

PART-I PHYSICS

1. The root mean square speed of smoke particles of mass $5 \times 10^{-17} \text{ kg}$ in their Brownian motion in air at NTP is approximately.

[Given $k = 1.38 \times 10^{-23} \text{ J K}^{-1}$]

- (a) 60 mm s^{-1} (b) 12 mm s^{-1}
(c) 15 mm s^{-1} (d) 36 mm s^{-1}

2. The equation of a particle executing simple harmonic motion is given by $x = \sin \Pi \left(t + \frac{1}{3} \right) \text{ m}$. At $t = 1 \text{ s}$, the speed of particle will be (Given: $\Pi = 3.14$)

- (a) 0 cm s^{-1} (b) 157 cm s^{-1}
(c) 272 cm s^{-1} (d) 314 cm s^{-1}

3. Following are expressions for four plane simple harmonic waves

(i) $y_1 = A \cos 2\pi \left(n_1 t + \frac{x}{\lambda_1} \right)$

(ii) $y_2 = A \cos 2\pi \left(n_1 t + \frac{x}{\lambda_1} + \pi \right)$

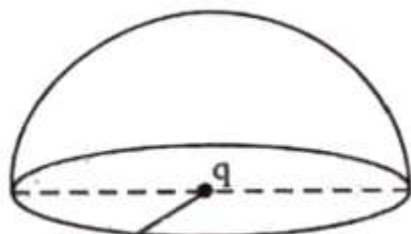
(iii) $y_3 = A \cos 2\pi \left(n_2 t + \frac{x}{\lambda_2} \right)$

(iv) $y_4 = A \cos 2\pi \left(n_2 t - \frac{x}{\lambda_2} \right)$

The pairs of waves which will produce destructive interference and stationary waves respectively in a medium, are

- (a) (iii, iv), (i, ii) (b) (i, iii), (ii, iv)
(c) (i, iv), (ii, iii) (d) (i, ii), (iii, iv)

4. If a charge q is placed at the centre of a closed hemispherical nonconducting surface, the total flux passing through the flat surface would be :



- (a) zero (b) $\frac{q}{2\epsilon_0}$
(c) $\frac{q}{4\epsilon_0}$ (d) $\frac{q}{2\pi\epsilon_0}$

5. The electric potential $V(x)$ in a region around the origin is given by $V(x) = 4x^2$ volts. The electric charge enclosed in a cube of 1 m side with its centre at the origin is (in coulomb)

- (a) $8\epsilon_0$ (b) $-4\epsilon_0$
 (c) 0 (d) $-8\epsilon_0$
6. A heater coil is cut into two equal parts and only one part is now used in the heater. The heat generated will now be
 (a) four times (b) doubled
 (c) halved (d) one fourth
7. In a region, steady and uniform electric and magnetic fields are present. These two fields are parallel to each other. A charged particle is released from rest in this region. The path of the particle will be a
 (a) helix (b) straight line
 (c) ellipse (d) circle
8. An object is thrown vertically upwards. At its maximum height, which of the following quantity becomes zero?
 (a) Momentum (b) Potential energy
 (c) Acceleration (d) Force
9. The self-induced emf of a coil is 25 volts. When the current in it is changed at uniform rate from 10 A to 25 A in 1 s, the change in the energy of the inductance is:
 (a) 740 J (b) 437.5 J
 (c) 540 J (d) 637.5 J
10. Alternating current can- not be measured by (d)(c) ammeter because
 (a) Average value of current for complete cycle is zero
 (b) (a)(c) Changes direction
 (c) (a)(c) can- not pass through (d)(c) Ammeter
 (d) (d)(c) Ammeter will get damage
11. The magnetic field of a plane electromagnetic wave is given by: $\vec{B} = 2 \times 10^{-8} \sin(0.5 \times 10^3 x + 1.5 \times 10^{11} t) \hat{j} \text{ T}$. The amplitude of the electric field would be:
 (a) 6 Vm^{-1} along x-axis
 (b) 3 Vm^{-1} along z-axis
 (c) 6 Vm^{-1} along z-axis
 (d) $2 \times 10^{-8} \text{ Vm}^{-1}$ along z-axis
12. An ideal gas is expanding such that $PT^3 = \text{constant}$. The coefficient of volume expansion of the gas is:
 (a) $\frac{1}{T}$ (b) $\frac{2}{T}$
 (c) $\frac{4}{T}$ (d) $\frac{3}{T}$

13. Two light beams of intensities in the ratio of 9: 4 are allowed to interfere. The ratio of the intensity of maxima and minima will be :

