1. The number of free electrons per 10 mm of an ordinary copper wire is 2×10^{21}. The average drift speed of the electrons is 0.25 mm/s. The current flowing is:

A. 0.8 A B. 8 A C. 80 A D. 5 A

2. Which of the following cells is more likely to be damaged due to short circuiting?

A. Daniel B. Dry C. Acid D. Fuel

3. A gas expands from 5 litre to 105 litre at a constant pressure $100 N/m^2$. The work done is

A. 1 Joule B. 4 Joule C. 8 Joule D. 10 Joule

4. The Helium nuclei can be formed from

A. Hydrogen nuclei by process of chain reaction B. Hydrogen nuclei through nuclear fission
C. Hydrogen nuclei through nuclear fusion D. None of these

5. In the atom bomb dropped by Americans in 1945 on Nagasaki, Japan, the fissionable material used was

A. Helium 4 B. Plutonium 239 C. Uranium 235 D. Uranium 233

6. The engine of a truck moving a straight road delivers constant power. The distance travelled by the truck in time t is proportional to

A. t B. t^2 C. $\sqrt{t}$ D. $t^{3/2}$

7. The velocity of electron in ground state of hydrogen atom is

A. 2×10^5 m/s B. 2×10^6 m/s C. 2×10^7 m/s D. 2×10^8 m/s

8. The radius of the first orbit of the electron in a hydrogen atom is 5.3×10^{-11} m; then the radius of the second orbit must be

A. 15.9×10^{-11} m B. 10.6 x 10 m C. 21.2×10^{-11} m D. 42.4×10^{-11} m

9. A person pushes a rock of 10^{10}Kg mass by applying a force of only 10N for just 4 seconds. The work done is

A. 1000 Joule B. 0 J C. nearly zero D. positive

10. One can take pictures of objects which are completely invisible to the eye using camera films which are sensitive to

A. ultra-violet rays B. sodium light C. visible light D. infra-red rays

11. Light from a 100 watt filament bulb is passed through an evacuated glass tube containing sodium vapour at a high temperature. If the transmitted light is viewed through a spectrometer, we will observe

A. D_1 and D_2 lines of sodium with good intensity B. dark lines where D_1 and D_2 lines should have been observed
C. continuous radiation from the bulb only D. the entire emission spectrum of sodium

12. Under the action of a constant force, a particle is experiencing a constant acceleration. The power is

A. zero B. positive
C. negative D. increasing uniformly with time

13. If in a plane convex lens the radius of curvature of the convex surface is 10 cm and the focal length of the lens is 30 cm, the refractive index of the material of the lens will be

A. 1.5 B. 1.66 C. 1.33 D. 3

14. A plane convex lens has radius of curvature 30 cm. If the refractive index is 1.33, the focal length of lens is

A. 10 cm B. 90 cm C. 30 cm D. 60 cm

15. A beam of light is converging towards a point *I* on a screen. A plane parallel plate of glass (thickness in the direction of the beam = *t*, refractive index = μ) is introduced in the path of the beam. The convergence point is shifted by

A. t (μ - 1) away B. t (1 + 1/μ) away C. t (1 - 1/μ) nearer D. t (1 + 1/μ) nearer

16 . In Young's double silt experiment the separation between the silts is halved and the distance between the silts and screen is doubled. The fringe width will be

A. unchanged B. halved C. doubled D. quadrupled

17. Wavelength of red light is λ_r, violet rays is λ_v and X -ray is λ_x then the order of wavelengths is

A. $\lambda_x > \lambda_v > \lambda_r$ B. $\lambda_v > \lambda_x > \lambda_r$ C. $\lambda_r > \lambda_x > \lambda_v$ D. $\lambda_r > \lambda_v >$

18. The amount of work done by the labourer who carries *n* bricks, each of mass *m*, to the roof of a house whose height is *h* is

A. *n mgh* B. *mgh*/*n* C. zero D. *ghn*/*m*

19. In LCR circuit in the state of resonance, which of the following statements is correct ? (cos ϕ)=

A. 0 B. 0.5 C. 1 D. None of these

20. In LCR circuit, phase difference between voltage and current cannot be

A. 80° B. 90° C. 145° D. 0°

21. If speed is plotted along x-axis and Kinetic energy against y-axis, then the graph obtained has a shape similar to that of

A. circle B. ellipse C. hyperbola D. parabola

22. A magnetic needle lying parallel to a magnetic field requires *w* units of work to turn it through 60°. The torque needed to maintain the needle in this position will be

