1. An electron and a proton are associated with the same de Broglie wavelength. Then the ratio of their kinetic energy is

(A) 1: 1836

(B) $1:\frac{2}{1836}$

(C) $1:\sqrt{1836}$

(D) $1:\frac{1}{\sqrt{1836}}$

2. The energy of hydrogen atom in the n^{th} orbit is E_n, then the energy in the n^{th} orbit of single ionised helium atom is

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

(B) $2E_n$

(C) $4E_n$

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

3. In forward bias the width of depletion layer

(A) decreases with increase in V
(B) increases with increase in V
(C) independent of V
(D) is zero

4. The heat of 70 calories is required to raise the temperature of 2 mole of an ideal gas at constant pressure from 30°C to 35°C. The amount of heat needed to raise the temperature of the same gas through the same range at constant volume is

(A) 30 cal
(B) 40 cal
(C) 45 cal
(D) 50 cal

5. The radii of curvature of a double convex lens are 15 cm and 30 cm and its refractive index is 1.5 then its focal length is

(A) 20 cm
(B) 30 cm
(C) 15 cm
(D) 12 cm

6. A man weighing 70 kg carries a 30 kg box to the top of the building of height 20 m. Then the work done by the man is

(A) 980 J
(B) 19600 J
(C) 7840 J
(D) 20000 J

7. In a Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen, when light of wavelength 600 nm is used. If the wavelength of the light is changed to 400 nm, the number of fringes observed in the same segment of the screen is given by

(A) 12
(B) 18
(C) 24
(D) 30

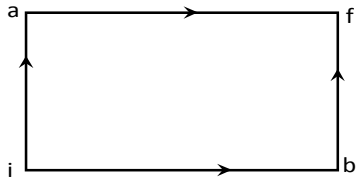
8. A U tube contains water and spirit separated by mercury. The mercury columns in the two arms are in level with 10 cm of water in one arm and 12.5 cm of spirit in the other. Then the relative density of the spirit is

(A) 0.8
(B) 0.9
(C) 1
(D) 1.12

9. Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Lengths of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all temperatures, which one of the following relations holds good?

(A) $\alpha_1 l_1 = \alpha_2 l_2$
(B) $\alpha_1 l_2 = \alpha_2 l_1$
(C) $\alpha_1^2 l_1 = \alpha_2^2 l_2$
(D) $\alpha_1 l_1^2 = \alpha_2 l_2^2$

10. When a system is taken from state *i* to state *f* along the path *iaf*, it is found that $Q = 50$ cal and $W = 20$ cal. Along the path *ibf*, if $Q = 36$ cal, work done along the path *ibf* is



(A) 16 cal
(B) 66 cal
(C) 14 cal
(D) 6 cal

11. If the mass of a gas molecule be *m*, then the root mean square speed of the gas molecule at temperature *T* will be

(A) $\sqrt{\frac{3kT}{m}}$

(B) $\sqrt{\frac{2kT}{m}}$

(C) $\sqrt{\frac{8kT}{m\pi}}$

(D) $\sqrt{\frac{m}{3kT}}$

12. When a vibrating tuning fork is placed vertically on a table, then the vibrations in the table board will be

(A) free vibrations
(B) forced vibrations
(C) resonant vibrations
(D) maintained vibrations

13. When sound waves travel in any gaseous medium then at any point of the medium, process is

(A) isothermal
(B) isobaric
(C) adiabatic
(D) isochoric

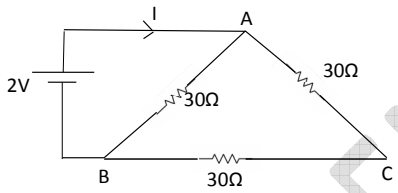
14. The slope of the time-speed graph gives

(A) velocity of the body
(B) distance travelled by the body
(C) acceleration of the body
(D) direction of motion

15. An electric field $\vec{E} = 25\hat{\imath} + 30\hat{\jmath}$ N/C exists in a region of space. If the potential at the origin is taken to be zero, then the potential at x = 2 m, y = 2 m is

(A) −110 V
(B) −140 V
(C) −120 V
(D) −130 V

16. The value of the current I in the circuit is



(A) 0.1 A
(B) 1 A
(C) 2 A
(D) 0.3 A

17. In a potentiometer arrangement, a cell of emf 1.5 V gives a balance point at 27 cm length of wire. If the cell is replaced by another cell and balance point shifts to 54 cm, the emf of the second cell is

(A) 3 V
(B) 1.5 V
(C) 0.75 V
(D) 2.25 V

18. The specific resistance of a conductor increases with

(A) increase in temperature
(B) increase in cross sectional area
(C) decrease in length
(D) decrease in cross sectional area

19. For a monoatomic gas, the adiabatic relation between pressure P and volume V is

(A) PV = constant

(B) $PV^{\frac{5}{3}}$ = constant

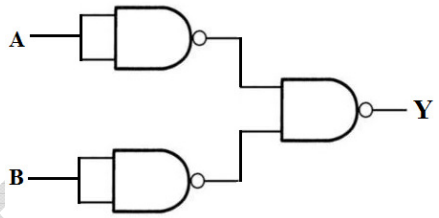
(C) $PV^{\frac{7}{5}}$ = constant

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

20. A charged particle is moving along a magnetic field line. The magnetic force on the particle is

(A) along its velocity
(B) opposite to its velocity
(C) perpendicular to its velocity
(D) zero

21. The given combination of logic gates represents the following gate



(A) OR
(B) XOR
(C) NAND
(D) NOR

22. The K_α line from molybdenum (atomic number = 42) has a wavelength of 0.7078Å. The wavelength of K_α line of zinc (atomic number = 30) will be

(A) 1 Å
(B) 1.3872 Å
(C) 0.3541 Å
(D) 0.5 Å

23. According to uncertainty principle for an electron, time measurement will become uncertain if …….. is measured with high certainty.

(A) Energy
(B) Position
(C) Momentum
(D) Velocity

24. How much work is required to carry a 6 μC charge from the negative to the positive terminal of a 9 V battery?

(A) 54×10^{-3} J
(B) 54×10^{-6} J
(C) 54×10^{-9} J
(D) 54×10^{-12} J

25. The ratio of resolving powers of an optical microscope for two wavelengths $\lambda_1 = 4000$ Å and $\lambda_2 = 6000$ Å is

(A) 8 : 27
(B) 9 : 4
(C) 3 : 2
(D) 16 : 81

26. The core of transformer is laminated to

(A) prevent it from moisture
(B) prevent it from noise
(C) prevent it from heat
(D) reduce the loss of energy

27. The density of a material in the shape of a cube is determined by measuring three sides of the cube and its mass. If the relative errors in measuring the mass and length are respectively 1.5% and 1%, the maximum error in determining the density is

(A) 2.5%
(B) 3.5%
(C) 4.5%
(D) 6%

28. Given $S = a + bt + ct^2$, if S is measured in metres and t in seconds. The unit of c is

(A) m^2s
(B) m
(C) ms^{-1}
(D) ms^{-2}

29. Two cars A and B move in the same direction with velocities $V_A = 20\,\boldsymbol{i}$ m/s and $V_B = 15\,\boldsymbol{i}$ m/s. Then the relative velocity of A with respect to B is

(A) $35\,\boldsymbol{i}$ m/s
(B) $5\,\boldsymbol{i}$ m/s
(C) $35\,\boldsymbol{j}$ m/s
(D) $5\,\boldsymbol{j}$ m/s

30. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 s and the velocity of the wave is 300 m/s. What is the phase difference between the oscillations of two points?