- (a) 2: 3 (b) 16: 81
(c) 25: 169 (d) 25: 1

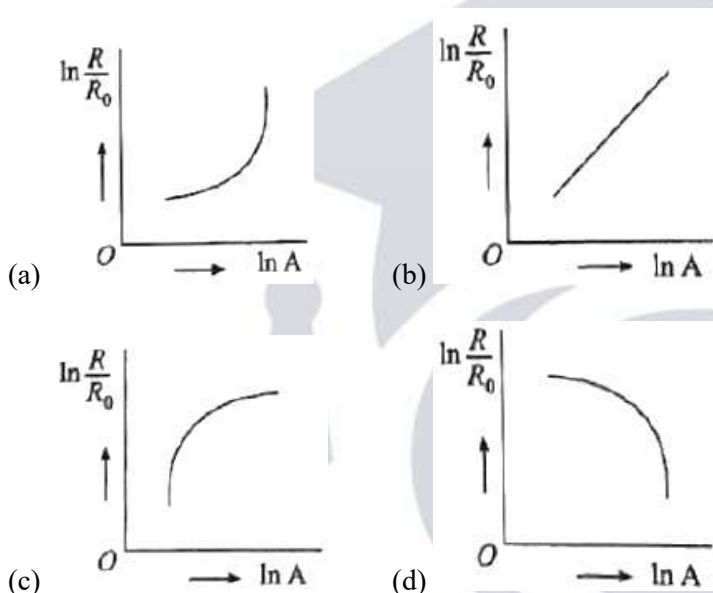
14. The deBroglie wavelength of a proton and α -particle are equal. The ratio of their velocities is :

- (a) 4: 3 (b) 4: 1
(c) 4: 2 (d) 1: 4

15. The recoil speed of a hydrogen atom after it e in going from $n = 5$ state to $n = 1$ state will be

- (a) 4.34 m/s (b) 2.19 m/s
(c) 4.17 m/s (d) 3.25 m/s

16. Which of the following figure represents the variation or $\ln \left(\frac{R}{R_0} \right)$ with $\ln A$ (If R = radius of a nucleus and A = its mass number)?



17. Zener breakdown occurs in a p – n junction having p and n both :

- (a) lightly doped and have wide depletion layer
(b) heavily doped and have narrow depletion layer
(c) lightly doped and have narrow depletion layer
(d) heavily doped and have wide depletion layer

18. If E and H represents the intensity of electric field and magnetising field respectively, then the unit of E/H will be:

- (a) ohm (b) mho
(c) joule (d) newton

19. A stone of mass m , tied to a string is being whirled in a vertical circle with a uniform speed. The tension in the string is :

- (a) the same throughout the motion
- (b) minimum at the highest position of the circular path
- (c) minimum at the lowest position of the circular path
- (d) minimum when the rope is in the horizontal position

20. A particle is moving with a velocity $\vec{v} = K(\hat{y}\hat{i} + x\hat{j})$, where K is a constant. The general equation for its path is:

- (a) $y = x^2 + \text{constant}$
- (b) $y^2 = x + \text{constant}$
- (c) $y^2 = x^2 + \text{constant}$
- (d) $xy = \text{constant}$

21. A particle of mass M originally at rest is subjected to a force whose direction is constant but magnitude varies with time according to the relation

$$F = F_0 \left[1 - \left(\frac{t - T}{T} \right)^2 \right]$$

Where F_0 and T are constants. The force acts only for the time interval $2T$. The velocity of the particle after time $2T$ is:

- (a) $2 F_0 T/M$
- (b) $F_0 T/2M$
- (c) $4 F_0 T/3M$
- (d) $F_0 T/3M$

22. The magnetic moment of an electron (e) revolving in an orbit around nucleus with an orbital angular momentum is given by:

- (a) $\vec{\mu}_L = \frac{e\vec{L}}{2m}$
- (b) $\vec{\mu}_L = -\frac{e\vec{L}}{2m}$
- (c) $\vec{\mu}_L = -\frac{e\vec{L}}{m}$
- (d) $\vec{\mu}_L = \frac{2e\vec{L}}{m}$

23. Angular momentum of the particle rotating with a central force is constant due to

- (a) constant torque
- (b) constant force
- (c) constant linear momentum
- (d) zero torque

24. The escape velocity of a body depends upon mass as

- (a) m^0
- (b) m^1
- (c) m^2
- (d) m^3

25. Potential energy as a function of r is given by $U = \frac{A}{r^{10}} - \frac{B}{r^5}$, where r is the interatomic distance, A and B are positive constants. The equilibrium distance between the two atoms will be:

- (a) $\left(\frac{A}{B}\right)^{\frac{1}{5}}$ (b) $\left(\frac{B}{A}\right)^{\frac{1}{5}}$
(c) $\left(\frac{2A}{B}\right)^{\frac{1}{5}}$ (d) $\left(\frac{B}{2A}\right)^{\frac{1}{5}}$

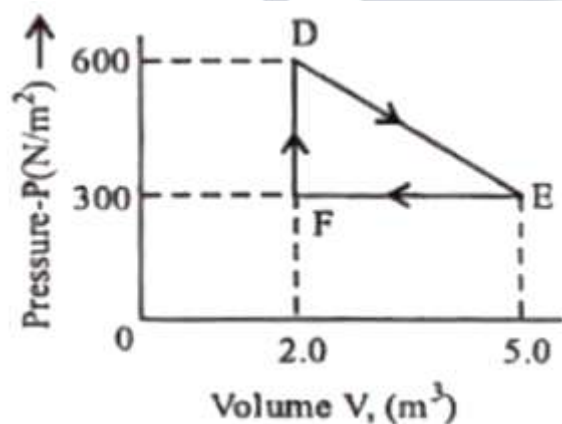
26. If two soap bubbles of different radii are connected by a tube

- (a) air flows from the smaller bubble to the bigger
(b) air flows from bigger bubble to the smaller bubble till the sizes are interchanged
(c) air flows from the bigger bubble to the smaller bubble till the sizes become equal
(d) there is no flow of air.

