CUSAT CAT 2023 Question Paper

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

TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT I

PHYSICS UG SHIFT I
(FINAL)

1. In an instrument used for measuring angle, 29 divisions of the main scale exactly coincides with 30 divisions of the Vernier scale. If the smallest division on the main scale is 0.5°, then the least count of the instrument will be

(A) one degree
(B) half minute
(C) half degree
(D) one minute

2. A particle is executing simple harmonic motion from centre with an amplitude A and time period T. Its displacement after $2T$ will be

(A) A
(B) $2A$
(C) $4A$
(D) zero

3. If a spring extends by x on loading, the energy stored in the spring is (T is the tension in the spring and K is the spring constant)

(A) $\frac{T^2}{2K}$
(B) $\frac{2K}{T^2}$
(C) $\frac{T}{2K}$
(D) $\frac{T}{K}$

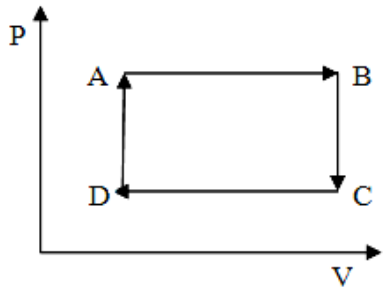
4. A mercury drop does not spread on a glass plate because the angle of contact between glass and mercury is

(A) less than 90°
(B) more than 90°
(C) zero
(D) 90°

5. Water is used as a coolant in engines because

(A) water is a bad conductor of heat
(B) water has low density
(C) water has high specific heat
(D) water is polar solvent

6. In the following P-V diagram for a gas which one of the following is **CORRECT**?



(A) The temperature of the gas will increase as it goes from A to B
(B) The temperature of the gas will increase as it goes from B to C
(C) The temperature of the gas remain constant during these changes
(D) The temperature of the gas decrease as it goes from D to A

7. A swimmer is swimming 10 m below the water surface of a lake. He then experiences a pressure of

(A) 2 atm
(B) 5 atm
(C) 1 atm
(D) 7 atm

8. A capacitor works as a charge storing device in

(A) AC circuits
(B) DC circuits
(C) both AC and DC circuits
(D) None of the above

9. A uniform electric field having a magnitude E_o and direction along the positive X-axis exists. If the potential at a point $x = 0$ is V, then the additional potential at $X = +x$ will be

(A) $+x\,E_o$

(B) $-x\,E_o$

(C) $+x^2E_o$

(D) $-x^2E_o$

10. A small signal AC voltage $V(t) = V_o \sin \omega t$ applied across an ideal capacitor. Then which one of the following is **TRUE**?

(A) Current $I(t)$ leads the voltage $V(t)$ by 90°

(B) Current $I(t)$ lags the voltage $V(t)$ and average power dissipated in the capacitor is zero

(C) Current $I(t)$ is in phase with voltage $V(t)$

(D) Current $I(t)$ leads voltage $V(t)$ by 180°

11. When the mass of the electron becomes equal to three times its rest mass, its speed will become (c = velocity of light)

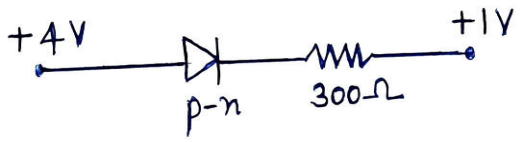
(A) $\frac{2\sqrt{2}}{3}c$

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

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

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

12. In the circuit given below, the value of the current is



(A) Zero

(B) 10^{-2} A

(C) 10^{2} A

(D) 10^{-3} A

13. In Young's double slit experiment, two waves interfere to produce an interference pattern. The third minima of the pattern have a

(A) Phase difference of 3π

(B) Phase difference of $\frac{5\pi}{2}$

(C) Path difference of 3λ

(D) Path difference of $\frac{5\lambda}{2}$

14. If ω_c is the frequency of a carrier wave and ω_m is the frequency of the modulation signal, then the amplitude modulated wave will have frequencies

(A) ω_c and ω_m

(B) ω_c, $\omega_c + \omega_m$ and $\omega_c - \omega_m$

(C) ω_c and $\sqrt{\omega_m \omega_c}$

(D) ω_c and $\omega_c \cdot \omega_m$

15. For a head-on collision of α- particles with a gold nucleus, the impact parameter is

(A) zero

(B) of the order of 10^{-6} m

(C) of the order of 10^{-10} m

(D) of the order of 10^{-14} m

16. The damping force of an oscillator is directly proportional to the velocity. The unit of constant of proportionality is

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

17. A tube closed at one end and filled with air produces when excited; it produces the fundamental note of frequency 512 Hz. If the tube is open at both ends, the fundamental frequency that can be produced is

(A) 128 Hz
(B) 256 Hz
(C) 512 Hz
(D) 1024 Hz

18. A particle covers half of the circle of radius r. The displacement and distance of the particle are, respectively

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

19. An equiconvex lens has a focal length f. If the lens is cut along the line perpendicular to the principal axis and passing through the pole, what will be the focal length of any half part?

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

20. When 40 g of water at 10°C is mixed with 80 g of water at 100°C. The resultant temperature is

(A) 55°C
(B) 60°C
(C) 65°C
(D) 70°C

21. A long thin flat sheet has a uniform surface charge density σ. The magnitude of electric field at a distance r from it is

(A) $\frac{\sigma}{\varepsilon_0}$

(B) $\frac{\sigma}{\varepsilon_0 r}$

(C) $\frac{\sigma}{2\varepsilon_0}$

(D) $\frac{\sigma}{2\varepsilon_0 r}$

22. A point charge q is moved on an equipotential surface with potential V. The work done is

(A) Zero
(B) qV
(C) $\frac{qV}{2}$
(D) $2qV$

23. A wire of resistance 8 Ω is bent into a circle. The resistance between the ends of a diameter of the circle is

(A) $\frac{1}{4}\,\Omega$
(B) $\frac{1}{8}\,\Omega$
(C) 2 Ω
(D) 16 Ω

24. The SI unit of luminous intensity is

(A) Lux
(B) Lumen
(C) Candela
(D) Candela power

25. Which of the following particles can be added to the nucleus without changing its chemical properties?

(A) Electrons
(B) Neutrons
(C) Protons
(D) β-particles

26. Which one of the following is a non-polar molecule?

(A) HCl
(B) CO
(C) H_2O
(D) O_2

27. When a bulk piece of conductor is subjected to changing magnetic flux, induced currents are produced in them. However, their flow patterns resemble swirling in water. These currents are called

(A) Saturation current
(B) Eddy current
(C) Leak current
(D) Dark current

28. A standard 100 watt incandescent light bulb emits approximately

(A) 17 lumens
(B) 170 lumens
(C) 1700 lumens
(D) 1.7 lumens

29. In 1929, Nobel Prize in Physics was awarded to …… for his discovery of the wave nature of electrons.

(A) Schrodinger
(B) Hamiltonian
(C) Debye
(D) de Broglie

30. Rydberg constant, R is

(A) $1.097 \times 10^{-7}\ m^{-1}$
(B) $1.097 \times 10^{7}\ m^{-1}$
(C) $1.97 \times 10^{9}\ m^{-1}$
(D) $1.097 \times 10^{11}\ m^{-1}$

31. The mass (kg) of observable Universe is about

(A) 10^{55}
(B) 10^{41}
(C) 10^{30}
(D) 10^{25}

32. On an average, a human heart is found to beat 75 times in a minute. Then its period is

(A) 0.4 s
(B) 0.8 s
(C) 1.2 s
(D) 2.4 s

33. Match the following.

Technology	**Scientific Principle**
(a) Production of ultra high magnetic fields	(i) Bernoulli's principle
(b) Cyclotron	(ii) Superconductivity
(c) Aeroplane	(iii) Motion of charged particles in electromagnetic fields
(d) Rocket propulsion	(iv) Faraday's law of induction
(e) Electric generator	(v) Newton's law of motion

(A) (a)-(iv); (b)-(v); (c)-(i); (d)-(ii); (e)-(iii)
(B) (a)-(ii); (b)-(v); (c)- (iv); (d)-(iii); (e)-(i)
(C) (a)-(ii); (b)-(iii); (c)-(i); (d)-(v); (e)- (iv)
(D) (a)-(v); (b)-(iv); (c)-(iii); (d)-(ii); (e)-(i)

34. A ray of light travelling in the direction $\frac{1}{2}\left(\hat{i}+\sqrt{3}\hat{i}\right)$ is incident on a plane mirror. After reflection, it travels along the direction $\frac{1}{2}\left(\hat{i}-\sqrt{3}\hat{i}\right)$. The angle of incidence is

(A) 30°
(B) 60°
(C) 45°
(D) 75°

35. Two springs of force constant 1200 N/m and 2400 N/m respectively are stretched with a same force. Their potential energies will be in the ratio of

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

36. Water in a bucket is whirled in a vertical circle with a string attached to it. The Water does not fall down even when the bucket is inverted at the top of its path. We conclude that in this position

(A) $mg = \frac{mv^2}{r}$

(B) mg is greater than $\frac{mv^2}{r}$

(C) mg is not greater than $\frac{mv^2}{r}$

(D) mg is not less than $\frac{mv^2}{r}$

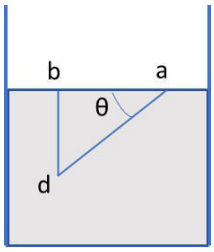
37. Choose the **CORRECT** option from the following.

(A) Gauss's law is valid only for symmetrical charge distributions
(B) Gauss's law is valid only for charges placed in vacuum
(C) The electric field calculated by Gauss's law is the field due to the charges inside the Gaussian surface
(D) The flux of the electric field through a closed surface due to all the charges is equal to the flux due to the charges enclosed by the surface

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

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

39. A glass prism of $\mu = 1.5$ is immersed in water as shown in the figure. A beam of light incident normally on the face *ab* is internally reflected from the face *ad* so as to incident normally on face *bd*. Given that refractive index of water is $\frac{4}{3}$. Then the value of θ is



(A) $\theta > \sin^{-1}\left(\frac{8}{9}\right)$

(B) $\theta > \sin^{-1}\left(\frac{2}{3}\right)$

(C) $\theta < \sin^{-1}\left(\frac{2}{3}\right)$

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

40. Which of the following is **WRONGLY** matched?

(A) Raman effect – Scattering of light
(B) Thomson effect – Thermoelectricity
(C) Hall effect – Work function
(D) Photoelectric effect – Quantum nature of light

41. Due to relative motion of the magnet with respect to coil, an emf is induced in the coil in accordance with

(A) Ampere's circuital law
(B) Faraday's law
(C) Gauss's law
(D) Biot-Savart law

42. For photoelectric emission from certain metal, the cut off frequency is ν. If radiation of frequency 2ν impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is the mass of the electron)

(A) $\sqrt{\frac{h\nu}{2m}}$

(B) $\sqrt{\frac{h\nu}{m}}$

(C) $\sqrt{\frac{2h\nu}{m}}$

(D) $2\sqrt{\frac{h\nu}{m}}$

43. A carbon resistor of (47 ±4.7) kΩ is to be marked with rings of different colours for its identification. The colour code sequence will be