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

31. A particle moves in xy-plane with coordinates given by $x = a \sin \omega t$ and $y = a \cos \omega t$. The particle follows

(A) an elliptical path
(B) a circular path
(C) a parabolic path
(D) a straight-line path inclined equally to x and y-axis

32. The resistance of a wire is R. It is bent at the middle by 180° and both the ends are twisted together to make a shorter wire. Then the resistance of the new wire is

(A) $2R$

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

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

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

33. The maximum power dissipated in an external resistance R, when connected to a cell of emf E and internal resistance r will be

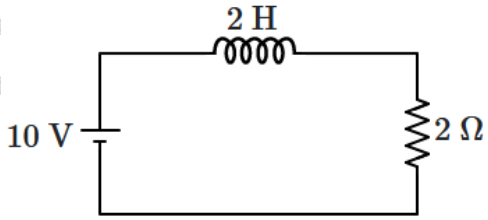
(A) $\frac{E^2}{r}$

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

(C) $\frac{E^2}{3r}$

(D) $\frac{E^2}{4r}$

34. What is the magnetic energy stored in the coil of the circuit below?



(A) Zero
(B) Infinite
(C) 25 J
(D) 50 J

35. A circular coil carrying a certain current produces a magnetic field B_o at its centre. The coil is now rewound so as to have 3 turns and the same current is passed through it. The new magnetic field at the centre is

(A) $3\,B_o$

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

(C) $9\,B_o$

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

36. An electron makes a transition from orbit $n = 4$ to orbit $n = 2$ of a hydrogen atom. The wave number of the emitted radiation is (R = Rydberg constant)

(A) $\frac{16}{3R}$

(B) $\frac{3R}{16}$

(C) $\frac{2R}{16}$

(D) $\frac{4R}{16}$

37. A radioactive nucleus undergoes a series of decay process represented by the scheme below:

$$A\,(\alpha-\text{decay}) \rightarrow A_1\,(\beta-\text{decay}) \rightarrow A_2\,(\alpha-\text{decay}) \rightarrow A_3\,(\gamma-\text{decay}) \rightarrow A_4$$

If the mass number and atomic number of A are 180 and 72 respectively, then what are these numbers for A_4 ?

(A) 172 and 69
(B) 174 and 70
(C) 176 and 69
(D) 176 and 70

38. Hydrogen atom is excited from ground state to another state with principal quantum number equal to 4. Then the number of spectral lines in the emission spectra will be

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

39. In any fission process, ratio of mass of daughter nucleus to mass of parent nucleus is

(A) less than 1
(B) greater than1
(C) equal to 1
(D) depends on the mass of parent nucleus

40. A screw gauge gives the following readings when used to measure the diameter of a wire.

Main scale reading : 0 mm, Circular scale reading : 52 divisions

Given that, 1 mm on main scale corresponds to 100 divisions on the circular scale. The diameter of the wire from the above data is

(A) 0.52 cm
(B) 0.026 cm
(C) 0.26 cm
(D) 0.052 cm

41. A train of 150 m length is going towards North direction at a speed of 10 m/s. A parrot flies at the speed of 5 m/s towards South direction parallel to the railways track. The time taken by the parrot to cross the train is

(A) 12 s
(B) 8 s
(C) 15 s
(D) 10 s

42. A person standing on the floor of an elevator drops a coin. The coin reaches the floor in time t_1 if the elevator is at rest and in time t_2 if the elevator is moving uniformly. Then which of the following option is correct?

(A) $t_1 < t_2$ or $t_1 > t_2$ depending upon whether the lift is going up or down
(B) $t_1 < t_2$
(C) $t_1 > t_2$
(D) $t_1 = t_2$

43. When a block of mass M is suspended by a long wire of length L, the length of the wire becomes $(L + l)$. The elastic potential energy stored in the extended wire is

(A) MgL

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

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

(D) Mgl

44. A liquid does not wet the solid surface if angle of contact is

(A) equal to 45°
(B) equal to 60°
(C) greater than 90°
(D) zero

45. Three liquids of densities ρ_1, ρ_2 and ρ_3 (with $\rho_1 > \rho_2 > \rho_3$), having the same value of surface tension T, rise to the same height in three identical capillaries. The angles of contact θ_1, θ_2 and θ_3 obey

(A) $\frac{\pi}{2} > \theta_1 > \theta_2 > \theta_3 \geq 0$

(B) $0 \leq \theta_1 < \theta_2 < \theta_3 < \frac{\pi}{2}$

(C) $\frac{\pi}{2} < \theta_1 < \theta_2 < \theta_3 < \pi$

(D) $\pi > \theta_1 > \theta_2 > \theta_3 > \frac{\pi}{2}$

46. A 4 μF capacitor is charged to 400 V and then its plates are joined through a resistance of 1 kΩ. The heat produced in the resistance is

(A) 0.16 J
(B) 1.28 J
(C) 0.64 J
(D) 0.32 J

47. The color code of a resistance is given below. The values of resistance and tolerance respectively, are

(A) 47 kΩ, 10%
(B) 4.7 kΩ, 5%
(C) 470 Ω, 5%
(D) 470 kΩ, 5%

48. Light with an average flux of 20 W/cm^2 falls on a non-reflecting surface at normal incidence having surface area 20 cm^2. The energy received by the surface during time span of 1 minutes is

(A) 16×10^3 J
(B) 24×10^3 J
(C) 48×10^3 J
(D) 12×10^3 J

49. Out of the following options which one can be used to produce a propagating electromagnetic wave?

(A) A stationary charge
(B) A chargeless particle
(C) An accelerating charge
(D) A charge moving at constant velocity

50. For which one of the following, Bohr model is not valid?

(A) Singly ionised helium atom (He^+)
(B) Deuteron atom
(C) Singly ionised neon atom (Ne^+)
(D) Hydrogen atom

51. The ratio of wavelengths of the last line of Balmer series and the last line of Lyman series is

(A) 2
(B) 1
(C) 4
(D) 0.5

52. A rod is measured to have a length of 5.6 cm using a ruler with the smallest division of 0.1 cm. Calculate the percentage of error in the measurement.

(A) 1.79%
(B) 2.80%
(C) 0.79%
(D) 3.10%

53. A bicycle starts from rest and accelerates at 1.5 m/s^2 for 4 seconds. Find the total distance covered by the bicycle.

