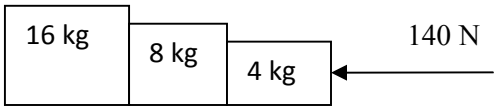
Sr. No.	Question

1. While walking on smooth surface one should take small steps to ensure
   (A) Large friction (B) Small friction
   (C) Larger normal force (D) Smaller normal force

2. What happens to a vehicle travelling in an unbanked curved path if the friction between the road and tires suddenly disappears
   (A) Moves along tangent (B) Moves radially in
   (C) Moves radially out (D) Moves along the curve

3. A ball of mass 0.2 kg strikes an obstacle and moves at 60^0 to its initial direction. If its speed changes from 20m/s to 10m/s the magnitude of impulse received by the ball is ------Ns
   (A) $2\sqrt{7}$ (B) $2\sqrt{3}$
   (C) $2\sqrt{5}$ (D) $3\sqrt{2}$

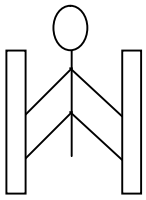
4. A spacecraft of mass 2000kg moving with 600 m/s suddenly explodes into two pieces. One piece of mass 500 kg is stationary. The velocity of other part in m/s is
   (A) 600 (B) 800
   (C) 1500 (D) 1000

5. 

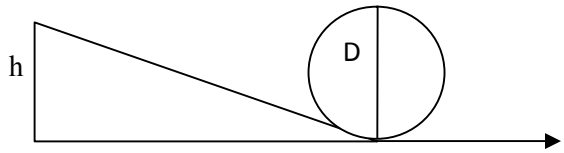
   The force on 16 kg is…….?

   (A) 140N (B) 120N
   (C) 100N (D) 80N

6. A man of mass 40 kg is at rest between the walls. If co eff. of friction between man and wall is 0.8, find the normal reaction exerted by wall on man (take g = 10 m/s/s)



   (A) 100 N (B) 250 N
   (C) 80 N (D) 50 N

7. 

   Find minimum height in terms of D to complete the loop

   (A) 7D/4 (B) 9D/4
   (C) 5D/4 (D) 3D/4

8. Gravitational force between two bodies is F. The space around the mass is now filled with a liquid of specific gravity 3. The gravitational force will be
(A) F/9 (B) 3F
(C) F (D) F/3

9. A man weighs 75 kg on the surface of earth. His weight on the geostationary satellite is
(A) infinity (B) 150kg
(C) zero (D) 75/2 kg

10. g at a depth of 1600 km inside the earth in m/s/s is
(A) 6.65 (B) 7.35
(C) 8.65 (D) 4.35

11. A block of mass 19 M is suspended by a string of length 1m. A bullet of mass M hits it and gets embedded in it. If the block completes the vertical circle the velocity of bullet in m/s is
(A) 140 (B) $20\sqrt{19.6}$
(C) $20\sqrt{9.8}$ (D) 20

12. A rubber ball falls from a height of 4m and rebounds to 1.5m. The % loss of energy during the impact is
(A) 20 (B) 62.5
(C) 23 (D) 60

13. 25 kg of sand is deposited each second on a conveyor belt moving at 10m/s. The extra power required to maintain the belt in motion is
(A) 2600W (B) 250W
(C) 325W (D) 2500W

14. A uniform rod of mass M and length L standing vertically on a horizontal floor falls without slipping at the bottom. The moment of inertia will be
(A) $ML^2/3$ (B) $ML^2/6$
(C) $ML^2/9$ (D) $ML^2/12$

15. If the velocity of C.M of a rolling body is V, then velocity of highest point in the body will be
(A) $\sqrt{2}$ V (B) V
(C) 2V (D) $V/\sqrt{2}$

16. The angular momentum of two rotating bodies are equal. If the ratio of their M.I is 1:4, the ratio of their rotational K.E is
(A) 1:2 (B) 2:1
(C) 1:4 (D) 4:1

17. The level of water in a tank is 5m. A hole 1 cm^2 is made at the bottom. The rate of leakage in m^3 /s is (take g= 10 m/s/s)
(A) 10^{-3} (B) 10^{-4}
(C) 10 (D) 10^{-2}

18. Two blocks A and B float in water. A floats with $1/4^{th}$ of its volume immersed and B floats with $3/5^{th}$ of its volume immersed. The ratio of their densities is
(A) 5:12 (B) 12:5
(C) 3:20 (D) 20:3

19. The terminal velocity of a spherical ball of lead of radius R is V while falling through a viscous liquid varies with R such that
(A) V/R is constant (B) VR is constant
(C) V is constant (D) V/R^2 is constant

20. A hydraulic press uses a piston of 100 cm^2 to exert a force of 10^7 dynes on water. The area of the other piston that supports a mass of 2000 kg is (take g = 10m/s/s)
(A) $100cm^2$ (B) 10^9 cm^2
(C) 2×10^4 cm^2 (D) 2×10^{10} cm^2

21. When kerosene and coconut oil of co eff. of viscosity 0.002 and 0.0154 Ns/m^2 are allowed through the same pipe, under same pressure difference and same time collects 1 lit of coconut oil. The volume of kerosene that flows is
(A) 5.5 lit (B) 6.6 lit
(C) 7.7 lit (D) 8.8 lit

22. There is a circular hole in metal plate. When the plate is heated the radius of the hole becomes
(A) increased (B) decreased
(C) unchanged (D) depends on metal

23. Specific heat of a substance depends on 1. Nature of substance. 2. Mass of substance. 3. Heat given to substance
(A) Only 1is correct (B) Both 1 and 2 are correct
(C) All are correct (D) Only 1 and 3 are correct

24. In a give process dW=0, dq is <0 then for a gas
(A) Temperature increases (B) Volume decreases
(C) Pressure increases (D) Pressure decreases

25. The efficiency of carnot engine depends on
(A) Working substance (B) Sink temperature
(C) Source temperature (D) Both B and C

26. A 200 turn coil of self inductance 30 mH carries a current of 5 mA. Find the magnetic flux linked with each turn of coil.
(A) 7.5×10^{-7}Wb (B) 1.6×10^{-7}Wb
(C) 3×10^{-7}Wb (D) 1.5×10^{-7}Wb

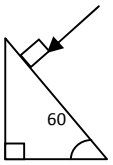
27. The instantaneous value of current in an AC circuit is $I = 2 \sin (100 \pi t + \pi/3)$ A. At what first time, the current will be maximum?
(A) 1/100 s (B) 1/200 s
(C) 1/500 s (D) 1 s

28. What in electric system represents force in mechanical system ?
(A) L (B) I
(C) 1/C (D) q

29. A capacitor of 1 μF is charged with 0.01C of electricity. How much energy is stored in it?
(A) 30J (B) 40J
(C) 50J (D) 60J

30. An electromagnetic wave is travelling in vacuum with a speed of 3×10^8 m/s. Find the velocity in a medium having relative electric and magnetic permeability 2 and 1, respectively.
(A) $3/\sqrt{2} \times 10^8$m/s (B) 1.5×10^8m/s
(C) 2×10^8m/s (D) No change

31. Trace the path of a ray of light passing through a glass prism as shown in the figure. If the refractive index of glass is $\sqrt{3}$, find out the value of angle of emergence from prism.



