Units & Dimensions

Choose the correct answers :

1. Choose the wrong statement
   (1) All quantities may be represented dimensionally in terms of the base quantities
   (2) A base quantity cannot be represented dimensionally in terms of the rest of base quantities
   (3) The dimension of a base quantity in other base quantities is always zero
   (4) The dimension of a derived quantity is never zero in any base quantity

2. Which one of the following statements is *not* correct?
   (1) A dimensionally correct equation may be correct
   (2) A dimensionally correct equation may be incorrect
   (3) A dimensionally incorrect equation may be correct
   (4) A dimensionally incorrect equation may be incorrect

3. Which of the following functions of *A* and *B* may be performed, if *A* and *B* possess different dimensions?
   (1) $A + B$ (2) $A - B$
   (3) A/e^{AB} (4) A/B

4. A physical quantity is measured and the result is expressed as *nu*, where *u* is the unit used and *n* is the numerical value. If the result is expressed in various units, then
   (1) $n \propto$ size of u (2) $n \propto u^2$
   (3) $n \propto u^{-1}$ (4) $n \propto \sqrt{u}$

5. Which of the following sets of physical quantities cannot be considered fundamental quantities in any system of units ?
   (1) Length, mass and velocity
   (2) Mass, time and velocity
   (3) Velocity, length and time
   (4) Length, time and mass

6. A quantity *y* is related to another quantity *x* by the equation $y = kx^a$, where *k* and *a* are constants. If percentage error in the measurement of *x* is *p* then that in *y* depends upon
   (1) *k* and *a* (2) *x* and *a*
   (3) *p* and *a* (4) *p*, *k* and *a* all

7. Which one of the following has least number of significant figures ?
   (1) 1.020 (2) 2.3×10^4
   (3) 302.0 (4) 0.203

8. Using significant figures, 22.3566 – 14.16 can be expressed as
   (1) 8.2 (2) 8.20
   (3) 8.197 (4) 8.1966

9. A box contains 1.2 kg of gold. Two pieces of gold, measuring 1.5 g and 30 mg are added to the box. Mass of gold, to the significant figure would be now as
   (1) 1.2 kg (2) 1201.5 g
   (3) 1201539 mg (4) All of these

10. The radius of a circle is 2.12 m. Its area according to idea of significant figures is
   (1) 14.1124 m^2 (2) 14.112 m^2
   (3) 14.11 m^2 (4) 14.1 m^2

11. Nuclear cross-sectional area is measured in barns. 1 barn is equal to
   (1) 10^{-30} m^2 (2) 10^{-28} m^2
   (3) 10^{-26} m^2 (4) 10^{-24} m^2

12. The order of $(2)^{30}$ is approximately
   (1) 10^5 (2) 10^{10}
   (3) 10^{15} (4) 10^{20}

13. Value of force of 100 dynes in a system, based on metre, kilogram and minute as the fundamental units, would be
   (1) 6 units (2) 3.6 units
   (3) 600 units (4) 3600 units

14. One torr is a pressure exerted by
   (1) 1 mm of Hg (2) atmosphere at STP
   (3) 1 cm of Hg (4) none of these

15. In the equation $b = a^2 \cos^2 2\pi\frac{\beta\gamma}{\alpha}$, if the units of *a*, α and β are *m*, s^{-1} and $(m/s)^{-1}$ respectively, the units of *b* aqnd γ are
   (1) m and $(m/s^2)^{-1}$ (2) m^2 and m/s^2
   (3) m^2 and $(m/s^2)^{-1}$ (4) m and m/s^2

16. 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 (*k* is a constant of proportionality)
   (1) $T = k\sqrt{\frac{\rho r^3}{S}}$ (2) $T = k\sqrt{\frac{\rho^{1/2} r^3}{S}}$
   (3) $T = k\sqrt{\frac{\rho r^3}{S^{1/2}}}$ (4) none of these

17. Given that $p = \frac{RT}{V - b} e^{-\alpha V/RT}$. the dimensional formula of α is same as that of:

(1) V (2) p
(3) T (4) R

18. The equation of state of a gas is

$$\left[P + \frac{aT^2}{V}\right] V^C = (RT + b),$$

where a, b, c and R are constants. The isotherms can be represented by $P = AV^m - BV^n$, where A and B depend only on temperature and
(1) m = – c and n = –1 (2) m = c and n = 1
(3) m = – c = n = 1 (4) m = c and n = –1

19. In the relation : $P = \frac{\alpha}{\beta} e^{-\frac{\alpha Z}{k\theta}}$, P is pressure, Z is distance, k is Boltzmann constant and θ is the temperature. The dimensional formula of β will be
(1) $M^oL^2T^o$ (2) $M^1L^2T^1$
(3) $M^1L^oT^{-1}$ (4) $M^oL^2T^{-1}$

20. A spherical body of mass m and radius r is allowed to fall in a medium of viscosity η and density ρ. The time in which the velocity of the body increases from zero to 0.63 times the terminal velocity (v) is called time constant (τ). Dimensionally τ can be represented by
(1) $mr^2/6\pi\eta$ (2) $\sqrt{6\pi mr\eta / g^2}$
(3) $\rho/6\pi\eta rv$ (4) $\rho r^2/6\pi\eta$

21. In the relation $y = r \sin(\omega t + kx)$, the dimensional formula for kx is same as:
(1) r/ω (2) r/y
(3) $\omega t/r$ (4) $yr/\omega t$

22. The equation of the stationary wave is :
$y = 2A \sin(2ct/\lambda) \cos(2\pi x/\lambda)$
Which of the following statements is wrong?
(1) The unit of ct is same as that of λ
(2) The unit of x is same as that of λ
(3) The unit of $2\pi c/\lambda$ is same as that of $2\pi x/\lambda t$
(4) The unit of c/λ is same as that of x/λ

23. The potential energy of a particle varies with distance x from a fixed origin as $U = \frac{A\sqrt{x}}{x^2 + B}$ where A and B are dimensional constants. Then dimensional formula for AB is
(1) $M^1L^{7/2}T^{-2}$ (2) $M^1L^{11/2}T^{-2}$
(3) $M^1L^{5/2}T^{-2}$ (4) $M^1L^{9/2}T^{-2}$

24. Dimensions of (G/g) are
(1) $M^{-1}L^2T^{-1}$ (2) $M^{-1}L^2T^0$
(3) $M^{-1}L^1T^0$ (4) $M^{-1}L^1T^{-1}$

25. If force, length and time would have been the fundamental units, what would have been the dimensional formula for mass ?
(1) $F^1L^{-1}T^2$ (2) $F^1L^1T^{-2}$
(3) $F^{-1}L^1T^{-1}$ (4) $F^1L^1T^{-2}$

26. The dimensions of the quantity having units calorie/gram will be
(1) $M^2L^2T^{-2}$ (2) $M^0L^2T^{-2}$
(3) M^0LT^{-2} (4) $M^{-1}L^2T^{-2}$

27. A solid sphere has numerically equal volume and surface area. The volume of this sphere is
(1) 64π units (2) 27π units
(3) 48π units (4) 36π units

28. The diameter of sun is about 1.39×10^9 m and its distance from the earth is 1.5×10^{11} m. Its angular diameter, as observed from the earth, is nearly
(1) 1.06° (2) 0.53°
(3) 0.26° (4) 0.12°

29. Area of a square is (100 ± 2) cm^2. The side of the square is
(1) 10 ± 0.5 cm (2) 10 ± 1 cm
(3) 10 ± 2 cm (4) None of these

30. Mass of a cubic metre of air at NTP is nearly
(1) 1300 g (2) 130 g
(3) 13 g (4) 1.3 g

31. A cube has numerically equal volume and surface area. The volume of this cube is
(1) 216 units (2) 1000 units
(3) 512 units (4) 576 units

32. While measuring the acceleration due to gravity by a simple pendulum, a student makes a positive error of 1% in the measurement of length of the pendulum and a negative error of 3% in the measurement of time period. His maximum percentage error in the measurement of g will be
(1) 2% (2) 4%
(3) 7% (4) 5%

33. The dimensional formula of moment of couple is
(1) ML^2T^{-2} (2) MLT^{-2}
(3) $ML^{-1}T^{-3}$ (4) $ML^{-2}T^{-2}$

34. 1 m is the distance travelled by light in vacuum
(1) in $\frac{1}{3 \times 10^8}$ sec (2) in $\frac{1}{299,792,458}$ sec
(3) in 3×10^{-8} sec (4) in $\frac{1}{299,758,492}$ sec

35. Mention a scalar and a vector physical quantity which have same dimensions.
(1) Work, heat
(2) Work, torque
(3) Energy, weight
(4) Gravitational P.E. and Gravitational field

36. Astronomical unit (A.U.), parsec and light year (*ly*) are the three units for large distances. These in the descending order of magnitude are
(1) A.U. > parsec > *ly*
(2) A.U. > *ly* > parsec
(3) parsec > *ly* > A.U.
(4) *ly* > A.U. > parsec

37. Which of the following relations is not correct?
(1) $1\ km^3 = 10^{18}\ mm^3$
(2) $1\ kg = 10^9\ \mu g$
(3) $1\ ms^{-2} = 12960\ km/hr^2$
(4) $10\ MV = 10^9\ mV$

38. The circular scale of a spherometer is divided into 200 equal divisions. If least count of the instrument is 0.005 mm, then the distance between two consecutive threads of the spherometer screw is
(1) 1.0 mm (2) 0.5 mm
(3) 0.25 mm (4) 2.0 mm