(A) Violet-Yellow-Orange-Silver
(B) Green-Orange-Violet-Gold
(C) Yellow-Green-Violet-Gold
(D) Yellow-Violet-Orange-Silver

44. An AC voltage source of variable angular frequency ω and fixed amplitude V_o is connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When ω increased,

(A) the bulb glows dimmer
(B) the bulb glows brighter
(C) the total impedance of the circuit is unchanged
(D) total impedance of the circuit increases

45. The spring constant of a spring balance is 5×10^2 Nm^{-1}. It is initially stretched by 5 cm from the unstretched position. Then the work done to stretch it further by another 5 cm is

(A) 18.75 J
(B) 25.0 J
(C) 6.25 J
(D) 12.5 J

46. A toy boat containing pieces of iron is floating in a dish of water. If one of the pieces of iron is removed from the boat and placed in the water outside the boat, then

(A) the level of water in the dish will rise
(B) the level of water in dish will fall
(C) the level of water in the dish will remain unchanged
(D) the toy boat will sink

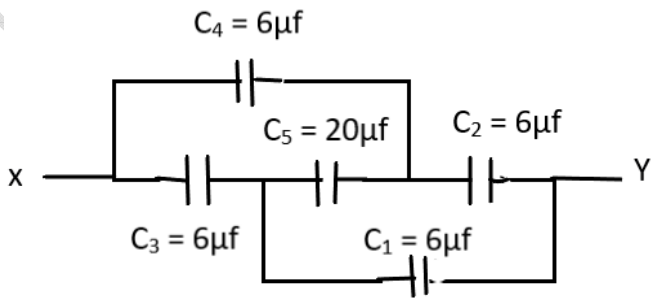
47. Which one of the following is a simple harmonic motion?

(A) Wave moving through a string fixed at both ends
(B) Earth spinning about its own axis
(C) Ball bouncing between two rigid vertical walls
(D) Particle moving in a circle with uniform speed

48. Faraday's laws of electromagnetic induction are consequence of conservation of

(A) energy
(B) energy and magnetic field
(C) charge
(D) magnetic field

49. What is the effective capacitance between points *X* and *Y*?



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

50. In an induction coil the current increases from zero to 6 amp in 0.3 s by which induced emf of 30 V is produced. The value of coefficient of self induction of coil will be

(A) 1 Henry
(B) 1.5 Henry
(C) 2 Henry
(D) 3 Henry

51. The truth table given below is for which gate?

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

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

52. A source of light is placed at a distance of 1 m from the photocell and the cut-off potential is found to be V_0. If the lamp is moved to a distance of 2 m then the cut-off potential will become

(A) $2\,V_0$
(B) $\frac{V_0}{2}$
(C) $\frac{V_0}{4}$
(D) V_0

53. The dimension of torque is

(A) MLT^{-2}
(B) ML^2T^{-2}
(C) $M^2L^2T^{-2}$
(D) M^2LT^{-2}

54. An arrow of mass 20 g, moving at 150 m/s penetrates 5 cm into a log and then comes to rest. Assuming that the force exerted by the log is uniform, the magnitude of the force is

(A) 450 N
(B) 4500 N
(C) 22500 N
(D) 2250000 N

55. A wheel of perimeter 220 cm rolls on a level road at a speed of 9 km/h. How many revolutions does the wheel make per second?

(A) $\frac{25}{22}$ rev/s
(B) $\frac{9}{220}$ rev/s
(C) $\frac{90000}{22}$ rev/s
(D) $\frac{9\times 2\pi}{220}$ rev/s

56. The volume of water decreases from its initial volume of 1000 cm^3, under a pressure change from 10^5 N/m^2 to 10^6 N/m^2. If the compressibility of water is 50×10^{-11} $N^{-1}m^2$, the decrease in volume of water is

(A) 0.45 cm^3
(B) 2.22 cm^3
(C) 8.42 cm^3
(D) 50.22 cm^3

57. An object is seen through a simple microscope of focal length 12 cm. Find the angular magnification produced if the image is formed at the near point of the eye which is 25 cm away from it.

(A) 2.08
(B) 3.08
(C) 6.16
(D) 9.24

58. Two particles A and B having charges 8.0×10^{-6}C and -2.0×10^{-6}C respectively are held fixed with a separation of 20 cm. At what distance from B should a third charged particle be placed so that it does not experience a net electric force?

(A) 2 cm
(B) 20 cm
(C) 40 cm
(D) 80 cm

59. An inductor of inductance 100 mH is connected in series with a resistance, a variable capacitance and an AC source of frequency 2.0 kHz. What should be the value of the capacitance so that maximum current may be drawn into the circuit?

(A) 6.3 nF
(B) 12.6 nF
(C) 43.4 nF
(D) 63.0 nF

60. A particle moves in a circle of radius 10.0 cm at a speed that uniformly increases. If the speed changes from 5.0 m/s to 6.0 m/s in 2.0 s, find the angular acceleration.

(A) 0.5 rad/s^2
(B) 1.0 rad/s^2
(C) 2.5 rad/s^2
(D) 5.0 rad/s^2

61. Two sound waves move in the same direction in the same medium. The pressure amplitudes of the waves are equal but the wavelength of the first wave is double the second wave. Let the average power transmitted across a cross section by the first wave be P_1 and that by the second wave be P_2. Then

(A) $P_1 = P_2$
(B) $P_1 = 4P_2$
(C) $P_2 = 2P_1$
(D) $P_1 = \frac{P_2}{2}$

62. The charge on two plates of a parallel plate capacitor of capacitance C are $3Q$ and $-Q$, respectively. The potential of the capacitor is [None of the plates of capacitor is grounded]

(A) $\frac{Q}{C}$

(B) $\frac{3Q}{C}$

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

(D) $\frac{2Q}{C}$

63. A silver wire has a resistance of 2.1 Ω at 27.5°C, and a resistance of 2.7 Ω at 100°C. What is the temperature coefficient of resistivity of silver?

(A) $0.0059°C^{-1}$
(B) $0.0039°C^{-1}$
(C) $0.0129°C^{-1}$
(D) $0.0030°C^{-1}$

64. An induced e.m.f. is produced when a magnet is plunged into a coil. The strength of the induced e.m.f. is independent of

(A) the strength of the magnet
(B) number of turns of coil
(C) the resistivity of the wire of the coil
(D) speed with which the magnet is moved

65. In which of the following series, does the 121.5 nm line of the spectrum of the hydrogen atom lies?

(A) Lyman series
(B) Balmer series
(C) Paschen series
(D) Brackett series

66. The waves used by artificial satellites in communication is

(A) Infrared rays
(B) Radio waves
(C) X rays
(D) Micro waves

67. When a body is taken from the equator to the poles, its weight

(A) remains the same
(B) decreases
(C) increases
(D) increases at north pole and decreases at south pole

68. When a body is stationary

(A) there is no force acting on it
(B) the forces acting on it are not in contact with it
(C) the combination of the forces acting on it balance each other
(D) the body is in vacuum

69. When a planet moves around the Sun

(A) the angular momentum remains conserved
(B) the angular speed remains constant
(C) the linear velocity remains constant
(D) the linear momentum remains constant

70. The V-I Characteristics of the diode lie in the

(A) 1^{st} and 2^{nd} quadrant
(B) 1^{st} and 3^{rd} quadrant
(C) 1^{st} and 4^{th} quadrant
(D) only in the 1^{st} quadrant

71. Force F applied on a body moves it through a distance S along F. Energy spent is

(A) $F \times S$
(B) $\frac{F}{S}$
(C) $F \times S^2$
(D) $\frac{F}{S^2}$

72. What is the surface energy of an air bubble inside a soap solution?

(A) $4\pi r^2 T$
(B) $8\pi r^2 T$
(C) $2\pi r^2 T$
(D) $\pi r^2 T$

73. Temperature can be expressed as a derived quantity in terms of

(A) length and mass
(B) mass and time
(C) length, mass and time
(D) length and time

74. Which of the following is a non-central force?

(A) Electrostatic force
(B) Nuclear force
(C) Gravitational force
(D) Spring force

75. The unit of angular acceleration in the SI system is

(A) $N\ kg^{-1}$
(B) $m\ s^{-2}$
(C) $rad\ s^{-2}$
(D) $m\ kg^{-1}\ K$

CHEMISTRY (UG) – **SHIFT I**
(FINAL)

76. A radioactive source has a half-life of 40 s, how long will it take for $\frac{5}{8}$ of the source to decay?

(A) 127 s
(B) 57 s
(C) 147 s
(D) 560 s

77. Which of the following two gases can be cooled from room temperature by the Joule-Thomson effect?

(A) Hydrogen and Oxygen
(B) Helium and Nitrogen
(C) Helium and Hydrogen
(D) Nitrogen and Oxygen

78. The increase in internal energy of the system is 100 J when 300 J heat is supplied to it. What is the amount of work done by the system?

(A) 100 J
(B) 200 J
(C) 300 J
(D) 400 J

79. A container of volume 5.0 L is divided into two compartments of equal size. In the left compartment there is nitrogen at 1.0 atmosphere pressure and 25°C, in the right compartment there is hydrogen at the same temperature and pressure. What will happen when the partition is removed?

(A) The entropy increases, and the free energy decreases
(B) The entropy decreases, and the free energy decreases
(C) The entropy increases, and the free energy increases
(D) The entropy decreases, and the free energy increases

80. A unit cell has the following characteristics, $a \neq b \neq c$; $\alpha = \gamma = 90°$, $\beta \neq 90°$. The unit cell belongs to the crystal system

(A) Orthorhombic
(B) Rhombohedral
(C) Monoclinic
(D) Triclinic

81. The hydrogen electrode is dipped in a solution of pH 3 at 25°C, the potential of the cell would be (the value of $\frac{2.303RT}{F} = 0.059\,\text{V}$)

(A) +0.177 V
(B) −0.177 V
(C) +0.087 V
(D) +0.059 V

82. To protect iron against corrosion the most durable metal plating on it is

(A) Tin plating
(B) Copper plating
(C) Zinc plating
(D) Nickel plating

83. The rate constant of a zero-order reaction is 0.04 M sec^{-1}. The concentration of the reactant remaining after 25 sec is 0.5 M. The initial concentration of the reactant is

(A) 0.5 M
(B) 1.25 M
(C) 0.125 M
(D) 1.5 M

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

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

85. Ferrous oxide has a cubic structure, with the edge length of 5.0 Å. If the density of the solid is 3.84 g cm^{-3}, the number of Fe^{2+} and O^{2-} ions present per unit cell is ($N_A = 6.02 \times 10^{23}$)

(A) $2Fe^{2+}$ and $2O^{2-}$
(B) Fe^{2+} and O^{2-}
(C) $4Fe^{2+}$ and $4O^{2-}$
(D) $3Fe^{2+}$ and $4O^{2-}$

86. The Clausius-Clayperon equation helps to calculate

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

87. Electrical conductivity of an electrolyte depends upon the

(A) number of molecules in the electrolytes
(B) number of ions present in the electrolytes
(C) number of molecules present in the solvent
(D) number of charges present in the solution

88. Addition of Ag^{+}, Pb^{2+}, Fe^{3+} and Si^{4+} causes coagulation of negatively charged colloidal sol. Then which of the following is true?