27. The focal length f is related to the radius of curvature r of the spherical convex mirror by:

- (a) $f = +\frac{1}{2}r$ (b) $f = -r$
(c) $f = -\frac{1}{2}r$ (d) $f = r$

28. A thermodynamic system is taken from an original state D to an intermediate state E by the linear process shown in the figure. Its volume is then reduced to the original volume from E to F by an isobaric process. The total work done by the gas from D to E to F will be Volume V , (m^3)



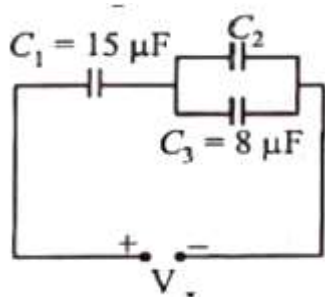
- (a) -450 J (b) 450 J
(c) 900 J (d) 1350 J

29. A vertical electric field of magnitude $4.9 \times 10^5 \text{ N/C}$ just prevents a water droplet of a mass 0.1 g from falling. The value of charge on the droplet will be:

(Given $g = 9.8 \text{ m/s}^2$)

- (a) $1.6 \times 10^{-9} \text{ C}$ (b) $2.0 \times 10^{-9} \text{ C}$
(c) $3.2 \times 10^{-9} \text{ C}$ (d) $0.5 \times 10^{-9} \text{ C}$

30. In the circuit shown in the figure, the total charge is $750 \mu\text{C}$ and the voltage across capacitor C_2 is 20 V . Then the charge on capacitor C_2 is :



- (a) $450\mu\text{C}$ (b) $590\mu\text{C}$
(c) $160\mu\text{C}$ (d) $650\mu\text{C}$

31. For a transistor α and β are given as $\alpha = \frac{I_C}{I_E}$ and $\beta = \frac{I_C}{I_B}$. Then the correct relation between α and β will be:

- (a) $\alpha = \frac{1-\beta}{\beta}$ (b) $\beta = \frac{\alpha}{1-\alpha}$
(c) $\alpha\beta = 1$ (d) $\alpha = \frac{\beta}{1-\beta}$

32. A current I flows along the length of an infinitely long, straight, thin walled pipe. Then

- (a) the magnetic field at all points inside the pipe is the same, but not zero
(b) the magnetic field is zero only on the axis of the pipe
(c) the magnetic field is different at different points inside the pipe
(d) the magnetic field at any point inside the pipe is zero

33. A Carnot engine has efficiency of 50%. If the temperature of sink is reduced by 40°C , its efficiency increases by 30%. The temperature of the source will be:

- (a) 166.7 K (b) 255.1 K
(c) 266.7 K (d) 367.7 K

34. When you walk through a metal detector carrying a metal object in your pocket, it raises an alarm. This phenomenon works on

- (a) Electromagnetic induction
(b) Resonance in ac circuits
(c) Mutual induction in ac circuits
(d) interference of electromagnetic waves

35. An electron moving with speed v and a pno with speed c , have same D Broglie wavelength. The ratio of kinetic energy of electron to that of photon is:

- (a) $\frac{3c}{v}$ (b) $\frac{v}{3c}$
(c) $\frac{v}{2c}$ (d) $\frac{2c}{v}$

PART-II CHEMISTRY

36. Assuming fully decomposed, the volume of CO_2 released will be

- (a) 1.12 L (b) 2.24 L
(c) 4.06 L (d) 0.84 L

37. Among the following, the species having the smallest bond is

- (a) NO^- (b) NO^+
(c) O_2 (d) NO

38. The oxidation number of phosphorus in $\text{Ba}(\text{H}_2\text{PO}_2)_2$ is

- (a) +3 (b) +2
(c) +1 (d) -1

39. The correct order of thermal stability of hydroxides is:

- (a) $\text{Ba}(\text{OH})_2 < \text{Ca}(\text{OH})_2 < \text{Sr}(\text{OH})_2 < \text{Mg}(\text{OH})_2$
(b) $\text{Mg}(\text{OH})_2 < \text{Sr}(\text{OH})_2 < \text{Ca}(\text{OH})_2 < \text{Ba}(\text{OH})_2$
(c) $\text{Mg}(\text{OH})_2 < \text{Ca}(\text{OH})_2 < \text{Sr}(\text{OH})_2 < \text{Ba}(\text{OH})_2$
(d) $\text{Ba}(\text{OH})_2 < \text{Sr}(\text{OH})_2 < \text{Ca}(\text{OH})_2 < \text{Mg}(\text{OH})_2$

