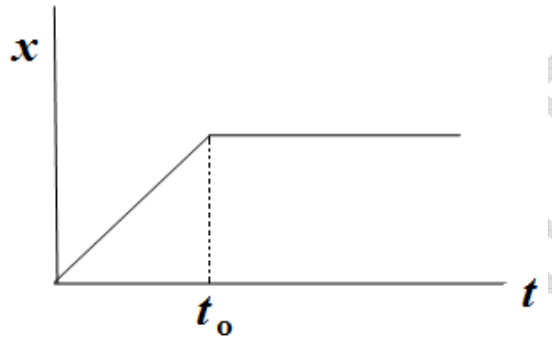
B.TECH. (PHYSICS) – SHIFT III

1. A body starts from rest and moves with an acceleration of 20 cm/s^2. Distance travelled by the body in 10 s is

(A) 200 cm
(B) 2000 cm
(C) 1000 cm
(D) 20 cm

2. The figure below shows the displacement-time graph of a moving particle on the x-axis. Then which one of the following is CORRECT?



(A) The particle is continuously going in the positive x-direction
(B) The particle is at rest
(C) The velocity increases up to a time t_o and then becomes constant
(D) The particle moves at a constant velocity up to a time t_o and then stops

3. A particle moving in a circular path has an angular momentum L. If the frequency of rotation is halved, then the angular momentum becomes

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

4. Adiabatic demagnetization of a paramagnetic salt usually results in

(A) drop in temperature
(B) drop in magnetic susceptibility
(C) rise in temperature
(D) critical magnetic filed

5. According to Bohr principle, the relation between principal quantum number n and the Radius (r) of the orbit is

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

6. An α – particle with a velocity v bombards a heavy stationary nucleus. Then the distance of closest approach depends on the velocity of the α – particle as

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

7. Two wires 'A' and 'B' are stretched by the same load. The area of cross-section of the wire 'A' is double that of 'B'. Then the stress on 'B' is

(A) equal to that on A
(B) twice that on A
(C) half that on A
(D) four times that on A

8. For liquids which do not wet the solids (like Mercury), the angle of contact is

(A) $< 90°$
(B) is equal to $90°$
(C) $> 90°$
(D) Zero

9. A parallel LC circuit is operated at a frequency ω below its resonance frequency ω_o. Then its reactance will be

(A) resistive
(B) capacitative
(C) inductive
(D) zero

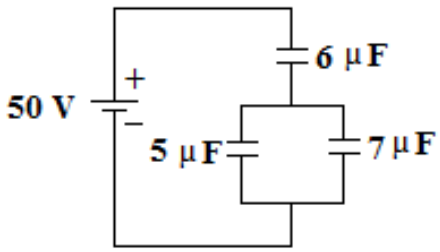
10. Vibrational motion of the molecules occurs at frequencies in the

(A) ultraviolet region
(B) radio frequency region
(C) infra red region
(D) gamma ray region

11. Two plates of a parallel plate capacitor separated by a layer of air has a capacitance of 15 μF. If a sheet of mica with dielectric constant $k = 6$ is inserted between the plates, the capacitance will be

(A) 2.5 μF
(B) 0.4 μF
(C) 90 μF
(D) 9 μF

12. In the following circuit, what is the total charge on the combination of capacitors?



(A) 2×10^{-4} Coulomb
(B) 200 Coulomb
(C) 2×10^{4} Coulomb
(D) 12.5 Coulomb

13. A thunder clap is heard 5.5 seconds later the lightning flash. The distance of the flash is (Given velocity of sound = 330 m/s)

(A) 1760 m
(B) 1540 m
(C) 1870 m
(D) 1815 m

14. Which one of the following is not an optical defect?

(A) Optical rotation
(B) Chromatic aberration
(C) Coma
(D) Astigmatism

15. If the output of a semiconductor transistor to be proportional to the input signal, the transistor has to be operated in the

(A) Plateau region
(B) Cut-off region
(C) Active region
(D) Saturation region

16. Communication between the ground station and an artificial satellite occurs normally at

(A) radio frequencies
(B) microwave frequencies
(C) infrared frequencies
(D) ultraviolet frequencies

17. Velocity – time curve for a body projected vertically upwards is

(A) Parabola
(B) Hyperbola
(C) Straight line
(D) Ellipse

18. When a cell is undergoing charging process

(A) There is no voltage drop in its internal resistance
(B) Its terminal potential is less than its emf
(C) Its terminal potential is more than its emf
(D) Its terminal potential is zero

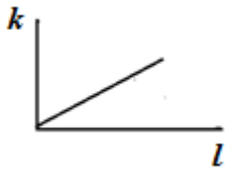
19. The velocity of light is maximum in

(A) Glass
(B) Vacuum
(C) Diamond
(D) Water

20. A metal cube is placed in empty vessel. When the water is filled in the vessel so that cube is completely immersed in water, the force on the bottom of the vessel in contact with cube

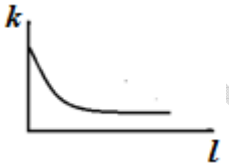
(A) will increase
(B) will decrease
(C) will remain same
(D) will become zero

21. Which of the following graph depicts spring constant k versus length l of the spring correctly?

(A) 

(B) 

(C) 

(D) 

22. A body moving in circular motion with constant speed has

(A) constant velocity
(B) constant acceleration
(C) constant kinetic energy
(D) constant displacement

23. The main difference between the electric lines of force and magnetic lines of force is

(A) the electric lines of force are closed curves whereas magnetic lines of force are not
(B) the electric lines of force are in the form of open curves whereas the magnetic lines are closed curves
(C) the electric lines of force tend to contract lengthwise whereas the magnetic lines of force do not
(D) the electric lines of force are continuous and magnetic lines of force are discrete

24. The electron configuration for the noble gas atom is

(A) $1s^2 2s^2 2p^6$

(B) $1s^2 2s^2 2p^5$

(C) $1s^2 2s^2 2p^6 3s^2 3p^6 4p^2$

(D) $1s^2 2s^2$

25. The truth table given below is for …….. gate

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

(A) XOR
(B) OR
(C) AND
(D) NAND

26. In LCR circuit, if resistance increases, quality factor

(A) increases finitely
(B) decreases finitely
(C) remains constant
(D) None of the above

27. A capacitor of capacitance C has charge Q and stored energy is W. If the charge is increased to $2Q$, the stored energy will be

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

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

(C) $2W$

(D) $4W$

28. A wire can sustain the weight of 20 kg before breaking. If the wire is cut into two equal parts, each part can sustain weight of

(A) 10 kg
(B) 5 kg
(C) 20 kg
(D) 40 kg

29. A solid sphere, hollow sphere and a disc, all having same mass and radius, are placed at the top of an inclined plane and released. The friction coefficients between the objects and inclined plane are same and not sufficient to allow pure rolling. Least time will be taken in reaching the bottom will be by

(A) solid sphere
(B) hollow sphere
(C) the disc
(D) all will take same time

30. A 20 N metal block is suspended by a spring balance. A beaker containing some water is placed on a weighing machine which reads 40 N. The spring balance is now lowered so that the block gets immersed in the water. The spring balance now reads

