B.TECH. (PHYSICS) – SHIFT II

1. In measurements of physical quantities, the standard deviation $\sigma$ and the probable error '*r*' are related by

   (A) $r = \pm 0.6745\ \sigma$
   (B) $r = \sqrt{\sigma}$
   (C) $\sigma = \pm 0.6745\ r$
   (D) $\sigma = \sqrt{r}$

2. Two bodies having masses in the ratio of 3 : 1 possess same kinetic energy. The ratio of linear momentum of B to A is

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

3. 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) 1 kW

4. The ratio of specific heats ($C_p/C_v$) for monoatomic gas is about

   (A) 1.5
   (B) 1.33
   (C) 1.4
   (D) 1.67

5. A Carnot engine is working between steam point and ice point. Then its efficiency will be

   (A) 24.9%
   (B) 25.7%
   (C) 26.8%
   (D) 28.8%

6. The angular momentum of the electron results in

(A) Zeeman effect
(B) Magnetic moment
(C) Stark effect
(D) Emission of light and emission spectrum

7. If $g$ is the acceleration due to gravity at a place on the surface of the earth and $g'$ is the acceleration due to gravity at a depth $h$ below the surface of the earth ($h <$ R, the radius of the earth), then

(A) $g' = g - \frac{h}{R}$

(B) $g' = g - \frac{R}{h}$

(C) $g' = g$

(D) $g' = g\left[1 - \frac{h}{R}\right]$

8. Coefficient of surfacial expansion of a solid is $2 \times 10^{-5} / °C$ . Then the coefficient of linear expansion is

(A) $4 \times 10^{-5} / °C$
(B) $3 \times 10^{-5} / °C$
(C) $2 \times 10^{-5} / °C$
(D) $1 \times 10^{-5} / °C$

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

(A) Water vapour
(B) Carbon dioxide
(C) Methane
(D) Nitrogen

10. An inductor of inductance 30 mH is connected to a 220 V, 100 Hz AC source. It offers an inductive reactance of

(A) 10.58 Ω
(B) 12.64 Ω
(C) 18.85 Ω
(D) 22.67 Ω

11. A step down transformer with a primary winding of 1,74,000 turns and secondary windings of 1000 turns operates from a 40,000 V high tension line and supplies a load of 60 A. Assuming 100% efficiency, the power output of the transformer is

(A) 2400 KW
(B) 13.8 KW
(C) 24,000 KW
(D) 40,000 KW

12. The parallel combination of inductor and capacitor is called

(A) a rectifier circuit
(B) a filter circuit
(C) a tank circuit
(D) an acceptor circuit

13. A closed organ pipe has a frequency '*n*'. If its length is doubled, its frequency nearly becomes

(A) Halved
(B) Doubled
(C) Three times
(D) Four times

14. Two slits are made one millimeter apart and the screen is placed one meter away. What is the fringe separation when the blue-green light of wavelength 500 nm is used?

(A) 0.05 mm
(B) 0.01 mm
(C) 0.5 mm
(D) 0.1 mm

15. What is the ratio of output frequency of a full wave rectifier to half wave rectifier fed with a input signal of frequency 50 Hz?

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

16. An amplitude modulated wave varies from 10 V to 4 V. Its percentage modulation is

(A) 36%
(B) 42.8%
(C) 54%
(D) 68%

17. Which of the following is fundamental quantity?

(A) Velocity
(B) Time
(C) Volume
(D) Force

18. In a p-type semiconductor, the majority and minority charge carriers are, respectively,

(A) Protons and Neutrons
(B) Electrons and Holes
(C) Electrons and Protons
(D) Holes and Electrons

19. Speed of electromagnetic waves in vacuum is equal to

(A) $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$

(B) $\mu_0 \varepsilon_0$

(C) $\sqrt{\mu_0 \varepsilon_0}$

(D) $\frac{1}{\mu_0 \varepsilon_0}$

20. The displacement of a particle in SHM is always measured from

(A) Mean position
(B) Extreme position
(C) Mid-point of mean and extreme position
(D) Initial position

21. Two resistances $R_1 = 10.0\ \Omega \pm 0.1\ \Omega$ and $R_2 = 5.0 \pm 0.1\ \Omega$ are connected in parallel. Then % of error in the resultant value of $R$ is

(A) 4.3%
(B) 1.393%
(C) 3.83%
(D) 0.0133%

22. If earth shrinks to half its radius without changing its mass then the length of the day will be

(A) 6 hours
(B) 12 hours
(C) 8 hours
(D) 24 hours

23. $\sigma 1$ and $\sigma 2$ are the electrical conductivities of Ge and Na respectively. If these substances are heated then

(A) $\sigma 1$ and $\sigma 2$ increases
(B) $\sigma 1$ increases and $\sigma 2$ decreases
(C) $\sigma 1$ decreases and $\sigma 2$ increases
(D) $\sigma 1$ and $\sigma 2$ decreases

24. Which one of the following phenomena is not explained by Huygen's construction of wavefront?

(A) Refraction
(B) Reflection
(C) Diffraction
(D) Origin of spectra

25. The frequency of $X$-rays, $\gamma$-rays and ultraviolet rays are respectively $a$, $b$ and $c$. Then

(A) $a > b, b < c$
(B) $a < b, b > c$
(C) $a < b, b < c$
(D) $a > b, b > c$

26. When a source of sound moves towards an observer

(A) the frequency of the source is increased
(B) the velocity of sound in the medium is increased
(C) the wavelength of the sound in the medium towards the observer is decreased
(D) the amplitude of vibration of the particles is increased

27. If the angle between two nonzero vectors $\vec{A}$ and $\vec{B}$ is 120°, its resultant $\vec{C}$

(A) must be equal to $|A-B|$

(B) must be greater than $|A-B|$

(C) may be equal to $|A-B|$

(D) must be less than $|A-B|$

28. Two mercury drops of same radius merge to form a bigger drop. Then the released surface energy is

(A) $1.65\ \pi r^2 S$

(B) $3.3\ \pi r^2 S$

(C) $2.56\ \pi r^3 S$

(D) $2.56\ \pi r^2 S$

29. The temperature of a hypothetical gas increases to $\sqrt{2}$ times when compressed adiabatically to half the volume. Its equation can be written as

(A) $PV$ = constant

(B) $PV^{\frac{1}{2}}$ =constant

(C) $PV^{\frac{3}{2}}$ =constant

(D) $PV^{\frac{5}{2}}$ =constant

30. Bernoulli theorem is based on conservation of

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

31. Two bodies $A$ and $B$ of equal masses are suspended from two separate massless springs of spring constant $k_1$ and $k_2$ respectively. If the bodies oscillate vertically such that their maximum velocities are equal, the ratio of the amplitude of $A$ to that of $B$ is

(A) $\frac{k_1}{k_2}$

(B) $\frac{k_2}{k_1}$

(C) $\sqrt{\frac{k_1}{k_2}}$

(D) $\sqrt{\frac{k_2}{k_1}}$

32. A particle of mass $m$ is observed from an inertial frame of reference and is found to move in a circle of radius $r$ with a uniform speed $v$. The centrifugal force on it is