(A) 30 (B) 45
(C) 60 (D) 75

32. Light wave from two coherent sources of intensities in ratio 64:1 produces interference. Calculate the ratio of maxima and minima of the interference pattern.
(A) 8:1 (B) 64:1
(C) 9:7 (D) 81:49

33. In young's experiment, the width of the fringes obtained with light of wavelength 6000 A^0 is 2 mm. What will be the fringe width, if the entire apparatus is immersed in a liquid of refractive index 1.33?
(A) 1 mm (B) 1.5 mm
(C) 2 mm (D) 2.5 mm

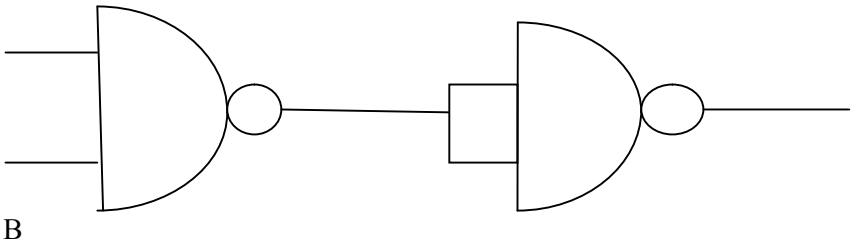
34. Unpolarised light is incident on plane glass surface. What should be the angle of incidence in degrees, so that the reflected and refracted rays are perpendicular to each other?
(A) 37 (B) 47
(C) 57 (D) 67

35. Determine the de-Broglie wavelength associated with an electron, accelerated through a potential difference of 100 V.
(A) $1.227A^0$ (B) $12.27A^0$
(C) $122.7A^0$ (D) $1227A^0$

36. A particle with rest mass m_0 is moving with velocity c. What is the de-Broglie wavelength associated with it?
(A) infinity (B) zero
(C) radio wave (D) X ray

37. Which among the following series gives visible light?
(A) Lyman (B) Balmer
(C) Bracket (D) None of these

38. Identify the logic operation performed by this circuit
A



B

(A) AND (B) OR
(C) NAND (D) NOR

39. The number of silicon atoms per m^3 is 5×10^{28}. This is doped simultaneously with 5×10^{22} atoms per m^3 of arsenic and 5×10^{20} atoms per m^3 of indium. Calculate the number of holes, given that $n_i = 1.5 \times 10^{16}\ m^{-3}$.

(A) $4.54 \times 10^{9} m^{-3}$ (B) $4.95 \times 10^{22} m^{-3}$

(C) $1.5 \times 10^{16} m^{-3}$ (D) $5 \times 10^{28} m^{-3}$

40. Two charges $+5\mu C$ and $-5\mu C$ are placed 5 mm apart. Determine E at a point 10 cm from centre on the positive charge side along the axial line.

(A) 4.5×10^{5} N/C (B) 4.5×10^{5} NC

(C) 4.5×10^{-5} N/C (D) 4.5×10^{-5} NC

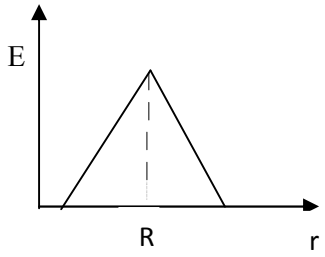
41. If the Gaussian surface is so chosen that there are some charges inside and some outside then the electric field is due to

(A) Only inside charges (B) Only outside charges

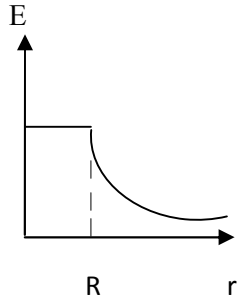
(C) All the charges (D) Cannot determine

42. The following is a diagram showing the variation of E with r from centre of uniformly charge spherical shell of radius R

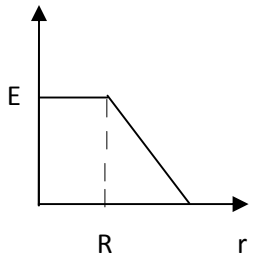
(A)



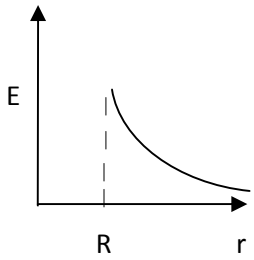
(B)



(C)



(D)



43. Net capacitance of 3 identical capacitor in series is $1\mu F$. What is the net capacitance in μF if connected in parallel?

(A) 3 (B) 6

(C) 9 (D) 12

44. An inductor of 5H carries a steady current of 2A. In what time if the current is made zero can a 40V self induced emf be produced in the inductor.

(A) 2s (B) 1s

(C) 0.5s (D) 0.25s

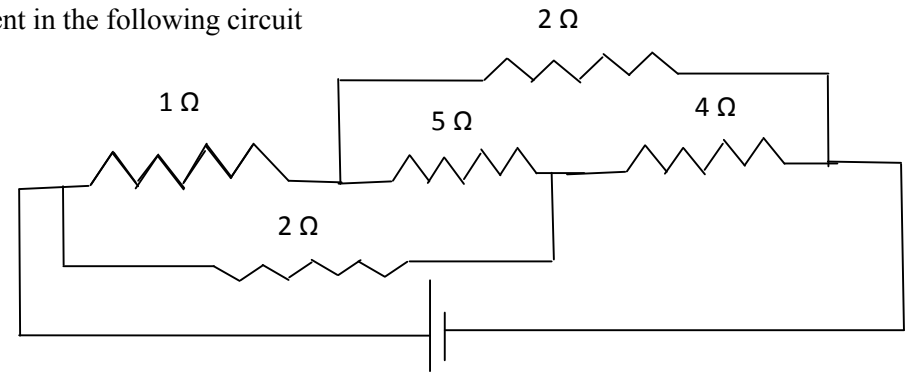
45. A cell of emf E and internal resistance r gives 0.5A with R=12 ohms and 0.25 with R = 25 ohms. Its internal resistance in ohms will be

(A) 0.5 (B) 1

(C) 2 (D) 3

46.