(A) 60 N
(B) 44 N
(C) 36 N
(D) 20 N

31. The force between two charges situated in air is F. The force between the same charges if the distance between them is reduced to half and they are situated in a medium having dielectric constant 4 is

(A) $\frac{F}{4}$
(B) $4F$
(C) $16F$
(D) F

32. When an electron jumps from the fourth orbit to the second orbit one gets the

(A) Second line of Paschen series
(B) Second line of Balmer series
(C) First line of Pfund series
(D) Second line of Lyman series

33. In a double slit experiment, when a thin film of thickness t having refractive index μ is inserted in front of one of the slits, the maximum at the centre of the fringe pattern shifts by one fringe width. If λ is the wavelength of the light used, the value of t is

(A) $\frac{\lambda}{\mu-1}$

(B) $\frac{\lambda}{2\mu-1}$

(C) $\frac{2\lambda}{\mu-1}$

(D) $\frac{\lambda}{2(\mu-1)}$

34. The electric charge is quantized. This was established by

(A) J. J. Thomson
(B) William Crookes
(C) Wilhelm Roentgen
(D) R.A. Millikan

35. The output of a step down transformer is measured to be 24 V when connected to a 12 watt light bulb. The value of the peak current is

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

(B) 2 A

(C) $\sqrt{2}$ A

(D) $2\sqrt{2}$ A

36. If the galvanometer current is 10 mA, the resistance of the galvanometer is 40 Ω and shunt of 2 Ω is connected to the galvanometer, the maximum current which can be measured by this ammeter is

(A) 0.21 A
(B) 2.1 A
(C) 210 A
(D) 21 A

37. A particle of mass 10^{-3} kg and charge 5 μC is thrown at a speed of 20 m/sec against a uniform electric field of strength 2×10^{5} NC^{-1}. The distance travelled by particle before coming to rest is

(A) 0.1 m
(B) 0.2 m
(C) 0.3 m
(D) 0.4 m

38. The restoring force of simple harmonic motion is maximum when

(A) at rest
(B) crosses mean position
(C) is half way between the mean and extreme position
(D) displacement is maximum

39. An ice cube is suspended in vacuum in a gravity free hall. As the ice melts it

(A) will retain its cubical shape
(B) will change its shape to spherical
(C) will fall down on the floor of the hall
(D) will fly up

40. Water is used to cool radiators of engine, because

(A) of its lower density
(B) it is easily available
(C) it is cheap
(D) it has high specific heat

41. Distance -Time graph of accelerated motion is a

(A) Straight line
(B) Parabola
(C) Ellipse
(D) Hyperbola

42. The measured weight of a person sitting in a lift accelerating upwards is

(A) less than actual weight
(B) equal to actual weight
(C) more than actual weight
(D) zero

43. The Reynold's number for fluid flow in a pipe is independent of the

(A) Viscosity of the fluid
(B) Length of the pipe
(C) Velocity of the fluid
(D) Diameter of the pipe

44. Heat given to a substance for phase change is called

(A) specific heat
(B) latent heat
(C) sensible heat
(D) radiant heat

45. Brownian motion is an evidence for

(A) Kinetic theory of matter
(B) Photoelectric effect
(C) Electromagnetic radiation
(D) Corpuscular theory of light

46. When a point charge is kept at the centre of a metallic insulated spherical shell

(A) Electric field outside the sphere is zero
(B) Electric field inside the sphere is zero
(C) Electric potential inside the sphere is zero
(D) Net induced charge on the sphere is zero

47. A 1 kΩ resistor has 20 mA of current flowing through it. The applied voltage is then

(A) 0.05 V
(B) 1 V
(C) 15 V
(D) 20 V

48. Order of magnitude of magnetic field on the earth's surface is

(A) 10^{8} Tesla
(B) 1 Tesla
(C) 10^{-2} Tesla
(D) 10^{-5} Tesla

49. The polarity of induced emf is given by

(A) Ampere's circuital law
(B) Biot-Savart law
(C) Lenz's law
(D) Fleming's right hand rule

50. The graph between inductive reactance and frequency is

(A) parabola
(B) straight line
(C) hyperbola
(D) an arc of a circle

51. The wavelength of a source transmitting electromagnetic waves of frequency 8.2×10^6 Hz is

(A) 36.6 m
(B) 18.8 m
(C) 42.8 m
(D) 58.0 m

52. Which phenomenon best supports the theory that matter has a wave nature?

(A) Electron momentum
(B) Photon diffraction
(C) Electron diffraction
(D) Photon momentum

53. Doping of germanium with arsenic will result in

(A) *n*-type semiconductor
(B) *p*-type semiconductor
(C) Insulator
(D) Intrinsic semiconductor

54. Identify the unit vector in the following

(A) $\hat{i}+\hat{j}$

(B) $\frac{\hat{i}}{\sqrt{2}}$

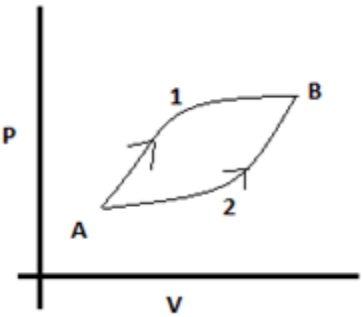
(C) $\hat{k}-\frac{\hat{j}}{\sqrt{2}}$

(D) $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$

55. A boy pushes a toy box 2.0 m along the floor by means of a force of 10 N directed downward at an angle of 60° to the horizontal. The work done by the boy is

(A) 10 J
(B) 12 J
(C) 8 J
(D) 6 J

56. What is the relation between the internal energy and heat supplied in the process 1 and 2 shown in the diagram? Both paths start at A and end at B.



(A) $U_1 > U_2, Q_1 > Q_2$
(B) $U_1 < U_2, Q_1 > Q_2$
(C) $U_1=U_2, Q_1 = Q_2$
(D) $U_1 = U_2, Q_2 > Q_2$

57. Which of the following statement is **true**?

(A) A Van de Graff generator produces large voltage and less current
(B) A Van de Graff generator produces large resistance and less voltage
(C) A Van de Graff generator produces large current and large resistance
(D) A Van de Graff generator produces large current and less voltage

58. Determine the self-inductance of a coil, which has a magnetic flux of 50 milliwebers that is produced when a current of 5 A flows through it

(A) 1×10^{-2} Wb
(B) 1×10^{-3} Wb
(C) 100 Wb
(D) 1×10^{3} Wb

59. Consider a beam of electrons (each electron with energy E_0) incident on a metal surface kept in an evacuated chamber. Then,

(A) no electrons will be emitted as only photons are emitted by the metal
(B) electrons can be emitted but all with an energy E_0
(C) electrons can be emitted with any energy, with a maximum of $E_0 - \phi$ (ϕ is the work function)
(D) electron can be emitted with any energy, with a maximum of E_0

60. Which one of the following statements is **not true**?

(A) Resistance of an intrinsic semiconductor decreases with increase in temperature.
(B) Doping of pure Si with trivalent impurities gives p-type semiconductor.
(C) The majority carriers in n-type semiconductor are holes.
(D) A p-n junction can act as semiconductor diode.