40. Which of the following has correct increasing basic strength?

- (a) $\text{MgO} < \text{BeO} < \text{CaO} < \text{BaO}$
(b) $\text{BeO} < \text{MgO} < \text{CaO} < \text{BaO}$
(c) $\text{BaO} < \text{CaO} < \text{MgO} < \text{BeO}$
(d) $\text{CaO} < \text{BaO} < \text{BeO} < \text{MgO}$

41. Water sample is reported to be highly polluted if BOD (Biological Oxygen Demand) value of sample becomes

- (a) more than 17ppm. (b) equal to 10ppm.
(c) equal to 5 ppm. (d) less than 5 ppm.

42. 200 mL of an aqueous solution of a protein contains its 1.26 g. The osmotic pressure of this solution at 300 K is found to be 2.57×10^{-3} bar. The molar mass of protein will be ($R = 0.083 \text{ L bar mol}^{-1}\text{K}^{-1}$)

- (a) 51022gmol^{-1} (b) 122044gmol^{-1}
(c) 31011gmol^{-1} (d) 61038gmol^{-1}

43. Lyophilic sols are more stable than lyophobic sols because:

- (a) the colloidal particles have positive charge
- (b) the colloidal particles have negative charge
- (c) the colloidal particles are solvated
- (d) there is strong electrostatic repulsion between the colloidal particles

44. Which of the following is not permissible arrangement of electrons in an atom?

- (a) $n = 5, l = 3, m = 0, s = +1/2$
- (b) $n = 3, l = 2, m = -3, s = -1/2$
- (c) $n = 3, l = 2, m = -2, s = -1/2$
- (d) $n = 4, l = 0, m = 0, s = -1/2$

45. The value of van der Waals constant 'a' for gases O_2 , N_2 , NH_3 and CH_4 are 1.360, 1.390, 4.170 and 2.253 litre² atm mol⁻² respectively. The gas which can most easily be liquefied is :

- (a) O_2 (b) N_2
- (c) NH_3 (d) CH_4

46. Which one of the following does not have a pyramidal shape?

- (a) $(CH_3)_3 N$ (b) $(SiH_3)_3 N$
- (c) $P(CH_3)_3$ (d) $P(SiH_3)_3$

47. Boric acid is polymeric due to

- (a) its acidic nature
- (b) the presence of hydrogen bonds
- (c) its monobasic nature
- (d) its geometry

48. Which of the following order is not correct?

- (a) $MeBr > Me_2CHBr > Me_3CBr > Et_3CBr^N(S_N2)$
- (b) $PhCH_2Br > PhCHBrMe > PhCBrMe_2 > PhCBrMePh(S_N1)$
- (c) $MeI > MeBr > MeCl > MeF(S_N2)$
- (d) All are correct

49. A catalyst is a substance which:

- (a) is always in the same phase as in the reaction
- (b) alters the equilibrium in a reaction
- (c) does not participate in the reaction but alters the rate of reaction
- (d) participates in the reaction and provides an easier pathway for the same

50. Which of the following is a non-reducing sugar?

- (a) Lactose (b) Fructose
(c) Sucrose (d) Maltose

51. An ideal gas expands against a constant external pressure of 2.0 atmosphere from 20 litre to 40 litre and absorbs 10 kJ of heat from surrounding. What is the change in internal energy of the system? (given: 1 atm-litre = 101.3 J)

- (a) 4052 J (b) 5948 J
(c) 14052 J (d) 9940 J

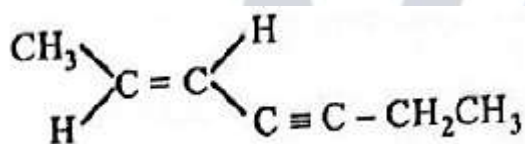
52. The polymer used for optical lenses is:

- (a) polypropylene (b) polyvinyl chloride
(c) polythene (d) polymethyl methacrylate

53. Which of the following arrangements represents the increasing order (smallest to largest) of ionic radii of the given species O^{2-} , S^{2-} , N^{3-} , P^{3-} ?

- (a) $O^{2-} < N^{3-} < S^{2-} < P^{3-}$
(b) $O^{2-} < P^{3-} < N^{3-} < S^{2-}$
(c) $N^{3-} < O^{2-} < P^{3-} < S^{2-}$
(d) $N^{3-} < S^{2-} < O^{2-} < P^{3-}$

54. The IUPAC name of the following compound is



- (a) (E)-2-hepten-4-yne (b) (Z)-5-hepten-3-yne
(c) (E)-5-hepten-3-yne (d) (Z)-2-hepten-4-yne

55. In CsCl type structure, the co-ordination number of Cs^+ and Cl^- respectively are

- (a) 6,6 (b) 6,8
(c) 8,8 (d) 8,6

56. Which one of the following reactions will not result in the formation of carbon-carbon bond?

- (a) Reimer-Tiemann reaction (b) Friedel Craft's acylation
(c) Wurtz reaction (d) Cannizzaro reaction