(A) $\frac{mv^2}{r}$ towards the centre

(B) $\frac{mv^2}{r}$ away from centre

(C) $\frac{mv^2}{r}$ along the tangent through the particle

(D) zero

33. Two radioactive materials $A$ and $B$ have decay constants $10\lambda$ and $\lambda$, respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of $A$ to that of $B$ will be $\frac{1}{e}$ after a time

(A) $\frac{1}{9\lambda}$

(B) $\frac{11}{10\lambda}$

(C) $\frac{1}{10\lambda}$

(D) $\frac{1}{11\lambda}$

34. As an electron makes a transition from an excited state to the ground state of a hydrogen like atom/ion

(A) Kinetic energy decreases, potential energy increases but total energy remains same
(B) Kinetic energy and total energy decrease but potential energy increases
(C) Kinetic energy increases but potential energy and total energy decreases
(D) Kinetic energy, potential energy and total energy decreases

35. Which of the following is best method to reduce eddy currents?

(A) Laminating core
(B) Using thick wires
(C) Reducing hysteresis loss
(D) Using thin wires

36. A bar magnet of magnetic moment $M$ and moment of inertia $I$ is freely suspended such that the magnetic axial line is in the direction of the magnetic meridian. If the magnetic induction of earth's horizontal field is $B_H$ and the magnet is displaced by a very small angle $\theta$, angular acceleration is

(A) $\frac{MB_H\theta}{I}$

(B) $\frac{IB_H\theta}{M}$

(C) $\frac{M\theta}{IB_H}$

(D) $\frac{I\theta}{MB_H}$

37. For which of the following dependences of drift velocity $v_d$ on electric field $E$, is Ohm's law obeyed?

(A) $v_d \propto E$

(B) $v_d \propto E^2$

(C) $v_d \propto \sqrt{E}$

(D) $v_d \propto \frac{1}{E}$

38. The freezer in a refrigerator is located at the top section so that

(A) the entire chamber of the refrigerator is cooled quickly due to convection
(B) the motor is not heated
(C) the heat gained from the environment is high
(D) the heat gained from the environment is low

39. Two rods of same length and area of cross section and Young's modulii $Y_1$ and $Y_2$ are joined end to end. The equivalent Young's modulus for the composite rod is

(A) $\frac{Y_1 + Y_2}{2}$

(B) $\frac{Y_1 + Y_2}{Y_1 Y_2}$

(C) $\frac{2Y_1 Y_2}{Y_1 + Y_2}$

(D) $Y_1 + Y_2$

40. A prism can produce a minimum deviation $\delta$ in a light beam. If three such prisms are combined, the minimum deviation that can be produced in this beam is

(A) 0

(B) $\frac{\delta}{3}$

(C) $\delta$

(D) $3\delta$

41. Light year is used to measure the

(A) Time
(B) Distance
(C) Energy
(D) Mass

42. The motion of a rocket is based on the principle of conservation of

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

43. According to Hook's law, if stress is increased, the ratio of stress to strain

(A) decreases
(B) increases
(C) remains constant
(D) zero

44. Convection does not take place in

(A) Boiling of water
(B) Sea and land breeze
(C) Heating air around a furnace
(D) Warming of glass of the bulb due to filament

45. The number of degrees of freedom of a triatomic gas is

(A) 1
(B) 2
(C) 6
(D) 8

46. A stone tied to a string is rotated in a circle with the other end of the string as the centre. If the string breaks the stone will

(A) move towards the centre
(B) move away from the centre
(C) move along the tangent
(D) stop

47. In a parallel plate capacitor, the capacity increases if

(A) area of the plate is increased
(B) distance between the plates increases
(C) area of the plate is decreased
(D) dielectric constant decreases

48. If an ammeter is used in the place of a voltmeter, then we must connect the ammeter with

(A) a low resistance in parallel
(B) a high resistance in parallel
(C) a high resistance in series
(D) a low resistance in series

49. At magnetic poles the angle of dip is

(A) 45°
(B) 90°
(C) 30°
(D) 5°

50. In a step-down transformer with 20 turns in the secondary coil and 100 turns in the primary coil, if the voltage applied to the primary coil is 120 V, the voltage output from the secondary coil is

(A) 24 V
(B) 12 V
(C) 6 V
(D) 18 V

51. Ratio of the angle subtended at the eye by the image to the angle subtended at the eye by the object is called

(A) Magnifying power of a simple microscope
(B) Magnifying power of a telescope
(C) Magnifying power of a electron microscope
(D) Astigmatism

52. If the diameter of the objective of a telescope is doubled, the intensity of the image is increased to

(A) Two times
(B) Four times
(C) Eight times
(D) Sixteen times

53. The time taken for a radio signal to travel 150 km from the transmitter to receiving antenna is

(A) $5 \times 10^{-4}$ s
(B) $4.5 \times 10^{-3}$ s
(C) $5 \times 10^{-8}$ s
(D) $4.5 \times 10^{-6}$ s

54. In uniformly accelerated motion, how many variables are required to fully describe the system?

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

55. 1 Joule is equal to

(A) 10 ergs
(B) $10^4$ ergs
(C) $10^7$ ergs
(D) $10^9$ ergs

56. Two satellites of mass $m$, and 10 $m$, are put in the same orbit around the sun. If $T_1$ and $T_2$ are their time periods, then $\frac{T_1}{T_2} =$

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

57. What is the number of molecules in 2.24 L of $SO_2$ at STP?

(A) $6.023\times10^{23}$
(B) $6.023\times10^{22}$
(C) $6.023\times10^{20}$
(D) $6.023\times10^{2}$

58. A 250-turn rectangular coil of length 2.1 cm and width 1.25 cm carries a steady current of 85 μA and is subjected to a magnetic field of strength 0.85 T. The work done for rotating the coil by 180° against the torque is

(A) 1.5 pJ
(B) 4.55 pJ
(C) 9.5 pJ
(D) 2.3 pJ

59. What is the de Broglie wavelength of a ball of mass 150 g moving at a speed of 50 m/s?

(A) $8.8 \times 10^{-34}$ m
(B) $8.8 \times 10^{-30}$ m
(C) $8.8 \times 10^{-25}$ m
(D) $8.8 \times 10^{-35}$ m

60. In the common emitter amplifier, the phase difference between the input voltage and output voltage signal across the collector and emitter is

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

61. Which of the following is a dimensionless quantity?

(A) Meter (m)
(B) Kilogram (kg)
(C) Radian (rad)
(D) Second (s)

62. A projectile is launched with a speed of 20 m/s at an angle $\theta$ from the ground. At what point in its trajectory does the projectile have the maximum kinetic energy?

(A) At the apex of its trajectory
(B) At the initial point
(C) Upon reaching the ground
(D) Halfway between the initial and final points

63. A rocket of mass 1000 kg is initially at rest in space. The rocket engines are turned on, and a constant thrust of 5000 N is exerted for 20 seconds. What is the final velocity of the rocket?

(A) 50 m/s
(B) 100 m/s
(C) 150 m/s
(D) 200 m/s

64. An object is thrown vertically upwards with an initial velocity of 20 m/s. Considering the gravitational force acting on the object during its ascent, what is the net work done by the gravitational force?