39. Twenty-five vernier divisions coincide with twenty-four main scale divisions. If the main scale is in half-millimetre, then the least count of the vernier is
(1) 0.02 cm (2) 0.002 cm
(3) 0.002 mm (4) 0.001 cm

40. Dimensions of latent heat are that of
(1) velocity × acceleration
(2) mass × acceleration
(3) mass × velocity
(4) square of velocity

41. Which of the following quantities has the same dimensions as the gravitational constant ?
(1) $(\text{Velocity})^2$ / mass per unit length
(2) Force / mass per unit length
(3) $(\text{Momentum})^2$ / force
(4) Work / time

42. Turpentine oil is flowing through a tube of length l and radius r. The pressure difference between the two ends of the tube is p; the viscosity of the oil is given by $\eta = \frac{p(r^2 - x^2)}{4vl}$, where v is the velocity of oil at a distance x from the axis of the tube. From this relation, the dimensions of viscosity η are
(1) $M^0L^0T^0$ (2) MLT^{-1}
(3) ML^2T^{-2} (4) $ML^{-1}T^{-1}$

43. The number of particles crossing the unit area perpendicular to the Z-axis per unit time is given by the relation : $N = -D\frac{N_2 - N_1}{Z_2 - Z_1}$; where N_2 and N_1 are number of particles per unit volume at Z_2 and Z_1, respectively. What is the dimensional formula for D?
(1) $M^0 L^2 T^{-1}$ (2) $M^0 L^2 T^2$
(3) $M^0 L^{-2} T^{-1}$ (4) $M^0 L^{-2} T^1$

44. If velocity of light be represented by unity and 300 seconds be the unit of time, then unit of length would be
(1) 9×10^{10} m (2) 10^6 m
(3) 10^{10} m (4) 3×10^8 m

45. If $Z = X - Y$, the maximum percentage error in the measurement of Z will be
(1) $\left[\frac{\Delta X}{X} - \frac{\Delta Y}{Y}\right] \times 100\%$ (2) $\left[\frac{\Delta X}{X-Y} - \frac{\Delta Y}{X-Y}\right] \times 100\%$
(3) $\left[\frac{\Delta X}{X} + \frac{\Delta Y}{Y}\right] \times 100\%$ (4) $\left[\frac{\Delta X}{X-Y} + \frac{\Delta Y}{X-Y}\right] \times 100\%$

46. The velocity v of a particle in a medium varies with time t, according to the equation : $v = at^2 + \frac{b}{c+t^2}$.
The dimensions of a, b and c are

	a	b	c
(1)	$L T^{-3}$	$L T^{-1}$	T^{-2}
(2)	$L T^{-2}$	$L T$	T
(3)	$L T^{-2}$	$L T$	T^2
(4)	$L T^{-3}$	$L T$	T^2

47. Joule's constant has
(1) units as well as dimensions
(2) units but no dimensions
(3) dimensions but no units
(4) neither units nor dimensions

48. The displacement x in time t is given by relation: $x = \frac{t+a}{b} + \frac{b}{c}t^2$, where a, b and c are constants. The dimensions of a, b and c are

	a	b	c
(1)	T	$L T^{-1}$	$L^{-2} T^3$
(2)	T	$L^{-1} T$	$L^2 T^{-3}$
(3)	T	$L^{-1} T$	$L^{-2} T^3$
(4)	T	$L^{-1} T^{-1}$	$L^{-2} T^3$

49. An experimentalist measures quantities a, b and c to find the value of x, given by relation :
$x = a^{-1} b^2/c^{3/2}$. If the percentage error in the measurement of a, b and c are, respectively, ±1%, ± 3% and ± 2%, then the percentage error in the measurement of x can be

(1) ±2% (2) ±10%
(3) ±6% (4) ±8%

50. A physical quantity *X* is represented by the relation $X = M^aL^bT^{-c}$. If percentage errors in the measurement of M, L and *T* are $\alpha\%$, $\beta\%$ and $\gamma\%$ respectively then maximum percentage error in the measurement of *X* is
(1) $(\alpha a - \beta b + \gamma c)\%$
(2) $(\alpha a + \beta b + \gamma c)\%$
(3) $(\alpha a - \beta b - \gamma c)\%$
(4) none of these

51. The formula for the period of a simple pendulum is $T = 2\pi\sqrt{l/g}$. Such a pendulum is used to determine g. The fractional error in the measurement of the period *T* is $\pm x$ and that in the measurement of the length *l* is $\pm y$. The fractional error in the calculated value of g is not greater than
(1) $x + y$ (2) $x - y$
(3) $2x + y$ (4) $2x - y$

52. The acceleration (*a*) of a particle is found to depend on time *t* as : $a = At + Bt^2 + \frac{Ct}{D+t^2}$. The dimensions of *A*, *B*, *C* and *D* are, respectively
(1) $LT^{-3}, LT^{-4}, LT^{-2}, LT^{-1}$
(2) $LT, LT^{-2}, LT^{-1}, T^2$
(3) $LT^{-3}, LT^{-4}, LT^{-1}, T^2$
(4) $LT^{-2}, LT^{-3}, LT^{-1}, T^2$

53. What are the dimensions of ratio of universal gravitational constant and universal gas constant?
(1) $M^2 L^{-1} T^{-2} K^{-1}$ (2) $M^0 L^5 T^{-4} K^{-1}$
(3) $M^{-2}L^{-1}T^0K^1$ (4) $M^{-2}L^1T^0K^1$

54. Gravitational field intensity at a distance *x* from the centre of earth of mass *M* is GM/x^2, where *G* is universal gravitational constant. Dimensions of (GM/x^2) are
(1) $M^{-1} L T^{-1}$ (2) $M^0 L^1 T^{-2}$
(3) $M^{-1} L^1 T^{-2}$ (4) $M^0 L^{-1} T^2$

55. Modified form of gas equation is $\left(P + \frac{a}{V^2}\right)(V - b) = RT$, where *P* is pressure, *V* is volume and *T* is temperature in kelvin scale; and *a*, *b* and *R* are constants. The dimensions of *a*/*b* are
(1) $M^1 L^2 T^{-2}$ (2) $M^1 L^1 T^{-2}$
(3) $M^1 L^3 T^{-2}$ (4) $M^{-1} L^2 T^{-2}$

56. In the relation $F = \alpha t^{-1} + \beta t^2$, *F* denotes force, *t* denotes time and α and β are constants. Dimensions of α and β are, respectively,
(1) $M L T^{-3}$ and $M L T^{-4}$
(2) $M L T^{-1}$ and $M L T^{-3}$
(3) $M L T^{-1}$ and $M L T^{-4}$
(4) $M L T^{-2}$ and $M L T^{-4}$

57. The force *F* acting on a particle in terms of time *t* and distance *x* is given by the relataion
$F = (A \cos Bx)(C \sin Dt)$
The dimensions of (*AC*) and (*BD*) are, respectively,
(1) MLT^{-2} and $M^o L^{-1} T^{-1}$
(2) MLT^{-2} and $ML^{-1}T^{-1}$
(3) ML^2T^{-2} and $M^o L^{-1} T^{-2}$
(4) MLT^{-2} and $M^o L T^{-1}$

58. A drop of olive oil of radius 0.25 mm spreads into a circular film of diameter 20 cm on the water surface. If thickness of the film is equal to diameters of 10 molecules of the oil, then diameter of oil molecule is
(1) 1.04×10^{-10} m (2) 2.08×10^{-10} m
(3) 0.52×10^{-10} m (4) 1.56×10^{-10} m

59. The dimensions of Planck's constant (*h*) are same as that of
(1) torque
(2) linear momentum
(3) angular acceleration
(4) angular momentum

60. The dimensions of heat have
(1) + 1 in length (2) – 1 in mass
(3) – 2 in length (4) – 2 in time

61. Let a force of 1 newton be converted into another system of units (new) in which length is measured in mm, mass in g and time in s. The value of 1 N in the new system is
(1) 10^3 (2) 10^6
(3) 10^4 (4) 10^5

62. Which of the following is not a vector quantity ?
(1) Angular velocity of a body
(2) Current flowing in a wire
(3) Impulse acting on a body
(4) Electrical field

63. The position of a particle at any time *t* is given by the relation : $s_{(t)} = \frac{a}{b}(1 - e^{-at})$, where $a > 0$; and *a* and *b* are constants. The dimensions of *b* and *a* are, respectively.
(1) $M^0 L T$ and $M^0 L^0 T$
(2) $M^0 L T^{-1}$ and $M^0 L^0 T^{-1}$
(3) $M^0 L^{-1} T^{-1}$ and $M^0 L^0 T^{-1}$
(4) $M^0 L T^{-1}$ and $M^0 L^0 T$

64. Which one of the following has dimensions different from the other three ?
(1) Energy per unit of volume
(2) Product of voltage and charge per unit volume
(3) Stress per unit strain
(4) Angular momentum per unit velocity

65. A resistor of 10 kΩ having tolerance of 10% is connected in series with another resistor of 20 kΩ having tolerance of 20%. The tolerance of the combination will be nearly equal to

(1) 15% (2) 17%

(3) 13% (4) 30%

66. If T is the tension in a wire of mass per unit length m, diameter D and density of its material ρ, then which of the following relations is correct for its time period t, when it is set in vibration ?

