**101 Test in Physics Chemistry and Mathematics (Shift 4)**

1. The diameter of a circle is 2.486 m. Its area with due regard to significant figures is (Given $\pi = 3.142$)

   (A) $4.85454\ m^2$

   (B) $4.8545\ m^2$

   (C) $4.584\ m^2$

   (D) $4.855\ m^2$

2. The position of a particle as a function of time $t$ is given by $x(t) = at + bt^2 - ct^3$ where, $a$, $b$ and $c$ are constants. When the particle attains zero acceleration, then its velocity will be

   (A) $a + \frac{b^2}{4c}$

   (B) $a + \frac{b^2}{3c}$

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

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

3. A particle moves in a circular arc of radius $r$. In half the period of revolution, its displacement and distance covered are

   (A) $2r$ and $2\pi r$
   (B) $2r$ and $\pi r$
   (C) $r$ and $\pi r$
   (D) $r$ and $2\pi r$

4. In a tug of war contest, two men pull a horizontal rope from opposite sides. The winner will be the man who

   (A) exerts greater force on the rope
   (B) exerts greater force on the ground
   (C) exerts force on the rope which is greater than the tension in the rope
   (D) makes a smaller angle with the vertical

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

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

6. A rubber sheet is introduced between two charges separated by a distance. Then the force between them will

(A) increase
(B) decrease
(C) remains the same
(D) be reduced to zero

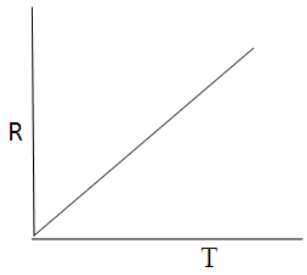
7. What is the potential difference acquired by an alpha particle accelerated through a potential difference of $10^6$ V?

(A) zero
(B) $3.2 \times 10^{-13}$ J
(C) $1.6 \times 10^{-19}$ J
(D) 1 eV

8. A stone is dropped into a lake from a tower of 500 *m* high. The sound of the splash will be heard at the top of the tower approximately after (given velocity of sound = 330 *m/s*)

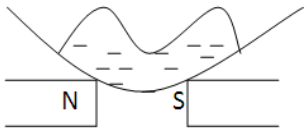
(A) 11.5 seconds
(B) 1.5 seconds
(C) 10 seconds
(D) 14 seconds

9. The variation of resistance (R) as a function of temperature (T) for a certain material is shown in the graph. The material is most likely to be



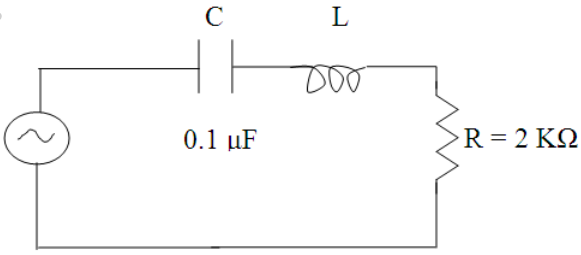

(A) pure metal
(B) impure metal
(C) semiconductor
(D) superconductor

10. A certain liquid taken in a watch glass is placed on closely spaced pole pieces of a magnet. The liquid then moves towards the pole pieces causing a depression at its center as shown. The liquid is most likely to be




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

11. The following series resonant LCR circuit has a quality factor (Q-factor) of 0.4 and a bandwidth of 1.3 KHz. The value of inductance is then




(A) 0.1 H
(B) 0.94 H
(C) 2 H
(D) 10 H

12. Semiconductors have

(A) positive temperature coefficient of resistance
(B) negative temperature coefficient of resistance
(C) zero temperature coefficient of resistance
(D) positive temperature coefficient at lower temperature and negative temperature coefficient at higher temperatures

13. If the average time between collisions of electrons in Copper is $2.5 \times 10^{-14}$ *s* and the average speed of the free electrons is $1.6 \times 10^{6}$ m/s, then the mean free path of the electrons will be

(A) $4 \times 10^{-8}$ m
(B) $4 \times 10^{-8}$ cm
(C) $4 \times 10^{8}$ m
(D) 4 m

14. Which one of the following is an example of non-Ohmic resistance?

(A) Copper wire
(B) Tungsten wire
(C) Diode
(D) Carbon resistance

15. In a circuit containing two unequal resistors connected in parallel

(A) the current is the same in both the resistors
(B) a large current flows through the larger resistor
(C) the voltage drop across both the resistances is same
(D) the smaller resistance has smaller conductance

16. Two identical fuses are rated at 10 A. If they are connected

(A) in parallel, the combination acts as a fuse of rating 10 A
(B) in parallel, the combination acts as a fuse of rating 20 A
(C) in series, the combination acts as a fuse of rating 20 A
(D) in series, the combination acts as a fuse of rating 5 A

17. The number of electrons in 1 Coulomb of charge is

(A) $6.25 \times 10^{18}$

(B) $62.5 \times 10^{18}$

(C) $6.023 \times 10^{23}$

(D) $1.6 \times 10^{-19}$

18. In a hydrogen atom, which of the following electronic transitions would involve the maximum energy change?

(A) $n = 2$ to $n = 1$
(B) $n = 3$ to $n = 1$
(C) $n = 4$ to $n = 2$
(D) $n = 3$ to $n = 2$

19. Numerical aperture of an optical fiber is a measure of

(A) attenuation of light signals in the fiber
(B) difference between the refractive indices of core and the cladding
(C) light gathering power of the fiber
(D) signal distortion in the fiber

20. Shearing stress causes change in

(A) Length
(B) Area
(C) Volume
(D) Shape

21. A liquid will not wet the surface of a solid if the angle of contact is

(A) 0°
(B) 45°
(C) greater than 90°
(D) 60°

22. If two liquids of same volume but different densities $\rho_1$ and $\rho_2$ respectively are mixed, then the density of the mixture is

(A) $\rho_1 + \rho_2$

(B) $\frac{\rho_1 + \rho_2}{2}$

(C) $\frac{\rho_1 \rho_2}{\rho_1 + \rho_2}$

(D) $\frac{2\rho_1 \rho_2}{\rho_1 + \rho_2}$

23. The wings or fins of aircraft are so designed that the speed of air

(A) on the topside is more than on the lower side
(B) on the topside is less than on the lower side
(C) is same on both side
(D) is turbulent

24. A black body at high temperature $T$ radiates energy at a rate of $E$ W/m$^2$. When the temperature falls to one-half of its initial value, the radiated energy will be

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

(B) $\frac{E^2}{4}$

(C) $2E$

(D) $\frac{E}{16}$

25. The efficiency of the reversible heat engine is $\eta_R$ and that of irreversible heat engine is $\eta_I$. Which one of the following relations is correct?

(A) $\eta_R > \eta_I$

(B) $\eta_R < \eta_I$

(C) $\eta_R = \eta_I$

(D) $\eta_R > 1$ and $\eta_I < 1$

26. The molar specific heat at constant pressure of an ideal gas is (7/2)R, where R is gas constant. The ratio of specific heat at constant pressure to constant volume is

(A) 9/7
(B) 7/5
(C) 8/7
(D) 5/7

27. If $P$, $V$ and $T$ are the pressure, volume and temperature of a gas in jar A, and $2P$, $V/4$ and $2T$ are the pressure, volume and temperature of another gas in jar B, then the ratio of the number of molecules in the jar A and B will be

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

28. The volume of the cubic cell is $10^{-30}$ $m^3$. Then its lattice parameter is

(A) $10^{-30}$ m

(B) $10^{-10}$ m

(C) $\frac{1}{3} \times 10^{-30}$ m

(D) $\frac{3}{4\pi} \times 10^{-30}$ m

29. The doping of the base of a transistor is

(A) Equal to the emitter or collector
(B) Slightly more than that of emitter or collector
(C) Less than that of emitter or collector
(D) Much more than that of emitter or collector

30. A source is moving away with a velocity 0.2 v, where v is the velocity of sound. If the source sounds a frequency of 800 Hz, what is the apparent frequency heard by the stationary listener?