(A) Zero
(B) Negative
(C) Positive
(D) Cannot be determined

65. A fluid with viscosity $\eta$ flows through a horizontal pipe of radius $r$ and length $L$ The pressure difference between the two ends of the pipe is $P$. What is the flow rate of the fluid?

(A) $\frac{\pi r^4 P}{8\eta L}$

(B) $\frac{\pi r^4 P}{4\eta L}$

(C) $\frac{\pi r^4 P}{2\eta L}$

(D) $\frac{\pi r^3 P}{8\eta L}$

66. According to kinetic theory, the pressure exerted by an ideal gas on the walls of its container is due to

(A) Collisions between gas molecules
(B) Gravitational attraction between gas molecules
(C) Magnetic forces between gas molecules
(D) Electrostatic repulsion between gas molecules

67. What is the speed of a wave with a frequency of 50 Hz and a wavelength of 2 m?

(A) 25 m/s
(B) 50 m/s
(C) 100 m/s
(D) 200 m/s

68. Identify the **incorrect** statement from the following.

(A) The direction of momentum and the velocity of an object is the same
(B) Momentum is a scalar quantity
(C) The object has a large momentum if either mass or velocity is large
(D) Momentum describes the motion of an object

69. The average number of atoms per unit cell in a body centered cubic structure is

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

70. The work done against electrostatic force gets stored in the …… form

(A) Thermal energy
(B) Potential energy
(C) Kinetic energy
(D) Gravitational energy

71. The energy difference between the ground state and the first excited state of an electron in a box of length 1.0Å is

(A) $1.81 \times 10^{-17}$ eV
(B) $1.81 \times 10^{-17}$ Cal
(C) $1.81 \times 10^{-17}$ J
(D) $1.81 \times 10^{-17}$ KCal

72 A measure of the repeatability of measurement of a quantity is

(A) error
(B) precision
(C) accuracy
(D) sensitivity

73. Ratio of absolute viscosity to the density of the fluid is called

(A) relative viscosity
(B) viscosity index
(C) kinematic viscosity
(D) fluidity

74. Just before striking the ground, a 2.0 kg mass has 400 J of KE. If friction can be ignored, from what height was it dropped?

(A) 200 m
(B) 20 m
(C) 40.8 m
(D) 40 m

75. Inversion temperature of a gas is the temperature above which

(A) the gas shows cooling effect while passing through a narrow orifice
(B) the temperature of the gas remains unaltered while passing through narrow orifice
(C) the gas shows heating effect while passing through a narrow orifice
(D) the gas can be liquefied

**CHEMISTRY UG**
**(SHIFT II - FINAL)**

76. The heat of formation of sulphur dioxide is $\Delta H_f = -297$ kJ. The heat liberated on burning 8 g of sulphur in oxygen is

(A) −148.5 kJ
(B) −74.25 kJ
(C) 148.5 kJ
(D) 74.25 kJ

77. The efficiency of a heat engine is given by

(A) $\frac{W}{q_2} = \frac{T_2 - T_1}{T_2}$

(B) $\frac{W}{q_2} = \frac{T_1 - T_2}{T_2}$

(C) $\frac{W}{q_2} = \frac{T_2 - T_1}{T_1}$

(D) $\frac{W}{q_2} = \frac{T_1 - T_2}{T_1}$

78. The pH of the blood is maintained by buffer system given by

(A) NaCl and HCl
(B) $NH_4Cl$ and $NH_4OH$
(C) Sodium citrate and Citric acid
(D) $HCO_3^-$ and $H_2CO_3$

79. In which of the following reactions, increase in the volume at constant temperature does not affect the number of moles at equilibrium?

(A) $2NH_3 \rightarrow N_2 + 3H_2$
(B) $C\ (g) + ½\ O_2\ (g) \rightarrow CO\ (g)$
(C) $H_2\ (g) + O_2\ (g) \rightarrow H_2O_2\ (g)$
(D) None of the above

80. An azeotropic solution of two liquids has the boiling point lower than either of them, when it

(A) shows negative deviation from Raoult's law
(B) shows no deviation from Raoul's law
(C) shows positive deviation from Raoult's law
(D) contains non-volatile solute

81. In a $H_2$-$O_2$ fuel cell, combustion of hydrogen occurs to

(A) Remove adsorbed oxygen from electrode surface
(B) Create potential difference between the two electrodes
(C) Produce high purity water
(D) Generate heat

82. Out of Cu, Ag, Fe and Zn, the metal which can displace all others from salt solution is

(A) Ag
(B) Cu
(C) Zn
(D) Fe

83. According to Arrhenius theory, the activation energy (Ea) for a reaction with rate constant k at a temperature T is …… (R is gas constant)

(A) $E_a = RT^2 \frac{dlnk}{dT}$

(B) $E_a = -RT^2 \frac{dlnk}{dT}$

(C) $E_a = RT \frac{dlnk}{dT}$

(D) $E_a = -RT \frac{dlnk}{dT}$

84. The presence of double layer in colloids accounts for

(A) kinetic properties
(B) electrokinetic properties
(C) optical properties
(D) tyndal effect

85. Which of the following is an example of isobar?

(A) ${}^{14}_{6}C$ and ${}^{15}_{6}C$

(B) ${}^{14}_{6}C$ and ${}^{14}_{7}N$

(C) ${}^{15}_{7}N$ and ${}^{14}_{7}C$

(D) ${}^{6}_{14}C$ and ${}^{7}_{14}C$

86. Among the given equations, the correct one representing a closed system is

(A) $\Delta U = q - w$
(B) $\Delta U = q$
(C) $\Delta U = -w$
(D) $\Delta U = \Delta q + \Delta w$

87. If in a nearly saturated solution, the dissolution process is endothermic, then the solubility should

(A) decrease with rise in temperature
(B) increase with rise in temperature
(C) increase with reduce in temperature
(D) decrease with reduce in temperature

88. $A_2(g) + 2B(g) \rightleftharpoons C(g) + 2D(s)$, the $K_c$ for the given reaction will be

(A) $K_c = \dfrac{[C][D]^2}{[A_2][B]^2}$

(B) $K_c = \dfrac{[C]}{[A_2][B]^2}$

(C) $K_c = \dfrac{[A_2][B]^2}{[C][D]^2}$

(D) $K_c = \dfrac{[A_2][B]^2}{[C]}$

89. If the initial concentration of the reactants in a reaction increases then the equilibrium constant

(A) also increases
(B) decreases
(C) remain constant
(D) may increase or decrease

90. The enthalpy of unit mass for any system is

(A) $H = U + pV + S$
(B) $H = U + pV - S$
(C) $H = U + pV$
(D) $H = U - pV + S$

91. Within an atom, the probability density $|\psi|^2$ is always

(A) zero
(B) negative
(C) $\pm 1$
(D) positive

92. According to Ostwald's dilution law

(A) $\alpha = \frac{\sqrt{k_a}}{C}$

(B) $\alpha = \left(\frac{k_a}{C}\right)^{1/2}$

(C) $\alpha = \frac{\sqrt{k_a}}{V}$

(D) $\alpha = \frac{k_a}{V}$

93. The fuel cell reaction generates electricity directly from $2H_2 + O_2 \rightarrow 2H_2O$. What potential should the battery generate (under standard conditions)?