(A) $Fe^{3+} > Si^{4+} > Pb^{2+} > Ag^{+}$
(B) $Ag^{+} < Pb^{2+} < Fe^{3+} < Si^{4+}$
(C) $Ag^{+} > Pb^{2+} > Fe^{3+} > Si^{4+}$
(D) $Ag^{+} = Pb^{2+} = Fe^{3+} = Si^{4+}$

89. The root mean square velocity (u), average velocity (p) and most probable velocity (q) of a molecule are related to each other. Then which of the following is true?

(A) $q > p > u$
(B) $p > q > u$
(C) $u > p > q$
(D) $u = p = q$

90. A plant cell shrinks when it is kept in

(A) Hypertonic solution
(B) Hypotonic solution
(C) Water
(D) Isotonic solution with cell sap

91. One Einstein of energy is

(A) $E = \frac{2.859}{\lambda} \times 10^{5}$ cal mol^{-1}

(B) $E = \frac{2.859}{\lambda} \times 10^{-5}$ k cal mol^{-1}

(C) $E = \frac{2.859}{\lambda} \times 10^{5}$ J mol^{-1}

(D) $E = \frac{2.859}{\lambda} \times 10^{-5}$ kJ mol^{-1}

92. The correct unit of Van der Waal's constant 'a' is

(A) $atm\ mol^{2}\ L^{-2}$
(B) $atm\ mol^{-2}\ L^{2}$
(C) $atm^{-1}\ mol^{-2}\ L^{2}$
(D) $atm\ mol^{2}\ L^{2}$

93. If travelling at same speeds, which of the following matter waves have the shortest wave length?

(A) Electron
(B) Alpha particle
(C) Neutron
(D) Proton

94. In H_2-O_2 fuel cell, the reaction occurring at cathode is

(A) $2H_2O + O_2 + 4e^- \rightarrow 4OH^-$
(B) $2H_2 + O_2 \rightarrow 2H_2O$
(C) $H + OH^- \rightarrow H_2O$
(D) $H + e^- \rightarrow ½\ H_2$

95. For 10 M CH_3COOH solution if K_a is 10^{-5} then find out α (degree of dissociation)

(A) 10^{-6}
(B) 10^{-5}
(C) 10^{-3}
(D) 10^{-2}

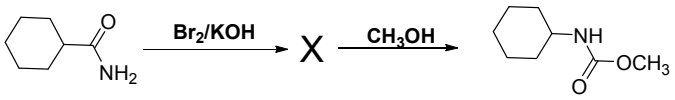
96. What is the hybridization of carbons in C_{60} (buckminsterfullerene)? Identify the number of pentagons and hexagons in C_{60}.

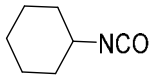
(A) Both sp and sp^2. 12 pentagons, 20 hexagons
(B) sp only. 12 pentagons, 20 hexagons
(C) sp, sp^2 and sp^3. 12 pentagons, 24 hexagons
(D) sp^2 only. 12 pentagons, 20 hexagons

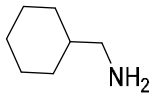
97. Number of isomers possible for $C_2H_2Cl_2$ is/are

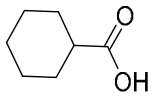
(A) 1
(B) 2
(C) 3
(D) 4

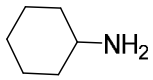
98. Identify X in the following chemical reaction



(A) 

(B) 

(C) 

(D) 

99. Which among the following name reaction yields alkanes?

(A) Wurtz-Fittig reaction
(B) Wurtz reaction
(C) Friedel-Crafts reaction
(D) Vilsmeyer-Haack reaction

100. Turmeric is a good source for

(A) Curcumin
(B) Nicotine
(C) Terramycin
(D) Anabasine

101. Pick the closest change in the HCH bond angle in **ethene** when it reacts with bromine to give 1,2-dibromoethane

(A) 30°
(B) 60°
(C) 10°
(D) 0°

102. An amino acid having secondary amine component is

(A) Alanine
(B) Tryptophan
(C) Asparagine
(D) Proline

103. The eclipsed and staggered confirmations of n-butane differ drastically in

(A) C_2-C_3 bond distance
(B) angle between C_1-C_2-C_3 and C_2-C_3-C_4 planes
(C) C_1-C_2-C_3 bond angle
(D) H-C-H bond angles

104. 2-Methylbutane on reacting with I_2 in presence of sunlight gives mainly

(A) 2-iodo-2-methylbutane
(B) unchanged 2-methylbutane
(C) 1-iodo-2-methylbutane
(D) 1-iodo-3-methylbutane

105. In the reaction below, **A** and **B** are respectively

(A) CH_3COOH, Cl_3CCOOH
(B) CH_3CH_2OH, CH_3CH_2Cl
(C) CH_3CHO, Cl_3CCHO
(D) CH_3COCH_3, Cl_3CCOCH_3

106. Diethyl oxalate forms a solid oxamide derivative with

(A) both primary and secondary amines
(B) both secondary and tertiary amines
(C) primary amines only
(D) aromatic secondary amines only

107. Most crucial function of insulin in human body is to

(A) regulate blood sugar level
(B) regulate kidney function
(C) regulate hormone balance in body
(D) regulate hydrolysis of starch

108. Acetic anhydride is a controlled substance in India since it is

(A) highly toxic
(B) used in the synthesis of illegal substances like heroin
(C) extremely expensive
(D) highly explosive

109. Among carbon tetrachloride, chlorobenzene and benzyl chloride which will give a white precipitate with alcoholic silver nitrate?

(A) Carbon tetrachloride and chlorobenzene
(B) Carbon tetrachloride and benzyl chloride
(C) Benzyl chloride only
(D) All the three halides

110. Iodoform (CHI_3) on heating with Ag powder forms

(A) Ethyne
(B) Ethene
(C) Ethane
(D) Methanoic acid

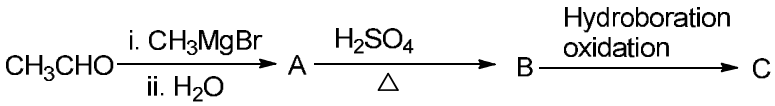
111. One mole of methoxybenzene (anisole, $C_6H_5OCH_3$) on heating with conc. HI gives

(A) One mole of CH_3OH and one mole of C_6H_5I
(B) One mole of CH_3I and one mole of C_6H_5OH
(C) One mole of CH_3I and one mole of C_6H_5I
(D) 4-Iodoanisole as the only product

112. Schiff's bases are prepared by

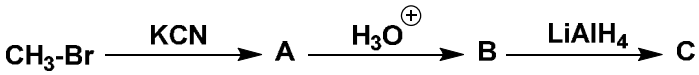
(A) condensation of aldehydes and ketones with hydrazine
(B) condensation of aldehydes and ketones with secondary amines
(C) condensation of aldehydes and ketones with primary amines
(D) condensation of aldehydes and hydroxylamine

113. Compounds 'A' and 'C' in the following reaction are



(A) identical
(B) positional isomers
(C) functional isomers
(D) optical isomers

114. In the following reaction sequence



The end product (**C**) is

(A) Acetaldehyde
(B) Ethyl alcohol
(C) Acetone
(D) Ethane

115. What is common between Heme and Chlorophyl?

(A) Both are red in colour
(B) Both have magnesium in them
(C) Both are proteins
(D) Both are co-ordination complexes of porphyrinic ligands

116. The group having isoelectronic species is

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

117. The electronic configuration with the highest first ionization energy is

(A) $[Ne]3s^2 3p^1$
(B) $[Ne]3s^2 3p^2$
(C) $[Ne]3s^2 3p^3$
(D) $[Ne]3s^2 3p^4$

118. The number and type of bonds in C_2^{2-} ion in CaC_2 are

(A) One σ bond and one π – bond
(B) One σ bond and two π – bonds
(C) Two σ bonds and two π – bonds
(D) Two σ bonds and one π – bond

119. Which of the following is an amphoteric hydroxide?

(A) $Be(OH)_2$
(B) $Ca(OH)_2$
(C) $Mg(OH)_2$
(D) $Sr(OH)_2$

120. 0.5 moles of gas *A* and *x* moles of gas *B* exert pressure of 200 Pa in a container of volume 10 m^3 at 1000 K. Given *R* is the gas constant in $JK^{-1}mol^{-1}$, *x* is

(A) $\frac{2R}{4+R}$
(B) $\frac{2R}{4-R}$
(C) $\frac{4+R}{2R}$
(D) $\frac{4-R}{2R}$

121. In basic medium, H_2O_2 exhibits which of the following reactions?

(a) $Mn^{2+} \rightarrow Mn^{4+}$ (b) $I_2 \rightarrow I^-$ (c) $PbS \rightarrow PbSO_4$

Choose the most appropriate answer from the options given below.

(A) (a) and (c)
(B) (a) and (b)
(C) (a) only
(D) (b) only

122. In graphite and diamond, the percentage of p-character in their hybrid orbitals respectively are

(A) 33 and 25
(B) 67 and 75
(C) 50 and 75
(D) 33 and 75

123. Which of the following has the maximum C – C bond length?

(A) Graphite
(B) Naphthalene
(C) C_{60}
(D) Diamond

124. Which of the following represents the general electronic configuration of an element belonging to the p-block of the periodic table?

(A) $(n-2)f^{0}(n-1)d^{0}ns^{2}np^{0-6}$
(B) $(n-2)f^{0}(n-1)d^{1-10}ns^{2}np^{1-6}$
(C) $(n-2)f^{0}(n-1)d^{0}ns^{2}np^{1-6}$
(D) $(n-2)f^{1-14}(n-1)d^{1-10}ns^{2}np^{1-6}$

125. The number of P-O bonds in P_4O_6 is

(A) 9
(B) 6
(C) 12
(D) 18

126. Which of the following has the highest crystal field stabilization energy?

(A) $[Fe(OH)_5]^{3-}$
(B) $[Fe(Cl)_6]^{3-}$
(C) $[Fe(CN)_6]^{3-}$
(D) $[Fe(H_2O)_6]^{3+}$

127. Magnetic moment of Gd^{3+} ion (Z = 64) is

(A) 3.62 BM
(B) 9.72 BM
(C) 7.9 BM
(D) 10.60 BM

128. The coordination number of Th in $K_4[Th(C_2O_4)_4(H_2O)_2]$ is

(A) 14
(B) 6
(C) 8
(D) 10

129. How many number of molecules and atoms are present in 2.24 L of a diatomic gas at STP?

(A) 3.0×10^{22}; 6.0×10^{22}
(B) 6.02×10^{23}; 15.0×10^{22}
(C) 6.0×10^{22}; 12.0×10^{22}
(D) 15.0×10^{22}; 7.5×10^{22}

130. Which of the following series of lines are the only lines in the hydrogen spectrum, which appear in the near infrared region?

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

131. Number of angular nodes for 4f orbital

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

132. If A, B, C and D are four different ligands, how many geometrical isomers will be formed for square planar $[PtABCD]^{2+}$?