A. (√ 3) w B. w

C. $(\sqrt{3}w)/2$ D. 2w

23. A vertical straight conductor carries a current vertically upwards. A point *p* lies to the east of it at a small distance and another point *Q* lies to west of it at the same distance. The magnetic field at *p* is

A. greater than at *Q* B. same as at *Q*

C. less than at *Q* D. greater or less at *Q* depending upon the strength of the current

24. In a parallel arrangement if $(R_1 > R_2)$, the power dissipated in resistance R_1 will be

A. less than R_2 B. same as R_2 C. more than R_2 D. none of these

25. For a fuse wire to be installed in the supply line in a house which one of the following is immaterial ?

A. the specific resistance of the material of the fuse wire B. the diameter of the fuse wire

C. the length of the fuse wire D. none of these

26. If *V* is voltage applied, E_a is emf drop across the armature, the armature current of a d.c. motor I_a is given by

A. $(V + E_a)/R_a$ B. E_a/R_a C. $V- E_a/R_a$ D. V/R_a

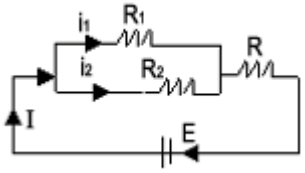
27. The current of 2.0 amperes passes through a cell of e.m.f. 1.5 volts having internal resistance of 0.15Ω . The potential difference measured in volts across both the terminals of the cell will be

A. 1.35 B. 1.50 C. 1.00 D. 1.20

28. In this circuit, current ratio i_1/i_2 depends upon

A. R_1, R_2 and R B. R, R_1, R_2 and E

C. R_1 and R_2 D. E and R



29. A cell of emf *E* is connected across a resistance *r*. The potential difference between the terminals of the cell is found to be *V*. The internal resistance of the cell must be

A. 2(E - V)V/r B. 2(E - V)r/E C. (E - V) r/V D. (E- V)/r

30. Copper and germanium are both cooled to 70 K from room temperature, then

A. resistance of copper increases while that of germanium decreases B. resistance of copper decreases while that of germanium increases

C. resistance of both decreases D. resistance of both increases

31. The potential difference between the points A and B of the electrical circuit given is

A. 1.5 V B. 1.0 V

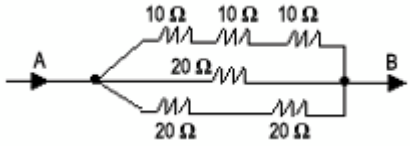
32. A moving coil galvanometer has a resistance of 9.8Ω and gives a full scale deflection when a current of 10 mA passes tbrough it. The value of the shunt required to convert it into a mini ammeter to measure current upto 500 mA is

A. 0.02Ω B. 0.2Ω C. 2Ω D. 0.4Ω

33. The total electrical resistance between the points *A* and *B* of the circuit shown in the figure is

A. 9.02 Ω A. 15 Ω

C. 30 Ω D. 100 Ω



34. If the plates of a charged parallel plate capacitor are pulled away from each other

A. capacitance increases B. energy increases C. voltage increases D. voltage decreases

35. A parallel plate capacitor is charged by connecting its plates to the terminals of a battery. The battery remains connected and a glass plate is interposed between the plates of the capacitor, then

A. the charge on plates will be reduced

B. the charge on plates will increase

C. the potential difference between the plates of the capacitor will be reduced

D. the potential difference between the plates of the capacitor will increase

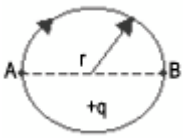
36. A person weighing 70Kg wt lifts a mass of 30 Kg to the roof of a building 10 m high. If he takes 50 sec to do so,then the power spent is

A. 19.6 W B. 196 W C. 300 W D. 50 W

37. Work done in carrying a charge *q* from *A* to *B* along a semi-circle is

A. $2\pi\ rq$ B. $4\pi\ rq$

C. $\pi\ rq$ D. 0



38. A particle *A* has charge +*q* and particle B has charge +4*q* with each of them having the same mass m. When allowed to fall from rest through same electrical potential difference, the ratio of their speed $V_A : V_B$ will become