(1) $t = \frac{1}{lD}\sqrt{\frac{T}{m}}$ (2) $t = 2l\sqrt{\frac{m}{T}}$

(3) $t = 2l\sqrt{\frac{\pi\rho}{T}}$ (4) $t = 2l\sqrt{\frac{T}{\pi\rho}}$

67. If velocity V, time T and force F are chosen as fundamental quantities, then dimensions of mass is

(1) $F^{-1} T^{1} V^{1}$ (2) $F^{-1} T^{-1} V^{1}$

(3) $F^{1} T^{1} V^{-1}$ (4) $F^{1} T^{-2} V^{-1}$

68. A wire has a mass of 0.3 ± 0.003 g, radius of 0.5 ± 0.005 mm and length of 6 ± 0.06 cm. The maximum percentage error in the measurement of its density is

(1) 1 (2) 2

(3) 3 (4) 4

69. Which one of the following has no dimensions ?

(1) Coefficient of viscosity

(2) Coefficient of friction

(3) Coefficient of thermal conductivity

(4) Coefficient of linear expansion

70. The dimensional formula of angular impulse is

(1) $M L T^{-1}$ (2) $M L^{2} T^{-1}$

(3) $M L^{2} T^{-2}$ (4) $M L T^{-3}$

71. $M L^{2} T^{-2}$ are *not* the dimensions of

(1) calorie

(2) magnetic energy

(3) Joule's constant

(4) torque acting on dipole

72. $M^{1} L^{-1} T^{-2}$ are not the dimensions of

(1) thrust per unit area

(2) stress

(3) Young's modulus of elasticity

(4) coefficient of viscosity

73. Which one of the following has dimensions different from the other three ?

(1) Velocity gradien

(2) Angular velocity

(3) Resistance/inductance

(4) Capacitance/resistance

74. Dimensions of coefficient of viscosity are $ML^{-1}T^{-1}$. Generally it is given in terms of poise [P] which is a C.G.S. unit. While converting the value to S.I. system, multiply poise by

(1) 10^{1} (2) 10^{-1}

(3) 10^{2} (4) 10^{-2}

75. Dimensions of solar constant are

(1) $M^{1}L^{0} T^{-2}$ (2) $M^{1}L^{0}T^{-3}$

(3) $M^{1}L^{-1}T^{-2}$ (4) $M^{1}L^{1}T^{-3}$

76. In a particular system, the units of length, mass and time are chosen to be 10 cm, 10 g and 0.1 sec, respectively, unit of force in this system will be

(1) 0.1 N (2) 10 N

(3) 1 N (4) 10^{-2} N

77. If E represents kinetic energy, V velocity and T time; and these are chosen as the fundamental units, then the dimensions of surface tension would be

(1) $E V^{-1} T^{-2}$ (2) $E^{2} V^{-1} T^{-2}$

(3) $E V^{-2} T^{-1}$ (4) $E V^{-2} T^{-2}$

78. If time T, velocity V and energy E are taken as the fundamental units, then the dimensional formula for coefficient of viscosity is

(1) $T V^{-3} E^{-2}$ (2) $T^{-2} V^{-3} E^{1}$

(3) $T^{-2} V E^{-2}$ (4) $T^{-2} V^{-2} E$

79. Which one of the following is not related to Stefan's constant ?

(1) $J s^{-1} m^{-2} K^{-4}$ (2) $M L^{-1} T^{-3} K^{-4}$

(3) $W K^{-4} m^{-2}$ (4) $M T^{-3} K^{-4}$

80. Which two of the following are dimensionless quatities ?

(i) Absorption power

(ii) Coefficient of friction

(iii) Emissive power

(iv) Coefficient of viscosity

(1) (i) and (ii) (2) (i) and (iii)

(3) (iii) and (iv) (4) (ii) and (iv)

81. The pair of physical quantities, which have different dimensions, is

(1) Reynold number and coefficient of friction

(2) Latent heat and gravitational potential

(3) Curie and frequency of light wave

(4) Planck's constant and torque

82. A gas bubble from an explosion under water oscillates with a period T, proportional to $P^{a}D^{b}E^{c}$, where P is static pressure, D is density and E is total energy of the explosion. The values of a, b, and c are

(1) $a = 0, b = 1, c = 2$
(2) $a = 1, b = 2, c = 3$
(3) $a = \frac{5}{6}, b = -\frac{1}{2}, c = \frac{1}{3}$
(4) $a = -\frac{5}{6}, b = \frac{1}{2}, c = \frac{1}{3}$

83. $M L T^{-3} K^{-1}$ is the dimensional formula for
(1) Boltzmann constant
(2) Universal gas constant
(3) Coefficient of thermal conductivity
(4) Coefficient of linear expansion

84. Which one of the following is the unit of magnetic flux ?
(1) Volt second (2) Henry-ampere
(3) Tesla-metre^2 (4) All the above

85. Permeability of a medium, other than vacuum, has dimensions of
(1) $M^0 L^0 T^0 A^0$ (2) $M L T^{-2} A^{-2}$
(3) $M L^2 T^{-2} A^{-2}$ (4) $M^{-1} L^{-3} T^4 A^2$

86. The dimensions of $\frac{1}{2} \in_0 E^2$ ($\in_0$ = permittivity of free space and E = electric field intensity) are
(1) $M L T^{-1}$ (2) $M L^2 T^{-2}$
(3) $M L^{-1} T^{-2}$ (4) $M L^2 T^{-1}$

87. Ratio of magnetic field induction and electric field intensity has dimensions of
(1) $M^0 L T^{-1}$ (2) $M^1 L^{-1} T^{-1}$
(3) $M^0 L^{-1} T^1$ (4) $M^{-1} L^{-1} T^1$

88. The dimensions of self-inductance (L) are
(1) $M L^2 T^{-2} A^{-2}$ (2) $M L^2 T^{-3} A^{-2}$
(3) $M L T^{-2} A^{-2}$ (4) $M L^2 T^{-1} A^{-2}$

89. Dimension of RCV/L (where R = resistance, C = capacitance, V = potential difference and L = inductance) is
(1) T (2) A
(3) T^{-1} (4) A^{-1}

90. What are the dimension of $\mu_0\varepsilon_0$, where μ_0 is the permeability and ε_0 is the permittivity of free space or vacuum ?
(1) $M^1 L^1 T^{-2}$ (2) $M^0 L^{-2} T^2$
(3) $M^0 L^2 T^{-2}$ (4) $M^0 L^1 T^{-1}$

91. Dimensions of [G × force] is same as that of
(1) [acceleration]^2 (2) [velocity]^2
(3) [acceleration]^4 (4) [velocity]^4

92. Mass of air in a room, measuring 5 m × 5 m × 4 m, is about
(1) 1300 g (2) 130 g
(3) 13 kg (4) 130 kg

93. A system has basic dimensions as density [D], velocity [V] and area [A]. The dimensional representation of force in this system is :
(1) AV^2D (2) A^2VD
(3) AVD^2 (4) A^0VD

94. Dimensions of entropy are
(1) $MLT^{-2}K^{-1}$ (2) $MLT^{-3}K^{-1}$
(3) $ML^2T^{-3}K^{-1}$ (4) $ML^2T^{-2}K^{-1}$

95. If in a new system, unit of mass is 10 kg, unit of length is 1 km and unit of time is 1 minute, then the unit of energy in this system is
(1) 6×10^{-3} J (2) 3.6×10^{-4} J
(3) 3.6×10^{-2} J (4) 6×10^{-4} J

96. Using dimensional analysis for the equation : $[\text{velocity}]^x = [\text{pressure difference}]^{3/2} \times [\text{density}]^{-3/2}$, value of x is equal to
(1) 3/2 (2) 1/2
(3) 3 (4) 2

97. All of the following have same dimensions but different units, except
(1) angular velocity and frequency
(2) universal gas constat and Boltzmann constant
(3) luminous flux and power of illumination
(4) energy and work

98. Which are the dimensions of magnetic flux ?
(1) $M L^2 T^{-2} A^{-1}$ (2) $M L^2 T^{-3} A^{-2}$
(3) $M L^3 T^{-2} A^{-1}$ (4) $M L^2 T^{-2} A^{-2}$

99. Which of the following is not associated with the dimension $ML^0 T^{-2}$?
(1) Surface tension
(2) Force constants of spring
(3) Surface energy
(4) Restoring force of a spring

100. A quantity $X = \in_0 L \frac{dV}{dt}$, where $\in_0$ is the permittivity of free space, L is the length, dV is the potential difference and Δt is the time interval. The dimensional formula of X is same as that of
(1) resistance (2) charge
(3) voltage (4) current

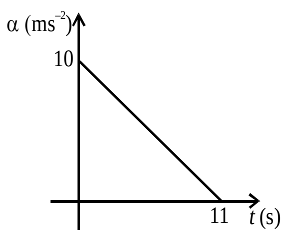
Choose the correct answers :

1. A goods train of length 300 m is travelling at a speed of 60 km/hr. It will cross a bridge of length 200 m in
   (1) 18 s (2) 24 s
   (3) 30 s (4) 36 s

2. A body covers the first half distance between two places at a speed of 42 km/hr and the second half at a speed of 56 km/hr. The average speed of the car is
   (1) 47.4 km/hr (2) 49 km/hr
   (3) 48 km/hr (4) 50 km/hr