Find current in the following circuit



(A) 1A (B) 2A
(C) 3A (D) 4A

47. Two identical circular loops P and Q of radius r are placed in parallel planes with same axis at a distance of 2r. Find B at the midpoint of the axis between them if same current I flows through both loops.
(A) $\mu_0 I/2^{3/2}r$ (B) $\mu_0 2I/2^{3/2}r$
(C) $\mu_0 I/4\pi$ r (D) Cannot be determined

48. A block of mass 4 kg is kept on a rough horizontal surface. The coefficient of static friction is 0.8. If a force of 19 N is applied on the block parallel to the floor, then the force of friction between the block and floor is:
(A) 19N (B) 18 N
(C) 16N (D) 9.8N

49. Current in a circuit falls steadily from 2A to 0A in 10 ms. Calculate L if emf induced is 200V.
(A) 1H (B) 2H
(C) 3H (D) 4H

50. Self inductance of the air core inductor increases from 0.01 mH to 10 mH on introducing an iron core. What is the relative permeability of the core used?
(A) 500 (B) 800
(C) 900 (D) 1000

51. Among the following, the most stable complex is
(A) $[Fe(H_2O)_6]^{3+}$ (B) $[Fe(NH_3)_6]^{3+}$
(C) $[Fe(C_2O_4)_3]^{3-}$ (D) $[Fe(Cl)_6]^{3-}$

52. Which is the correct coordination number (C.N) and oxidation number (O.N) of the transition metal atom in $[Co(NH_3)_2(H_2O)_2Cl_2]^+$?
(A) C.N=3, O.N=+1 (B) C.N=4, O.N=+2
(C) C.N=6, O.N=+1 (D) C.N=6, O.N=+3

53. In a solid, oxide ions are arranged in ccp, cations A occupy one sixth of the tetrahedral voids and cation B occupy one third of the octahedral voids. The formula of the solid is:
(A) ABO_3 (B) A_3BO
(C) AB_3O (D) $A_3B_3O_3$

54. On mixing acetone to methanol some of the hydrogen bonds between methanol molecules break. Which of the following statements is correct about the above process?

(A) At specific composition methanol acetone mixture will form minimum boiling azeotrope and show positive deviation from Raoult's law

(B) At specific composition methanol acetone mixture will form maximum boiling azeotrope and show positive deviation from Raoult's law

(C) At specific composition methanol acetone mixture will form minimum boiling azeotrope and show negative deviation from Raoult's law

(D) At specific composition methanol acetone mixture will form maximum boiling azeotrope and show negative deviation from Raoult's law

55. K_H value for argon, carbon dioxide, formaldehyde and methane gases are 40.39, 1.67, 1.83 X 10^{-5} and 0.413, respectively. The correct arrangement of these gases in the order of their increasing solubility is:

(A) formaldehyde<methane<carbon dioxide<argon

(B) formaldehyde< carbon dioxide <methane<argon

(C) argon<carbon dioxide< methane<formaldehyde

(D) argon <methane <carbon dioxide <formaldehyde

56. The number of faradays of electricity required for electrolytic conversion of the mole of nitrobenzene to aniline is:

(A) 3F

(B) 4F

(C) 6F

(D) 5F

57. The positive value of the standard electrode potential of Ag^+/Ag indicates that:

(A) This redox couple is a stronger reducing agent than H^+/H_2 couple

(B) This redox couple is a stronger oxidizing agent than H^+/H_2 couple

(C) Ag can displace H_2 from acid

(D) Ag can displace H_2 from base

58. Milk is refrigerated in order to slow the rate of decomposition by bacterial action. The decrease in reaction rate is due to:

(A) A decrease in surface area

(B) A decrease in $\triangle H$ for the reaction

(C) A decrease in the fraction of particles possessing sufficient energy

(D) The introduction of an alternative pathway with greater activation energy.

59. Which of the following statements is not correct?

(A) The rate of a reaction decreases with passage of time as concentration of reactants decrease

(B) The instantaneous rate a reaction is same at any time during the reaction

(C) For a zero order reaction the concentration of reactants remains changed with passage of time

(D) The rate of a reaction decreases with increase in concentration of reactant (s)

60. Which of the following gases shows the lowest adsorption per gram of charcoal? The critical temperatures are given in parenthesis:

(A) H_2 (33K)

(B) CH_4 (190K)

(C) SO_2(630K)

(D) CO_2 (304K)

61. Freundlich adsorption isotherm is given by the expression $x/m=kp^{1/n}$. Which of the following statements are false?

i. When 1/n=0, the adsorption is independent of pressure.
ii. When n=0, the plot of x/m vs p graph is a line parallel to x axis.
iii. When 1/n=0, the adsorption is directly proportional to pressure.
iv. When n=0, plot of x/m vs p is a curve

(A) i and ii (B) ii and iv
(C) i and iii (D) all are false

62. In the extraction of chlorine by electrolysis of an aqueous solution of sodium chloride, which of the following statements are true?

i. $\triangle G^0$ for the overall reaction is positive
ii. $\triangle G^0$ for the overall reaction is negative
iii. E^0 for the overall reaction is positive
iv. E^0 for the overall reaction is negative

(A) i and iv (B) i and iii
(C) ii and iii (D) iii and iv

63. Which of the following pairs of ions are isoelectronic and isostructural ?

(A) NO_2^+ and NO_3^- (B) ClO_3^- and ICl_4^-
(C) XeO_3^{2-} and PCl_3 (D) ClO_3^- and SO_3^{2-}

64. Which of the following hydrides is the strongest reducing agent?

(A) NH_3 (B) PH_3
(C) AsH_3 (D) SbH_3

65. Consider the reactions,

i. $Zn + \text{Conc. } HNO_3 \text{ (hot)} \longrightarrow Zn(NO_3)_2 + X + H_2O$
ii. $Zn + \text{dil. } HNO_3 \text{ (cold)} \longrightarrow Zn(NO_3)_2 + Y + H_2O$