(A) 660 Hz
(B) 867 Hz
(C) 667 Hz
(D) 956 Hz

31. The change in potential energy, when a body of mass $m$ is raised to a height $nR$ from the earth's surface is ($R$ = radius of earth)

(A) $mgR\left(\frac{n}{n-1}\right)$

(B) $nmgR$

(C) $mgR\left(\frac{n^2}{n^2+1}\right)$

(D) $mgR\left(\frac{n}{n+1}\right)$

32. If the decay constant of certain radioactive sample is 0.113 per minute, then the half-life of the sample is

(A) 6.13 min
(B) 0.078 min
(C) 0.163 min
(D) 8.85 min

33. A certain radioactive substance has a disintegration constant of 0.0231 per day. Then the time taken for $\frac{1}{8}^{\text{th}}$ of the original number of atoms to remain unchanged is

(A) 39 days
(B) 9 days
(C) 90 days
(D) 3.9 days

34. If $\Delta m$ is the mass defect of a nucleus and $A$ its mass number, then the packing fraction is

(A) $\frac{\Delta m}{A}$

(B) $\Delta m.A$

(C) $\frac{A}{\Delta m}$

(D) $\Delta mc^2$

35. Which one of the following statements about Peltier effect is **INCORRECT**?

(A) Peltier effect occurs only at the junction
(B) Peltier effect is irreversible
(C) Peltier effect is reversible
(D) In Peltier effect, heat evolved or absorbed depends on the nature of the metals and temperature

36. The magnetic field at any point on a straight current carrying conductor is

(A) $\frac{\mu_o I}{4\pi r^2}$

(B) $\frac{\mu_o I}{4r}$

(C) Zero

(D) $\frac{\mu_o I}{2\pi r}$

37. A coil has an inductance of 0.04 Henry. The e.m.f. induced in it when the current flowing through the coil is changing at the rate of 100 A/s is

(A) Zero
(B) 4 V
(C) – 4 V
(D) 2.5 KV

38. The current in a coil is changing at a rate of 10 A/s. Then an e.m.f. of 4 V is induced in a neighboring coil. The mutual inductance of the pair of coils is then

(A) 40 H
(B) 0.4 H
(C) 2.5 H
(D) 4 H

39. One atomic mass unit (amu) is equivalent to

(A) 931 eV
(B) 931 MeV
(C) 931 keV
(D) 931 milli eV

40. If $Z$ is the atomic number and $n$ is the principal quantum number, then the total energy of an electron in the $n^{th}$ orbit of an atom is given by

(A) $\frac{13.6Z^2}{n^2}$ eV

(B) $-\frac{13.6Z^2}{n^2}$ eV

(C) $-\frac{13.6}{n^2}$ eV

(D) $-\frac{13.6Z^2}{n}$ eV

41. If $m$ is the mass of the particle, its de Broglie wavelength $\lambda$ is proportional to

(A) $\sqrt{m}$

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

(C) $\frac{1}{\sqrt{m}}$

(D) $m$

42. The number of photons emitted per second from a lamp radiating a power of 10 Watt at a wavelength of 6000 $A^o$ is about

(A) $3 \times 10^{18}$ per sec

(B) $3 \times 10^{10}$ per sec

(C) $3 \times 10^{8}$ per sec

(D) $1 \times 10^{24}$ per sec

43. Photometer is an instrument used for

(A) counting the number of photons
(B) measuring the photoconductivity of a substance
(C) measuring the luminous intensities of light sources
(D) studying photoelectric effect

44. When light passes from one medium to another medium, then the physical property which does not change is

(A) Velocity
(B) Frequency
(C) Wavelength
(D) Refractive index

45. Two thin lenses with focal lengths $f_1$ and $f_2$ have materials with dispersive powers $\omega_1$ and $\omega_2$ respectively. Then to form an achromatic combination of these lenses, essential condition is that

(A) $\frac{\omega_1}{f_1} - \frac{\omega_2}{f_2} = 0$

(B) $\frac{\omega_1}{f_1} + \frac{\omega_2}{f_2} = 0$

(C) $\omega_1 + \omega_2 = 0$

(D) $f_1 + f_2 = 0$

46. The refractive indices for red and violet colours for crown glass are 1.5155 and 1.5245 respectively. Then the dispersive power of the crown glass is

(A) 0.009
(B) 3.04
(C) 0.0045
(D) 1.52

47. For a given material of the glass, the refractive index of the glass prism depends on

(A) the angle of the prism
(B) the angle through which it deviates an incident beam of light
(C) the wavelength of the light
(D) the intensity of the incident light

48. Which one of the following phenomena is **NOT** common to both sound and light waves?

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

49. If $i$ is the polarizing angle and $r$ is the angle of refraction, then

(A) $i - r = 90°$
(B) $i + r = 60°$
(C) $i + r = 90°$
(D) $i = r$

50. If the refractive index of glass is 1.5, the speed of light in glass is (Velocity of light in vacuum is $3 \times 10^8$ m/s)

(A) $3 \times 10^8$ m/s
(B) $3 \times 10^{10}$ m/s
(C) $0.5 \times 10^8$ m/s
(D) $2 \times 10^8$ m/s

51. If the coefficient of absorption and transmission of a surface are 0.73 and 0.23 respectively, then the coefficient of reflection will be

(A) 0.06
(B) 0.04
(C) 0.96
(D) 0.24

52. Which one of the following statements about Poisson's ratio ($\sigma$) is **INCORRECT**?

(A) $\sigma$ is the ratio of lateral strain to longitudinal strain
(B) $\sigma$ has no units and dimensions
(C) Theoretically, $\sigma$ lies between $-1$ and ½
(D) For some substances, value of $\sigma$ is negative

53. A potential barrier of 0.50 V exists across a $p$-$n$ junction. If the depletion region is $5.0 \times 10^{-7}$ m wide, the intensity of the electric field in this region is

(A) $1.0 \times 10^6$ V/m
(B) $1.0 \times 10^5$ V/m
(C) $2.0 \times 10^5$ V/m
(D) $2.0 \times 10^6$ V/m

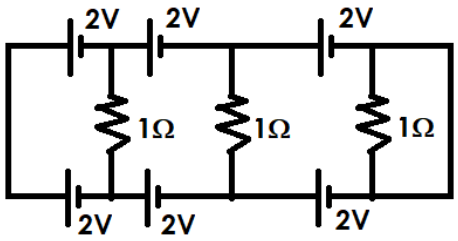
54. If a semiconductor photodiode can detect a photon with a maximum wavelength of 400 nm, then its band gap energy is
(Given Planck's constant, $h = 6.63 \times 10^{-34}$ Js; Speed of light, $c = 3 \times 10^{8}$ m/s; $1\ eV = 1.602 \times 10^{-19}$ J )