61. Which one of the following is a scalar quantity?

(A) Velocity
(B) Acceleration
(C) Distance
(D) Force

62. Which one of the following statements describes Newton's First Law of Motion?

(A) An object will accelerate if acted upon by an unbalanced force.
(B) An object remains at rest or in uniform motion unless acted upon by a net external force
(C) Force is equal to the rate of change of momentum
(D) Every action has an equal and opposite reaction

63. Which one of the following expressions represents the work-energy theorem?

(A) $W = \Delta E$
(B) $W = F \times d$
(C) $W = mgh$
(D) $W = P \times t$

64. What is the condition for rotational equilibrium of a body?

(A) Net force acting on the body is zero
(B) Net torque acting on the body is zero
(C) The body must be at rest
(D) The body must have constant linear velocity

65. What is the change in volume of a metal rod when its temperature increases by ΔT, given that the coefficient of linear expansion of the metal is α.

(A) $\alpha \Delta T$
(B) $2\alpha \Delta T$
(C) $3\alpha \Delta T$
(D) $4\alpha \Delta T$

66. In which one of the following states of matter do the particles possess the highest kinetic energy?

(A) Gas
(B) Liquid
(C) Solid
(D) Plasma

67. Three capacitors each of capacitance 9 pF are connected in series. Calculate the total capacitance of the combination.

(A) 27 pF
(B) 9 pF
(C) 3 pF
(D) 6 pF

68. The change in momentum of an object is given by which of the following equation?

(A) $\Delta p = m/(v_f - v_i)$
(B) $\Delta p = (v_f - v_i)/m$
(C) $\Delta p = (m_f - m_i)\, v$
(D) $\Delta p = m\,(v_f - v_i)$

69. Which one of the following rules is used to identify the direction of the current induced in a wire moving in a magnetic field?

(A) Fleming's left-hand rule
(B) Ampere's rule
(C) Fleming's right-hand rule
(D) Biot-Savart law

70. …… states that an emf is induced whenever there is a change in the magnetic field linked with electric circuits.

(A) Lenz's Law
(B) Faraday's Law of Electromagnetic Induction
(C) Ohm's Law
(D) Biot-Savart Law

71. The decay constant (λ) and the half-life (T) of a radioactive isotope are related by the formula,

(A) $\lambda = 1/\log_e 2\ T$
(B) $\lambda = \log_e 2\ /\ T$
(C) $\lambda = 1/\log_e 2$
(D) $\lambda = 2/T$

72. The digits of a measured number that are known to be correct are called

(A) accuracy digits
(B) precision digits
(C) significant digits
(D) correct digits

73. Bipolar junction transistor is a

(A) current controlled current device
(B) current controlled voltage device
(C) voltage controlled current device
(D) voltage controlled voltage device

74. The speed of light in a certain glass is 1.91×10^8 m/s. What is the refractive index of the glass?

(A) 1.57
(B) 0.64
(C) 1.09
(D) 4.90

75. An electron microscope is used to look at an atom of 0.1 nm diameter. If the desired resolution is 0.005 nm, the minimum energy of the electron should be

(A) 0.957 eV
(B) 6×10^4 eV
(C) 1×10^7 eV
(D) 1.24 keV

CHEMISTRY UG
(SHIFT III - FINAL)

76. A mixture of 2 moles of carbon monoxide and one mole of oxygen in a closed vessel is ignited to convert carbon monoxide to carbon dioxide. If ΔH is the enthalpy change and ΔE is the change in internal energy, then

(A) $\Delta H > \Delta E$
(B) $\Delta H < \Delta E$
(C) $\Delta H = \Delta E$
(D) The relationship depends on the volume of the vessel

77. The Clausius-Clayperon equation helps to calculate

(A) Latent heat of vaporization
(B) Melting point of the solvent
(C) Heat of neutralization
(D) Molecular weight of solute

78. 40 mg of pure sodium hydroxide is dissolved in 10 litre of distilled water. The pH of the solution is

(A) 9.0
(B) 10.0
(C) 11.0
(D) 12.0

79. When 10 mL of 0.2 M of H_2SO_4 is added to 90 mL of H_2O, the concentration of H_2SO_4 is.

(A) 0.02 N
(B) 0.04 M
(C) 0.04 N
(D) 0.002 M

80. A 0.1 molal solution has boiling point of 100.052°C, then the molal elevation constant of water is

(A) $5.2\ \text{Km}^{-1}$
(B) $0.52\ \text{Km}^{-1}$
(C) $0.052\ \text{Km}^{-1}$
(D) $52\ \text{Km}^{-1}$

81. $E°_{Ag^+/Ag} = 0.80\ \text{V}$ and $E°_{Ni^+/Ni} = -0.25\ \text{V}$. The EMF of the cell Ni-Ag is

(A) +0.21 V
(B) +1.05 V
(C) −2.10 V
(D) −1.05 V

82. The decay of a radioactive element exhibits the characteristics of a reaction of

(A) Zero order
(B) First order
(C) Second order
(D) Fractional order

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

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

84. In physical adsorption, the forces of attraction are

(A) ionic
(B) covalent
(C) Vander Waal's
(D) H-bonding

85. The rates of diffusion of gases are inversely proportional to square root of their densities. This statement refers to

(A) Daltons law
(B) Avogadros law

(C) Boyles law
(D) Grahams law

86. If the standard enthalpy and entropy change of a reaction are positive and negative, respectively, the correct statement is

(A) the reaction is non-spontaneous at all temperatures
(B) the reaction is spontaneous at all temperatures
(C) the reaction is non-spontaneous only at relatively very high temperatures
(D) the reaction is spontaneous only at relatively very high temperatures

87. NaCl crystals generally shows …….

(A) Schottky defect
(B) Frenkel defect
(C) Metal excess defect
(D) Both Schottky defect and Frenkel defect

88. For reaction:

$$4A + B \rightarrow 2C + 2D$$

Which of the following statement is **incorrect**?

(A) Rate of disappearance of B is $\frac{1}{4}^{th}$ of rate of disappearance of A

(B) Rate of formation of C is $\frac{1}{2}^{th}$ of rate of consumption of A

(C) Rate of appearance of D is $\frac{1}{2}^{th}$ of rate of disappearance of B

(D) Rate of appearance of C and D are equal

89. Which factor would increase the rate of chemical reaction?

I. Increasing the temperature
II. Removing products as they are formed
III. Adding a catalyst

(A) I and II
(B) II and III
(C) I, II and III
(D) I only

90. Which of the following statement is **not true**?

(A) A reaction having fraction order must be a complex reaction
(B) Order of reaction is determined from experimental data
(C) Molecularity of a reaction may be equal to three
(D) Order of the reaction is always positive integers

91. The thermodynamical potential enthalpy $H = U + pV$, then which of the following relation hold true?

(A) $T = -\left(\frac{\partial H}{\partial S}\right)_v$ and $V = \left(\frac{\partial H}{\partial P}\right)_S$

(B) $T = \left(\frac{\partial H}{\partial S}\right)_P$ and $V = -\left(\frac{\partial H}{\partial P}\right)_S$

(C) $T = -\left(\frac{\partial H}{\partial P}\right)_S$ and $V = \left(\frac{\partial H}{\partial P}\right)_v$