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

54. Which among the following forces is a contact force?

(A) Gravitational force
(B) Magnetic force
(C) Frictional force
(D) Electrostatic force

55. A body moves in a circular path with constant speed. Which of the following statements is true?

(A) Work is done by centrifugal force
(B) Work done by the net force is zero
(C) Kinetic energy of the body changes
(D) Velocity of the body remains constant

56. A series of LCR circuit driven by 300 V at a frequency of 50 Hz contains a resistance R = 3 kΩ, an inductor of inductive reactance $X_L = 250\ \pi\ \Omega$ and an unknown capacitor. The value of capacitance to maximize the average power should be (take $\pi^2 = 10$)

(A) 400 μF
(B) 4 μF
(C) 40 μF
(D) 25 μF

57. Which is the correct ascending order of wavelengths ?

(A) $\lambda_{visible} < \lambda_{X\text{-}ray} < \lambda_{gamma\text{-}ray} < \lambda_{microwave}$
(B) $\lambda_{gamma\text{-}ray} < \lambda_{X\text{-}ray} < \lambda_{visible} < \lambda_{microwave}$
(C) $\lambda_{X\text{-}ray} < \lambda_{gamma\text{-}ray} < \lambda_{visible} < \lambda_{microwave}$
(D) $\lambda_{microwave} < \lambda_{visible} < \lambda_{gamma\text{-}ray} < \lambda_{X\text{-}ray}$

58. Two coherent sources produce waves of different intensities which interfere. After interference, the ratio of the maximum intensity to the minimum intensity is 16. The intensity of waves is in the ratio

(A) 4 : 1
(B) 25 : 9
(C) 16 : 9
(D) 5 : 3

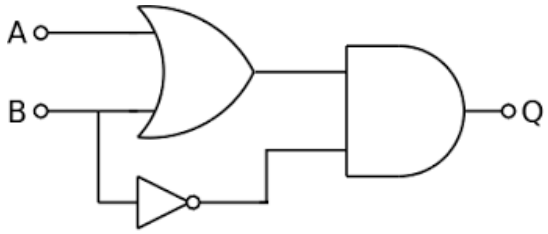
59. A hydrogen atom, initially in the ground state is excited by absorbing a photon of wavelength 980 Å. The radius of the atom in the excited state, in terms of Bohr radius a_0, will be (h_c = 12500 eV-Å)

(A) 9 a_0
(B) 25 a_0
(C) 4 a_0
(D) 16 a_0

60. The current voltage relation of diode is given by $I = (e^{1000VT} - 1)$ mA, where the applied voltage V is in volts and the temperature T is in degree Kelvin. If a student makes an error measuring ± 0.01 V while measuring the current of 5 mA at 300 K, what will be the error in the value of current on mA ?

(A) 0.5 mA
(B) 0.05 mA
(C) 0.2 mA
(D) 0.02 mA

61. Which one of the following will be the output of the given circuit ?



(A) NOR Gate
(B) NAND Gate
(C) AND Gate
(D) XOR Gate

62. Two identical thin metal plates has charge q_1 and q_2 respectively such that $q_1 > q_2$. The plates were brought close to each other to form a parallel plate capacitor of capacitance C . The potential difference between them is

(A) $\frac{(q_1 + q_2)}{C}$

(B) $\frac{(q_1 - q_2)}{C}$

(C) $\frac{(q_1 - q_2)}{2C}$

(D) $\frac{2(q_1 - q_2)}{C}$

63. A cell of emf 90 V is connected across series combination of two resistors each of 100 Ω resistance. A voltmeter of resistance 400 Ω is used to measure the potential difference across each resistor. The reading of the voltmeter will be

(A) 45 V
(B) 40 V
(C) 80 V
(D) 90 V

64. Ratio of thermal energy released in two resistor R and $3R$ connected in parallel in an electric circuit is

(A) 3 : 1
(B) 1 : 1
(C) 1 : 3
(D) 1 : 27

65. A moving coil galvanometer has a coil with 175 turns and area 1 cm^2. It uses a torsion band of torsion constant 10^{-6} N-m/rad. The coil is placed in a magnetic field B parallel to its plane. The coil deflect by 1° for a current of 1 mA. The value of B (in Tesla) is approximately

(A) 10^{-3}
(B) 10^{-1}
(C) 10^{-4}
(D) 10^{-2}

66. An AC circuit has R = 100 Ω, C = 2 μF and L= 80 mH, connected in series. The quality factor of the circuit is

(A) 0.5
(B) 2
(C) 20
(D) 400

67. A block of mass 5 kg is placed at rest and a table of rough surface. Now, if a force of 30 N is applied in the direction parallel to surface of the table, the block slides through a distance of 50 m in an interval of time 10 s. Coefficient of kinetic friction is (given, g = 10 ms^{-2})

(A) 0.60
(B) 0.75
(C) 0.50
(D) 0.25

68. A body of mass 0.5 kg travels on straight line with path velocity v = ($3x^2$ + 4) m/s. The net work done by the force during its displacement from x = 0 to x = 2 m is

(A) 64 J
(B) 60 J
(C) 120 J
(D) 128 J

69. A system consists of two identical spheres each of mass 1.5 kg and radius 50 cm at the ends of a light rod. The distance between the centres of the two spheres is 5 m. What will be the moment of inertia of the system about an axis perpendicular to the rod passing through its midpoint ?

(A) 1.905×10^{-5} kgm^2
(B) 18.75×10^{-5} kgm^2
(C) 19.05 kgm^2
(D) 1.875×10^{-5} kgm^2

70. A steel wire having a radius of 2.0 mm, carrying a load of 4 kg, is hanging from ceiling. Given that $g = 3.1\ \pi \text{ms}^{-2}$, what will be the tensile stress that would be developed in the wire ?

(A) 4.8×10^6 Nm^{-2}
(B) 5.2×10^6 Nm^{-2}
(C) 6.2×10^6 Nm^{-2}
(D) 3.1×10^6 Nm^{-2}

71. A hollow spherical shell of outer radius R floats just submerged under the water surface. The inner radius of the shell is r. If the specific gravity of the shell material is $\frac{27}{8}$ with respect to water, the value of r is

(A) $\frac{4}{9}R$
(B) $\frac{8}{9}R$
(C) $\frac{1}{3}R$
(D) $\frac{2}{3}R$

72. In the wave equation, $Y = 0.5 \sin\frac{2\pi}{\lambda}(400t - x)$ the velocity of wave will be

(A) 200 m/s
(B) $200\sqrt{2}$ m/s
(C) 400 m/s
(D) $400\sqrt{2}$ m/s

73. Two point charges Q each are placed at a distance d apart. A third point charge q is placed at a distance x from mid-point on the perpendicular bisector. The value of x at which charge q will be experience the maximum coulomb's force is

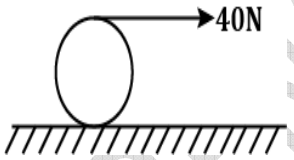
(A) $x = d$

(B) $x = \frac{d}{2}$

(C) $x = \frac{d}{\sqrt{2}}$

(D) $x = \frac{d}{2\sqrt{2}}$

74. A string is wound around a hollow cylinder of mass 5 kg and radius 0.5 m. If the string is now pulled with a horizontal force of 40 N, and the cylinder is rolling without slipping on a horizontal surface (see the figure) then the angular acceleration of the cylinder will be (neglect the mass and thickness of the string)



(A) 12 rad/s^2
(B) 16 rad/s^2
(C) 10 rad/s^2
(D) 20 rad/s^2

75. Convert a velocity of 72 kmh^{-1} into ms^{-1} with the help of dimensional analysis.

(A) 20 ms^{-1}
(B) 40 ms^{-1}
(C) 100 ms^{-1}
(D) 200 ms^{-1}

76. From the following thermochemical data provided,the enthalpy of formation of $CH_4(g)$ from graphite and $H_2(g)$ is …….

$CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(l)$; ΔH = -890.3 kJ/mol ……(i)
$C(graphite) + O_2(g) \rightarrow CO_2(g)$; ΔH = -393.5 kJ/mol ……..(ii)
$H_2(g) + ½\ O_2(g) \rightarrow H_2O(l)$; ΔH = -285.8 kJ/mol ……(iii)

(A) –75 kJ/mol
(B) +75 kJ/mol
(C) –175 kJ/mol
(D) +175 kJ/mol

77. The heat of combustion of liquid toluene (C_7H_8) at 298 K and 1 atm pressure is $-3910.3\ kJ.mol^{-1}$.

$C_7H_8\ (g) + 9O_2\ (g) \rightarrow 7(CO_2) + 4\ H_2O$ ($\Delta H = -3910.3\ kJ.mol^{-1}$)

How much heat energy will be evolved when 46 g of toluene is burnt in an open container? (1 Cal = 4.1 J)

(A) 106 kCal
(B) 238 kCal
(C) 477 kCal
(D) 954 kCal

78. For a general chemical reaction aA + bB⇌cC + dD, If the equilibrium constant is K. Then equilibrium constant for the reaction 2aA + 2bB ⇌2cC + 2dD will be

(A) 2K
(B) K
(C) K^2
(D) K/2

79. The formation of carbon monoxide from coal is shown by the equation

$C(s)+H_2O(g) \rightleftharpoons CO(g)+H_2(g)$

The wrong statement about the chemical equilibria of the reaction is

I As concentration of water increases, quantity of Hydrogen will increase
II Addition of CO will decrease the amount of Hydrogen
III By increasing the pressure, the reaction proceeds in forward direction
IV Quantity of CO remains unchanged by the addition of coal into the system

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

80. Consider the endothermic forward reaction of gas-phase water splitting as shown below,
$2H_2O\ (g) \rightleftharpoons 2H_2\ (g) + O_2\ (g)$

Which of the following step will decrease the amount of water in the equilibrium condition?

(A) Adding more O_2 into the reaction system
(B) Introduction of inert He-atmosphere for the reaction
(C) Decreasing the total volume of the container
(D) Increasing temperature at constant pressure

81. The mole fraction of 10 moles of Glucose in water solution is 0.50. The volume of water taken for dissolving glucose is

(A) 9 mL
(B) 18 mL
(C) 90 mL
(D) 180 mL

82. The standard reduction potentials of $Cr_2O_7^{2-}/Cr^{3+}$ and Cr^{3+}/Cr are 1.33 and 0.74 V respectively. The reduction potential of $Cr_2O_7^{2-}/Cr$ is

(A) 2.07 V
(B) 1.77 V
(C) 1.33 V
(D) 0.59 V

83. The molar conductivities at infinite dilution for the strong electrolytes NH_4Cl, NaOH and NaCl are respectively 149.7 $\Omega^{-1}cm^2mol^{-1}$, 248.1 $\Omega^{-1}cm^2mol^{-1}$ and 126.5 $\Omega^{-1}cm^2mol^{-1}$. The molar conductivity of NH_4OH at infinite dilution is

(A) 271.3 $\Omega^{-1}cm^2mol^{-1}$
(B) 224.9 $\Omega^{-1}cm^2mol^{-1}$
(C) 177.8 $\Omega^{-1}cm^2mol^{-1}$
(D) 28.1 $\Omega^{-1}cm^2mol^{-1}$

84. Rate of chemical reactions in solution do not depend to a great extend upon

(A) Pressure
(B) Temperature
(C) Concentration
(D) Catalyst

85. The decomposition of carbon disulfide, (CS_2), to carbonmonosulfide (CS), and sulfur is first order with $k = 2.8 \times 10^{-7}$ s^{-1} at 1000°C

$CS_2 \rightarrow CS + S$

The half-life of this reaction at 1000°C is

(A) 5.0×10^7 s
(B) 2.5×10^6 s
(C) 3.8×10^5 s
(D) 6.1×10^4 s

86. $\Psi^2=0$ represents

(A) A node
(B) An orbital
(C) Angular wave function
(D) Wave function

87. The position of both an electron and helium atom is known within 1.0 nm. The momentum of the electron is known within 5.0×10^{-26}kg ms^{-1}. The minimum uncertainty in the measurement of the momentum of the helium atom is

(A) 7.0×10^{-26}kg ms^{-1}
(B) 5.0×10^{-26}kg ms^{-1}
(C) 8.0×10^{-26}kg ms^{-1}
(D) 6.0×10^{-26}kg ms^{-1}

88. For a chemical reaction $A \rightarrow B$, it is found that the rate of the reaction quadruples when the concentration of A is doubled. The rate expression for the reaction is, rate = k $[A]^n$ where the value of n is

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

89. Which of the following is dependent on temperature?

(A) Mole fraction
(B) Molality
(C) Weight percentage
(D) Molarity

90. The solubility products of $Al(OH)_3$ and $Zn(OH)_2$ are 8.5×10^{-23} and 1.8×10^{-14} respectively. If NH_4OH is added to a solution containing Al^{3+} and Zn^{2+} ions, then substance precipitated first is

(A) $Al(OH)_3$
(B) $Zn(OH)_2$
(C) Both together
(D) No precipitate is formed

91. If 75% of a first order reaction was completed in 60 minutes, 50% of the same reaction under the same conditions would be completed in

(A) 20 minutes
(B) 30 minutes
(C) 35 minutes
(D) 75 minutes

92. Radioactive disintegration is an example of

(A) zero order reaction
(B) first order reaction
(C) second order reaction
(D) third order reaction

93. The e.m.f. of the cell Zn/Zn^{2+} (0.01 M) || Fe^{2+} (0.001 M) Fe at 298 K is 0.2905 volt. Then the value of equilibrium constant for the cell reaction is

(A) 10
(B) 10^{10}
(C) $\frac{1}{10}$
(D) $\frac{1}{10^{10}}$

94. Henry's law constant for molality of methane ib benzene at 298 K is 4.27×10^5 mm Hg. The mole fraction of methane in benzene at 298 K under 760 mm Hg is

(A) 1.78×10^{-3}
(B) 0.174
(C) 0.114
(D) 0.281

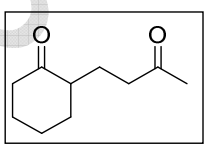
95. What is the effect of Frenkel defect on the density of ionic solids?