(A) 1.1 eV
(B) 2.0 eV
(C) 1.5 eV
(D) 3.1 eV

55. If the full wave rectifier is operating from 50 Hz mains, then the fundamental frequency in the ripple will be

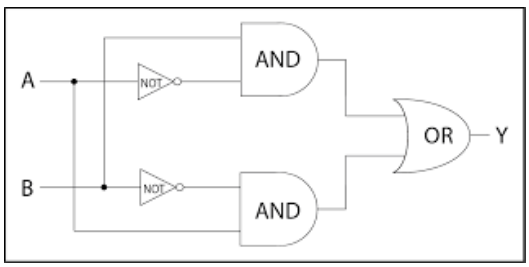
(A) 50 Hz
(B) 60 Hz
(C) 100 Hz
(D) 25 Hz

56. In the following circuit, the current in each resistor is




(A) 0.5 A
(B) 0 A
(C) 1 A
(D) 0.25 A

57. The logic circuit below represents which one of the following gates?




(A) XOR gate
(B) NAND gate
(C) XNOR gate
(D) NOR gate

58. The fundamental radio antenna is a metal rod which has a length equal to

(A) $\lambda$ in free space at the frequency of operation
(B) $\lambda/2$ in free space at the frequency of operation
(C) $\lambda/4$ in free space at the frequency of operation
(D) $3\lambda/4$ in free space at the frequency of operation

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

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

60. Parsec is the unit of

(A) Time
(B) Distance
(C) Luminosity
(D) Escape velocity

61. The conclusion that every additional electron enters the orbital with lowest possible energy has been drawn from

(A) Hund's rule
(B) Aufbau principle
(C) Pauli's exclusion principle
(D) De-Broglie's principle

62. The cathode rays have same charge to mass ratio as

(A) Anode rays
(B) $\gamma$-particles
(C) $\beta$-particles
(D) $\alpha$-particles

63. The phenomenon of splitting of spectral lines under the influence of electric field is known as

(A) Stark effect
(B) Zeeman effect
(C) Compton effect
(D) Photoelectric effect

64. ……. is the **CORRECT** order of effusion among the gases $H_2$, $O_2$, $CO_2$ and $NH_3$.

(A) $H_2 > NH_3 > O_2 > CO_2$

(B) $NH_3 > O_2 > H_2 > CO_2$

(C) $H_2 < NH_3 < O_2 < CO_2$

(D) $NH_3 < H_2 < O_2 < CO_2$

65. Which of the following is **NOT** a state function?

(A) Internal energy
(B) Gibbs free energy
(C) Work
(D) Enthalpy

66. In an isolated system, a liquid is in equilibrium with its vapour. Then the molar entropy of the vapour is

(A) equal to that of liquid
(B) less than that of liquid
(C) more than that of liquid
(D) equal to zero

67. The rate constant for a first order reaction is $2.44 \times 10^{-3}\ s^{-1}$.
Then the half-life for the reaction is

(A) 264 s
(B) 274 s
(C) 284 s
(D) 294 s

68. Calculate the weight of Copper deposited at cathode when one Faraday of electricity is passed through $CuSO_4$ solution (Given: Atomic mass of Cu is 63.50, and current efficiency for copper deposition is 100%).

(A) 15.87 g
(B) 21.16 g
(C) 31.75 g
(D) 63.50 g

69. The potential of calomel electrode with 0.01 M KCl is ($E°$ for calomel electrode is 0.268 V)

(A) 0.150 V
(B) 0.268 V
(C) 0.327 V
(D) 0.386 V

70. For a reaction; $aA \rightarrow bB$, the rate of reaction is doubled when the concentration of $A$ is increased by four times. The order of the reaction is equal to

(A) 0
(B) 0.5
(C) 1
(D) 2

71. The coordination number of $Zn^{2+}$ and $S^{2-}$ ions in the zinc blende (ZnS) type structure is

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

72. The ionic strength of 0.01 M solution of an electrolyte of the type $M_2X_3$ is

(A) 0.01
(B) 0.03
(C) 0.06
(D) 0.15

73. The number of radial nodes in 5s atomic orbital is

(A) 5
(B) 4
(C) 3
(D) 0

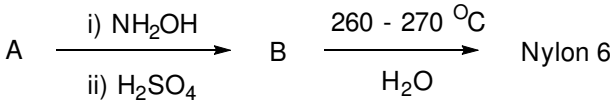
74. Which of the following lines in the atomic spectrum of H appear in the visible region?

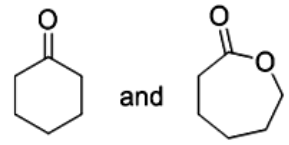
(A) Lyman
(B) Balmer
(C) Paschen
(D) Pfund

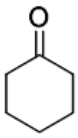
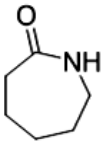
75. Which among the following undergoes SN2 substitution at the fastest rate?

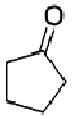
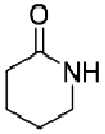
(A) iodomethane
(B) iodoethane
(C) 2-iodopropane
(D) 2-iodo-2-methylpropane

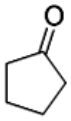
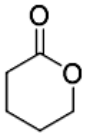
76. In the following preparation of Nylon 6, identify compounds A and B.




(A)  and 

(B)  and 

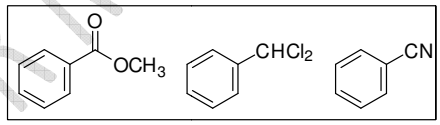
(C)  and 

(D)  and 

77. Phenol is more acidic than methanol due to

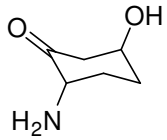
(A) aromaticity of phenol
(B) resonance stabilization of phenoxide ion
(C) less efficient solvation of phenol
(D) weaker hydrogen bonding between phenol molecules that enables easier removal of protons

78. Which among the following methods is **NOT** suitable for the preparation of benzaldehyde?



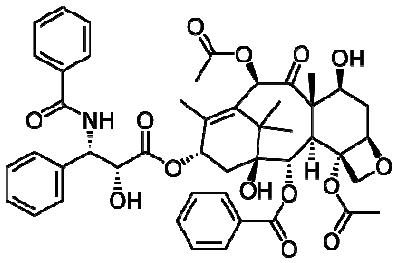
(A) Reaction of benzene with carbon dioxide and HCl in the presence of anhydrous aluminum chloride
(B) Controlled reduction of methylbenzoate with DIBAL-H
(C) Reaction of benzal chloride (a *gem*-dihalide) with water at 373 K
(D) Reaction of benzonitrile with stannous chloride in the presence of HCl followed by hydrolysis under acidic conditions

79. The IUPAC name of the following compound is



(A) 2-amino-5-hydroxycyclohexan-1-one
(B) 2-hydroxy-5-aminocyclohexan-1-one
(C) 1-amino-4-hydroxycyclohexan-2-one
(D) 1-hydroxy-4-aminocyclohexan-3-one

80. Following organic compound is the structure of paclitaxel which is an anti-cancer chemotherapeutic drug. What are the functional groups present in paclitaxel?



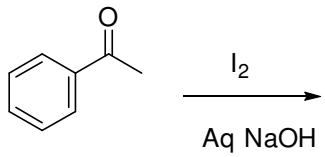
(A) Ester, Ether, Primary Alcohol and Alkene
(B) Ester, Ketone, Secondary Alcohol, Aldehyde
(C) Ketone, Amide, Ester, Alkene
(D) Peptide linkage, *tert*-Alcohol, Ether, Ketone

81. What is the order of stability of the following carbanions?

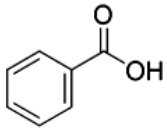
II I III IV

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

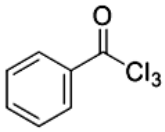
82. Identify the yellow precipitate formed in the following reaction.