(D) $V = \left(\frac{\partial H}{\partial P}\right)_S$ and $T = \left(\frac{\partial H}{\partial S}\right)_P$

92. For the Daniel cell Zn | Zn^{2+} || Cu^{2+} | Cu | with E° cell = 1.1 V the application of opposite potential greater than 1.1 V results in

(A) oxidation of Cu and reduction of Zn^{2+}
(B) increase in cell potential
(C) increase in current
(D) decrease in cell potential

93. Choose the correct relation for osmotic pressure, temperature and concentration

(A) $\Pi \propto \frac{C}{RT}$

(B) $\Pi \propto CRT$

(C) $\Pi \propto \frac{1}{CRT}$

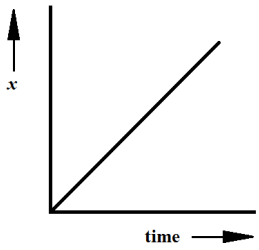
(D) $\Pi \propto \frac{T}{CR}$

94. In the electrochemical reaction: $2Fe^{3+} + Zn \rightarrow Zn^{2+} + 2Fe^{2+}$

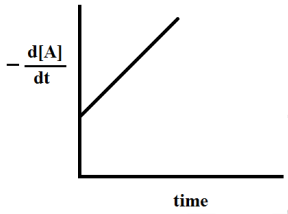
Increasing the concentration of Fe^{2+}

(A) Increase cell emf
(B) Increase the current flow
(C) Decrease the cell emf
(D) Will not alter cell emf

95. Graph between concentration x of the product and time of the reaction $A \rightarrow B$ is of the following type



Hence, graph $\frac{d[A]}{dt}$ and time will be of the

(A)


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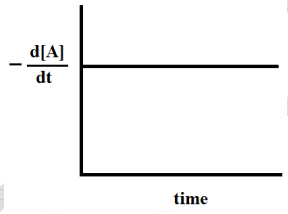

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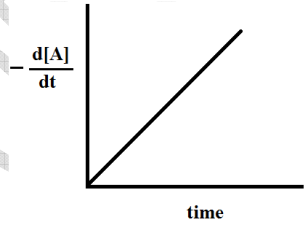

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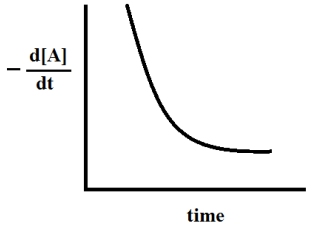
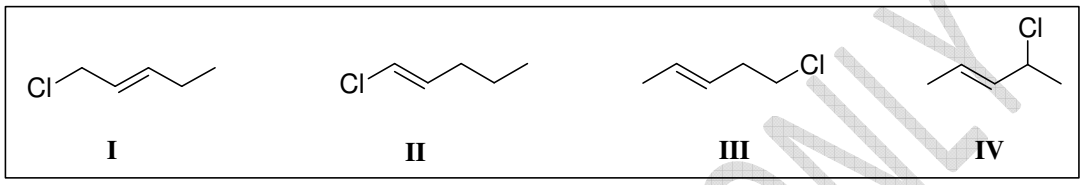


96. Which of the following reagents will react with *n*-butane to give isolable product/s?

(A) Alkaline $KMnO_4$ at room temperature
(B) Aqueous KOH solution
(C) Iodine in presence of light
(D) Bromine in presence of light

97. Arrange the following compounds according to the ease of nucleophilic substitution of Cl by hydroxyl anion to give the corresponding alcohols.



(A) IV > I > III > II
(B) I > IV > II > III
(C) II > III > I > IV
(D) III > II > IV > I

98. Which among the following is least toxic to humans?

(A) Mustard gas
(B) Chloropicrin
(C) Phosgene
(D) Menthol

99. Benzene is nitrated using conc. HNO_3 and conc.H_2SO_4. Which among the following ion is involved in the nitration step?

(A) Nitrite $(NO_2)^-$
(B) Nitrosonium $(NO)^+$
(C) Nitronium $(NO_2)^+$
(D) Nitrate $(NO_3)^-$

100. 1°, 2°, 3° alcohols can be distinguished by

(A) Victor-Meyer test
(B) Hinsberg test
(C) Molisch's test
(D) Biuret test

101. From among the following statements on Friedel-Crafts reactions, pick the wrong statement

(A) Mechanistically, Friedel-Crafts reaction is an aromatic electrophilic substitution reaction
(B) Presence of electron withdrawing groups such as nitro groups enhances the rate of Friedel-Crafts reaction
(C) In Friedel-Crafts alkylation reaction, $AlCl_3$ is used in catalytic amounts whereas in Friedel-Crafts acylation reaction $AlCl_3$ and acid chloride are used in a 1:1 molar ratio
(D) Both acid chlorides and acid anhydrides can be used for Friedel crafts acylation reaction

102. Theoretically BOD (biological oxygen demand) value of clean water should not be above

(A) 10 ppm
(B) 5 ppm
(C) 3 ppm
(D) 20 ppm

103. Keratin, the protein present in hair contains cysteine residues. “Hair styling” is possible due to ease of formation of

(A) S-S bond
(B) P-P bond
(C) C-F bond
(D) N-F bond

104. Mobile Phase and Retention Factor are the terms used in which among the following Purification and Separation Techniques?

(A) Resolution of racemic mixtures by forming chiral inclusion complexes
(B) Column Chromatography
(C) Steam Distillation
(D) Solvent-Solvent extraction

105. IUPAC name of the alkyne that can be converted into 3-ethylpentane upon hydrogenation is

(A) 3-ethylpent-1-yne
(B) 3-ethylpent-4-yne
(C) 3,3-diethylprop-1-yne
(D) 1,1-diethylprop-3-yne

106. How many planes of symmetry does *cis*-1,3-Dimethylcyclobutane have ?

(A) Zero
(B) One
(C) Two
(D) Three

107. Which among the following molecules gives garlic its distinctive odour?

(A) Allicin
(B) Nicotine
(C) Quinine
(D) Ornithine

108. What is the approximate change in the HCH bond angle in **ethene** when it reacts with chlorine to form 1,2-dichloroethane?

