CUSAT CAT 2021 Question Paper

Cochin University of Science and Technology Common Admission Test (CUSAT CAT)

101 – TEST FOR B TECH / 5 YR INTEGRATED MSC
(SHIFT I)

PHYSICS

1. The density of a material in the form of a cube is measured using its dimensions and mass. If the error in measurement of length and mass is 0.6% and 1.2% respectively, the maximum error in calculation of density is

(A) 3.0%
(B) 4.0%
(C) 4.5%
(D) 6.0%

2. If m is the mass of a body and E its kinetic energy, then its linear momentum is

(A) $m\sqrt{E}$
(B) $2\sqrt{mE}$
(C) $\sqrt{mE}$
(D) $\sqrt{2mE}$

3. The separation between carbon and oxygen in CO molecule is 0.12 nm. What is the distance of the center of mass from the carbon atom?

(A) 0.03 nm
(B) 0.068 nm
(C) 0.05 nm
(D) 0.06 nm

4. In a Young's double slit experiment, let S_1 and S_2 be two slits and C be the center of the screen. If angle $\angle S_1CS_2 = \theta$, and λ is the wavelength, the fringe width will be

(A) $\frac{\lambda}{\theta}$
(B) $\lambda\theta$
(C) $\frac{2\lambda}{\theta}$
(D) $\frac{\lambda}{2\theta}$

5. For a series RLC circuit driven with voltage of amplitude V_m and frequency $\omega_o = \frac{1}{\sqrt{LC}}$, the current exhibits resonance. The quality factor, Q of the circuit is given by

(A) $\omega_o L/R$
(B) $\omega_o R/L$
(C) $R/(\omega_o L)$
(D) CR/ω_o

6. The half-life of ^{215}At is 100 μs. The time taken for the radioactivity decay of a sample of ^{215}At to 1/16th of its initial value is

(A) 400 μs
(B) 6.3 μs
(C) 40 μs
(D) 300 μs

7. The shortest wavelength of X-rays emitted from an X-ray tube depends on

(A) the current in the tube
(B) the voltage applied to the tube
(C) the nature of the gas in the tube
(D) the atomic number of the target material

8. The electromagnetic waves detected using a thermopile and used in physiotherapy are

(A) X - rays
(B) γ – rays
(C) ultraviolet radiations
(D) infrared radiations

9. If the wavelength of an electromagnetic wave is about the diameter of an apple, the region of radiation is

(A) X-ray
(B) UV
(C) infrared
(D) microwave

10. In an AC circuit containing a pure resistor and an inductor in series, the phase lag between current and voltage is

(A) dependent on the AC frequency
(B) independent of AC frequency
(C) always zero
(D) always 90°

11. Kirchhoff's junction rule is a reflection of

(A) conservation of energy
(B) conservation of charges
(C) conservation of momentum
(D) conservation of current density

12. If the carrier power of a 100% modulated AM wave is suppressed, the percentage saving in power will be

(A) 50%
(B) 100%
(C) 66.66%
(D) 75%

13. White X-rays are called "white" because

(A) they are produced most abundantly in X-ray tubes
(B) they have a nature similar to visible white light
(C) they have a continuous range of frequencies
(D) they can be converted into visible light coated screens

14. An antenna uses electromagnetic waves of frequency 5 MHz. For proper working, the size of the antenna should be

(A) 15 m
(B) 3 km
(C) 60 m
(D) 300 m

15. The rectangular Cartesian components of grad φ are

(A) $\frac{\partial \phi}{\partial x}, \frac{\partial \phi}{\partial y}, \frac{\partial \phi}{\partial z}$

(B) $\frac{\partial \phi}{\partial x^2}, \frac{\partial \phi}{\partial y^2}, \frac{\partial \phi}{\partial z^2}$

(C) $\frac{\partial^2 \phi}{\partial x^2}, \frac{\partial^2 \phi}{\partial y^2}, \frac{\partial^2 \phi}{\partial z^2}$

(D) $\varphi,\ \varphi^2, \varphi^3$

16. An ideal gas undergoes a thermodynamic process such that $dW = 0$ and $dQ < 0$. Then for the gas

(A) the temperature will decrease
(B) the temperature will increase
(C) the volume will increase
(D) there is no change in temperature

17. Optical fibres transmit light signals from one place to another place by

(A) internal conical refraction
(B) double refraction
(C) interference of light signals
(D) total internal reflection

18. When the source and the listener move in the same direction with a speed equal to the half of the speed of sound, the change in frequency of the sound is

(A) zero
(B) 25%
(C) 50%
(D) 75%

19. Two vectors A and B are said to be parallel to each other if

(A) $A \times B \neq 0$
(B) $A \times B = 0$
(C) $A \times B = B \times A$
(D) $A \times B = AB$

20. Two protons are kept at a separation of 10 nm. If F_e and F_n represent the electromagnetic force and nuclear force, then

(A) $F_e » F_n$
(B) F_e and F_n differ only slightly
(C) $F_e = F_n$
(D) $F_e « F_n$

21. An inductor of inductance L and a resistor R are joined in series and connected to a source of frequency ω. The power dissipated in the circuit is

(A) $\frac{V^2 R}{R^2 + \omega^2 L^2}$
(B) $\frac{V^2 R}{\sqrt{R^2 + \omega^2 L^2}}$
(C) $\frac{R^2 + \omega^2 L^2}{V}$
(D) $\frac{V^2}{R^2 + \omega^2 L^2}$

22. Find the odd one out

(A) silicon
(B) gallium arsenide
(C) barium titanate
(D) Cadmium sulphide

23. The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?

(A) 10 Hz
(B) 20 Hz
(C) 30 Hz
(D) 40 Hz

24. If a stone and a pencil are dropped simultaneously in vacuum from the top of a tower, which of the two will reach the ground first?

(A) Pencil
(B) Stone
(C) Both will reach the ground simultaneously
(D) Either stone or pencil depending on which is heavier

25. A conductor AB = r carries a current i in a magnetic field B. The force on the conductor F is

(A) $F = r \times B$
(B) $F = i\,(r \times B)$
(C) $F = i\,(B \times r)$
(D) $|F| = i\,(r.B)$

26. Three small identical spheres having charges -8.4×10^{-16} C, -7.2×10^{-16} C and 0.6×10^{-16} C are brought in contact and then separated. Now the number of electrons on each ball is

(A) 3375
(B) 3125
(C) 2925
(D) 2775

27. Nichrome wire has been used as heating element because of its

(A) low melting point
(B) high conductivity
(C) low specific resistance
(D) high specific resistance

28. The torque on a rectangular coil placed in an uniform magnetic field is large, when the

(A) number of turns is large
(B) number of turns is less
(C) plane of the coil is perpendicular to the field
(D) area of the coil is small

29. When a moving coil galvanometer is shunted with a resistance of 30 Ohms, then its deflection is reduced to half. The actual resistance of the galvanometer is

(A) 10 Ohms
(B) 15 Ohms
(C) 20 Ohms
(D) 30 Ohms

30. Canal rays were discovered by

(A) Neil Bohr
(B) J.J. Thomson
(C) Millikan
(D) Eugen Goldstein

31. Which of the following transition produces the spectral line of maximum wavelength in hydrogen atom?

(A) $4 \rightarrow 3$
(B) $3 \rightarrow 2$
(C) $5 \rightarrow 4$
(D) $6 \rightarrow 5$

32. The bandwidth of the amplitude modulation is

(A) equal to the signal frequency
(B) twice the signal frequency
(C) thrice the signal frequency
(D) four times the signal frequency

33. Which one of the following of carrier wave remains constant in amplitude modulation?

(A) amplitude and phase
(B) frequency and phase
(C) amplitude and frequency
(D) phase and time

34. What will be the input current when a step up transformer has a power input of 23 kW at 230 volts?

(A) 1 A
(B) 10 A
(C) 52.9 A
(D) 100 A

35. In an AC generator, the current from the coil is transferred to the external circuit through

(A) split rings
(B) slip rings
(C) O-rings
(D) field magnet

36. A long solenoid having N turns, length (l), area of cross section A, carrying a current I is placed in a magnetic field of inductance B. The total magnetic flux is

(A) $\varphi = \mu_o N I$
(B) $\varphi = \mu_o N I / l$
(C) $\varphi = \mu_o N I A / l$
(D) $\varphi = \mu_o N^2 I A / l$

37. In Raman spectrum, the intensity of Stokes lines will be _____ the intensity of corresponding anti Stokes lines.

(A) greater than
(B) less than
(C) equal to
(D) greater or less than

38. In an X-ray tube, when 35 kV is applied, the minimum wavelength of the emitted radiation is

(A) 3.0 Å
(B) 1.5 Å
(C) 0.821 Å
(D) 0.333 Å

39. The half-life period of a particle is 624 s. Its mean life is

(A) 11.3 s
(B) 22.6 s
(C) 90 s
(D) 900 s

40. What will be the energy of the thermal neutrons?

(A) few MeV
(B) few keV
(C) few eV
(D) 0.025 eV

41. Which one of the following is not purely an electrostatic accelerator?

(A) Betatron
(B) Linear accelerator
(C) Van de Graff generator
(D) Cockcroft-Walton accelerator

42. The moment of inertia of a disc of mass M and radius R about its diameter as axis is

(A) $MR^2/2$
(B) $MR^2/4$
(C) MR^2
(D) $(3/4)\,MR^2$

43. An electron beam is moving horizontally towards east. If this beam is passed through a uniform magnetic field directed vertically upwards, then the direction of the deflected beam is

(A) east
(B) west
(C) north
(D) south

44. A pn-junction diode works as insulator if it is connected

(A) in forward bias
(B) in reverse bias
(C) to a.c.
(D) to d.c.

45. A passenger is sitting in a fast moving car. The car blows horn with a frequency of f Hz. If the apparent frequency of the sound heard by the passenger is f' Hz, then

(A) $f' = f$
(B) $f' < f$
(C) $f' > f$
(D) $f' = 1/f$

46. Let v_{max} and a_{max} are the maximum velocity and maximum acceleration of a simple harmonic oscillator respectively, then its time period in terms of v_{max} and a_{max} is

(A) zero
(B) 2π
(C) $[2\pi v_{max}]/\alpha_{max}$
(D) $[2\pi\alpha_{max}]/v_{max}$

47. A red paper illuminated by green light appears

(A) black
(B) blue
(C) green
(D) yellow

48. A thermodynamics system goes from state (i) P_1, V to 2 P_1, V (ii) P_1, V to P_1, 2 V. Then the work done in the two cases will be

(A) zero and $P_1 V$
(B) $P_1 V$ and zero
(C) $P_1 V$ and $P_1 V$
(D) zero and zero

49. Which one of the following pair of physical quantities do not have same dimension?

(A) Planck's constant and Angular momentum
(B) Impulse and moment of force
(C) Force and rate of change of linear momentum
(D) Pressure and Young's modules

50. The exponential law of radioactive decay is

(A) $\frac{N}{N_0} e^{-\lambda/t} = 1$
(B) $\frac{N_0}{N} e^{-\lambda/t} = 1$
(C) $\frac{N_0}{N} e^{\lambda/t} = 1$
(D) $\frac{N}{N_0} e^{\lambda t} = 1$

51. Which of the following is the universal gate?

(A) NOT
(B) OR
(C) AND
(D) NAND

52. When metals combine with non-metals, then

(A) electrons of the outer shells are shared
(B) electrons in the outer shells of non-metals are transferred to metals
(C) electrons in the outer shells of metals are transferred to the non-metals atoms
(D) hydrogen gas is given off

53. The Compton shift is maximum for scattering angle of

(A) 0°
(B) 45°
(C) 90°
(D) 180°

54. A stone released with zero velocity from the top of a tower, reaches the ground in 4 s. The height of the tower is (g = 10 m/s^2)

(A) 20 m
(B) 40 m
(C) 80 m
(D) 120 m

55. Swimming is possible on account of

(A) first law of motion
(B) second law of motion
(C) third law of motion
(D) Newton's law of gravitation

56. A steel wire is stretched to double its length, then its Young's modulus

(A) becomes half
(B) becomes double
(C) remains same
(D) becomes one-fourth

57. Thermoelectric thermometer is based on

(A) Photoelectric effect
(B) Seebeck effect
(C) Compton effect
(D) Joule effect

58. The number of degrees of freedom for each atom of a monatomic gas is

(A) 3
(B) 5
(C) 6
(D) 1

59. The capacity of parallel plate capacitor depends on

(A) metal used to make plates
(B) thickness of plate
(C) potential applied across the plate
(D) area of plate

60. A hydrogen atom is paramagnetic. A hydrogen molecule is

(A) diamagnetic
(B) paramagnetic
(C) ferromagnetic
(D) ferrimagnetic

61. 10 cm is a wavelength corresponding to the spectrum of

(A) infrared rays
(B) ultraviolet rays
(C) microwaves
(D) X-rays

62. In a semiconductor, the forbidden energy gap between the valance band and conduction band is of the order of

(A) 1 MeV
(B) 0.1 MeV
(C) 1 eV
(D) 5 eV

63. The mass of a ship is 2×10^7 kg. On applying a force of 25×10^5 N, it is displaced through 25 m. After the displacement, the velocity acquired by the ship will be

(A) 12.5 m/s
(B) 5 m/s
(C) 3.7 m/s
(D) 2.5 m/s

64. A system consists of 3 particles each of mass m located at points (1, 1), (2, 2) and (3, 3). The coordinates of the centre of mass are

(A) (6, 6)
(B) (3, 3)
(C) (1, 1)
(D) (2, 2)

65. If a spring extends by 'x' on loading, then the energy stored by the spring is (if T is tension in the spring and k is spring constant)

(A) $T^2/2x$
(B) $T^2/2k$
(C) $2x/T^2$
(D) $2T^2/k$

66. A simple pendulum is executing simple harmonic motion with a time period T. If the length of the pendulum is increased by 21%, the percentage increase in the time period of the pendulum of increased length is

(A) 10%
(B) 21%
(C) 30%
(D) 50%

67. If a diamagnetic substance is brought near north or south pole of a bar magnet, it is

(A) attracted by the poles
(B) repelled by the poles
(C) repelled by the north pole and attracted by the south pole
(D) attracted by north pole and repelled by south pole

68. The inductive reactance of an inductor of $1/\pi$ Henry at 50 Hz frequency is

(A) $50/\pi$ Ohm
(B) $\pi/50$ Ohm
(C) 100 Ohm
(D) 50 Ohm

69. How fast a person should drive his car so that the red signal of light appears green (λ_{red} = 6200 Å, λ_{green} = 5400 Å)

(A) 1.5×10^8 m/s
(B) 7×10^7 m/s
(C) 3.9×10^7 m/s
(D) 2×10^8 m/s

70. The position of a particle is given by $x = a \sin \omega t$, $y = a \cos 2\omega t$. The trajectory is

(A) parabola
(B) hyperbola
(C) straight line
(D) cycloid

71. If an annular disc of radii r_1 and r_2 is heated, then

(A) r_1 increases, r_2 decreases
(B) r_2 increases, r_1 decreases
(C) both r_1 and r_2 increase
(D) r_1 increases, r_2 remains unchanged

72. Velocity of sound in air is 332 m/s. Its velocity in vacuum is

(A) > 332 m/s
(B) 3×10^8 m/s
(C) 332 m/s
(D) zero

73. A steady current flows in a metallic conductor of non-uniform cross-section. The quantity/quantities constant along the length of the conductor is/are

(A) current, electric field and drift velocity
(B) drift speed only
(C) current and drift speed
(D) current only

74. A convex lens is dipped in a liquid whose refractive index is equal to refractive index of the lens. Then its focal length will

(A) remain unchanged
(B) be 0
(C) be infinity
(D) be small but non zero

75. AND gate can be produced using two gates of

(A) NOT
(B) NOR
(C) XOR
(D) NAND

CHEMISTRY

76. Iodine crystals are

(A) electrical conductors
(B) insulators
(C) semiconductors
(D) high melting

77. In an ionic solid with the larger anions and smaller cations, the ions that form close packed structure are

(A) anions
(B) cations
(C) half of total anions
(D) half of total cations

78. When a piece of copper is added to concentrated hydrochloric acid,

(A) it remains insoluble
(B) it readily dissolves
(C) it slowly dissolves
(D) it dissolves with the release of hydrogen

79. The electrode potential of a half cell

(A) does not vary with concentration of the solution
(B) depends on the concentration of the solution
(C) depends on the rate of diffusion of the cation
(D) depends on the rate of diffusion of the anion

80. A catalyst

(A) decreases the ΔG of a reaction
(B) increases the ΔG of a reaction
(C) does not alter the ΔG of a reaction
(D) shifts the equilibrium of the reaction

81. As per the Freundlich's adsorption isotherm, the amount adsorbed per gram of the adsorbent is independent of pressure, when

(A) $n = 0$
(B) $n > 1$
(C) $n = 1$
(D) $1/n = 0$

82. When an ideal solution is formed from pure n-hexane and n-heptane, the wrong statement is

(A) no heat is evolved
(B) no volume change occurs
(C) large quantity of heat is evolved
(D) it obeys Raoult's law

83. If cells placed in sodium chloride solution shrink, the solution is called

(A) hypertonic
(B) hypotonic
(C) isotonic
(D) azeotropic

84. The van't Hoff's factor for ethanoic acid in benzene is equal to

(A) zero
(B) close to 0.5
(C) unity
(D) two

85. When a dilute solution of KI is added to a dilute solution of $AgNO_3$,

(A) a positively charged sol results
(B) a negatively charged sol results
(C) a neutral sol results
(D) both the positive and negative sol particles result

86. Hardy – Schulze rule states that the ease of coagulation of a negatively charged colloid with the cations varies in the order

(A) $Fe^{3+} > Mg^{2+} > K^+$
(B) $K^+ > Mg^{2+} > Fe^{3+}$
(C) $Mg^{2+} > Fe^{3+} > K^+$
(D) $Fe^{3+} > K^+ > Mg^{2+}$

87. For the following reaction, the initial concentration of HI (0.005 mol L^{-1}) becomes half of it after 25 min. The rate of decomposition of HI is equal to

$2HI_{(g)} \rightarrow H_{2(g)} + I_{2(g)}$

(A) –0.0005 mol L^{-1} min^{-1}
(B) 0.00005 mol L^{-1} min^{-1}
(C) –0.0001 mol L^{-1} min^{-1}
(D) +0.000.2 mol L^{-1} min^{-1}

88. When acetone is added to ethanol, the solution shows

(A) positive deviation from Raoult's law
(B) negative deviation from Raoult's law
(C) no deviation from Raoult's law
(D) ideal behavior

89. For the Daniel cell of emf 1.1 V, if an external emf of 1.5V is applied,

(A) the copper electrode will dissolve
(B) the zinc electrode will dissolve
(C) the electrode reactions will be ceased
(D) copper will be deposited

90. The material that shows increase in conductivity with increase in temperature is

(A) copper
(B) silver
(C) alumina
(D) titania

91. One mole of a gas expands from 6 m^3 to 8 m^3 in a container against a constant external pressure of 3 Pa at 300 K. The work done on the gas, w, is

(A) –2 J
(B) –6 J
(C) +575 J
(D) –575 J

92. The latent heat of phase change from ice to water is 80 cal per gram at 0 °C. Then change in entropy (in eu) for the surrounding, when 1 mole water freezes at 0 °C

(A) ≈ –5.3 eu
(B) ≈ 5.3 eu
(C) ≈ 0.3 eu
(D) zero

93. At 25 °C, *p*Kw is 14. The degree of dissociation of water is nearly

(A) 10^{-4}
(B) 1.8×10^{-9}
(C) 10^{-7}
(D) 5.6×10^{-6}

94. Which one of the following uranium isotopes is used as atomic fuel?

(A) $^{233}U_{92}$
(B) $^{235}U_{92}$
(C) $^{236}U_{92}$
(D) $^{238}U_{92}$

95. Most abundant element in the earth crust is

(A) O
(B) Al
(C) Fe
(D) Si

96. Soda acid type fire extinguishers contain H_2SO_4 and

(A) $NaHCO_3 + Na_2CO_3$
(B) $NaHCO_3$ solution
(C) Na_2CO_3
(D) $CaCO_3$

97. The correct order of electronegativity of N, O, F and P is

(A) F > O > N > P
(B) F > N > P > O
(C) F > O > P > N
(D) N > O > P > F

98. Find the correct order of electron affinity on the following elements.

S, O and Se

(A) S > O > Se
(B) O > S > Se
(C) S > Se > O
(D) Se > O > S

99. The solution of sodium metal in liquid ammonia acts as a strong reducing agent due to the presence of

(A) Sodium atoms
(B) Solvated electrons
(C) Sodium hydroxide
(D) Sodium azide

100. The isostructural group with I_3^- ion is

(A) NO_2^-, XeF_2, N_3^-
(B) ICl_2^-, XeF_2, N_3^-
(C) NH_2^-, NO_2^-, ICl_2^-
(D) BH_3, CO_2, ICl_2^-

101. The diamagnetic metal complex ion is

(A) $[NiCl_4]^{2-}$
(B) $[CoCl_4]^{2-}$
(C) $[CoF_6]^{3-}$
(D) $[Ni(CN)_4]^{2-}$

102. The CFSE of cobalt(II) in complex ion $[CoCl_4]^{2-}$ is

(A) $0.6\Delta t$
(B) $1.2\Delta t$
(C) $1.8\Delta t$
(D) $2.4\Delta t$

103. The species in which the colour is not due to d-d transitions is

(A) $[Ti(H_2O)_6]^{3+}$
(B) $[CoF_6]^{3-}$
(C) $[Cu(NH_3)_4]^{2+}$
(D) $[CrO_4]^{2-}$

104. Per ton of the material consumed, which is expected to produce the greatest quantity of $SO_2(g)$?

(A) Burning coal
(B) Burning natural gas
(C) Smelting zinc sulphide
(D) Smelting lead sulphide

105. The acceptable value for the missing quantum number in the following set of quantum numbers is:

$n = 3, l = ?, m_l = 2, m_s = +½$

(A) $l = 3$
(B) $l = 1$
(C) $l = 2$
(D) $l = 0$

106. Which must possess greater velocity to produce matter waves of same wavelength?

(A) protons
(B) neutrons
(C) electrons
(D) α-particles

107. Which of the following ions has a trigonal planar shape?

(A) SO_3^{2-}
(B) PO_4^{3-}
(C) PF_6^-
(D) CO_3^{2-}

108. Number of angular nodes for 4*d* orbital is

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

109. What type of radioactive decay causes the atomic number of a nucleus to increase by one unit?

(A) Electron capture
(B) α-emission
(C) β-emission
(D) γ-ray emission

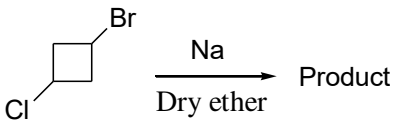
110. The type of hybridization of each carbon in the compound, $H_3C{-}CH{=}C{=}CH{-}CH_3$ is

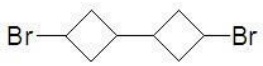
(A) sp^3, sp^2, sp^2, sp^2, sp^3
(B) sp^3, sp^2, sp, sp^2, sp^3
(C) sp^3, sp, sp, sp, sp^3
(D) sp^3, sp, sp^2, sp, sp^3

111. If the sodium fusion extract of an organic compound gives violet colour upon treatment with sodium nitroprusside, then which of the following statement is correct?