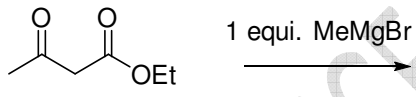

(A) NaI

(B) 


(C) $CHI_3$

(D) 


83. One of the products of the following reaction is a gas under standard pressure and temperature. Identify that gaseous product.



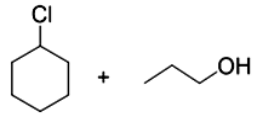

(A) $H_2$

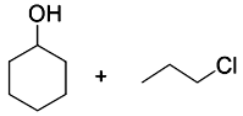
(B) $CO_2$

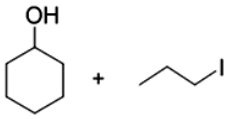
(C) $CH_4$

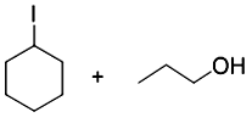
(D) CO

84. Which pair will be the best suited for Williamson ether synthesis of propoxycyclohexane?

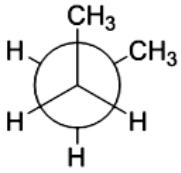
(A) 

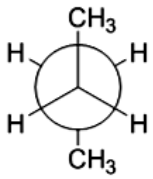

(B) 

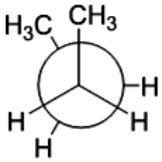

(C) 

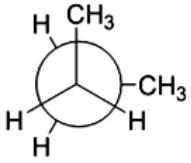

(D) 


85. Which conformation of butane is most stable?

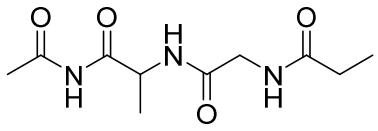
(A) 


(B) 


(C) 


(D) 

86. Number of peptide bond(s) present in the following compound is,



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

87. Which of the following combinations of enzyme, substrate and product is **CORRECT**?

(A) Enzyme: Maltase, Substrate: Maltose, Product: Glucose + Fructose
(B) Enzyme: Sucrase, Substrate: Sucrose, Product: Glucose + Fructose
(C) Enzyme: Amylase, Substrate: Lactose, Product: Galactose + Fructose
(D) Enzyme: Invertase, Substrate: Sucrose, Product: Glucose + Mannose

88. Ethylenediaminetetraacetate (EDTA) ion is

(A) hexadentate ligand with four "O" and two "N" donor atoms
(B) unidentate ligand
(C) bidentate ligand with two "N" donor atoms
(D) tridentate ligand with three "N" donor atoms

89. Zr (Z = 40) and Hf (Z = 72) have similar atomic and ionic radii because of

(A) belonging to same group
(B) diagonal relationship
(C) lanthanoid contraction
(D) having similar chemical properties

90. The **INCORRECT** statement among the following is

(A) Actinoid contraction is greater for element to element than Lanthanoid contraction
(B) Most of the trivalent lanthanoid ions are colourless in the solid state
(C) Lanthanoids are good conductors of heat and electricity
(D) Actinoids are highly reactive metals, especially when finely divided

91. Identify the **INCORRECT** statement from the following

(A) Pig iron contains about 4% carbon and many impurities in smaller amount and it can be moulded into a variety of shapes
(B) Wrought iron is the purest form of iron
(C) Vapour phase refining is carried out for nickel by Mond's process
(D) Blister copper has blistered appearance due to evolution of $CO_2$

92. The type of hybridization of boron in diborane is

(A) sp- hybridization
(B) $sp^2$- hybridization
(C) $sp^3$- hybridization
(D) $sp^3d$- hybridization

93. Which of the following diatomic molecular species has only π bonds according to Molecular Orbital Theory?

(A) $O_2$
(B) $N_2$
(C) $C_2$
(D) $Be_2$

94. Identify the **INCORRECT** statement related to $PCl_5$ from the following

(A) Three equatorial P-Cl bonds make an angle of 120° with each other
(B) Two axial P-Cl bonds make an angle of 180° with each other
(C) Axial P-Cl bonds are longer than equatorial P-Cl bonds
(D) $PCl_5$ molecule is non-reactive

95. The existence of two different coloured complexes with the composition of $[Co(NH_3)_4Cl_2]^+$ is due to

(A) linkage isomerism
(B) geometrical isomerism
(C) coordination isomerism
(D) ionization isomerism

96. Which of the following statements is **FALSE**?

(A) $Ca^{2+}$ ions are important in blood clotting

(B) $Ca^{2+}$ ions are not important in maintaining the regular beating of the heart

(C) $Mg^{2+}$ ions are important in the green parts of plants

(D) $Mg^{2+}$ ions form a complex with ATP

97. Bronze is an alloy of

(A) Copper and Nickel
(B) Copper and Iron
(C) Copper and Tin
(D) Copper and Aluminium

98. Pure ozone is a

(A) violet gas, dark blue liquid and pale blue solid
(B) pale blue gas, dark blue liquid and violet-black solid
(C) green gas, pale blue liquid and dark blue solid
(D) pale green gas and dark blue solid and liquid

99. Match the following.

| | | | |
|---|---|---|---|
| i. | *Gypsum* | a. | PbS |
| ii. | *Epsom salt* | b. | $MgSO_4.7H_2O$ |
| iii. | *Baryte* | c. | $CaSO_4.2H_2O$ |
| iv. | *Galena* | d. | $BaSO_4$ |

(A) i-c, ii-b, iii-d, iv-a
(B) i-b, ii-d, iii-c, iv-a
(C) i-d, ii-c, iii-a, iv-d
(D) i-b, ii-c, iii-d, iv-a

100. Which among the following is the correct formula of chloric acid?

(A) $HOClO_2$

(B) HOClO

(C) $HOClO_3$

(D) HOCl

101. If $n!$, $3\times n!$ and $(n+1)!$ are in G.P, then $n!$, $5\times n!$ and $(n+1)!$ are

(A) in A.P
(B) not in A.P
(C) in G.P
(D) not in G.P

102. The simplest form of $\dfrac{2}{\sqrt{2+\sqrt{2+\sqrt{2+2\cos 4x}}}}$ is

(A) $\sec\dfrac{\pi}{2}$

(B) $\sec x$

(C) $\cos x$

(D) 1

103. Sum of two positive numbers is $k$ and the sum of whose squares is minimum. Then the numbers are

(A) $\dfrac{k}{2},\dfrac{k}{2}$

(B) $k-1,1$

(C) $k,0$

(D) $k,k-5$

104. The differential equation of the family of circles with fixed radius 5 units and center on the line $y = 2$ is

(A) $(y-2)^2 y'^2 = 25-(y-2)^2$

(B) $(x-2)^2 y'^2 = 25-(y-2)^2$

(C) $(y-2)y'^2 = 25-(y-2)^2$

(D) $(x-2)y'^2 = 25-(y-2)^2$

105. If $x^2+6x-27>0$ and $x^2-3x-4<0$, then

(A) $x<4$

(B) $x>3$

(C) $3<x<4$

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

106. If $\cos\frac{x}{a}=\sin\frac{x}{b}$, then $|a\cos 2x+b\sin 2x|$ is equal to

(A) $\sqrt{a^2b}$

(B) $\sqrt{ab^2}$

(C) $|b|$

(D) $|a|$

107. tan $5x$ tan $3x$ tan $2x$ is equal to

(A) tan $5x$ + tan $3x$ + tan $2x$
(B) 0
(C) tan $5x$ − tan $3x$ − tan $2x$
(D) 1