Compounds X and Y are, respectively

(A) N_2O, NO (B) NO_2, NO_2
(C) N_2, N_2O (D) NO_2, NO

66. When $KMnO_4$ acts as an oxidizing agent in weakly alkaline medium, the oxidation number of manganese decreases by:

(A) 1 (B) 2
(C) 3 (D) 5

67. Acidified potassium dichromate solution turns green when Na_2SO_3 is added to it due to the formation of:

(A) $CrSO_4$ (B) $Cr_2(SO_4)_3$
(C) CrO_4^{2-} (D) $Cr_2(SO_3)_3$

68. The d-electron configurations of Cr^{2+}, Mn^{2+}, Fe^{2+} and Co^{2+} are d^4, d^5, d^6 and d^7, respectively. Which one of the following complexes will exhibit minimum paramagnetic behavior? (atomic numbers of Cr=24, Mn=25, Fe=26, Co=27)

(A) $[Cr(H_2O)_6]^{2+}$ (B) $[Mn(H_2O)_6]^{2+}$
(C) $[Fe(H_2O)_6]^{2+}$ (D) $[Co(H_2O)_6]^{2+}$

69. When 2-Bromopentane is heated with potassium ethoxide in ethanol, the major product obtained is:

(A) 2-Ethoxypentane (B) Pent-1-ene
(C) Cis-Pent-2-ene (D) Trans-Pent-2-ene

70. Which of the following undergoes nucleophilic substitution exclusively by S_N^1mechnism?
(A) Chloroethane (B) Isopropyl chloride
(C) Chlorobenzene (D) Benzyl chloride

71. The number of possible stereoisomers for $CH_3CH{=}CHCH_2CH(Br)CH_3$ is:
(A) 8 (B) 2
(C) 4 (D) 6

72. 2-Methoxy-2-methylpropane on heating with HI produces:
(A) Methanol and sec-propyl iodide (B) Methyl iodide and tert-butyl alcohol
(C) Methyl iodide and isobutene (D) Methanol and tet-butyl iodide

73. The least acidic compound among the following is:
(A) o-Nitrophenol (B) m-Nitrophenol
(C) p-Nitrophenol (D) Phenol

74. An alkene C_7H_{14} on reductive ozonolysis gives an aldehyde with formula C_3H_6O and a ketone. The ketone is:
(A) 2-Butanone (B) 2-Pentanone
(C) 3-Pentanone (D) Propanone

75. The increasing order of the rate of addition of HCN to the compounds i) Formaldehyde ii) Acetone iii) Acetophenone iv) benzophenone
(A) i<ii < iii< iv (B) iv< ii< iii < i
(C) iv<iii< ii< i (D) iv< i< ii< iii

76. The carboxylic acid that does not undergo Hell-Vohlard-Zelinsky reaction is:
(A) CH_3COOH (B) $(CH_3)_2CHCOOH$
(C) $CH_3CH_2CH_2COOH$ (D) $(CH_3)_3CCOOH$

77. $C_2H_5NH_2 \xrightarrow{NaNO_2/HCl} X \xrightarrow{P/Br_2} Y \xrightarrow[(excess)]{NH_3} Z.$
In the above sequence, Z is:
(A) cyanoethane (B) ethanamide
(C) methanamine (D) ethanamine

78. The attachment of which of the following group at para position in aniline will raise the K_b value?
(A) $-SO_3H$ (B) $-OH$
(C) $-F$ (D) $-Br$

79. Which of the following is an example of globular protein?
(A) myosin (B) collagen
(C) keratin (D) haemoglobin

80. Which one of the following is synthesized in our body by sun rays?
(A) Vitamin D (B) Vitamin B
(C) Vitamin K (D) Vitamin A

81. Caprolactum is the is the starting material for the synthesis of
(A) Nylon-6 (B) Nylon6,6
(C) Terylene (D) Nylon 10

82. The species which can serve as an initiator for cationic polymerization is
(A) Lithium aluminium hydride (B) Nitric acid
(C) Aluminium chloride (D) BuLi

83. Aspirin is an:
(A) analgesic (B) antipyretic
(C) antimalarial (D) Both analgesic and antipyretic

84. The equivalent mass of iron in the reaction $2Fe + 3Cl_2 \rightarrow 2FeCl_3$ is:
(A) Half of its atomic mass (B) One third of its atomic mass
(C) Same as atomic mass (D) One fourth of its atomic mass

85. Which of the following sets of quantum numbers is correct for an electron in 4f subshell?
(A) n=4, l=3, m=4, s = +1/2 (B) n=4, l=3, m=−4, s = −1/2
(C) n=4, l=3, m=+1, s = +1/2 (D) n=3, l=2, m=−2, s = +1/2

86. The correct sequence of atomic radii is:
(A) Na>Mg>Al>Si (B) Al>Si>Na>Mg
(C) Si>Al>Mg>Na (D) Si>Al>Na>Mg

87. In which of the following, the bond angle around the central atom is maximum?
(A) NH_3 (B) NH_4^+
(C) PCl_3 (D) SCl_2

88. Which of the following molecule does not exist
(A) NF_3 (B) NF_5
(C) PF_5 (D) N_2H_4

89. If helium is allowed to expand in vacuum, it liberates heat because
(A) It is an inert gas (B) It is an ideal gas
(C) Its critical temp. is low (D) It is a light gas

90. i) $H_2(g) + 1/2O_2(g) \rightarrow H_2O(I) + x$ KJ ii) $H_2(g) + 1/2O_2(g) \rightarrow H_2O(g) + y$ KJ; For the given two reactions,
(A) x > y (B) x < y
(C) x = y (D) x +y = 0

91. If the bond dissociation energies of XY, X_2, Y_2 (all diatomic molecules) are in the ratio 1:1:0.5, respectively and $\Delta_f H$ of XY is -200KJmol^{-1}, the bond dissociation energy of X_2 will be:
(A) 400 KJmol^{-1} (B) 300 KJmol^{-1}
(C) 200 KJmol^{-1} (D) 100 KJmol^{-1}

92. What will be the correct order of vapour pressure of water, ethanol and ether at 30^0C? Given that among these compounds water has maximum boiling point and ether has minimum boiling point.
(A) Water<ether<ethanol (B) Water<ethanol<ether
(C) Ether<ethanol<water (D) Ethanol<ether<water

93. Which of the following will occur if a 0.1M solution of a weak acid is diluted to 0.01M at constant temperature?
(A) $[H^+]$ will decrease to 0.001M (B) pH will decrease
(C) Percentage ionization will increase (D) K_a will increase