3. A point travels half of the distance with a velocity of 15 ms^{-1}. The remaining part of the distance is covered with a velocity of 14 ms^{-1} for half the time and with velocity of 6 ms^{-1} for the other half of the time. The mean velocity of the point, averaged over the whole time of its motion, is
   (1) $13\,{}^{1}/_{3}$ ms^{-1} (2) 12 ms^{-1}
   (3) 14 ms^{-1} (4) 12.5 ms^{-1}

4. A particle starts from rest. Its acceleration (α) versus time (t) relation is as shown in the figure. The maximum speed of the particle will be



   (1) 110 m/s (2) 55 m/s
   (3) 220 m/s (4) 165 m/s

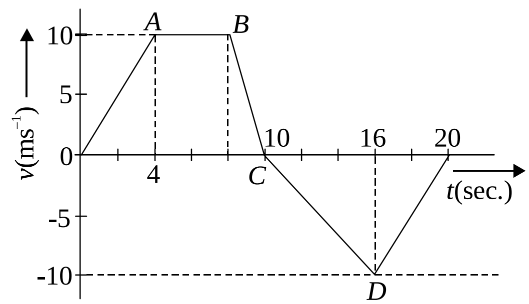
5. A train, 150 m long, is travelling towards North at a speed of 10 ms^{-1}. A bird is flying at 2.5 ms^{-1} parallel to the track of train, towards South. The time taken by the bird to cross the train is
   (1) 10 s (2) 15 s
   (3) 30 s (4) 12 s

6. A car travelling at a speed of 30 km/hr is brought to rest within a distance of 8 m by the application of brakes. If the same car were travelling at a speed of 45 km/hr, then by the application of same brakes, the car could have been brought to rest within
   (1) 12 m (2) 15 m
   (3) 16 m (4) 18 m

7. A body starts from rest and moves along a path with a constant acceleration. The ratio of distances travelled by the body in n seconds to that in nth second is
   (1) $\frac{n^2}{2n-1}$ (2) $\frac{n}{n-1}$
   (3) $\frac{n^2}{2n+1}$ (4) $\frac{n^2}{(n-1)^2}$

8. A small block slides without friction down an inclined plane starting from rest. Let S_n be the distance travelled from time $t = n - 1$ to $t = n$. Then $\frac{S_n}{S_{n+1}}$ is
   (1) $\frac{2n-1}{2n}$ (2) $\frac{2n+1}{2n-1}$
   (3) $\frac{2n-1}{2n+1}$ (4) $\frac{2n}{2n+1}$

9. The velocity-time graph of a body in motion is shown below. The average velocity of the body in the time interval 0-20 seconds is



   (1) 2.0 ms^{-1} (2) 90 m/min
   (3) 3.6 km/hr (4) 5.4 km/hr

10. In the above problem, the average speed in the time interval 0-16 sec. is
   (1) 2.5 ms^{-1} (2) 5.0 ms^{-1}
   (3) 6.0 ms^{-1} (4) 6.25 ms^{-1}

11. The velocity of a body increases from 2 ms^{-1} to 8 ms^{-1} in 5 seconds. The distance travelled by the body during this time is
   (1) 20 m (2) 30 m
   (3) 25 m (4) 50 m

12. A particle experiences a constant acceleration for 30 seconds, after starting from rest. If it travels a distance of S_1 in first 20 seconds, then distance travelled by it in the next 10 seconds would be
   (1) 1.25 S_1 (2) 1.5 S_1
   (3) 3 S_1 (4) 0.75 S_1

13. A body covers 10 m in fourth second of its motion and 30 m in nineth second of its motion from its starting position. What is its displacement after 2 seconds after starting from its initial position ?
   (1) 0 (2) 4 m
   (3) 6 m (4) 8 m

14. A conveyor belt is moving horizontally at a speed of 4 ms^{-1}. If a box of mass 30 kg is gently put on it, it takes 0.4 s for the box to come to rest, relative to the belt. The distance moved by the box on the conveyor belt is

(1) 1.6 m (2) 0.4 m
(3) 0.6 m (4) 0.8 m

15. A person driving at 60 km/hr finds a child on the road 30 m ahead. He immediately stops the engine of the car and applies brakes to stop the car within 5 m of child (supposed stationary). The time taken to stop the car is
(1) 2.0 s (2) 3.0 s
(3) 2.5 s (4) 4.0 s

16. A body, moving with constant retardation a, loses two-thirds of its initial velocity u. The distance covered by the body during this change of velocity is
(1) $\left[\frac{2u}{3a}\right]^2$ (2) $\frac{4u^2}{9a}$
(3) $\frac{2u^2}{3a}$ (4) $\frac{2u^2}{9a}$

17. A bullet when fired normally through a plank loses 10% of its velocity while penetrating through it. How many similar planks (minimum number) should be placed close to one another so that bullet can be stopped ?
(1) 4 (2) 6
(3) 11 (4) 10

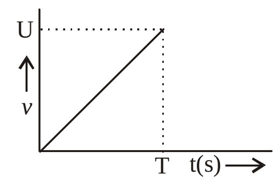
18. A truck crosses a stationary motor-cyclist with a speed of 54 km/hr. Immediately, the motor-cyclist starts his motor-cycle with an acceleration of 0.5 ms^{-2} in the direction of motion of the truck. He will catch the truck within
(1) 30 seconds (2) 45 seconds
(3) 60 seconds (4) 90 seconds

19. When a bus crosses a stationary motor-cyclist with a speed of 45 km/hr, at the same instant, the motor-cyclist starts his motor cycle with a constant acceleration and follows the bus. When the motorcyclist catches the bus, his speed is
(1) 15 ms^{-1} (2) 20 ms^{-1}
(3) 25 ms^{-1} (4) 30 ms^{-1}

20. A passenger is at a distance of 75 m from the bus when he finds that the bus has started. With what speed should be run after the bus to catch it within 30 seconds, if the bus starts accelerating at the rate of 0.5 ms^{-2} ?
(1) 10 ms^{-1} (2) 12.5 ms^{-1}
(3) 15 ms^{-1} (4) 17.5 ms^{-1}

21. Two cars are moving in the same direction with a speed of 30 km/hr. These are separeted from each other by 5 km. A third car, moving in the opposite direction meets the two cars after an interval of 5 minutes. The speed of the third car is
(1) 30 km/hr (2) 40 km/hr
(3) 45 km/hr (4) 25 km/hr

22. The velocity-time graph of a body is shown in the figure. If the slope of line is m, then the distance travelled by the body in time T is



(1) $mU^2/2T$ (2) $U^2/2T$
(3) $2mU^2$ (4) $U^2/2m$

23. An object of mass 3 kg is at rest. Now, a force $\vec{F} = 6t^2\,\hat{i} + 4t\,\hat{j}$ is applied on the object. Then velocity of the object, at t = 3 sec, is
(1) $18\hat{i} + 3\hat{j}$ (2) $18\hat{i} + 6\hat{j}$
(3) $3\hat{i} + 18\hat{j}$ (4) $18\hat{i} + 4\hat{j}$

24. A ball is thrown vertically upward in air. If the air resistance cannot be neglected, then the acceleration of the ball at the highest point of its motion is
(1) 0 (2) > g
(3) < g (4) = g

25. A stone is dropped into a well 19.6 m deep. After how much time, the sound will be heard, if the velocity of sound is 340 m/s ?
(1) 2.06 s (2) 3.13 s
(3) 2.95 s (4) 4.08 s

26. The distances travelled by a body under gravity, when released from rest, in the first 3 seconds and in the third second of its motion are in the ratio
(1) 7 : 3 (2) 9 : 1
(3) 9 : 4 (4) 9 : 5

27. A balloon is rising vertically upwards with a velocity of 12 ms^{-1}. When it is at a height of 65 m above the ground, it gently releases a stone. If g = 10 ms^{-2}, the stone will reach the ground in
(1) $3\sqrt{2}$ s (2) 5 s
(3) 7.5 s (4) 10 s

28. A sand bag is dropped from a rising balloon at a height of 60 m above the ground. If the bag reaches the ground in 5 seconds, the velocity of the balloon, when the bag was dropped from it, was (g = 9.8 ms^{-2})
(1) 15.0 ms^{-1} (2) 12.5 ms^{-1}
(3) 9.8 ms^{-1} (4) 14.7 ms^{-1}

29. A ball is released from a bridge 122.5 m above the river. After the first ball has been falling for one second, a second ball is thrown vertically down after the first. If both the balls hit the water in the river at the same time, the second ball was thrown down with a velocity of about
(1) 26.1 ms^{-1} (2) 9.8 ms^{-1}
(3) 14.7 ms^{-1} (4) 11 ms^{-1}

30. A body *P* is released from a great height and falls freely towards the earth. Another body *Q* is released from the same height exactly one second later. Then, the separation between *P* and *Q*, three seconds after the release of *Q*, would be
(1) 24.5 m (2) 29.4 m
(3) 34.3 m (4) 43.3 m

31. A body is released from the top of a tower of height *h* metres. It takes 2*t* seconds for the body to reach the ground. After *t*/2 seconds, after the release of the body, it would be
(1) At *h*/4 metres from the ground
(2) At 3*h*/4 metres from the ground
(3) At *h*/16 metres from the ground
(4) At 15*h*/16 metres from the ground

32. When a body is released from a height *H*, it covers 36% of the height in last second of its motion. From what height is the body released ? Take $g = 10$ ms^{-2}.
(1) 44.1 m (2) 122.5 m
(3) 125 m (4) 156 m

33. A body *A* is released from a height of 400 m. Exactly at the same time another body *B* is projected vertically upward from ground, with a velocity of 100 ms^{-1}. The two will meet after an interval of
(1) 2 s (2) 3 s
(3) 4 s (4) 6 s

34. A body *P* is thrown up vertically. After 2 seconds, another body *Q* is thrown up from the same position and with same vertical velocity. If both meet after further 6 seconds, with what initial velocity was each body thrown up ?
(1) 35 ms^{-1} (2) 55 ms^{-1}
(3) 70 ms^{-1} (4) 80 ms^{-1}

35. A body falls from a certain height. Two seconds later, another body falls from the same height. How long after the beginning of the motion of the first body is the distance between the bodies twice the distance at the moment the second body starts to fall ?
(1) 3 s (2) 5 s
(3) 6 s (4) 10 s

36. A body *M* is allowed to move along a smooth inclined and straight path, making an angle of 30º with the horizontal. Another body *N* is allowed to fall from the same height but along the vertical path. If both the bodies reach the ground with same velocity, then ratio of the times taken by the two bodies to reach the ground would be
(1) 1 : 1
(2) 2 : 1
(3) $\sqrt{2}$: 1
(4) Ratio of times cannot be calculated as height is not given.

