UNITS AND MEASUREMENTS 2

41)	**a**	**42)**	**c**	**43)**	**c**	**44)**	**a**
45)	**b**	**46)**	**b**	**47)**	**b**	**48)**	**a**
49)	**b**	**50)**	**a**	**51)**	**a**	**52)**	**d**
53)	**b**	**54)**	**b**	**55)**	**a**	**56)**	**d**
57)	**a**	**58)**	**b**	**59)**	**a**	**60)**	**b**
61)	**a**	**62)**	**a**	**63)**	**b**	**64)**	**c**
65)	**c**	**66)**	**d**	**67)**	**d**	**68)**	**a**
69)	**c**	**70)**	**d**	**71)**	**b**	**72)**	**b**
73)	**d**	**74)**	**a**	**75)**	**a**	**76)**	**b**
77)	**d**	**78)**	**a**	**79)**	**a**	**80)**	**a**

41 **(a)**

Quantities having different dimensions can only be divided or multiplied but they cannot be added or subtracted

42 **(c)**

$\left[\frac{1}{2}\epsilon_0 E^2\right]$ = [Energy density]

$= \frac{ML^2T^{-2}}{L^3} = ML^{-1}T^{-2}$

43 **(c)**

1 fermi $= 10^{-15} metre$

44 **(a)**

1 C.G.S. unit of density = 1000 M.K.S. unit of density

$\Rightarrow$ 0.5 gm/cc= 500 kg/m^3

45 **(b)**

In $g = \ln h - 2\ln t$

$$\left(\frac{\Delta g}{g} \times 100\right)_{max} = \frac{\Delta h}{h} \times 100 + 2\frac{\Delta t}{t} \times 100 = e_1 + 2e_2$$

49 **(b)**

Capacitance $C = \frac{\text{Charge}}{\text{potential}} = \frac{q}{V}$

Also potential $= \frac{\text{work}}{\text{charge}} \left(\because V = \frac{W}{q}\right)$

$\therefore \quad C = \frac{q^2}{J}$ as well as $C = \frac{J}{V^2}$.

Thus, (a), (c), (d) are equivalent to farad but (b) is not equivalent to farad.

51 **(a)**

Time defined in terms of the rotation of the earth is called universal time (UT).

52 **(d)**

The number of significant figures in all of the given numbers is 4.

53 **(b)**

$RC = T$

$\because [R] = ML^2T^{-3}A^{-2}]$ and $[C] = [M^{-1}L^{-2}T^4A^2]$

54 **(b)**

Surface tension, $T = \frac{F}{l}$

$\therefore \quad [T] = \frac{[F]}{[l]}$

$= \frac{[\mathrm{MLT^{-2}}]}{[\mathrm{L}]} = [\mathrm{ML^0T^{-2}}] = [\mathrm{MT^{-2}}]$

55 **(a)**

$\rho = \frac{RA}{l}$ *i.e.* dimension of resistivity is $[ML^3T^{-1}Q^{-2}]$

56 **(d)**

$Y = \frac{X}{3Z^2} = \frac{M^{-1}L^{-2}T^4A^2}{[MT^{-2}A^{-1}]^2} = [M^{-3}L^{-2}T^8A^4]$

57 **(a)**

$R = \frac{V}{I} \Rightarrow \pm\frac{\Delta R}{R} = \pm\frac{\Delta V}{V} \pm \frac{\Delta I}{I}$

$= 3 + 3 = 6\%$

58 **(b)**

Both force constant and surface tension represent force per unit length.

59 **(a)**

Momentum $p \propto f^a v^b \rho^c$

$[MLT^{-1}]=[T^{-1}]^a[LT^{-1}]^b[ML^{-3}]^c$

$[MLT^{-1}] = [M^c L^{b-3c} T^{-a-b}]$

$\Rightarrow \ c = 1.$

$b - 3c = 1 \Rightarrow b = 4$

$-a - b = -1$

$a + b = 1, a = -3$

$\therefore \ [p] = [f^{-3} v^4 \rho]$

60 **(b)**

Required volume $= \frac{75\times10^4\times26}{10^3\times10^3\times10^3}(\text{km})^3$

61 **(a)**

The formula for fine structure constant is

$$= \frac{e^2}{4\pi\varepsilon_0\left(\frac{h}{2\pi}\right)c}$$

62 **(a)**

Charge = current × time

63 **(b)**

Both $\frac{1}{2}LI^2$ and $\frac{1}{2}CV^2$ represent energy.

64 **(c)**

S_{nth} represents the distance covered in nth sec.

65 **(c)**

Intensity $(I)=\frac{\text{Energy}}{\text{Area}\times\text{time}}$

66 **(d)**

Joule-sec is the unit of angular momentum where as other units are of energy

67 **(d)**

Required error in density = 3% + 3 × 2% = 9%.

68 **(a)**

Bxt is unitless. ∴ Unit of B is $m^{-1}s^{-1}$

69 **(c)**

% error in velocity = % error in L + % error in t

$$= \frac{0.2}{13.8} \times 100 + \frac{0.3}{4} \times 100$$

$$= 1.44 + 7.5 = 8.94\ \%$$

70 **(d)**

Let $L = [h^a c^b G^c]$

$$\therefore \quad [L^1] = [\mathrm{ML^2T^{-1}}]^a [\mathrm{LT^{-1}}]^b [\mathrm{M^{-1}L^3T^{-2}}]^c$$

$$\Rightarrow \quad a = \frac{1}{2}, b = -\frac{3}{2}, c = \frac{1}{2}$$

Hence, $L = \left[h^{1/2} c^{-3/2} G^{1/2}\right]$

71 **(b)**

We know that kinetic energy $= \frac{1}{2}mv^2$

Required percentage error is 2%+2× 3% $ie, 8\%$

72 **(b)**

[Pressure]=[stress]= $[ML^{-1}T^{-2}]$

73 **(d)**

The number of significant figures in 4.8000×10^4 is 5 (zeros on right after decimal are counted while zeros in powers of 10 are not counted).

The number of significant figures in 48000.50 is 7 (all the zeros between two non-zero digits are significant).

74 **(a)**

[surface tension]=$[\mathrm{ML^0T^{-2}}]$, [viscosity]=$[\mathrm{ML^{-1}T^{-1}}]$.

Clearly, mass has the same power in the two physical quantities.

75 **(a)**

$$\phi = BA = \frac{F}{I \times L} A = \frac{[MLT^{-2}][L^2]}{[A][L]} = [ML^2T^{-2}A^{-1}]$$

76 **(b)**

Pyrometer is used the for measurement for temperature

77 **(d)**

$E = F/q$ = Newton/coulomb

78 **(a)**

Couple = Force × Arm length = $[MLT^{-2}][L] = [ML^{2}T^{-2}]$

79 **(a)**

$$T = \frac{32 \times 10^{-5}}{(10)^{-2}}$$

$= 32 \times 10^{-3}\text{Nm}^{-1} = 0.032\text{Nm}^{-1}$.

80 **(a)**

Volume $V = l^3 = (1.2 \times 10^{-2}m)^3 = 1.728 \times 10^{-6}m^3$

∵ length $l$has two significance figures. Therefore, the correct answer is

$V = 1.7 \times 10^{-6}m^3$