57. Water is

- (a) more polar than H_2S

- (b) more or less identical in polarity with H_2S
- (c) less polar than H_2S
- (d) None of these

58. Carboxylic acids are more acidic than phenol and alcohol because of

- (a) intermolecular hydrogen bonding
- (b) formation of dimers
- (c) highly acidic hydrogen
- (d) resonance stabilization of their conjugate base

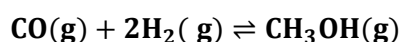
59. The order of increasing sizes of atomic radii among the elements O, S, Se and As is :

- (a) $\text{As} < \text{S} < \text{O} < \text{Se}$ (b) $\text{Se} < \text{S} < \text{As} < \text{O}$
- (c) $\text{O} < \text{S} < \text{As} < \text{Se}$ (d) $\text{O} < \text{S} < \text{Se} < \text{As}$

60. Bauxite ore is generally contaminated with impurity of oxides of two elements X and Y. Which of the following statement is correct?

- (a) X is a non-metal and belongs to the third period while Y is a metal and belongs to the fourth period
- (b) One of two oxides has three-dimensional polymeric structure.
- (c) Both (a) and (b) are correct.
- (d) None of the above.

61. The partial pressure of $\text{CH}_3\text{OH}(\text{g})$, $\text{CO}(\text{g})$ and $\text{H}_2(\text{g})$ in equilibrium mixture for the reaction,



are 2.0, 1.0 and 0.1 atm respectively at 427°C . The value of K_p for the decomposition of CH_3OH to CO and H_2 is

- (a) 10^2 atm (b) $2 \times 10^2 \text{ atm}^{-1}$
- (c) 50 atm^2 (d) $5 \times 10^{-3} \text{ atm}^2$

62. The conjugate base of $(\text{CH}_3)_2\text{NH}_2^+$ is

- (a) $(\text{CH}_3)_2\text{NH}$ (b) $(\text{CH}_3)_2\text{N}^+$
- (c) $(\text{CH}_3)_3\text{N}^+$ (d) $(\text{CH}_3)_2\text{N}^-$

63. Which of the following is not present in a nucleotide?

- (a) Guanine (b) Cytosine
- (c) Adenine (d) Tyrosine

64. The shape of $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is

- (a) tetrahedral (b) square planar
(c) pyramidal (d) octahedral

65. Heroin is a derivative of

- (a) cocaine (b) morphine
(c) caffeine (d) nicotine

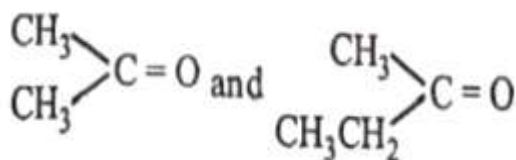
66. The limiting equivalent conductivity of NaCl, KCl and KBr are 126.5, 150.0 and $151.5 \text{ S cm}^2 \text{ eq}^{-1}$, respectively. The limiting equivalent ionic conductivity for Br is $78 \text{ S cm}^2 \text{ eq}^{-1}$. The limiting equivalent ionic conductivity for Na^+ ions would be:

- (a) 128 (b) 125
(c) 49 (d) 50

67. Rate of dehydration of alcohols follows the order:

- (a) $2^\circ > 1^\circ > \text{CH}_3\text{OH} > 3^\circ$
(b) $3^\circ > 2^\circ > 1^\circ > \text{CH}_3\text{OH}$
(c) $2^\circ > 3^\circ > 1^\circ > \text{CH}_3\text{OH}$
(d) $\text{CH}_3\text{OH} > 1^\circ > 2^\circ > 3^\circ$

68. An alkene having molecular formula C_7H_{14} was subjected to ozonolysis in the presence of zinc dust. An equimolar amount of the following two compounds was obtained



The IUPAC name of the alkene is

- (a) 3,4-dimethyl-3-pentene (b) 3,4-dimethyl-2-pentene
(c) 2,3-dimethyl-3-pentene (d) 2,3-dimethyl-2-pentene

69. Lanthanoid contraction can be observed in

- (a) At (b) Gd
(c) Ac (d) Lw

70. The form of iron obtained from blast furnace is:

- (a) Steel (b) Cast Iron
(c) Pig Iron (d) Wrought Iron

PART-III MATHEMATICS

71. A class has 175 students. The following data shows the number of students opting one or more subjects. Maths-100, Physics-70, Chemistry-40, Maths and Physics-30, Maths and Chemistry-28, Physics and Chemistry-23, Maths, Physics and Chemistry-18. How many have offered Maths alone?