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

133. 0.2 mol AgCl is obtained, when 0.1 mol of the complex, $MCl_3(NH_3)_5$, is treated with excess of $AgNO_3$. The complex will be

(A) 1 : 3 electrolyte
(B) 1 : 2 electrolyte
(C) 1 : 1 electrolyte
(D) 3 : 1 electrolyte

134. Which of the following alkali metals does react with water least vigorously?

(A) Li
(B) Na
(C) K
(D) Cs

135. The most stable radioactive isotope of hydrogen is

(A) deuterium
(B) hydronium
(C) protium
(D) tritium

MATHEMATICS UG
(SHIFT – I **FINAL**)

136. If $x^2+mx+1=0$ and $(b-c)x^2+(c-a)x+(a-b)=0$ have both roots common, then

(A) $m=-2$
(B) $m=-3$
(C) a,b,c are in A.P.
(D) a,b,c are in G.P.

137. A box contains 2 white balls, 3 black balls and 4 red balls. The number of ways in which 3 balls can be drawn from the box if at least one black ball is to be included in the draw is

(A) 32
(B) 64
(C) 96
(D) 128

138. If ${}^{2n+1}P_{n-1} : {}^{2n-1}P_n = 3:5$, then n is equal to

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

139. Let n be a positive integer such that $\left(1+x+x^2\right)^n = a_0 + a_1 x + ... + a_{2n} x^{2n}$, then $\sum_{r=0}^{2n} a_r$

(A) 3^{n-2}

(B) 3^{n-1}

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

(D) 3^n

140. If A and B are square matrices of same order and A is non-singular, then, for a positive integer n, $\left(A^{-1}BA\right)^n$ is

(A) $A^{-n}B^nA^n$

(B) $A^nB^nA^{-n}$

(C) $A^{-1}B^nA$

(D) $n\left(A^{-1}BA\right)$

141. If $\begin{bmatrix} 0 & x \\ y & 0 \end{bmatrix}^4 = I$, then

(A) $x = 1 = 2y$

(B) $x = y$

(C) $x = y^2$

(D) $xy = 1$

142. If $S = \frac{1}{2}\left(\frac{1}{2}+\frac{1}{3}\right) - \frac{1}{4}\left(\frac{1}{2^2}+\frac{1}{3^2}\right) + \frac{1}{6}\left(\frac{1}{2^3}+\frac{1}{3^3}\right) + \cdots$ then S is equal to

(A) $\log 1$

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

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

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

143. The domain of the relation $R=\{(x, y): x,\ y \in Z,\ x^2+y^2 \leq 4\}$ in Z is

(A) $\{0, 1, 2\}$

(B) $\{-2, 0\}$

(C) $\{-2, -1, 0, 1, 2\}$

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

144. Let $f: R \to R$ be defined by $f(x)=\log\left(\frac{1+x}{1-x}\right)$ for $x \in R$. Then $f(m)+f(n)=$

(A) $f(m+n)$

(B) $f\left(\frac{m+n}{1+mn}\right)$

(C) $f(m \cdot n)$

(D) 0

145. Three numbers are chosen at random without replacement from $1,2,3,...,10$. The probability that the minimum of the chosen numbers is 4 or their maximum 8, is

(A) $\frac{1}{40}$

(B) $\frac{7}{40}$

(C) $\frac{3}{40}$

(D) $\frac{11}{40}$

146. If the probability density function of a random variable X is $f(x)=\frac{x}{2}$, in $0\le x\le 2$, then $P(X>1.5/X>1)$ is

(A) $\frac{7}{16}$

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

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

(D) $\frac{21}{64}$

147. $\cos\frac{2\pi}{7}+\cos\frac{4\pi}{7}+\cos\frac{6\pi}{7}=$

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

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

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

(D) 1

148. Let $a=\frac{1}{5\cos x+12\sin x}$ for all real x. Then

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

(B) $a=1$

(C) $a=-\frac{2}{13}$

(D) $a=\frac{2}{13}$

149. Let λ_1 and λ_2 be two values lying in $[0, 2\pi]$ for which $\tan\lambda = \theta$. Then $\tan\frac{\lambda_1}{2} \cdot \tan\frac{\lambda_2}{2} =$

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

150. If $\tan A = 2\tan B + \cot B$, then $2\tan(A-B) =$

(A) $2\tan B$
(B) $2\cot B$
(C) $\cot B$
(D) $\tan B$

151. If the sines of two angles of a triangle are equal to $\frac{3}{5}$ and $\frac{15}{17}$, then the cosine of the third angle is

(A) $\frac{11}{85}$
(B) $\frac{13}{85}$
(C) $\frac{23}{85}$
(D) $\frac{19}{85}$

152. If $\tan^{-1}\left(\frac{1-x}{1+x}\right) = \frac{1}{2}\tan^{-1}x$, then the value of x is

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

153. The pair of points which lie on the same side of the straight line $3x-8y-7=0$ is

(A) $(0,-1), (0,0)$
(B) $(-1-1), (3,7)$
(C) $(-1-1), (3,-7)$
(D) $(0,1), (3,0)$

154. Let $A=(3,0)$ and $B=(-3,0)$. Let P be any point on the curve $16x^2+25y^2=400$. Then $PA+PB=$

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

155. Let $y=|\cos x|+|\sin x|$. Then $\frac{dy}{dx}$ at $x=\frac{2\pi}{3}$ is

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

156. $\lim_{x\to 1}\frac{\sqrt[3]{x^2}-2\sqrt[3]{x}+1}{(x-1)^2}=$

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

157. The minimum value of $f(x) = a\sec x - b\tan x,\ a > b > 0,$ is

(A) $a^2 + b^2$

(B) $a^2 - b^2$

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

(D) $\sqrt{a^2 - b^2}$

158. The minimum value of $e^{|2x^2-2x+1|}\sin^2 x$ is

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

159. Let $f(x) = \max\{x + |x|,\ x - [x]\}$ where $[x]$ denotes the greatest integer less than or equal to x. Then $\int_{-2}^{2} f(x)\,dx =$

(A) 5
(B) 3
(C) -2
(D) 1

160. If $y(t)$ is a solution of $(1+t)\frac{dy}{dt} - ty = 1$ and $y(0) = -1,$ then $y(1) =$

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

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

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

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

161. For all $x \in R$, if $kx^2 - 9kx + 5k + 1 > 0$, then k lies in the interval

(A) $\left(-\frac{4}{61}, 0\right)$

(B) $\left(0, -\frac{4}{6}\right)$

(C) $\left[0, \frac{4}{61}\right)$

(D) $\left(-\frac{4}{61}, \frac{4}{61}\right)$

162. The minimum value of $P = bcx + cay + abz$ when $xyz = abc$, is

(A) $3abc$
(B) $6abc$
(C) abc
(D) $4abc$

163. If $z_1 = 9y^2 - 4 - 10ix$, $z_2 = 8y^2 - 20i$ and $z_1 = \overline{z}_2$, then $z = x + iy$ is equal to

(A) $2 + 2i$
(B) $-2 \pm 2i$
(C) $-2 \pm i$
(D) $2 - i$

167. The inequality $|z - 4| < |z - 2|$ represents the region given by

(A) $\mathrm{Re}(z) > 0$
(B) $\mathrm{Re}(z) < 0$
(C) $\mathrm{Re}(z) > 2$
(D) $\mathrm{Re}(z) > 3$

165. If w is a non-real cube root of unity, then the value of $1\cdot(2-w)\left(2-w^2\right)+2\cdot(3-w)\left(3-w^2\right)+\cdots+(n-1)(n-w)\left(n-w^2\right)$ is

(A) n^3

(B) $\frac{n^2(n-1)^2}{4}-n+1$

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

(D) $\left(\frac{n(n-1)}{4}\right)^2$

166. Sum to n terms of the series $\frac{4}{1\cdot2\cdot3}+\frac{5}{2\cdot3\cdot4}+\frac{6}{3\cdot4\cdot5}+\ldots$

(A) $\frac{5}{4}+\frac{(2n+5)}{2(n+1)(n+2)}$

(B) $\frac{1}{4}-\frac{(2n+5)}{2(n+1)(n+2)}$

(C) $\frac{5}{4}-\frac{(2n+5)}{2(n+1)(n+2)}$

(D) $\frac{1}{4}+\frac{(2n+5)}{2(n+1)(n+2)}$

167. Sum to infinity of the series $1+\frac{4}{5}+\frac{7}{5^2}+\frac{10}{5^3}+\ldots$ is

(A) $\frac{16}{25}$

(B) $\frac{11}{8}$

(C) $\frac{35}{16}$

(D) $\frac{8}{11}$

168. If $x^3 - ax + b = 0$ and $x^2 - px + q = 0$ have a root in common and the second equation has equal roots, then

(A) $b + q = ap$
(B) $p + q = a$
(C) $a + p = q$
(D) $2(b + q) = pa$

169. Let a, b, c be real numbers with $a \neq 0$ and let α, β be the roots of the equation $ax^2 + bx + c = 0$. Then $a^3x^2 + abcx + c^3 = 0$ has roots

(A) $\alpha^2\beta, \alpha\beta^2$
(B) $\alpha\beta^2$
(C) $\alpha^2\beta, \beta\alpha$
(D) $\alpha^3\beta, \alpha\beta^3$

170. The total number of proper factors of 7875 is

(A) 23
(B) 24
(C) 22
(D) 21

171. In a Poisson distribution, if $P(X = 2) = P(X = 3)$, then $P(X = 4)$ is equal to

(A) e^{-2}
(B) $\frac{27e^{-2}}{4}$
(C) $\frac{27e^{-3}}{8}$
(D) $\frac{2e^{-3}}{4}$

172. If $f(x)=\sin^4 x+\cos^4 x+1$, then the range of $f(x)$ is

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

(B) $\left[1, \frac{3}{2}\right]$

(C) $[1, 2]$

(D) $[2, 3]$

173. The fifth term of a GP is 2. Then the product of first 9 terms is

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

174. $\lim_{x\to 0}\frac{\sqrt{1-\cos 2x}}{\sqrt{2}x}$

(A) exists and equal to 1
(B) exists and equal to -1
(C) exists
(D) does not exist

175. If $A=\begin{bmatrix}2 & -0.1\\ 0 & 3\end{bmatrix}$ and $A^{-1}=\begin{bmatrix}\frac{1}{2} & a\\ 0 & b\end{bmatrix}$, then $a+b$ is equal to

(A) $\frac{7}{20}$

(B) $\frac{3}{20}$

(C) $\frac{19}{60}$

(D) $\frac{11}{20}$

176. If the points (x, y), (x', y') and $(x-x', y-y')$ are collinear, then

(A) $xy = x'y'$

(B) $xx' = yy'$

(C) $xy' = x'y$

(D) $x' - y' = 1$

177. The maximum value of $S = 5 + 4\frac{2}{3} + 4\frac{1}{3} + \ldots$ is equal to

(A) 30
(B) 40
(C) 55
(D) 60

178. The ordinary differential equation corresponding to the general solution $y = A\sin 2t + B\cos 2t$ is

(A) $\frac{d^2y}{dt^2} + \frac{dy}{dt} + 4y = 0$

(B) $\frac{d^2y}{dt^2} + 4y = 0$

(C) $\frac{d^2y}{dt^2} + 8y = 0$

(D) $\frac{d^2y}{dt^2} - 4y = 0$

179. If $\frac{1-3p}{2}, \frac{1+4p}{3}, \frac{1+p}{6}$ are the probability of three mutually exclusive and exhaustive events, then the set of all values of 'p' is in