(A) Nitrogen is present in the compound and the violet colour is due to the formation of $[Fe(CN)_6]^{4-}$
(B) Both nitrogen and bromine are present in the compound and the violet colour is due to the formation of $(NH_4)_2MoO_4$
(C) Sulfur is present in the compound and the violet colour is due to the formation of $[Fe(CN)_5NOS]^{4-}$
(D) Both nitrogen and sulfur are present in the compound and the violet colour is due to the formation of $[Fe(SCN)]^{2+}$

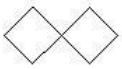
112. Major product of the following reaction is



(A) 

(B) 

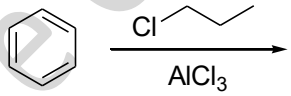
(C) 

(D) 

113. When propyne is treated with mercuric sulphate and dilute sulfuric acid at 60 °C, it forms

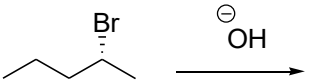
(A) acetone through anti-Markovnikov addition of water
(B) propionaldehyde through Markovnikov addition of water
(C) acetone through Markovnikov addition of water
(D) propionaldehyde through anti-Markovnikov addition of water

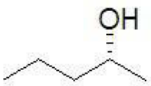
114. Major product formed in the following reaction is

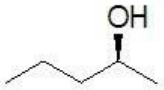


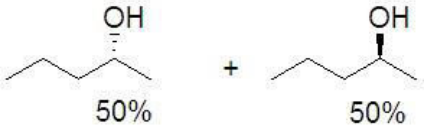
(A) *n*-propylbenzene
(B) isopropylbenzene (cumene)
(C) 1-phenylpropene
(D) 1,3-di-(*n*-propyl)benzene

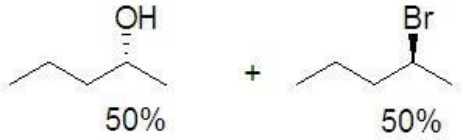
115. The product(s) of the following bimolecular nucleophilic substitution reaction is (are)



(A) 

(B) 

(C) 

(D) 

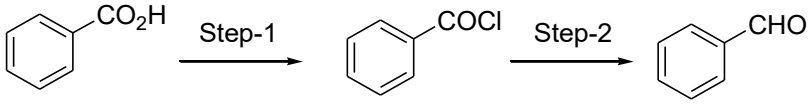
116. A compound P with molecular formula C_9H_{12} upon air oxidation gives compound Q, which upon treatment with dilute acid gives compounds R and S. R gives violet colour when treated with neutral $FeCl_3$. S gives an yellow precipitate on reaction with iodine in the presence of NaOH. The compounds P and S are

(A) P = *n*-propylbenzene and S = acetone
(B) P = *n*-propylbenzene and S = phenol
(C) P = isopropylbenzene (cumene) and S = acetone
(D) P = 1,2,4-trimethylbenzene and S = phenol

117. The major product formed in the nitration of anisole (methoxybenzene) is

(A) *o*-nitroanisole
(B) *p*-nitroanisole
(C) *m*-nitroanisole
(D) 3,4-dinitroanisole

118. Suitable reagents to perform the following transformations are

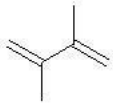


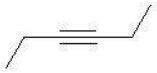
(A) For step-1: $SOCl_2$ and for step-2: H_2, Pd-$BaSO_4$
(B) For step-1: $SOCl_2$ and for step-2: $NaBH_4$
(C) For step-1: Cl_2 and for step-2: H_2, Pd-$BaSO_4$
(D) For step-1: PCl_5 and for step-2: $LiAlH_4$

119. A compound P with molecular formula C_6H_{10} decolorizes bromine water and undergoes oxidation with acidified $KMnO_4$ to give a dicarboxylic acid with the same number of carbon atoms. The dicarboxylic acid serves as an important precursor in the manufacture of nylon-6,6. The compound P is

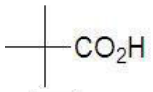
(A) 

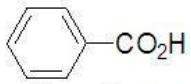
(B) 

(C) 

(D) 

120. Which one of the following carboxylic acids would undergo Hell-Volhard-Zelinsky reaction?

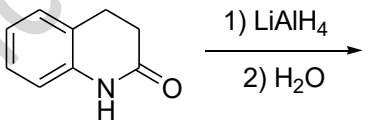
(A) 

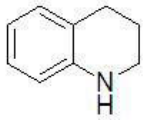
(B) 

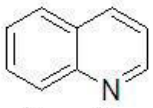
(C) 

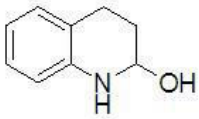
(D) CF_3CO_2H

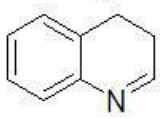
121. Major product formed in the following reaction is



(A) 

(B) 

(C) 

(D) 

122. Gabriel phthalimide synthesis cannot be used for introducing the NH_2 group in

(A) *n*-butylamine
(B) benzylamine
(C) aniline
(D) 2-aminopropanoic acid

123. In amylose,

(A) α-D-(+)-glucose units are linked through C1-C4 glycosidic linkage
(B) α-D-(+)-glucose units are linked to β-D-(−)-fructose through C1-C2 glycosidic linkage
(C) α-D-(+)-glucose units are linked through C1-C2 glycosidic linkage
(D) β-D-(+)-glucose units are linked through C1-C4 glycosidic linkage

124. The Ziegler-Natta catalyst is

(A) Et_2Zn and $TiCl_4$
(B) Et_3Al and $SnCl_4$
(C) Et_2Zn and $SnCl_4$
(D) Et_3Al and $TiCl_4$

125. Which one of the following is not a tranquilizer?

(A) Meprobamate
(B) Ranitidine
(C) Valium
(D) Serotonin

MATHEMATICS

126. The value of x with $\log_{\frac{1}{2}} x \geq \log_{\frac{1}{3}} x$ lies in

(A) (0, 1]
(B) (0, 1)
(C) [0, 1)
(D) [0, 1]

127. If $\alpha \in \left(0, \frac{\pi}{2}\right)$, then the expression $\sqrt{x^2+x} + \frac{\tan^2 \alpha}{\sqrt{x^2+x}}$ is always greater than or equal to

(A) $2 \tan \alpha$
(B) 2
(C) 1
(D) $\sec^2 \alpha$

128. If $\left|z - \frac{4}{z}\right| = 2$, then the maximum value of $|z|$ is

(A) $\sqrt{3}+1$
(B) $\sqrt{5}+1$
(C) 2
(D) $2+\sqrt{2}$

129. If α, β are roots of the equation $x^2 - 2x + 4 = 0$, then $\alpha^n + \beta^n$ is equal to

(A) $2^n \cos\left(\frac{n\pi}{3}\right)$
(B) $2^n \sin\left(\frac{n\pi}{3}\right)$
(C) $2^{n+1} \cos\left(\frac{n\pi}{3}\right)$
(D) $2^{n+1} \sin\left(\frac{n\pi}{3}\right)$

130. If $\log_{\cos x} \tan x + \log_{\sin x} \cot x = 0$, then the most general solutions of x are

(A) $n\pi + \frac{\pi}{4}, n \in I$
(B) $2n\pi + \frac{\pi}{4}, n \in I$
(C) $2n\pi - \frac{3\pi}{4}, n \in I$
(D) $2n\pi - \frac{\pi}{2}, n \in I$

131. The value of $\left|\sqrt{2i} - \sqrt{-2i}\right|$ is

(A) 2
(B) $\sqrt{2}$
(C) 0
(D) $2\sqrt{2}$

132. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{\cos x}{1+e^x} dx$ is equal to

(A) -1
(B) 0
(C) 1
(D) None of these

133. The centre of the circle passing through the point (0, 1) and touching the curve $y = x^2$ at (2, 4) is

(A) $\left(-\frac{16}{5}, \frac{27}{10}\right)$
(B) $\left(-\frac{16}{7}, \frac{53}{10}\right)$
(C) $\left(-\frac{16}{5}, \frac{53}{10}\right)$
(D) $\left(-\frac{16}{7}, -\frac{53}{10}\right)$

134. If $z_1 = 8+4i$, $z_2 = 6+4i$ and $\arg\left(\frac{z-z_1}{z-z_2}\right) = \frac{\pi}{4}$, then z satisfies

(A) $|z-7-4i| = 1$
(B) $|z-4i| = 8$
(C) $|z-7-5i| = \sqrt{2}$
(D) $|z-4i| = \sqrt{18}$

135. Which of the following is a non-abelian group?

(A) Cube roots of unity under multiplication
(B) $(Z, +)$
(C) $(Z_n, +_n)$
(D) 2×2 non-singular matrices under matrix multiplication

136. The equation of the parabola with its focus at (3, 4) and vertex at the focus of the parabola $y^2 - 12x - 4y + 4 = 0$ is

(A) $x^2 - 6x - 8y - 25 = 0$
(B) $x^2 - 6x + 8y - 25 = 0$
(C) $x^2 - 6x - 8y + 25 = 0$
(D) $x^2 + 6x - 8y - 25 = 0$

137. The locus of z satisfying $\text{Im}(z^2) = 4$ is

(A) a circle
(B) a rectangular hyperbola
(C) a pair of straight lines
(D) an ellipse

138. The solution of the differential equation $\left(x\sin\left(\frac{y}{x}\right)\right)dy - \left(y\sin\left(\frac{y}{x}\right) - x\right)dx = 0$ is

(A) $\cos\left(\frac{y}{x}\right) = 0$
(B) $\sin\left(\frac{y}{x}\right) = 0$
(C) $\cos\left(\frac{y}{x}\right) - \log x = c$
(D) $\sin\left(\frac{y}{x}\right) - \log x = c$

139. If a, b, c are in A.P. and a^2, b^2, c^2 are in H.P., then

(A) $a = b = c$
(B) $2b = 3a + c$
(C) $b^2 = \sqrt{ac/8}$
(D) $2b = a$

140. If x, y, z are three positive real numbers, then the value of $(x+y)(y+z)(z+x)$ is

(A) $\geq 8xyz$
(B) $< 8xyz$
(C) $= 8xyz$
(D) $\leq xyz$

141. The product $(32)(32)^{1/6}(32)^{1/36}...\infty$ is equal to

(A) 16
(B) 64
(C) 32
(D) 0

142. The harmonic mean of the roots of the equation $\left(5+\sqrt{2}\right)x^2-\left(4+\sqrt{5}\right)x+8+2\sqrt{5}=0$ is

(A) 2
(B) 4
(C) 6
(D) 8

143. If $ax^2+bx+c=0$ and $2x^2+3x+4=0$ have a common root where $a,b,c\in$ (set of natural numbers), the least value of $a+b+c$ is

(A) 13
(B) 11
(C) 7
(D) 9

144. If $x=\sqrt{7+4\sqrt{3}}$, then $x+\frac{1}{x}$ is equal to

(A) 4
(B) 6
(C) 3
(D) 2

145. If α,β,γ are the roots of $x^3+64=0$, then the equation whose roots are $\left(\frac{\alpha}{\beta}\right)^2$ and $\left(\frac{\alpha}{\gamma}\right)^2$ is

(A) $x^2-4x+16=0$
(B) $x^2+x+1=0$
(C) $x^2+4x+16=0$
(D) $x^2-x+1=0$

146. The roots of the equation $(x-a)(x-b)=abx^2$ are always

(A) real
(B) imaginary
(C) rationals
(D) irrationals

147. Which of the following functions is nonperiodic?

(A) $f(x) = x - [x]$

(B) $f(x) = \begin{cases} 1 \text{ if } x \text{ is a rational number} \\ 0 \text{ if } x \text{ is an irrational number} \end{cases}$

(C) $f(x) = \sqrt{\frac{8}{1+\cos x} + \frac{8}{1-\cos x}}$

(D) $\log(1+|x|)$

148. If $\log_{10} x + \log_{10} y \geq 2$, then the smallest possible value of $x+y$ is

(A) 10
(B) 30
(C) 20
(D) 40

149. The only value of x satisfying the equation $6\sqrt{\frac{x}{x+4}} - 2\sqrt{\frac{x+4}{x}} = 11$ where $x \in R$ is

(A) $16/3$
(B) $-16/3$
(C) $4/35$
(D) $-4/35$

150. The number of real values of a for which the system of equations $x + ay - z = 0$, $2x - y + az = 0$, $ax + y + 2z = 0$ has a non-trivial solution is

(A) 0
(B) 1
(C) 2
(D) 3

151. In the binomial expansion of $(a-b)^n$, $n \geq 5$ the sum of the 5th and 6th terms is zero. Then, $\frac{a}{b}$ equals

(A) $\frac{n-5}{6}$
(B) $\frac{n-4}{5}$
(C) $\frac{5}{n-4}$
(D) $\frac{6}{n-5}$

152. The coefficient of t^{24} in the expansion of $\left(1+t^2\right)^{12}\left(1+t^{12}\right)\left(1+t^{24}\right)$ is

(A) ${}^{12}C_6 + 2$
(B) ${}^{12}C_5$
(C) ${}^{12}C_6$
(D) ${}^{12}C_7$

153. The equation $z^2 + \bar{z}^2 - 2|z|^2 + z + \bar{z} = 0$, where z is a complex number, represents

(A) a straight line
(B) a circle
(C) an ellipse
(D) a parabola

154. Let $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ and $10B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$. If B is the inverse of A, then α is

(A) –2
(B) 1
(C) 2
(D) 5

155. If [ ] denotes the greatest integer function, then $\left[\left(\sqrt{2}+1\right)^6\right]$ is equal to

(A) 196
(B) 197
(C) 198
(D) 199

156. $\tan\theta \sin\left(\frac{\pi}{2}+\theta\right)\cos\left(\frac{\pi}{2}-\theta\right) =$

(A) 1
(B) -1
(C) $\frac{1}{2}\sin 2\theta$
(D) None of the above

157. If $\sin(A+B)\ \sin(A-B)$ is equal to

(A) $\sin^2 A - \cos^2 B$
(B) $\sin\left(A^2 - B^2\right)$
(C) $\sin^2 A - \sin^2 B$
(D) $\cos^2 A - \cos^2 B$

158. If $\cos\theta + \sqrt{3}\sin\theta = 2,$ then the minimum value of θ is

(A) $\pi/3$
(B) $2\pi/3$
(C) $4\pi/3$
(D) $5\pi/3$

159. $\lim_{x\to\pi/3} \frac{2\sin(x-\frac{\pi}{3})}{1-2\cos x}$ is

(A) $1/\sqrt{2}$
(B) $2/\sqrt{3}$
(C) $2/3$
(D) $1/3$

160. The value of $\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{1}{3}$ is

(A) 0
(B) $\pi/3$
(C) $\pi/6$
(D) $\pi/4$

161. If $\binom{2n}{3} : \binom{n}{2} = 44 : 3$, then the value of n is

(A) 3
(B) 4
(C) 5
(D) 6

162. If $\sin\left\{\frac{1}{5}\cos^{-1} x\right\} = 1$, then $x =$

(A) 0
(B) 1
(C) -1
(D) ∞

163. In a ΔABC, $b = \sqrt{3}+1$, $c = \sqrt{3}-1$, $\angle A = 60°$, then the value of $\tan\frac{1}{2}(B-C)$ is

(A) 2
(B) $1/2$
(C) 1
(D) 3

164. If $\begin{vmatrix} x^n & x^{n+2} & x^{n+3} \\ y^n & y^{n+2} & y^{n+3} \\ z^n & z^{n+2} & z^{n+3} \end{vmatrix} = (y-z)(z-x)(x-y)\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)$, then n is equal to

(A) 2
(B) -2
(C) -1
(D) 1

165. If $f(x) = |\log_{10} x|$ then at $x = 1$,

(A) f is not continuous
(B) f is continuous but not differentiable
(C) f is differentiable
(D) the derivative is 1

166. If the ratio of the roots of $ax^2+bx+c=0,\ a\neq 0$ is $4:5$, then $\frac{b^2}{ac}$ is equal to

(A) $\frac{20}{49}$

(B) $\frac{49}{20}$

(C) $\frac{81}{20}$

(D) $\frac{20}{81}$

167. The locus represented by $|Z-1|=|Z+i|$ is

(A) a circle of radius 1

(B) an ellipse with foci at $(1, 0)$ and $(0,-1)$

(C) a straight line through the origin

(D) a circle on the line joining $(1,0),(0,1)$ as diameter

168. The solution set of the equation $\begin{vmatrix} 2 & 3 & x \\ 2 & 1 & x^2 \\ 6 & 7 & 3 \end{vmatrix}=0$ is

(A) ϕ

(B) $\{0, 1\}$

(C) $\{1, -1\}$

(D) $\{1,-3\}$

169. A square root of $3+4i$ is

(A) $\sqrt{3}+1$

(B) $2+i$

(C) $-2+i$

(D) None of the above

170. The sum of the series $1+\frac{5}{2!}+\frac{9}{3!}+\frac{17}{4!}+\infty$ is

(A) $e(e+1)$

(B) $e(1-e)$

(C) $e(e-1)$

(D) e^2+e-4

171. If $(1+3p)/3$, $(1-p)/4$ and $(1-2p)/2$ are the probabilities of three mutually exclusive events, then the set of all values of p is

(A) $-1 \le p \le 1/5$
(B) $-2 \le p \le 1/3$
(C) $1/3 \le p \le 1/2$
(D) $1/4 \le P \le 1/3$

172. If $2\alpha+3\beta+\gamma=0$, then the line $\alpha x+5\beta y+2\gamma=0$ passes through the fixed point

(A) $\left(4,\frac{6}{5}\right)$
(B) $\left(\frac{6}{5},4\right)$
(C) $\left(-4,-\frac{6}{5}\right)$
(D) $\left(-\frac{6}{5},-4\right)$

173. If $f(x)=\cos(\log x)$, then $f\left(x^2\right)f\left(y^2\right)-\frac{1}{2}\left[f\left(x^2/y^2\right)+f\left(x^2y^2\right)\right]$, has the value of

(A) -2
(B) -1
(C) $1/2$
(D) 0

174. A and B are two independent events. Then probability that both A and B occur, is $1/6$ and the probability that none of them occurs, is $1/3$. The minimum value of probability of occurrence of A, is

(A) $1/2$
(B) $1/3$
(C) $1/4$
(D) $1/5$

175. The equation of the directrix of the parabola $(x-\alpha)^2=4a(y-\beta)$ is

(A) $x+a=\alpha$
(B) $x+a=\beta$
(C) $y+a=\beta$
(D) $y+a=\alpha$

176. The minimum value of $27\tan^2\theta + 3\cot^2\theta$ is

(A) 9
(B) 18
(C) 27
(D) 30

177. The interval in which the function $y = \dfrac{x-1}{x^2-3x+3}$ transforms the real line is

(A) $(0, \infty)$
(B) $(-\infty, \infty)$
(C) [0, 1]
(D) $\left[-\dfrac{1}{3}, 1\right]$

178. The rank of the matrix $\begin{pmatrix} 2 & 3 & 4 \\ 2a & 3a & 4a \\ 2a^2 & 3a^2 & 4a^2 \end{pmatrix}$ is

(A) 3
(B) 2
(C) 1
(D) 0

179. Twelve tickets are numbered from 1 to 12. One ticket is drawn at random, then the probability of the number to be divisible by 2 or 3, is

(A) 2/3
(B) 7/12
(C) 5/6
(D) 3/4

180. $\lim_{x\to 0}\left\{\sin x - x/x^3\right\}$ equals

(A) 1/3
(B) −1/3
(C) 1/6
(D) −1/6

181. If $f(x)=\log_3 x$ and $g(x)=x^2$, then the composite function $f\left(g(x)\right)$ is equal to

(A) $2f(x)$
(B) $\left(f(x)\right)^2$
(C) $g(x)$
(D) $2g(x)$

182. The projection of the vector $2\hat{i}+\hat{j}-3\hat{k}$ on the vector $\hat{i}-2\hat{j}+\hat{k}$ is

(A) $\dfrac{-3}{\sqrt{14}}$
(B) $\dfrac{3}{\sqrt{14}}$
(C) $-\sqrt{\dfrac{3}{2}}$
(D) $\dfrac{3}{\sqrt{2}}$

183. The smallest positive x satisfying the equation $\log_{\cos x}\sin x+\log_{\sin x}\cos x=2$ is

(A) $\pi/2$
(B) $\pi/3$
(C) $\pi/4$
(D) $\pi/6$

184. The median of a set of 9 distinct observation is 20.5. If each of the largest 4 observations of the set is increased by 2, then the median of the new set

(A) is increased by 2
(B) is decreased by 2
(C) is two times the original median
(D) remains the same as that of the original set

185. The position vector of the points A,B,C are $2\hat{i}+\hat{j}-\hat{k}$, $3\hat{i}-2\hat{j}+\hat{k}$ and $\hat{i}+4\hat{j}-3\hat{k}$ respectively. These points

(A) form an isosceles triangle
(B) form a right angled triangle
(C) are collinear
(D) for a scalene triangle

186. The statement $p \to (q \to p)$ is equivalent to

(A) $p \to (p \leftrightarrow q)$
(B) $p \to (p \to q)$
(C) $p \to (p \vee q)$
(D) $p \to (p \wedge q)$

187. If $y = \log\big(\log(\log x)\big)$, then $\frac{dy}{dx}$ is equal to

(A) $\log(\log x)$
(B) $\log x.\log(\log x)$
(C) $\frac{1}{x.\log x.\log(\log x)}$
(D) $\frac{1}{\log x.\log(\log x)}$

188. Slope of the tangent to the curve $xy - 3x + 2y = 6$ at the point (2, 3) is

(A) 1
(B) $\frac{1}{2}$
(C) ∞
(D) 0

189. If $z = x^2 \tan^{-1}\left(\frac{y}{x}\right) - y^2 \tan^{-1}\left(\frac{x}{y}\right)$, then $\partial^2 z/\partial x \partial y =$

(A) $\frac{y^2 - x^2}{x^2 + y^2}$
(B) $\frac{x^2 - y^2}{\left(x^2 + y^2\right)^2}$
(C) $\frac{(x-y)^2}{x^2 + y^2}$
(D) $\frac{(x^2 - y^2)}{x^2 + y^2}$

190. The argument of the complex number -5 is

(A) 0
(B) $-\pi$
(C) $\frac{\pi}{2}$
(D) π

191. One function is selected from all the function $F : S \to S$, where $S = \{1,2,3,4,5,6\}$. The probability that it is onto function is

(A) $5/81$
(B) $5/162$
(C) $5/324$
(D) $7/324$

192. The equation of the tangent to the curve $y = 4 + \sin^2 x$ at $x = 0$ is $y =$

(A) 2
(B) 3
(C) 4
(D) 6

193. The non-zero vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are related by $\vec{a} = 8\vec{b}$ and $\vec{c} = -7\vec{b}$. Then, the angle between $\vec{a}$ and $\vec{c}$

(A) 0
(B) $\pi/4$
(C) $\pi/2$
(D) π

194. The point P is equidistant from $A(1,3)$, $B(-3,5)$ and $C(5,-1)$. Then PA is equal to

(A) 5
(B) $5\sqrt{5}$
(C) 25
(D) $5\sqrt{10}$

195. The area bounded by the curves $x+2|y|=1$ and $x=0$ is

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

196. If $a > 1$, then the roots of the equation $(1-a)x^2+3ax-1=0$ are

(A) both positive
(B) both negative
(C) opposite in sign
(D) imaginary conjugate

197. The tangent from the origin to the parabola $y^2+4=4x$ are inclined at an angle

(A) $\pi/6$
(B) $\pi/4$
(C) $\pi/3$
(D) $\pi/2$

198. If the points $(-2,0)$, $\left(-1,\frac{1}{\sqrt{3}}\right)$ and $(\cos\theta,\sin\theta)$ are collinear, then the number of values of $\theta=[0,2\pi]$ is

(A) 0
(B) 1
(C) 2
(D) infinite

199. The contrapositive of the statement "I go to school if it does not rain" is

(A) if it rains, I do not go to school
(B) if I do not go to school, it rains
(C) if it rains, I go to school
(D) if I go to school, it rains

200. The function $f(x)=\left[x(x-3)\right]^2$ increases for all values of x lying in the interval

(A) $0<x<3/2$
(B) $0<x<\infty$
(C) $-\infty<x<0$
(D) $1<x<3$

201. Let $f:\square\to\square$ be a positive valued increasing function with $\lim\limits_{x\to\infty}\dfrac{f(3x)}{f(x)}=1$. Then $\lim\limits_{x\to\infty}\dfrac{f(2x)}{f(x)}$ is

(A) $\dfrac{3}{2}$
(B) 3
(C) $\dfrac{2}{3}$
(D) 1

202. If one of the lines of $my^2+\left(1-m^2\right)xy-mx^2=0$ is a bisector of the angle between the lines $xy=0$, then m is