A. 2:1 B. 1:2 C. 1:4 D. 4:1

39. The electric field at a small distance *R* from an infinitely long plane sheet is directly proportional to

A. $R^2/2$ B. R/2 C. R^{-2} D. none of these

40. In the diagram, the electric field intensity will be zero at a distance

A. between -q and +2q charge B. towards +2q on the line drawn

C. away from the line towards +2q D. away from the line towards -q

41. Wein's displacement law is given by

A. λ_m = constant B. T/λ_m = constant C. $\lambda_m T$ = constant D. $T = \lambda_m$ = constant

42. If two electrons are forced to come closer to each to each other, then the potential energy

A. becomes zero B. increases C. decreases D. becomes infinite

43. The specific heat at constant pressure is greater than that of the same gas at constant volume because

A. at constant volume work is done in expanding the gas

B. at constant pressure work is done in expanding the gas

C. the molecular attraction increases more at constant pressure

D. the molecular vibration increases more at constant pressure

44. The specific heats of CO_2 at constant pressure and constant volume are 0.833 J/kg.K and 0.641 J/kg.K respectively. If molecular weight of CO_2 is 44, what is the universal constant *R?*

A. 4.19 x 10^7 erg/cal B. 848.8 J/gm/K C. 8.448 J/mol/K D. 4.19 J/cal

45. The freezing point of the liquids decreases when pressure is increased, if the liquid

A. expands while freezing B. contracts while freezing

C. does not change in volume while freezing D. none

46. The equation of a transverse wave on a stretched string is given by

$y = 0.05 \sin \pi (2t/0.002 - x/0.1)$ where x and y are expressed in metres and t in sec.

The speed of the wave is

A.100 m/sec B. 50 m/s C. 200 m/s D. 400 m/s

47. The ratio of velocity of the body to the velocity of sound is called

A. Magic number B. Laplace number C. Natural number D. Mach number

48. Television signals on earth cannot be received at distances greater than 100 km from the transmission station. The reason behind this is that

A. the receiver antenna is unable to detect the signal at a distance greater than 100 km

B. the TV programme consists of both audio and video signals

C. the TV signals are less powerful than radio signals

D. the surface of earth is curved like a sphere

49. A ball is thrown from a height of *h* m with an initial downward velocity v_0. It hits the ground, loses half of its Kinetic energy & bounces back to the same height. The value of v_0 is

A. $\sqrt{2gh}$ B. $\sqrt{gh}$ C. $\sqrt{3gh}$ D. $\sqrt{2.5gh}$

50. A thick rope of rubber of density 1.5×10^3 kg/m^3 and Young's modulus 5×10^6 N/m^2, 8m in length, when hung from ceiling of a room, the increase in length due to its own weight is

A. 9.6×10^{-3}m B. 19.2×10^{-5}m C. 9.6cm D. 9.6mm

51. Water is falling on the blades of a turbine at a rate 6000Kg/min. The height of the fall is100m. What is the power gained by the turbine?

A. 10KW B. 6KW C. 100KW D. 600KW

52. If momentum of alpha-particle, neutron, proton, and electron are the same, the minimum K.E. is that of

A. alpha-particle B. neutron C. proton D. electron

53. An electric motor while lifting a given load produces a tension of 4500 N in the cable attached to the load. If the motor winds the cable at the rate of 2m/s, then power must be

A. 9 kW B. 15 kW C. 225 kW D. 9000 H.P

54. If an electric iron electrons are accelerated through a potential difference of V volts. Taking electronic charge and mass to be respectively *e* and *m*, the maximum velocity attained by the electrons is

A. $2eV/\sqrt{}$ m B. $\sqrt{}$ $(2eV)/m$ *C.* $2m/eV$ *D.* $v^2/8em$

55. A particle is moving on a circular track of radius 20 cm with a constant speed of 6 m/s. Its acceleration is

A. 0 B. 180 m/s^2 C. 1.2 m/s^2 D. 36 m/s^2

56. A satellite of the earth is revolving in a circular orbit with a uniform speed *v*. If gravitational force suddenly disappears, the satellite will:

A. continue to move with the speed *v* along the original orbit

B. move with the velocity *v* tangentially to the original orbit

C. fall downward with increasing velocity

D. ultimately come to rest somewhere on the original orbit

57. The kinetic energy *K* of a particle moving along a circle of radius *R* depends on the distance covered *s* as $K = as^2$. The force acting on the part1cle is

A. $2as^2/R$ B. $2as(1 + s^2/R)^{1/2}$ C. $as(1 + s^2/R^2)^{1/2}$ D. None of these

58. Einstein was awarded Nobel Prize for his work in

A. Photoelectric effect B. Special theory of relativity

C. General theory of relativity D. None of these

59. One second is defined to be equal to

A. 1650763.73 periods of the Krypton clock B. 652189.63 periods of the Krypton clock

C. 1650763.73 periods of the Cesium clock D. 9192631770 periods of the Cesium clock

60. The dimensions of energy and torque respectively are
A. ML^2T^{-2} and ML^2T^{-2} B. MLT^2 and ML^2T^{-2} C. ML^2T^{-2} and MLT^{-2} D. MLT^{-2} and MLT^{-2}