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

(B) $(0,\ 1)$

(C) $\left(0, \frac{1}{3}\right)$

(D) $\left(-\frac{1}{4}, 0\right)$

180. The equation of the largest circle with centre (1, 0) that can be inscribed in the ellipse $x^2 + 4y^2 = 16$ is

(A) $(x-1)^2 + (y-0)^2 = \frac{1}{3}$

(B) $(x-1)^2 + (y-0)^2 = \frac{7}{3}$

(C) $(x-1)^2 + (y-0)^2 = \frac{11}{3}$

(D) $(x-1)^2 + (y-0)^2 = \frac{13}{3}$

181. The imaginary part of $(z-1)(\cos\alpha - i\sin\alpha) + (z-1) - 1(\cos\alpha + i\sin\alpha)$ is zero if

(A) $|z-1| = 2$
(B) $\arg(z-1) = 2\alpha$
(C) $\arg(z-1) = \alpha$
(D) $|z| = 1$

182. a, b, c are three unequal numbers such that a, b, c are in AP and $b-a, c-b, a$ are in GP. Then $a : b : c$ is

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

183. The number of solutions of the equation $a^{f(x)} + g(x) = 0,\ a > 0,\ g(x) \neq 0$ and has minimum value of $\frac{1}{2}$, is

(A) one
(B) two
(C) zero
(D) infinitely many

184. The set of points of discontinuity of the function $\frac{1}{\log|x|}$ in $\mathbb{R}$ is

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

185. The solution set for $\left(\sqrt{2+\sqrt{2}}\right)^x + \left(\sqrt{2-\sqrt{2}}\right)^x = 2.2^{x/4}$ is

(A) $\{0\}$
(B) $\{0, 2\}$
(C) $\{2\}$
(D) $[0, 2]$

186. Let $f(x) = \begin{vmatrix} x^3 & \sin x \\ 1 & 2 \end{vmatrix}$. Then $\int_{-a}^{a} f(x)\,dx$ is equal to

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

187. The value of $\frac{\cos\theta}{1+\sin\theta}$ is equal to

(A) $\tan\left(\frac{\pi}{3}-\frac{\theta}{2}\right)$
(B) $\tan\left(\frac{\pi}{4}-\frac{\theta}{2}\right)$
(C) $\tan\left(\frac{\theta}{3}-\frac{\pi}{4}\right)$
(D) $\tan\left(\frac{\theta}{4}-\frac{\pi}{4}\right)$

188. Let $\vec{a}=2\hat{i}+3\hat{j}-\hat{k}$, $\vec{b}=3\hat{i}-\hat{j}+\hat{k}$ and $\vec{c}=\hat{i}+\hat{j}+3\hat{k}$. If $\vec{r}\times\vec{b}=\vec{c}\times\vec{b}$ and $\vec{r}\cdot\vec{a}=0$, then $\vec{r}$ is equal to

(A) $\frac{1}{2}\left(\hat{i}+\hat{j}+\hat{k}\right)$

(B) $2\left(-\hat{i}+\hat{j}+\hat{k}\right)$

(C) $2\left(\hat{i}+\hat{j}+\hat{k}\right)$

(D) $\frac{1}{2}\left(\hat{i}-\hat{j}+\hat{k}\right)$

189. The roots of the algebraic equation $x^3+x^2+x+1=0$ are

(A) $1,-1,1$
(B) $0,0,0$
(C) $-1, j,-j$
(D) $1, j,-j$

190. If the imaginary part of $\frac{2z+1}{iz+1}$ is – 4, then the locus of the point representing z in the complex plane is

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

191. The equation of the circle passing through (1, –3) and the points common to two circles $x^2+y^2-6x+8y-16=0$ and $x^2+y^2+4x-2y-8=0$ is

(A) $x^2+y^2-4x+6y+24=0$

(B) $2x^2+2y^2+3x+y-20=0$

(C) $3x^2+3y^2-5x+7y-19=0$

(D) $3x^2+3y^2+5x-7y-19=0$

192. $\lim_{n\to\infty}\left(1-\frac{1}{n}\right)^{2n} =$

(A) 0

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

(C) e^{-2}

(D) 1

193. The function $f(x)=x^2+mx+n$, where m and n real constants, describes

(A) a one-to-one mapping
(B) an onto mapping
(C) a non one-to-one but an onto mapping
(D) a mapping which is neither one-to-one nor onto

194. If $|g(x)-g(y)|\le|(x-y)^2|$; $x, y\in R$ and $g(0)=1$, then

(A) $g(x)$ can take any value
(B) $g(x)<0,\ x\in R$
(C) $g(x)>0,\ x\in R$
(D) $g(x)=0,\ x\in R$

195. All possible values of $\sqrt{x^2-4}$ lie in

(A) $[0,\infty)$

(B) $[-2,2]$

(C) $(0,2]$

(D) $(-\infty,\infty)$

196. If a, b, p, q are non-zero real numbers, then number of common roots of two equations $2a^2x^2-2abx+b^2=0$ and $p^2x^2+2pqx+q^2=0$ is

(A) 1
(B) 0
(C) 2
(D) ∞

197. The number of complex numbers z satisfying $\mathrm{Re}\left(z^2\right)=0$ and $|z|=\sqrt{3}$ is

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

198. The degree of the polynomial $(1+x)\left(1+x^6\right)\left(1+x^{11}\right)...\left(1+x^{101}\right)$ is

(A) 21
(B) 101
(C) 1071
(D) 501

199. Let $f(x)$ be a continuous function defined for $1\le x\le 3$. If $f(x)$ takes rational values for all x and $f(2)=10$, then $f(1.5)$ is

(A) 0
(B) 10
(C) not defined
(D) a constant

200. If $\int\frac{1}{x+x^5}dx=f(x)+c$, then $\int\frac{x^4}{x+x^5}dx$ is equal to

(A) $\log|x|+f(x)+c$
(B) $\log|x|-f(x)+c$
(C) $xf(x)+c$
(D) $\log f(x)+x+c$

201. If a,b,c are in A.P., then the straight line $ax + by + c = 0$ will always pass through the point

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

202. Lines $\vec{r} = \vec{a}_1 + t\vec{b}_1$ and $\vec{r} = \vec{a}_2 + s\vec{b}_2$ lie on a plane, if

(A) $\vec{a}_1 \times \vec{a}_2 = \vec{0}$

(B) $\vec{b}_1 \times \vec{b}_2 = \vec{0}$

(C) $\left(\vec{a}_1 - \vec{a}_2\right) \cdot \left(\vec{b}_1 - \vec{b}_2\right) = \vec{0}$

(D) $\left(\vec{a}_1 \cdot \vec{a}_2\right) \cdot \left(\vec{b}_1 \cdot \vec{b}_2\right) = \vec{0}$

203. Let R be a reflexive relation on a finite set A having n elements and let there be m ordered pairs in R. Then

(A) $m \geq n$

(B) $m \leq n$

(C) $m = n$

(D) m^2

204. Let $f : R \to R$ and $g : R \to R$ be given by $f(x) = |x|$ and $g(x) = [x]$ for each $x \in R$. Then $\{x \in R : g(f(x)) \leq f(g(x))\}$ is equal to

(A) $\mathbb{Z} \cup (-\infty, 0)$

(B) $(-\infty, 0)$

(C) $\mathbb{Z}$

(D) $\mathbb{R}$

205. If coefficient of x^n in $(1+x)^{101}\left(1-x+x^2\right)^{100}$ is non-zero, then n cannot be of the form

(A) $3t + 1$

(B) $3t$

(C) $3t + 2$

(D) $6t + 1$

206. The sum of all natural numbers less than 200, that are divisible neither by 3 nor by 5, is

(A) 10730

(B) 10732

(C) 15375

(D) 8022

207. The maximum value of $(7-x)^4(2+x)^5$, when x lies between -2 and 7, is

(A) $\left(4^4 5^5\right)^6$

(B) $\left(4^4 5^4\right)^9$

(C) $\left(4^4 5^5\right)^9$

(D) $\left(4^5 5^4\right)^9$

208. The number of words that can be formed with the letters of the word MATHEMATICS by rearranging them is

(A) $\frac{11!}{2!2!}$

(B) $\frac{11!}{2!2!2!}$

(C) $\frac{11!}{2!}$

(D) 11!

209. If the number of terms in the expansion $(x + y + z)^n$ is 36, then the value of n is

(A) 8
(B) 7
(C) 9
(D) 10

210. With reference to a universal set, the relation of inclusion of a subset in another, is

(A) a symmetric relation
(B) an equivalence relation
(C) a reflexive relation
(D) not a transitive relation

211. If α, β, γ are the roots of $x^3 + px^2 + q = 0$, where $q \neq 0$, then $\Delta = \begin{vmatrix} \frac{1}{\alpha} & \frac{1}{\beta} & \frac{1}{\gamma} \\ \frac{1}{\beta} & \frac{1}{\gamma} & \frac{1}{\alpha} \\ \frac{1}{\gamma} & \frac{1}{\alpha} & \frac{1}{\beta} \end{vmatrix}$ is equal to

(A) $\frac{p}{q}$

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

(C) $\frac{p^2}{q}$

(D) 0

212. If one of the lines given by the equation $2x^2 + axy + 3y^2 = 0$ coincide with one of those given by $2x^2 + bxy - 3y^2 = 0$ and the other lines represented by them be perpendicular, then

(A) $a = -5, b = 1$
(B) $a = 5, b = -1$
(C) $a = 5, b = 1$
(D) $a = -5, b = -1$

213. The number of natural numbers which are smaller than 2×10^8 and which can be written by means of the digits 1 and 2 is

(A) 766
(B) 856
(C) 656
(D) 866

214. If $\alpha+\beta=\gamma$ and tan $\gamma=22$, ' a ' is the arithmetic and ' b ' is the geometric mean respectively of tan α and tan β, then the value of $\frac{a^3}{\left(1-b^2\right)^3}$ is equal to

(A) 1331
(B) 1320
(C) 1330
(D) 1335

215. If $z=4+i\sqrt{7}$, then value of $z^3-4z^2-9z+91$ equals

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

216. If $S=\left\{x\in\mathbb{R}:\left(\log_{0.6}0.216\right)\log_5\left(5-2x\right)\le 0\right\}$ then S is equal to

(A) $[2.5,\infty)$
(B) $[2,2.5)$
(C) $(2,2.5)$
(D) $(0,2.5)$

217. If the lines joining the origin to the intersection of the line $y=mx+2$ and the curve $x^2+y^2=1$ are at right angles, then

(A) $m^2=1$
(B) $m^2=3$
(C) $m^2=7$
(D) $2m^2=1$

218. If P is a point (x, y) on the line $y = -3x$ such that P and the point $(3, 4)$ are on the opposite sides of the line $3x - 4y = 8$, then