37. A truck and a car are brought to rest by the application of same braking force. The truck will stop in shorter distance
(1) if both are moving with same velocity
(2) if both are moving with same kinetic energy
(3) if both are moving with same momentum
(4) in all the above cases

38. The brakes applied to a car produce a retardation of 6 ms^{-2}. If the car takes 1.5 seconds to stop after the appication the brakes, then distance travelled by the car during this time is
(1) 9.0 m (2) 6.75 m
(3) 7.50 m (4) 8.25 m

39. A bullet, moving at the speed of $200\sqrt{2}$ ms^{-1} is fired into a block which it penetrates to the extent of 20 cm. If the thickness of the same block is reduced to 10 cm, then the same bullet will emerge out of the block with a velocity of
(1) 100 ms^{-1} (2) $100\sqrt{2}$ ms^{-1}
(3) 200 ms^{-1} (4) $50\sqrt{2}$ ms^{-1}

40. A body starts from rest with a constant acceleration and covers 80 m in 4 seconds. The distance travelled by the body in the third second of its motion will be
(1) 20 m (2) 25 m
(3) 27.5 m (4) 30 m

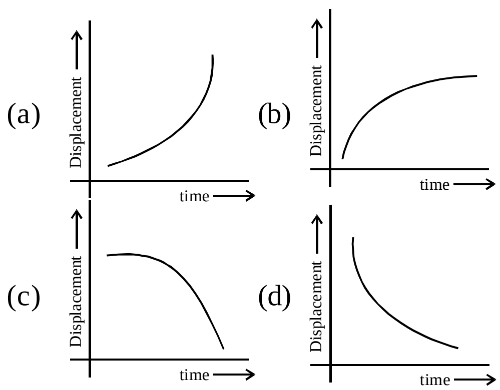
41. A body is thrown vertically up from the ground with velocity *v* and strikes the point of projection with same speed. The average speed of the body, over the entire path of its motion is
(1) *v* (2) *v*/4
(3) *v*/2 (4) zero

42. The distance travelled by a particle in time *t* is given by the relation $s = 5t + 2.5\,t^2$. The average speed of the body in time interval 0 to 4 seconds is
(1) 17.5 ms^{-1} (2) 72.5 ms^{-1}
(3) 16 ms^{-1} (4) 15 ms^{-1}

43. A drunkard moves 5 steps forward and 3 steps backward alternately, along the same line. If he starts moving towards a water-tank 14 steps away, after what time will he fall into tank, if 1 step takes 1 sec.?
(1) 37 sec (2) 38 sec
(3) 40 sec (4) 44 sec

44. A body at rest is accelerated uniformly for time t, till it attains a velocity of 4 ms^{-1}. Then immediately it is retarted at uniform rate for time t_2 till it is brought to rest. If $t_1 : t_2 = 3 : 2$ then its average speeds during times t_1 and t_2 are respectively
(1) 2 ms^{-1}, 2 ms^{-1} (2) 3ms^{-1}, 2 ms^{-1}
(3) 2 ms^{-1}, 3ms^{-1} (4) can't be found

45. Displacement - time graphs for a body moving along a straight line are shown as under. Here,



(1) (a) and (b) represent acceleration but (c) and (d) represent retardation
(2) (a) and (c) represent acceleration but (b) and (d) represent retardation
(3) (a) and (d) represent acceleration but (b) and (c) represent retardation
(4) (a) represents acceleration but (b), (c) and (d) represent retardation

46. Two particles A and B start from rest and move for equal time on a straight line. The particle A has an acceleration a for the first half time and 2a for the second half time. The particle B has an acceleration of 2a for the fist half time and a for the second half time. Then
(1) A covers more distance
(2) B covers more distance
(3) both cover equal distance
(4) distances covered cannot be related

47. A body is moving towards east with a speed of 9 ms^{-1} when a deceleration of 1 ms^{-2} starts acting on it. The distance travelled by the body during 9th second of the application of the force, is
(1) zero (2) 0.5 m
(3) 1.0 m (4) 0.25 m

48. A ball A is thrown up vertically with speed u. At the same instant another ball B is released from rest at height h. At time t, the speed of A, relative to B, is
(1) u (2) $u - 2gt$
(3) $\sqrt{u^2 - 2gh}$ (4) $u - gt$

49. A ball is thrown vertically upwards with a velocity of 30 m/s. If the acceleration due to gravity is 10 m/s^2, what will be the distance travelled by it in the last second of motion ?
(1) 5 m (2) 10 m
(3) 25 m (4) 30 m

50. Two bodies A and B are thrown vertically up from the ground, with velocities 20 ms^{-1} and 40 ms^{-1}, respectively. The ratio of the distances travelled by the bodies in their respective last one second of upward motion, is
(1) 1 : 2 (2) 1 : 4
(3) 1 : $\sqrt{2}$ (4) 1 : 1

51. A *cheetah* is the fastest animal and can achieve a peak velocity of 108 km/hr upto a distance of 500 m. If the *cheetah* spots his prey at a distance of 180 m, what is the maximum time, it will take to get it to prey?
(1) 10 sec. (2) 15 sec.
(3) 20 sec. (4) 18 sec.

52. A particle is projected vertically upwards and it attains maximum height H. If the ratio of times to attain height h ($h < H$) is 1/3, then h equals
(1) 2H/3 (2) 5 H/9
(3) 3H/4 (4) 4 H/9

53. A point traversed half of the distance with a velocity v_0. The remaining part of the distance was covered with velocity v_1 for half the time and with velocity v_2 for the other half of the time. The mean velocity of the point averaged over the whole time of motion is
(1) $\frac{v_0 + v_1 + v_2}{3}$ (2) $\frac{2v_0 + v_1 + v_2}{3}$
(3) $\frac{v_0 + 2v_1 + v_2}{3}$ (4) $\frac{2v_0(v_1 + v_2)}{2v_0 + v_1 + v_2}$

54. A body is thrown up vertically from the ground. It crosses a point after 4 seconds and after further 8 seconds it hits the ground. If g = 10 ms^2, then the maximum height reached by the body is
(1) 180 m (2) 200 m
(3) 240 m (4) 160 m

55. A ball hangs from a string inside a rail road car, moving along a straight track. The string is observed to be inclined towards the front of the car, making a constant small angle with the vertical. It shows that the car is

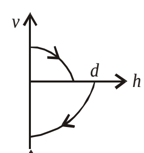
(1) moving with a uniform acceleration
(2) moving with a uniform velocity
(3) moving with a uniform deceleration
(4) moving with a constantly decreasing acceleration

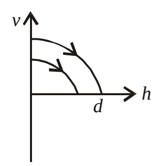
56. The displacement-time graph for two particles A and B are straight lines, inclined at angles of 30º and 60º, respectively, with time-axis. The ratio of the velocities $v_A : v_B$ will be
(1) 1 : 3 (2) 3 : 1
(3) $\sqrt{3} : 2$ (4) 1 : 2

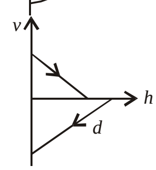
57. A passenger is standing distance d m away from a bus. The bus begins to move with a constant acceleration a. To catch the bus, the passenger runs at a constant speed u towards the bus. For the passenger to catch the bus, his minimum speed is
(1) $\sqrt{ad}$ (2) $\sqrt{2ad}$
(3) $2\sqrt{ad}$ (4) none of these

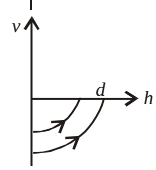
58. A stone is dropped from a height H and it travels a vertical distance of 53.9 m in last second of its motion. Value of H is
(1) 156.8 m (2) 122.5 m
(3) 127.4 m (4) 176.4 m

59. A ball is dropped vertically from a height d above the ground. It hits the ground and bounces up vertically to a height d/2. Neglecting subsequent motion and air resistance, its velocity v varies with height h above the ground as

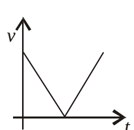
(1) 

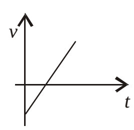
(2) 

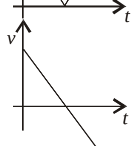
(3) 

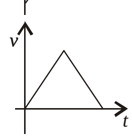
(4) 

60. A ball is projected vertically upwards. Which of the following graphs represents the velocity of the ball during its flight, when air resistance is ignored?