108. Let 1, $a_1$, $a_2$, . . . , $a_{10}$ be the $11^{th}$ roots of unity. Then $(1 + a_1)$ . . . $(1 + a_{10})$ is equal to

(A) 1
(B) 2
(C) 11
(D) ∞

109. The region of the argand diagram defined by $|z-i|<3$ represents

(A) interior of a circle with centre on $x$ axis
(B) interior of a circle with centre at origin
(C) interior of a circle with centre on $y$ axis
(D) a pair of straight lines

110. The first and last terms of an AP are 1 and 11. If the sum of its terms is 36, then the number of terms will be

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

111. Let $y = \cos^{-1}\left(\frac{2\cos x - 3\sin x}{\sqrt{13}}\right)$. Then $\frac{dy}{dx}$ is equal to

(A) 0
(B) $x$
(C) $2x$
(D) 1

112. $\Delta ABC$ has vertices (0, 0), (10, 20), and (40, 0). If the line $y = kx$ cuts the triangle into two triangles of equal area, then $k$ is equal to

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

(B) $-\frac{5}{4}$

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

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

113. The value of $\lim_{x \to 2} \frac{e^{3x-6} - 1}{\sin(2 - x)}$ is

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

(B) 3

(C) $-3$

(D) $-1$

114. $\int \frac{dx}{x(x+1)}$ is equal to

(A) $\log\left|\frac{x+1}{x}\right|+c$

(B) $\log\left|\frac{x}{x+1}\right|+c$

(C) $\log\left|\frac{x-1}{x}\right|+c$

(D) $\log\left|\frac{x-1}{x+1}\right|+c$

115. If $\vec{a}$ and $\vec{b}$ are two non-zero, non-collinear vectors, then $2\left[\vec{a} \quad \vec{b} \quad \hat{i}\right]\hat{i}+2\left[\vec{a} \quad \vec{b} \quad \hat{j}\right]\hat{j}+2\left[\vec{a} \quad \vec{b} \quad \hat{k}\right]\hat{k}+\left[\vec{a} \quad \vec{b} \quad \vec{a}\right]$ is equal to

(A) $2\left(\vec{a}\times\vec{b}\right)$

(B) $\vec{a}\times\vec{b}$

(C) $\vec{a}+\vec{b}$

(D) $\vec{a}-\vec{b}$

116. Solution of $\frac{dx}{dy}+mx=0$, where $m<0$ is

(A) $x=ce^{my}$

(B) $x=ce^{-my}$

(C) $x=c+my$

(D) $x=c$

117. The sum of the infinite geometric series $1+\frac{1}{4}+\frac{1}{16}+\frac{1}{64}+...$ is

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

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

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

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

118. If $\int_1^b (b-4x)dx \geq 6-5b$ and $b>1,$ then $b$ equals

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

119. If the line $y=3x+\lambda$ touches the hyperbola $9x^2-5y^2=45,$ then the value of $\lambda^2$ is

(A) 45
(B) 36
(C) 6
(D) 15

120. The unit vector parallel to the resultant of the vectors $2\vec{i}+3\vec{j}-\vec{k}$ and $4\vec{i}-3\vec{j}+2\vec{k}$ is

(A) $\frac{6\vec{i}+\vec{k}}{\sqrt{17}}$

(B) $\frac{6\vec{j}+\vec{k}}{\sqrt{17}}$

(C) $\frac{6\vec{i}-\vec{k}}{\sqrt{37}}$

(D) $\frac{6\vec{i}+\vec{k}}{\sqrt{37}}$

121. If $2f(x) = f'(x)$ and $f(0) = 3$, then $f(2)$ equals

(A) $4e^3$

(B) $3e^4$

(C) $2e^3$

(D) $3e^2$

122. If the expression $\left(ax - 1 + \frac{1}{x}\right)$ is non-negative for all positive real $x$, then the minimum value of $a$ must be

(A) 0

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

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

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

123. The differential equation for $y = A\cos\alpha x + B\sin\alpha x$, where $A$ and $B$ are arbitrary constants, is

(A) $\frac{d^2y}{dx^2} - \alpha^2 y = 0$

(B) $\frac{d^2y}{dx^2} + \alpha^2 y = 0$

(C) $\frac{d^2y}{dx^2} - \alpha y = 0$

(D) $\frac{d^2y}{dx^2} + \alpha y = 0$

124. If $\vec{a}$, $\vec{b}$ and $\sqrt{3}\vec{a}-\vec{b}$ are unit vectors, then the angle between $\vec{a}$ and $\vec{b}$ is

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

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

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

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

125. Suppose two cards are selected at random from a deck of 52 cards. Let $X$ be the number of queens obtained. Then $E(X) =$

(A) $\frac{1}{13}$

(B) $\frac{2}{13}$

(C) $\frac{5}{13}$

(D) $\frac{37}{221}$

126. If $n$ is even, then the sum of $n$ terms of the series $1^2-2^2+3^2-4^2+5^2-6^2+...$ is

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

(B) $-n(n+1)$

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

(D) $\frac{n^2-n}{4}$

127. $\lim_{x\to 0} \frac{1+x+x^2-e^x}{x^2} =$

(A) 1

(B) 2

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

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

128. A function $y = f(x)$ has a second order derivatives $f''(x) = 6(x-1)$. If its graph passes through the point (2, 1) and at that point the tangent to the graph is $y = 3x - 5$, then the function is

(A) $(x-1)^3$

(B) $(x+1)^3$

(C) $(x-1)^2$

(D) $(x+1)^2$

129. The function $f(y) = \sin^{-1}(\tan y)$ is not differentiable at

(A) $y = 0$

(B) $y = -\frac{\pi}{6}$

(C) $y = \frac{\pi}{6}$

(D) $y = \frac{\pi}{4}$

130. The angle between the curves $y = x^2$ and $y = (x-2)^2$ at their point of intersection is

(A) $\theta = \sin^{-1}\left(\frac{1}{2}\right)$

(B) $\theta = \frac{\sin(\pi)}{\cos(0)}$

(C) $\theta = \tan^{-1}\left(\frac{1}{2}\right)$

(D) $\theta = \tan^{-1}\left(\frac{4}{3}\right)$

131. If $n = 2^3 \times 3^4 \times 5^4 \times 7,$ then the number of consecutive zeros in $n$ is

(A) 2
(B) 3
(C) 4
(D) 7

132. If $A$ and $B$ are two subsets of a set $X$, then $\{A \cap (X - B)\} \cup B$ is equal to

(A) $A \cup B$
(B) $A \cap B$
(C) $X$
(D) $B$

133. Let $m$, $n$ be real numbers. If $\alpha$ is the root of $x^2 + 3m^2x + 5n^2 = 0$, $\beta$ is a root of $x^2 + 9m^2x + 15n^2 = 0$ and $0 < \alpha < \beta$, then the equation $x^2 + 6m^2x + 10n^2 = 0,$ has a root $\gamma$ that always satisfies