(A) $x > \frac{8}{15},\ y < -\frac{8}{5}$

(B) $x > \frac{8}{5},\ y < -\frac{8}{15}$

(C) $x = \frac{8}{15},\ y = -\frac{8}{5}$

(D) $x \neq 8,\ y = 36$

219. Two integers r and s are drawn one at a time without replacement from the set $\{1, 2, ..., n\}$. If $P_k = P(r \leq k \mid s \leq k)$, and $n = 25$, then $8P_7 =$

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

220. If the numerical value of $\left(\cos^{-1}\left(\frac{4}{5}\right) + \tan^{-1}\left(\frac{2}{3}\right)\right)$ is $\frac{a}{b}$, then

(A) $a + b = 23$
(B) $a + b = 0$
(C) $3b = a + 2$
(D) $2a = 3b$

221. A fair coin is tossed n times. If the probability that head occurs 6 times is equal to the probability that head occurs 8 times, then value of n is

(A) 24
(B) 48
(C) 14
(D) 16

222. If A and B are acute positive angles satisfying the equations $3\sin^3 A+2\sin^2 B=1$ and $3\sin 2A-2\sin 2B=0,$ then $A+2B$ is equal to

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

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

(C) $\frac{3\pi}{4}$

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

223. If $\sin^{-1}x+\sin^{-1}y+\sin^{-1}z=\frac{3\pi}{2}$ then the value of $3000(x+y+z)-\frac{816}{x^2+y^2+z^2}$ is equal to

(A) 8724
(B) 8728
(C) 8772
(D) 8767

224. Let P, Q, R be three points on a parabola $y^2=4ax$ whose ordinates are in geometrical progression, then the tangents at P and R meet on

(A) the line through Q parallel to x-axis
(B) the line through Q parallel to y-axis
(C) the line joining Q and the vertex
(D) the line joining Q and the focus

225. Let $f:\{2,3,4,5\}\to\{3,4,5,9\}$ and $g:\{3,4,5,9\}\to\{7,11,15\}$ be functions defined as $f(2)=3,\ f(3)=4,\ f(4)=f(5)=5$ and $g(3)=g(4)=7$ and $g(5)=g(9)=11.$ Then $g\circ f(2,3,4,5)=$

(A) $(7,7,11,11)$
(B) $(3,5,7,4)$
(C) $(5,7,11,7)$
(D) $(9,9,15,15)$

FINAL ANSWER KEY									
Subject Name: TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT I									
SI No.	**Key**	**SI No.**	**Key**	**SI No.**	**Key**	**SI No.**	**Key**	**SI No.**	**Key**
1	D	31	A	61	A	91	B	121	B
2	D	32	B	62	D	92	B	122	B
3	A	33	C	63	B	93	B	123	D
4	B	34	A	64	C	94	A	124	C
5	C	35	D	65	A	95	C	125	C
6	A	36	C	66	D	96	D	126	C
7	A	37	D	67	C	97	C	127	C
8	B	38	A	68	C	98	A	128	D
9	B	39	A	69	A	99	B	129	C
10	B	40	C	70	B	100	A	130	C
11	A	41	B	71	A	101	C	131	B
12	B	42	C	72	B	102	D	132	A
13	D	43	D	73	C	103	B	133	B
14	B	44	B	74	B	104	B	134	A
15	A	45	A	75	C	105	A	135	D
16	A	46	B	76	B	106	C	136	C
17	D	47	A	77	D	107	A	137	B
18	B	48	A	78	B	108	B	138	A
19	B	49	D	79	A	109	C	139	D
20	D	50	B	80	C	110	A	140	C
21	C	51	D	81	B	111	B	141	D
22	A	52	D	82	C	112	C	142	D
23	C	53	B	83	D	113	B	143	C
24	C	54	B	84	D	114	B	144	B
25	B	55	A	85	C	115	D	145	D
26	D	56	A	86	A	116	A	146	C
27	B	57	B	87	D	117	C	147	C
28	C	58	B	88	B	118	B	148	A
29	D	59	D	89	C	119	A	149	B
30	B	60	D	90	A	120	D	150	C

SI No.	Key	SI No.	Key	SI No.	Key
151	B	181	C	211	D
152	B	182	C	212	C
153	B	183	C	213	A
154	B	184	A	214	A
155	D	185	A	215	C
156	B	186	A	216	B
157	D	187	B	217	C
158	B	188	B	218	A
159	A	189	D	219	A
160	B	190	D	220	A
161	C	191	B	221	C
162	A	192	C	222	B
163	B	193	D	223	B
164	D	194	C	224	B
165	B	195	A	225	A
166	C	196	B		
167	C	197	D		
168	D	198	C		
169	A	199	B		
170	C	200	B		
171	C	201	D		
172	A	202	C		
173	D	203	A		
174	D	204	D		
175	A	205	C		
176	C	206	B		
177	B	207	C		
178	B	208	B		
179	A	209	B		
180	C	210	C		

TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT II

PHYSICS UG SHIFT II
(FINAL)

1. If the screw on a screw-gauge is given six rotations, it moves by 3 mm on the main scale. If there are 50 divisions on the circular scale, the least count of the screw gauge is

(A) 0.001 cm
(B) 0.01 cm
(C) 0.001 mm
(D) 1 mm

2. Which one of the following equations does **NOT** represent a true simple harmonic motion? (Symbols have usual meaning.)

(A) $x = A \sin(\omega t + \varphi)$
(B) $x = A \cos(\omega t - \varphi)$
(C) $x = A \sin \omega t + B \cos \omega t$
(D) $x = A \sin(\omega t + \varphi) + B \sin(2\omega t + \varphi)$

3. A wire fixed at the upper end and stretched by length l by applying a force F. The work done in stretching the wire is

(A) Fl
(B) $2Fl$
(C) $\frac{Fl}{2}$
(D) $\frac{F}{2l}$

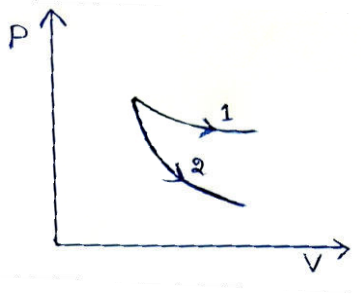
4. If the surface tension of a liquid is 5 Nm^{-1}, then the surface energy of this liquid film on a ring of area 0.15 m^2 is

(A) 0.75 J
(B) 1.5 J
(C) 2.25 J
(D) 3.0 J

5. For cooking purpose, it is desirable that the material of the utensil should have

(A) low conductivity and low specific heat
(B) high conductivity and low specific heat
(C) low conductivity and high specific heat
(D) high conductivity and high specific heat

6. The P-V plots for two gases (1 and 2) during adiabatic processes are shown below.



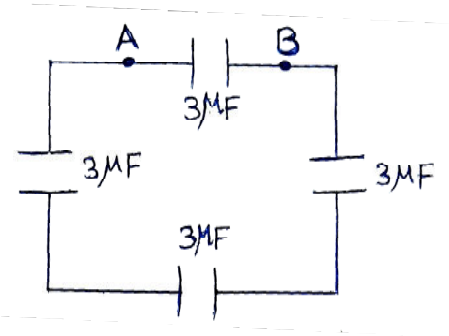
Then

(A) 1 and 2 both should correspond to a diatomic gas
(B) 1 corresponds to diatomic and 2 corresponds to monoatomic gas
(C) 1 and 2 both should correspond to a monoatomic gas
(D) 1 should correspond to monoatomic and 2 should correspond to diatomic gas

7. The average depth of Indian Ocean is about 3000 m. If the bulk modulus of ocean water is 2×10^9 Nm^{-2}, the fractional compression $\frac{\Delta V}{V}$ of water at the bottom of the ocean will be (assume $g = 9.81$ ms^{-2})

(A) 1.36%
(B) 1.47%
(C) 1.8%
(D) 2%

8. In the following circuit, the capacitance between the points A and B will be



(A) 3 μF
(B) 12 μF
(C) 4 μF
(D) 1 μF

9. Which one of the following is most suitable for making permanent magnet?

(A) Steel
(B) Soft iron
(C) Copper
(D) Nickel

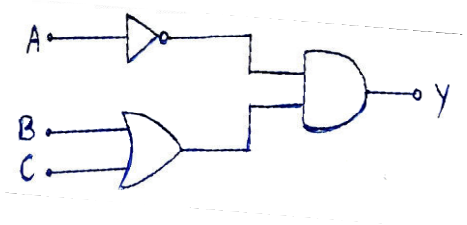
10. A step down transformer has a 10 *V* secondary tapping. If the primary at 220 *V* draws a current of 5 *A*, and the secondary draws a current of 88 *A*, what is the efficiency of the transformer?

(A) 8.8%
(B) 88%
(C) 80%
(D) 8%

11. If the uncertainty in the measurement of position of an electron is 10^{-10} m, what is the uncertainty in the measurement of its momentum?

(A) 3.33×10^{-24} kgms^{-1}
(B) 1.65×10^{-25} kgms^{-1}
(C) 6.6×10^{-24} kgms^{-1}
(D) 6.6×10^{-20} kgms^{-1}

12. The Boolean expression for the circuit below is



(A) $Y = \overline{A} \cdot B + C$
(B) $Y = \overline{A} \cdot \left(\overline{B} + \overline{C}\right)$
(C) $Y = \overline{A} \cdot \left(B + \overline{C}\right)$
(D) $Y = \overline{A} \cdot \left(B + C\right)$

13. Which one of the following utilizes the phenomenon of total internal reflection?

(A) Formation of mirage
(B) Formation of rainbow
(C) Light propagation in optical fibers
(D) All of the above

14. Three stars A, B and C have surface temperature of T_A, T_B and T_C respectively. If A appears bluish, B appears reddish and C appears yellowish, then

(A) $T_A > T_C > T_B$
(B) $T_A > T_B > T_C$
(C) $T_B > T_C > T_A$
(D) $T_C > T_B > T_A$

15. A stone of mass 200 g is tied to the end of a string of length 0.5 m. It is whirled in a circle with a frequency of 0.5 Hz. What is the tension in the string?

(A) $\frac{\pi^2}{2}$ N
(B) $\frac{\pi^2}{4}$ N
(C) $\frac{\pi^2}{5}$ N
(D) $\frac{\pi^2}{10}$ N

16. If the gravitational force of attraction between two bodies varies as $\frac{1}{r^3}$, the period of revolution of a planet around the sun would vary as

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

17. Two waves $y_1 = 0.2\sin 320t$ and $y_2 = 0.2\sin 314t$ are propagating along the same direction. The number of beats produced per second are

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

18. The shift in wavelength due to Doppler's effect is 0.2 Å for a star producing wavelength of 3000 Å. The velocity of recession of the star will be

(A) 5 km/s
(B) 10 km/s
(C) 20 km/s
(D) 30 km/s

19. If the light is polarised by reflection, then the angle between reflected and refracted light is

(A) 36°
(B) 45°
(C) 90°
(D) 180°

20. The ratio of the slope of isothermal and adiabatic curves is

(A) γ

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

(C) 1

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

21. Two dipoles of charges of magnitude 'e' are placed inside a cube. What will be the total electric flux coming out of the cube?