94. Which of the following species involves the transfer of $5N_A$ electrons per mole of it ?
(A) $MnO_4^{2-} \rightarrow MnO_4^-$ (B) $MnO_4^- \rightarrow Mn^{2+}$
(C) $MnO_4^- \rightarrow MnO_2$ (D) $CrO_4^{2-} \rightarrow Cr^{3+}$

95. 30-volume hyderogen peroxide means:
(A) 30% H_2O_2 by volume (B) 30g of H_2O_2 solution containing 1g of it
(C) 1 cm^3 of solution liberates 30 cm^3 of O_2 gas at STP (D) 30 cm^3 of the solution contains one

mole of H_2O_2

96. The correct sequence of covalent character is represented by:
(A) LiCl<NaCl<$BeCl_2$ (B) $BeCl_2$<LiCl<NaCl
(C) NaCl<LiCl< $BeCl_2$ (D) $BeCl_2$<NaCl< LiCl

97. Which of the following is known as pyrene?
(A) CCl_4 (B) CS_2
(C) S_2Cl_2 (D) Solid CO_2

98. The most stable carbocation amongst the following is:
(A) $(CH_3)_2CH^+$ (B) Ph_3C^+
(C) $CH_3CH_2^+$ (D) CH_2=CH-CH_2^+

99. The molecule that will have dipole moment is:
(A) 2,2-Dimethylpropane (B) cis-2-Butene
(C) trans-2-Butene (D) 2,2,3,3-Tetramethylbutane

100. Of the five isomeric hexanes, the isomer which can give two monochlorinated compound is:
(A) 2-Methylpentane (B) 2,2-Dimethylbutane
(C) 2,3-Dimethylbutane (D) n-Hexane

101. If the letters of the word SACHIN are arranged in all possible ways and these words are written out as in dictionary, then the word SACHIN appears at serial number
(A) 601 (B) 600
(C) 603 (D) 602

102. The number of ways of distributing 8 identical balls in 3 distinct boxes so that none of the boxes remain empty is
(A) 5 (B) 21
(C) 3^8 (D) $^8C_3$

103. The number of arrangements of the letters of the word BANANA in which the two N's do not appear adjacently is
(A) 40 (B) 60
(C) 80 (D) 100

104. Number of divisors of the form 4n+2 ($n \geq 0$) of the integer 240 is
(A) 4 (B) 8
(C) 10 (D) 3

105. 6 men and 4 women are to be seated in a row so that no two women sit together. The number of ways they can be seated is
(A) 604800 (B) 17280
(C) 120960 (D) 518400

106. If the cube roots of unity are 1,ω, ω^3, then the roots of the equation $(x-1)^3 + 8 = 0$ are
(A) -1, -1 + 2 ω, -1 - 2 ω^2 (B) -1, -1, -1
(C) -1, 1-2 ω, 1-2 ω^2 (D) -1, 1+2 ω, 1+2 ω^2

107. If z_1 and z_2 are two non-zero complex numbers such that $|z_1 + z_2| = |z_1| + |z_2|$, then arg (z_1) – arg (z_2) is equal to
(A) $\frac{\pi}{2}$ (B) $-\frac{\pi}{2}$
(C) 0 (D) 1

108. If arg (z) < 0, then arg (-z) – arg (z) =
(A) π (B) $-\pi$
(C) $-\pi/2$ (D) $\pi/2$

109. If ω is an imaginary cube root of unity, then $(1+\omega-\omega^2)^7$ equals
(A) $128\,\omega$ (B) $-128\,\omega$
(C) $128\,\omega^2$ (D) $-128\,\omega^2$

110. The points z1, z2, z3, z4 in the complex plane are the vertices of a parallelogram taken in order if and only if
(A) z1 + z4 = z2+ z3 (B) z1 + z3 = z2+ z4
(C) z1 + z2 = z3+ z4 (D) None of these

111. Let R = {(3,3) (6,6) (9,9) (12,12), (6,12) (3,9) (3,12), (3,6)}be in a relation on the set A= {3, 6, 9, 12}. The relation is
(A) Reflexive and transitive (B) Reflexive only
(C) An equivalence relation (D) Reflexive and symmetric only

112. If a real valued function f (x) satisfies the functional equation f (x–y) = f (x) f (y) – f (a–x) f (a+y), where 'a' is a given constant and f (0) =1, then f (2a–x) is equal to
(A) –f (x) (B) f (x)
(C) f (x) + f (a–x) (D) f (–x)

113. If the graph of the function f (x) is symmetrical about the line x=2, then
(A) f (x+2) = f (x–2) (B) f (2+x) = f (2–x)
(C) f (x) = f (–x) (D) f (x) = –f (–x)

114. The function f : R → R defined by f (x) = sin x is
(A) into (B) onto
(C) one-one (D) many-one

115. In a college of 300 students, every student reads 5 newspapers and every newspaper is read by 60 students. The number of newspapers is
(A) At least 30 (B) At most 20
(C) Exactly 25 (D) None of these

116. The value of a for which the sum of the squares of the roots of the equation $x^2 – (a – 2)\,x – a – 1 = 0$ assume the least value is
(A) 1 (B) 0
(C) 3 (D) 2

117. If the roots of the equation $x^2 – bx + c = 0$ be two consecutive integers, then $b^2 – 4c$ equals
(A) – 2 (B) 3
(C) 2 (D) 1

118. If (1-p) is a root of quadratic equation $x^2 + px + (1– p) = 0$, then the roots are
(A) 0, 1 (B) – 1, 1
(C) 0, –1 (D) – 1, 2

119. The number of real solutions of the equation $x^2 - 3|x| + 2 = 0$ is/are
(A) 2 (B) 4
(C) 1 (D) 3

120. If $x^2 + 2ax + 10 – 3a > 0$ for every real value of x, then
(A) $a > 5$ (B) $a < – 5$
(C) $– 5 < a < 2$ (D) $2 < a < 5$

121. The angle between two diagonals of a cube is
(A) 45^o (B) 60^o
(C) 90^o (D) $\tan^{-1}2\sqrt{2}$

122. If the angle between two vectors $\vec{\imath}+\vec{k}$ *and* $\vec{\imath}-\vec{j}+a\vec{k}$ *is π/3, then the value of a is*
(A) 2 (B) 4
(C) -2 (D) 0