(A) $\gamma = \frac{\alpha}{4} + \beta$

(B) $\beta < \gamma$

(C) $\alpha < \gamma < \beta$

(D) $\gamma = \frac{\alpha}{2} + \beta$

134. If $A = \cos^2 x + \sin^4 x$, then, for all values of $x$,

(A) $1 \le A \le 2$

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

(C) $\frac{13}{16} \le A \le 1$

(D) $A = 3$

135. Let $z_1$ and $z_2$ be two different complex numbers such that $|z_1| = 1$ and $|z_2| = 1$.

Then $\left|\frac{z_2 - z_1}{1 - \overline{z}_1 z_2}\right|$ is equal to

(A) 1

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

(C) 2

(D) 0

136. Let $a > 1$, $b > 1$, $c > 1$ be in Geometric Progression.

Then $\frac{1}{1+\log_e a}, \frac{1}{1+\log_e b}, \frac{1}{1+\log_e c}$ are

(A) in Arithmetic Progression
(B) in Geometric Progression
(C) in Harmonic Progression
(D) not in any progression

137. Let $n$ be an integer which leaves remainder one when divided by three. Then $\left(1+\sqrt{3}i\right)^n + \left(1-\sqrt{3}i\right)^n$ equals

(A) $2^n$

(B) $2^{n+1}$

(C) $(-1)^{n+1} 2^n$

(D) $-2^n$

138. Let $P=\left(-\sin(\beta-\alpha), -\cos\beta\right)$, $Q=\left(\cos(\beta-\alpha), \sin\beta\right)$ and $R=\left(\cos(\beta-\alpha+\theta), \sin(\beta-\theta)\right)$, $\left(0<\alpha,\beta,\theta<\frac{\pi}{4}\right)$ be the three points in a plane. Then

(A) $P$, $Q$, $R$ are non-collinear
(B) $Q$ lies on the line segment of $RP$
(C) $R$ lies on the line segment of $PQ$
(D) $P$ lies on the line segment of $QR$

139. The image of the point $P(2, 3)$ with respect to the line $x = y$ is the point $Q$ and the image of $Q$ with respect to the line $x = 0$ is $A(x, y)$. Then

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

140. All chords of the curve $3x^2 - y^2 - 2x + 4y = 0$ that subtends a right angle at the origin, pass through a fixed point whose coordinates are

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

141. The locus of the middle points of chords of the parabola $y^2 = 8x$ drawn through the vertex is a parabola whose

(A) focus is (2, 0)
(B) latus rectum = 4
(C) latus rectum = 8
(D) focus is (0,−1)

142. The equation of the common tangent touching the circle $(x - 3)^2 + y^2 = 9$ and parabola $y^2 = 4x$ below the $x$-axis is

(A) $\sqrt{3}y = -x + \sqrt{3}$
(B) $\sqrt{3}y = x + \sqrt{3}$
(C) $\sqrt{3}y = x - \sqrt{3}$
(D) $\sqrt{3}y = 2x - \sqrt{3}$

143. It is given that the tangent at the point (2sec $\theta$, 3tan $\theta$) of the hyperbola $\frac{x^2}{4}-\frac{y^2}{9}=1$ is parallel to the line $3x - y + 4 = 0$. Then the value of $\theta$ is

(A) 90°
(B) 60°
(C) 45°
(D) 30°

144. A common tangent to $9x^2 - 16y^2 = 144$ and $x^2 + y^2 = 9$ is

(A) $y=\frac{3x}{\sqrt{7}}+\frac{15}{\sqrt{7}}$

(B) $y=\frac{3x}{\sqrt{7}}-\frac{15}{\sqrt{7}}$

(C) $y=3x\sqrt{\frac{2}{7}}+\frac{15}{\sqrt{7}}$

(D) $y=3\frac{3x}{\sqrt{7}}-\frac{15}{\sqrt{7}}$

145. Let $(x+iy)^{1/3}=a+ib.$ Then $\frac{x}{a}+\frac{y}{b}$ is equal to

(A) $a^2 - b^2$
(B) $4(a^2 - b^2)$
(C) $6(a^2 - b^2)$
(D) $8(a^2 - b^2)$

146. If $z = -2 + 2\sqrt{3}i$, then $z^{2n}+2^{2n}.\ z^n+2^{4n}$ may be equal to

(A) 1
(B) 0 , $n$ is a multiple of 3
(C) $2^{2n}$ , $n$ is not a multiple of 3
(D) $3.4^{2n}$, $n$ is a multiple of 3

147. Assume that $\sum_{n=1}^{n} n,\ \frac{\sqrt{10}}{3},\ \sum_{n=1}^{n} n^2,\ \sum_{n=1}^{n} n^3$ are in a geometric progression. Then the value of $n$ is

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

148. If $s_n = \sum_{k=1}^{n} \frac{1+2+2^2+\ldots \text{to } k \text{ terms}}{2^k}$, then $s_n$ is equal to

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

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

(C) $2^n-(n+1)$

(D) $2^n-1$

149. If $a, b, c, d, e, f$ are in Arithmetic Progression, then $e - c$ is equal to

(A) $2(b - c)$
(B) $f - d$
(C) $2(d - c)$
(D) $2(f - d)$

150. The sum of the infinite series $\left(\frac{1}{3}\right)^2+\frac{1}{3}\left(\frac{1}{3}\right)^4+\frac{1}{5}\left(\frac{1}{3}\right)^6+\ldots$ is equal to

(A) $\frac{1}{4}\log 2$

(B) $\frac{1}{6}\log 2$

(C) $\frac{1}{4}\log 3$

(D) $\frac{1}{6}\log 3$

151. If $y = \sin x$, then $\frac{d^2}{dy^2}\left(\cos^7 x\right)$ is equal to

(A) $35\cos^3 x - 42\cos^5 x$

(B) $35\cos^3 x + 42\cos^5 x$

(C) $42\cos^3 x - 35\cos^5 x$

(D) $42\cos^3 x + 35\cos^5 x$

152. Let $g(x)$ be the inverse function $f(x)$ and $f'(x) = \frac{1}{1+x^3}$, then $g'(x)$ is equal to

(A) $\frac{1}{1+\left(g(x)\right)^3}$

(B) $\frac{1}{1+\left(f(x)\right)^3}$

(C) $1+\left(g(x)\right)^3$

(D) $1+\left(f(x)\right)^3$

153. The domain of the function $f(x) = \sin^{-1}\left(\frac{4}{3+2\cos x}\right)$ is

(A) $2n\pi - \frac{\pi}{6} \le x \le 0$, $n$ is an integer

(B) $2n\pi - \frac{\pi}{6} \le x \le 2n\pi + \frac{\pi}{6}$, $n$ is an integer

(C) $0 \le x \le 2n\pi + \frac{\pi}{6}$, $n$ is an integer

(D) $2n\pi - \frac{\pi}{3} \le x \le 2n\pi + \frac{\pi}{3}$, $n$ is an integer

154. Let [,] be the greatest integer function. If $\left[x + [2x]\right] < 3$, then

(A) $x \in (-\infty, 1)$

(B) $x \in [0, 1)$

(C) $x \in [-\infty, 3/2)$

(D) $x \in [0, 3/2)$

155. Let $f : R \to R$ be defined by $f(x) = (x+1)^2 - 1,\ x \geq -1$. Then the set of values of $x$ for which $f(x) = f^{-1}(x)$ is given by

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

156. $\lim\limits_{x\to\infty}\left(\dfrac{x^2+5x+3}{x^2+x+2}\right)^x$ equals

(A) $e^2$
(B) $e^3$
(C) $e^4$
(D) $e^5$

157. $\lim\limits_{x\to\infty}\left(\sin\sqrt{x+1} - \sin\sqrt{x}\right)$ is equal to