(A) $-\dfrac{1}{2}$
(B) -2
(C) ±1
(D) 2

203. The number of points on the line $x+y=4$ which are unit distance apart from the line $2x+2y=5$ is

(A) 0
(B) 1
(C) 2
(D) ∞

204. $\int \frac{\sin x - \cos x}{\sqrt{1+\sin 2x}} dx$ is equal to

(A) $\log(\sin x + \cos x) + c$
(B) $-\log(\sin x + \cos x) + c$
(C) $\log \sec\left(x - \frac{\pi}{4}\right) + c$
(D) $-\log \sec\left(x - \frac{\pi}{4}\right) + c$

205. The range of λ for which the circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 4\lambda x + 9 = 0$ have two common tangents, is

(A) $\lambda \in \left(-\frac{13}{8}, \frac{13}{8}\right)$
(B) $\lambda > \frac{13}{8}$ or $\lambda < -\frac{13}{8}$
(C) $1 < \lambda < \frac{13}{8}$
(D) $\lambda \in \left[-\frac{13}{8}, \frac{13}{8}\right]$

206. If $I_n = \int_0^1 \left[(n+1)x^n + nx^{n-1} + \ldots + 2x + 1\right] dx$, then the value of I_n is

(A) $n - 1$
(B) n
(C) $n + 1$
(D) $n + 2$

207. The area of the region bounded by the lines $y = |x - 2|$, $x = 1$, $x = 3$ and the x-axis is

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

208. The value of a for which the difference of the roots of the equation $ax^2+(a-1)x+2=0$ is min, is given by

(A) $1/5$
(B) 5
(C) $-1/5$
(D) None of the above

209. The line $x-1=0$ is the directrix of the parabola $y^2-kx+8=0$. Then, one of the value of k *is*

(A) $\frac{1}{8}$
(B) 8
(C) 4
(D) $\frac{1}{4}$

210. Area between the curve $y=4+3x-x^2$ and x-axis is

(A) $\left(\frac{125}{3}\right)$ sq. unit
(B) $\left(\frac{125}{4}\right)$ sq. unit
(C) $\left(\frac{125}{6}\right)$ sq. unit
(D) None of the above

211. The focus of the parabola $y=2x^2+x$ is

(A) $(0, 0)$
(B) $\left(\frac{1}{2},\frac{1}{4}\right)$
(C) $\left(-\frac{1}{4},0\right)$
(D) $\left(-\frac{1}{4},\frac{1}{8}\right)$

212. The order and degree of the differential equation $y+\left(\frac{d^3y}{dx^3}\right)^2=\sqrt[3]{1+\frac{dx}{dy}}$ are respectively

(A) 3, 5
(B) 3, 6
(C) 3, 2
(D) 5, 4

213. The area bounded by the straight lines $x=0,\ x=2$ and the curve $y=2^x,\ y=2x-x^2$ is

(A) $\frac{4}{3}-\frac{1}{\log 2}$
(B) $\frac{3}{\log 2}+\frac{4}{3}$
(C) $\frac{4}{\log 2}-1$
(D) $\frac{3}{\log 2}-\frac{4}{3}$

214. The number of solutions of the equation $z^2=\overline{z}$, where z is a complex number, is

(A) 2
(B) 3
(C) 4
(D) 6

215. The differential equation of all circles passing through the origin and having their centres on the x-axis is

(A) $x^2=y^2+xy\frac{dy}{dx}$
(B) $x^2=y^2+3xy\frac{dy}{dx}$
(C) $y^2=x^2+2xy\frac{dy}{dx}$
(D) $y^2=x^2-2xy\frac{dy}{dx}$

216. Which one of the following function is not periodic?

(A) $e^{\sin x}$

(B) $\dfrac{1}{10+\sin x+\cos x}$

(C) $\log_e(\cos x)$

(D) $\sin\left(e^x\right)$

217. Differential coefficient of $\log_{10} x$ with respect to $\log_x 10$ is

(A) $-\dfrac{(\log 10)^2}{(\log x)^2}$

(B) $\dfrac{(\log_x 10)^2}{(\log 10)^2}$

(C) $\dfrac{(\log_{10} x)^2}{(\log 10)^2}$

(D) $-\dfrac{(\log x)^2}{(\log 10)^2}$

218. The derivative of $\sin^{-1}\left(\dfrac{2x}{1+x^2}\right)$ with respect to $\cos^{-1}\left(\dfrac{1-x^2}{1+x^2}\right)$ is

(A) 11

(B) 1

(C) 2

(D) 4

219. $\lim_{n\to\infty}\left[\dfrac{n!}{n^n}\right]^{1/n}$ equals

(A) e

(B) $1/e$

(C) $\pi/4$

(D) $4/\pi$

220. If $\frac{1}{a}=\frac{1}{b}=\frac{1}{c}=\frac{1}{a+b+c}$ then $\frac{1}{a^5}=\frac{1}{b^5}=\frac{1}{c^5}=$

(A) 0
(B) 1
(C) $1/\left(a^5+b^5+c^5\right)$
(D) None of the above

221. If $x=y\sqrt{1-y^2}$, then $\frac{dy}{dx}$ is equal to

(A) x
(B) $\frac{\sqrt{1-y^2}}{1+2y^2}$
(C) $\frac{\sqrt{1-y^2}}{1-2y^2}$
(D) 0

222. The solution of $\sec^2 x\tan^2 ydx+\sec^2 y\tan^2 xdy=0$ is

(A) $\frac{\tan x-\tan y}{\tan x\tan y}=c$
(B) $\frac{\tan x+\tan y}{\tan x}=c$
(C) $\frac{\tan x+\tan y}{\tan x\tan y}=c$
(D) $\frac{\tan x+\tan y}{\tan y}=c$

223. A differentiable function $f(x)$ is defined for all $x>0$ and satisfies $f\left(x^3\right)=4x^4$ for all $x>0$. The value of $f'(8)$ is

(A) $\frac{16}{3}$
(B) $\frac{32}{3}$
(C) $\frac{16\sqrt{2}}{3}$
(D) $\frac{32\sqrt{2}}{3}$

224. If $\Delta(n)=\begin{vmatrix} x^n & \sin x & \cos x \\ n! & \sin\frac{n\pi}{2} & \cos\frac{n\pi}{2} \\ \alpha & \alpha^2 & \alpha^3 \end{vmatrix}$, then the value of $\frac{d^n}{dx^n}[\Delta(x)]$ at $x=0$ is

(A) -1
(B) 0
(C) 1
(D) 2

225. The vector in the direction of $3i-4j$ that has magnitude 7 unit is

(A) $\frac{21}{5}i-\frac{28}{5}j$
(B) $\frac{3}{5}i-\frac{4}{5}j$
(C) $21i-28j$
(D) $\frac{21}{5}i+\frac{28}{5}j$

226. If $f(x)=ax+b$ and $g(x)=cx+d$, then $f\{g(x)\}=g\{f(x)\}$ is equivalent to

(A) $f(a)=g(c)$
(B) $f(b)=g(b)$
(C) $f(d)=g(b)$
(D) $f(c)=g(a)$

227. In a ΔABC, $\tan A$ and $\tan B$ are the roots of $pq(x^2+1)=r^2x$. Then ΔABC is

(A) a right angled triangle
(B) an equilateral triangle
(C) an acute angled triangle
(D) an obtuse angled triangle

228. The number of ways in which we can choose a committee from four men and six women so that the committee includes at least two men and at least twice as many women as men is

(A) 94
(B) 126
(C) 136
(D) 156

229. If $f(x)=\begin{cases}\dfrac{1-\cos x}{x}, & x\neq 0\\ k, & x=0\end{cases}$ is continuous at $x=0$, then the value of k is

(A) 0
(B) $\frac{1}{2}$
(C) $\frac{1}{4}$
(D) $-\frac{1}{2}$

230. If $f(2)=4$ and $f'(2)=1$, then the value of $\lim\limits_{x\to 2}\dfrac{xf(2)-2f(x)}{x-2}$ is

(A) –3
(B) 1
(C) 3
(D) 2

231. The value of $\lim\limits_{x\to\frac{\pi}{2}}\dfrac{2x-\pi}{\cos x}$ is equal to

(A) –1
(B) –2
(C) 2
(D) 1

232. The function $f(x)=xe^{1-x}$

(A) strictly increases in the interval $\left(\frac{1}{2},2\right)$
(B) increases in the interval $(0,\infty)$
(C) decreases in the interval $(0,2)$
(D) strictly decreases in the interval $(1,\infty)$

233. If three positive real numbers a,b,c are in A.P. and $abc=4$ then minimum possible value of b is

(A) $2^{3/2}$
(B) $2^{2/3}$
(C) $2^{1/3}$
(D) 1

234. Let $f : N \to Y$ be a function defined as $f(x) = 4x + 3$ where $Y = \{y \in N : y = 4x + 3 \text{ for some } x \in N\}$. Then the inverse of f is

(A) $g(y) = \frac{3y + 4}{3}$

(B) $g(y) = 4 + \frac{y + 3}{4}$

(C) $g(y) = \frac{y + 3}{4}$

(D) $g(y) = \frac{y - 3}{4}$

235. The first two terms of a geometric progression add up to 12. The sum of the third and the fourth terms is 48. If the terms of the geometric progression are alternately positive and negative, then the first term is

(A) –4
(B) –12
(C) 12
(D) 4

236. If ω is a cube root of unity, then a root of the equation $\begin{vmatrix} x+1 & \omega & \omega^2 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & 1+\omega \end{vmatrix} = 0$ is

(A) $x = 1$
(B) $x = \omega$
(C) $x = \omega^2$
(D) $x = 0$

237. Let α and β be two real numbers and the matrix $A = \begin{bmatrix} 0 & \alpha \\ \beta & 0 \end{bmatrix}$ be such that $A^3 + A = 0$. Then

(A) $\alpha\beta = 2$
(B) $\alpha\beta = 0$
(C) $\alpha\beta = 1$
(D) $\alpha\beta = -1$

238. The number of surjection's from $A=\{1,2,...n\}$, $n\geq 2$, onto $B=\{a,b\}$ is

(A) nP_2
(B) 2^n-2
(C) 2^n-1
(D) None of the above

239. For real numbers x and y, we define xRy if and only if $x-y+\sqrt{2}$ is an irrational number. Then the relation R is

(A) Reflexive
(B) Symmetric
(C) Transitive
(D) None of the above

240. The set of all values of x for which $\log(1+x)<x$ is

(A) $x>0$
(B) $0<x<1$
(C) $x\geq 0$
(D) $x=1$

241. A house has multi-storey's. The lowest storey is 20 ft. high. A stone which is dropped from the top of the house passes the lowest story in 1/4 second. The height of the house is

(A) 100 ft.
(B) 110 ft.
(C) 110.25 ft.
(D) None of the above

242. A particle is projected with a velocity of 39.2 m/sec at an angle of $30°$ to the horizontal. It will move at right angles to the direction of projection after the time.

(A) 8 sec
(B) 5 sec
(C) 6 sec
(D) 10 sec

243. The value of $\int_{\frac{1}{\pi}}^{\frac{2}{\pi}} \frac{1}{x^2} \sin\frac{1}{x} dx$ is equal to

(A) 0
(B) 1
(C) 2
(D) -1

244. Three houses are available in a locality. Three persons apply for the houses. Each applies for one house without consulting others. The probability that all the three apply for the same house is

(A) $\frac{8}{9}$
(B) $\frac{7}{9}$
(C) $\frac{2}{9}$
(D) $\frac{1}{9}$

245. Last two digits of the natural number 19^{9^4} is

(A) 29
(B) 39
(C) 90
(D) 19

246. The number of solutions of $\frac{1}{x}+\frac{1}{y}=\frac{1}{6}$, where $x, y \in \square$ is

(A) 9
(B) 18
(C) 21
(D) 28

247. If $(3,2,5)$ is one end of a diameter of the sphere $x^2+y^2+z^2-6x-12y-2z+20=0$, then co-ordinates of the other end of the diameter are

(A) (4, 3, 5)
(B) $(4,3,-3)$
(C) $(4,9,-3)$
(D) None of the above

248. The weighted mean of first n natural numbers whose weights are equal to the squares of corresponding number is

(A) $\frac{n+1}{2}$

(B) $\frac{3n(n+1)}{2(2n+1)}$

(C) $\frac{(n+1)(2n+1)}{6}$

(D) $\frac{n(n+1)}{2}$

249. $\int 5^{5^{5^x}}.5^{5^x}.5^x\,dx$ equal to

(A) $\frac{5^{5^x}}{(\log 5)^3}+c$

(B) $5^{5^{5^x}}(\log 5)^3+c$

(C) $\frac{5^{5^{5^x}}}{(\log 5)^3}+c$

(D) None of these

250. The sum of the coefficients of all those term with integral power of x in the expansion of $\left(1+\sqrt{x}\right)^9$ is

(A) 128
(B) 225
(C) 312
(D) 256

FINAL ANSWER KEY																	
Subject Name: 101 B TECH 18-S1																	
SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key
1	A	31	D	61	C	91	B	121	A	151	B	181	A	211	C	241	C
2	D	32	B	62	C	92	B	122	C	152	A	182	C	212	B	242	A
3	B	33	B	63	D	93	B	123	A	153	D	183	C	213	D	243	B
4	A	34	D	64	D	94	B	124	D	154	D	184	D	214	C	244	D
5	A	35	B	65	B	95	A	125	B	155	B	185	C	215	C	245	D
6	A	36	C	66	A	96	A	126	A	156	D	186	C	216	D	246	A
7	B	37	A	67	B	97	A	127	A	157	C	187	C	217	D	247	C
8	D	38	D	68	C	98	C	128	B	158	A	188	D	218	B	248	B
9	D	39	D	69	C	99	B	129	C	159	B	189	D	219	B	249	C
10	A	40	D	70	D	100	B	130	B	160	D	190	D	220	C	250	D
11	B	41	A	71	C	101	D	131	A	161	D	191	C	221	C		
12	C	42	B	72	D	102	B	132	C	162	A	192	C	222	C		
13	C	43	C	73	D	103	D	133	C	163	C	193	D	223	B		
14	A	44	B	74	C	104	C	134	C	164	C	194	D	224	B		
15	A	45	A	75	D	105	C	135	D	165	B	195	B	225	A		
16	A	46	C	76	B	106	C	136	C	166	C	196	A	226	C		
17	D	47	A	77	A	107	D	137	B	167	C	197	D	227	A		
18	A	48	A	78	A	108	C	138	C	168	D	198	B	228	C		
19	B	49	B	79	B	109	C	139	A	169	B	199	B	229	A		
20	A	50	D	80	C	110	B	140	A	170	D	200	A	230	D		
21	A	51	D	81	D	111	C	141	B	171	C	201	D	231	B		
22	C	52	C	82	C	112	B	142	B	172	A	202	C	232	D		
23	B	53	D	83	A	113	C	143	D	173	D	203	A	233	B		
24	C	54	C	84	B	114	B	144	A	174	B	204	B	234	D		
25	B	55	C	85	B	115	B	145	B	175	C	205	B	235	B		
26	B	56	C	86	A	116	C	146	A	176	B	206	C	236	D		
27	D	57	B	87	C	117	B	147	D	177	D	207	A	237	D		
28	A	58	A	88	B	118	A	148	C	178	C	208	A	238	B		
29	D	59	D	89	A	119	B	149	B	179	A	209	C	239	A		
30	D	60	A	90	D	120	C	150	D	180	D	210	C	240	C		

101 – TEST FOR B TECH / 5 YR INTEGRATED MSC
PHYSICS UG
(SHIFT II)

1. An athlete completes one round of a circular track of radius R in 40 s. What will be his displacement at the end of 2 min 20 seconds?

(A) $7\,R$
(B) $2\,R$
(C) $2\,\pi R$
(D) $7\,\pi R$

2. The phase difference between the displacement and velocity of a particle executing SHM is

(A) $\pi/2$
(B) π
(C) $\pi/4$
(D) 0

3. The work done per unit volume in stretching a wire is

(A) $\frac{\text{force} \times \text{extension}}{2}$
(B) $\frac{\text{stress} \times \text{strain}}{2}$
(C) force × extension
(D) stress × strain

4. A capacitor connected to a cell of emf E is fully charged. If V is the potential difference across the capacitor, then which one of the following is correct?

(A) V > E
(B) V = E = 0
(C) V = E
(D) V < E

5. In a common emitter amplifier circuit using an *n-p-n* transistor, the phase difference between the input and the output voltage will be

(A) 135°
(B) 180°
(C) 45°
(D) 90°

6. If λ is the decay constant, $T_{½}$ is the half life and T is the mean life of a radioactive element, then which of the following is true

(A) $T_{½} = \frac{1}{\lambda}$, $T = \frac{ln2}{\lambda}$

(B) $T_{½} = \frac{ln2}{\lambda}$, $T = \frac{1}{\lambda}$

(C) $T_{½} = \lambda\, ln2$, $T = \frac{1}{\lambda}$

(D) $T_{½} = \frac{\lambda}{ln2}$, $T = \frac{ln2}{\lambda}$

7. Ozone layer in the atmosphere absorbs

(A) radio waves
(B) infrared
(C) ultra violet rays
(D) X-rays

8. In a Rutherford experiment, for head-on collision of α- particles with a gold nucleus, the impact parameter is

(A) of the order of 10^{-14} m
(B) of the order of 10^{-10} m
(C) of the order of 10^{-6} m
(D) zero

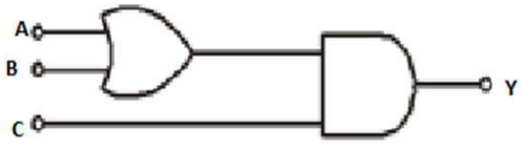
9. The speed of electromagnetic waves in free space is 3×10^8 ms^{-1}. The frequency of a radio wave of wavelength 150 m is

(A) 45 MHz
(B) 2 MHz
(C) 20 kHz
(D) 2 kHz

10. In a series resonant circuit, the AC voltages across R, L and C are respectively 5 V, 10 V and 10 V. The AC voltage applied to the circuit is

(A) 25 V
(B) 15 V
(C) 5 V
(D) 20 V

11. To get output 1 for the following circuit, the correct choice for the input is



(A) A = 0, B = 1, C = 0
(B) A = 1, B = 0, C = 0
(C) A = 1, B =1, C = 0
(D) A = 1, B = 0, C = 1

12. For a transistor amplifier, the voltage gain

(A) is high at high and low frequencies and constant at middle frequency range
(B) constant at high frequencies and low at low frequencies
(C) remains constant at all frequencies
(D) is low at high and low frequencies and constant at mid frequencies

13. Frequency of revolution of an electron revolving in the n^{th} orbit of H- atom is proportional to

(A) n
(B) $\frac{1}{n^3}$
(C) $\frac{1}{n^2}$
(D) n^2

14. In which of the following devices, the eddy current effect is not used?

(A) Induction furnace
(B) Magnetic braking in train
(C) Electromagnet
(D) Electric heater

15. The center of mass of a system of particles does not depend on

(A) mass of the particles
(B) position of the particles
(C) forces on the particles
(D) relative distance between particles

16. Vectors A and B have same magnitude. In addition, the magnitude of their resultant is also equal to the magnitude of either of them. Then A and B are at an angle

(A) 120°
(B) 60°
(C) 90°
(D) 45°

17. In a sample of radioactive material, what percentage of initial number of active nuclei will decay during one mean life?

(A) 37%
(B) 63%
(C) 50%
(D) 69.3%

18. In a compound microscope, maximum magnification is obtained when the image

(A) is formed at infinity
(B) is formed at the least distance of distinct vision
(C) coincides with objective lens
(D) is at any finite distance

19. If P, Q and R are physical quantities having different dimensions, which one of the following combinations can never be a meaningful quantity?

(A) $PQ - R$
(B) $\frac{PR - Q^2}{R}$
(C) $\frac{P - Q}{R}$
(D) $\frac{PQ}{R}$

20. Light of a certain frequency and intensity is incident on a photosensitive material causing photoelectric effect. If both the frequency and intensity are doubled, the photoelectric saturation current becomes

(A) unchanged
(B) doubled
(C) halved
(D) quadrupled

21. The phenomenon involved in the reflection of radio waves by ionosphere is similar to

(A) scattering of light by air particles
(B) total internal reflection of light in air during a mirage
(C) reflection of light by plane mirror
(D) dispersion of light by water molecules during the formation of a rainbow

22. Gyromagnetic ratio of a nucleus is

(A) a vector
(B) a scalar
(C) a tensor
(D) zero

23. The following four wires of length L and radius r are made of the same material. Which of these wires will have the largest extension, when the same tension is applied?

(A) L = 50 cm, r = 0.25 mm
(B) L = 100 cm, r = 0.5 mm
(C) L = 200 cm, r = 1 mm
(D) L = 300 cm, r = 1.5 mm

24. Kepler's second law regarding constancy of aerial velocity of a planet is a consequence of conservation of

(A) energy
(B) mass
(C) linear momentum
(D) angular momentum

25. A hollow metal sphere carrying electric charge produces no electric field at the points

(A) outside the sphere
(B) inside the sphere
(C) on its surface
(D) at a distance more than its radius

26. When the force between two charges in vacuum is 0.6 N, then what will be the force if vacuum is replaced by a medium whose permittivity is five times greater than that of in vacuum?

(A) 0.30 N
(B) 0.12 N
(C) 8.33 N
(D) 4.165 N

27. In a thermocouple at one of the junction, the Peltier coefficient depends on

(A) the temperature of the junction
(B) the current in the junction
(C) the time for which the current flows
(D) the heat absorbed or evolved

28. An ideal voltmeter has

(A) zero resistance
(B) finite resistance
(C) infinite resistance
(D) resistance depends on the load

29. The intensity of the X-rays emitted in an X-ray tube can be increased by

(A) increasing the target potential
(B) increasing the filament current
(C) increasing the target resistance
(D) increasing the filament resistance

30. A photon having energy 15.2 eV will have the frequency

(A) 3.67×10^{15} Hz
(B) 2.29×10^{15} Hz
(C) 3.67×10^{22} Hz
(D) 2.29×10^{22} Hz

31. The wave number of the sodium vapour lamp having spectral line of wavelength 5890 Å is,

(A) $1.6978 \times 10^{6}\ m^{-1}$
(B) $1.6978 \times 10^{8}\ m^{-1}$
(C) $5.0933 \times 10^{6}\ m^{-1}$
(D) $5.0933 \times 10^{8}\ m^{-1}$

32. Which part of the electromagnetic wave is used for the communication purpose?

(A) Radio waves only
(B) Microwaves only
(C) Infrared waves only
(D) Both radio waves and microwaves

33. If E_c and E_s are the amplitudes of the carrier and signal waves, then the magnitude of the upper side band and lower side band is

(A) $m E_c / 2$
(B) $m E_s / 2$
(C) $m (E_c + E_s) / 2$
(D) $m (E_c - E_s) / 2$

34. A rectangular coil having 100 turns of size 5 cm × 2 cm is placed perpendicularly in a magnetic field of induction 0.10 Wb/m^2. When the magnetic field of induction is changed to 0.01 Wb/m^2 in 0.1 second, then the emf induced is

(A) 0.09 V
(B) 0.06 V
(C) 0.03 V
(D) 0.003 V

35. The self-inductance of a long solenoid having N turns, length (l), area of cross section A in air medium is

(A) $L = N \varphi$
(B) $L = \mu_o N^2 A / l$
(C) $L = \mu_o \varphi N A / l$
(D) $L = N \varphi / l$

36. Herapathite (iodoquinine sulphate) is a

(A) polarizer
(B) uniaxial crystal
(C) biaxial crystal
(D) reflector

37. Tyndall effect is due to the _____ of light.

(A) reflection
(B) refraction
(C) polarization
(D) scattering

38. From the Laue pattern, one can get information about the material

(A) crystal system
(B) Bravais lattice
(C) lattice constants
(D) crystal symmetry

39. A nuclear reactor is producing energy of 1000 MW. When the energy per fission is 200 MeV, then the number of fission per second is

(A) 3.125×10^{19}
(B) 5.000×10^{19}
(C) 6.250×10^{19}
(D) 9.375×10^{19}

40. The coolant materials used in the nuclear reactors have the characteristic of _____ specific heat capacity and _____ boiling point.