123. The scalar $\vec{A}.(\vec{B}+\vec{C})\times(\vec{A}+\vec{B}+\vec{C})$ equals
(A) 0 (B) $[\vec{A}\,\vec{B}\vec{C}]+[\vec{B}\vec{C}\,\vec{A}]$
(C) $[\vec{A}\,\vec{B}\vec{C}]$ (D) None of these

124. The points with position vectors $60\hat{\imath}+3\hat{\imath}, 40\hat{\imath}-8\hat{\jmath}, a\hat{\imath}-52\hat{\jmath}$ are collinear if
(A) a= – 40 (B) a=40
(C) a=20 (D) None of these

125. The number of vectors of unit length perpendicular to vectors $\vec{a}$ = (0 1, 1) and $\vec{b}$ = (1 1, 0) is
(A) one (B) two
(C) three (D) infinite

126. The angle between the lines 2x = 3y = – z and 6x = – y = – 4z is
(A) 0^o (B) 90^o
(C) 45^o (D) 30^0

127. Distance between two parallel planes 2x + y + 2z = 8 and 4x + 2y + 4z + 5 = 0 is
(A) 3/2 (B) 5/2
(C) 7/2 (D) 9/2

128. The method of least squares dictates that we choose regression line where the sum of the square of deviations of the points from the line is:
(A) Maximum (B) Minimum
(C) Zero (D) Positive

129. If the value of any regression coefficient is zero, then two variables are:
(A) Qualitative (B) Correlated
(C) Dependent (D) Independent

130. A process by which we estimate the value of dependent variable on the basis of one or more independent variables is called:
(A) Correlation (B) Regression
(C) Residual (D) Slope

131. If A = $\begin{bmatrix}1 & -1\\ 1 & 1\end{bmatrix}$, then A^3=
(A) A (B) 2A
(C) 3A (D) 4A

132. The value of $\begin{vmatrix}1+x & 1 & 1\\ 1 & 1+y & 1\\ 1 & 1 & 1+z\end{vmatrix}$ is equal to
(A) 1+x+y+z (B) x+y+z
(C) xyz (D) xyz+xy+xz+yz

133. If $A^2 - A + I = 0$, then the inverse of A is
(A) A (B) A–I
(C) I–A (D) I

134. The number of bijective functions from a set A to itself when A contains 106 elements is

(A) 106 (B) 106^3

(C) 106 ! (D) 2^{106}

135. The value of $\begin{vmatrix} 11 & 12 & 13 \\ 12 & 13 & 14 \\ 13 & 14 & 15 \end{vmatrix}$ is

(A) 1 (B) 0

(C) -1 (D) 67

136. The mean deviation of the data 3, 10, 10, 4, 7, 10, 5 from the mean is

(A) 2 (B) 2.57

(C) 3 (D) 3.75

137. The standard deviation of the data 6, 5, 9, 13, 12, 8, 10 is

(A) $\sqrt{\frac{52}{7}}$ (B) $\frac{52}{7}$

(C) $\sqrt{6}$ (D) 6

138. Let a, b, c, d, e be the observations with mean m and standard deviation s. The standard deviation of the observations a+k, b+k, c+k, d+k, e+k is

(A) ks (B) s

(C) s+k (D) s/k

139. Coefficients of variation of two distributions are 50 and 60, and their arithmetic means are 30 and 25, respectively. Difference of their standard deviations is

(A) 2.5 (B) 1

(C) 1.5 (D) 0

140. Consider the first 10 positive integers. If we multiply each number by -1 and then add 1 to each number, the variance of the numbers so obtained is

(A) 8.25 (B) 6.50

(C) 3.87 (D) 2.87

141. For a linear programming equations, convex set of equations is included in the region of

(A) Feasible solutions (B) Disposed solutions

(C) Profit solutions (D) Loss solutions

142. Infeasibility means that the number of solutions to the linear programming models that satisfies all constraints is

(A) at least 1 (B) 0

(C) An infinite number (D) At least 2

143. A constraint that does not affect the feasible region is a

(A) Non-negativity constraint (B) Redundant constraint

(C) Standard constraint (D) Slack constraint

144. Consider the following LPP. Maximize $3x_1 + 8x_2$ subject to $2x_1 + 5x_2 \leq 10$, $6x_1 + x_2 \leq 6$, $x_1, x_2 \geq 0$. The optimal value of the function is

(A) 0 (B) 3

(C) $\frac{111}{7}$ (D) 16

145. For linear inequalities, solution set for a group of inequalities is classified as

(A) Concave set (B) Convex set

(C) Loss set (D) Profit set

146. Which of the following is unary operations?

(A) Addition (B) Multiplication

(C) Square root (D) None of these

147. If * is a binary operation in A then

(A) A is closed under * (B) A is not closed under *

(C) A is not closed under + (D) A is closed under –

148. Which of the following statements is not correct ?

(A) $Log_{10}\ 10 = 1$ (B) Log (2 + 3) = log (2 x 3)

(C) $Log_{10}\ 1 = 0$ (D) Log (1+2+3) = log 1 + log2 + log 3

149. If log (a/b) + log (b/a) = log (a+b), then

(A) a+b=1 (B) a–b=1

(C) a=b (D) $a^2 - b^2 = 1$

150. The value of e is

(A) 0 (B) 1

(C) 2.718 (D) 2.14

151. $1 + \sin x + \sin^2 x + \ldots$ up to $\infty = 4 + 2\sqrt{3}$, $0 < x < \Pi$ and $x \neq \frac{\pi}{2}$ then x =

(A) $\frac{\pi}{6}, \frac{\pi}{3}$ (B) $\frac{\pi}{3}, 5\frac{\pi}{6}$

(C) $2\frac{\pi}{3}, \frac{\pi}{6}$ (D) $\frac{\pi}{3}, 2\frac{\pi}{3}$

152. A cow is tied to a post by a rope. The cow moves along the circular path always keeping the rope tight. If it describes 44 meters, when it has traced out 72^o at the centre, the length of the rope is

(A) 35 meters (B) 22 meters

(C) 56 meters (D) 45 meters

153. $If\ f(x) = \int_{-1}^{x} |t|\, dt, for\ any\ x\ \geq 0, f(x) =$

(A) $\frac{1}{2}(1 - x^2)$ (B) $1 - x^2$

(C) $\frac{1}{2}(1 + x^2)$ (D) $1 + x^2$

154. The total of number of terms in the expansion of $(x + y)^{100} + (x–y)^{100}$ after simplification is

(A) 50 (B) 51

(C) 202 (D) 100

155. *The maximum value of* $\frac{\log x}{x}$ *in* $(2, \infty)$ *is*

(A) 1 (B) $\frac{2}{e}$

(C) e (D) $\frac{1}{e}$

156. *The series* $\frac{1}{2 \cdot 5} + \frac{1}{5 \cdot 8} + \frac{1}{8 \cdot 11} +$ *... ... up to n terms is equal to*