61. When Benzene diazonium chloride reacts with hypophosphorous acid, it produces
A. benzene B. phenol C. phenylphosphite D. phenylphosphate

62. The reaction of aliphatic primary amine with nitrous acid in cold produces
A. nitrile B. alcohol C. diazonium salt D. secondary amine

63. Ethylamine can be prepared by the action of bromine and caustic potash on
A. acetamide B. propionamide C. formamide D. methyl cyanide

64. The aldol condensation of acetaldehyde results in the formation of
A. $CH_3COCHOHCH_3$ B. $CH_3CHOHCH_2CHO$ C. $CH_3CH_2CHOHCHO$ D. $CH_3CH_2OH + CH_3COOH$

65. Which compound reacts fastest with Lucas reagent at room temperature?
A. Butan-l-ol B. Butan-2-ol C. 2-Methyl propan-l-ol D. 2-Methyl propan-2-ol

66. The reaction with D_2O, $(CH_3)_3CMgCl$ produces
A. $(CH_3)_3CD$ B. $(CH_3)_3CO$ C. $(CD_3)_3CD$ D. $(CD_3)_3COD$

67. The reaction with alcoholic potash, l-chlorobutane gives
A. 1-Butene B. 1-Butanol C. 2-Butene D. 2-Butanol

68. The active nitrating agent during nitration of benzene is
A. NO_3^- B. HNO_2^- C. NO_2^- D. HNO_3

69. The number of sigma and pi bonds in 1-buten-3-yne are
A. 5 sigma and 5 pi B. 7 sigma and 3 pi C. 8 sigma and 2 pi D. 6 sigma and 4 pi

70. The most stable carbonium ion among the cations is
A. sec-butyl B. ter-butyl C. n-butyl D. none of these

71. How many optically active stereo-isomers are possible for butane-2, 3-diol?
A. 1 B. 2 C. 3 D. 4

72. B.P. and M.P. of inert gases are
A. high B. low C. very high D. very low

73. $[CO(NH_3)_5Br]\ SO_4$ and $[CO(NH_3)_5\ SO_4]\ Br$ are examples of which type of isomerism ?
A. Linkage B. Geometrical C. Ionization D. Optical

74. The valency of Cr in the complex $[Cr(H_2O)_4\ Cl_2]^+$ is
A. 3 B. 1 C. 6 D. 5

75. In Nessler's reagent, the ion is
A. Hg^{+} B. Hg^{2+} C. HgI_2^{2-} D. HgI_4^{2-}

76. In solid $CuSO_4.5H_2O$, copper is co-ordinated to
A. five water molecules B. four water molecules C. one sulphate ion D. one water molecule

77. Which of the following is a weak acid?
A. HCl B. HBr C. HP D. HI

78. When SO_2 is passed through acidified $K_2Cr_2O_7$ solution,
A. the solution turns blue B. the solution is decolourised
C. SO_2 is reduced D. green $Cr_2(SO_4)_3$ is formed

79. Which of the following has lowest boiling point?
A. H_2O B. H_2S C. H_2Se D. H_2Te

80. Nitric oxide is prepared by the action of dil. HNO_3 on
A. Fe B. Cu C. Zn D. Sn

81. The laughing gas is
A. nitrous oxide B. nitric oxide C. nitrogen trioxide D. nitrogen pentaoxide

82. Ordinary glass is
A. sodium silicate B. calcium silicate
C. calcium and Sodium silicate D. copper silicate

83. The chemical name of phosgene is
A. Phosphene B. Carbonyl chloride C. Phosphorous oxychloride D. Phosphorous trichloride

84. Which one of the following is strongest Lewis acid?
A. BF_3 B. BCl_3 C. BBr_3 D. BI_3

85. Three centred bond is present in
A. NH_3 B. B_2H_6 C. BCl_3 D. $AlCl_3$

86. Plaster of Paris is
A. $CaSO_4.H_2O$ B. $CaSO_4.2H_2O$ C. $CaSO_4.1/2\ H_2O$ D. $CaSO_4.3/2\ H_2O$

87. Rocky impurities present in a mineral are called
A. flux B. gangue C. matte D. slag

88. Free hydrogen is found in
A. acids B. water C. marsh gas D. water gas

89. When zeolite, which is hydrated sodium aluminium silicate, is treated with hard water; the

sodium ions are exchanged with

A. H^+ B. K^+ C. SO_4^{2-} D. Mg^{2+}

90. On passing 0.3 faraday of electricity through aluminium chloride, the amount of aluminium metal deposited on cathode is (Al = 27)