(A) The density of the crystal increases
(B) The density of the crystal decreases
(C) The density of the crystal remains unchanged
(D) There is no relationship between density of a crystal and defect present in it

96. Most acidic proton among the highlighted protons of **H**OC**H**$_2$CH_2C**H**$_2$C≡C**H** is

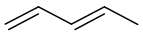
(A) C≡C**H**
(B) HOC**H**$_2$
(C) **H**OCH_2
(D) C**H**$_2$C≡CH

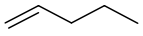
97. Correct IUPAC nomenclature for the following is

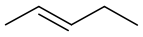


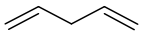
(A) 2-butan-(2-cyclohexanone) ketone
(B) 2-(3-oxobutyl)cyclohexanone
(C) 2-(2-oxobutyl)cyclohexanone
(D) 2-oxobutan-2-cyclohexanone

98. Identify the Hoffmann elimination product formed when 2-bromopentane reacts with sodium *tert*-butoxide in *tert*-butanol.

(A) 

(B) 

(C) 

(D) 

99. Identify the product formed in each case - when an alkyne C_3H_4 reacts with:

(i) $Hg(OAc)_2/H_2O$; $NaBH_4$,

(ii) BH_3; H_2O_2/OH^-

(A) (i) acetone (ii) propionaldehyde
(B) (i) propionaldehyde (ii) acetone
(C) (i) ethanol (ii) propionaldehyde
(D) (i) ethanol (ii) acetone

100. What products among below are formed by reaction of buta-1,3-diene with HCl (1 equivalent)?

(A) i only
(B) i and iv
(C) i and ii
(D) i and iii

101. Acetophenone reacts with iodine - KI solution and aqueous NaOH to give yellow solid P, which can be removed by filtration. The filtrate when acidified with HCl produces a white precipitate of compound Q. Identify P and Q.

(A) PhCHO and $PhCO_2H$
(B) CHI_3 and PhCHO
(C) CHI_3 and $PhCO_2H$
(D) CH_3I and $PhCOCO_2H$

102. Which among $MgBr_2$, $(CH_3)_3P$, CH_3CH_2OH and $(CH_3)_2NH$ can act as both Lewis acid and Lewis base?

(A) $MgBr_2$
(B) $(CH_3)_2NH$
(C) CH_3CH_2OH
(D) $(CH_3)_3P$

103. An aminoacid containing sulphur atom is:

(A) Valine
(B) Serine
(C) Lysine
(D) Cysteine

104. The hybridization of N in $(C_2H_5)_3N$ and its CNC bond angle are:

(A) sp^2, >109.5°
(B) sp^2, <109.5°
(C) sp^3, >109.5°
(D) sp^3,<109.5°

105. Which of the following is also known as Schiff base?

(A) imine
(B) cyanohydrin
(C) lithium hydroxide
(D) sodamide

106. A monomer of polyurethane is

(A) diisocyanate
(B) diisocyanide
(C) diamine
(D) dicarboxylic acid

107. Hydrolysis of sucrose yields

(A) glucose + maltose
(B) glucose + fructose
(C) glucose + galactose
(D) maltose + fructose

108. Oxidation of cyclohexene yields a dicarboxylic acid **G** which is a monomer for a polyamide polymer**.** Identify the oxidizing agent.

(A) OsO_4,NaOH
(B) O_3, Me_2S
(C) O_3, H_2O_2
(D) O_3, $NaBH_4$

109. Carbonyl carbon in which of the following compounds are in the same oxidation level?

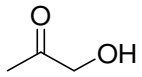
CH_3COOH, CH_3CHO, CH_3COCl, CH_3CONH_2

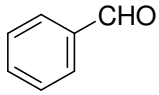
(A) CH_3COOH and CH_3CHO
(B) CH_3COOH, CH_3CHO and CH_3COCl
(C) All four
(D) CH_3COOH, CH_3COCl and CH_3CONH_2

110. The deficiency of which of the following vitamins causes scurvy?

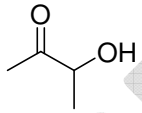
(A) Vitamin A
(B) Vitamin B
(C) Vitamin C
(D) Vitamin D

111. Which among following compounds test negative with Tollens reagent?

(A) 

(B) 

(C) 

(D) 

112. Cyclic trimer of formaldehyde is

(A) paraformaldehyde
(B) paraldehyde
(C) 1,3,5-trioxane
(D) bakelite

113. 1-Bromo-2-methylpropane is treated sequentially with i) Mg, Et_2O ii) CO_2, iii) H_3O^+. What is the product formed?

(A) 2-methylpropanoic acid
(B) 2-methylbutanoic acid
(C) 3-methylpropanoic acid
(D) 3-methylbutanoic acid

114. Under normal conditions, which of the following reactions is unsuccessful with benzaldehyde?

(A) Oxidation with Fehling's reagent
(B) Cannizaro reaction
(C) Aldol condensation
(D) Benzoin condensation

115. Benzene reacting with CH_3COCl + anhydrous $AlCl_3$ to give acetophenone is an example for

(A) Aromatic nuceleophilic substitution
(B) Lewis acid catalyzed addition
(C) Hunsdiecker reaction
(D) Aromatic electrophilic substitution

116. An element X has the following isotopic composition of ^{200}X :90% ^{199}X : 8% ^{202}X : 2% . X's weighted average atomic mass is most similar to

(A) 201 amu
(B) 202 amu
(C) 199 amu
(D) 200 amu

117. With a density of 1.80 g ml^{-1}, concentrated aqueous sulfuric acid is 98% H_2SO_4 by mass. Acid volume needed to produce one liter of 0.1 M H_2SO_4 is

(A) 5.55 ml
(B) 11.10 ml
(C) 16.65 ml
(D) 22.20 ml

118. If an electron's energy in the ground state of a hydrogen atom is -x eV, then energy in the second excited state of He^+ is

(A) -x eV
(B) -4/9 x eV
(C) +2 eV
(D) -9/4 x eV

119. Which combination of quantum numbers n, l, m and s for the electron in the atom does not provide permissible solution of wave equation?

(A) 3,2,-2,1/2
(B) 3,3,1,-1/2
(C) 3, 2, 1, ½
(D) 3,1,1,1/2

120. Which of the following is not true for covalent molecules?

(A) They may exhibit isomerism
(B) They have low melting and boiling points
(C) They show ionic reactions
(D) They show molecular reactions

121. Which of the following chemical species pairs has ions with the same central atom hybridization?

(A) $NO_2^-$and NH_2^-
(B) NO_2^- and NO_3^-
(C) NH_4^+ and NO_3^-
(D) SCN^- and NH_2^-

122. Which of the following species contains equal number of σ- and π- bonds?

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

123. Which of the following pairs of ions are isoelectronic and isostructural?

(A) ClO_3^-, SO_3^{2-}
(B) CO_3^{2-}, SO_3^{2-}
(C) ClO_3^-, CO_3^{2-}
(D) SO_3^{2-}, NO_3^-

124. What percent of a sample of nitrogen must be allowed to escape if its temperature, pressure and volume are to be changed from 220°C, 3 atmand 1.65 litre to 110℃, 0.7 atm and 1.00 litre respectively?