(A) $\frac{4e}{\varepsilon_0}$

(B) $\frac{2e}{\varepsilon_0}$

(C) $\frac{e}{\varepsilon_0}$

(D) Zero

22. The ratio of magnetic field at the centre of a current carrying circular coil to its magnetic moment is r. If the current and the radius both are halved, then the new ratio becomes

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

(B) $2r$

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

(D) $8r$

23. Lenz's law is a consequence of the law of conservation of

(A) energy
(B) charge
(C) electric flux
(D) linear momentum

24. The monochromatic light is refracted from air into glass of refractive index μ. The ratio of the wavelengths of the incident and refractive waves is

(A) 1 : 1
(B) μ : 1
(C) 1 : μ
(D) μ^2 : 1

25. A nucleus (atomic number 100 and mass number 200) emits four α-particles and the resultant nucleus emits five β-particles. The atomic and mass number of the final nucleus are

(A) 191, 92
(B) 186, 87
(C) 186, 97
(D) 191, 97

26. A compass needle suffers a deflection when placed near a wire carrying an electric current. This was observed by

(A) Hans Christian Oersted
(B) Hendrik Antoon Lorentz
(C) Gustav Robert Kirchhoff
(D) Georg Simon Ohm

27. $\oint B\, dA = 0$ is representation of

(A) Gauss's Law for electricity
(B) Gauss's Law for magnetism
(C) Faraday's Law
(D) Ampere – Maxwell Law

28. In the formation of rainbows, the violet light emerges at an angle of

(A) 10°
(B) 20°
(C) 30°
(D) 40°

29. In Pfund series, the value of principal quantum number 'n' starts from

(A) n = 2, 3, 4, ...
(B) n = 4, 5, 6, ...
(C) n = 5, 6, 7, ...
(D) n = 6, 7, 8, ...

30. The atomic mass of chlorine atom is

(A) 17.23 u
(B) 35.47 u
(C) 71.47 u
(D) 3.547 u

31. If the total energy of the reactants is more than the products of the reaction, heat is released and the reaction is said to be an

(A) exothermic
(B) endothermic
(C) elongate
(D) amplitude

32. Ultrasonic waves in air produced by a vibrating quartz crystal are

(A) longitudinal waves
(B) transverse waves
(C) gravity waves
(D) electromagnetic waves

33. A point source of light is placed at a distance of $2f$ from a converging lens of focal length f. The intensity on the other side of the lens is maximum at a distance

(A) f
(B) $2f$
(C) more than $2f$
(D) between f and $2f$

34. Tesla is the unit of

(A) electric flux
(B) magnetic flux
(C) electric field
(D) magnetic induction

35. If the water falls from a dam into a turbine wheel 19.6 m below, then the velocity of the water at the turbine is

(A) 9.8 m/sec
(B) 32.6 m/sec
(C) 58.8 m/sec
(D) 19.6 m/sec

36. A constant torque of 31.4 Nm is exerted on a pivoted wheel. If the angular acceleration of wheel is 4π rad/s^2, then the moment of inertia will be

(A) 2.5 kgm^2
(B) 4.5 kgm^2
(C) 3.5 kgm^2
(D) 5.5 kgm^2

37. If the velocity of a particle is $v = At + Bt^2$ where A and B are constants. Then the distance travelled by it between 1 s and 2 s is

(A) $\frac{3}{2}A + 4B$
(B) $3A + 7B$
(C) $\frac{3}{2}A + \frac{7}{3}B$
(D) $\frac{1}{2}A + \frac{1}{3}B$

38. The magnetic field in a travelling electromagnetic wave has a peak value of 35 nT. The peak value of electric field strength is

(A) 6 V/m
(B) 8.3 V/m
(C) 10.5 V/m
(D) 12.5 V/m

39. The slits in Young's double slit experiment are having equal width and the source is placed symmetrically with respect to the slits. The intensity at the central fringe is I_o. If one of the slit is closed, the intensity at this point will be

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

40. To increase the angular magnification of a simple microscope, one should increase the

(A) focal length of the lens
(B) power of the lens
(C) aperture of the lens
(D) object size

41. Three capacitors of capacitances $6\mu F$ each are available. The minimum and maximum capacitances, which may be obtained are

(A) $6\ \mu F$, $18\ \mu F$
(B) $3\ \mu F$, $12\ \mu F$
(C) $2\ \mu F$, $12\ \mu F$
(D) $2\ \mu F$, $18\ \mu F$

42. Consider the spectral line resulting from the transition $n = 2 \rightarrow n = 1$ in the atoms and ions given below. The shortest wavelength is produced by

(A) hydrogen atom
(B) deuterium atom
(C) singly ionized helium
(D) doubly ionized lithium

43. If a *pn* diode is reverse biased then the resistance measured by an ohmmeter will be

(A) zero
(B) low
(C) high
(D) infinite

44. An open pipe is suddenly closed at one end with the result that the frequency of the third harmonic of the closed pipe is found to be higher by 100 Hz than the fundamental frequency of the open pipe. Then the fundamental frequency of the open pipe is

(A) 100 Hz
(B) 150 Hz
(C) 200 Hz
(D) 400 Hz

45. A light and a heavy body have equal kinetic energy. Which one has a greater momentum?

(A) The heavy body
(B) The light body
(C) Both (A) and (B)
(D) Cannot be said

46. Internal energy per mole of gas depends on

(A) viscosity
(B) density
(C) temperature
(D) thermal conductivity

47. If a sound wave enters water from air, then what remains unchanged?

(A) Frequency
(B) Amplitude
(C) Velocity
(D) Wavelength

48. To convert a galvanometer into an ammeter, we should connect

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

49. If a stationary charge is put inside a magnetic field, the charge will

(A) move in a straight line
(B) move in circle
(C) remain stationary
(D) move in a helix

50. Two plane mirrors are inclined at an angle of 60°. An object is placed symmetrically between the mirrors. The total number of images formed by the two mirrors is

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

51. What is the voltage gain in a common emitter amplifier where input resistance is 3 Ω and load resistance 24 Ω, $\beta = 0.6$?

(A) 8.4
(B) 4.8
(C) 2.4
(D) 480

52. Consider the following two statements (I) and (II) and identify the correct choice.

(I) The characteristic X-ray spectrum depends on the nature of the material of the target.
(II) The short wavelength limit of the continuous X-ray spectrum varies inversely on the potential difference applied to the X-ray tube.

(A) (I) is true and (II) is false
(B) (I) is false and (II) is true
(C) Both (I) and (II) are true
(D) Both (I) and (II) false

53. Two vectors having equal magnitudes Y make an angle α with each other. The magnitude of the resultant is

(A) Y
(B) $2Y$
(C) $2Y\cos\left(\frac{\alpha}{2}\right)$
(D) $2Y\cos(\alpha)$

54. A block slides down an incline of angle 30° with an acceleration $\frac{g}{4}$. Find the kinetic friction co-efficient

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

55. The mass of moon is 7.4×10^{22} kg and its radius is 1740 km. The escape velocity from moon is

(A) 1740 km/s

(B) 870.4 km/s
(C) 2.38 km/s
(D) 1.7 km/s

56. A 50 cm long horizontally placed wire of mass 20 g is fixed to a wall at one end and supports a mass of 1.6 kg at the other end hanging downwards with the help of a pulley. The length of the wire between the wall and the pulley is 40 cm. The fundamental frequency of the string between the wall and the pulley is

(A) 15 Hz
(B) 25 Hz
(C) 50 Hz
(D) 100 Hz

57. The pressure of the gas in a constant volume gas thermometer is 80 cm of mercury in melting ice at 1 atm. When the bulb is placed in a liquid, the pressure becomes 160 cm of mercury. The temperature of liquid is

(A) 273.15 K
(B) 373.15 K
(C) 546.30 K
(D) 636.15 K

58. A parallel plate capacitor has plates of area 200 cm^2 and the separation between the plates 1.00 mm. What potential difference will be developed if a charge of 1.00 nC is given to the capacitor?

(A) 0.17 V
(B) 1.00 V
(C) 5.65 V
(D) 11.30 V

59. Ultraviolet light of wavelength 280 nm is used in an experiment on photoelectric effect with lithium cathode whose work function is 2.5 eV. Find the maximum kinetic energy of the photoelectrons

(A) 1.9 eV
(B) 2.5 eV
(C) 4.4 eV
(D) 7.5 eV

60. A cart of weight 72 kg, and a man of weight 65 kg move towards each other on a smooth horizontal surface. The velocity of the cart and the man are 3 km/h

and 6 km/h respectively. When the man reaches the cart, he jumps into it. Then the speed of the cart carrying the man is

(A) 4.42 km/h
(B) 3.23 km/h
(C) 1.87 km/h
(D) 1.27 km/h

61. If the linear momentum is increased by 50%, then kinetic energy will be increased by

(A) 50%
(B) 20%
(C) 125%
(D) 100%

62. A heater coil is cut into two equal parts and only one part is now used in the heater. The heat generated will now be

(A) doubled
(B) four times
(C) one-fourth
(D) halved

63. An electron is projected with uniform velocity along the axis of a current carrying long solenoid. Which of the following is true?

(A) The electron will be accelerated along the axis
(B) The electron path will be circular about the axis
(C) The electron will experience a force at 45° to the axis and hence execute a helical path
(D) The electron will continue to move with uniform velocity along the axis of the solenoid

64. The polarity of induced emf is given by

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

65. In an n-type silicon, which of the following statement is true?

(A) Electrons are the majority carriers and trivalent atoms are the dopants
(B) Electrons are the minority carriers and pentavalent atoms are the dopants
(C) Holes are the minority carriers and pentavalent atoms are the dopants
(D) Holes are the majority carriers and trivalent atoms are the dopants

66. The amplitude of the magnetic field of harmonic electromagnetic wave in vacuum is $B_0 = 450$ nT. What is the amplitude of electric field part of the wave?