- (a) 35 (b) 48
(c) 60 (d) 22

72. Let R be a relation on the set N be defined by $\{(x, y) \mid x, y \in N, 2x + y = 41\}$. Then, R is

- (a) Reflexive (b) Symmetric
(c) Transitive (d) None of these

73. The function $f: R \rightarrow R$ defined by $f(x) = x^2 + x$ is.

- (a) one-one (b) onto
(c) many-one (d) None of these

74. If $12\cot^2 \theta - 31\operatorname{cosec} \theta + 32 = 0$, then the value of $\sin \theta$ is

- (a) $\frac{3}{5}$ or 1 (b) $\frac{2}{3}$ or $-\frac{2}{3}$
(c) $\frac{4}{5}$ or $\frac{3}{4}$ (d) $\pm \frac{1}{2}$

75. The modulus of $\frac{(1+i\sqrt{3})(2+2i)}{(\sqrt{3}-i)}$ is

- (a) 2 (b) 4
(c) $3\sqrt{2}$ (d) $2\sqrt{2}$

76. If α, β are the roots of the equation $ax^2 + bx + c = 0$, then $\frac{\alpha}{a\beta+b} + \frac{\beta}{a\alpha+b} =$

- (a) $\frac{2}{a}$ (b) $\frac{2}{b}$
(c) $\frac{2}{c}$ (d) $-\frac{2}{a}$

77. The solution set of the inequality $37 - (3x + 5) \geq 9x - 8(x - 3)$ is

- (a) $(-\infty, 2)$ (b) $(-\infty, -2)$
(c) $(-\infty, 2]$ (d) $(-\infty, -2]$

78. If ${}^{n+2}C_8 : {}^{n-2}P_4 = 57 : 16$, then the value of n is:

- (a) 20 (b) 19
(c) 18 (d) 17

79. The middle term in the expansion of $\left(\frac{10}{x} + \frac{x}{10}\right)^{10}$ is

- (a) ${}^{10}C_5$ (b) ${}^{10}C_6$
(c) ${}^{10}C_5 \frac{1}{x^{10}}$ (d) ${}^{10}C_5 x^{10}$

80. The fourth, seventh and tenth terms of a G.P. are p, q, r respectively, then:

- (a) $p^2 = q^2 + r^2$ (b) $q^2 = pr$
(c) $p^2 = qr$ (d) $pqr + pq + 1 = 0$

81. The point $(t^2 + 2t + 5, 2t^2 + t - 2)$ lies on the line $x + y = 2$ for

- (a) All real values of t (b) Some real values of t
(c) $t = \frac{-3 \pm \sqrt{3}}{6}$ (d) None of these

82. The equations of the lines which cuts off an intercept 1 from y -axis and equally inclined to the axes are

- (a) $x - y + 1 = 0, x + y + 1 = 0$
(b) $x - y - 1 = 0, x + y - 1 = 0$
(c) $x - y - 1 = 0, x + y + 1 = 0$
(d) None of these

83. The distance between the parallel lines $3x - 4y + 7 = 0$ and $3x - 4y + 5 = 0$ is $\frac{a}{b}$. Value of $a + b$ is

- (a) 2 (b) 5
(c) 7 (d) 3

84. For what value of k , does the equation

$$9x^2 + y^2 = k(x^2 - y^2 - 2x)$$

represent equation of a circle?

- (a) 1 (b) 2
(c) -1 (d) 4

85. A parabola has the origin as its focus and the line $x = 2$ as the directrix. Then the vertex of the parabola is at

- (a) (0,2) (b) (1,0)

- (c) (0,1) (d) (2,0)

86. Equation of the ellipse whose axes are the axes of coordinates and which passes through the point $(-3, 1)$ and has eccentricity $\sqrt{\frac{2}{5}}$ is

- (a) $5x^2 + 3y^2 - 48 = 0$ (b) $3x^2 + 5y^2 - 15 = 0$
(c) $5x^2 + 3y^2 - 32 = 0$ (d) $3x^2 + 5y^2 - 32 = 0$

87. The co-ordinates of the point which in the ratio 3:4 internally are points $(2, -1, 3)$ and $(4, 3, 1)$ in the ratio 3:4 internally are given by:

- (a) $\left(\frac{2}{7}, \frac{20}{7}, \frac{10}{7}\right)$ (b) $\left(\frac{10}{7}, \frac{15}{7}, \frac{2}{7}\right)$
(c) $\left(\frac{20}{7}, \frac{5}{7}, \frac{15}{7}\right)$ (d) $\left(\frac{15}{7}, \frac{20}{7}, \frac{3}{7}\right)$

88. The relationship between a and b, so that the function f defined by $f(x) = \begin{cases} ax + 1 & \text{if } x \leq 3 \\ bx + 3 & \text{if } x > 3 \end{cases}$ is continuous at $x = 3$, is

- (a) $a = b + \frac{2}{3}$ (b) $a - b = \frac{3}{2}$
(c) $a + b = \frac{2}{3}$ (d) $a + b = 2$

89. $f(x) = \begin{cases} x \sin \frac{1}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$ at $x = 0$ is

- (a) continuous as well as differentiable
(b) differentiable but not continuous
(c) continuous but not differentiable
(d) neither continuous nor differentiable