(1) 

(2) 

(3) 

(4) 

61. The driver of an express train, moving with a velocity v_1, finds that a goods train is moving ahead with a velocity v_2 in the same direction and on the same track. He applies the brakes and produces an acceleration a. The minimum time required to avoid collision is
(1) $\frac{v_1 - v_2}{a}$ (2) $\frac{v_2 - v_1}{a}$
(3) $\frac{\sqrt{v_1^2 - v_2^2}}{a}$ (4) $\frac{\sqrt{v_1 v_2}}{a}$

62. When the driver in a suspicious car moving at a speed of 72 km/hr finds that a police van is following him at a speed of 54 km/hr, he accelerates his car at the rate of 0.5 ms^{-2}. The driver of the police van starts chasing the suspicious car and accelerates the van at a rate of 1 ms^{-2}. If suspicious car is ahead of the police van by 75 m, the police van will overtake the suspicious car in
(1) 75 s (2) 30 s
(3) 45 s (4) 60 s

63. A body, moving along vertical direction, has downward velocity of 10 ms^{-1}, when it is at a height of 20 m from the ground. What maximum height did the body attain, before falling back to the ground ?
(1) 30 m (2) 20 m
(3) 25 m (4) 40 m

64. An electric train can be accelerated at the rate of 5 ms^{-2} but can be retarded at the rate of 3 ms^{-2}. The minimum time required to cover a distance of 6.0 km will be
(1) 60 sec (2) 90 sec
(3) 100 sec (4) 80 sec

65. A bus is beginning to move with an acceleration of 1 ms^{-2}. A man who is 48 m behind the bus starts running at 10 ms^{-1} to catch the bus. The man will be able to catch the bus after
(1) 6 sec (2) 16 sec
(3) 8 sec (4) 10 sec

66. A body, falling from rest, is observed to fall through 78.4 m in 2 seconds. How long had it been falling before it was observed ?
(1) 1 sec (2) 2 sec
(3) 3 sec (4) 4 sec

67. An engine approaches a hill with a constant speed. When it is at a distance of 0.9 km from the hill, it blows a whistle whose echo is heard by the driver after 5 seconds. If the speed of sound in air is 330 ms^{-1}, then speed of the engine is
(1) 30 ms^{-1} (2) 60 ms^{-1}
(3) 32 ms^{-1} (4) 27.5 ms^{-1}

68. A particle is moving such that relation between time and position is $t = Ax^2 + Bx$, where A and B are constant. The retardation of the particle is
(1) $2A(2Ax + B)^{-2}$ (2) $2A(2Ax + B)^{-3}$
(3) $2A(2Ax + B)^{2}$ (4) $2A(2Ax + B)^{3}$

69. A particle starts from rest with a constant acceleration. At a time t second, its speed is found to be 100 ms^{-1} and one second later its speed is found to be 120 ms^{-1}. The distance travelled by the body during $(t + 1)$th second is
(1) 100 m (2) 105 m
(3) 110 m (4) 120 m

70. In the above question, total distance travelled in $(t + 1)$ seconds would be
(1) 275 m (2) 480 m
(3) 330 m (4) 360 m

71. At moment $t = 0$, a particle leaves the origin and moves in the positive direction of the x-axis. Its velocity varies with time as : $v = 10\ (1–0.2\ t)$ cm s^{-1}. The x-co-ordinate of the particle at $t = 10$ s is
(1) 2 cm (2) 0
(3) 10 cm (4) 5 cm

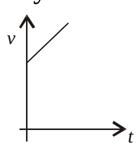
72. The distance travelled by a particle in time t is given by the relation $s = –2.0t + 2t^2$, where s is in metre and t is in sec. The average speeds of the particle during first and third seconds are, respectively,
(1) 0 and 4 ms^{-1} (2) 2 ms^{-1} and 6 ms^{-1}
(3) 0 and 8 ms^{-1} (4) 2 ms^{-1} and 8 ms^{-1}

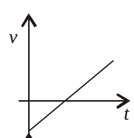
73. The equation of motion of a particle is given by the relation: $s = 18\ t + 3\ t^2 – 2\ t^3$ where s is the total distance covered from starting point in metres, at the end of t seconds. The maximum speed of the particle will be
(1) 15 m / sec (2) 23 m/sec
(3) 19.5 m / sec (4) 25 m / sec

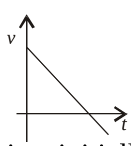
74. A body moves in a straight line along x-axis. Its distance from the origin is given by the equation $x = 8t – 4t^2$. The average velocity in the interval from $t = 0$ to $t = 4$ is
(1) 2 m/s (2) – 8 m/s
(3) – 4 m/s (4) zero

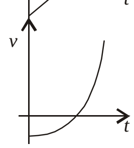
75. A charged particle, starting from rest, has a velocity that increases linearly with time as $v = kt$, where $k = 2\ ms^{-2}$. The distance covered by the particle in the interval 4-8 seconds will be
(1) 24 m (2) 48 m
(3) 72 m (4) 96 m

76. A particle moves along x-axis in such a way that its x-coordinate varies with time t according to the equation : $x = –8 + 4t – 6t^2$. The velocity of the particle will vary with time according to the graph

(1) 

(2) 

(3) 

(4) 

77. A point, initially at rest, moves along x-axis. Its acceleration varies with time as $a = 5t + 5\ ms^{-2}$. If it strats from the origin, then the distance travelled by it in one second is nearly
(1) 2.5 m (2) 3.5 m
(3) 4.5 m (4) 5.0 m

78. A car, initially at rest, starts moving rectilinearly first with acceleration of 5.0 ms^{-2} and then uniformly and finally decelerating at same rate of 5.0 ms^{-2} till it comes to stop. If total time of motion is 25 s and its average velocity during this time is 72 km/hr, then time of its uniform motion is
(1) 7.5 sec (2) 10.0 sec
(3) 15.0 sec (4) 12.5 sec

79. A body at rest is accelerated uniformly and covers 40% of distance during acceleratioin. Then it covers another 40% of the distance with the speed attained. Brakes are applied to be bring it to rest, covering the remaining portion. If total distance travelled is 360 m in 24 s, then the maximum speed of body is
(1) 18 ms^{-1} (2) 20 ms^{-1}
(3) 24 ms^{-1} (4) 16 ms^{-1}

80. In the above question, acceleration and retardation are, respectively,
(1) 3 ms^{-2}, – 6 ms^{-2} (2) 3 ms^{-2}, – 4 ms^{-2}
(3) 2 ms^{-2}, –3 ms^{-2} (4) 2 ms^{-2}, – 4 ms^{-2}

81. A train accelerates uniformly from rest until a speed of 60 km/hr is reached. It maintains this speed and passes the 25 kilometre mark after 30 minutes. The acceleration of the train should be
(1) 1/18 ms^{-2} (2) 1/36 ms^{-2}
(3) 1/9 ms^{-2} (4) 1/6 ms^{-2}

82. A train is accelerated for time t, it maintains the velocity attained for another time 33t, and finally is retarted in further time 0.5t to come to rest. If total time of its motion is 11.5 minutes and the maximum velocity attained is 72 km/hr, then the acceleration of the train is
(1) 1.5 ms^{-2} (2) 2.0 ms^{-2}
(3) 2.5 ms^{-2} (4) 1.0 ms^{-2}

83. A particle starts from rest and travels a distance s with uniform acceleration. Then it travels a distance 2 s with uniform speed attained. Finally it travels a distance 3 s with uniform retardation and comes to rest. If the complete motion of the particle is a straight line, then the ratio of its average velocity to the maximum velocity is
(1) 6/7 (2) 4/5
(3) 3/5 (4) 2/5

84. A subway train starts from rest at a station and accelerates at a rate of 2 ms^{-2} for 10 s. It then runs at a constant speed for 30 s and decelerates at 4 ms^{-2}, until it stops at the next station. The distance between the two stations is
(1) 650 m (2) 700 m
(3) 750 m (4) 800 m

85. The initial velocity of a particle is u and its acceleration is a, given by the relation $a = \alpha t^2$. Which one of the following relations is true for the motion of the particle
(1) $v = u + \alpha t^3$ (2) $v = u + \alpha t^3/3$
(3) $v = u + \alpha t^2/2$ (4) $v = u + \alpha t$

86. The velocity of a particle moving in the positive direction of the x-axis, varies as $v = \alpha\sqrt{x}$, where α is a positive constant. Assuming that at $t = 0$, the particle was located at $x = 0$, the time dependence velocity of the particle is
(1) $v = 2\alpha^2 t$ (2) $v = \alpha^2 t/2$
(3) $v = \alpha^2 t$ (4) $v = \alpha^2 t/3$

87. The relation between time t and displacement x for a body in motion is : $t = \alpha x^2 + \beta x$, where α and β constants. The retardation acting on the body is

(1) $2\alpha v^3$ (2) $2\beta v^3$

(3) $\frac{\alpha+\beta}{2}.v^3$ (4) $2\alpha\beta v^3$

88. A stone is thrown vertically upwards from the ground, and after times t_1 and t_2 it crosses same point along the path of its motion. Total time of its flight is

(1) $\sqrt{t_1 t_2}$ (2) $t_1 + t_2$

(3) $\sqrt{\frac{t_1^2+t_2^2}{2}}$ (4) $\frac{2t_1 t_2}{t_1+t_2}$

89. In the above question, the initial velocity with which the body is thrown up, is

(1) $g(t_1 + t_2)$ (2) $g(t_1 + t_2)/2$

(3) $g(t_2 - t_1)$ (4) $2g(t_1 + t_2)$

90. In the above question, the maximum height attained by the body is

(1) $\frac{g(t_1+t_2)^2}{2}$ (2) $\frac{g(t_1+t_2)^2}{4}$

(3) $\frac{g(t_1+t_2)^2}{8}$ (4) $\frac{g(t_1+t_2)^2}{16}$

91. From a certain height, a body is thrown vertically up with a certain velocity; and it takes time t_1, for the body to hit the ground. If the same body is thrown vertically down from the same height with same velocity, the time taken by the body to hit the ground is t_2. After what time will the same body hit the ground if it is just released from the same height ?