(A) 0.40
(B) 0.43
(C) 0.68
(D) 1.23

94. For a second order reaction, the time required for half change is

(A) Directly proportional to the initial concentration
(B) Independent of the initial concentration
(C) Inversely proportional to the initial concentration
(D) Inversely proportional to the square of the initial concentration

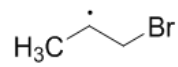
95. Arrhenius equation is $k = A\ e^{-Ea/RT}$. Choose the correct statement.

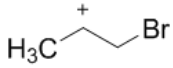
(A) A depends on temperature
(B) Ea depends on temperature
(C) Both Ea and A are independent of temperature
(D) Both Ea and A depend on temperature

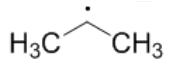
96. Overall 3D structure of a simple protein is called

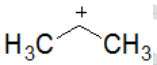
(A) Quaternary structure
(B) Tertiary structure
(C) Secondary structure
(D) Primary structure

97. The reactive intermediate involved when HBr is added to propene in the presence of peroxide is

(A) 


(B) 


(C) 


(D) 


98. Reagents used in Wolff-Kishner reduction of cyclohexanone to give cyclohexane is/are

(A) $LiAlH_4$
(B) Na, liq $NH_3$
(C) Zn, HCl
(D) $NH_2NH_2$, NaOH

99. Benzene diazonium chloride can be converted to chlorobenzene by treating with

(A) $PCl_5$
(B) $Cl_2$, $FeCl_3$
(C) $CuCl_2$
(D) CuCl

100. Which is the reserve carbohydrate in animals?

(A) Starch
(B) Pectin
(C) Glycogen
(D) Inulin

101. Nitration of phenol is much faster than nitration of benzene due to ……. of OH group

(A) +*I* effect
(B) +*M* effect
(C) –*I* effect
(D) Hydrogen bonding with the incoming nitronium ion electrophile

102. Which among the following is alleged to have been used to poison a famous historic figure?

(A) Mg
(B) Si
(C) Al
(D) As

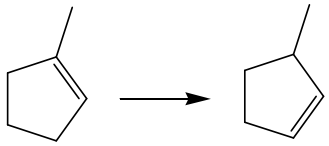
103. AZT is the azido derivative of a DNA nucleoside based anti-AIDS drug. The nitrogen base present in AZT is not present in RNA. Which among the following nucleic acid base does AZT contain?

(A) Uracil
(B) Cytosine
(C) Thymine
(D) Guanine

104. There are two different isomeric compounds with molecular formula $C_2H_6O$. One of these isomers has a much higher boiling point than the other. Explain why?

(A) Due to difference in their ability to form strong intermolecular hydrogen bonds
(B) Due to large difference in their dipole moments
(C) Due to difference in the number of carbon-carbon bonds in the two isomers
(D) Due to difference in carbon oxygen bonds in the two isomers

105. How to accomplish the following transformation?



(A) Anhydrous $AlCl_3$ catalyzed rearrangement
(B) Markovnikov addition of HBr followed by base catalyzed E1 elimination of HBr
(C) Anti-Markovnikov addition of HBr followed by base catalyzed E2 elimination of HBr
(D) Base catalysed equilibration

106. Trans addition of $Br_2$ to Compound X gave *meso*-2,3-dibromobutane. What is the identity of compound X?

(A) 1-butene
(B) *cis*-but-2-ene
(C) *trans*-but-2-ene
(D) 1,3-butadiene

107. Glutaric acid can be written as 

with n equals to (remember, Oh, My Such Good Apples)

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

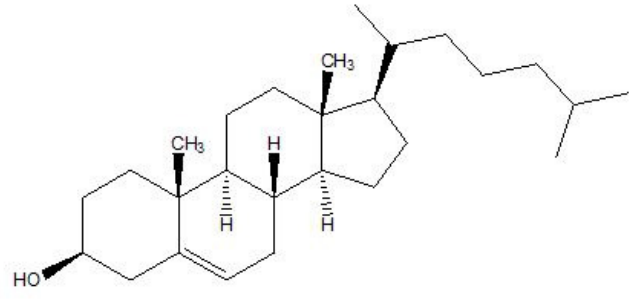
108. Which of the following, in aqueous solutions of equal concentration, has the lowest pH?

(A) $ClCH_2CO_2H$
(B) $CH_3CO_2H$
(C) $Cl_2CHCO_2H$
(D) $C_2H_5OH$

109. Nucleic acids are biopolymers. The monomer units present in them

(A) Pyrimidine and purine bases
(B) Sugars
(C) Nucleosides
(D) Nucleotides

110. Shown below is Cholesterol, which is the most abundant compound from steroids in animals. (Note: Thick solid wedge indicates a bond coming above the plane, while broken wedge indicates a bond below the plane)




How many chiral carbons are present in Cholesterol?

(A) 10
(B) 8
(C) 6
(D) 4

111. Picric acid is

(A) Strong acid that can protonate electron rich aromatic compounds
(B) Monomer used in the preparation of polyester PET
(C) 2,4,6-trinitrobenzoic acid
(D) 2,4,6-trinitrophenol

112. According to rules for drawing Fischer projection, the groups on the horizontal line are

(A) Above the plane of the paper
(B) Below the plane of the paper
(C) In the plane of paper
(D) Group appearing on the right side is above and group appearing on the left is below the plane of the paper

113. Reaction of silver salts of carboxylic acids with halogen to form organic halides with one carbon less (Hunsdiecker reaction) proceeds through

(A) Carbocation intermediate
(B) Carbanion intermediate
(C) Radical intermediate
(D) Carbene intermediate

114. Aspirin is an acetylation product of

(A) Aspartic acid
(B) *o*-Hydroxybenzoic acid
(C) Asparagine
(D) *m*-Hydroxybenzoic acid

115. Resonance energy of benzene is

(A) 152 kJ/mol
(B) 36 kJ/mol
(C) 36 eV/mol
(D) 36 cal/mol

116. The number of unpaired electrons in the complexes $[Cu(en)_2(H_2O)_2]Cl_2$ and $K_3[CrI_6]$ are

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

117. The number of geometric and optical isomers of the complex $[Co(en)_3]Cl_3$ are

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

118. Which of the following pairs does not represent an acid and its conjugate base?

(A) $HNO_3$ and $NO_3^-$
(B) $H_2SO_4$ and $HSO_4^-$
(C) $H_2SO_4$ and $SO_4^{2-}$
(D) $HSO_4^-$ and $SO_4^{2-}$

119. Which is the most acidic compound?

(A) $CH_4$
(B) $NH_3$
(C) $H_2O$
(D) $H_2S$

120. What type of bond, a hydrogen atom need have for hydrogen bonding to occur?

(A) An ionic bond
(B) A polar covalent bond
(C) A non-polar covalent bond
(D) An alkaline bond

121. Which of the following compounds **cannot** act as a Lewis base?

(A) $NF_3$
(B) $PCl_5$
(C) $SF_4$
(D) $ClF_3$

122. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R

**Assertion A** : The H–O–H bond angle in water molecule is 104.5°.
**Reason R** : The lone pair - lone pair repulsion of electrons is higher than the bond pair - bond pair repulsion.