A. 0.27 g B. 0.3 g C. 2.7 g D. 0.9 g

91. The migration of colloidal particles under influence of an electric field is known as

A. Electro-osmosis B. Brownian movement C. Cataphoresis D. Dialysis

92. In a colloidal state, particle size ranges from

A. 1 to 10 A^o B. 20 to 50 A^o C. 10 to 1000 A^o D. 1 to 280 A^o

93. The half-life of a first order reaction is 69.35. The value of rate constant of the reaction is

A. 1.05^{-1} B. 0.15^{-1} C. 0.015^{-1} D. 0.0015^{-1}

94. Heat of neutralisation of a strong acid and strong base is always

A. 13.7 Kcal/mol B. 9.6 Kcal/mol C. 6 Kcal/mol D. 11.4 Kcal/mol

95. In exothermic reactions,

A. $H_R = H_P$ B. $H_R > H_P$ C. $H_R < H_P$ D. None of the above

96. Which is a buffer solution?

A. $CH_3COOH + CH_3COONa$ B. $CH_3COOH + CH_3COONH_4$ C. $CH_3COOH + NH_4Cl$ D. NaOH + NaCl

97. The pH of 0.01 M solution of HCl is

A. 1.0 B. 2.0 C. 10.0 D. 11.0

98. In which of the following case does the reaction go fastest to completion?

A. $k = 10^2$ B. $k = 10^{-2}$ C. k = 10 D. k = 1

99. What quantity of limestone ($CaCO_3$) on heating will give 28 kg of CaO?

A. 1000 kg B. 56 kg C. 44 kg D. 50 kg

100. The percentage of oxygen in NaOH is

A. 40 B. 16 C. 18 D. 10

101. If we take 44 g of CO_2 and 14 g of N_2, what will be the mole fraction of CO_2 in the mixture?

A. 1/5 B. 1/3 C. 1/2 D. 1/4

102. The molarity of a solution of Na_2CO_3 having 5.3 g/250 ml of solution is

A. 0.2 M B. 2 M C. 20 M D. 0.02 M

103. A gas is initially at 1 atm pressure. To compress it to 1/2th of its initial volume, pressure to be applied is

A. 1 atm B. 4 atm C. 2 atm D. 1/4 atm

104. The value of *R* in calorie/degree/mole is
A. 0.0831 B. 8.31 C. 8.31×10^7 D. 1.987

105. Which of the following possesses zero resistance at 0 K?
A. Conductors B. Semi-conductors C. Super-conductors D. Insulators

106. CsCl has lattice of the type
A. ccp B. fcc C. bcc D. hcp

107. In the reaction between sodium and chlorine to form sodium chloride,
A. sodium atom is reduced B. sodium ion is reduced C. chlorine atom is reduced D. chloride ion is reduced

108. Octahedral molecular shape exists in _____hybridisation.
A. sp^3d B. sp^3d^2 C. sp^3d^3 D. sp^2d^2

109. NH_3 and BF_3 form an adduct readily because they form
A. a co-ordinate bond B. a covalent bond C. an ionic bond D. a hydrogen bond

110. Diagonal relationship exists between
A. Li and Mg B. Na and Mg C. K and Mg D. Al and Mg

111. Which element has the highest electro-negativity?
A. F B. He C. Ne D. Na

112. Loss of a -particle is equivalent to
A. loss of two neutrons only B. loss of two protons only
C. loss of two neutrons and loss of two protons D. none of the above

113. Stable compounds in + 1 oxidation state are formed by
A. B B. Al C. Ga D. Th

114. Sodium hexametaphosphate is used as
A. a cleansing agent B. an insecticide C. a water softner D. an iron exchange resin

115. The strongest acid is
A. $ClO_3(OH)$ B. $ClO_2(OH)$ C. $SO(OH)_2$ D. $SO_2(OH)_2$

116. Which one among the following pairs of ions cannot be separated by H_2S in dilute hydrochloric acid?
A. Bi^{3+}, Sn^{4+} B. Al^{3+}, Hg^{2+} C. Zn^{2+}, Cu^{2+} D. Ni^{2+}, Cu^{2+}

117. The alkane would have only the primary and tertiary carbon is

A. Pentane B. 2-methylbutane C. 2, 2-dimethylpropane D. 2, 3-dimethylbutane

118. The product of reaction of alcoholic silver nitrite with ethy1 bromide is
A. ethane B. ethene C. nitroethane D. ethyl a1coho1