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

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

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

159. Let $f$ be a function which is continuous and differentiable for all real $x$. If $f(2) = -4$ and $f'(x) \geq 6$ for all $x \in [2, 4]$, then

(A) $f(4) \leq 8$
(B) $f(4) \geq 8$
(C) $f(4) \geq 12$
(D) $f(4) \leq 12$

160. Let $f(x) = \dfrac{x^2 - 1}{x^2 + 1}$ for every real number $x$. Then the minimum value of $f$

(A) does not exist because $f$ is unbounded
(B) is not attained even though $f$ is bounded
(C) is equal to 1
(D) is equal to $-1$

161. The set of all values of a satisfying $\log_2\left(ax^2 + x + a\right) \geq 1$ for all $x \in R$, is

(A) $\left(0, 1 + \dfrac{\sqrt{5}}{2}\right)$

(B) $\left(1 + \dfrac{\sqrt{5}}{2}, \infty\right)$

(C) $\left(0, 1 - \dfrac{\sqrt{5}}{2}\right)$

(D) $\left(1 - \dfrac{\sqrt{5}}{2}, 1 + \dfrac{\sqrt{5}}{2}\right)$

162. If the roots of the equation $(a^2 + b^2)y^2 - 2(ac + bd)y + c^2 + d^2 = 0$ are equal, then

(A) $ab = dc$
(B) $ac = bd$
(C) $ad = -bc$
(D) $ad = bc$

163. The number of integers $k$ such that $1 \leq k \leq 100$ and $2^k + 3^k + 5^k$ is divisible by 4 is

(A) 47
(B) 48
(C) 49
(D) 50

164. The number of ways of arranging letters of the word BACANA so that C and N do not appear together is

(A) 30
(B) 40
(C) 60
(D) 80

165. The system of equations

$$2x\cos^2\theta + y\sin 2\theta - 2\sin\theta = 0$$
$$x\sin 2\theta + 2y\sin^2\theta = -2\cos\theta$$
$$x\sin\theta - y\cos\theta = 0 \text{ for all values of } \theta \text{, can}$$

(A) can have a unique non-trivial solution
(B) cannot have a solution
(C) can have infinite number solutions
(D) can have only trivial solution

166. $\frac{1}{n!}+\frac{1}{2!(n-2)!}+\frac{1}{4(n-4)!}+\ldots+\infty$ is equal to

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

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

(C) $\frac{2^{n-1}}{n!}$

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

167. An elevator starts with $m$ passengers and steps at n floors ($m \leq n$). The probability that no two passengers alight at the same floor is

(A) $\frac{{}^{n}P_{m}}{m^{n}}$

(B) $\frac{{}^{n}C_{m}}{m^{n}}$

(C) $\frac{{}^{n}C_{m}}{n^{m}}$

(D) $\frac{{}^{n}P_{m}}{n^{m}}$

168. 10 different books and 2 different pens are given to 3 boys so that each gets equal number of things. The probability that the same boy does not receive both the pens is

(A) $\frac{7}{11}$

(B) $\frac{5}{11}$

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

(D) $\frac{5}{11}$

169. If $\tan^2\theta = 2\tan^2\phi + 1$, then $\cos 2\theta + \sin^2\phi$ is equal to

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

170. If $\sin\theta = 3\sin(\theta + 2\alpha)$, then the value of $\tan(\theta + \alpha) + 2\tan\alpha$ is

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

171. If $P$ is a point on the altitude $AD$ of the triangle $ABC$ such that $\angle CDP = \frac{B}{3}$, then AP is equal to

(A) $2a\sin\frac{C}{3}$

(B) $2b\sin\frac{C}{3}$

(C) $2c\sin\frac{B}{3}$

(D) $2c\sin\frac{C}{3}$

172. The equation of the family of curves which intersect the hyperbola $xy = 2$ orthogonally is

(A) $y = \frac{x^2}{4} + C$

(B) $y = \frac{x^3}{6} + C$

(C) $y = -\frac{x^3}{6} + C$

(D) $y = -\frac{x^2}{4} + C$

173. A normal at any point $(x, y)$ to the curve $y = f(x)$ cuts triangle of unit area with the axes. The equation of the curve is

(A) $y^2 - x^2\left(\frac{dy}{dx}\right)^2 = 4\frac{dy}{dx}$

(B) $x^2 - y^2\left(\frac{dy}{dx}\right)^2 = \frac{dy}{dx}$

(C) $x + y\frac{dy}{dx} = y$

(D) $x^2 + 2xy\frac{dy}{dx} + y^2\left(\frac{dy}{dx}\right)^2 = 2\frac{dy}{dx}$

174. Let $z$ and $w$ be two complex numbers such that $|z| \leq 1$, $|w| \leq 1$ and $|z + iw| = |z - \bar{w}\, i| = 2$. Then $z$ is equal to

(A) 1 or $i$
(B) $-1$ or $i$
(C) 1 or $-1$
(D) $-1$ or $-i$

175. The distance between the foci of the hyperbola $x^2 - 3y^2 - 4x - 6y - 11 = 0$ is

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

176. If $\begin{vmatrix} g(y) & g'(y) \\ g'(y) & g''(y) \end{vmatrix} = 0$, $g(0) = 1$ and $g'(0) = 2$, then $g(1)$ belongs to the interval

(A) [5, 7]
(B) [8, 10]
(C) [9, 12]
(D) [6, 9]

177. Let $M$ be a $3 \times 4$ real matrix and $MX = N$ be an inconsistent system of equations. Then the highest possible rank of $M$ is

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

178. The function $f(x) = |x+1|$ on the interval $[-2, 0]$ is

(A) differentiable but not continuous
(B) continuous and differentiable
(C) continuous but not differentiable
(D) neither continuous nor differentiable

179. The value of $\cos 105°$ is equal to

(A) $\frac{1}{4}\left(\sqrt{2}-\sqrt{3}\right)$

(B) $\frac{1}{\sqrt{2}}\left(2-\sqrt{6}\right)$

(C) $\frac{1}{4}\left(\sqrt{2}-\sqrt{6}\right)$

(D) $\frac{\sqrt{6}}{4}$

180. Let $[A]_{3\times1}, [B]_{3\times3}, [C]_{3\times5}, [D]_{5\times3}, [E]_{5\times5}$ and $[F]_{5\times1}$ be real matrices where $[B]$ and $[E]$ are symmetric. The following statements are made with respect to these matrices.

Statement (i) Matrix product $[D]^T[F][D]$ is always symmetric.

Statement (ii) Matrix product $[F]^T[C]^T[B][C][F]$ is a scalar.