Choose the correct alternative from given below.

(A) A is false but R is true
(B) Both A and R are true, but R is not the correct explanation of A
(C) A is true but R is false
(D) Both A and R are true, and R is the correct explanation of A

123. The **incorrect** statement regarding the structure of C60 is

(A) The six-membered rings are fused to both six and five-membered rings
(B) Each carbon atom forms three sigma bonds
(C) The five-membered rings are fused only to six-membered rings
(D) It contains 12 six-membered rings and 24 five-membered rings

124. The oxidation states of X in $H_4X_2O_7$, $H_4X_2O_5$ and $H_4X_2O_6$, respectively, are

(A) 7, 5 and 6
(B) 5, 4 and 3
(C) 5, 3 and 4
(D) 6, 4 and 5

125. The interaction energy of London forces between two particles is proportional to $r^x$, where $r$ is the distance between the particles. The value of $x$ is

(A) 3
(B) –3
(C) –6
(D) 6

126. The bond order and magnetic behaviour of $O_2^-$ ion are

(A) 1.5 and paramagnetic
(B) 1.5 and diamagnetic
(C) 2 and diamagnetic
(D) 1 and paramagnetic

127. Strongest back donation of an electron pair from halide to boron is expected in

(A) $BCl_3$
(B) $BF_3$
(C) $BBr_3$
(D) $BI_3$

128. Which among the following is **NOT** isostructural?

(A) $SO_3$
(B) $NO_3^-$
(C) $PCl_3$
(D) $CO_3^{2-}$

129. According to molecular orbital theory, the species among the following that does not exist is

(A) $He_2^+$
(B) $He_2^-$
(C) $Be_2$
(D) $O_2^{2-}$

130. The correct statement about $B_2H_6$ is

(A) Terminal B–H bonds have less p-character when compared to bridging bonds
(B) The two B–H–B bonds are not of same length
(C) All B–H–B angles are of 120°
(D) Its fragment, $BH_3$, behaves as a Lewis base

131. Which among the following species has unequal bond lengths?

(A) $BF_4^-$
(B) $XeF_4$
(C) $SF_4$
(D) $SiF_4$

132. Identify the ion having the 'spin only' magnetic moment equal to 4.9 BM

(A) $Ni^{2+}$
(B) $Cr^{2+}$
(C) $V^{2+}$
(D) $Mn^{2+}$

133. The number of bonds between the two Mn in $Mn_2(CO)_{10}$ is

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

134. Select the correct option

(A) $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ both are diamagnetic
(B) $[Ni(CO)_4]$ is paramagnetic and $[NiCl_4]^{2-}$ is diamagnetic
(C) $[Ni(CO)_4]$ is diamagnetic and $[NiCl_4]^{2-}$ is paramagnetic
(D) $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ both are paramagnetic

135. The Cr compounds that is **not** involved in the reaction sequence of chromyl chloride test for confirmation of $Cl^-$ ion is

(A) $K_2Cr_2O_7$
(B) $CrO_2Cl_2$
(C) $Cr_2O_3$
(D) $CrO_3$

136. The value of $\begin{vmatrix} 1 & \omega^3 & \omega^2 \\ \omega^3 & 1 & \omega \\ \omega^2 & \omega & 1 \end{vmatrix}$ is

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

137. The series $\frac{1}{1}+\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{3}}+\frac{1}{\sqrt{4}}+\ldots$ is

(A) divergent
(B) convergent
(C) oscillatory
(D) constant

138. The value of $\lim_{x\to 0}\frac{x-\sin x}{x^3}=$

(A) $\frac{1}{3}$

(B) $\frac{1}{4}$

(C) $\frac{1}{5}$

(D) $\frac{1}{6}$

139. A missile fixed from ground level rises $x$ meters vertically upwards in $t$ seconds and $x=100t-\frac{25}{2}t^2$. The maximum height reached is

(A) 100 m
(B) 300 m
(C) 150 m
(D) 200 m

140. $\int \sin^6\theta \cos^4\theta \, d\theta =$

(A) $\frac{3\pi}{512}$

(B) $\frac{\pi}{512}$

(C) $\frac{5\pi}{512}$

(D) $\frac{7\pi}{512}$

141. If the first 2 moments of a distribution about the value 5 are 2 and 20, then the standard deviation of the distribution is

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

142. In a group of employed persons, 30% are women. 65% of the men and 40% of the women pay income tax. The probability that a randomly chosen person is not a income tax payer is

(A) 0.575
(B) 0.525
(C) 0.475
(D) 0.425

143. The function $f: R \rightarrow R$ defined by $f(x) = x + 1$ is

(A) surjective only
(B) injective only
(C) both surjective and injective
(D) neither surjective nor injective

144. The area bounded by the curve $y = \sin x$ between $x = 0$ and $x = \pi$ is

(A) 2 sq.unit
(B) 4 sq.unit
(C) 8 sq.unit
(D) 16 sq.unit

145. The equation of the tangent to the curve $y = x^3$ at the point (1, 1) is

(A) $y = 3x$
(B) $y = 3x - 1$
(C) $y = 3x - 3$
(D) $y = 3x - 2$

146. The number of common terms in the two sequences 15, 19, 23, 27, …., 415 and 14, 19, 24, 29, …, 464 is

(A) 18
(B) 21
(C) 20
(D) 19

147. Let $A$ be non singular square matrix of order $5 \times 5$ . Then |adj $A$| is equal to

(A) $|A|$
(B) $|A|^2$
(C) $|A|^3$
(D) $|A|^4$

148. The differentiation of $\log(\cos x)$ is

(A) $\cot x$
(B) $\dfrac{-\cos x}{\sin x}$
(C) $-\cot^2 x$
(D) $-\tan^2 x$

149. Which of the functions have maxima?

(A) $f(x) = e^x$
(B) $f(x) = \dfrac{1}{x}$
(C) $f(x) = \tan x$
(D) $f(x) = \sin x$

150. If $\log(xy^3) = 1,\ \log(x^2y) = 1,$ then $\log(xy)$ is equal to

(A) 1

(B) $\frac{3}{5}$

(C) $\frac{4}{5}$

(D) 2

151. Area bounded by the function $f(x) = [x]$, where $[x]$ is the greatest integer less than or equal to $x$, in the interval [2, 3] is

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

152. Consider the system of linear equations $x + 2y + z = 7$ ; $x + y + \lambda z = 3$ ; $x + 3y - 5z = 5$. This system has unique solution for

(A) any real number $\lambda$
(B) $\lambda = 7$
(C) any real number except $\lambda = 7$
(D) no value of $\lambda$

153. $\begin{vmatrix} 4C_1 & 4C_2 & 4C_3 \\ 5C_1 & 5C_2 & 5C_3 \\ 6C_1 & 6C_2 & 6C_3 \end{vmatrix} =$