(A) high, high
(B) high, low
(C) low, high
(D) low, low

41. One Curie is equal to _____ disintegrations per second.

(A) 3.7×10^{8}
(B) 3.7×10^{9}
(C) 3.7×10^{10}
(D) 3.7×10^{12}

42. The average binding energy per nucleon in the mass number region 20 to 80 is

(A) 8.7 MeV
(B) 5.8 MeV
(C) 6.9 MeV
(D) 7.8 MeV

43. Three resistances each of 1 Ω are connected to form a triangle. The resistance between any two terminals is

(A) 2 Ω
(B) 2/3 Ω
(C) 3/2 Ω
(D) 1/3 Ω

44. When a piece of copper and another of germanium are cooled from room temperature to 89 K then the resistance of

(A) copper decreases and germanium increases
(B) copper increases and germanium decreases
(C) each of them decreases
(D) each of them increases

45. A sonometer wire vibrates with a frequency f Hz. It is replaced by another wire of thrice the diameter. The frequency of vibration of the wire, when the tension and other parameters remain constant, is

(A) $3f$ Hz
(B) $f/3$ Hz
(C) $f/9$ Hz
(D) $9f$ Hz

46. Sound waves are travelling in a medium whose adiabatic elasticity is E and isothermal elasticity is E'. Then the velocity of sound waves is proportional to

(A) E'
(B) $\sqrt{E'}$
(C) E
(D) $\sqrt{E}$

47. A converging lens is used to form an image on a screen. When the upper half of the lens is covered by an opaque screen

(A) half the image will disappear
(B) intensity of the image will increase
(C) complete image will be formed
(D) intensity of the image will remain same

48. The motion of the molecules of a monoatomic gas is

(A) vibratory
(B) rotatory
(C) translatory
(D) constant

49. When a charged particle absorbs radiant energy ε in the time $2\pi/\omega$, then the linear momentum transferred to the particle in the same time is

(A) ε/c
(B) c/ε
(C) $c+\varepsilon$
(D) $c-\varepsilon$

50. Which of the following is correct in terms of the relative strength of the four fundamental forces of nature in their decreasing order?

(A) Gravitational, electromagnetic, electroweak and strong
(B) Strong, electroweak, electromagnetic and gravitational
(C) Strong, electroweak, gravitational and electromagnetic
(D) Strong, electromagnetic, electroweak and gravitational

51. The principle involved when we squeeze one end of a tube to get toothpaste out from the other end is

(A) Archimedes principle
(B) Pascal's principle
(C) principle of reflection
(D) principle of superposition for forces

52. Of the following radiations, which one penetrates less through matter?

(A) Gamma
(B) Beta
(C) Alpha
(D) X-rays

53. The electric field intensity at the surface of charged conductor is

(A) perpendicular to the surface
(B) at 45° to the surface
(C) zero
(D) tangential to the surface

54. When milk is churned, cream gets separated due to

(A) centripetal force
(B) centrifugal force
(C) frictional force
(D) gravitational force

55. Two bodies of masses m and 4m are moving with equal kinetic energies. The ratio of their linear momenta will be

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

56. At which temperature, Centigrade and Fahrenheit scales are equal?

(A) 40 degrees
(B) –40 degrees
(C) 37 degrees
(D) –80 degrees

57. During melting of ice, its entropy

(A) increases
(B) decreases
(C) remains same
(D) cannot change

58. The average acceleration in one time period in simple harmonic motion is

(A) $A\omega^2$
(B) $A\omega^2/2$
(C) $A\omega^2/\sqrt{2}$
(D) zero

59. Below the superconducting transition temperature, the material exhibits

(A) ferromagnetism
(B) super fluidity
(C) super capacitance
(D) diamagnetism

60. A 100 millihenry coil carries a current of 1 A. Energy stored in its magnetic field is

(A) 0.5 J
(B) 1 J
(C) 0.05 J
(D) 0.1 J

61. When a drop of oil spread on a water surface, it displays beautiful colours in daylight because of

(A) dispersion of light
(B) reflection of light
(C) polarization of light
(D) interference of light

62. The resistance R = V/I where V = 100 ± 5 volts and I = 10 ± 0.2 amperes. What is the total error in R?

(A) 5%
(B) 7%
(C) 5.2%
(D) 5/2%

63. A shell of mass 10 kg is moving with a velocity of 10 ms^{-1}. Then it blasts and forms two parts of mass 9 kg and 1 kg respectively. If the 1^{st} mass is stationary, the velocity of the 2^{nd} is

(A) 1 m/s
(B) 10 m/s
(C) 100 m/s
(D) 1000 m/s

64. If the distance between two masses is doubled, the gravitational attraction between them

(A) is doubled
(B) become four times
(C) is reduced to half
(D) is reduced to quarter

65. In a Carnot engine, when $T_2 = 0°C$ and $T_1 = 200°C$, its efficiency is η_1, and when $T_1 = 0°C$ and $T_2 = -200°C$ its efficiency is η_2. Then η_1/η_2, is given by

(A) 0.577
(B) 0.733
(C) 0.638
(D) 1.577

66. Eight drops of mercury of equal radii combine to form a big drop. Then the radius of bigger drop compared to each individual small drop is

(A) 8 times
(B) 4 times
(C) 2 times
(D) 32 times

67. The self inductance of a coil is 5 Henry. A current of 1 Amp changes to 2 Amp within 5 second through the coil. The value of induced e.m.f. will be

(A) 10 volt
(B) 0.10 volt
(C) 1.0 volt
(D) 100 volt

68. Relation between critical angles of water and glass is

(A) $C_w > C_g$
(B) $C_w < C_g$
(C) $C_w = C_g$
(D) $C_w = C_g = 0$

69. If the potential difference applied across X-ray tube is V volts, then approximately minimum wavelength of the emitted X-rays will be

(A) $1227/\sqrt{V}$ Å
(B) $1240/V$ Å
(C) $2400/V$ Å
(D) $12400/V$ Å

70. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius (1.01)R. The period of the second satellite is larger than the first one by approximately

(A) 0.7%
(B) 1%
(C) 1.5%
(D) 3%

71. The potential energy of a simple harmonic oscillator when the particle is half way to its end point is

(A) E/2
(B) 2E/3
(C) E/8
(D) E/4

72. At the top of the trajectory of a projectile, the acceleration is

(A) maximum
(B) minimum
(C) zero
(D) *g*

73. A potential of V = $200\sqrt{2}$ cos ωt is passed through a dc voltmeter. Its reading will be

(A) $200\sqrt{2}$ V
(B) 200 V
(C) 100 V
(D) zero

74. Which of the following properties show light is a transverse wave?

(A) Interference
(B) Reflection
(C) Diffraction
(D) Polarization

75. The energy released when 1/12 carbon atom of $^{12}_{6}C$ (or 1 amu) is converted into energy is

(A) 931 MeV
(B) 939 MeV
(C) 935 MeV
(D) 938 MeV

CHEMISTRY

76. The packing efficiency of simple cubic unit cell is

(A) higher than that of ccp
(B) higher than that of bcc
(C) lower than that of both ccp and bcc
(D) equal to that of ccp and bcc

77. The density of a unit cell is

(A) higher than that of its crystal
(B) lower than that of its crystal
(C) same as that of its crystal
(D) None of the above

78. The conductivity of 0.001028 M acetic acid is 4.95×10^{-5} S cm^{-1} and its limiting molar conductivity is 390.5 S cm^2 mol^{-1}. It is degree of dissociation is equal to

(A) 0.0012
(B) 0.1233
(C) 0.2233
(D) 0.0123

79. If a current of 500 ampere is passing for one second, it is equal to

(A) 0.000518 F per sec
(B) 0.518 F per sec
(C) 0.0518 F per sec
(D) 0.00518 F per sec

80. Freundlich adsorption isotherm of a gas on a solid surface is

(A) applicable only at high pressures
(B) applicable only at low pressures
(C) applicable only at moderate pressures
(D) applicable at low and moderate pressures

81. Zeolites are

(A) microporous crystalline alumino silicates
(B) non-porous crystalline alumino silicates
(C) amorphous alumino silicates
(D) microporous crystalline magnesium silicates

82. An azeotropic mixture at its boiling point

(A) can be separated into its components
(B) has different composition for the liquid and vapour
(C) cannot be separated into its components
(D) has different components for the liquid and vapour

83. The wrong statement of chemisorption is

(A) it is highly specific
(B) it is very exothermic
(C) it is reversible
(D) it involves formation of a strong bond

84. The unit cell edge of an element with the bcc structure is 288×10^{-10} cm. Its density is 7.2 g/cm^3. The number of unit cells in 208 g of the element is equal to

(A) 10.01×10^{23}
(B) 12.08×10^{23}
(C) 14.04×10^{23}
(D) 16.03×10^{23}

85. The semiconductors are

(A) alkalimetal oxides
(B) alkaline earth metal oxides
(C) most of the transition metal oxides
(D) oxides of group IV elements

86. According to Le Chatelier's principle, high temperature favours the formation of more products at equilibrium, if the forward reaction

(A) Accompanied by decrease in number of gas molecules
(B) Accompanied by increase in number of gas molecules
(C) Is endothermic
(D) Is exothermic

87. The coordination of each particle in simple cubic, body centred cubic, face centred and hexagonal cubic packing are

(A) 6, 8, 12, 12
(B) 6, 8, 12, 14
(C) 4, 8, 12, 12
(D) 6, 6, 6, 6

88. Vapour pressure of water at 296 K is 19.8 mm of Hg. 0.1 mole of glucose is dissolved in 172.8 g of water. The vapour of the solution is

(A) 19.6 mm
(B) 16.9 mm
(C) 19.0 mm
(D) 18.9 mm

89. The boiling point of an azeotropic mixture in water-ethanol is less than that of both water and ethanol. This means that the mixture

(A) Shows negative deviation from Rauolt's law
(B) Shows positive deviation from Rauolt's law
(C) Shows no deviation from Rauolt's law
(D) Is an ideal solution

90. A calculator batter provides a current of 10^{-5} A. The number of coulombs required to operate 1000 hours is

(A) 1.0
(B) 10
(C) 0.010
(D) 36

91. The potential of half-cell consisting of zinc electrode in 0.01 M $ZnSO_4$ solution at 25°C is (E° = –0.763 V)

(A) –0.704 V
(B) –0.822 V
(C) –0.382 V
(D) +0.704 V

92. The rate constant for a first order reaction is 60 s^{-1}. The time taken to reduce the initial concentration of the reactant to its $1/16^{th}$ value will be

(A) 0.00462 s
(B) 0.462 s
(C) 0.0462 s
(D) 4.63 s

93. Standard free energies of formation (in kJ mol^{-1}) at 298 K are –237.2, –394.4 and –8.2 for $H_2O(I)$, $CO_2(g)$, and pentane(g), respectively. The value of $E°_{cell}$ for the pentane-oxygen fuel cell is

(A) 1.968 V
(B) 2.0968 V
(C) 0.0968 V
(D) 1.0968 V

94. In what way the ionization energy varies in the 1st group elements?

(A) Increases down the group
(B) Decreases down the group
(C) Remains unchanged
(D) Variation is not regular

95. The set containing only amphoteric oxides is

(A) ZnO, K_2O and SO_3
(B) SnO_2, Al_2O_3 and ZnO
(C) ZnO, P_2O_5 and Cl_2O_7
(D) PbO_2, SnO_2 and SO_3

96. Which of the following has more than one unshared pair of electrons on the central atom?

(A) BrF_5
(B) ClF_3
(C) NF_3
(D) IF_7

97. In metallurgical processes, aluminium acts as

(A) a reducing agent
(B) an oxidizing agent
(C) a flux
(D) a solder

98. Which of the following imparts violet colouration to the Bunsen burner non-luminous flame?

(A) NaCl
(B) $BaCl_2$
(C) $CaCl_2$
(D) KCl

99. The complex, which exhibit optical isomerism, is

(A) trans-$[Co(en)_2Cl_2]Cl$
(B) $[PtCl_2(NH_3)_2]$
(C) $[Co(en)_3]Cl_3$
(D) $[Fe(\eta^5\text{-}C_5H_5)_2]$

100. Which of the following is π-acid ligand?

(A) NH_3
(B) CO
(C) F^-
(D) ethylenediammine

101. The magnetic moment of the complex ion, $[MnF_6]^{3-}$, is

(A) 1.73 BM
(B) 3.90 BM
(C) 4.90 BM
(D) 2.73 BM

102. Which of the following nuclides is most radioactive?

(A) $^{31}P_{15}$
(B) $^{66}Zn_{30}$
(C) $^{37}Cl_{17}$
(D) $^{108}Ag_{47}$

103. Which of the following is a not a green house gas?

(A) CO
(B) CO_2
(C) Water vapour
(D) CH_4

104. What type of orbital is designated for the set of quantum numbers: $n = 4$, $l = 2$, $m_l = -2$?

(A) 4 *p*
(B) 4 *f*
(C) 4 *d*
(D) 4 *s*

105. Which of the following sets of quantum numbers is not allowed?

(A) $n = 3, l = 2, m_l = -1$
(B) $n = 6, l = 2, m_l = -1$
(C) $n = 4, l = 3, m_l = -1$
(D) $n = 3, l = 0, m_l = +1$

106. Ionic size decreases in the order

(A) $N^{3-} > O^{2-} > F^{-} > Na^{+} > Mg^{2+}$
(B) $N^{3-} > O^{2-} > F^{-} > Mg^{2+} > Na^{+}$
(C) $N^{3-} > F^{-} > O^{2-} > Na^{+} > Mg^{2+}$
(D) $O^{2-} > N^{3-} > F^{-} > Na^{+} > Mg^{2+}$

107. The $t_{1/2}$ of a radioisotope is 15 min. What percent of radioactivity of that isotope will remain after 45 min?

(A) 10%
(B) 12.5%
(C) 15%
(D) 17.5%

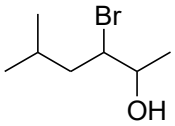
108. Water gas is a mixture of

(A) H_2O + air
(B) CO + H_2
(C) CO + CO_2
(D) H_2 + CO_2

109. Which category of synthetic detergents is used in toothpaste?

(A) Zwitterionic detergent
(B) Anionic detergent
(C) Cationic detergent
(D) Non-ionic detergent

110. The IUPAC name of the following compound is

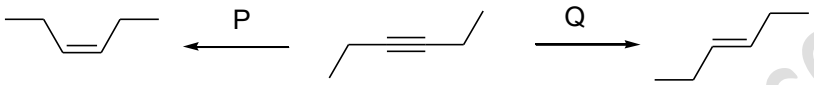


(A) 4-bromo-5-hydroxy-2-methylhexane
(B) 1,4,4-trimethyl-2-bromobutanol
(C) 2-bromo-2-isobutyl-1-methylethanol
(D) 3-bromo-5-methylhexan-2-ol

111. On complete combustion, 0.25 g of an organic compound gave 0.30 g of carbon dioxide and 0.10 g of water. The percentage compositions of carbon and hydrogen in the compound are

(A) C = 32.73 and H = 4.44
(B) C = 30.73 and H = 5.33
(C) C = 34.36 and H = 5.33
(D) C = 36.36 and H = 4.44

112. The reagents P and Q in the following transformations are



(A) P = H_2, Pd-$CaCO_3$, $Pb(OAc)_2$, quinoline & Q = Li, $NH_3(\ell)$
(B) P = H_2, Ni & Q = Na, $NH_3(\ell)$
(C) P = H_2, Pd-$CaCO_3$, $Pb(OAc)_2$, quinoline & Q = H_2, Ni
(D) P = $NaBH_4$ & Q = H_2, Pd-$CaCO_3$, $Pb(OAc)_2$, quinoline

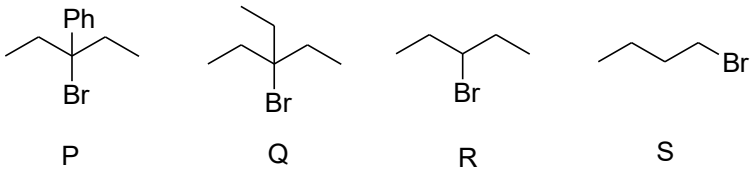
113. Which of the following alkenes forms acetone as the only product upon ozonolysis?

(A) 2-Methylpropene
(B) But-2-ene
(C) 2,3-Dimethylbut-2-ene
(D) 2-Methylbut-1-ene

114. When the nucleophile is changed from H_2O to ^-OH (^-OH is more powerful nucleophile than H_2O) in the nucleophilic substitution reaction of *tert*-butylbromide, to give *tert*-butanol

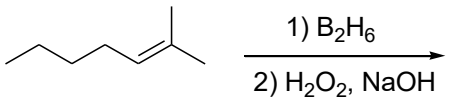
(A) the rate of the reaction remains nearly unaffected
(B) the rate of the reaction increases substantially
(C) the rate of the reaction decreases
(D) mechanism of substitution changes from S_N1 to S_N2

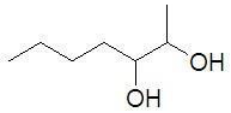
115. Which among the following compounds undergoes fastest S_N1 reaction?

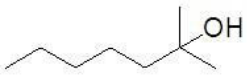


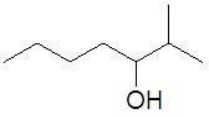
(A) P
(B) Q
(C) R
(D) S

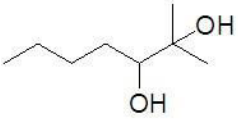
116. Major product of the following reaction is



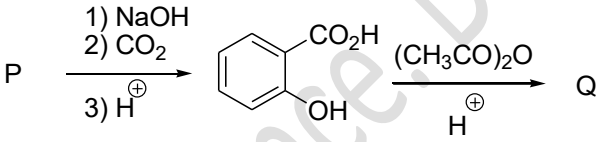
(A) 

(B) 

(C) 

(D) 

117. The starting material P and product Q in the following reaction are:

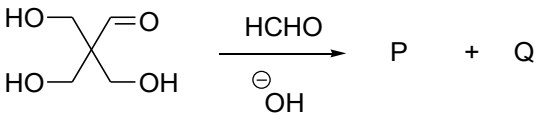


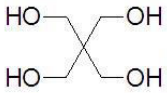
(A) P = phenol and Q = aspirin
(B) P = benzoic acid and Q = aspirin
(C) P = phenol and Q = methyl salicylate
(D) P = benzoic acid and Q = methyl salicylate

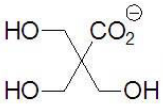
118. An organic compound P with molecular formula C_8H_8O forms an orange-red precipitate with 2,4-dinitrophenylhydrazine and yellow precipitate on heating with iodine in the presence of NaOH. It does not reduce Tollens' or Fehling's reagent and it does not decolorize bromine water. When treated with zinc-amalgam and con. HCl, it gives a compound Q with molecular formula C_8H_{10}. The compounds P and Q are

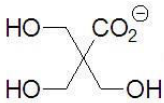
(A) P = acetophenone and Q = 1,2-dimethylbenzene (*o*-xylene)
(B) P = 2-phenylacetaldehyde and Q = ethylbenzene
(C) P = 4-methylbenzaldehyde and Q = 1,4-dimethylbenzene (*p*-xylene)
(D) P = acetophenone and Q = ethylbenzene

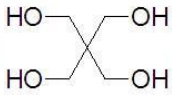
119. The products P and Q in the following reaction are



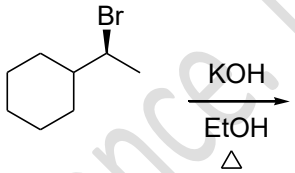
(A) P =  & Q = $HCO_2^{\ominus}$

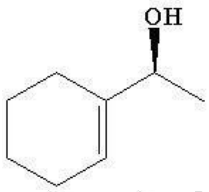
(B) P =  & Q = CH_3OH

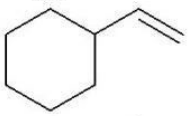
(C) P =  & Q = $HCO_2^{\ominus}$

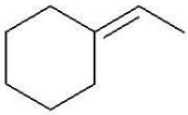
(D) P =  & Q = CH_3OH

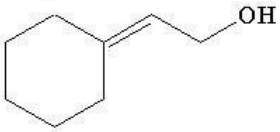
120. Major product formed in the following reaction is



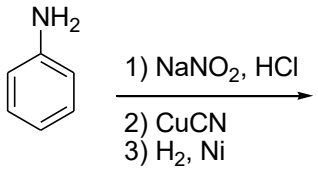
(A) 

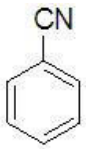
(B) 

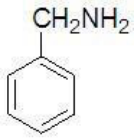
(C) 

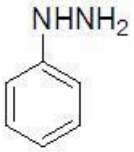
(D) 

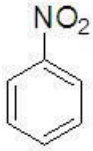
121. Major product formed in the following reaction sequence is



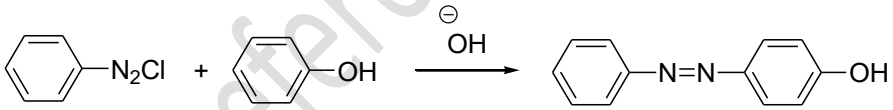
(A) 

(B) 

(C) 

(D) 

122. Consider the following reaction.



Here, benzene diazonium chloride acts as

(A) nucleophile
(B) electrophile
(C) Lewis base
(D) Bronsted base

123. The maximum number of dipeptides that could be made from the three different amino acids is

(A) 4
(B) 6
(C) 9
(D) 8

124. Which one of the following is an example for biodegradable polymers?

(A) Nylon 6
(B) Nylon 6,6
(C) Glyptal
(D) Nylon 2-nylon 6

125. Which among the following is not a detergent?

(A) Sodium laurylsulphate
(B) Sodium dodecylbenzenesulphonate
(C) cetyltrimethylammonium bromide
(D) calcium stearate

MATHEMATICS

126. The value of x, for which $\log_e(x-3)<1$ lies in

(A) (0, 3)
(B) (0, e)
(C) (0, e + 3)
(D) (3, 3 + e)

127. The area bounded by the curve $y = \cos x$ between $x=\frac{-\pi}{2}$ and $x=\frac{3\pi}{2}$ is

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

128. The number of values of x satisfying is $\left(\sqrt{12}\right)^x+\left(\sqrt{3}\right)^x=\left(\sqrt{13}\right)^{x/2}$

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

129. If $f(x)=x(x+3)e^{-\left(\frac{1}{2}\right)x}$ satisfies Rolle's Theorem in $[-3, 0]$, then the value of c is

(A) –3
(B) –1
(C) 0
(D) –2

130. Let $f(x)=ax^2+bx+c$ and $a\neq 0$. Suppose $f(-1)<1$, $f(1)>-1$ and $f(3)<-4$. Then

(A) b is an integer
(B) $b+1>0$
(C) $b+1<0$
(D) b is positive real

131. If $z=x+iy$ and x, y are real, then $|x|+|y|\leq k|z|$, where k is equal to

(A) 1
(B) $\sqrt{2}$
(C) $\sqrt{3}$
(D) 2

132. For any complex number z, the minimum value of $|z|+|z-1|\geq$

(A) 1
(B) 0
(C) $\frac{1}{2}$
(D) $\frac{3}{2}$

133. Locus of the point z satisfying the equation $|iz-1|+|z-i|=2$ is

(A) a straight line
(B) a circle
(C) an ellipse
(D) a pair of straight lines

134. The value of $\left(\frac{1+i}{\sqrt{2}}\right)^8+\left(\frac{1-i}{\sqrt{2}}\right)^8$ is equal to

(A) 4
(B) 6
(C) 8
(D) 2

135. Number of elements of order 4 in the group $\left(Z_5 - \{[0]\}, \cdot_5\right)$ is

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

136. The equation of the ellipse whose axes are coincident with the coordinate axes and which touches the straight lines $3x - 2y - 20 = 0$ and $x + 6y - 20 = 0$ is

(A) $\frac{x^2}{5} + \frac{y^2}{8} = 1$
(B) $\frac{x^2}{8} + \frac{y^2}{5} = 1$
(C) $\frac{x^2}{40} + \frac{y^2}{10} = 1$
(D) $\frac{x^2}{10} + \frac{y^2}{40} = 1$

137. $\lim_{x \to 0} \frac{\sin 2x + 2\sin^2 x - 2\sin x}{\cos x - \cos^2 x}$ is equal to

(A) –4
(B) –2
(C) 2
(D) 4

138. Sum of n terms of the series $\sqrt{2} + \sqrt{8} + \sqrt{18} + \sqrt{32} + \ldots$ is equal to

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

139. If $f(x)$ is a function satisfying $f(x+y)=f(x).f(y)$ for all $x, y \in$ such that $f(1)=3$ and $\sum_{x=1}^{n} f(x)=120,$ then the value of n is

(A) 4
(B) 5
(C) 6
(D) 7

140. The sum of the series $1+2x+3x^2+4x^3+\ldots$ up to infinity when x lies between 0 and 1 (i.e., $0<x<1$) is

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

141. The positive integer n for which $2\times2^2+3\times2^3+4\times2^4+\ldots+n\times2^n=2^{n+10}$ is

(A) 510
(B) 511
(C) 512
(D) 513

142. If $\sin\alpha,\ \cos\alpha$ are the roots of the equation $ax^2+bx+c=0\ (c\neq0)$, then

(A) $a^2-b^2+2ac=0$
(B) $(a+c)^2=b^2-c^2$
(C) $a^2+b^2-ac=0$
(D) $(a-c)^2=b^2+c^2$

143. The positive value of $\sqrt{6+\sqrt{6+\sqrt{6+\ldots\infty}}}$ is

(A) 3
(B) 6
(C) –2
(D) –4

144. If $\int_a^b f(x)dx = 5a + 3b$, then $\int_a^b \big(f(x) + 10\big)dx$ is equal to

(A) $13b + 15a$
(B) $15a - 7b$
(C) $-5a - 5b$
(D) $13b - 5a$

145. The functions f and g are given by $f(x) = (x)$, where (x) denotes the fractional part of x and $g(x) = \frac{1}{2}\sin[x]\pi$, where $[x]$ denotes the integral part of x. Then the range of $g \circ f$ is

(A) $[-1,1]$
(B) $\{0\}$
(C) $\{-1,1\}$
(D) [0, 1]

146. If $\left(a^2 - 1\right)x^2 + (a-1)x + a^2 - 4a + 3 = 0$ is an identity in x, then the value of a is

(A) 1
(B) 3
(C) –1
(D) –3

147. The inequality $|z - i| < |z + i|$ represents the region

(A) $\text{Im}(z) > 0$
(B) $\text{Im}(z) < 0$
(C) $\text{Re}(z) > 0$
(D) $\text{Re}(z) < 0$

148. The total number of 9 digit numbers with different digits is

(A) 10!
(B) 9!
(C) 9.9!
(D) 10.10!