(A) 81.8%
(B) 71.8%
(C) 76.8%
(D) 86.8%

125. At room temperature, which of the following gaseous mixtures defies Dalton's law of partial pressure?

(A) NO_2 and O_2
(B) NH_3 and HCl
(C) CO and CO_2
(D) SO_2 and SO_3

126. The partial pressure of hydrogen in a flask containing 2g H_2 and 32g SO_2 is

(A) $1/16^{th}$ of total pressure
(B) $1/9^{th}$ of total pressure
(C) $2/3^{rd}$ of total pressure
(D) $1/8^{th}$ of total pressure

127. The mixture of three gases X, Y, and Z is enclosed in closed vessel at constant temperature. Molecular weight of X is highest and that of Y is the least. When equilibrium is established the

(A) Gas X will be more at bottom
(B) Gas Y will be more at top
(C) Gases X, Y and Z homogeneously present
(D) Gas Y will be more at bottom

128. Pd has exceptional electronic configuration of $4d^{10}5s^0$.It belongs to

(A) Period 4, group 11
(B) Period 5, group 10
(C) Period 6, group 9
(D) Period 3, group 16

129. Which one of them is expected to have highest third ionization energy?

(A) Vanadium
(B) Chromium
(C) Manganese
(D) Iron

130. Which one the following pairs of substances on reaction will not evolve H_2 gas?

(A) copper and HCl
(B) iron and steam
(C) iron and sulphuric acid
(D) sodium and ethyl alcohol

131. Hydrogen can be used to form helium at

(A) High temperature and high pressure
(B) High temperature and low pressure
(C) Low temperature and high pressure
(D) Low temperature and low pressure

132. Which of these produces oxide when heated vigorously?

(A) $LiNO_3$
(B) $NaNO_3$
(C) KNO_3
(D) $RbNO_3$

133. Which of the statement is incorrect?

(A) Aluminium reacts with excess NaOH to give $Al(OH)_3$
(B) $NaHCO_3$ on heating gives Na_2CO_3
(C) Pure sodium metal dissolves in liquid ammonia to give blue solution
(D) NaOH reacts with glass to give sodium silicate

134. Which of the following alkaline earth metal sulphates has hydration enthalpy higher than the lattice energy?

(A) $CaSO_4$
(B) $BeSO_4$
(C) $BaSO_4$
(D) $SrSO_4$

135. Which of the following oxides is not expected to react with NaOH?

(A) CaO
(B) SiO_2
(C) BeO
(D) B_2O_3

136. Let $f:[0,\infty)\to\mathbb{R}$ be defined by $f(x)=\sqrt{x}$. Then

(A) f is one-one
(B) f is onto
(C) f is both one-one and onto
(D) f is neither one-one nor onto

137. The number of asymptotes of $\tan^{-1}x$ is

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

138. The number of possible orders of a matrix with 10 elements is

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

139. The possible values of x that satisfies the equation $\begin{vmatrix} x-1 & x & x+2 \\ 0 & x-3 & 3 \\ 0 & 0 & x-5 \end{vmatrix} = 0$ are

(A) 1, 2, 3
(B) 3, 4, 6
(C) 2, 5, 7
(D) 1, 3, 5

140. Let $f : \mathbb{R} \to \mathbb{R}$ be defined by $f(x) = \frac{|x|}{x}$, $x \neq 0$. Then

(A) f is continuous in $[0, \infty)$

(B) f is continuous

(C) f is continuous in $(-1, 1)$

(D) f is not continuous in $(-\infty, 0]$

141. If a die shows an even number, then the probability of getting 4 is

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

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

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

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

142. $\frac{d}{dx}\left(\frac{2}{\pi}\sin x°\right) =$

(A) $\frac{2}{\pi}\cos x°$

(B) $\frac{\pi}{180}\cos x°$

(C) $\frac{\pi}{90}\cos x°$

(D) $\frac{1}{90}\cos x°$

143. The local minimum of the function $f(x) = x^3 - 18x$ is attained at $x =$

(A) -3
(B) 27
(C) 3
(D) -27

144. Let $S = \{x \in \mathbb{R} \mid \tan x = x\}$. Then $|S|$ is

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

145. The value of $\int_0^1 x(1+x)^{88}\,dx$ is

(A) 0

(B) $\frac{1}{8010}$

(C) $-\frac{1}{8010}$

(D) 1

146. The last digit of $M = 1! + 2! + 3! + ... 2025!$ is

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

147. Let M denote set of all matrices of form $\begin{pmatrix} x & x \\ x & x \end{pmatrix}$, $x \in \mathbb{R} \setminus \{0\}$. Then the identity element of M under the matrix multiplication is

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

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

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

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

148. The number of strings which can be formed using the letters of the word 'MATRIX' either starts with A or ends with R, is

(A) 100
(B) 216
(C) 432
(D) 720

149. In a cricket squad of 15 members, only 5 can bowl. From this, a team of 11 members with 4 bowlers has to be selected. The probability for this selection is

(A) $\frac{2}{455}$

(B) $\frac{6}{1365}$

(C) $\frac{40}{91}$

(D) $\frac{54}{91}$

150. The number of ways of arranging the letters of the name EULER is

(A) 24
(B) 10
(C) 120
(D) 60

151. For real numbers a and b, define $a \lozenge b = (a-b)^2$. Then $(x-y)^2 \lozenge (y-x)^2$ is equal to

(A) 0
(B) $2x^2$
(C) $2y^2$
(D) xy

152. A number is palindrome if it remains same when its digits are reversed. A palindrome between 100 and 1000 is chosen at random. The probability that it is divisible by 2 is

(A) $\frac{2}{45}$
(B) $\frac{1}{10}$
(C) $\frac{1}{9}$
(D) $\frac{1}{50}$

153. The number of values of 'a' such that the equation $x^2 + y^2 + 4ax - 2ay + a^2 = 0$ represents a real circle is

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

154. The first three terms of a geometric progression are $\sqrt{2}, \sqrt[3]{2}$ and $\sqrt[6]{2}$. Then the next term is

(A) $\sqrt[9]{2}$
(B) $\sqrt[8]{2}$
(C) $\sqrt[7]{2}$
(D) 1

155. Which of the following is **TRUE**?

(A) There exists two distinct irrational numbers such that their sum is rational
(B) There exists two distinct irrational numbers such that their difference is rational
(C) There exists two distinct irrational numbers such that their product is rational
(D) All the above