(A) $\frac{n}{4n+6}$ (B) $\frac{1}{6n+4}$

(C) $\frac{n}{6n+4}$ (D) $\frac{n}{3n+7}$

157. $\lim_{x \to 1} \frac{\tan(x^2 - 1)}{x - 1}$ *equals*

(A) 2 (B) $\frac{1}{2}$

(C) -2 (D) $-\frac{1}{2}$

158. *If* $x^m y^n = (x + y)^{m+n}$ *then* $\frac{dy}{dx}$ *is equal to*

(A) $\frac{x+y}{xy}$ (B) xy

(C) 0 (D) $\frac{y}{x}$

159. *If* $y = e^{\sin^{-1}(t^2-1)}$ *and* $x = e^{\sec^{-1}\left(\frac{1}{t^2-1}\right)}$ *then* $\frac{dy}{dx}$ *is equal to*

(A) $\frac{x}{y}$ (B) $-\frac{y}{x}$

(C) $\frac{y}{x}$ (D) $-\frac{x}{y}$

160. *Find the sum of* 1^{st} *n terms of the series* $\frac{1^2}{1} + \frac{1^2 + 2^2}{1 + 2} + \frac{1^2 + 2^2 + 3^2}{1 + 2 + 3} +$ ...,

(A) $\frac{n+2}{3}$ (B) $\frac{n(n+2)}{3}$

(C) $\frac{n(n-2)}{3}$ (D) $\frac{n(n-2)}{6}$

161. *The value of* $\tan\frac{\pi}{8}$ *is equal to*

(A) $\frac{1}{2}$ (B) $\sqrt{2} + 1$

(C) $\frac{1}{\sqrt{2} + 1}$ (D) $1 - \sqrt{2}$

162. $The\ solution\ for\ the\ differential\ equation\ \frac{dy}{y}+\frac{dx}{x}=0\ is$

(A) $\frac{1}{y}+\frac{1}{x}=c$ (B) $\log x\,.\log y=c$

(C) $xy=c$ (D) $x+y=c$

163. $If\ PA.=\frac{1}{3}, PB.=\frac{1}{4}, P(A\cup B)=\frac{5}{12}, then\ P(A/B)=$

(A) $\frac{25}{16}$ (B) $\frac{5}{4}$

(C) $\frac{16}{25}$ (D) $\frac{2}{3}$

164. $If\ (a-2)x^2+9y^2=4\ represents\ rectangular\ hyperbola\ then\ a\ equals$

(A) 0 (B) 2

(C) 9 (D) None of these

165. $If\ \sum n=55,\ then\ the\ value\ of\ \sum n^2\ is\ equal\ to$

(A) 385 (B) 506

(C) 1115 (D) 3025

166. $The\ 11^{th}\ term\ in\ expansion\ of\ \left(x+\frac{1}{\sqrt{x}}\right)^{14}\ is$

(A) $\frac{999}{x}$ (B) $\frac{1001}{\frac{x}{x}}$

(C) 1 (D) $\frac{\frac{x}{x}}{1001}$

167. $\int_0^{\frac{\pi}{2}}\frac{sin^{1000}x\,dx}{sin^{1000}x+cos^{1000}x}\ is\ equal\ to$

(A) 1000 (B) 1

(C) $\frac{\pi}{2}$ (D) $\frac{\pi}{4}$

168. $f\ e^x\ x^5\ dx\ \ is$

(A) $e^x[x^5+5x^4+20x^3+60x^2+120x+120]+C$ (B) $e^x[x^5-5x^4-20x^3-60x^2-120x-120]+C$

(C) $e^x[x^5-5x^4+20x^3-60x^2+120x-120]+C$ (D) $e^x[x^5+5x^4+20x^3-60x^2-120x+120]+C$

169. $\int\frac{\sec x}{\sec x+\tan x}dx\ is\ equal\ to$

(A) $\tan x-\sec x+C.$ (B) $\log(1+\sec x)+C.$

(C) $\sec x+\tan x+C.$ (D) $\log\sin x+\log\cos x+C.$

170. $If\ f(x)+\ be^{ax}+ae^{bx}, then\ f''(0)=$

(A) 0 (B) 2ab

(C) $ab\ (a+b)$ (D) ab

171. $The\ length\ of\ the\ latus\ rectum\ of\ the\ parabola\ 4y^2+3x+3y+1=0\ is$

(A) $\frac{4}{3}$ (B) 7

(C) 12 (D) $\frac{3}{4}$

172. $The\ principal\ value\ of\ sin^{-1}\tan\left(-\frac{5\pi}{4}\right)is$

(A) $\frac{\pi}{4}$ (B) $-\frac{\pi}{4}$

(C) $\frac{\pi}{2}$ (D) $-\frac{\pi}{2}$

173. $If\ y = e^{m\ sin^{-1}x}, then\ \frac{d^2y}{dx^2}\ at\ x = 0\ is$

(A) m (B) m^2

(C) $-m^2$ (D) $2m$

174. $If\ y = \sin(2\ sin^{-1}x), then\ it\ satisfies\ the\ differential\ equation$

(A) $(1-x^2)y_2 - xy_1 + 4y = 0.$ (B) $(1+x^2)y_2 - xy_1 + 4y = 0.$

(C) $(1-x^2)y_2 - xy_1 + y = 0.$ (D) $(1+x^2)y_2 - xy_1 + 4y = 0.$

175. $The\ value\ of\ cos\left[2\ tan^{-1}\frac{1+x}{1-x} + sin^{-1}\frac{1-x^2}{1+x^2}\right]is$

(A) $\sqrt{2}$ (B) 1

(C) 0 (D) -1

176. The equation of the circle which touches the x-axis and whose centre is (1,2), is

(A) $x^2 + y^2 - 2x + 4y + 1 = 0.$ (B) $x^2 + y^2 - 2x - 4y + 1 = 0.$

(C) $x^2 + y^2 + 2x + 4y + 1 = 0.$ (D) $x^2 + y^2 + 4x + 2y + 1 = 0.$

177. $The\ differential\ equation\ y\frac{dy}{dx} + x = c\ represents$

(A) A family of hyperbolas (B) A family of circles whose centres are on the y-axis.