119. Formy1 chloride has not been so prepared. Which one of the following can function as formyl chloride in formulation?
A. HCHO + HCl B. $HCOOCH_3$ + HCl C. CO + HCl D. $HCONH_2$ + HCl

120. Amongst the following, the most basic compound is
A. Benzylarnine B. Aniline C. Acetanilide D. p-Nitroaniline

121. If the roots of $x^2 - bx + c = 0$ are consecutive integers, then $b^2 - 4c$ is equal to
A. 4 B. 3 C. 2 D. 1

122. Condition that the two lines represented by the equation $ax^2 + 2hxy + by^2 = 0$ to the perpendicular is
A. a = - b B. ab = 1 C. a = b D. ab = -1

123. If $A \subseteq B$, then $A \cap B$ is equal to
A. B^c B. A^c C. B D. A

124. In order that the function $f(x) = (x + 1)^{\cot x}$ is continuous at x = 0, f(0) must be defined as
A. f(0) = 0 B. f(0) = e C. f(0) = 1/e D. none of the above

125. The eccentricity of the ellipse $16x^2 + 7y^2 = 112$ is
A. 4/3 B. 7/16 C. $3/\sqrt{7}$ D. 3/4

126. If z_1, z_2, z_3 are three complex numbers in A.P., then they lie on
A. a circle B. an ellipse C. a straight line D. a parabola

127. If $[(a^2 + 1)^2]/(2a - i) = x + iy$, then $x^2 + y^2$ is equal to
A. $[(a^2 + 1)^4]/(4a^2 + 1)$ B. $[(a + 1)^2]/(4a^2 + 1)$ C. $[(a^2 - 1)^2]/(4a^2 - 1)^2$ D. none of the above

128. The vertices of a triangle are (0, 0), (3, 0) and (0, 4). Its orthocentre is at
A. (3/2, 2) B. (0, 0) C. (1, 4/3) D. none of the above

129. The eccentricity of the conic $9x^2 - 16y^2 = 144$ is
A. 5/4 B. 4/3 C. 4/5 D. $\sqrt{7}$

130. The vertices of a triangle are (0, 3), (-3, 0) and (3, 0). The co-ordinates of its orthocentre are

A. (0, 2) B. (0, -3) C. (0, 3) D. (0, -2)

131. If t is the parameter for one end of a focal chord of the parabola $y^2 = 4ax$, then its length is
A. $a[t - (1/t)]$ B. $a[t + (1/t)]$ C. $a[t - (1/t)]^2$ D. $a[t + (1/t)]^2$

132. The value of $\cos^2 \theta + \sec^2 \theta$ is always
A. equal to 1 B. less than 1
C. greater than or equal to 2 D. greater than 1, but less than 2

133. The number of points of intersection of $2y = 1$ and $y = \sin x$, $-2\pi \leq x \leq 2\pi$ is
A. 2 B. 3 C. 4 D. 1

134. If $\sin \theta_1 + \sin \theta_2 + \sin \theta_3 = 3$, then $\cos \theta_1 + \cos \theta_2 + \cos \theta_3 =$
A. 0 B. 1 C. 2 D. 3

135. The number of solutions in $0 \leq x \leq \pi/2$ of the equation $\cos 3x \tan 5x = \sin 7x$ is
A. 5 B. 7 C. 6 D. none of the above

136. One end of a diameter of the circle $x^2 + y^2 - 4x - 2y - 4 = 0$ is (5, -6), the other end is
A. (4, -9) B. (-9, -4) C. (4, 9) D. (9, -4)

137. The set of values of m for which both the roots of the equation $x^2 - (m + 1)x + m + 4 = 0$ are real and negative consists of all m, such that
A. $-3 \geq m$ or $m \geq 5$ B. $-3 < m \leq 5$ C. $-4 < m \leq -3$ D. $-3 < m \leq -1$

138. Let $P_n(x) = 1 + 2x + 3x^2 + ... + (n + 1)x^n$ be a polynomial such that n is even. Then the number of real roots of $P(x) = 0$ is
A. 1 B. n C. 0 D. none of the above

139. The next term of the sequence 1, 3, 6, 10, ... is
A. 16 B. 13 C. 15 D. 14

140. If H is the harmonic mean between P and Q, then $H/P + H/Q$ is
A. $(P + Q)/PQ$ B. $PQ/(P + Q)$ C. 2 D. none of the above