156. The angle made by the vector $\vec{i}+\vec{j}+\sqrt{2}\vec{k}$ with z-axis is

(A) 1°
(B) 30°
(C) 45°
(D) 60°

157. Let S be the set of all points at which the function $f(x)=\begin{cases}1, & x \text{ is rational}\\ -1, & x \text{ is irrational}\end{cases}$ is continuous. Then S is equal to

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

158. The number of subsets of $\{2,3,4,5,6,7,8,9\}$ that contains at least one composite number is

(A) 16
(B) 32
(C) 64
(D) 240

159. A straight line through the point (2, 2) intersects the lines $\sqrt{3}x+y=0$ and $\sqrt{3}x-y=0$ at the points A and B. The equation of the line AB so that the ΔOAB is equilateral, is

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

160. The slopes of the lines represented by $x^2 + 6hxy + 3y^2 = 0$ are two tangents to a circle. Then the radius of the circle is

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

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

(C) ± 1

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

161. Suppose a circle passes through (0, 2) and (3, 5) and touches the y-axis at Q. If O is the origin, then OQ is equal to

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

162. Which of the following is **TRUE** ?

(A) Division is a closed binary operation in $\mathbb{Z}$
(B) Division is a closed binary operation in $\mathbb{N}$
(C) Division is a closed binary operation in $\mathbb{R} \setminus \{0\}$
(D) Division is a closed binary operation in $\mathbb{R}$

163. If α, β are the roots of the equation $x^2 - 2x + 4 = 0$, then the value of $\alpha^5 + \beta^5$ is

(A) 32
(B) 64
(C) 128
(D) 256

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

(A) $x^2 + y^2 + 2x + 2y = 0$

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

(C) $x + y + 2 = 0$

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

165. The equation $z\overline{z}+(1-4i)z+(1+4i)\overline{z}+1=0$ represents a circle of radius

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

166. $\log_3 2, \log_6 2, \log_{12} 2$ are in

(A) AP but not in GP
(B) GP but not in AP
(C) HP
(D) Both AP and GP

167. The sum of the series $(1+3)+(1+3+3^2)+(1+3+3^2+3^3)+...$ up to n terms is

(A) $3^{n+2}-n-\frac{3}{4}$

(B) $3^{n+2}-\frac{n}{2}-\frac{3}{4}$

(C) $3^{n+1}-\frac{n}{4}$

(D) $3^{n+1}-1$

168. If $x=3+3^{\frac{1}{3}}+3^{\frac{2}{3}}$, then the value of x^3-9x^2+18x is

(A) 3
(B) 16
(C) 21
(D) 12

169. Number of divisors of the form $4n+2$ $(n\geq 0)$ of the integer 280 is

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

170. If the coefficient of x^3 and x^4 in the expansion of $(4+kx)^7$ are equal, then the value of k is

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

171. The system of linear equations $\begin{matrix} x+2y+z=4 \\ 4x+3y+2z=7 \\ 5x+5y+3z=8 \end{matrix}$ has

(A) infinite number of solutions
(B) exactly 3 solutions
(C) a unique solution
(D) no solution

172. The value of $\begin{vmatrix} 1 & 1 & 1 \\ bc & ca & ab \\ b+c & c+a & a+b \end{vmatrix}$ is

(A) 1
(B) 0
(C) $(a-b)(b-c)(c-a)$
(D) $(a+b)(b+c)(c+a)$

173. $\sum_{m=1}^{\infty} \frac{1}{m!}\left(\sum_{n=1}^{m} 3^{n-1}\right)$ is equal to

(A) e
(B) $\frac{e^3+e}{2}$
(C) e^3
(D) $\frac{e^3-e}{2}$

174. Let $f : \mathbb{R} \to \mathbb{R}$ be a mapping defined by $f(x) = x^3 + 4$. Then f is

(A) bijective
(B) surjective
(C) injective
(D) not bijective

175. Let A and B be the sets of all positive divisors of 400 and 1000 respectively including 1. Then the number of elements in $A \cap B$ is

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

176. If the probability of a defective bolt is 0.1, then the mean and the standard deviation of the distribution of bolts in a total of 400 are respectively

(A) 30, 3
(B) 40, 5
(C) 30, 4
(D) 40, 6

177. The probability that an even number appears on all when throwing three dice simultaneously, is

(A) $\frac{1}{8}$
(B) $\frac{5}{8}$
(C) $\frac{2}{9}$
(D) $\frac{4}{13}$

178. An example of a rational number is

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

179. The quadratic equation whose roots are $\sin^2 18°$ and $\cos^2 36°$, is

(A) $16x^2 - 12x + 1 = 0$
(B) $16x^2 + 12x + 1 = 0$
(C) $16x^2 - 12x - 1 = 0$
(D) $16x^2 + 10x + 1 = 0$

180. In a triangle ABC, if $\angle B = \frac{\pi}{2}$, then $\cos^2 A + \cos^2 C$ is equal to

(A) –2
(B) 1
(C) 2
(D) 0

181. 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) $(3,1),(-7,-11)$

182. The shortest distance between the line $y - x = 1$ and the curve $x = y^2$, is

(A) $\frac{3\sqrt{2}}{8}$
(B) $\frac{2\sqrt{3}}{8}$
(C) $\frac{3\sqrt{2}}{5}$
(D) $\frac{\sqrt{3}}{4}$

183. If $x^x y^y z^z = c$, then $\frac{\partial z}{\partial x}$ is equal to

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

(B) $-\frac{1+\log x}{1+\log z}$

(C) $\frac{1+\log z}{1+\log x}$

(D) $\frac{1-\log z}{1-\log x}$

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

(A) 0

(B) 1

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

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

185. In the interval $(-3, 3)$, the function $f(x) = \frac{x}{3} + \frac{3}{x}$, $x \neq 0$ is

(A) increasing
(B) decreasing
(C) neither increasing nor decreasing
(D) partly increasing and partly decreasing

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

(A) 0

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

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

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

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

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

188. The number of distinct real values of λ, for which the vectors $-\lambda^2\hat{i} + \hat{j} + \hat{k}$, $\hat{i} - \lambda^2\hat{j} + \hat{k}$ and $\hat{i} + \hat{j} - \lambda^2\hat{k}$ are coplanar, is

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

189. If z is a point on the argand plane such that $|z - 1| = 1$, then $\frac{z-2}{z}$ is equal to

(A) $\tan(\arg z)$
(B) $\cot(\arg z)$
(C) $i\tan(\arg z)$
(D) 2

190. If $2 - i$ is a root of the equation $ax^2 + 12x + b - 0$ (where a and b are real), then the value of ab is equal to

(A) 45
(B) 15
(C) –15
(D) –45

191. For $a, b \in R$, the equation $x^2 + (a-b)x + (1-a-b) = 0$ has unequal roots for all values of b. Then

(A) $a < 1$
(B) $a > 1$
(C) $a = 2$
(D) a is real

192. The sum of the last ten coefficients in the expansion of $(1+x)^{19}$ when expanded in ascending powers of x, is

(A) 2^{18}
(B) 2^{19}
(C) 2^{17}
(D) 2^{20}

193. A parents has two children. If one of them is boy, then the probability that the other is, also a boy is

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

194. A function f is such that $f'(a) = f''(a) = f'''(a) = ... = f^{2n}(a) = 0$ and f has a local maximum value b at $x = a$ if $f(x)$ is

(A) $(x-a)^{2n+2}$
(B) $b-1-(x+1-a)^{2n-1}$
(C) $b-(x-a)^{2n+2}$
(D) $(x-a)^{2n+2}-b$

195. The minimum value of $e^{x^4} - x^3 + x^2$ is

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

196. The solution of the differential equation $2x\frac{dy}{dx} - y = 3$ represents

(A) circles
(B) straight lines
(C) ellipses
(D) parabolas

197. A gentle man has 6 friends to invite. In how many ways can he send invitation cards to them, if he has three servants to carry the cards?