149. The sum of all the values of x satisfying the equation $\log_{17}\log_{11}\left(\sqrt{x+11}+\sqrt{x}\right)=0$ is

(A) 25
(B) 36
(C) 171
(D) 0

150. The number of five-digit telephone numbers having at least one of their digits repeated is

(A) 90000
(B) 100000
(C) 30240
(D) 69760

151. In a group of 8 girls, two of them are sisters. The number of ways in which the girls can sit so that two sisters are not sitting together is

(A) 34820
(B) 31410
(C) 30830
(D) 30240

152. The function $f:\square\to\square$ defined by $f(n)=\begin{cases}\dfrac{n-1}{2}, & \text{when } n \text{ is odd}\\ \dfrac{n}{2}, & \text{when } n \text{ is even}\end{cases}$

(A) is onto but not one-one
(B) is one-one and onto both
(C) is neither one-one nor onto
(D) is one-one but not onto

153. In the expansion of $\left(x-\dfrac{1}{x}\right)^6$, the constant term is

(A) 20
(B) –20
(C) 30
(D) –30

154. The sum of all three digit numbers which are even is

(A) 247050
(B) 247052
(C) 247048
(D) 247060

155. The value of n for which the determinant $\begin{vmatrix} \binom{8}{3} & \binom{9}{5} & \binom{10}{7} \\ \binom{8}{4} & \binom{9}{6} & \binom{10}{8} \\ \binom{9}{n} & \binom{10}{n+2} & \binom{11}{n+4} \end{vmatrix}$ becomes zero is

(A) 2
(B) 3
(C) 4
(D) 5

156. If $\sin\theta + \text{cosec}\,\theta = 2$, then $\sin^2\theta + \text{cosec}^2\theta$ is equal to

(A) 1
(B) 4
(C) 2
(D) 0

157. If $x > 0$, and $\log_2 x + \log_2\left(\sqrt{x}\right) + \log_2\left(\sqrt[4]{x}\right) + \log_2\left(\sqrt[8]{x}\right) + \ldots = 4$, then x equals

(A) 2
(B) 3
(C) 4
(D) 5

158. If z and w are two non-zero complex number such that $|z| = |w|$ and $\arg z + \arg w = \pi$, then z equals

(A) $\bar{w}$
(B) $-\bar{w}$
(C) w
(D) $-w$

159. The number of different positive divisors of 2160 is

(A) 30
(B) 40
(C) 50
(D) 60

160. The maximum value of $f(x) = 4x^3 - 15x^2 + 12x - 2$ is

(A) $\frac{3}{4}$
(B) $-\frac{3}{4}$
(C) –6
(D) 6

161. If $\lim_{x \to 0}(1+ax)^{b/x} = e^4$, where a and b are natural numbers, then

(A) $a = 4,\ b = 2$
(B) $a = 8,\ b = 4$
(C) $a = 16,\ b = 8$
(D) $ab = 4$

162. In a ΔABC, if $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$ and the side $a = 2$, then area of the triangle is

(A) 1
(B) 2
(C) $\sqrt{3}/2$
(D) $\sqrt{3}$

163. $\lim_{x \to 0}\left(\frac{1+\tan x}{1+\sin x}\right)^{\operatorname{cosec} x}$ is equal to

(A) 1
(B) e
(C) e^{-1}
(D) e^2

164. The coefficient of x in $f(x)=\begin{vmatrix} x & 1+\sin x & \cos x \\ 1 & \log(1+x) & 2 \\ x^2 & 1+x^2 & 0 \end{vmatrix}$, $-1<x\le 1$, is

(A) 1
(B) -2
(C) -1
(D) 0

165. If $\cos A+\cos B+\cos C=3/2$, then the triangle is

(A) equilateral
(B) right angled
(C) isosceles
(D) with an angle 45°

166. The value of $1000\left[\frac{1}{1\times 2}+\frac{1}{2\times 3}+\ldots+\frac{1}{999\times 1000}\right]$ is equal to

(A) 1000
(B) 999
(C) 1001
(D) $\frac{1}{999}$

167. The line $y=3x$ bisects the angle between the lines $ax^2+2axy+y^2=0$ if $a=$

(A) 3
(B) 11
(C) $3/11$
(D) $11/3$

168. If the locus of a point which moves so that the line joining the points of contacts of the tangents drawn from it to the circle $x^2+y^2=b^2$ touches the circle $x^2+y^2=a^2$, is the circle $x^2+y^2=c^2$, then a, b, c are in

(A) A.P.
(B) G.P.
(C) H.P.
(D) $a=b=c$

169. If x satisfies the equation $x^2 - 2x\cos\theta + 1 = 0$, then the value of $x^n + 1/x^n$ is equal to

(A) $2^n \cos n\theta$
(B) $2^n \cos^n \theta$
(C) $2\cos n\theta$
(D) $2\cos^n \theta$

170. The sum of the series $\cos x - \frac{1}{2}\cos^2 x + \frac{1}{3}\cos^3 x - \frac{1}{4}\cos^4 x + \ldots$ is equal to

(A) $\log 2 + 2\log\left|\cos\left(\frac{x}{2}\right)\right|$
(B) $\log 2 - 2\log\left|\cos\left(\frac{x}{2}\right)\right|$
(C) $\log 2 + \log\left|\cos\left(\frac{x}{2}\right)\right|$
(D) $\log 2 - \log\left|\cos\left(\frac{x}{2}\right)\right|$

171. In a class of 100 students, there are 70 boys whose average marks in a subject is 75. If the average marks of the complete class is 72, then the average marks of the girls is

(A) 73
(B) 74
(C) 68
(D) 65

172. Whatever be the value of θ, the locus of the point of intersection of the lines $x\cos\theta + y\sin\theta = a$ and $x\sin\theta - y\cos\theta = b$ is

(A) an ellipse
(B) a straight line
(C) a circle
(D) a pair of straight lines

173. Let $f(x) = bx^2 + cx + d$. The values of b and c for which the identity $f(x+1) - f(x) = 8x + 3$ is satisfied, are

(A) $b = c,\ c = 1$
(B) $b = 4,\ c = -1$
(C) $b = -1,\ c = 4$
(D) $b = -1,\ c = 1$

174. For a party 8 guests are invited by a husband and his wife. They sit around a circular table for dinner. The probability that the husband and his wife sit together is

(A) 2/7
(B) 2/9
(C) 1/9
(D) 4/9

175. The domain of real valued function $f(x)=\sqrt{\left(\log_{16} x^2\right)}$ of the real variable x is

(A) $x>0$
(B) $|x|\geq 1$
(C) $|x|\geq 4$
(D) $x\geq 4$

176. The straight line $3x+y=9$ divides the line segment joining the points (1, 3) and (2, 7) in the ratio

(A) 3 : 4 internally
(B) 3 : 4 externally
(C) 4 : 5 internally
(D) 5 : 6 externally

177. The value of $f(0)$ so that $f(x)=\dfrac{\left(4^x-1\right)^3}{\sin\left(\dfrac{x}{4}\right)\log\left(1+\dfrac{x^2}{3}\right)}$ is continuous everywhere, is equal to

(A) $3(\log 4)^3$
(B) $(\log 4)^3$
(C) $12(\log 4)^3$
(D) $15(\log 4)^3$

178. If $\log_{0.2}(x-2)<\log_{0.04}(x-2)$, then x lies in the interval

(A) $(3,\infty)$
(B) (2, 3)
(C) (1, 2)
(D) $(0,\infty)$

179. A function $y = f(x)$ has a second order derivatives $f''(x) = 6(x-1)$. If its graph passes through the point (2, 1) and at that point the tangent to the graph is $y = 3x - 5$, then the function is

(A) $(x-1)^3$
(B) $(x+1)^3$
(C) $(x-1)^2$
(D) $(x+1)^2$

180. If $f(x) = \sin\dfrac{e^{x-2}-1}{\log(x-1)}$, then $\lim_{x\to 2} f(x)$ is given by

(A) -2
(B) -1
(C) 0
(D) 1

181. If a function f has the property that $f(x) + f(y) = f(x+y)$ for all real x and y, then $f(-x)$ is equal to

(A) 0
(B) 1
(C) $f(x)$
(D) $-f(x)$

182. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ and $|\vec{a}| = 3$, $|\vec{b}| = 4$ and $|\vec{c}| = \sqrt{37}$, then the angle between $\vec{a}$ and $\vec{b}$ is

(A) $\dfrac{\pi}{4}$
(B) $\dfrac{\pi}{2}$
(C) $\dfrac{\pi}{6}$
(D) $\dfrac{\pi}{3}$

183. For two data sets, each of size 5, the variances are given to be 4 and 5 and the corresponding means are given to be 2 and 4, respectively. The variance of the combined data set is

(A) $5/2$
(B) $11/2$
(C) 6
(D) $13/2$

184. If a function is defined by $f(x)=\begin{cases} x, & \text{when } x \text{ is rational} \\ -x, & \text{when } x \text{ is irrational} \end{cases}$.

Then

(A) f is continuous at every x, except $x = 0$
(B) f is discontinuous at every x, except $x = 0$
(C) f is continuous at everywhere
(D) f is discontinuous at everywhere

185. Let $f(x)=(x-x_0)g(x)$ where $g(x)$ is continuous at x_0, then $f'(x_0)$ is equal to

(A) 0
(B) x_0
(C) $g(x_0)$
(D) $g'(x_0)$

186. If $u=\sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$, then $\left[x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}\right]=$

(A) u
(B) $\sin u$
(C) $\tan u$
(D) 1

187. If SD of variate x is σ, then the SD of $\frac{ax+b}{p}$, $\forall a,b,\ p \in R$ is

(A) $\left|\frac{a}{p}\right|\sigma_x$

(B) $\left|\frac{p}{a}\right|\sigma_x$

(C) $\frac{p}{a}\sigma_x$

(D) σ_x

188. If $z = xyf\left(x/y\right)$, then $\left[x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y}\right] =$

(A) z

(B) 0

(C) $1/z$

(D) $2z$

189. If $f(x,y) = \ln\left(x\tan^{-1} y\right)$, then $f_{xy} =$

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

(B) 0

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

(D) y

190. The ratio in which $\hat{i} + 2\hat{j} + 3\hat{k}$ divides the join of $-2\hat{i} + 3\hat{j} + 5\hat{k}$ and $7\hat{i} - \hat{k}$ is

(A) 1 : 2

(B) 2 : 3

(C) 3 : 4

(D) 1 : 4

191. In a binomial distribution $B\left(n, p=1/4\right)$ if the probability of at least one success is greater than or equal to $9/10$, then n is greater than

(A) $\dfrac{1}{\log_{10} 4-\log_{10} 3}$

(B) $\dfrac{1}{\log_{10} 4+\log_{10} 3}$

(C) $\dfrac{9}{\log_{10} 4-\log_{10} 3}$

(D) $\dfrac{4}{\log_{10} 4-\log_{10} 3}$

192. The angle of intersection of the curves $y=x^2$ and $6y=7-x^3$ at (1, 1) is

(A) $\pi/4$

(B) $\pi/3$

(C) $\pi/2$

(D) π

193. The transformed equation of $3x^2+3y^2+2xy=2,$ when the coordinate axes are rotated through an angle of 45°, is

(A) $x^2+2y^2=1$

(B) $2x^2+y^2=1$

(C) $x^2+y^2=1$

(D) $x^2+3y^2=1$

194. If orthocenter and circumcentre of a triangle are respectively (1, 1) and (3, 2), then the coordinates of its centroid are

(A) $\left(\frac{7}{3},\frac{5}{3}\right)$

(B) $\left(\frac{5}{3},\frac{7}{3}\right)$

(C) (7, 5)

(D) (5, 7)

195. If the curves $y^2 = 16x$ and $9x^2 + by^2 = 16$ cut each other at right angles, then the value of b is

(A) 2
(B) 4
(C) $9/2$
(D) 0

196. The term independent of x in the expansion of $(1+x)^3\left(x-\frac{1}{x}\right)^6$ is

(A) 25
(B) –25
(C) 65
(D) –65

197. The area of the triangle formed by the tangent and the normal to the parabola $y^2 = 4ax$, both drawn at the same end of the latuscrectum and the axis of the parabola is

(A) $2\sqrt{2}a^2$
(B) $2a^2$
(C) $4a^2$
(D) $4a$

198. If the straight lines $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ intersect on the $x-$axis, then

(A) $ag = fh$
(B) $ah = fg$
(C) $af = gh$
(D) $a = ghf$

199. The median of a set of 9 distinct observations is 20.5. If each of the largest 4 observations of the set is increased by 2, then the median of the new set

(A) is decreased by 2
(B) is two times the original median
(C) remains the same as that of the original set
(D) is increased by 2

200. The function $f : R \to R$ be defined by $f(x) = 2x - 7$ for all $x \in R$. Then f is

(A) injective but not surjective
(B) surjective but not injective
(C) neither injective nor surjective
(D) bijective

201. If $f(x) = \begin{cases} x, & \text{when } x \text{ is rational} \\ 1-x, & \text{when } x \text{ is irrational} \end{cases}$,

then

(A) f is differentiable for all real x
(B) f is continuous for all real x
(C) f is continuous only at $x = \frac{1}{2}$
(D) f is discontinuous for all real x

202. A square is inscribed in the circle $x^2 + y^2 - 2x + 4y + 3 = 0$. Its sides are equal to the coordinate axes. Then one vertex of the square is

(A) $(0, 2)$
(B) $(0, -3)$
(C) $(2, 0)$
(D) $(2, -1)$

203. The centre of the circle which circumscribes the square formed by $x^2 - 8x + 12 = 0$ and $y^2 - 14y + 45 = 0$ is

(A) (3, 7)
(B) (4, 7)
(C) (2, 5)
(D) (6, 9)

204. The radius of the circle touching the straight lines $x-2y-1=0$ and $3x-6y+7=0$, is

(A) $\frac{3}{\sqrt{5}}$

(B) $\frac{\sqrt{5}}{3}$

(C) $\sqrt{5}$

(D) $\frac{1}{\sqrt{2}}$

205. ABC is an isosceles triangle and the coordinates of the base are $B(1,3)$ and $C(-2,7)$. Then the coordinates of vertex A can be

(A) $(1, 6)$

(B) $(1/2, 5)$

(C) $(5/6, 6)$

(D) $(-8, 1/8)$

206. The function $f(x)=(3-x)e^{2x}-4xe^{x}-x$ has

(A) a maximum at $x=0$

(B) a minimum at $x=0$

(C) neither a maximum nor a minimum at $x=0$

(D) $f(x)$ is not differentiable at $x=0$

207. In an arranged discrete series in which total number of observations 'n' is even, then the median is

(A) $\frac{n}{2}^{\text{th}}$ item

(B) $\left(\frac{n}{2}+1\right)^{\text{th}}$ item

(C) The mean of $\frac{n}{2}^{\text{th}}$ and $\left(\frac{n}{2}+1\right)^{\text{th}}$ item

(D) n

208. The number of solutions of $\tan^{-1}\sqrt{x(x+1)}+\sin^{-1}\sqrt{x^2+x+1}=\pi/2$ is

(A) 0
(B) 1
(C) 2
(D) infinite

209. A ladder rest against a wall at an angle α to the horizontal. Its foot is pulled away from the wall through a distance a so that it slides a distance b down wall making an angle β with the horizontal, then $\tan(\alpha+\beta)$ is equal to

(A) $\frac{a}{b}$
(B) $\frac{b}{a}$
(C) $\frac{2ab}{a^2-b^2}$
(D) $\frac{2ab}{b^2-a^2}$

210. Area bounded by the curve $y=\log x$, $y=0$ and $x=e$ is given by

(A) e
(B) $e/2$
(C) 1
(D) ∞

211. The line $y=2t^2$ intersects the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ in real points, if

(A) $|t|\le 1$
(B) $|t|<1$
(C) $|t|>1$
(D) $|t|\ge 1$

212. A man standing on level plane observer the angle of elevation of top of a pole to be α. He walks, a distance equal to double the height of the pole and finds that elevation is 2α. Then α is equal to

(A) $\pi/12$
(B) $\pi/6$
(C) $\pi/4$
(D) $\pi/3$

213. The number of values of c such that the line $y = 4x + c$ touches the curve $\frac{x^2}{4} + y^2 = 1$, is

(A) 1
(B) 2
(C) ∞
(D) 0

214. The domain of $f(x) = \cos^{-1}(2x)$ is

(A) $(-1,1)$
(B) $\left(-\frac{1}{2}, \frac{1}{2}\right]$
(C) $\left[-1, \frac{1}{2}\right]$
(D) $\left[-\frac{1}{2}, \frac{1}{2}\right]$

215. If $y = \sqrt{x \log_x x}$, then $\frac{dy}{dx}$ at $x = e$ is

(A) $\frac{1}{e}$
(B) $\frac{1}{\sqrt{e}}$
(C) $\sqrt{e}$
(D) e

216. The area enclosed between the curves $y^2 = x$ and $y = |x|$ is

(A) $2/3$ sq unit
(B) 1 sq unit
(C) $1/6$ sq unit
(D) $1/3$ sq unit

217. If y is a function of x and $\log(x+y) - 2xy = 0$, then the value of $y'(0)$ is equal to

(A) 1
(B) -1
(C) 2
(D) 0

218. If $x^2 + y^2 = t - \frac{1}{t}$ and $x^4 + y^4 = t^2 + \frac{1}{t^2}$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{1}{x^2y^3}$
(B) $\frac{1}{xy^3}$
(C) $\frac{1}{x^2y^2}$
(D) $\frac{1}{x^3y}$

219. The set of points where $f(x) = \frac{x}{1+|x|}$ is differentiable are in

(A) $(0, \infty)$
(B) $(-\infty, 0) \cup (0, \infty)$
(C) $(-\infty, -1) \cup (-1, \infty)$
(D) $(-\infty, \infty)$

220. If $f(x+y) = 2f(x)f(y)$, $f'(5) = 1024(\log 2)$ and $f(2) = 8$, then the value of $f'(3)$ is equal to

(A) 64(log 2)
(B) 128(log 2)
(C) 256(log 2)
(D) 1024(log 2)

221. General solution of the equation $\sin x-3\sin 2x+\sin 3x=\cos x-3\cos 2x+\cos 3x$ is

(A) $n\pi+\frac{\pi}{2}$

(B) $(-1)^n\frac{n\pi}{2}+\frac{\pi}{8}$

(C) $2n\pi+\cos^{-1}\frac{2}{3}$

(D) $\frac{n\pi}{2}+\frac{\pi}{8}$

222. Domain of the function $f(x)=\sqrt{\log_{10}\left(\frac{5x-x^2}{4}\right)}$ is

(A) $0\le x\le 5$
(B) $1\le x\le 4$
(C) $1\le x\le 5$
(D) $0\le x\le 4$

223. The domain of the function $f(x)=x^{\frac{1}{\log x}}$ is

(A) $(0,\infty)-\{1\}$
(B) $(0,\infty)$
(C) $[0,\infty)$
(D) $[0,\infty)-\{1\}$

224. The function $f(x)=\frac{\sec^{-1}x}{\sqrt{x-[x]}}$, where $[x]$ denotes the greatest integer less than or equal to x is defined for all x belonging to

(A) $\square$
(B) $\square^{+}-(0,1)$
(C) $\square^{+}-\{n\,|\,n \text{ is an integer}\}$
(D) $\square-\{(-1,1)\cup\{n\,|\,n \text{ is an integer}\}\}$

225. For the function $f(x) = e^{\cos x}$, Rolle's Theorem is

(A) applicable when $0 \le x \le \frac{\pi}{2}$

(B) applicable when $\frac{\pi}{2} \le x \le \frac{3\pi}{2}$

(C) applicable when $\frac{\pi}{4} \le x \le \frac{\pi}{2}$

(D) applicable when $0 \le x \le \pi$

226. If $f(x) = -x \tan x$, then the function $f(x)$ is

(A) monotonically increasing in $\left(0, \frac{\pi}{2}\right)$

(B) monotonically decreasing in $\left(0, \frac{\pi}{2}\right]$

(C) strictly decreasing in $\left(0, \frac{\pi}{2}\right)$

(D) not monotonic in $\left(0, \frac{\pi}{2}\right)$

227. Ram is visiting a friend. Ram knows that his friend has 2 children and 1 of them is a boy. Assuming that a child is equally likely to be a boy or a girl, then the probability that the other child is a girl, is

(A) 1/3
(B) 1/2
(C) 2/9
(D) 2

228. Let $f(x) = 2x^2 + 5x + 1$. If we write $f(x)$ as
$f(x) = a(x+1)(x-2) + b(x-2)(x-1) + c(x-1)(x+1)$ for real numbers a, b, c, then

(A) there are infinite number of choices for a, b, c
(B) only one choice for a but infinite number of choices for b and c
(C) exactly one choice for each of a, b, c
(D) more than one but finite number of choices for a, b, c

229. If the function $f:\square \to \square$ is defined by $f(x)=\left(x^2+1\right)^{10}$, for all $x\in\square$, then f is

(A) one-one but not onto
(B) onto but not one-one
(C) neither one-one nor onto
(D) both one-one and onto

230. $\lim_{x\to 1}\left(\frac{1+x}{2+x}\right)^{\frac{1-\sqrt{x}}{1-x}}$ is

(A) 1
(B) $\sqrt{\frac{2}{3}}$
(C) does not exist
(D) 2

231. A function $f(x)$ is defined as follows for real x, $f(x)=\begin{cases}1-x^2, & \text{for } x<1\\ 0, & \text{for } x=1\\ 1+x^2, & \text{for } x>1\end{cases}$.