(C) A family of parabolas (D) A family of circles whose centres are on the x-axis.

178. A stone is thrown vertically upwards and the height x ft reached by the stone in t seconds is given by, x+ 80t – 16t^2. The stone reaches the maximum height in

(A) 2s (B) 2.5s

(C) 3s (D) 1.5s

179. $The\ area\ of\ the\ region\ bounded\ by\ y = 2x - x^2\ and\ the\ x-axis\ is$

(A) $\frac{8}{3}sq.units$ (B) $\frac{4}{3}sq.units$

(C) $\frac{7}{3}sq.units$ (D) $\frac{2}{3}sq.units$

180. $If\ f(x) = \begin{cases} 2a - x, & -a < x < a \\ 3x - 2a, & a \le x \end{cases}$ then which of the following is true

(A) $f(x)\ is\ discontinuous\ at\ x = a.$ (B) $f(x)\ is\ not\ differentiable\ at\ x = a.$

(C) $f(x)\ is\ differentiable\ at\ x \ge a.$ (D) $f(x)\ is\ continuous\ at\ all\ x < a.$

181. A die is tossed thrice. If getting an even number is considered as success, the variance of the probability distribution is

(A) $\frac{3}{4}$ (B) $\frac{1}{2}$

(C) $\frac{1}{4}$ (D) $\frac{2}{3}$

182. The coordinates of the foot of the perpendicular drawn from the point (3,4) on the line 2x +y – 7 = 0 is
(A) $\left(\frac{9}{5}, \frac{17}{5}\right)$ (B) (1, 5)
(C) (−5, 1) (D) (1, −5)

183. The point (5, –7) lies outside the circle
(A) $x^2 + y^2 - 8x = 0$ (B) $x^2 + y^2 - 5x + 7y = 0$
(C) $x^2 + y^2 - 5x + 7y - 1 = 0$ (D) $x^2 + y^2 - 8x + 7y - 2 = 0$

184. If $\tan 15^o = 2 - \sqrt{3}$, then $2 \tan 1095^o + \cot 975^o + \tan(-195^o) =$
(A) $2 + \sqrt{3}$ (B) $4 + 2\sqrt{3}$
(C) $4 - 2\sqrt{3}$ (D) $2 - \sqrt{3}$

185. The number of circles touching the lines x = 0, y = a and y = b is
(A) One (B) Two
(C) Four (D) Infinite

186. The order and degree of the differential equation $\left[1 + \left(\frac{dy}{dx}\right)^5\right]^{\frac{1}{3}} = \frac{d^2y}{dx^2}$ are respectively,
(A) 1, 5 (B) 2, 1
(C) 2, 5 (D) 2, 3

187. $x^{2n} - y^{2n}$ is divisible by
(A) x – y (B) y – x
(C) x + y (D) None of these

188. Mr. X has a 75% chance of attending the annual meet. Miss Y has an 80% chance, if Mr. X also attends. Otherwise she has a 50% chance of attending. If I go to the meet and see Miss Y there, then the probability that Mr. X is also there, is
(A) $\frac{24}{29}$ (B) $\frac{25}{29}$
(C) $\frac{26}{29}$ (D) $\frac{27}{29}$

189. $\int_1^3 \frac{\sqrt{4-x}}{\sqrt{x} + \sqrt{4-x}} dx$
(A) 0 (B) 1
(C) 3 (D) 2

190. $\lim_{x \to 0} \frac{a^{\sin x} - 1}{b^{\sin x} - 1}$
(A) $\frac{\log a}{\log b}$ (B) $\log\left(\frac{a}{b}\right)$
(C) 1 (D) 0

191. The value of $\frac{C_1}{2} + \frac{C_3}{4} + \frac{C_5}{6} +$ ... . *where* C_1, C_3, C_5 ... ... are the binomial coefficients of order n, is
(A) $\frac{2^{n+1} - 1}{n+1}$ (B) $\frac{2^n - 1}{n+1}$
(C) $\frac{2^{n+1}}{n+1}$ (D) $\frac{2^{n+1} + 1}{n+1}$

192. The value of $\binom{n}{r} + 2\,.\binom{n}{r-1} + \binom{n}{r-2}, where\ \binom{n}{k}$ denotes the binomial coefficient of order n, is

(A) $\binom{n}{r}$ (B) $\binom{n+1}{r}$

(C) $\binom{n+2}{r}$ (D) None of these

193. Which one of the following is possible?

(A) $\cos\theta = \frac{7}{3}$ (B) $\sin\theta = \frac{a^2+b^2}{a^2-b^2}, (a \neq b)$

(C) $\sec\theta = \frac{4}{5}$ (D) $\tan\theta = 45$

194. In the expansion of $\left(x^2 - \frac{1}{3x}\right)^9$ the term independent of x is

(A) T_7 (B) T_6

(C) T_8 (D) T_9

195. $If\ x = e^{y+e^{y+\cdots\infty}}, x > 0, then\ \frac{dy}{dx}\ is$

(A) $\frac{x}{1+x}$ (B) $\frac{1}{x}$

(C) $\frac{1-x}{x}$ (D) $\frac{1+x}{x}$

196. $\int e^x \left(\frac{1+\sin x}{1+\cos x}\right) dx\ is$

(A) $\tan\left(\frac{x}{2}\right) + C$ (B) $e^x \sin x + C$

(C) $e^x \tan\left(\frac{x}{2}\right) + C$ (D) $e^x + C$

197. The function $f(x) = [x]$, where [x] denotes greatest integer function is continuous at

(A) –2 (B) 1.5

(C) 4 (D) 1

198. If the arithmetic mean of two positive numbers a and b (a>b) is twice their G.M., then a:b is

(A) $6+\sqrt{7} : 6-\sqrt{7}$ (B) $2+\sqrt{3} : 2-\sqrt{3}$

(C) $5+\sqrt{6} : 5-\sqrt{6}$ (D) None of these

199. $\lim_{x\to 0} x \sin\left(e^{1/x}\right)\ is\ equal\ to$

(A) 0 (B) 1

(C) $\frac{e}{2}$ (D) Does not exist

200. Differential coefficient of $e^{x^2}\ with\ respect\ to \log x^2\ is$

(A) e^{x^2} (B) xe^{x^2}

(C) $x^2e^{x^2}$ (D) $2x^2e^{x^2}$