(A) 18
(B) 19
(C) 20
(D) 21

154. Which of the following statement is false about inverse sine function?

(A) Domain is $[-1, 1]$

(B) Range is $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$

(C) An even function

(D) An odd function

155. $\tan^{-1}\left(\frac{1}{4}\right)+\tan^{-1}\left(\frac{2}{9}\right)=$

(A) $\cos^{-1}\left(\frac{3}{5}\right)$

(B) $\cos^{-1}\left(\frac{2}{\sqrt{5}}\right)$

(C) $\cos^{-1}\left(\frac{2}{11}\right)$

(D) $\cos^{-1}\left(\frac{4}{5}\right)$

156. The distance covered by the particle is given by $s(t)=\frac{t^3}{3}-t^2+3.$ After starts moving, the velocity and acceleration are zero respectively at

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

157. The general solution of differential equation $\log\frac{dy}{dx}=x+y$ is

(A) $e^x+e^y=C$
(B) $e^x+e^{-y}=C$
(C) $e^{-x}+e^y=C$
(D) $e^{-x}+e^{-y}=C$

158. Let $A$ and $B$ be any two events. Which of the following is **not** true?

(A) $P(B-A)=P(\overline{A}\cap B)$
(B) $P(A\cup B)=P(A)+P(B-A)$
(C) $P(A-B)=P(A\cup\overline{B})$
(D) $P(A\cup B)=P(B)+P(A\cap\overline{B})$

159. Let $M = \left\{ \begin{pmatrix} x & x \\ x & x \end{pmatrix} : x \in \mathbb{R} - \{0\} \right\}$. If $X, E \in M$ such that $X \cdot E = X$ for all $X \in M$, where $\cdot$ is matrix multiplication. Then $E$ is

(A) $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

(B) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

(C) $\begin{pmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix}$

(D) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

160. In a multiple choice examination with four multiple options (out of which, only one is correct), for each of five questions, the probability that a candidate would get four correct answers by just guessing is

(A) $\frac{15}{256}$

(B) $\frac{3}{1024}$

(C) $\frac{405}{1024}$

(D) $\frac{15}{1024}$

161. Kiran ride a bicycle for 30 minutes at a speed of 16 km/hr, then walked for 90 minutes at speed of 4 km/hr. The overall average speed is

(A) 7
(B) 9
(C) 10
(D) 12

162. If the line $y = x + a$ passes through the vertex of the parabola $y = x^2 + a^2$, then the number of possible values of $'a'$ is

(A) 0
(B) 1
(C) 2
(D) $\infty$

163. The cost function of certain commodity is $c(x) = 30x + 250$ and the price of the commodity is fixed at ₹55. Then the break even point is

(A) 5
(B) 10
(C) 15
(D) 20

164. In four throws with pair of dice, the chance of throwing doublets at least twice is

(A) $\frac{5}{432}$

(B) $\frac{7}{432}$

(C) $\frac{11}{432}$

(D) $\frac{13}{432}$

165. Which of the following is true?

(A) $\sin\theta + i\cos\theta = i(\cos\theta - i\sin\theta)$

(B) $(\cos\theta - i\sin\theta)^{-n} = \cos n\theta - i\sin n\theta$

(C) $(\cos\theta + i\sin\theta)^{-n} = -\cos n\theta - i\sin n\theta$

(D) $z^n + \frac{1}{z^n} = \frac{\cos n\theta}{2}$, where $z = \cos\theta + i\sin\theta$

166. The matrix $A = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$ satisfies the equation

(A) $A^2 - I = 2A$
(B) $A^2 - 2A + I = 0$
(C) $A^2 - 2I = 0$
(D) $A^2 - 4A + I = 0$

167. $\int_0^1 x \tan^{-1} x dx =$

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

168. The number of real values of $x$ for which $\sqrt{120 - \sqrt{x}}$ is an integer, is

(A) 6
(B) 9
(C) 10
(D) 11

169. For a positive integer $n$, let $n^2 - 3n + 2$ be prime. Then number of possible values of $n$ is

(A) 0
(B) 1
(C) 3
(D) infinitely many

170. The product of three consecutive positive integers is 8 times their sum. Then the sum of their squares is

(A) 50
(B) 77
(C) 110
(D) 194

171. Let $S(n)$ equal the sum of the digits of positive integer $n$. For a particular integer $n$, let $S(n) = 1274$. Then the possible value of $S(n + 1)$ is

(A) 1
(B) 3
(C) 1239
(D) 1265

172. Let $f(x)$ be differentiable function for all $x$ with $f'(x) \leq 17$ and $f(2) = 7$. Then the maximum value of $f(7)$ is

(A) 82
(B) 92
(C) 102
(D) 112

173. The sum of three whole numbers taken in pairs are 12, 17 and 19. The middle number is

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

174. $\lim_{n\to\infty}\left[\frac{n!}{n^n}\right]^{\frac{1}{n}}$ equals

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

175. The value of $x$ satisfying the condition $|x + 3| > |2x - 1|$ lies in the interval

(A) $\left(-\frac{2}{3}, 4\right)$

(B) $\left(-\infty, \frac{2}{3}\right)$

(C) $(0, 2)$

(D) $(0, \infty)$

176. For $a, b, c > 0$, the equations $a(1 - b) > \frac{1}{4}$, $b(1 - c) > \frac{1}{4}$ and $c(1-a) > \frac{1}{4}$ are

(A) consistent for some values
(B) inconsistent
(C) consistent
(D) inconsistent for some values

177. For real positive numbers $a, b, c$, the minimum value of $\frac{b+c}{a}+\frac{c+a}{b}+\frac{a+b}{c}$ is

(A) 1
(B) 2
(C) 4
(D) 6

178. If $x^2 - x + 1 = 0$, then the value of $\sum_{n=1}^{5}\left(x^n + \frac{1}{x^n}\right)^2$ is

(A) 8
(B) 10
(C) 12
(D) 16

179. If $\mathrm{Im}\left(\frac{z+2i}{z+2}\right) = 0$, then $z$ lies on the curve

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

180. In an AP, the notation $S_r$ denotes the sum of first $r$ terms, $S_p = q$ and $S_q = p$. Then $S_{p+q}$ is equal to

(A) 0
(B) $-(p + q)$
(C) $p + q$
(D) $pq$

181. Assume that $m$, $n$, $p$ are in Harmonic Progression. Then $\frac{m}{n+p}, \frac{n}{p+m}, \frac{p}{m+n}$ are in

(A) Harmonic Progression
(B) Geometric Progression
(C) Arithmetic Progression
(D) Standard Progression

182. The sum of the series $1 + 2x + 3x^2 + 4x^3 + \ldots$ up to infinity is

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

(B) $\frac{1}{1-x}$

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

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

183. If the sum of the roots of the equation $\frac{x^2 - bx}{ax - c} = \frac{k-1}{k+1}$, then the value of $k$ is

(A) $\frac{a-b}{a+b}$

(B) $\frac{a+b}{a-b}$

(C) $\frac{1}{c}$

(D) $c$

184. If $x^2 - 1$ is a factor of $x^4 + ax^3 + 3x - b$, then

(A) $a = 3, b = -1$
(B) $a = -3, b = 1$
(C) $a = 3, b = 1$
(D) $a = 4, b = 3$

185. If $\alpha$ is a root of the equation $4x^2 + 2x - 1 = 0$, then the other root of the equation is

(A) $3\alpha^2 - 4\alpha$
(B) $4\alpha^3 - 3\alpha$
(C) $3\alpha^2 + 4\alpha$
(D) $4\alpha^3 + 3\alpha$