Then

(A) $f(x)$ is not continuous at $x = 1$
(B) $f(x)$ is continuous but not differentiable at $x = 1$
(C) $f(x)$ is both continuous and differentiable $x = 1$
(D) f is a constant function

232. The greatest value of $f(x)=(x+1)^{1/3}-(x-1)^{1/3}$ on [0, 1] is

(A) 0
(B) 1
(C) 2
(D) −1

233. $\int\left(\frac{(\log x-1)}{1+(\log x)^2}\right)^2 dx$ is equal to

(A) $\frac{x}{(\log x)^2+1}+c$

(B) $\frac{xe^x}{(1+x^2)}+c$

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

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

234. The value of $\int x\left(x^x\right)^x(2\log x+1)dx$ is

(A) $\left(x^x\right)^x+c$

(B) x^x+c

(C) $x^{\log x}+c$

(D) $\left(x^{\log x}\right)^x+c$

235. The value of $\int_{-\pi/2}^{\pi/2}\log\left(\frac{2-\sin\theta}{2+\sin\theta}\right)d\theta$ is

(A) 0

(B) 1

(C) 2

(D) 3

236. If a,b,c are different and $\begin{vmatrix} a & a^2 & a^3-1 \\ b & b^2 & b^3-1 \\ c & c^2 & c^3-1 \end{vmatrix}=0$, then

(A) $a+b+c=0$

(B) $abc=1$

(C) $a+b+c=1$

(D) $ab+bc+ca=0$

237. If $f(x)=\begin{vmatrix}\cos x & 1 & 0\\ 1 & 2\cos x & 1\\ 0 & 1 & 2\cos x\end{vmatrix}$, then $\int_0^{\pi/2} f(x)dx =$

(A) 1/3
(B) 1/4
(C) 1/2
(D) 0

238. Set A has 3 elements and set B has 4 elements. The number of injections that can be defined from A to B is

(A) 144
(B) 12
(C) 24
(D) 64

239. The value of $\int_0^a \sqrt{\frac{a-x}{x}}dx$ is

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

240. Which of the following is an even function?

(A) $f(x)=\frac{a^x+a^{-x}}{a^x-a^{-x}}$
(B) $f(x)=\frac{a^x+1}{a^x-1}$
(C) $f(x)=x\left(\frac{a^x-1}{a^x+1}\right)$
(D) $f(x)=\log_2\left(x+\sqrt{x^2+1}\right)$

241. From 6 different novels and 3 different dictionaries, 4 novels and 1 dictionary are to be selected and arranged in a row on a shelf so that the dictionary is always in the middle. Then the number of such arrangements is

(A) at least 750 but less than 1000
(B) at least 1000
(C) at least 500 but less than 750
(D) less than 500

242. A ball weighting 0.01 kg hits a head surface vertically with a speed of 5 m/sec and rebounds with the same speed. The ball remains in contact with the surface for 0.01 sec. The average force exerted by the surface on the ball in Newton is

(A) 0.1
(B) 1.0
(C) 5.0
(D) 10.0

243. If the constant term in the expansion of $\left(\sqrt{x}-\frac{k}{x^2}\right)^{10}$ is 405, then k is

(A) ± 2
(B) $\pm\sqrt[4]{3}$
(C) ± 3
(D) $\pm\sqrt[3]{4}$

244. $\log_7 \log_7 \sqrt{7\sqrt{7\sqrt{7}}}$ is equal to

(A) $3\log_2 7$
(B) $\log_7 2$
(C) $1-3\log_7 2$
(D) $1-3\log_2 7$

245. The equation of the sphere with centre at $(2,3,-4)$ and touching the plane $2x+6y-3z+15=0$ is

(A) $x^2+y^2+z^2-4x-6y+8z-20=0$
(B) $x^2+y^2+z^2+4x-6y-8z-20=0$
(C) $x^2+y^2+z^2-4x-6y+8z+20=0$
(D) $x^2+y^2+z^2+4x+6y+8z+20=0$

246. If $y = \tan^{-1}\left(\frac{\sqrt{a}-\sqrt{x}}{1+\sqrt{ax}}\right)$, then $\frac{dy}{dx} =$

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

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

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

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

247. The distance x covered by a particle moving in a straight line in time t is given by the relation $2x^2 + 3x = t$. If v is the velocity of the particle in time t, then its acceleration at time t is

(A) $-2v^3$
(B) $-4v^3$
(C) $-2v^2$
(D) $-3v^3$

248. If the difference between mean and mode is 63, the difference between mean and median is:

(A) 189
(B) 21
(C) 31.5
(D) 485

249. A function $f : \square \to \square$ is given by $f(x) = \begin{cases} px+q, & \text{when } x > 2 \\ 2px-3q+1, & \text{when } x < 2 \end{cases}$.

If $\lim_{x\to 2} f(x)$ exists, then the relation between p and q is

(A) $2p - 2q = 1$
(B) $2p - 3q = 1$
(C) $3q - 2p = 1$
(D) $4q - 2p = 1$

250. Let $f:\square \to \square$, $g:\square \to \square$, be continuous functions. Then the value of the integral $\int_{-\pi/2}^{\pi/2}\{f(x)+f(-x)\}\{g(x)-g(-x)\}dx$ is

(A) π
(B) 1
(C) -1
(D) 0

FINAL ANSWER KEY																	
Subject Name: 101 B TECH 18-S2																	
SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key
1	B	31	A	61	D	91	A	121	B	151	D	181	D	211	A	241	B
2	A	32	D	62	B	92	C	122	B	152	C	182	D	212	A	242	D
3	B	33	A	63	C	93	D	123	C	153	B	183	B	213	B	243	C
4	C	34	A	64	D	94	B	124	D	154	A	184	B	214	D	244	C
5	B	35	B	65	A	95	B	125	D	155	C	185	C	215	B	245	A
6	B	36	A	66	C	96	B	126	D	156	C	186	C	216	C	246	C
7	C	37	D	67	C	97	A	127	D	157	C	187	A	217	A	247	B
8	D	38	D	68	A	98	D	128	D	158	B	188	D	218	D	248	B
9	B	39	A	69	D	99	C	129	D	159	B	189	B	219	D	249	D
10	A	40	A	70	C	100	B	130	B	160	A	190	A	220	A	250	D
11	D	41	C	71	D	101	C	131	B	161	D	191	A	221	D		
12	D	42	D	72	C	102	D	132	A	162	D	192	C	222	B		
13	B	43	B	73	D	103	A	133	A	163	A	193	B	223	A		
14	D	44	A	74	D	104	C	134	D	164	B	194	A	224	D		
15	C	45	B	75	A	105	D	135	B	165	A	195	C	225	B		
16	A	46	D	76	C	106	A	136	C	166	B	196	A	226	C		
17	B	47	C	77	C	107	B	137	D	167	C	197	C	227	B		
18	B	48	C	78	B	108	B	138	C	168	B	198	C	228	C		
19	C	49	A	79	D	109	B	139	A	169	C	199	C	229	C		
20	B	50	D	80	D	110	D	140	D	170	A	200	D	230	B		
21	B	51	B	81	A	111	A	141	D	171	D	201	C	231	A		
22	B	52	C	82	C	112	A	142	A	172	C	202	D	232	C		
23	A	53	A	83	C	113	C	143	A	173	B	203	B	233	A		
24	D	54	B	84	B	114	A	144	D	174	B	204	B	234	A		
25	B	55	C	85	C	115	A	145	B	175	B	205	C	235	A		
26	B	56	B	86	C	116	C	146	A	176	A	206	C	236	B		
27	A	57	A	87	A	117	A	147	A	177	C	207	C	237	A		
28	C	58	D	88	A	118	D	148	C	178	A	208	B	238	C		
29	B	59	D	89	B	119	A	149	A	179	A	209	D	239	D		
30	A	60	C	90	D	120	C	150	D	180	D	210	C	240	C		

101 – TEST FOR B TECH / 5 YR INTEGRATED MSC
(SHIFT III)

PHYSICS

1. A certain screw gauge has a pitch of 0.5 mm. If there are 50 divisions on the head scale, the dimension of the object can then be determined to an accuracy of

(A) 0.05 cm
(B) 0.01 cm
(C) 0.001 cm
(D) 0.0001 cm

2. The refractive index of glass measured by a given method by four independent measurements is found to have values of 1.54, 1.58, 1.52 and 1.56 respectively. The mean value of refractive index with percentage error is

(A) 1.55 ± 1.29 %
(B) 1.55 ± 0 %
(C) 1.56 ± 6 %
(D) 1.56 ± 0 %

3. A particle moves for 20 seconds with velocity 3 m/s and then with velocity 4 m/s for another 20 seconds and finally moves with velocity 5 m/s for next 20 seconds. Then the average velocity of the particle is

(A) 3 m/s
(B) 4 m/s
(C) 5 m/s
(D) Zero

4. An athlete completes one round of a circular track of radius R in 40 s. What will be his displacement at the end of 2 min 40 seconds?

(A) $8R$
(B) $8\pi R$
(C) $2R$
(D) Zero

5. A wheel having 1 m diameter makes 60 revolutions per minute. The linear speed of a point on its circumference is

(A) $\pi/2$ m/s
(B) π m/s
(C) 2π m/s
(D) 60π m/s

6. A car starts from rest to cover a distance s. The coefficient of friction between the road and the tyres is μ. The maximum time in which the car can cover the distance is proportional to

(A) μ
(B) $\sqrt{\mu}$
(C) $1/\mu$
(D) $1/\sqrt{\mu}$

7. A diesel engine pumps 40 kg of water in 1 second. The water comes out vertically upwards with a velocity of 3 m/s. What is the power of the engine in kilo Watt?

(A) 12 kW
(B) 1.2 kW
(C) 120 kW
(D) 1200 kW

8. Which one of the following is the S.I. unit of electric field strength?

(A) Am^{-1}
(B) Nm^{-1}
(C) Vm^{-1}
(D) Coulomb $s^{-1}cm^{-1}$

9. If the distance between the two charged particles is reduced to half the original distance, then the force between them becomes

(A) doubled
(B) one-forth
(C) one-half
(D) four times

10. A metal sheet is placed between two charges separated by a distance. Then the force between them will

(A) increase
(B) decrease
(C) remains the same
(D) be reduced to half the initial value

11. If the separation between carbon and oxygen in CO molecule is 0.12 nm, then the distance of the center of mass from the carbon atom is

(A) 0.03 nm
(B) 0.068 nm
(C) 0.05 nm
(D) 0.06 nm

12. A hole is drilled along the earth's diameter and a stone is dropped into it. When the stone is at the center of the earth, it has

(A) mass
(B) weight
(C) potential energy
(D) zero mass

13. Two wires of the same radius and material have lengths in the ratio 1:2. If these are stretched by the same force, the strain produced in the two cases will be in the ratio

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

14. The phase difference between the displacement and velocity of a particle executing SHM is

(A) $\pi/2$
(B) π
(C) $\pi/4$
(D) 0

15. Standing waves are produced in a 10 m long stretched string. If the string vibrates in 5 segments and the wave velocity is 20 m/sec, the frequency is

(A) 2 Hz
(B) 4 Hz
(C) 5 Hz
(D) 10 Hz

16. A parallel plate condenser is charged and isolated. When a sheet of glass is interposed between the plates

(A) the charges on the plates will be reduced
(B) the potential difference between the plates will be reduced
(C) the potential difference between the plates will be increased
(D) the charges on the plates will be increased

17. If a capacitor of Capacitance 10 micro Farad (μF) is charged to a potential difference of 100 V, the energy stored in it is

(A) 0.5 J
(B) 0.05 ergs
(C) 10 J
(D) 0.05 J

18. With increase in altitude, the conductivity of the atmosphere

(A) first increases and then decreases
(B) increases
(C) decreases
(D) remains constant

19. An electric iron box has a heater coil of resistance 50 Ω. If it is connected to 230 V AC mains, the current flowing through the heater coil will be

(A) 4.6 mA
(B) 5 A
(C) 4.6 A
(D) 15 A

20. Glass has a resistivity of the order of

(A) 10^{-8} Ω m
(B) 10^{-5} Ω m
(C) 10^{8} Ω m
(D) 10^{12} Ω m

21. A long solenoid of n turns has a self inductance L and area of cross section a. When a current flows through the solenoid, it produces a magnetic field B. The current flowing through the solenoid is

(A) $B\,a\,n\,/\,L$
(B) $BanL$
(C) $Bn\,/\,aL$
(D) $B\,/\,anL$

22. A conductor of length r moves in a uniform magnetic field of induction B with a velocity $\boldsymbol{v}$. The emf induced across the conductor is

(A) $(v \times B)\,.\,r$
(B) $v.\,(r \times B)$
(C) $B\,.\,(r \times v)$
(D) $r \times (v \times B)$

23. The penetrating powers of α, β and γ radiation, in decreasing order are

(A) α, β, γ
(B) γ, α, β
(C) β, γ, α
(D) γ, β, α

24. A half-wave rectifier is being used to rectify an alternating voltage of frequency 50 Hz. The number of pulses of rectified current obtained in one second is

(A) 50
(B) 25
(C) 100
(D) 6

25. The voltage V and the current I flowing through an A.C circuit are given by $V = 2 \cos 100\,\pi t$ and $I = 4 \sin 100\,\pi t$, where t represents time. The power dissipated in the circuit is

(A) zero Watt
(B) 8 Watt
(C) 4 Watt
(D) 2 Watt

26. An alternating e.m.f. is given by $V = 100 \sin 314\, t$. Its frequency is

(A) 100 Hz
(B) 50 Hz
(C) 314 Hz
(D) 60 Hz

27. In a purely inductive circuit, the current

(A) is in phase with voltage
(B) is out of phase with voltage
(C) leads the voltage by 90°
(D) lags behind the voltage by 90°

28. The current and voltage in an A.C. circuit are given by $I = I_o \sin\left(\omega t - \frac{\pi}{2}\right)$ and $E = E_o \sin \omega t$. Then the average power consumption P in the circuit is

(A) $P = \frac{E_o I_o}{\sqrt{2}}$
(B) $P = \frac{EI}{\sqrt{2}}$
(C) $P = \frac{E_o I_o}{2}$
(D) zero

29. Two electric bulbs whose resistances are in the ratio 1:2, are connected in parallel to a constant voltage source. The power dissipated in them is in the ratio

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

30. The neutral temperature for a thermocouple is 270°C. If the temperature of the cold junction is 15°C, then the inversion temperature is

(A) 255°C
(B) 285°C
(C) 570°C
(D) 525°C

31. A source emits a sound of frequency 400 Hz but the listener hears it to be 390 Hz. Then

(A) the listener is moving towards the source
(B) the source is moving toward the listener
(C) the listener is moving away from the source
(D) the listener has a defective ear

32. The binding energy of the electron in a hydrogen atom is 13.6 eV, the energy required to remove the electron from the first excited state of Li^{++} is

(A) 122.4 eV
(B) 30.6 eV
(C) 13.6 eV
(D) 3.4 eV

33. Which of the following nuclei has lowest value of the binding energy per nucleon?

(A) ${}_2He^4$
(B) ${}_{24}Cr^{52}$
(C) ${}_{62}Sm^{152}$
(D) ${}_{80}Hg^{100}$

34. The average number of neutrons emitted during the fission of U^{235} is

(A) 3
(B) 2
(C) 1.5
(D) 2.5

35. The radioactive decay of uranium into thorium is represented by the equation ${}_{92}U^{238} \rightarrow {}_{90}Th^{234} + X$, then X is

(A) an electron
(B) a neutron
(C) a proton
(D) an alpha particle

36. The same radioactive nucleus may emit

(A) all the three α, β and γ simultaneously
(B) either α or β or γ at a time
(C) all the three α, β and γ at a time
(D) only α and β

37. The radius of a nucleus of mass number A is proportional to

(A) A
(B) $A^{1/2}$
(C) $A^{1/3}$
(D) A^{3}

38. Which one of the statements about nuclear forces is INCORRECT?

(A) Nuclear forces are short range forces
(B) Nuclear forces are charge independent forces
(C) Nuclear forces are exchange forces
(D) Nuclear forces are central forces

39. Which one of the statements about neutron is INCORRECT?

(A) Neutron is a fundamental particle
(B) Neutron has no charge
(C) Nuclei of all elements in nature contain neutron
(D) Neutron has a spin

40. The ground state energy of the hydrogen atom is

(A) 13.6 eV
(B) 0 eV
(C) –3.4 eV
(D) –13.6 eV

41. Which one of the statements about matter waves is INCORRECT?

(A) Matter waves are not electromagnetic waves
(B) Matter waves are also called probability waves
(C) de Broglie waves are pilot waves i.e., these waves guide the particle
(D) The phase velocity of the matter waves in vacuum is independent of wavelength

42. Kinetic energy of the cathode rays (electrons) depend on

(A) voltage applied to the electrode
(B) depend on work function
(C) depend on both (A) and (B)
(D) does not depend on any physical quantity

43. A man cannot see objects clearly at a distance greater than 2 m. He is then suffering from

(A) short sight
(B) long sight
(C) astigmatism
(D) presbyopia

44. The magnifying power of a simple microscope can be increased by if we use eyepiece of

(A) higher focal length
(B) smaller focal length
(C) higher diameter
(D) smaller diameter

45. If the focal length of the objective and eyepiece lens of an astronomical telescope are f_o and f_e respectively, then its magnifying power is

(A) $\frac{f_o}{f_e}$
(B) $\frac{f_e}{f_o}$
(C) $\frac{2f_o}{f_e}$
(D) $2f_e$

46. If f_r and f_v stand for focal length of the lens for red colour and violet colour respectively, then the longitudinal chromatic aberration of the lens for parallel rays is given by

(A) $f_r - f_v$
(B) $f_v - f_r$
(C) $f_r f_v$
(D) $f_v + f_r$

47. The deviation produced by a flint glass prism for violet and red light rays are 3.25° and 3.10° respectively. Then the angular dispersion is

(A) 6.35°
(B) 3.175°
(C) 0.15°
(D) 6.35 radians

48. Total internal reflection is NOT possible in the case when light travels from

(A) glass to air
(B) glass to water
(C) water to glass
(D) water to air

49. When the angle of incidence on a certain material is 60°, the reflected light is completely polarized. The angle of refraction is then

(A) 60°
(B) 90°
(C) 30°
(D) 45°

50. A sugar solution of length 15 cm has specific rotation of 65° and produces a optical rotation of 7°. Then the concentration of the solution is

(A) 0.7 g/cc
(B) 13.9 g/cc
(C) 0.0717 g/cc
(D) 0.01g/cc

51. To observe diffraction, the size of an obstacle

(A) should be of the order of wavelength
(B) should be much larger than the wavelength
(C) has no relation to wavelength
(D) should be exactly $\lambda/2$.

52. If the distance between the screen and the slit is doubled in Young's double slit experiment, the fringe width will become

(A) four times
(B) two times
(C) one-half
(D) one-fourth

53. When light waves suffer reflection at the interface between air and glass, the change of phase of the reflected wave is

(A) zero
(B) π
(C) 2π
(D) $\pi/2$

54. If a string of string constant k is stretched by a length x under tension T, the energy stored is

(A) $\frac{2k}{T^2}$

(B) $\frac{2T^2}{k^2}$

(C) $\frac{T^2}{2k}$

(D) $\frac{2T}{k^2}$

55. The Young's modulus of a perfectly rigid body is

(A) zero
(B) unity
(C) infinite
(D) may be any finite non-zero value

56. A wire elongates by l mm when a load W is hanged at from it. If the wire goes over a pulley and the two weights W each are hung at the two ends, the elongation of the wire (in mm) will be

(A) $l/2$
(B) l
(C) $2l$
(D) zero

57. If two liquids of same masses but densities ρ_1 and ρ_2 respectively are mixed, then the density of the mixture is

(A) $\rho_1 + \rho_2$

(B) $\frac{\rho_1 + \rho_2}{2}$

(C) $\frac{\rho_1 \rho_2}{\rho_1 + \rho_2}$

(D) $\frac{2\rho_1 \rho_2}{\rho_1 + \rho_2}$

58. A boy carries on his head an airtight box containing a bird resting on the floor of the box. When the bird starts flying inside the box, he will feel that the box is now

(A) lighter
(B) heavier
(C) same in weight as before
(D) lighter in the beginning and heavier later

59. A cork ball is floating on the surface of water in a beaker. The beaker is covered with a bell jar and the air is evacuated. What will happen to the ball?

(A) Sink a little
(B) Rise a little
(C) Remain unchanged
(D) Sink completely

60. The thermometer used as a reference standard is

(A) mercury thermometer
(B) platinum resistance thermometer
(C) gas thermometer
(D) thermocouple thermometer

61. If α is coefficient of linear expansion, β is coefficient of superficial expansion and γ is the coefficient of cubical expansion, then for the same rise in temperature, the percentage changes in α, β and γ are in the ratio

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

62. If K and σ respectively are the thermal and electrical conductivities of a metal at absolute temperature T, then

(A) $\frac{K}{\sigma T} = \text{constant}$
(B) $\frac{K}{\sigma} = \text{constant}$
(C) $\frac{K}{T} = \text{constant}$
(D) $\frac{\sigma}{KT} = \text{constant}$

63. The velocity V of thermal radiation is (C = velocity of light in vacuum)

(A) $V < C$
(B) $V > C$
(C) $V = C$
(D) dependent on the medium

64. Which one of the following statements about electromagnetic waves is INCORRECT?

(A) They do not require material medium for propagation
(B) They are not deflected in electric an magnetic fields
(C) The waves are transverse in nature
(D) They cannot be diffracted

65. If $\vec{E}$ and $\vec{B}$ represent electric and magnetic field vectors of the electromagnetic waves, then the direction of propagation of the waves will be along

(A) $\vec{B} \times \vec{E}$
(B) $\vec{E}$
(C) $\vec{B}$
(D) $\vec{E} \times \vec{B}$

66. The area of B-H hysteresis loop in a ferromagnetic material is a measure of the

(A) net energy dissipated per unit volume per cycle of magnetization of the material
(B) permeability of the material
(C) susceptibility of the material
(D) retentivity of the material

67. The unit cubic cell of Al has an edge length equal to 4.5×10^{-10} m. The number of unit cells in an aluminium foil of volume 91×10^{-6} m^3 is

(A) 10^{24}
(B) 10^{-24}
(C) 10^{8}
(D) 10^{23}

68. The gate with the Boolean expression $Y = \overline{A \cdot B}$ for its output is

(A) AND
(B) NAND
(C) XOR
(D) XNOR

69. The Boolean expression for NOR gate is

(A) $Y = A + \overline{B}$
(B) $Y = \overline{A + B}$
(C) $Y = \overline{A} + B$
(D) $Y = \overline{A} + \overline{B}$

70. What gate has the truth table given below?

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(A) NOT
(B) AND
(C) NAND
(D) NOR

71. A transistor amplifier is operated in common emitter configuration at constant collector voltage of V_C = 1.5 V, such that the change in the base current from 100 μA to 150 μA produces a change in the collector current from 5 mA to 10 mA. The current gain β of the circuit is then

(A) 50
(B) 67
(C) 75
(D) 100

72. A two stage transistor amplifier has a gain of 10 for the first stage and a gain of 20 for the second stage. The overall gain of the cascade amplifier will be

(A) 30
(B) 10
(C) 200
(D) 2

73. Long range radio transmission is possible when the radio waves are reflected from the ionosphere. For this to happen, the frequency of the radio waves must be in the range

(A) 80-150 MHz
(B) 8-25 MHz
(C) 1-3 MHz
(D) 150-1500 kHz

74. The colour of a star is dependent on its

(A) radius
(B) distance from the earth
(C) temperature
(D) structure

75. Hubble constant *H* has the dimensions of

(A) mass
(B) length
(C) $(\text{time})^{-1}$
(D) temperature

CHEMISTRY

76. Given the latent heat of vapouration of water as 40.7 kJ mol^{-1} at 373 K, ΔS for one mole of water converted to steam at 373 K is