(1) $\frac{t_1+t_2}{2}$ (2) $\frac{t_1 t_2}{t_1+t_2}$

(3) $\sqrt{\frac{t_1^2+t_2^2}{2}}$ (4) $\sqrt{t_1 t_2}$

92. In the above question, the velocity with which the body is thrown up or down is

(1) $\frac{1}{2}g\sqrt{t_1 t_2}$ (2) $\frac{1}{2}g\sqrt{t_1^2-t_2^2}$

(3) $\frac{1}{2}g[t_1-t_2]$ (4) $\frac{1}{2}g\sqrt{t_1+t_2}$

93. In the above question, the height from which body is thrown or released is

(1) $g\frac{t_1 t_2}{2}$ (2) $g\frac{t_1^2+t_2^2}{2}$

(3) $g\left[\frac{t_1+t_2}{2}\right]^2$ (4) $g\frac{t_1^2-t_2^2}{2}$

94. A body falling freely under gravity passes two points 45 m apart vertically, in one second. If g = 10 ms^{-2}, the body began to fall from a height (before crossing the first point)

(1) 100 m (2) 125 m

(3) 120 m (4) 80 m

95. Let A, B, C and D be the points on a vertical line such that $AB = BC = CD$. If a body is released from position A, then times of descent through AB, BC and CD are in the ratio

(1) $1 : (\sqrt{3} - \sqrt{2}) : (\sqrt{3} + \sqrt{2})$

(2) $1 : (\sqrt{2} - 1) : (\sqrt{3} - \sqrt{2})$

(3) $1 : (\sqrt{2} - 1) : \sqrt{3}$

(4) $1 : \sqrt{2} : (\sqrt{3} - 1)$

96. A bird flies for 4 seconds with a velocity of $|t - 2|$ ms^{-1} in a straight line, where t is measured in seconds. It covers a distance of

(1) 8 m (2) 6 m

(3) 4 m (4) 2 m

97. A stone is thrown vertically upwards with a certain velocity. It is found that when in its ascent it is 117.6 m.from the ground, it takes 2 seconds to return to the same point again. The velocity of the projection of the stone is

(1) 44.1 ms^{-1} (2) 53.9 ms^{-1}

(3) 49 ms^{-1} (4) 98 ms^{-1}

98. A point moves in a straight line so that its displacement x (metre) in time t (seconds) is given by the relation : $x^2 = t^2 + 1$. Its acceleration in ms^{-2}, would be

(1) $\frac{1}{x} - \frac{t^2}{x^3}$

(2) $\frac{1}{x^3}$

(3) by both (1) and (2)

(4) by neither (1) nor (2)

99. A man in a lift ascending with an upward acceleration 'a' throws a ball vertically upwards with a velocity v and catches it after t_1 seconds. Afterwards when the lift is descending with the same acceleration 'a' acting downwards the man again throws the ball vertically upwards with the same velocity and catches it after t_2 seconds ? The acceleration of the lift is

(1) $g\left(\frac{t_1}{t_2}+\frac{t_2}{t_1}\right)$ (2) $g\left(\frac{t_2+t_1}{t_2-t_1}\right)$

(3) $g\left[\frac{t_2-t_1}{t_2+t_1}\right]$ (4) $g\left[\frac{\sqrt{t_1^2+t_2^2}}{t_1+t_2}\right]$

100. In the above question velocity with which the ball is thrown up is

(1) $g\frac{(t_1+t_2)}{t_1 t_2}$ (2) $g\left(\frac{t_1 t_2}{t_1+t_2}\right)$

(3) $g\left[\frac{t_1 t_2}{t_2-t_1}\right]$ (4) $g\sqrt{t_1^2+t_2^2}$

Assertion-Reason Type Questions (For AIIMS)

Each of the questions given below consists of two statements, an assertion (*A*) and reason (*R*). Darken the number corresponding to the appropriate alternative on the answer sheet as follows :

(1) If both ***A*** and ***R*** are true and ***R*** is the correct explanation of ***A***, then mark **1**

(2) If both ***A*** and ***R*** are true but ***R*** is not the correct explanation of ***A***, then mark **2**

(3) If ***A*** is true but ***R*** is false, then mark **3**

(4) If both ***A*** and ***R*** are false, then mark **4**

1. *A*. The relative velocity between any two bodies is equal to sum of the velocities of two bodies.

   R. Some times, relative velocity between two bodies is equal to difference in velocities of the two.

2. *A*. The displacement time graph of a body moving with uniform acc. is a straight line.

   R. This follows from $s = ut + \frac{1}{2}at^2$, where symbols have their usual meaning.

3. *A*. A body falling freely may do so with constant velocity.

   R. This occurs when body falls under gravity.

4. *A*. Displacement of a body is algebraic sum of the area under velocity time graph.

   R. Displacement = velocity × time; and it is a vector quantity.

5. *A*. A body may have acceleration even when its velocity is zero.

   R. Acceleration is rate of change of speed.

6. *A*. A body may be accelerated even when it is moving uniformly.

   R. When direction of motion of the body is changing.

7. *A*. Displacement of a body may be zero even when distance travelled by it is not zero.

   R. The displacement is the shortest distance.

8. *A*. A body moving with a uniform velocity is in equilibrium.

   R. A body can move with a uniform velocity if a constant force is acting on it.

9. *A*. A dimensionally correct relation may not be mathematically correct.

   R. Numerical values have no dimensions.

10. *A*. Nobody is at absolute rest.

    R. Every body is in motion with respect to some other body in the universe.

ANSWERS TO ASSIGNMENT

UNITS & DIMENSIONS

1.	(4)	2.	(3)	3.	(4)	4.	(3)	5.	(3)
6.	(3)	7.	(2)	8.	(2)	9.	(1)	10.	(4)
11.	(2)	12.	(2)	13.	(2)	14.	(1)	15.	(2)
16.	(1)	17.	(2)	18.	(1)	19.	(1)	20.	(4)
21.	(2)	22.	(4)	23.	(2)	24.	(2)	25.	(1)
26.	(2)	27.	(4)	28.	(2)	29.	(2)	30.	(1)
31.	(1)	32.	(3)	33.	(1)	34.	(2)	35.	(2)
36.	(3)	37.	(4)	38.	(1)	39.	(2)	40.	(4)
41.	(1)	42.	(4)	43.	(1)	44.	(1)	45.	(4)
46.	(4)	47.	(2)	48.	(3)	49.	(2)	50.	(2)
51.	(3)	52.	(3)	53.	(4)	54.	(2)	55.	(1)
56.	(3)	57.	(1)	58.	(2)	59.	(4)	60.	(4)
61.	(2)	62.	(2)	63.	(3)	64.	(4)	65.	(2)
66.	(2)	67.	(3)	68.	(4)	69.	(2)	70.	(2)
71.	(3)	72.	(4)	73.	(4)	74.	(2)	75.	(2)
76.	(1)	77.	(4)	78.	(2)	79.	(2)	80.	(1)
81.	(4)	82.	(4)	83.	(3)	84.	(4)	85.	(2)
86.	(3)	87.	(3)	88.	(1)	89.	(2)	90.	(2)
91.	(4)	92.	(4)	93.	(1)	94.	(4)	95.	(2)
96.	(3)	97.	(4)	98.	(1)	99.	(4)	100.	(4)

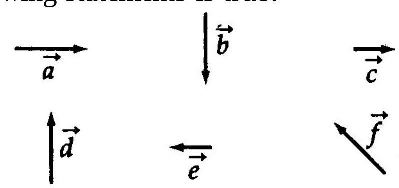
1.	(3)	2.	(3)	3.	(2)	4.	(2)	5.	(4)
6.	(4)	7.	(1)	8.	(3)	9.	(3)	10.	(4)
11.	(3)	12.	(1)	13.	(1)	14.	(4)	15.	(2)
16.	(2)	17.	(2)	18.	(3)	19.	(3)	20.	(1)
21.	(1)	22.	(4)	23.	(2)	24.	(4)	25.	(1)
26.	(4)	27.	(2)	28.	(2)	29.	(4)	30.	(3)
31.	(4)	32.	(3)	33.	(3)	34.	(3)	35.	(1)
36.	(2)	37.	(3)	38.	(2)	39.	(3)	40.	(2)
41.	(3)	42.	(4)	43.	(4)	44.	(1)	45.	(2)
46.	(2)	47.	(2)	48.	(2)	49.	(1)	50.	(4)
51.	(3)	52.	(2)	53.	(4)	54.	(1)	55.	(3)
56.	(1)	57.	(2)	58.	(4)	59.	(1)	60.	(3)
61.	(1)	62.	(2)	63.	(3)	64.	(4)	65.	(3)
66.	(3)	67.	(1)	68.	(2)	69.	(3)	70.	(4)
71.	(2)	72.	(3)	73.	(3)	74.	(2)	75.	(2)
76.	(3)	77.	(2)	78.	(3)	79.	(3)	80.	(4)
81.	(2)	82.	(4)	83.	(3)	84.	(3)	85.	(2)
86.	(2)	87.	(1)	88.	(2)	89.	(2)	90.	(3)
91.	(4)	92.	(3)	93.	(1)	94.	(4)	95.	(2)
96.	(3)	97.	(3)	98.	(3)	99.	(3)	100.	(2)