(A) 30°
(B) 15°
(C) 11°
(D) 0°

109. A Natural amino acid having benzyl side chain is

(A) Alanine
(B) Valine
(C) Asparagine
(D) Phenylalanine

110. Pick the wrong statement regarding Clemmensen reduction and Wolff-Kishner reduction

(A) Clemmensen reduction is more suitable for acid sensitive compounds while Wolff-Kishner reduction is more suitable for base sensitive compounds
(B) Zinc amalgam is used as a reagent in Clemmensen reduction while hydrazine is used as a reagent in Wolff-Kishner reduction.
(C) Both are useful to reduce ketones and aldehydes to the corresponding hydrocarbons
(D) Both reactions are successful with aromatic and aliphatic aldehydes and ketones

111. Which among the following would act as an electrophile?

(A) BH_3
(B) NH_3
(C) H_2O
(D) H_2S

112. The common name of 3-Bromopropene is

(A) Propylidene bromide
(B) Vinyl bromide
(C) *tert*-Butyl bromide
(D) Allyl bromide

113. Phenol gives a violet colour with

(A) Bromine water
(B) Neutral $FeCl_3$ solution
(C) Fehling solution
(D) Diazomethane

114. Molisch's test is used to check the presence of

(A) Carbohydrates
(B) Steroids
(C) Alkaloids
(D) Amino acids

115. Addition of bromine to *trans*-but-2-ene to give *meso*-2,3-dibromobutane proceeds through

(A) Carbocation intermediate
(B) Carbanion intermediate
(C) Bromonium ion intermediate
(D) Free radical intermediate

116. The orange colour of $K_2Cr_2O_7$ and purple colour of $KMnO_4$ is due to

(A) d-d transitions and charge transfer transitions
(B) d-d transitions in both
(C) charge transfer transition in both
(D) charge transfer transitions and d-d transitions

117. The number of moles of oxalate ions oxidized by one mole of MnO_4^- ion is

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

(B) 5

(C) $\frac{2}{5}$

(D) $\frac{5}{2}$

118. The number of radial node(s) for 3p orbital is

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

119. The four quantum numbers for the electron in the outer most orbital of potassium are

(A) n = 3, l = 0, m = 1, s = +½
(B) n = 4, l = 0, m = 0, s = +½
(C) n = 2, l = 0, m = 1, s = +½
(D) n = 4, l = 0, m = 1, s = +½

120. Which of the following does not show variable oxidation state?

(A) Bromine
(B) Fluorine
(C) Iodine
(D) Chlorine

121. What is the Bohr radius of the electron of hydrogen atom?

(A) 0.24 Å
(B) 0.48 Å
(C) 0.53 Å
(D) 1.06 Å

122. Which of the following statements exactly represents Dalton's atomic theory?

(A) Atoms are indivisible and indestructible
(B) Atoms of different elements can combine in simple whole-number ratios to form compounds
(C) All atoms of a given element are identical in mass and properties
(D) Atoms can be created or destroyed in chemical reactions

123. Which of the following set of quantum numbers cannot represent an electron?

(A) 1,1,1, ±½
(B) 1,0,0, ±½
(C) 1,0,0, +½
(D) 2,0,0, +½

124. What is the position uncertainty in locating an electron with speed of 25 ms^{-1} having uncertainty of 0.1%?

(A) $\Delta x = 3.317 \times 10^{-5}$
(B) $\Delta x = 2.317 \times 10^{-3}$
(C) $\Delta x = 1.220 \times 10^{-5}$
(D) $\Delta x = 3.323 \times 10^{-4}$

125. Which of the following anion has dπ-pπ bond?

(A) CO_3^{2-}
(B) PO_4^{3-}
(C) NO_3^-
(D) NO_2^-

126. In BrF_3 molecule, the lone pair of electrons occupy equatorial positions to minimize

(A) lone pair-bond pair repulsion only
(B) bond pair-bond pair repulsion only
(C) lone pair-lone pair repulsion and lone pair-bond pair repulsion
(D) lone pair-lone pair repulsion only

127. The hybrid orbital of ……. has only 20% d character.

(A) CCl_4
(B) SF_6
(C) SF_4
(D) Cl_2O

128. Exactly same number of σ and π bonds is present in

(A) $CH_2(CN)_2$
(B) HCO_3^-
(C) XeO_4
(D) $(CN)_2$

129. Which one of the following species cannot be identified in normal temperature and pressure conditions?

(A) Be^{2+}
(B) Be_2
(C) B_2
(D) Li_2

130. A given metal crystallizes out with a cubic structure having edge length of 361 pm. If there are four metal atoms in one unit cell, what is the radius of one atom?

(A) 108 pm
(B) 40 pm
(C) 127 pm
(D) 80 pm

131. Which of the following halides has the highest cation to anion size ratio?

(A) CsI
(B) CsF
(C) LiF
(D) NaF

132. Arrange O, S, F and Cl in the order of their increasing electron gain enthalpy.

(A) Cl < F < O < S
(B) O < S < F < Cl
(C) F < S < O < Cl
(D) S < O < Cl < F

133. Find out the number of valence electrons for the element *X*. The successive ionization energies of *X* is given below.

IE_1 : 250 kJ mol^{-1}

IE_2 : 820 kJ mol^{-1}

IE_3 : 1100 kJ mol^{-1}

IE_4 : 1400 kJ mol^{-1}

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

134. Permutit is chemically

(A) Hydrated sodium aluminium silicate
(B) Sodium hexaphosphate
(C) Sodium bicarbonate
(D) Calcium hydroxide

135. Hydrolith reacts with water to produce

(A) H_2
(B) H_2O_2
(C) NaH
(D) N_2

MATHEMATICS UG – SHIFT III
(FINAL)

136. If $c_0, c_1, c_2, ..., c_n$ denote the binomial coefficients in the expansion of $(1+x)^n$, then the value of $c_1 + 2c_2 + 3c_3 + ... + nc_n$ is

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

137. If $u_n = \dfrac{1}{\left(1+\dfrac{1}{n}\right)^{n^2}}$, the series $\sum u_n$ is convergent, if $\lim\limits_{n\to\infty}\left(u_n^{\frac{1}{n}}\right)$

(A) < 1
(B) $= 1$
(C) > 1
(D) ≤ 1

138. If $x = 2\cos t - \cos 2t$ and $y = 2\sin t - \sin 2t$, then at $t = \dfrac{\pi}{2}$, $\dfrac{dy}{dx} =$

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

139. A particle moves along a straight line according to the law $s = t^3 - 6t^2 + 9t + 3$. The velocity at the instant when its acceleration is zero is

(A) -3 units/sec
(B) +3 units/sec
(C) -6 units/sec
(D) +6 units/sec

140. The point on the curve $y^2 = x$ at which the tangent makes an angle of 45° with the x-axis, is

(A) $\left(\dfrac{1}{2}, \dfrac{1}{2}\right)$
(B) $\left(\dfrac{1}{2}, \dfrac{1}{3}\right)$
(C) $\left(\dfrac{1}{2}, \dfrac{1}{4}\right)$
(D) $\left(\dfrac{1}{4}, \dfrac{1}{2}\right)$

141. A box consist of 10 white, 4 red and 2 black balls. If two balls are chosen from the box at random, then the probability of getting at least one white ball is

(A) $\frac{5}{8}$

(B) $\frac{3}{8}$

(C) $\frac{7}{8}$

(D) $\frac{9}{8}$

142. The solution of the system of the equations by Cramer's rule $x + y + z = 6$, $2x - 3y + 4z = 8$ and $x - y + 2=5$, is

(A) $\{1, 2, 3\}$
(B) $\{1, 2, 4\}$
(C) $\{1, 3, 5\}$
(D) $\{1, 3, 4\}$

143. $\int \sin 7x \cos 5x \, dx =$

(A) $\frac{1}{35}\cos 7x \sin 5x + c$

(B) $-\frac{1}{2}\left[\frac{\cos 12x}{12} + \frac{\cos 2x}{2}\right] + c$

(C) $-\frac{1}{2}\left[\frac{\cos 6x}{6} + \cos x\right] + c$

(D) $\frac{1}{2}\left[\frac{\cos 12x}{12} + \frac{\cos 2x}{2}\right] + c$

144. If $\vec{u} = 2\vec{i} + 2\vec{j} - \vec{k}$ and $\vec{v} = 6\vec{i} - 3\vec{j} + 2\vec{k}$ then a unit vector perpendicular to both $\vec{u}$ and $\vec{v}$ is