(A) 3^6
(B) 6^3
(C) 8
(D) 3^8

198. Define $x \diamond y$ to be $|x - y|$ for all real numbers x and y. The value of $(1 \diamond (2 \diamond 3)) - ((1 \diamond 2) \diamond 3)$ is

(A) −2
(B) −1
(C) 0
(D) 1

199. The number of solutions of $\log_2\left(9-2^x\right) = 10^{\log_{10}(3-x)}$ is

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

200. If a, b, c are distinct positive real numbers and $a^2 + b^2 + c^2 = 1$, then $ab + bc + ca$ is

(A) less than 1
(B) equal to 1
(C) greater than 1
(D) any real number

201. The number of solutions of the equations $\sin\left(\frac{\pi x}{2\sqrt{3}}\right) = x^2 - 2\sqrt{3}x + 4$ is

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

202. For all integers $n \geq 9$, the value of $\frac{(n+2)!-(n+1)!}{n!}$ is always a

(A) multiple of 4
(B) multiple of 10
(C) prime number
(D) perfect square

203. In the value of 100!, the number of zeros at the end, is

(A) 11
(B) 22
(C) 23
(D) 24

204. $\lim_{n \to a}\left[\frac{n}{n^2+1}+\frac{n}{n^2+2}+...+\frac{n}{n^2+n}\right] =$

(A) 0
(B) 1
(C) infinite
(D) does not exist

205. $\int \frac{\left(x+\sqrt{1+x^2}\right)^{15}}{\sqrt{1+x^2}} dx =$

(A) $\frac{\left(x+\sqrt{1+x^2}\right)^{16}}{10}+c$

(B) $\frac{1}{15\sqrt{1+x^2+x}}+c$

(C) $\frac{15}{\sqrt{1+x^2-x}}+c$

(D) $\frac{\left(x+\sqrt{1+x^2}\right)^{15}}{15}+c$

206. The remainder left when $8^{2n}-(62)^{2n+1}$ is divided by 9 is

(A) 0
(B) 2
(C) 7
(D) 8

207. Let $f:R\to R$ be defined by $f(x)=\dfrac{x}{1+x^2}, x\in R,$ then the range of f is

(A) $\left[\dfrac{-1}{2},\dfrac{1}{2}\right]$

(B) $R-[-1,1]$

(C) $R-\left[\dfrac{-1}{2},\dfrac{1}{2}\right]$

(D) $(-1,1)-\{0\}$

208. If $z=x-iy$ and $z^{\frac{1}{3}}=p+iq,$ then $\dfrac{\left(\dfrac{x}{p}+\dfrac{y}{q}\right)}{p^2+q^2}=$

(A) –2
(B) –1
(C) 2
(D) 1

209. If α and β are the coefficients of x^4 and x^2 respectively in the expansion of $\left(x+\sqrt{x^2-1}\right)^6+\left(x-\sqrt{x^2-1}\right)^6,$ then

(A) $\alpha+\beta=60$
(B) $\alpha+\beta=-30$
(C) $\alpha-\beta=60$
(D) $\alpha-\beta=-132$

210. If the circle $x^2+y^2-6x-8y+\left(25-a^2\right)=0$ touches the axis of *x*, then *a* equals to

(A) 0
(B) ±4
(C) ±2
(D) ±3

211. The value of $\tan^{-1}\left(\sin\left(\cos^{-1}\left(\sqrt{\frac{2}{3}}\right)\right)\right)$ is

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

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

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

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

212. The integral $\int \sec^{\frac{2}{3}} x \operatorname{cosec}^{\frac{4}{3}} x \, dx =$

(A) $-3\tan^{\frac{-1}{3}} x + c$

(B) $-\frac{3}{4}\tan^{\frac{-4}{3}} x + c$

(C) $3\cot^{\frac{-1}{3}} x + c$

(D) $3\tan^{\frac{-1}{3}} x + c$

213. If a set *A* has 2 elements and a set *B* has 3 elements, then how many relations from *A* to *B* are possible?

(A) 6
(B) 32
(C) 64
(D) 9

214. The number of real roots of the equation $x^2 + 5|x| + 6 = 0$ is

(A) 4
(B) 3
(C) 2
(D) 0

215. The distance between the straight lines $2x + y + 4 = 0$ and $2x + y + 8 = 0$ is

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

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

(C) $\frac{9}{\sqrt{5}}$

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

216. The ratio in which the line joining $(1,2,3)$ and $(4,5,6)$ divide *xy* plane is

(A) 2

(B) –2

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

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

217. The domain of the function $\cos^{-1}(2x-1)$ is

(A) $[-2,0]$

(B) $[0,2]$

(C) $[1,0]$

(D) $[0,1]$

218. The maximum value of $\left(\frac{1}{x}\right)^x$ is

(A) e

(B) e^e

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

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

219. If $|\vec{a}| = 10, |\vec{b}| = 2$ and $\vec{a} \cdot \vec{b} = 12,$ then the value of $|\vec{a} \times \vec{b}|$ is

(A) 5
(B) 10
(C) 14
(D) 16

220. $\left(\frac{1+i}{\sqrt{2}}\right)^4$ is equal to

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

221. If ω is a cube root of unity, then the value of $(1-\omega^8)(1-\omega^4)(1-\omega^2)(1-\omega)$ is

(A) 1
(B) 9
(C) 0
(D) 6

222. The equation $x\frac{dx}{dy} + y = \alpha$ where α is constant represents a family of

(A) circles
(B) parabolas
(C) hyperbolas
(D) exponential curves

223. The order of the differential equation whose general solution is $y = c_1 \cos 2x + c_2 \cos^2 x + c_3 \sin^2 x + c_4$, is

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

224. If $\int \frac{x+3}{\sqrt{5-4x+x^2}}dx = A\int \frac{(-4-2x)}{\sqrt{5-4x+x^2}}dx + B\int \frac{dx}{\sqrt{5-4x+x^2}};$ then $2A+B$ is

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

(D) -1

225. Let a function $f : N \to N$ be defined by $f(n) = \begin{cases} 2n, & n = 2,4,6,8,... \\ n-1, & n = 3,7,11,15,..., \\ \dfrac{n+1}{2}, & n = 1,5,9,13,... \end{cases}$ then f is

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

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