90. The variance of the data 2, 4, 6, 8, 10 is

- (a) 8 (b) 7
(c) 6 (d) None of these

91. Find the probability of getting the sum as a perfect square number when two dice are thrown together.

- (a) $\frac{5}{12}$ (b) $\frac{7}{18}$
(c) $\frac{7}{36}$ (d) None of these

92. The principal value of $\sin^{-1}\left(\sin \frac{5\pi}{3}\right)$ is

- (a) $-\frac{5\pi}{3}$ (b) $\frac{5\pi}{3}$

(c) $-\frac{\pi}{3}$ (d) $\frac{4\pi}{3}$

93. If the system of linear equations

$$x + ky + 3z = 0$$

$$3x + ky - 2z = 0$$

$$2x + 4y - 3z = 0$$

has a non-zero solution (x, y, z), then $\frac{xz}{y^2}$ is equal to:

- (a) 10 (b) -30
(c) 30 (d) -10

94. The value of definite integral $\int_0^{\frac{\pi}{2}} \log(\tan x) dx$ is

- (a) 0 (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{2}$ (d) p

95. The area enclosed between the graph of $y = x^3$ and the lines $x = 0, y = 1, y = 8$ is

- (a) $\frac{45}{4}$ (b) 14
(c) 7 (d) None of these

96. The total number of 3-digit numbers, the sum of whose digits is even, is equal to

- (a) 450 (b) 350
(c) 250 (d) 325

97. To fill 12 vacancies, there are 25 candidates of which five are from scheduled caste. If 3 of the vacancies are reserved for scheduled caste candidates while the rest are open to all, then the number of ways in which the selection can be made

- (a) ${}^5C_3 \times {}^{22}C_9$ (b) ${}^{22}C_9 - {}^5C_3$
(c) ${}^{22}C_3 + {}^5C_3$ (d) None of these

98. $\frac{1}{q+r}, \frac{1}{r+p}, \frac{1}{p+q}$ are in (a)P. then,

- (a) p, q, r are in (a)P (b) p^2, q^2, r^2 are in (a)P
(c) $\frac{1}{p}, \frac{1}{q}, \frac{1}{r}$ are in (a)P (d) $p + q + r$ are in (a)P

99. The sum of the first n terms of the series

$$1^2 + 2 \cdot 2^2 + 3^2 + 2 \cdot 4^2 + 5^2 + 2 \cdot 6^2 + \dots$$

is $\frac{n(n+1)^2}{2}$ when n is even. When n is odd the sum is

(a) $\left[\frac{n(n+1)}{2}\right]^2$ (b) $\frac{n^2(n+1)}{2}$

(c) $\frac{n(n+1)^2}{4}$ (d) $\frac{3n(n+1)}{2}$

100. The locus of a point that is equidistant from the lines $x + y - 2\sqrt{2} = 0$ and $x + y - \sqrt{2} = 0$ is

(a) $x + y - 5\sqrt{2} = 0$ (b) $x + y - 3\sqrt{2} = 0$
(c) $2x + 2y - 3\sqrt{2} = 0$ (d) $2x + 2y - 5\sqrt{2} = 0$

101. The point diametrically opposite to the point $P(1, 0)$ on the circle $x^2 + y^2 + 2x + 4y - 3 = 0$ is

(a) $(3, -4)$ (b) $(-3, 4)$
(c) $(-3, -4)$ (d) $(3, 4)$

102. For the parabola $y^2 = -12x$, equation of directrix is $x = a$. The value of 'a' is

(a) 3 (b) 4
(c) 2 (d) 6

103. The eccentricity of the curve $2x^2 + y^2 - 8x - 2y + 1 = 0$ is:

(a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$
(c) $\frac{2}{3}$ (d) $\frac{3}{4}$

104. The equation of the hyperbola with vertices at $(0, \pm 6)$ and $e = \frac{5}{3}$ is

(a) $\frac{x^2}{36} - \frac{y^2}{64} = 1$ (b) $\frac{y^2}{36} - \frac{x^2}{64} = 1$
(c) $\frac{x^2}{64} - \frac{y^2}{36} = 1$ (d) $\frac{y^2}{64} - \frac{x^2}{36} = 1$

105.

$\sin^2 x$	$\cos^2 x$	1
$\cos^2 x$	$\sin^2 x$	1
-10	12	2

is equal to:

(a) 0
(b) $12\cos^2 x - 10\sin^2 x$
(c) $12\cos^2 x - 10\sin^2 x - 2$
(d) $10\sin 2x$

106. The function $f(x) = \begin{cases} x[x] & \text{if } 0 \leq x < 2 \\ (x-1)x & \text{if } 2 \leq x < 3 \end{cases}$

- (a) differentiable at $x = 2$
- (b) not differentiable at $x = 2$
- (c) continuous at $x = 2$
- (d) None of these

107. The local minimum value of the function f given by $f(x) = 3 + |x|, x \in \mathbb{R}$ is

- (a) 1
- (b) 2
- (c) 3
- (d) 0

108. Value of $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$ is

- (a) $\frac{\pi}{2}$
- (b) $-\frac{\pi}{2}$
- (c) $\frac{\pi}{4}$
- (d) None of these