141. A class is composed of two brothers and six other boys. In how many ways can all the boys be seated at a round table so that the two brothers are not seated besides each other?
A. 4320 B. 3600 C. 720 D. 1440

142. The binomial coefficient of the 4th term in the expansion of $(x - q)^5$ is
A. 15 B. 20 C. 10 D. 5

143. For $x \neq 0$, the term independent of x in the expansion of $(x - x^{-1})$ is equal to

A. $^{2n}C_n$ B. $[(-1)^n]\,[^{2n}C_n]$ C. $[(-1)^n]\,[^{2n}C_{n+1}]$ D. $^{2n}C_{n+1}$

144. k $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ **is equal to**

A. $\begin{vmatrix} a_1 & b_1 & kc_1 \\ a_2 & kb_2 & c_2 \\ ka_3 & b_3 & c_3 \end{vmatrix}$

B. $\begin{vmatrix} ka_1 & kb_1 & kc_1 \\ ka_2 & kb_2 & kc_2 \\ ka_3 & kb_3 & kc_3 \end{vmatrix}$

C. $\begin{vmatrix} ka_1 & b_1 & c_1 \\ ka_2 & b_2 & c_2 \\ ka_3 & b_3 & c_3 \end{vmatrix}$

D. $\begin{vmatrix} ka_1 & b_1 & c_1 \\ a_2 & kb_2 & c_2 \\ a_3 & b_3 & kc_3 \end{vmatrix}$

145. One root of the equation $\begin{vmatrix} 3x-8 & 3 & 3 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix}$ **= 0 is which of the following?**

A. 2/3 B. 8/3 C. 16/3 D. 1/3

146. If | A | = $\begin{vmatrix} a & b & c \\ x & y & z \\ p & q & r \end{vmatrix}$ **and | B | =** $\begin{vmatrix} q & -b & y \\ -p & a & -x \\ r & -c & z \end{vmatrix}$ **, then**

A. | A | = 2 | B | B. | A | = | B | C. | A | = - | B | D. none of the above

147. Equation of the sphere with centre (1, -1, 1) and radius equal to that of sphere $2x^2 + 2y^2 + 2z^2 - 2x + 4y - 6z = 1$ is

A. $x^2 + y^2 + z^2 - 2x + 2y - 2z + 1 = 0$ B. $x^2 + y^2 + z^2 + 2x - 2y + 2z + 1 = 0$

C. $x^2 + y^2 + z^2 - 2x + 2y - 2z - 1 = 0$ D. none of the above

148. Equation of the line passing through the point (1, 1, 1) and parallel to the plane $2x + 3y + 3z + 5 = 0$ is

A. $(x - 1)/1 = (y - 1)/2 = (z - 1)/1$ B. $(x - 1)/-1 = (y - 1)/1 = (z - 1)/-1$

C. $(x - 1)/3 = (y - 1)/2 = (z - 1)/1$ D. $(x - 1)/2 = (y - 1)/3 = (z - 1)/1$

149. If a, b, c are constants such that a and c are of opposite signs and r is the correlation coefficient between x and y, then the correlation coefficient between ax + b and cy + d is

A. (a/c)r B. r C. - r D. (c/a)r

150. From a deck of 52 cards, the probability of drawing a court card is

A. 3/13 B. 1/4 C. 4/13 D. 1/13

151. A binomial probability distribution is symmetrical if p, the probability of success in a single trial, is

A. > 1/2 B. < 1/2 C. < q, where q = 1 - p D. = 1/2

152. The binomial distribution whose mean is 10 and S.D. is $2\sqrt{2}$ is

A. $(4/5 + 1/5)^{50}$ B. $(4/5 + 1/5)^{1/50}$ C. $(4/5 + 5/1)^{50}$ D. none of the above

153. tan $(\cot^{-1}x)$ is equal to

A. $\pi/4 - x$ B. cot $(\tan^{-1}x)$ C. tan x D. none of the above

154. If f(x) is an odd periodic function with period 2, then f(4) equals

A. - 4 B. 4 C. 2 D. 0

155. The function $f(x) = [(x^3 + x^2 - 16x + 20)]/(x - 2)$ is not defined for x = 2. In order to make f(x) continuous at x = 2, f(2) should be defined as

A. 0 B. 1 C. 2 D. 3

156. Let f and g be differentiable functions satisfying g'(a) = 2, g(a) = b, and fog = 1 (identity function). Then f'(b) is equal to

A. 0 B. 2/3 C. 1/2 D. none of the above

157. A cone of maximum volume is inscribed in a given sphere. Then the ratio of the height of the cone to the diameter of the sphere is