(A) $(\vec{i} - 10\vec{j} - 8\vec{k})$

(B) $\frac{1}{\sqrt{17}}(\vec{i} - 2\vec{j} - 18\vec{k})$

(C) $\frac{1}{\sqrt{473}}(7\vec{i} - 10\vec{j} - 18\vec{k})$

(D) $\frac{1}{\sqrt{425}}(\vec{i} - 10\vec{j} - 18\vec{k})$

145. The curves $x^2 - y^2 = a^2$ and $xy = c^2$

(A) touch each other
(B) intersect each other
(C) cut orthogonally
(D) parallel to each other

146. The roots of the equation $x^2 - 4x - \log_2 A = 0$ are real and distinct, where A is a real number, if

(A) $A < \frac{1}{8}$

(B) $A < \frac{1}{16}$

(C) $A > \frac{1}{16}$

(D) $A > \frac{1}{8}$

147. Let $f(x) = \begin{cases} x, & x \geq 0 \\ x^2, & x < 0 \end{cases}$. Then f is

(A) not continuous
(B) continuous but not differentiable in $\mathbb{R}$
(C) both continuous and differentiable in $\mathbb{R}$
(D) differentiable only in [−1, 1]

148. The rate of change of area of a circle per second with respect to its radius at $r = \frac{100}{\pi}$ cm is

(A) 20 m^2/s
(B) 20π cm^2/s
(C) 0.02 m^2/s
(D) 0.02 cm^2/s

149. The unit vector in the direction of sum of vectors $3\vec{i} + 5\vec{j} - 4\vec{k}$ and $\vec{i} - 2\vec{j} + 3\vec{k}$ is

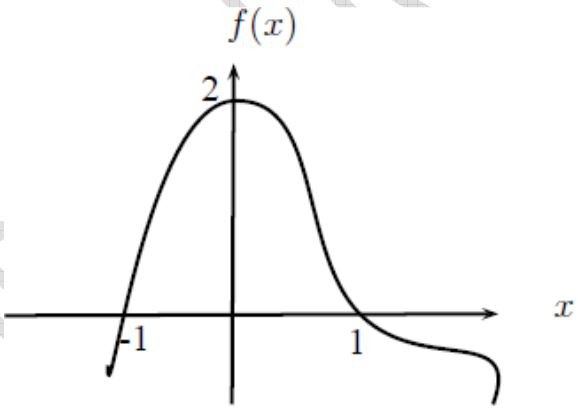
(A) $\frac{4}{\sqrt{26}}\vec{i} + \frac{3}{\sqrt{26}}\vec{j} + \frac{1}{\sqrt{26}}\vec{k}$

(B) $\frac{-4}{\sqrt{26}}\vec{i} + \frac{3}{\sqrt{26}}\vec{j} + \frac{1}{\sqrt{26}}\vec{k}$

(C) $\frac{4}{\sqrt{26}}\vec{i} + \frac{-3}{\sqrt{26}}\vec{j} + \frac{1}{\sqrt{26}}\vec{k}$

(D) $\frac{4}{\sqrt{26}}\vec{i} + \frac{3}{\sqrt{26}}\vec{j} - \frac{1}{\sqrt{26}}\vec{k}$

150. Part of the graph $f(x) = ax^3 + bx^2 + cx + d$ is shown in the figure



Then b is equal to

(A) 1
(B) 2
(C) 0
(D) –2

151. For all integers $n \geq 1$, define $a(n) = [\log_n (2002)]^{-1}$. Let $b = a(2) + a(3) + a(4) + a(5)$ and $c = a(10) + a(11) + a(12) + a(13) + a(14)$. Then $b - c$ is equal to

(A) -2

(B) -1

(C) $\frac{1}{2002}$

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

152. The angle between the planes $2x - y + z = 6$, $x + y + 2z = 3$ is

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

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

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

(D) $\frac{\pi}{5}$

153. If $A = \begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}$ then $A(adj\, A)$ is

(A) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

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

(C) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

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

154. The focus of the parabola $y^2 - 4y - 8x + 2 = 0$ is

(A) (1, 4)
(B) (1, 0)
(C) (−1, 2)
(D) (3, 2)

155. If $y = \sqrt{e^x + \sqrt{e^x + \sqrt{e^x + ...\infty}}}$ then $\frac{dy}{dx}$ is

(A) $\frac{1}{2\sqrt{e^x}}$

(B) e^x

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

(D) $\frac{e^x}{2y}$

156. Angle between sine and cosine curve at the point of intersection in the interval $\left[0, \frac{\pi}{2}\right]$ is

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

(B) $\tan^{-1}\left(\sqrt{2}\right)$

(C) $\tan^{-1}\left(2\sqrt{2}\right)$

(D) 0

157. $\int xe^x dx =$

(A) $(x-1)e^x$

(B) x^2e^x

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

(D) $(x-1)e^x + C$

158. The amplitude of complex number $\frac{2+3i}{3+2i}$ is

(A) $\tan^{-1}\left(\frac{5}{13}\right)$

(B) $\tan^{-1}\left(\frac{12}{13}\right)$

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

(D) $\tan^{-1}\left(\frac{5}{12}\right)$

159. If $f(x)=ax+b$ and $f^{-1}(x)=bx+a$ for $a,b\in\mathbb{R}$, then $a+b=$

(A) 1
(B) 0
(C) −1
(D) −2

160. Let a, b, c, d, e be five consecutive terms in an arithmetic sequence and suppose $a + b + c + d + e = 30$. Which of the following can be found?

(A) a
(B) b
(C) c
(D) d

161. The graph of the polynomial $P(x)=x^5+ax^4+bx^3+cx^2+dx+e$ has five distinct intercepts, one of which is at (0, 0) . Then the coefficient that cannot be zero is

(A) a
(B) b
(C) c
(D) d

162. If $x * y = x^3 - y$, then $h * (h * h)$ is equal to

(A) $-h$
(B) 0
(C) h
(D) $2h$

163. Area of the region bounded by the lines $7x - 5y = 35$, x-axis, $x = -2$, $x = 3$ is

(A) $\frac{63}{2}$

(B) $\frac{96}{5}$

(C) $\frac{8}{3}$

(D) 12

164. $\sum_{n=1}^{102} i^n =$

(A) 0
(B) $1 + i$
(C) $-1 + i$
(D) $1 - i$

165. An onto function $f: \{1, 2, 3\} \to \{4, 5, 6\}$

(A) may not be one-one
(B) always one-one
(C) never one-one
(D) one-one if f is identity function

166. A solution to the system of equations $x_1 - x_2 = 3$; $2x_1 + 3x_2 + 4x_3 = 17$; $x_2 + 2x_3 = 7$ is

(A) (2, 1, 4)
(B) (2,−1, 4)
(C) (−2,−1, 4)
(D) (2,−1,−4)

167. The product of all positive odd integers less than 10000 is

(A) $\dfrac{10000!}{(5000!)^2}$

(B) $\dfrac{10000!}{2^{50000}}$

(C) $\dfrac{9999!}{2^{50000}}$

(D) $\dfrac{10000!}{2^{5000} \cdot 5000!}$

168. If $g(y) = |\log_{10} y|$, then at $y = 1$

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

169. For how many number of positive integers m, does there exist at least one positive integer n such that $m \cdot n \leq m + n$?