Assertion-Reason Type Questions (For AIIMS)

1.	(2)	2.	(4)	3.	(3)	4.	(1)	5.	(2)
6.	(1)	7.	(2)	8.	(3)	9.	(1)	10.	(1)

CBSE - PMT

1. If the dimensions of a physical quantity are given by $M^a L^b T^c$, then the physical quantity will be
   (1) Force if $a = 0, b = -1, c = -2$
   (2) Pressure if $a = 1, b = -1, c = -2$
   (3) Velocity if $a = 1, b = 0, c = -1$
   (4) Acceleration if $a = 1, b = 1, c = -2$
2. A particle starts its motion from rest under the action of a constant force. If the distance covered in first 10 seconds is S_1 and that covered in the first 20 seconds is S_2, then : [
   (1) $S_2 = S_1$ (2) $S_2 = 2S_1$
   (3) $S_2 = 3S_1$ (4) $S_2 = 4S_1$
3. A bus is moving with a speed of 10 ms^{-1} on a straight road. A scooterist wishes to overtake the bus in 100 s. If the bus is at a distance of 1 km from the scooterist, with what speed should the scooterist chase the bus?
   (1) 10 ms^{-1} (2) 20 ms^{-1}
   (3) 40 ms^{-1} (4) 25 ms^{-1}
4. If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be
   (1) 56 m (2) 16 m
   (3) 24 m (4) 40 m
11. Two bodies, A (of mass 1 kg) and B (of mass 3 kg) are dropped from heights of 16 m and 25 m, respectively. The ratio of the time taken by them to reach the ground is
   (1) 5/12 (2) 4/5
   (3) 5/4 (4) 12/5
12. Two boys are standing at the ends *A* and *B* of a ground where $AB = a$. The boy at *B* starts running in a direction perpendicular to *AB* with velocity v_1. The boy at *A* starts running simultaneously with velocity v and catches the other boy in a time t, where t is
   (1) $a/\sqrt{v^2 + v_1^2}$ (2) $\sqrt{a^2/(v^2 - v_1^2)}$
   (3) $a/(v - v_1)$ (4) $a/(v + v_1)$
13. A ball is thrown vertically upward. It has a speed of 10 m/sec when it has reached one half of its maximum height. How high does the ball rise? Take $g = 10$ m/s^2.
   (1) 5 m (2) 15 m
   (3) 10 m (4) 20 m
14. The dimensions of universal gravitational constants are
   (1) $M^{-2}L^2T^{-1}$ (2) $M^{-1}L^3T^{-2}$
   (3) ML^2T^{-1} (4) $M^{-2}L^3T^{-2}$
15. A man throws balls with the same speed vertically upwards one after the other at an interval of 2 second. What should be the speed of the throw so that more than two balls are in the sky at any time? (Given $g = 9.8$ m/s^2)
   (1) At least 9.8 m/s
   (2) Any speed less than 19.6 m/s
   (3) Only with speed 19.6 m/s
   (4) More than 19.6 m/s
16. If a ball is thrown vertically upwards with speed u, the distance coverewd during at last t seconds of its ascent is
   (1) $1/2\ gt^2$ (2) $ut - 1/2\ gt^2$
   (3) $(u + ft)t$ (4) ut
17. The dimension of $\frac{1}{2}\in_0 E^2$, where $\in_0$ is permittivity of free space and E is electric field, is
   (1) $M L T^{-1}$ (2) $M L^2 T^{-2}$
   (3) $M L^{-1} T^{-2}$ (4) $M L^2 T^{-1}$
18. A particle moves a distance, x in time t according to equation $x = (t + 5)^{-1}$. The acceleration of particle is proportional to
   (1) $(\text{velocity})^{2/3}$ (2) $(\text{velocity})^{3/2}$
   (3) $(\text{distance})^2$ (4) $(\text{distance})^{-2}$
19. Six vectors, $\vec{a}$ through $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true?



   (1) $\vec{b} + \vec{e} = \vec{f}$ (2) $\vec{b} + \vec{c} = \vec{f}$
   (3) $\vec{d} + \vec{c} = \vec{f}$ (4) $\vec{d} + \vec{e} = \vec{f}$
20. A ball is dropped from a high rise platform at $t = 0$ starting from rest. After 6 seconds another ball is thrown downwards from the same platform with a speed v. The two balls meet at $t = 18$ s. What is the value of v? (take $g = 10$ m/s^2)

(1) 60 m/s (2) 75 m/s
(3) 55 m/s (4) 40 m/s

CBSE-PMT Mains

1. A student measures the distance traversed in free fall of a body, initially at rest in a given time. He uses this data to estimate *g*, the acceleration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e_1 and e_2 respectively, the percentage error in the estimation of *g* is

(1) $e_2 - e_1$ (2) $e_1 + 2e_2$
(3) $e_1 + e_2$ (4) $e_1 - 2e_2$

2. The density of a material in CGS system of units is 4 g/cm^3. In a system of units in which unit of length is 10 cm and unit of mass is 100 g, the value of density of material will b

(1) 0.04 (2) 0.4
(3) 40 (4) 400

3. A particle covers half of its total distance with speed v_1 and the rest half distance with speed v_2. Its average speed during the complete journey is

(1) $\frac{v_1 + v_2}{2}$ (2) $\frac{v_1 \; v_2}{v_1 + v_2}$
(3) $\frac{2v_1 \; v_2}{v_1 + v_2}$ (4) $\frac{v_1^2 \; v_2^2}{v_1^2 + v_2^2}$

NEET

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

(1) [F V^{-1} T^{-1}] (2) [F V^{-1} T]
(3) [F V T^{-1}] (4) [F V T^{-2}]

DPMT

1. A raindrop with radius 1.5 mm falls from a cloud at a height 1200 m from ground. The density of water is 1000 kg/m^3 and density of water is 1.2 kg/m^3. Assume the drop was spherical throughout the fall and there is no air drag. The impact speed of the drop will be]

(1) 27 km/h (2) 550 km/h
(3) zero (4) 129 km/h

2. You drive a car at a speed of 70 km/hr in a straight road for 8.4 km, and then the car runs out of petrol. You walk for 30 min to reach a petrol pump at a distance of 2 km. The average velocity from the beginning of your drive till you reach the petrol pump is

(1) 16.8 km/h (2) 35 km/h
(3) 64 km/h (4) 18.6 km/h

3. Tom and Dick are running forward with the same speed. They are throwing a rubber ball to each other at a constant speed V as seen by the thrower. According to Sam who is standing on the ground the speed of ball is

(1) same as V (2) greater than V
(3) less than V (4) none of these

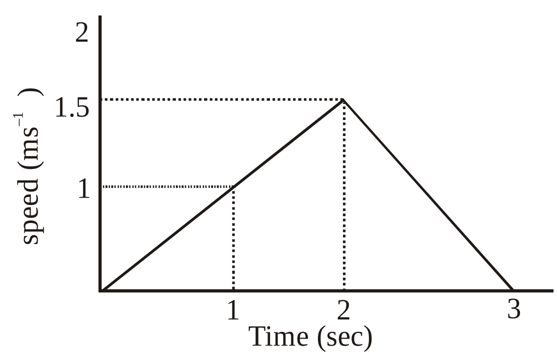
4. The angle subtended by a coin of radius 1 cm held at a distance of 80 cm from your eyes is

(3) 2m (4) 5 m

11 What is the dimension of surface tension?

(1) [ML^{1}T^0] (2) [ML^{1}T^{-1}]
(3) [ML^{0}T^{-2}] (4) [M^{1}L^{0}T^{-2}]

12. The speed time graph of a particle moving along a solid curve is shown below. The distance traversed by the particle from *t* = 0 to *t* = 3 is



(1) $\frac{10}{2}$ sec (2) $\frac{10}{4}$ sec
(3) $\frac{10}{3}$ sec (4) $\frac{10}{5}$ sec

AIIMS

1. When a ball is thrown up vertically with velocity V_0, it reaches a maximum height of *h*. If one wishes to

triple the maximum height then the ball should be thrown with velocity

(1) $\sqrt{3}\ V_0$

(2) $3\ V_0$

(3) $9\ V_0$

(4) $3/2\ V_0$

ANSWERS :
QUESTIONS FROM COMPETITIVE EXAMS

CBSE PMT

1.	(2)	2.	(4)	3.	(2)	4.	(2)	5.	(3)
6.	(1)	7.	(4)	8.	(1)	9.	(4)	10.	(2)
11.	(2)	12.	(2)	13.	(3)	14.	(2)	15.	(4)
16.	(1)	17.	(3)	18.	(2)	19.	(4)	20.	(2)

NEET

1.	(2)

CBSE-PMT Mains

1.	(2)	2.	(3)	3.	(3)

DPMT

1.	(2)	2.	(1)	3.	(2)	4.	(1)	5.	(3)
6.	(2)	7.	(4)	8.	(2)	9.	(2)	10.	(4)
11.	(3, 4)	12.	(2)						

AIIMS

1.	(1)