(A) 109.1 JK^{-1} mol^{-1}
(B) 40.7 kJ mol^{-1}
(C) 81.4 kJ mol^{-1}
(D) 218.2 JK^{-1} mol^{-1}

77. For a non-linear triatomic gas the value of the ratio of C_p and C_v at laboratory temperature is (assuming no vibrational contribution)

(A) 7/5
(B) 9/7
(C) 8/3
(D) 4/3

78. 6 moles of SO_2 and 6 moles of O_2 are allowed to form SO_3 in a closed vessel. At the equilibrium stage, 60% of SO_2 is used up. The total number moles of the mixture at equilibrium is

(A) 10.2
(B) 9.8
(C) 7.2
(D) 11.2

79. pH of a solution obtained by mixing equal volumes of the solutions with pH 3 and pH 5 is

(A) 4.0
(B) 3.5
(C) 3.3
(D) 2.0

80. The K_{sp} of AgCl is 1×10^{-10}, its solubility in pure water in 0.01 M NaCl is

(A) 2×10^{-10}
(B) 1×10^{-8}
(C) 2×10^{-8}
(D) 1×10^{-10}

81. The edge length of fcc unit cell is 508 pm. The radius of the atom is …… pm.

(A) 180
(B) 200
(C) 618
(D) 288

82. Crystalline solids having the least enthalpy of fusion is

(A) Molecular solid
(B) Metallic solid
(C) Ionic solid
(D) Covalent solid

83. Vapour pressure of water at 298 K is 19.8 mm of Hg. 0.1 mole of glucose is dissolved in 172.8 g of water. The vapour pressure of the solution is

(A) 19.6 mm
(B) 16.9 mm
(C) 19.0 mm
(D) 18.9 mm

84. Osmotic pressure of blood is 8.21 atm at 37°C. Amount of glucose that should be used per litre of intravenous injection that is at the same osmotic pressure of blood is

(A) 58.4 g
(B) 29.2 g
(C) 5.84 g
(D) 2.92 g

85. The equitant conductance of 1 M benzoic acid is 12.8 $Scm^2\ eq^{-1}$ and if the limiting equivalent conductance of benzoate ion and H^+ ion are 42 and 288.42 $Scm^2\ eq^{-1}$, respectively, its degree of dissociation is

(A) 39%
(B) 3.9%
(C) 0.35%
(D) 0.039%

86. Two half-cells of electrode potentials of E_1 and E_2 are combined to form a cell of potential E_3, (n_1, n_2 and n_3 are number of electrons involved in first electrode, second electrode and the cell) E_3 is

(A) $E_3 = E_2 - E_1$
(B) $E_3 = (E_1n_1 + E_2n_2)/n_3$
(C) $E_3 = (E_1n_1 - E_2n_2)/n_3^2$
(D) $E_3 = E_1 + E_2$

87. The potential of half-cell consisting of zinc electrode in 0.01 M $ZnSO_4$ solution at 25°C is ($E° = -0.763$ V)

(A) –0.8221 V
(B) –0.704 V
(C) –0.881 V
(D) –0.645 V

88. A dilute aqueous solution of $CuSO_4$ is electrolyzed using Pt electrodes. The products at the anode and cathode are

(A) O_2, H_2
(B) H_2, O_2
(C) O_2, Cu
(D) $S_2O_8^{2-}$, H_2

89. The half-life for radioactive decay of C^{14} is 5730 years. An archaeological artefact containing wood had only 80% of the C^{14} found in living tree. The age of the sample is

(A) 1845 years
(B) 2865 years
(C) 4584 years
(D) 1146 years

90. If the volume of the reaction vessel is halved, for the reaction, $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$, then the rate is

(A) $1/6^{th}$ of its initial value
(B) $1/4^{th}$ of its initial value
(C) 8 times of its initial value
(D) 4 times of its initial value

91. The rate equation for a reaction: $A \rightarrow B$ is $r = k[A]^0$. If the initial concentration of the reactant is 'a' mol dm^{-3}, then half-life period of reaction is

(A) a/k
(B) 2a/k
(C) a/2k
(D) k/a

92. The number of unit cells present in 39 g of potassium that crystallizes as body centered cubic structure is (N_A = Avogadro number)

(A) N_A
(B) 0.25 N_A
(C) 0.5 N_A
(D) 0.75 N_A

93. Which one of the following is not correctly matched?

(A) $[Ni(CN)_4]^{2-}$ – dsp^2 hybridization, dia-magnetic
(B) $[Cu(NH_3)_4]^{2+}$ – sp^3 hybridization, para-magnetic
(C) $[NiCl_4]^{2-}$ – sp^3 hybridization, tetrahedral
(D) $[CuCl_4]^{2-}$ – sp^3 hybridization, para-magnetic

94. Which one of the following statements is not true according to Werner's theory of coordination compounds?

(A) Both primary and secondary valencies can be satisfied by anions
(B) Secondary valency is non-directional
(C) Primary valency is ionic valency
(D) Metal ions exhibit two types of valencies

95. Which one of the following is true regarding the energies of d-orbitals of tetragonally distorted octahedral geometry?

(A) $d_{yz} > d_{xz} > d_{xy}$
(B) $d_{x^2-y^2} = d_{z^2}$
(C) $d_{xz} > d_{yz}$
(D) $d_{z^2} > d_{x^2-y^2}$

96. In the estimation of Ca(II) ions, in the presence of ammonia-ammonium chloride buffer solution, EDTA acts as a …… ligand.

(A) flexidentate
(B) pi-donor
(C) hexadentate
(D) tetradentate

97. How much amount of oxalic acid dihydrate crystals are required to prepare 1 L of a decinormal solution of it?

(A) 6.3 g
(B) 12.6 g
(C) 3.15 g
(D) 9 g

98. What is correct order of increasing acidic strength of oxides of nitrogen?

(A) $NO < N_2O_3 < N_2O_4 < N_2O_5$
(B) $NO = N_2O_3 < N_2O_4 = N_2O_5$
(C) $NO > N_2O_3 < N_2O_4 > N_2O_5$
(D) $NO > N_2O_3 > N_2O_4 > N_2O_5$

99. Regarding compounds of sulfur, which one of the following statements in not true?

(A) SF_6 does not undergo hydrolysis
(B) SF_4 undergoes hydrolysis
(C) SF_6 is thermally stable and chemically inert
(D) SF_4 acts as Lewis acid

100. Fluorine does not act as the central atom in interhalogen compounds, because

(A) it is highly electronegative
(B) of absence of d-orbitals
(C) of its small size
(D) of its gaseous nature

101. A hydrometallurgical process involves the following steps.

$Ag_2S + 4\ NaCN \rightarrow 2\ Na[Ag(CN)_2] + Na_2S$

$2\ Na[Ag(CN)_2] + Zn \rightarrow Na_2[Zn(CN)_4] + 2\ Ag\downarrow$

Which one of the following statements is true?

(A) In the second step Zn(II) is reduced to Zn(0)
(B) Dicyanoargentum(I) complex is insoluble in water
(C) In the first step Ag(I) is reduced to Ag(0)
(D) Tetracyanozinc(II) complex is soluble in water

102. Transition metals exhibit variable oxidation states. This is because

(A) the outermost shell is empty
(B) they are all metals
(C) the energies of $(n-1)$d and ns orbitals are almost equal
(D) the ionization energy to remove electron from ns orbital is very low

103. The general electronic configuration of inner-transition elements is

(A) $(n-2)f^{1-14}\ (n-1)d^{0,\ 1}$
(B) $(n-2)f^{1-14}\ (n-1)d^{0-1}\ ns^2$
(C) $(n-1)f^{1-14}\ (n-1)d^{0-1}\ ns^2$
(D) $(n-2)f^{1-14}\ ns^2$

104. Which of the following species would be diamagnetic?

(A) Cr^{3+}
(B) Co^{3+}
(C) Br
(D) Zn^{2+}

105. Which orbital is designated by the quantum numbers: $n = 5$, $l = 1$, $m_l = 0$?

(A) 5s
(B) 5p
(C) 5d
(D) 5f

106. If travelling at equal speeds, which of the following matter waves have the longest wavelength?

(A) Electron
(B) Proton
(C) Neutron
(D) α particle

107. Number of angular nodes for 4d orbital is

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

108. Which of the following will not show deflection from the path on passing through electric field?

(A) Electron
(B) Neutron
(C) Cathode rays
(D) Proton

109. Complete the following nuclear equation:

$^{59}_{27}Co + {}^{1}_{0}n \rightarrow {}^{56}_{25}Mn + ?$

(A) $4\,{}^{1}_{1}H$

(B) $4\,{}^{1}_{1}n$

(C) ${}^{4}_{2}He$

(D) $2\,{}^{1}_{1}H$

110. Which among the following sequence is best suited for selective transformation on 2-methylbutane to 2-methylbutan-2-ol?

(A) Treatment with Cl_2 in the presence of UV light followed by hydrolysis with potassium hydroxide in water

(B) Treatment with Cl_2 in the presence of UV light followed by hydrolysis with potassium hydroxide in ethanol

(C) Treatment with Br_2 in the presence of UV light followed by hydrolysis with potassium hydroxide in water

(D) Treatment with I_2 in the presence of UV light followed by hydrolysis with potassium hydroxide in a 1:1 mixture of water and ethanol

111. Ozone depletion in Antartica is due to

(A) sulphur containing gases
(B) peroxy acetyl nitrate
(C) chlorine nitrate
(D) fluorine

112. When an organic compound 'A' was treated sequentially with ammonia and Br_2/KOH, methanamine was obtained. Then 'A' is an

(A) ethanol
(B) ethyl acetate
(C) acetonitrile
(D) acetic acid

113. How many structural isomers are possible for C_3H_9N?

(A) 3
(B) 4
(C) 5
(D) 6

114. Which is a non-reducing sugar?

(A) Glucose
(B) Sucrose
(C) Maltose
(D) Fructose

115. 0.200 g of an organic compound contains 71% carbon. What is the mass of CO_2 produced when it is subjected to complete combustion?

(A) 0.142
(B) 0.039
(C) 0.521
(D) 0.733

116. Consider the following compounds:

(i) hydrazine
(ii) paracetamol
(iii) chlorophyll
(iv) saccharin

How many among them will test negative for nitrogen in Lassaigne's test ?

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

117. Which among the following is more reactive towards nitration using nitrating mixture?

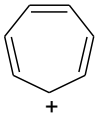
(A) *tertiary*-Butylbenzene
(B) Toluene
(C) Benzene
(D) Chlorobenzene

118. Which among the following is antiaromatic?

(A) 

(B) 

(C) 

(D) 

119. Hydrogenation of acetyl chloride in the presence of Pd-$BaSO_4$ as catalyst to obtain ethanal is

(A) Clemmensen reduction
(B) Rosenmund reduction
(C) Schmidt reaction
(D) Dakin reaction

120. Which among the following compounds will selectively give the same addition product with HBr under both Markonikkoff's and anti-Markonikkoff's addition conditions?

(A) CH_3-CH=CH-CH_2-CH_3
(B) CH_3-CH=CH-C(CH_3)$_2$
(C) CH_3-CH=CH-CH(CH_3)$_2$
(D) C_6H_5-CH=CH_2

121. Among the following, the organic compound that gives propyne on treatment with sodamide with minimal side products is

(A) $CH_3CH_2CHCl_2$
(B) $CH_3CCl=CH_2$
(C) $CH_3CCl=CH_2Cl$
(D) CH_3CCl_2-CH_3

122. Which among the following tests is useful to differentiate between styrene and phenol?

(A) Lucas test
(B) Test with bromine water
(C) Test with bromine in dry chloroform
(D) Test with $KMnO_4$

123. Identify the **incorrect** statement about natural rubber.

(A) Double bonds are located between C_2 and C_3 of each isoprene unit
(B) Has mostly trans double bonds
(C) Intermolecular forces are quite weak
(D) Has a randomly coiled structure

124. The monomer unit/units in cellulose is/are

(A) α-D-glucose
(B) β-D-glucose
(C) Alternating α-D-glucose and D-fructose units
(D) Alternating β-D-fructose and D-fructose units

125. Which among the following vitamins is the most efficient antioxidant?

(A) Vitamin D
(B) Vitamin C
(C) Vitamin B
(D) Vitamin A

MATHEMATICS

126. Suppose $\sqrt{\frac{1+\cos A}{1-\cos A}} = 2$. Then $\tan A =$

(A) $\tan A < 1$
(B) $\tan A > 2$
(C) $\tan A > 1$
(D) $\tan A = \infty$

127. Let a and b be non zero real numbers such that $a^2 + b^2 = 1$. Then

(A) $a + b = 1$
(B) $a + b \le \sqrt{2}$
(C) $a + b \ge \sqrt{2}$
(D) $a + b = 2$

128. Let $\tan^2 x = 2\tan^2 y + 1$. Then $\sin^2 y =$

(A) $\sin 2x$
(B) $-\cos 2x$
(C) $\cos 2x$
(D) $-\sin 2x$

129. Let $\tan\alpha = \frac{x}{x+1}$ and $\tan\beta = \frac{x+1}{x}$. Then $\alpha + \beta =$

(A) $\frac{\pi}{3}$
(B) $\frac{\pi}{6}$
(C) $\frac{\pi}{2}$
(D) $\frac{\pi}{4}$

130. Let $a = \sin x$, $b = \operatorname{cosec} x$ and $a + b = 3$. Then $a^2 + b^2 =$

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

131. Suppose $\frac{1+\sin 2\theta}{1-\sin 2\theta} = \cot^2(x+\theta)$, then x is equal to

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{3}$
(C) $\frac{2\pi}{3}$
(D) $\frac{3\pi}{4}$

132. The maximum value of $5\sin^2 x + 4\cos^2 x + \sin\frac{x}{2} + \cos\frac{x}{2}$ is

(A) $5+2\sqrt{2}$
(B) $5-2\sqrt{2}$
(C) $5+\sqrt{2}$
(D) $5-\sqrt{2}$

133. The chances to fail in Mathematics is 20% and the chances to fail in Chemistry is 25%. The chance to fail in at least one subject is

(A) $\frac{11}{13}$
(B) $\frac{14}{15}$
(C) $\frac{2}{5}$
(D) $\frac{11}{12}$

134. An urn contains 4 red and 6 blue balls. The probability that two balls are drawn in which second ball drawn is blue without replacements, is

(A) $\frac{3}{5}$
(B) $\frac{4}{5}$
(C) $\frac{2}{5}$
(D) $\frac{7}{15}$

135. The third moment about the mean for normal distribution is

(A) 5σ
(B) $3\sigma^2$
(C) $7\sigma^2$
(D) 0

136. A box contains 24 identical balls of which 12 are white and remaining black. The balls are drawn at random from the box one at a time with replacement. The probability that a white ball is drawn for the 4^{th} time on the 7^{th} draw is

(A) $\frac{6}{32}$
(B) $\frac{5}{32}$
(C) $\frac{7}{32}$
(D) $\frac{1}{2}$

137. 5 gentlemen and 5 ladies take seats at random round a table. The probability that they are sitting alternatively is

(A) $\frac{3}{126}$
(B) $\frac{1}{252}$
(C) $\frac{1}{126}$
(D) $\frac{3}{252}$

138. Let A and B be two non-empty subsets of a set X such that A is not a subset of B. Then

(A) A and B are disjoint
(B) $B \subseteq A$
(C) A is the complement of B
(D) A and B may be disjoint

139. Let $f : R \to R$ be defined by $f(x) = \cos 2x$. Then f is

(A) a one-to-one function
(B) an onto function
(C) both one-to-one and onto function
(D) neither one-to-one nor onto function

140. Let $f\left(z+\frac{1}{z}\right)=z^2+\frac{1}{z^2}$ for all real $z \in R \setminus \{0\}$. Then $f(z)=$

(A) z^2
(B) z^2-1
(C) z^2-2 for all $|z| \geq 2$
(D) z^2+2 for all $|z| \geq 2$

141. Define $f(x)=|x-1|$ for all real numbers x. Then

(A) $f\left(x^2\right)=(f(x))^2$ for all x
(B) $f(x+y)=f(x)+f(y)$ for all x, y
(C) $f(|x|)=|f(x)|$ for all x
(D) All (A) to (C) above are not true

142. The sum $\sum_{i=1}^{\infty} \frac{1}{i!}\left(\sum_{k=1}^{i} 2^{k-1}\right)$ is equal to

(A) e^2-e
(B) e^2+e
(C) e^2+1/e
(D) $e+1/e$

143. If $S=\sum_{n=0}^{\infty} \frac{(\log x)^{2n}}{(2n)!}$, then $S=$

(A) $x+x^{-1}$
(B) $x-x^{-1}$
(C) $\frac{x+x^{-1}}{2}$
(D) 0

144. The sum of the series $\frac{2^2}{2!}+\frac{3^2}{3!}+\ldots+\infty$ is

(A) $2e$
(B) $2e^2$
(C) $e/2$
(D) $-e/2$

145. If $y=-\left(x^3+\frac{x^6}{2}+\frac{x^9}{3}+\ldots+\infty\right)$

(A) $x=1-e^y$
(B) $x=1+e^y$
(C) $x^3=1-e^y$
(D) $x^3=1+e^{-y}$

146. Sum of the series $\frac{2}{1!}+\frac{4}{3!}+\frac{6}{5!}+\ldots+\infty$

(A) e
(B) e^2
(C) $-e$
(D) $-e^2$

147. The value of $f(\theta)=\begin{vmatrix}\cos^2\theta & \cos\theta\sin\theta & \sin\theta\\ \cos\theta\sin\theta & \sin^2\theta & -\cos\theta\\ \sin\theta & -\cos\theta & 0\end{vmatrix}$

(A) 0
(B) 1
(C) -1
(D) 2

148. If A is a skew-symmetric matrix of order n, then the trace of A is

(A) n^2
(B) n
(C) 0
(D) 1

149. Suppose $A=\begin{vmatrix} y-1 & 0 & 7 \\ y^2-1 & y-1 & 8 \\ 2y & 3y & 0 \end{vmatrix}=ay^3+by^2+cy+d$. Then

(A) $c=-17, d=0$
(B) $b=38, d=0$
(C) $a=-21, b=38$
(D) $a=21, d=0$

150. Let $A=\begin{bmatrix} 4x-7 & 2 & 2 \\ 2 & 4x-7 & 2 \\ 2 & 2 & 4x-7 \end{bmatrix}$. One of the root of the equation $|A|=0$ is

(A) $3/4$
(B) $-3/4$
(C) $4/3$
(D) $-4/3$

151. Let A be the matrix $\begin{bmatrix} -2 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -2 \end{bmatrix}$. Then the value of $|adj\, A|$ is equal to

(A) 8
(B) 64
(C) 16
(D) 32

152. Given that the matrix $\begin{bmatrix} 1/36 & 0 \\ x & 1/36 \end{bmatrix}=\begin{bmatrix} 6 & 0 \\ -a & 6 \end{bmatrix}^{-2}$. Then the value of x is

(A) $\frac{a}{108}$
(B) $\frac{5a}{108}$
(C) $\frac{3a}{118}$
(D) $\frac{a}{118}$

153. For a positive integer n, the third term in the expansion of $\left(\sqrt[4]{a}+\frac{a}{\sqrt{a^{-1}}}\right)^n$ is $15a^4$.

Then the value of n is

(A) 6
(B) –5
(C) 3
(D) 15

154. $\sum_{i=0}^{k}\frac{i.^kC_i}{^kC_{i-1}}$ is equal to

(A) $\frac{k(2k+1)}{2}$
(B) $\frac{k(k+1)}{2}$
(C) $\frac{k(2k-1)}{2}$
(D) $\frac{k(k^2+1)}{2}$

155. The coefficient of x^8 in the expansion of $\left[(1+x)^7+(1+x)^8+...+(1+x)^{14}\right]$

(A) $^{15}C_8$
(B) $^{15}C_6$
(C) $^{15}C_4$
(D) $^{15}C_5$

156. Given that the coefficient of x^7 and x^8 in the expansion of $\left(2+\frac{x}{4}\right)^n$ are equal. Then n =

(A) 91
(B) 8.7!
(C) 71
(D) 7.8!

157. Number of terms in the expansion of $\left(y^2+\sqrt{y^2-1}\right)^4+\left(y^2-\sqrt{y^2-1}\right)^4$ is

(A) 10
(B) 8
(C) 6
(D) 5

158. There are 5 letters and 5 different envelopes. The number of ways in which all the letters can be put in wrong envelope is

(A) 119
(B) 44
(C) 59
(D) 40

159. The number of diagonals in an octagon will be

(A) 12
(B) 16
(C) 18
(D) 20

160. The number of divisors of the form $4n+2\ (n\geq 0)$ of the integer 240 is equal to

(A) 3
(B) 4
(C) 12
(D) 15

161. There are three coplanar parallel lines. If any p points are taken on each of the lines, the maximum number of triangles with vertices at these points is

(A) $p^2(p+3)$
(B) $p^2(p-3)$
(C) $p^2(4p+3)$
(D) $p^2(4p-3)$

162. In class of 18 students, every student has to hand shake with every other student. The total number of handshakes was

(A) 17
(B) 18
(C) 153
(D) 306

163. Total number of numbers that are less than 4.10^6 and can be formed using the digits 1, 2, 3 is equal to

(A) $\frac{9.3^8+3}{2}$
(B) $\frac{9.3^8-2}{3}$
(C) $\frac{9.3^8+3}{3}$
(D) $\frac{9.3^8-3}{2}$

164. A variable name in certain computer language must be either an alphabet or an alphabet followed by a decimal digit. Total number of different variable names that can exist in that language is equal to

(A) 280
(B) 286
(C) 290
(D) 296

165. Let $X = \{a \mid a \text{ is a prime number and } a < 30\}$. The number of different rational numbers whose numerator and denominator belong to X is

(A) 90
(B) 91
(C) 180
(D) 181

166. Let $z^2 - z + 1 = 0$ and z be a complex number. Then the value of $z^n - z^{-n}$, where n is a multiple of 3 is

(A) $2(-1)^n$
(B) 2^n
(C) $(-1)^{n+1}$
(D) 0

167. Assume that $(1+i)(1+2i)(1+3i)...(1+xi)=\alpha+i\beta$. Then $2.5.10...\left(1+x^2\right)$ is equal to

(A) $\alpha^2-\beta^2$
(B) $\alpha^2+\beta^2$
(C) $\alpha-i\beta$
(D) $\alpha.\beta$

168. If ω is a cube root of unity, then $\left(3+5\omega+3\omega^2\right)^2+\left(3+3\omega+5\omega^2\right)^2$ is equal to

(A) –2
(B) 2
(C) 4
(D) –4

169. $\cos\left(i\log\left(\frac{x-iy}{x+iy}\right)\right)$ is equal to

(A) $\frac{x^2-y^2}{x^2+y^2}$
(B) $\frac{xy}{x^2+y^2}$
(C) $\frac{x^2-y^2}{2xy}$
(D) $\frac{2xy}{x^2+y^2}$

170. Let z be a complex number satisfying the relation $|z-36|^2=36|z-1|^2$.
Then $|z|$ is equal to

(A) 5
(B) 6
(C) 7
(D) 8

171. If z is a complex number such that $\left|\frac{z-1}{z+1}\right| = 0$ is purely real. Then

(A) z is purely imaginary
(B) z is purely real
(C) $|z| = 1$
(D) $\text{Re}(z) \neq 0$ and $\text{Im}(z) \neq 0$

172. The product of all values of $(\cos x + i \sin x)^{\frac{3}{4}}$ is

(A) $(\cos 4x + i \sin 4x)$
(B) $(\cos 4x - i \sin 4x)$
(C) $(\cos 3x - i \sin 3x)$
(D) $(\cos 3x + i \sin 3x)$

173. Let z be a complex number such that $|z+4| \leq 3$. Then

(A) $|z+1| = 6$
(B) $0 \leq |z+1| \leq 6$
(C) $|z+1| = 0$
(D) $3 \leq |z+1| \leq 6$

174. Let $a, b, c > 0$. Then $a(1-b) > \frac{1}{4}$, $b(1-c) > \frac{1}{4}$, $c(1-a) > \frac{1}{4}$

(A) are never possible
(B) are always possible
(C) are sometimes possible
(D) cannot be discussed