109. The equation of the plane which bisects the angle between the planes $3x - 6y + 2z + 5 = 0$ and $4x - 12y + 3z - 3 = 0$ which contains the origin is

- (a) $33x - 13y + 32z + 45 = 0$
- (b) $x - 3y + z - 5 = 0$
- (c) $33x + 13y + 32z + 45 = 0$
- (d) None of these

110. An urn contains five balls. Two balls are drawn and found to be white. The probability that all the balls are white is

- (a) $\frac{1}{10}$
- (b) $\frac{3}{10}$
- (c) $\frac{3}{5}$
- (d) $\frac{1}{2}$

PART - IV (APTITUDE TEST)

111. What is the total marks obtained by Meera in all the subject?

- (a) 448
- (b) 580
- (c) 470
- (d) 74.67

112. What is the average marks obtained by these seven students in History? (rounded off to two digits)

- (a) 72.86
- (b) 27.32
- (c) 24.86
- (d) 29.14

113. How many students have got 60% or more marks in all the subjects?

- (a) One (b) Two
(c) Three (d) Four

114. A series is given, with one term missing. Choose the correct alternative from the given ones that will complete the series. 5, 11, 24, 51, 106, _?

- (a) 122 (b) 217
(c) 120 (d) 153

115. In a certain code BANKER is written as LFSCBO. How will CONFER be written in that code?

- (a) GFSDPO (b) GFSEPO
(c) FGSDOP (d) FHSDPO

116. Kailash faces towards north. Turnings to his right, he walks 25 metres. He then turns to his left and walks 30 metres. Next, he moves 25 metres to his right. He then turns to the right again and walks 55 metres. Finally, he turns to the right and moves 40 metres. In which direction is he now from his starting point?

- (a) South-West (b) North-West
(c) South (d) South-East

117. An accurate clock shows 8 O'clock in the morning. Through how many degrees will the hour hand rotate when the clock shows 20 clock in the afternoon?

- (a) 144° (b) 150°
(c) 168° (d) 180°

118. Two statements are given followed by three conclusions numbered I, II and III. Assuming the statements to be true, even if they seem to be at variance with commonly known facts, decide which of the conclusions logically follow(s) from the statements.

Statements:

All utensils are spoons.

All bowls are spoons.

Conclusions:

(I) No utensil is a bowls.

(II) Some utensils are bowls

(III) No spoon is a utensil.

- (a) Only conclusions I follows
(b) Conclusions I and III follow

(c) Either conclusion I or II follows

(d) Only conclusion III follows

119. What was the ratio between the ages of P and Q four years ago?

(I) The ratio between the present ages of P and Q is 3: 4.

(II) The ratio between the present ages of Q and R is 4: 5.

(a) if the data in statement I alone are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

(b) if the data in statement II alone are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

(c) if the data in both the statements I and II together are not sufficient to answer the question.

(d) if the data in both the statements I and II together are necessary to answer the question.

120. What was the cost price of the suitcase purchased by Samir? I Samir got 25 percent concession on the labelled price. II. Samir sold the suitcase for ₹2000 with 25 percent profit on the labelled price:

(a) if the data in statement I alone are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

(b) if the data in statement II alone are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

(c) if the data in both the statements I and II together are not sufficient to answer the question.

(d) if the data in both the statements I and II together are necessary to answer the question.

PART-V ENGLISH

121. Read the following passage and answer the question that follows. Choose the correct answer.

His instrument struck against something hard, dangerously near the kidney.... "It is not quite at the kidney, my friend," Sadao murmured... "My friend," he always called his patients and so he did now, forgetting that this was his enemy.

To whom does Sadao attend to in the lines above?

(a) A relative (b) His friend

(c) His enemy (d) A patient

122. Choose the correct pronunciation for the word 'sorbet' from the following

(a) sore-bet (b) sore-bay

(c) sore-bye (d) shore- bay

123. What is the correct syllable division of the word 'indomitable'?

(a) in - do - mit - able (b) in - dom- i - ta - ble

- (c) in - do - mi - ta - ble (d) in - dom - i - table

124. Read the following passage and the question below. Choose the correct answer.

Gandhi never contented himself with large political or economic solutions. He saw the cultural and social backwardness in the Champaran villages and wanted to do something about it immediately. He appealed to teachers.

Which of the following statements is true about the passage?

- (a) Gandhi was dissatisfied with political or economic solutions
- (b) Gandhi was interested in the welfare of teachers of Champaran villages
- (c) Gandhi was happy about the cultural and social backwardness of Champaran villages
- (d) Gandhi was hopeful that teachers could save villages from cultural and social backwardness

125. Choose the correct meaning of the idiom 'a bolt out of the blue' from the given

- (a) Something totally unexpected
- (b) Lightning and thunderstorm
- (c) To do something kind
- (d) To mourn after someone