Then

(A) statement (i) is true but statement (ii) is false
(B) statement (i) is false but statement (ii) is true
(C) both the statements are true
(D) both the statements are false

181. The standard deviation of a uniformly distributed random variable between 0 and 1 is

(A) $\frac{7}{\sqrt{12}}$

(B) $\frac{5}{\sqrt{12}}$

(C) $\frac{1}{\sqrt{3}}$

(D) $\frac{1}{\sqrt{12}}$

182. For every real number $t$, let $f(t) = \frac{t}{1!} + \frac{3}{2!}t^2 + \frac{7}{3!}t^3 + \frac{15}{4!}t^4 + \ldots$ Then the equation $f(t) = 0$ has

(A) no real solution
(B) infinite number of real solutions
(C) exactly two real solutions
(D) exactly one real solution

183. Let $z^3 = \overline{z}$, where $z$ is a complex number not equal to zero. Then $z$ is a solution of the equation

(A) $z^2 = 1$
(B) $z^3 = 1$
(C) $z^4 = 1$
(D) $z^9 = 1$

184. The equation of the line normal to the function $f(x) = (x-8)^{\frac{2}{3}} + 1$ at the point (0, 5) is

(A) $y = 3x - 5$
(B) $3y = x + 15$
(C) $3y = x - 15$
(D) $y = 3x + 5$

185. The fifth term of a G.P is 2. Then the product of first 9 terms is

(A) 128
(B) 512
(C) 256
(D) 64

186. If the non-zero numbers $x$, $y$, $z$ are in A.P, and $\tan^{-1} x$, $\tan^{-1} y$, $\tan^{-1} z$ are also in A.P, then

(A) $x = y = z$
(B) $xy = yz$
(C) $x^2 = yz$
(D) $z^2 = xy$

187. Let $f(x) = m + n|x| + l|x|^2$, where $m$, $n$, and $l$ are real constants. Then $f'(0)$ exists if

(A) $n = 0$
(B) $l = 0$
(C) $m = 0$
(D) $n = m$

188. From a pack of playing cards, two cards are drawn at random. The probability that both cards will be a king, if the first card is not replaced is

(A) $\frac{1}{221}$

(B) $\frac{1}{169}$

(C) $\frac{1}{52}$

(D) $\frac{1}{26}$

189. $\lim_{x \to 0} \frac{|x|}{x}$

(A) is zero
(B) is infinity
(C) does not exist
(D) is $-1$

190. Consider the region $5x + y \le 100,\ x + y \le 60,\ x \ge 0,\ y \ge 0$. In this region, the point (26, 39)

(A) lies inside
(B) lies outside
(C) lies on the boundary
(D) is the only point in the region

191. If $C_n = a^n + b^n,\ a + b = 1,\ ab = -1,\ C_{n-1} = 11,\ C_{n+1} = 29,$ where $n \in \square$, then $(C_n)^2 =$

(A) 98
(B) 246
(C) 324
(D) 420

192. The value of $\lim_{x\to 8} \frac{x^{1/3}-2}{x-8}$ is

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

(B) $\frac{1}{12}$

(C) $\frac{1}{8}$

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

193. Assume that the duration in minutes of a telephone conversation follows the exponential distribution $f(x)=\frac{1}{5}e^{x/5}$, $x \geq 0$. The probability that the conversation will exceed five minutes is

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

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

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

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

194. Let $t_n$ denote the $n^{\text{th}}$ term of the infinite series $\frac{1}{1!}+\frac{10}{2!}+\frac{21}{3!}+\frac{34}{4!}+\frac{49}{5!}+\ldots$

Then $\lim_{n\to\infty} t_n$ is

(A) 0

(B) $e$

(C) $e^2$

(D) 1

195. Let $\vec{v}$ be a differentiable vector function and $f$ be a differentiable scalar function. Then $curl(f\vec{v}) =$

(A) $\vec{0}$

(B) $f\, curl(\vec{v})$

(C) $(grad\ f) \times \vec{v}$

(D) $(grad\ f) \times \vec{v} + (f\, curl(\vec{v}))$

196. If $|z| = |z-1|$, then

(A) $\mathrm{Re}(z) = 1$

(B) $\mathrm{Re}(z) = \frac{1}{2}$

(C) $\mathrm{Im}(z) = 1$

(D) $\mathrm{Im}(z) = \frac{1}{2}$

197. If $\theta$ is an acute angle such that $\tan^2\theta = \frac{8}{7}$, then the value of $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)}$ is

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

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

(C) $\frac{7}{4}$

(D) $\frac{64}{49}$

198. Let $R$ be a relation defined on the set $Z$ of all integers and $xRy$ when $x + 2y$ is divisible by 3. Then

(A) $R$ is not transitive
(B) $R$ is symmetric only
(C) $R$ is an equivalence relation
(D) $R$ is not an equivalence relation

199. The range of the function $f(x)=\sqrt{\frac{x}{1+x}}$ is

(A) $(0, \infty)$

(B) $[0, \infty]$

(C) $[0, \infty]-\{1\}$

(D) $[0, \infty)$

200. If tangent to the curve $y^2+3x-7=0$ at the point $(a, b)$ is parallel to the line $x-y=4,$ then the value of $b$ is

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

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

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

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

| KEY | | | | | | | | | | | | | |
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| 1 | D | 31 | D | 61 | B | 91 | D | 121 | B | 151 | A | 181 | D |
| 2 | B | 32 | A | 62 | C | 92 | C | 122 | C | 152 | C | 182 | D |
| 3 | B | 33 | C | 63 | A | 93 | C | 123 | B | 153 | D | 183 | C |
| 4 | B | 34 | A | 64 | A | 94 | D | 124 | A | 154 | A | 184 | D |
| 5 | A | 35 | B | 65 | C | 95 | B | 125 | B | 155 | B | 185 | B |
| 6 | B | 36 | C | 66 | A | 96 | B | 126 | A | 156 | C | 186 | A |
| 7 | B | 37 | C | 67 | C | 97 | C | 127 | C | 157 | C | 187 | A |
| 8 | A | 38 | B | 68 | C | 98 | B | 128 | A | 158 | A | 188 | A |
| 9 | A | 39 | B | 69 | D | 99 | A | 129 | D | 159 | B | 189 | C |
| 10 | C | 40 | B | 70 | B | 100 | A | 130 | D | 160 | D | 190 | B |
| 11 | B | 41 | B | 71 | A | 101 | A | 131 | B | 161 | B | 191 | C |
| 12 | B | 42 | B | 72 | D | 102 | A | 132 | A | 162 | D | 192 | D |
| 13 | A | 43 | C | 73 | B | 103 | A | 133 | C | 163 | C | 193 | A |
| 14 | C | 44 | B | 74 | B | 104 | A | 134 | B | 164 | D | 194 | A |
| 15 | C | 45 | B | 75 | A | 105 | C | 135 | A | 165 | B | 195 | D |
| 16 | B | 46 | D | 76 | B | 106 | D | 136 | C | 166 | C | 196 | B |
| 17 | A | 47 | C | 77 | B | 107 | C | 137 | C | 167 | D | 197 | B |
| 18 | B | 48 | B | 78 | A | 108 | A | 138 | A | 168 | B | 198 | D |
| 19 | C | 49 | C | 79 | A | 109 | A | 139 | B | 169 | B | 199 | C |
| 20 | D | 50 | D | 80 | C | 110 | D | 140 | A | 170 | D | 200 | D |
| 21 | C | 51 | B | 81 | A | 111 | D | 141 | B | 171 | C | | |
| 22 | B | 52 | D | 82 | C | 112 | A | 142 | A | 172 | B | | |
| 23 | A | 53 | A | 83 | C | 113 | C | 143 | D | 173 | D | | |
| 24 | D | 54 | D | 84 | C | 114 | B | 144 | C | 174 | C | | |
| 25 | A | 55 | C | 85 | B | 115 | A | 145 | B | 175 | D | | |
| 26 | B | 56 | B | 86 | A | 116 | B | 146 | D | 176 | D | | |
| 27 | D | 57 | A | 87 | B | 117 | D | 147 | D | 177 | C | | |
| 28 | B | 58 | C | 88 | A | 118 | B | 148 | A | 178 | C | | |
| 29 | C | 59 | C | 89 | C | 119 | B | 149 | C | 179 | C | | |
| 30 | C | 60 | B | 90 | B | 120 | D | 150 | B | 180 | B | | |