A. 3/4 B. 1/3 C. 1/4 D. 2/3

158. The function is decreasing in the interval

A. $-\infty < x < -10/3$ B. $0 < x < \infty$ C. $-3 < x < 3$ D. $-10/3 < x < 0$

159. Suppose that f''(x) is continuous for all x and f(0) = f'(1). If $\int_0^1 tf'(t)\,dt = 0$, then the value of f(1) is

A. 3 B. 2 C. 9/2 D. none of the above

160. Integrating factor of differential equation cos x (dy/dx) + y sin x = 1 is

A. sin x B. sec x C. tan x D. cos x

161. If $\int_0^a dx/(1 + 4x^2) = \pi/8$, then the value of a is

A. $\pi/2$ B. 1/2 C. $\pi/4$ D. 1

162. The maximum value of (log x)/x is

A. 2/e B. 1/e C. 1 D. e

163. If one root of the equation $x^2 + px + 12 = 0$ is 4, while the equation $x^2 + px + q = 0$ has equal roots, then the value of q is

A. 49/4 B. 4/49 C. 4 D. none of the above

164. The sum of the series 1/2 + 1/3 + 1/6 + ... to 9 terms is

A. -5/6 B. -1/2 C. 1 D. -3/2

165. The sum of all two digit numbers, which are odd is

A. 2475 B. 2530 C. 4905 D. 5049

166. How many ten digit numbers can be formed by using the digits 3 and 7 only?

A. $^{10}C_1 + {}^9C_2$ B. 2^{10} C. $^{10}C_2$ D. 10!

167. If x and y are real and different and $u = x^2 + 4y^2 + 9z^2 - 6xyz - 3zx - 2xy$, then u is always

A. non-negative B. zero C. non-positive D. none of the above

168. If a be a non-zero vector, then which of the following is correct?

A. a . a = 0 B. a . a > 0 C. a . a $\geq$ 0 D. a . a $\leq$ 0

169. If two vectors a and b are parallel and have equal magnitudes, then

A. they are equal B. they are not equal

C. they may or may not be equal D. they do not have the same direction

170. In a triangle, the lengths of the two larger sides are 10 and 9 respectively. If the angles are in A.P., then the length of the third side can be

A. $5 \pm \sqrt{6}$ B. $3\sqrt{3}$ C. 5 D. none of the above

171. The three lines $3x + 4y + 6 = 0$, $\sqrt{2}x + \sqrt{3}y + 2\sqrt{2} = 0$, and $4x + 7y + 8 = 0$ are

A. sides of a triangle B. concurrent C. parallel D. none of the above

172. The pole of the straight line $9x + y - 28 = 0$ with respect to the circle $2x^2 + 2y^2 - 3x + 5y - 7 = 0$ is

A. (3, 1) B. (1, 3) C. (3, -1) D. (-3, 1)

173. If the sets A and B are defined as $A = \{ (x, y) : y = e^x, x \in R \}$, $B = \{ (x, y) : y = x, x \in R \}$, then

A. $A \cup B = A$ B. $A \cap B = \phi$ C. $A \subseteq B$ D. $B \subseteq A$

174. The value of the integral $\int_0^{2a} \{ f(x)/[f(x) + f(2a - x)] \} dx$ is equal to

A. a B. 2a C. 3a D. none of the above

175. The slope of the normal at the point $(at^2, 2at)$ of the parabola $y^2 = 4ax$ is

A. 1/t B. t C. - t D. -1/t

176. If z is any complex number such that $| z + 4 | \leq 3$, then the greatest value of $| z + 1 |$ is

A. 2 B. 6 C. 0 D. - 6

177. The equation $\cos x + \sin x = 2$ has

A. only one solution B. two solutions

C. no solution D. infinite number of solutions

178. The most general value of θ, which satisfies both the equations $\tan \theta = -1$ and $\cos \theta = 1/\sqrt{2}$ will be

A. $n\pi + (7\pi/4)$ B. $n\pi + (-1)^n (7\pi/4)$ C. $2n\pi + (7\pi/4)$ D. none of the above

179. A spherical ball of radius r placed on the ground subtends an angle of 60^o at a point A of the ground. Then the distance of the point A from the centre of the ball is

A. 3r B. 2r C. 4r D. none of the above

180. In a triangle ABC, $a^2 \cos 2B + b^2 \cos 2A + 2ab \cos (A - B)$ is equal to

A. c B. c^2 C. 2c D. none of the above