186. The number of real roots of the equation $\left(x + \frac{1}{x}\right)^3 + x + \frac{1}{x} = 0$ is

(A) 0
(B) 2
(C) 4
(D) 6

187. Numbers greater than 1000, but not greater than 4000 that can be formed with the digits 0, 1, 2, 3, 4 (repetition of digits being allowed) is

(A) 375
(B) 385
(C) 396
(D) 456

188. If the coefficient of the $p^{\text{th}}$ term in the expansion of $(2x + 3)^6$ is 1440, then $p$ is

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

189. Let $S = \sum_{i=0}^{n} \binom{10}{i}\binom{20}{m-i}$ where $\binom{p}{q} = 0$ when $p < q$. The value of $m$, for which the value of the sum $S$ is maximum, is

(A) 5
(B) 10
(C) 15
(D) 20

190. The number of positive integral solutions of $x + y + z = n$, $n \in \mathbb{N}$ is

(A) ${}^{n-1}P_2$

(B) $\frac{(n+1)(n+2)(n+3)}{6}$

(C) ${}^{n-1}C_{n-4}$

(D) ${}^{n-1}C_2$

191. Let $[x]$ be the greatest integer less than or equal to $x$. If the set of equations $x - 3y = 4$; $5x + y = 2$; $[2\pi]x - [e]y = [2a]$ are consistent, then $a$ should lie in

(A) $\left[3, \frac{7}{2}\right)$

(B) $\left(3, \frac{7}{3}\right)$

(C) $\left[3, \frac{7}{3}\right]$

(D) $[3, \infty)$

192. If $x$ is real and $A = \begin{bmatrix} 1 & -1 & x \\ 1 & x & 1 \\ x & -1 & 1 \end{bmatrix}$ has no inverse, then $x$ is equal to

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

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

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

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

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

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

194. The sum of the series $1 + \frac{2^3}{2!} + \frac{3^3}{3!} + \frac{4^3}{4!} + \ldots$ is

(A) $2e$
(B) $3e$
(C) $5e$
(D) $6e$

195. 4 gentlemen and 4 ladies take seats at random, round a table. The probability that they are sitting alternatively is

(A) $\frac{4}{35}$

(B) $\frac{1}{70}$

(C) $\frac{1}{35}$

(D) $\frac{2}{35}$

196. The inverse of the function $f(x) = \dfrac{10^x - 10^{-x}}{10^x + 10^{-x}}$, is

(A) $f^{-1}(x) = \log_{10} \dfrac{x}{2-x}$

(B) $f^{-1}(x) = \dfrac{1}{2} \log_{10} \dfrac{x}{2-x}$

(C) $f^{-1}(x) = \dfrac{1}{2} \log_{10} \dfrac{x}{1-x}$

(D) $f^{-1}(x) = \log_{10} \dfrac{x}{2+x}$

197. The number of onto mappings from the set $A = \{1, 2, \ldots, 100\}$ to set $B = \{1, 2\}$ is

(A) $2^{100}$

(B) $2^{100} - 2$

(C) $2^{99} - 2$

(D) $2^{99}$

198. If $A$ is a matrix such that $A^2 + A + 2I = 0$, then

(A) $A$ is non-singular

(B) $A \neq 0$

(C) $A$ is symmetric

(D) $A^{-1} = -\dfrac{1}{2}(A + I)$

199. If $\sin \alpha$, $\sin \beta$ and $\cos \alpha$ are in Geometric Progression, then the roots of the equation $x^2 + 2x \cot \beta + 1 = 0$ are always

(A) equal
(B) real
(C) imaginary
(D) greater than 1

200. An example for a rational number is

(A) $\sin 15°$
(B) $\cos 15°$
(C) $\sin 15° \cos 15°$
(D) $\sin 15° \cos 75°$

201. The solution of the equation $4\sin^4 x + \cos^4 x = 1$ is

(A) $x = 2n\pi$
(B) $x = n\pi + 1$
(C) $x = (n+2)\pi$
(D) $x = 2n\pi$ or $n\pi \pm \sin^{-1}\left(\sqrt{\frac{2}{5}}\right)$

202. In a $\Delta ABC$, $a = 2b$ and $|A - B| = \frac{\pi}{3}$, the $\angle C$ is equal to

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{3}$
(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{8}$

203. $\tan\left[\cos^{-1}\frac{4}{5} + \tan^{-1}\frac{2}{3}\right]$ is equal to

(A) $\frac{13}{6}$
(B) $-\frac{13}{6}$
(C) $\frac{17}{6}$
(D) $-\frac{17}{6}$

204. The lines $x + 2y + 3 = 0$, $x + 2y - 7 = 0$ and $2x - y - 4 = 0$ are the sides of a square. Equation of a remaining side of the square can be

(A) $2x - y - 14 = 0$
(B) $2x - y + 8 = 0$
(C) $2x - y - 10 = 0$
(D) $2x - y - 6 = 0$

205. $\lim_{x \to 0} \frac{e^{x^2} - \cos x}{x^2}$ is equal to

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

(B) $\frac{2}{3}$

(C) $\frac{3}{2}$

(D) 2

206. $\int_0^{\frac{\pi}{2}} \frac{\cos x - \sin x}{1 + \cos x \sin x}$ is equal to

(A) 0

(B) $\frac{\pi}{2}$

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

(D) $\frac{\pi}{6}$

207. A solution of the differential equation $\left(\frac{dy}{dx}\right)^2 - x\frac{dy}{dx} + y = 0$ is

(A) $y = 0$
(B) $y = 2x$
(C) $y = 2x - 4$
(D) $y = 2x^2 - 4$

208. The number of solutions of the equation $\sin\left(e^x\right) = 3^x + 3^{-x}$ is

(A) 0
(B) 2
(C) 1
(D) Infinitely many

209. The tangent to the parabola $y^2 = 16x$, which is perpendicular to a line $y - 3x - 1 = 0$ is

(A) $x - y + 36 = 0$
(B) $3y - x - 36 = 0$
(C) $x + y - 36 = 0$
(D) $3y + x + 36 = 0$

210. The solution of the differential equation $x\dfrac{dy}{dx} = 2y + x^3e^x$, where $y = 0$ when $x = 1$, is

(A) $y = x^2\left(e^x - e\right)$
(B) $y = x^3\left(e - e^x\right)$
(C) $y = x^2\left(e - e^x\right)$
(D) $\tan x = (\sec x + c)\,y$

211. The points $A$, $B$, $C$ with position vectors $2\vec{i} - \vec{j} - \vec{k}$, $\vec{i} - 3\vec{j} - 5\vec{k}$ and $3\vec{i} - 4\vec{j} - 5\vec{k}$ are the vertices of

(A) a triangle but not a right angled triangle
(B) a right angled triangle
(C) an equilateral triangle
(D) an isosceles triangle

212. If $(2n + 1) + (2n + 3) + (2n + 5) + \ldots + (2n + 47) = 5280$, then the value of $1 + 2 + 3 + \ldots + n$ is

(A) 1854
(B) 1485
(C) 5148
(D) 4851

213. Let $f(x)=10-4x-x^2$ and the range of $f(x)$ be $(-\infty,b]$. Then $\sqrt{b+2}$ is equal to

(A) 0
(B) 4
(C) 14
(D) 16

214. If $\log_{10}2$, $\log_{10}\left(2^x+1\right)$ and $\log_{10}\left(2^x+3\right)$ are in A.P, then the value of $x$ is