175. The inequality $\frac{2}{x} < 3$ is true, when x belongs to

(A) $[2/3, \infty)$
(B) $(-\infty, 2/3]$
(C) $(2/3, \infty) \cup (-\infty, 0)$
(D) $(-\infty, 0)$

176. Let $\alpha \in \left(0, \frac{\pi}{2}\right)$. The value of the expression $\sqrt{x^2+x} + \frac{\sin^2 \alpha}{\sqrt{x^2+x}}$ is always greater than or equal to

(A) 1
(B) 2
(C) $2\sin\alpha$
(D) $2\text{cosec}\ \alpha$

177. Solutions of $2y-3=|y+6|$ are

(A) $-1,-1$
(B) $1,-1$
(C) $-1,9$
(D) 9

178. If $a \in R$ and $m = \frac{a^2}{1+a^4}$ is real, then

(A) $0 \le m \le \frac{1}{2}$
(B) $0 \le m \le 1$
(C) $0 \le m \le 2$
(D) $0 \le m \le \infty$

179. Let *a, b, c* be three distinct numbers which are in a Geometric Progression. Also the numbers *a, 2b, 3c* are in an Arithmetic Progression. Then the common ratio of the Geometric Progression is

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

180. Three positive real numbers *x*, *y*, *z* are in Arithmetic Progression and $xyz = 4$. The the minimum value of *y* is

(A) $\sqrt{2}$
(B) $\sqrt[3]{2}$
(C) $2^{1/3}$
(D) $2^{2/3}$

181. The maximum possible integer value of sum $15+14\frac{1}{7}+13\frac{2}{7}+...$ is

(A) 134
(B) 136
(C) 138
(D) 140

182. Let S_n denotes the sum of n terms of an Arithmetic Progression.
Then the value of $S_{n+3}-5S_{n+2}+7S_{n+1}-3S_n$ is

(A) 0
(B) 3
(C) 6
(D) 9

183. The sum of 10 terms of the series $\sqrt{3}+\sqrt{12}+\sqrt{48}+...$

(A) $S=1023\sqrt{3}$
(B) $S=1023\sqrt{2}$
(C) $S=1025\sqrt{2}$
(D) $S=1025\sqrt{3}$

184. The harmonic mean of two numbers is 8. Also their arithmetic mean is A and geometric mean is G. If G satisfies $2A + G^2 = 90$, then the numbers are

(A) $2,-2$
(B) $6,-12$
(C) $2,12$
(D) $6,12$

185. The sum $\sum_{r=1}^{n}\frac{r^2-r-1}{(r+1)!}$ is equal to

(A) $\frac{n}{(n+1)!}$
(B) $-\frac{1}{(n+1)(n-1)!}$
(C) $\frac{n}{(n+1)!}-1$
(D) $-\frac{n}{(n+1)!}-1$

186. The equation $\sqrt{y+2-4\sqrt{y-2}}+\sqrt{y+7-6\sqrt{y-2}}=1$ has

(A) no solution
(B) one solution
(C) two solutions
(D) more than two solutions

187. Let α and β be the roots of the equation $my^2 - ny - p = 0$.
Then the root of the equation $(m + px)^2 = n^2x$ are

(A) $\alpha+\beta, \alpha-\beta$
(B) $\frac{1}{\alpha^2}, \frac{1}{\beta^2}$
(C) $\frac{1}{\alpha^2}, -\frac{1}{\beta^2}$
(D) α^2, β^2

188. If the roots of the equation $y^2 - 2my + m^2 + m - 3 = 0$ are real and less than 3, then

(A) $m = 1$
(B) $m < -1$
(C) $m = 2$
(D) $m < 2$

189. Let β, β^2 be the roots of the equation $y^2+4y+1=0$.
Then β^{46}, β^{62} are roots of the equation

(A) $y^2+4y+1=0$
(B) $y^2-4y+1=0$
(C) $y^2-4y-1=0$
(D) $y^2+4y-1=0$

190. The number of real solutions of the equation $\left(\frac{7}{13}\right)^x = -13+x-x^2$ is

(A) 3
(B) 2
(C) 1
(D) 0

191. Given that the sum of the squares of the roots of the equation $y^2-(k-3)y-k-2=0$ is 13. Then number of values of k lying in the interval [1, 4] is

(A) 0
(B) 1
(C) 2
(D) 3

192. Let $8^{\sin^2 x}+8^{\cos^2 x}=6$. Then

(A) $\sin^2 x=\frac{2}{3}$
(B) $\sin x=-\frac{1}{3}$
(C) $\cos^2 x=\frac{1}{2}$
(D) $\cos x=-\frac{1}{2}$

193. The equation $|\sin x|=2\cos x$ has

(A) infinitely many solutions
(B) finitely many solutions
(C) has no solutions in integers
(D) has no solutions

194. The value of x satisfying $1+\cos x+\cos^2 x+\ldots=4+2\sqrt{3}$ in the interval $\left[\frac{\pi}{2},\pi\right]$ is

(A) $\frac{2\pi}{3}$
(B) $\frac{\pi}{2}$
(C) $\frac{4\pi}{5}$
(D) $\frac{3\pi}{4}$

195. In a triangle ABC, let $\frac{2\cos A}{a}+\frac{\cos B}{b}+\frac{2\cos C}{c}=\frac{a}{bc}+\frac{b}{ac}$. Then b^2+c^2 is equal to

(A) a^2
(B) ac
(C) bc
(D) $a+b$

196. Let a,b,c be the sides of a ΔABC. Further two equation $ax^2+bx+c=0$ and $x^2+\sqrt{5}x+2=0$ have a common root. Then the $\angle C=$

(A) $\frac{\pi}{2}$
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{3}$
(D) $\frac{2\pi}{6}$

197. If the sides of a triangle are proportional to the cosines of the opposite angles, then

(A) the triangle is right angled
(B) the triangle is isosceles
(C) the triangle is equilateral
(D) one of the angle is obtuse

198. Let $a=7,b=4,c=9$ a in a ΔABC. Then the values of $\sin\frac{A}{2}$ and $\cos A$ are equal to respectively

(A) $\sqrt{\frac{4}{13}}$ and $\frac{9}{13}$
(B) $\sqrt{\frac{5}{13}}$ and $\frac{8}{13}$
(C) $\sqrt{\frac{7}{13}}$ and $\frac{6}{13}$
(D) $\sqrt{\frac{6}{13}}$ and $\frac{7}{13}$

199. Given that the lengths of the sides p, q, r of a ΔPQR are in an Arithmetic Progression. Then the ration $\frac{q}{r}$ lies in the interval

(A) $\left(\frac{1}{3}, \frac{2}{3}\right)$

(B) $\left(\frac{2}{3}, 2\right)$

(C) $\left(\frac{2}{3}, 1\right)$

(D) $\left(\frac{1}{3}, \frac{4}{3}\right)$

200. The two adjacent sides AB and BC of a cyclic quadrilateral $ABCD$ are 2 and 5 units respectively and the angle between them is 60°. Then the area of circle circumscribing the quadrilateral $ABCD$ is

(A) $\frac{9\pi}{2}$

(B) $\frac{19\pi}{2}$

(C) $\frac{9\pi}{3}$

(D) $\frac{19\pi}{3}$

201. In a ΔABC, $2a^2 + 9b^2 + c^2 = 6ab + 2ac$, then $\cos C$ is equal to

(A) 1/2

(B) 1/3

(C) 1/4

(D) 1/6

202. In the ΔABC, $(a+b+c)\left(\tan\frac{A}{2}+\tan\frac{B}{2}\right)$ is equal to

(A) $2c\cot\frac{C}{2}$

(B) $2a\cot\frac{A}{2}$

(C) $2b\cot\frac{B}{2}$

(D) $\tan\frac{C}{2}$

203. $\sin\left[\frac{\pi}{6}-\sin^{-1}\left(-\frac{1}{2}\right)\right]$ is equal to

(A) 0
(B) ∞
(C) 1
(D) -1

204. If $\sin A+\cos B=a$ and $\sin B+\cos A=b$, $\sin(A+B)$ is equal to

(A) $\frac{a^2+b^2-2}{2}$

(B) $\frac{a^2+b^2+2}{2}$

(C) $\frac{a^2-b^2+2}{2}$

(D) $\frac{a^2-b^2-2}{2}$

205. The first and last terms of an Arithmetic Progression are 1 and 56. If the sum of its terms is 290, then the number of terms will be

(A) 4
(B) 6
(C) 8
(D) 10

206. Suppose A is a point which is at equidistant from $X(1,3), Y(-3,5)$ and $Z(5,-1)$. Then the point A is

(A) $(-8,-10)$
(B) $(8,-10)$
(C) $(-8,10)$
(D) $(8,10)$

207. The midpoint of the line joining $(-6, 4)$ and $(8,-6)$ divides the line joining $(3, 6)$ and $(-6,-3)$ in the ratio

(A) 2:7 externally
(B) 2:7 internally
(C) 3:7 internally
(D) 3:7 externally

208. The sum of the distances from a point to the two perpendicular lines is 2. The locus of the point is

(A) a square
(B) a pair of straight lines
(C) an ellipse
(D) a parabola

209. If a point $P(2,1)$ is shifted by a distance $\sqrt{2}$ units parallel to the line $x+y=0$, then the new position of P is

(A) $(-1,2)$
(B) $(-1,-2)$
(C) $(1,-2)$
(D) $(1,2)$

210. The length of the common chord of intersection of the circles $x^2+y^2-2x+4y-4=0$ and $x^2+y^2-2x-6y+6=0$ is

(A) 0
(B) 1
(C) 2
(D) 3

211. The equation of the tangents to the circle $x^2 + y^2 = 25$ with 3 as x coordinate are

(A) $3x \pm 5y = 25$
(B) $3x \pm 4y = 5$
(C) $3x \pm 4y = 25$
(D) $3x \pm 5y = 5$

212. The equation of the circumcircle of the triangle formed by the lines $x = 2, y = 0$ and $x + y - 6 = 0$ is

(A) $x^2 + y^2 + 8x - 4y - 12 = 0$
(B) $x^2 + y^2 - 8x - 4y - 12 = 0$
(C) $x^2 + y^2 - 8x - 4y + 12 = 0$
(D) $x^2 + y^2 + 8x - 4y + 12 = 0$

213. The equation of a parabola is $y^2 = 4x$. $P(1, 3)$ and $Q(1, 1)$ are two points in the xy-plane. Then, for the parabola

(A) P and Q are exterior points
(B) P is an interior point while Q is an exterior point
(C) P and Q are interior points
(D) P is an exterior point while Q is an interior point

214. A circle having its center at (2, 3) is cut orthogonally by the parabola $y^2 = 4x$. The possible intersection point of these curves can be

(A) (1, 2) or $\left(3, 3\sqrt{3}\right)$
(B) (9, 6) or $\left(2, 2\sqrt{2}\right)$
(C) (1, 2) or (4, 4)
(D) (1, 3) or $\left(2, 2\sqrt{2}\right)$

215. If the polar of $y^2 = 4ax$ is always touching the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then the locus of the pole is

(A) $4a^2x^2 + b^2y^2 = 4a^4$
(B) $4a^2x^2 - b^2y^2 = 4a^4$
(C) $4a^2x^2 - b^2y^2 = 4b^4$
(D) $4a^2x^2 - b^2y^2 = 4b^4$

216. The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ and having its center (0, 3) is

(A) 4
(B) 3
(C) $\sqrt{12}$
(D) $\frac{7}{2}$

217. The equation to the hyperbola having its eccentricity 2 and the distance between foci as 8, is

(A) $\frac{x^2}{4}-\frac{y^2}{12}=1$

(B) $\frac{x^2}{12}-\frac{y^2}{4}=1$

(C) $\frac{x^2}{2}-\frac{y^2}{4}=1$

(D) $\frac{x^2}{4}-\frac{y^2}{2}=1$

218. The equation of the hyperbola whose vertices are at (5, 0) and (−5, 0) and $x=\frac{25}{7}$ as one of its directrices, is

(A) $\frac{x^2}{25}-\frac{y^2}{24}=1$

(B) $\frac{x^2}{24}-\frac{y^2}{25}=1$

(C) $\frac{x^2}{16}-\frac{y^2}{25}=1$

(D) $\frac{x^2}{25}-\frac{y^2}{16}=1$

219. $\frac{d}{dx}\left\{\tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right)\right\}$ is equal to

(A) $\frac{3}{1+9x^2}\forall|x|<\frac{1}{\sqrt{3}}$

(B) $\frac{9}{1+x^2}\forall|x|<\frac{1}{\sqrt{3}}$

(C) $\frac{3}{1+x^2}\forall|x|<\frac{1}{\sqrt{3}}$

(D) $\frac{1}{9+x^2}\forall|x|<\frac{1}{\sqrt{3}}$

220. Let $x=\sec\theta-\cos\theta$ and $y=\sec^2\theta-\cos^2\theta$. Then $\left(\frac{dy}{dx}\right)^2=$

(A) $\frac{4\left(y^2-4\right)}{x^2+4}$

(B) $\frac{4\left(y^2+4\right)}{x^2+4}$

(C) $\frac{4\left(y^2-4\right)}{x^2-4}$

(D) $\frac{4\left(y^2+4\right)}{x^2-4}$

221. Given that the line $y = 3x + c$ touches the curve $\frac{x^2}{4}+\frac{y^2}{9}=1$. The value of c is

(A) an integer
(B) always a rational number
(C) always an irrational number
(D) sometimes a rational number

222. Let $f(x)=|\cos x|+|\sin x|$. Then $f'(2\pi/3)=$

(A) $\frac{1-\sqrt{3}}{2}$
(B) $\frac{\sqrt{3}-1}{2}$
(C) 0
(D) $\frac{\sqrt{3}+1}{2}$

223. If $x=a\left\{\cos\theta+\log\tan\left(\frac{\theta}{2}\right)\right\}$ and $y=a\sin\theta$, then $\frac{dy}{dx}$ is

(A) $\cot\theta$
(B) $\tan\theta$
(C) $\sin\theta$
(D) $\cos\theta$

224. If $f(x)=|x-1|$ $g(x)=f\left(f(x)\right)$, then, for all $x\geq 2$, $g'(x)=$

(A) 1
(B) 2
(C) -1
(D) 0

225. If $y=\sin\left[\cos^{-1}\left\{\sin\left(\cos^{-1}x\right)\right\}\right]$, then $\frac{dy}{dx}$ at $x=\frac{1}{2}$ is equal to

(A) 0
(B) 1
(C) $2/\sqrt{3}$
(D) -1

226. The function $f(x)=\sqrt{\log_{10}\left(\frac{5x-x^2}{4}\right)}$ exists for

(A) [1, 4]
(B) [1, 0]
(C) [0, 5]
(D) [5, 0]

227. The range of the function $f(x)=\dfrac{x+3}{|x+3|},\ x\neq -3$ is

(A) $\{0\}$
(B) $\{0, 1\}$
(C) $\{-3,3\}$
(D) $\{-1,1\}$

228. The period of the function $f(x)=\cos\dfrac{2x}{7}+\sin\dfrac{x}{2}$ is

(A) 7π
(B) 4π
(C) 14π
(D) 28π

229. Let $f:R\to R$ be defined as $f(x)=\begin{cases}0, & x \text{ is irrational}\\ \sin|x|, & x \text{ is rational}\end{cases}$.

Then which of the following is true?

(A) f is discontinuous for all x
(B) f is continuous for all x
(C) f is discontinuous at $x=k\pi$, where k is an integer
(D) f is continuous at $x=k\pi$, where k is an integer

230. The period of the function $f(x)=\ \text{cosec}^3 3x+\cot 4x$ is

(A) $\dfrac{\pi}{3}$
(B) $\dfrac{\pi}{4}$
(C) $\dfrac{\pi}{6}$
(D) π

231. $\lim\limits_{x\to\infty}\left(\dfrac{x+7}{x+3}\right)^{x+2}$ is equal to

(A) e^2
(B) e^4
(C) e^{-4}
(D) e^{-2}

232. Let m, n be natural numbers with $n > m$. $\lim\limits_{x \to 0} \dfrac{\sin x^n}{(\sin x)^m}$ is equal to

(A) 2
(B) -2
(C) -1
(D) 0

233. $\lim\limits_{x \to \frac{\pi}{2}} \dfrac{\sin x - (\sin x)^{\sin x}}{1 - \sin x + \log \sin x}$

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

234. If the curve $y = x^2 + bx + c$ touches the line $y = x$ at the point (1, 1), then the values of x for which the curve has a negative gradient are

(A) $x > \dfrac{3}{2}$
(B) $x < \dfrac{3}{2}$
(C) $x > \dfrac{1}{2}$
(D) $x < \dfrac{1}{2}$

235. The sub tangent, ordinate and sub normal to the parabola $y^2 = 4ax$ at a point (different from the origin) are

(A) in Harmonic Progression
(B) in Geometric Progression
(C) in Arithmetic Progression
(D) equal

236. If $0 < x < \dfrac{\pi}{2}$, then

(A) $\cos(\sin x) < \sin(\cos x)$
(B) $\sin(\cos x) > \cos x$
(C) $\cos(\sin x) > \sin(\cos x)$
(D) $\cos(\sin x) \leq \cos x$

237. The minimum value of $e^{\left(2x^2+2x+1\right)\sin^2 x}$ is

(A) 0
(B) 1
(C) 2
(D) 3

238. $\int \frac{dx}{x^2+4x+5}$ is equal to

(A) $\frac{1}{2}\left\{\tan^{-1}(x+2)+\frac{x+2}{x^2+4x+5}\right\}+c$

(B) $\frac{1}{2}\left\{\tan^{-1}(x+2)+\frac{x}{x^2+4x+5}\right\}+c$

(C) $\frac{1}{2}\left\{\tan^{-1}(x+2)+\frac{x-2}{x^2+4x+5}\right\}+c$

(D) $\frac{1}{2}\left\{\tan^{-1}(x-2)+\frac{x}{x^2+4x+5}\right\}+c$

239. $\int\left(\frac{x+2}{x+4}\right)^2 e^x dx$ is equal to

(A) $e^x\left(\frac{x}{x+4}\right)+c$

(B) $e^x\left(\frac{x+2}{x+4}\right)+c$

(C) $e^x\left(\frac{x-2}{x+4}\right)+c$

(D) $e^x\left(\frac{2xe^x}{x+4}\right)+c$

240. The value of $I = \int_0^1 x\left|x - \frac{1}{2}\right| dx$ is equal to

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

(B) $\frac{1}{3}$

(C) $\frac{1}{4}$

(D) $\frac{1}{8}$

241. Consider the group $\left(R \setminus \left\{\frac{1}{2}\right\}, *\right)$ where $a*b = a+b-2ab$ for all $a, b \in R \setminus \left\{\frac{1}{2}\right\}$. Then the inverse of arbitrary element a is

(A) $\frac{a}{a-1}$

(B) $\frac{a}{2a+1}$

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

(D) $\frac{a}{a+1}$

242. The area bounded by $y = 2x - x^2$ and y -axis is

(A) 3 sq. units
(B) 2 sq. units
(C) 1 sq. units
(D) 0 sq. units

243. If the position vector of three points are $\vec{a} - 2\vec{b} + 3\vec{c}, 3\vec{a} + 4\vec{b} - 5\vec{c}, -\vec{a} - 8\vec{b} + 11\vec{c}$, then the three points are

(A) non-coplanar
(B) non-collinear
(C) collinear
(D) unit vectors

244. The sides of a parallelogram are $\vec{a} = \vec{i} + 2\vec{j} - 3\vec{k}, \vec{b} = \vec{i} + \vec{j} + 2\vec{k}$. Then the unit vector parallel to one of the diagonals is

(A) $\frac{1}{\sqrt{14}}(2\vec{i} + 3\vec{j} + \vec{k})$

(B) $\frac{1}{\sqrt{14}}(2\vec{i} + 3\vec{j} - \vec{k})$

(C) $\frac{1}{\sqrt{26}}(\vec{j} + 5\vec{k})$

(D) $\frac{1}{26}(-\vec{j} - 5\vec{k})$

245. In a three dimensional space, the equation $8x + 7y = 0$ represents

(A) the z-axis
(B) the z-plane
(C) the x-axis
(D) the plane $y = 0$

246. The plane $x - 2y + z = 6$ and the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ are related as

(A) parallel to the plane
(B) at right angles to a plane
(C) lies in the plane
(D) meets the plane obliquely

247. If the position vectors of A, B and C are respectively $\hat{i} + \hat{j} + \hat{k}, \hat{i} - 2\hat{j} - 4\hat{k}$ and $2\hat{i} - 3\hat{j} - 3\hat{k}$, then $\cos^2 B$ is equal to

(A) $\frac{1}{63}$

(B) $\frac{4}{63}$

(C) $\frac{6}{63}$

(D) $\frac{11}{63}$

248. The number of solutions at $x = 5$ for the equation $\left|\frac{dy}{dx}\right| + |x| + 7 = 0$ is

(A) 0
(B) 1
(C) 5
(D) ∞

249. A solution of the differential equation $(x+y)^2 \frac{dy}{dx} = 4$ is

(A) $y = 2\tan^{-1}\left(\frac{x-y}{2}\right) + c$
(B) $y = 2\tan^{-1}\left(\frac{x+y}{2}\right) + c$
(C) $y = \tan^{-1}\left(\frac{x-y}{2}\right) + c$
(D) $y = \tan^{-1}\left(\frac{x+y}{2}\right) + c$

250. $I = \int_{-3}^{2} \left(|x+1| + |x+2|\right) dx =$

(A) 10
(B) 12
(C) 15
(D) 18

FINAL ANSWER KEY																	
Subject Name: 101 B TECH 16-S2																	
SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key
1	C	31	C	61	A	91	C	121	A	151	B	181	C	211	C	241	C
2	A	32	B	62	A	92	C	122	C	152	A	182	A	212	C	242	D
3	B	33	A	63	C	93	B	123	B	153	A	183	A	213	D	243	C
4	D	34	D	64	D	94	B	124	B	154	B	184	D	214	C	244	B
5	B	35	D	65	D	95	D	125	B	155	B	185	B	215	B	245	A
6	D	36	B	66	A	96	C	126	C	156	C	186	D	216	A	246	A
7	B	37	C	67	A	97	A	127	B	157	D	187	B	217	A	247	B
8	C	38	D	68	B	98	A	128	B	158	B	188	D	218	A	248	A
9	D	39	C	69	B	99	D	129	C	159	D	189	A	219	C	249	B
10	A	40	D	70	B	100	B	130	C	160	B	190	D	220	B	250	C
11	B	41	D	71	D	101	D	131	D	161	D	191	B	221	C		
12	A	42	C	72	C	102	C	132	C	162	C	192	A	222	B		
13	C	43	A	73	B	103	B	133	C	163	D	193	D	223	B		
14	A	44	B	74	C	104	D	134	A	164	B	194	A	224	A		
15	C	45	A	75	C	105	B	135	D	165	B	195	A	225	B		
16	C	46	A	76	A	106	A	136	B	166	D	196	B	226	A		
17	D	47	C	77	D	107	C	137	C	167	B	197	C	227	D		
18	B	48	C	78	A	108	B	138	D	168	D	198	D	228	D		
19	C	49	C	79	C	109	C	139	D	169	A	199	B	229	D		
20	D	50	C	80	B	110	D	140	C	170	B	200	D	230	D		
21	A	51	A	81	A	111	C	141	D	171	B	201	D	231	B		
22	A	52	B	82	A	112	B	142	A	172	D	202	A	232	D		
23	D	53	B	83	A	113	B	143	C	173	B	203	C	233	B		
24	B	54	C	84	A	114	B	144	A	174	A	204	A	234	D		
25	A	55	C	85	B	115	C	145	C	175	C	205	D	235	B		
26	B	56	B	86	A	116	A	146	A	176	C	206	A	236	C		
27	D	57	D	87	A	117	B	147	C	177	D	207	B	237	B		
28	D	58	C	88	C	118	A	148	C	178	A	208	A	238	A		
29	B	59	A	89	A	119	B	149	D	179	D	209	D	239	A		
30	D	60	C	90	C	120	C	150	A	180	D	210	A	240	D		