. then:

(a) $A \propto \frac{1}{\lambda}$ **(b)** $A \propto \frac{1}{\lambda^2}$ **(c)** $A \propto \frac{1}{\lambda^3}$ **(d)** $A \propto \frac{1}{\lambda^4}$

Problem 45. **Each side a cube is measured to be 7.203 *m*. The volume of the cube up to appropriate significaaaaant figures is**

(a) 373.714 **(b) 373.71** **(c) 373.7** **(d) 373**

Problem **46.** **The number of significant figures in 0.007 m^2 is**

(a) 1 **(b) 2** **(c) 3** **(d) 4**

Problem **47.** **The length, breadth and thickness of a block are measured as 125.5 *cm*, 5.0 *cm* and 0.32 *cm* respectively. Which one of the following measurements is most accurate**

(a) Length **(b) Breadth** **(c) Thickness** **(d) Height**

Problem **48.** **The mass of a box is 2.3 kg. Two marbles of masses 2.15 *g* and 12.39 *g* are added to it. The total mass of the box to the correct number of significant figures is**

(a) 2.340 *kg* **(b) 2.3145 *kg*.** **(c) 2.3 *kg*** **(d) 2.31 *kg***

Problem **49.** **The length of a rectangular sheet is 1.5 cm and breadth is 1.203 cm. The area of the face of rectangular sheet to the correct no. of significant figures is :**

(a) 1.8045 cm^2 **(b) 1.804** cm^2 **(c) 1.805** cm^2 **(d) 1.8** cm^2

Problem **50.** **Each side of a cube is measured to be 5.402 cm. The total surface area and the volume of the cube in appropriate significant figures are :**

(a) 175.1 cm^2**, 157** cm^2 **(b) 175.1** cm^2**, 157.6** cm^3

(c) 175 cm^2**, 157** cm^2 **(d) 175.08** cm^2**, 157.639** cm^3

Problem **51.** **Taking into account the significant figures, what is the value of 9.99 *m* + 0.0099 *m***

(a) 10.00 *m* **(b) 10 *m*** **(c) 9.9999 *m*** **(d) 10.0 *m***

Problem **52.** **The value of the multiplication 3.124** $\times$ **4.576 correct to three significant figures is**

(a) 14.295 **(b) 14.3** **(c) 14.295424** **(d) 14.305**

Problem **53.** **The number of the significant figures in** 11.118×10^{-6} ***V*** **is**

(a) 3 **(b) 4** **(c) 5** **(d) 6**

Problem **54.** **If the value of resistance is 10.845 *ohms* and the value of current is 3.23 *amperes*, the potential difference is 35.02935 *volts*. Its value in significant number would be**

(a) 35 *V* **(b) 35.0 *V*** **(c) 35.03 *V*** **(d) 35.025 *V***

Problem **55.** **A physical parameter *a* can be determined by measuring the parameters b, c, d and e using the relation *a* =** $b^{\alpha} c^{\beta} / d^{\gamma} e^{\delta}$**. If the maximum errors in the measurement of b, c, d and e are** b_1**%,** c_1**%,** d_1**% and** e_1**%, then the maximum error in the value of *a* determined by the experiment is**

(a) $(b_1 + c_1 + d_1 + e_1)$**%** **(b)** $(b_1 + c_1 - d_1 - e_1)$**%**

(c) $(\alpha b_1 + \beta c_1 - \gamma d_1 - \delta e_1)$**%** **(d)** $(\alpha b_1 + \beta c_1 + \gamma d_1 + \delta e_1)$**%**

Problem **56.** 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%, The maximum error in the measurement of pressure is

(a) 1% (b) 2% (c) 6% (d) 8%

Problem **57.** The relative density of material of a body is found by weighing it first in air and then in water. If the weight in air is (5.00 ± 0.05) *Newton* and weight in water is (4.00 ± 0.05) *Newton*. Then the relative density along with the maximum permissible percentage error is

(a) $5.0 \pm 11\%$ (b) $5.0 \pm 1\%$ (c) $5.0 \pm 6\%$ (d) $1.25 \pm 5\%$

Problem **58.** The resistance $R = \frac{V}{i}$ where $V = 100 \pm 5$ volts and $i = 10 \pm 0.2$ *amperes*. What is the total error in *R*

(a) 5% (b) 7% (c) 5.2% (d) $\frac{5}{2}\%$

Problem **59.** The period of oscillation of a simple pendulum in the experiment is recorded as 2.63 s, 2.56 s, 2.42 s, 2.71 s and 2.80 s respectively. The average absolute error is

(a) 0.1 s (b) 0.11 s (c) 0.01 s (d) 1.0 s

Problem **60.** The length of a cylinder is measured with a meter rod having least count 0.1 *cm*. Its diameter is measured with venier calipers having least count 0.01 *cm*. Given that length is 5.0 *cm*. and radius is 2.0 *cm*. The percentage error in the calculated value of the volume will be

(a) 1% (b) 2% (c) 3% (d) 4%

Problem **61.** In an experiment, the following observation's were recorded : $L = 2.820\ m$, $M = 3.00\ kg$, $l = 0.087\ cm$, Diameter $D = 0.041\ cm$ Taking $g = 9.81\ m/s^2$ using the formula , $Y = \frac{4Mg}{\pi D^2 l}$, the maximum permissible error in *Y* is

(a) 7.96% (b) 4.56% (c) 6.50% (d) 8.42%

Problem **62.** According to Joule's law of heating, heat produced $H = I^2 Rt$, where *I* is current, *R* is resistance and *t* is time. If the errors in the measurement of *I*, *R* and *t* are 3%, 4% and 6% respectively then error in the measurement of *H* is

(a) $\pm 17\%$ (b) $\pm 16\%$ (c) $\pm 19\%$ (d) $\pm 25\%$

Problem **63.** If there is a positive error of 50% in the measurement of velocity of a body, then the error in the measurement of kinetic energy is

(a) 25% (b) 50% (c) 100% (d) 125%

Problem **64.** A physical quantity *P* is given by $P = \frac{A^3 B^{\frac{1}{2}}}{C^{-4} D^{\frac{3}{2}}}$. The quantity which brings in the maximum percentage error in *P* is

(a) *A* (b) *B* (c) *C* (d) *D*