(A) $\log_2 5$
(B) $\log_5 2$
(C) $\log_{10}2$
(D) 1

215. If $1,\omega$ and $\omega^2$ are the cube roots of unity, then $\left(1-\omega+\omega^2\right)\left(1-\omega^2+\omega^4\right)\left(1-\omega^4+\omega^8\right)\left(1-\omega^8+\omega^{16}\right)$...upto $2n$ factors are

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

216. The number of integral terms in the expansion of $\left(5^{\frac{1}{2}}+5^{\frac{1}{4}}\right)^{680}$ is equal to

(A) 170
(B) 171
(C) 136
(D) 137

217. The equation of a tangent to the parabola $x^2=8y$, which makes an angle $\theta$ with the positive direction of $x$-axis, is:

(A) $y=y\tan\theta+2\cot\theta$
(B) $y=y\tan\theta-2\cot\theta$
(C) $x=y\cot\theta+2\tan\theta$
(D) $x=y\cot\theta-2\tan\theta$

218. The negation of $(p \wedge (\sim q)) \vee (\sim p)$ is equivalent to

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

219. Given $E(X+c)=12$ and $E(X-c)=8$ then the value of $c$ is

(A) 4
(B) 2
(C) –2
(D) 0

220. Let * be the binary operation defined on $R$ by $a*b=\frac{a*b}{4}$, for every $a,b \in R$, then the operation * is

(A) Commutative and Associative
(B) Commutative but not Associative
(C) Associative but not Commutative
(D) Neither Associative nor Commutative

221. $\tan^{-1}\left(\frac{1+\sqrt{3}}{3+\sqrt{3}}\right)+\sec^{-1}\left(\sqrt{\frac{8+4\sqrt{3}}{6+3\sqrt{3}}}\right)$ is equal to

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{2}$
(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{3}$

222. Let $A=\left[a_{ij}\right]_{2\times 2}$, where $a_{ij}\neq 0$ for all $i, j$ and $A^2=I$. Let $a$ be the sum of all diagonal elements of $A$ and $b=|A|$. Then, $4a^2+3b^2$ is equal to

(A) 4
(B) 3
(C) 7
(D) 14

223. $\int x^{51}\left(\tan^{-1}x+\cot^{-1}x\right)dx$ equals to

(A) $\frac{x^{52}}{52}\left(\tan^{-1}x-\cot^{-1}x\right)+c$

(B) $\frac{\pi x^{52}}{104}+\frac{\pi}{2}+c$

(C) $\frac{x^{52}}{52}\left(\tan^{-1}x+\cot^{-1}x\right)+c$

(D) $\frac{\pi x^{52}}{52}+\frac{\pi}{2}+c$

224. The value of $k$ for which the image of $(5,1,-3)$ by reflection in $2x+y-3z+k=0$ is the point $(1,-1,3)$ is

(A) 3
(B) 1
(C) $-6$
(D) 2

225. If $\bar{B}=2\hat{i}+\hat{j}-\hat{k}$ and $\bar{C}=\hat{i}+3\hat{k}$. If $\bar{A}$ is a unit vector, then the maximum value of the scalar triple product $\left[\bar{A}\bar{B}\bar{C}\right]$ is

(A) $-1$
(B) $\sqrt{10}+\sqrt{6}$
(C) $\sqrt{60}$
(D) $\sqrt{59}$

| FINAL ANSWER KEY | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subject Name: 101 B TECH 10 MAY 2024 - 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** |
| 1 | A | 31 | D | 61 | C | 91 | D | 121 | B | 151 | B | 181 | A | 211 | B |
| 2 | C | 32 | D | 62 | B | 92 | B | 122 | D | 152 | C | 182 | D | 212 | D |
| 3 | B | 33 | A | 63 | B | 93 | D | 123 | D | 153 | C | 183 | B | 213 | B |
| 4 | D | 34 | C | 64 | B | 94 | C | 124 | C | 154 | C | 184 | B | 214 | A |
| 5 | C | 35 | A | 65 | A | 95 | C | 125 | C | 155 | B | 185 | B | 215 | B |
| 6 | B | 36 | A | 66 | A | 96 | B | 126 | A | 156 | C | 186 | A | 216 | B |
| 7 | D | 37 | A | 67 | C | 97 | A | 127 | B | 157 | B | 187 | A | 217 | C |
| 8 | D | 38 | A | 68 | B | 98 | D | 128 | C | 158 | C | 188 | A | 218 | D |
| 9 | D | 39 | C | 69 | C | 99 | D | 129 | C | 159 | C | 189 | C | 219 | B |
| 10 | C | 40 | C | 70 | B | 100 | C | 130 | A | 160 | D | 190 | D | 220 | B |
| 11 | B | 41 | B | 71 | C | 101 | B | 131 | C | 161 | A | 191 | A | 221 | D |
| 12 | C | 42 | A | 72 | A | 102 | D | 132 | B | 162 | C | 192 | D | 222 | B |
| 13 | A | 43 | C | 73 | C | 103 | C | 133 | B | 163 | B | 193 | A | 223 | B |
| 14 | C | 44 | D | 74 | B | 104 | A | 134 | C | 164 | B | 194 | C | 224 | C |
| 15 | C | 45 | C | 75 | C | 105 | C | 135 | C | 165 | A | 195 | C | 225 | D |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | B | 46 | C | 76 | D | 106 | C | 136 | D | 166 | D | 196 | A |
| 17 | B | 47 | A | 77 | A | 107 | C | 137 | A | 167 | C | 197 | B |
| 18 | D | 48 | C | 78 | D | 108 | C | 138 | D | 168 | D | 198 | D |
| 19 | A | 49 | B | 79 | D | 109 | D | 139 | D | 169 | B | 199 | B |
| 20 | A | 50 | A | 80 | C | 110 | B | 140 | A | 170 | B | 200 | C |
| 21 | A | 51 | B | 81 | B | 111 | D | 141 | D | 171 | C | 201 | D |
| 22 | A | 52 | B | 82 | C | 112 | A | 142 | D | 172 | B | 202 | B |
| 23 | B | 53 | A | 83 | A | 113 | C | 143 | C | 173 | D | 203 | C |
| 24 | D | 54 | B | 84 | B | 114 | B | 144 | A | 174 | B | 204 | A |
| 25 | B | 55 | C | 85 | B | 115 | A | 145 | D | 175 | A | 205 | C |
| 26 | C | 56 | A | 86 | A | 116 | C | 146 | C | 176 | B | 206 | A |
| 27 | D | 57 | B | 87 | B | 117 | B | 147 | D | 177 | D | 207 | C |
| 28 | A | 58 | C | 88 | B | 118 | C | 148 | B | 178 | A | 208 | A |
| 29 | C | 59 | D | 89 | C | 119 | D | 149 | D | 179 | C | 209 | D |
| 30 | C | 60 | C | 90 | C | 120 | B | 150 | B | 180 | B | 210 | A |