(A) 4
(B) 9
(C) 16
(D) infinitely many

170. A deck of cards has red and black cards. The probability of a randomly chosen card being red is $\frac{1}{3}$. When four black card are added to the deck, the probability of choosing red becomes $\frac{1}{4}$. Then the number of cards in the deck originally is

(A) 9
(B) 12
(C) 16
(D) 20

171. The infinite product $\sqrt[3]{10} \cdot \sqrt[3]{\sqrt[3]{10}} \cdot \sqrt[3]{\sqrt[3]{\sqrt[3]{10}}} \ldots$ is

(A) $\sqrt{10}$
(B) $\sqrt[3]{10}$
(C) 10
(D) $10\sqrt[3]{10}$

172. If $p(x)$ is a polynomial such that sum of its co-efficients is zero, then the one of the roots is

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

173. Let $f(x) = 1 + \sqrt{x}$ and $g(x) = \dfrac{2x}{x^2 + 1}$. Then

(A) domain of $f + g$ is $(-1, \infty)$
(B) domain of $f + g$ is $\mathbb{R}$
(C) range of $f \cap$ range of g is $\{1\}$
(D) range of $f \cup$ range of g is $[-1, 1)$

174. The roots of $x^2 - 63x + k = 0$ are primes. Then the number of possible values of k is

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

175. Suppose $\log_e(x - 3) < 1$. Then x lies in

(A) $\{0, 3\}$
(B) $\{0, e\}$
(C) $(3, 3 + e)$
(D) $(0, e + 3)$

176. The set of values of x for which the inequalities $x^2 + 6x - 27 > 0$ and $x^2 - 3x - 4 < 0$ hold simultaneously is

(A) $x > 3$

(B) $x < 4$

(C) $3 < x < 4$

(D) $x = \frac{7}{2}$

177. Let t be a real number such that $|t| < 1$ and $x = 6(1 - 2t)$. Then

(A) $-6 < x < 18$
(B) $-18 < x < 6$
(C) $0 < x < 18$
(D) $-6 < x < 0$

178. Let $|z| = \max\{|z - 1|, |z + 1|\}$. Then

(A) $\left|z + \frac{1}{z}\right| = \frac{1}{2}$

(B) $\left|z - \overline{z}\right| = 1$

(C) $\left|z + \overline{z}\right| = 1$

(D) $\left|z + \frac{1}{z}\right| = \frac{1}{4}$

179. The product of the four values of $\left[\cos\left(\frac{\pi}{3}\right) + i\sin\left(\frac{\pi}{3}\right)^{\frac{3}{4}}\right]$ is

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

180. If a, b, c, d are non-zero real numbers such that $(a^2 + b^2 + c^2)(b^2 + c^2 + d^2) \leq (ab + bc + cd)^2$, then a, b, c, d are in

(A) Arithmetic progression (AP)
(B) Geometric Progression (GP)
(C) Harmonic progression (HP)
(D) Neither AP nor GP nor HP

181. The number of terms common to two Arithmetic Progressions 3, 7, 11, . . . , 407 and 2, 9, 16, . . . , 709 are

(A) 11
(B) 14
(C) 21
(D) 28

182. If $\frac{1}{b-a}+\frac{1}{b-c}=\frac{1}{a}+\frac{1}{c}$ and $b \neq a+c,$ then a,b,c are in

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

183. The sum of positive terms of the series $10+9\frac{4}{7}+9\frac{1}{7}+....$ is

(A) $\frac{352}{7}$

(B) $\frac{437}{7}$

(C) $\frac{852}{7}$

(D) $\frac{347}{7}$

184. Number of roots for the equation $\sqrt{x+3-4\sqrt{x-1}}+\sqrt{x+8-6\sqrt{x-1}}=1$ is

(A) 0
(B) 1
(C) 2
(D) ∞

185. If roots of the equation $x^n - 1 = 0$ are 1, a_1, a_2, . . . , a_{n-1}, then the value of $(1 - a_1)(1 - a_2) \ldots (1 - a_{n-1})$ is

(A) 0
(B) n
(C) n^2
(D) n^n

186. The maximum number of points into which 4 circles and 4 straight lines intersect is

(A) 26
(B) 36
(C) 50
(D) 72

187. Number of divisors of the form $4n + 2 (n \geq 0)$ of the integer 240 is

(A) 4
(B) 8
(C) 12
(D) 16

188. The remainder obtained, when $1! + 2! + 3! + \ldots 95!$ is divided by 6 , is

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

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

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

190. The number of ways to give away 20 apples to 3 boys, each boy receiving at least 4 apples, is

(A) ${}^{10}C_8$
(B) 90
(C) ${}^{22}C_{20}$
(D) ${}^{10}C_{12}$

191. If $A = \begin{bmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{bmatrix} = ka^2b^2c^2$, then the value of k is

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

192. The sum of the series $\frac{2^2}{2!} + \frac{3^2}{3!} + ... + \infty$ is

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

193. If $0 < x < \frac{\pi}{4}$, then the sum of the series $\tan x - \frac{1}{3}\tan^3 x + \frac{1}{5}\tan^5 x + ... + \infty$ is

(A) x
(B) $\log x$
(C) $2x$
(D) $x + \log x$

194. Let R be a relation over the set $N \times N$ defined by $(a, b)\ R\ (c, d) \Leftrightarrow a + d = b + c$. Then R is

(A) reflexive only
(B) symmetric only
(C) transitive only
(D) an equivalence relation

195. The probability of getting a sum of 12 in four throws of an ordinary die is

(A) $\frac{1}{6}\left(\frac{5}{6}\right)^3$

(B) $\left(\frac{5}{6}\right)^3$

(C) $\frac{1}{36}\left(\frac{5}{6}\right)^3$

(D) $\frac{1}{36}\left(\frac{5}{6}\right)^4$

196. There are n persons sitting in a row. Two of them are selected at random. The probability that two selected persons are not together is

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

(B) $1 - \frac{2}{n}$

(C) $\frac{n-1}{n}$

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

197. The probability that a man will live 10 more years, is $\frac{1}{4}$ and the probability that his wife will live 10 more years, is $\frac{1}{3}$. Then the probability that none of them will be alive after 10 years is

(A) $\frac{5}{2}$

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

(C) $\frac{7}{12}$

(D) $\frac{11}{12}$

198. Let a, b, c be three positive real numbers. The value of the determinant

$$\begin{vmatrix} \sqrt{a}+\sqrt{b} & 2\sqrt{c} & \sqrt{c} \\ \sqrt{bc}+\sqrt{2a} & c & \sqrt{2c} \\ b+\sqrt{ac} & \sqrt{bc} & c \end{vmatrix} \text{ is}$$

(A) $c\left(\sqrt{2}b-c\sqrt{b}\right)$

(B) $b\left(\sqrt{2}c-y\sqrt{b}\right)$

(C) $a\left(\sqrt{2}b-c\sqrt{b}\right)$

(D) $c\left(\sqrt{2}b+c\sqrt{b}\right)$

199. The value of $2^{\sin x}+2^{\cos x}$ is

(A) $\leq 2^{1-\frac{1}{\sqrt{2}}}$

(B) $\geq 2^{1-\frac{1}{\sqrt{2}}}$

(C) $\geq 2^{1+\frac{1}{\sqrt{2}}}$

(D) $\leq 2^{1+\frac{1}{\sqrt{2}}}$

200. If $\alpha+\beta=\frac{\pi}{2}$ and $\beta+\gamma=\alpha$, then $\tan\alpha$ is equal to

(A) $2(\tan\beta+\tan\gamma)$

(B) $\tan\beta+\tan\gamma$

(C) $2\tan\beta+\tan\gamma$

(D) $\tan\beta+2\tan\gamma$

201. If in a ΔABC, the values of cot A, cot B, cot C are in Arithmetic Progression, then $\tan A$ is equal to

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

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

(C) $\frac{8}{15}$

(D) $\frac{6}{15}$

202. In a ΔABC, $1-\tan\frac{B}{2}\tan\frac{C}{2}$ is equal to

(A) $\frac{2a}{a+b+c}$

(B) $\frac{2b}{a+b+c}$

(C) $\frac{2c}{a+b+c}$

(D) $\frac{2}{a+b+c}$

203. If $\cot^{-1}x+\cot^{-1}y+\cot^{-1}z=\frac{\pi}{2}$, then $x+y+z$ is equal to

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

(B) xyz

(C) $xy+yz+zx$

(D) 2

204. The two points on the line $x + y = 4$ that lie at a unit distance from the line $4x + 3y = 10$ are

(A) (–3, 1), (7, 11)
(B) (3, 1), (–7, 11)
(C) (3, 1), (7, 11)
(D) (3, 2), (–7, 12)

205. $\lim_{x\to 0} \frac{e^x + e^{-x} - 2\cos x - 4}{x^4}$ is equal to

(A) 0

(B) 1

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

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

206. The value of $\int_1^2 \frac{dx}{x(1+x^4)}$ is equal to

(A) $\frac{1}{4}\log\frac{17}{32}$

(B) $\frac{1}{4}\log\frac{32}{17}$

(C) $\log\frac{17}{2}$

(D) $\frac{1}{4}\log\frac{17}{2}$

207. The area bounded by the curves $y = |x| - 1$ and $y = -|x| + 1$ is

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

208. A Mathematics book contains 200 pages. A page is selected at random. What is the probability that the number on the page selected is a perfect square?

(A) $\frac{1}{20}$

(B) $\frac{7}{100}$

(C) $\frac{14}{100}$

(D) $\frac{7}{25}$

209. Let $f(x)=\frac{1}{1-x}$. Then the derivative of the function $f\left(f\left(f\left(x\right)\right)\right)$ is

(A) 1

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

(C) 0

(D) 2

210. A curve through (1, 0) and satisfying the differential equation $(1 + y^2)\,dx - xy\,dy = 0$ represents

(A) a circle
(B) a parabola
(C) an ellipse
(D) a hyperbola

211. If the four points with position vectors $3\vec{i}+6\vec{j}+9\vec{k}$, $\vec{i}+2\vec{j}+3\vec{k}$, $2\vec{i}+3\vec{j}+\vec{k}$ and $4\vec{i}+6\vec{j}+\lambda\vec{k}$ are coplanar, then the value of λ is

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

212. Let N be the set of natural numbers and R be the binary relation on N defined by

$R = \{(a, b) : a = b - 2, b > 6\}$. Then

(A) $(2, 4) \in R$
(B) $(3, 8) \in R$
(C) $(6, 8) \in R$
(D) $(8, 7) \in R$

213. Let $A=\{3,4,5\}$, the number of reflexive relations on A is

(A) 1
(B) 3
(C) 64
(D) 2^9

214. If a,b,c are positive real numbers, then least value of $(a+b+c)\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$ is

(A) 1
(B) 9
(C) 4
(D) 8

215. For all $z \in C$ on the curve $C_1 : |z| = 4$, let the locus of the point $z+\frac{1}{z}$ be the curve C_2. Then the curves

(A) C_1 and C_2 intersect at 4 points.
(B) C_1 lies inside C_2
(C) C_1 and C_2 intersect at 2 points
(D) C_2 lies inside C_1

216. If the coefficients of x and x^2 in $(1+x)^p(1-x)^q$ are 4 and -5 respectively, then $2p+3q$ is equal to

(A) 60
(B) 63
(C) 66
(D) 69

217. The eccentricity of the hyperbola whose length of the latus rectum is equal to 8 and the length of its conjugate axis is equal to half of the distance between its foci, is

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

218. Which of the following statements is Tautology?

(A) $p \to (p \wedge (p \to q))$

(B) $(p \wedge q) \to (\sim (p) \to q)$

(C) $(p \wedge (p \to q)) \sim q$

(D) $p \vee (p \wedge q)$

219. Let N be the sum of the numbers appeared when two fair dice are rolled and let the probability that $N-2, \sqrt{3N}, N+2$ are in geometric progression be $\frac{k}{36}$. Then, the value of k is

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

220. The minimum number of elements that must be added to the relation $R = \{(p,q),(q,r)\}$ on the set $\{p,q,r\}$ so that it becomes symmetric, and transitive is

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

221. If $\sin^{-1}\left(x - \frac{x^2}{2} + \frac{x^3}{4} - \frac{x^4}{8} + \ldots\right) = \frac{\pi}{6}$, where $|x| < 2$, then the value of x is

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

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

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

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

222. Let $P=\begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$, $A=\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $Q=PAP^T$ if $P^TQ^{2024}P=\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then

(A) $a=1,\ b=2024$
(B) $a=1,\ c=2024$
(C) $b=1,\ a=2024$
(D) $b=1,\ d=2024$

223. Let $y=y(t)$ be a solution of the differential equation $\frac{dy}{dt}+ay=ce^{-bt}$ where $a>0, b>0$ and $c>0$. Then $\lim\limits_{t\to\infty} y(t)$

(A) is 0
(B) is 1
(C) is -1
(D) does not exist

224. Let $\bar{a}$ and $\bar{b}$ be two vectors such that $|\bar{a}|=\sqrt{14}$, $|\bar{b}|=\sqrt{6}$ *and* $|\bar{a}\times\bar{b}|=\sqrt{48}$. Then, $\left(\bar{a}\cdot\bar{b}\right)^2$ is equal to

(A) 36
(B) 6
(C) 12
(D) 18

225. The points z_1, z_2, z_3 and z_4 in the complex plane are the vertices of a parallelogram taken in order, if and only if

(A) $z_1+z_4=z_2+z_3$
(B) $z_1+z_3=z_2+z_4$
(C) $z_1+z_2=z_3+z_4$
(D) $z_1-z_2=z_3+z_4$

FINAL ANSWER KEY

Subject Name: 101 B TECH 11 MAY 2024 - S3

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

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