(A) 140 N/C
(B) 135 N/C
(C) 130 N/C
(D) 145 N/C

67. There is no atmosphere on the Moon because

(A) it is closer to the Earth
(B) it revolves around the Earth
(C) it gets light from the Sun
(D) the root mean square velocity of the gas molecules is more than the escape velocity from moon

68. Which one of the following is **NOT** a conservative force?

(A) Magnetic force
(B) Force of friction
(C) Gravitational force
(D) Electrostatic force

69. The motion of holes and free electrons due to thermal agitation is called

(A) diffusion
(B) drift
(C) translation
(D) conduction

70. The color of an LED can be changed by

(A) increasing the charge carriers
(B) varying the doping level of the semiconductors
(C) increasing applied voltage
(D) by using different bandgap semiconductors

71. Consider a system of two identical particles. One of the particles is at permanent rest and the other has acceleration $\boldsymbol{a}$. The centre of mass has acceleration

(A) Zero
(B) $\frac{a}{2}$
(C) a
(D) $2a$

72. The unit of specific resistance is

(A) Ω
(B) Ω^2
(C) Ω metre
(D) Ω/m

73. Streamline flow is more likely for liquid with

(A) high density and high viscosity
(B) low density and low viscosity
(C) high density and low viscosity
(D) low density and high viscosity

74. In a nuclear reaction, which of the following is/are conserved?

(A) Mass only
(B) Energy only
(C) Momentum only
(D) Mass, energy and momentum

75. Resistance of the metallic conductors

(A) increases with rise in temperature
(B) decreases with rise in temperature
(C) remains unchanged with change in temperature
(D) becomes zero at very high temperature

CHEMISTRY (UG) – **SHIFT II**
(FINAL)

76. Which of the following sets of conditions makes a process spontaneous at all temperatures?

(A) $\Delta H = 0; \Delta S > 0$
(B) $\Delta H = 0; \Delta S < 0$
(C) $\Delta H < 0; \Delta S > 0$
(D) $\Delta H < 0; \Delta S < 0$

77. The alkali hydrolysis of an ester represented by

$RCOOR' + OH^- \longrightarrow RCOO^- + R'OH$

This reaction is,

(A) bimolecular and second-order
(B) bimolecular but first-order
(C) bimolecular but not second-order
(D) second-order but not bimolecular

78. Which of the following can be used to measure pH?

(A) Glass electrode
(B) Hydrogen electrode
(C) Quinhydrone electrode
(D) All of the above

79. Kinetic energy of a single molecule is given by the expression

(A) RT
(B) RT/N
(C) kT
(D) 1.5RT/N

80. In a reversible isothermal process change in internal energy

(A) $\Delta U = 0$
(B) $\Delta U > 0$
(C) $\Delta U < 0$
(D) $\Delta U = P\Delta V$

81. Heat of formation of sulphur dioxide, $\Delta H = -297$ kJ. The heat liberated on burning 8 g of sulphur in oxygen is

(A) 297 kJ
(B) 223 kJ
(C) 148.5 kJ
(D) 74.25 kJ

82. In physical adsorption, the forces of attraction are,

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

83. In a second order reaction $2A \rightarrow$ products, if the concentration of A is doubled, $t_{1/2}$ of the reaction

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

84. The ionic strength (μ) for 0.1 M $BaCl_2$ is given by

(A) 0.3 M
(B) 0.1 M
(C) 0.2 M
(D) 0.6 M

85. If 60 calories are added to a system and system does work of 20 calories on the surroundings, the change in internal energy of system?

(A) 20 calories
(B) 50 calories
(C) 40 calories
(D) 30 calories

86. For certain reaction R→P, the value of ΔH and ΔS are 60 KJ and 80 JK^{-1} respectively. The temperature at which $\Delta G = 0$ is

(A) 477°C
(B) 750°C
(C) 800°C
(D) 450°C

87. Root mean square velocity of molecule A is four times greater than that of molecule B at same temperature. The ratio of molecular weight of A to B ($M_A : M_B$)

(A) 1 : 4
(B) 2 : 1
(C) 4 : 1
(D) 1 : 16

88. The molecule which has zero dipole moment is

(A) CH_2Cl_2
(B) BF_3
(C) NF_3
(D) ClO_2

89. Limiting molar conductivity of NH_4OH (i.e., $\Lambda^0_m(NH_4OH)$) is equal to

(A) $\Lambda^0_m(NH_4Cl) + \Lambda^0_m(NaCl) - \Lambda^0_m(NaOH)$
(B) $\Lambda^0_m(NaOH) + \Lambda^0_m(NaCl) - \Lambda^0_m(NH_4Cl)$
(C) $\Lambda^0_m(NH_4OH) + \Lambda^0_m(NH_4Cl) - \Lambda^0_m(HCl)$
(D) $\Lambda^0_m(NH_4Cl) + \Lambda^0_m(NaOH) - \Lambda^0_m(NaCl)$

90. If a spoon of copper metal is placed in a solution of ferrous sulphate, then

(A) Cu will precipitate out
(B) Iron will precipitate
(C) Cu and Fe will precipitate
(D) no reaction will take place

91. The vapour pressure of two liquids P and Q are 80 and 60 Torr respectively. The total vapour pressure of the solution obtained by mixing three moles of P and two moles of Q would be

(A) 68 Torr
(B) 72 Torr
(C) 140 Torr
(D) 20 Torr

92. $3A \rightarrow 2B$ then the rate of reaction $\frac{d[B]}{dt}$

(A) $-\frac{3}{2}\frac{d[A]}{dt}$

(B) $-\frac{2}{3}\frac{d[A]}{dt}$

(C) $-\frac{1}{3}\frac{d[A]}{dt}$

(D) $2\frac{d[A]}{dt}$

93. Unit of third order reaction

(A) $L^2 mol^{-2} t^{-1}$

(B) $mol^{-1} L^{-1} t^{-1}$

(C) $mol\ L^{-1} S^{-1}$

(D) $mol^{-1} S^{-1}$

94. A compound X has face centred cubic structure its density is 3.4 g cm^{-3}. The length of the unit cell is (molecular weight of X is 99 g/mol)

(A) 5.78 Å

(B) 6.78 Å

(C) 7.78 Å

(D) 8.783 Å

95. The orbital angular momentum of an electron in 2s orbital is

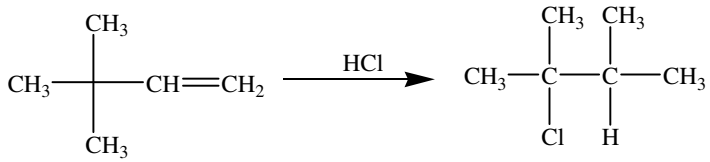
(A) zero

(B) one

(C) two

(D) three

96. Following reaction involves



(A) Anti Markovnikov addition and rearrangement
(B) Markovnikov addition and rearrangement
(C) Rearrangement followed by Markovnikov addition
(D) Rearrangement followed by anti Markovnikov addition

97. What is the function of heme in the human body?

(A) It helps transport oxygen in the blood
(B) It helps to digest food in the stomach
(C) It is a structural component of cell membranes
(D) It is a cofactor in enzymes involved in DNA replication

98. What does a full "curved" arrow ( ) signify while writing reaction mechanisms?

(A) That two structures are enantiomers
(B) Represents movement of two electrons in the direction of the arrow
(C) Represents movement of an atom or a group in the direction of the arrow
(D) Resonating structures

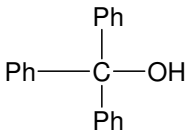
99. How many distinct internal alkynes share the molecular formula C_6H_{10} ?

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

100. Which among the following *essential* amino acids has sulphur containing side chain?

(A) Glycine
(B) Cysteine
(C) Methionine
(D) Tyrosine

101. Triphenyl carbinol can be prepared in one pot by the reaction of two equivalents of phenylmagnesium bromide with



triphenyl carbinol

(A) C_6H_5COOH (benzoic acid)

(B) C_6H_5CN (benzonitrile)

(C) $PhCOOCH_3$ (methyl benzoate)

(D) PhCHO (benzaldehyde)

102. Which among the following reaction sequences would result in retention of configuration at the reaction centre?

(A) S_N1 followed by E1

(B) S_N2 followed by E2

(C) S_N2 followed by another S_N2

(D) S_N2 followed by S_N1

103. Which among the following compounds is **NOT** formed in the positive test for nitrogen in Lassaigne's test for aniline?

(A) $Fe_4[Fe(CN)_6]_3$

(B) $Na_3[Fe(CN)_6]$

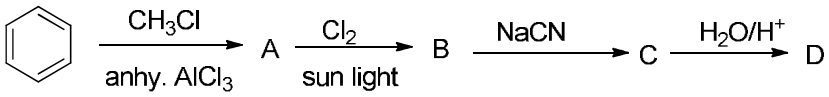
(C) $Fe(CN)_3$

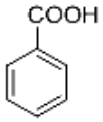
(D) $Na_3[Fe(CN)_5NOS]$

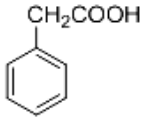
104. An alkene on ozonolysis followed by hydrolysis gave acetaldehyde as the only product. This alkene can exhibit

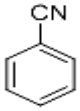
(A) optical isomerism
(B) geometrical isomerism
(C) both optical and geometrical isomerism
(D) neither optical nor geometrical isomerism

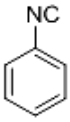
105. In the below sequence of reactions, 'D' is



(A) 

(B) 

(C) 

(D) 

106. Glucose and fructose are

(A) optical isomers
(B) tautomers
(C) functional isomers
(D) chain isomers

107. In nucleic acids the phosphate diester bond links

(A) two sugar units at the 5', 3' positions
(B) two nitrogen bases together
(C) one sugar unit with one nitrogen base
(D) two nucleic acid strands together

108. When injured, body generates prostaglandins as a warning signal. Prostaglandins stimulate inflammation in the tissue and cause sensation of pain. Which among the following drugs can inhibit the generation of prostaglandins?

(A) Meprobamate
(B) Dimetap
(C) Aspirin
(D) Salvarsan

109. Pick the statement that is **NOT** true for Freon refrigerant R-22.

(A) It causes ozone depletion
(B) Its molecular formula is CCl_2F_2
(C) It is prepared from $CHCl_3$
(D) It is used for preparing tetrafluoroethene (C_2F_4)

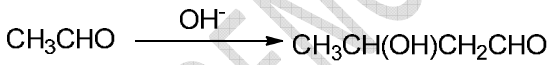
110. Ethylmagnesium Iodide on treatment with water gives

(A) Ethanol
(B) Ethene
(C) Ethane
(D) n-Butanol

111. Phenol reacts with bromine in water at room temperature to give

(A) 4-bromophenol without the evolution of HBr
(B) a mixture of 2- and 4- bromophenols without the evolution of HBr
(C) the corresponding addition product 1,2,3,4,5,6-hexabromocyclohexanol
(D) 2,4,6-tribromophenol with the evolution of HBr

112. Base catalyst condensation between two molecules of acetaldehyde to give 3-hydroxybutanal is an example for



(A) Stobbe condensation
(B) Benzoin condensation
(C) Aldol condensation
(D) Perkin reaction

113. Hybridization and geometry of carbon in ethene are

(A) sp^3 and Planar
(B) sp^2 and Planar
(C) sp and Linear
(D) sp^2 and Tetrahedral

114. Taj Mahal is being slowly disfigured and discoloured. This is primarily due to

(A) acid rain
(B) deposition of soot from stubble burning
(C) increased exposure to UV light due to ozone depletion
(D) global warming

115. Major product formed in the reaction of tolune with N-Bromosuccinimide (NBS) in presence of benzoyl peroxide is

(A) a mixture of 2- and 4-bromotoluene
(B) benzyl bromide
(C) 3-bromotoluene
(D) 4-bromotoluene

116. The correct order of the ionic radii of O^{2-}, N^{3-}, F^{-}, Mg^{2+}, Na^{+} and Al^{3+} is

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

117. Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar?

(A) Ca < S < Ba < Se < Ar
(B) S < Se < Ca < Ba < Ar
(C) Ba < Ca < Se < S < Ar
(D) Ca < Ba < S < Se <Ar

118. Among the following molecules/ions:
C_2^{2-}, N_2^{2-}, O_2^{2-}, O_2, which one is diamagnetic and exhibiting the highest bond length?

(A) O_2
(B) N_2^{2-}
(C) C_2^{2-}
(D) O_2^{2-}

119. Which of the following has unpaired electron(s)?

(A) N_2
(B) O_2^{-}
(C) O_2^{2+}
(D) O_2^{2-}

120. The number of protons, electrons and neutrons in a molecule of heavy water are respectively

(A) 8,10,11
(B) 10,10,10
(C) 10,11,10
(D) 11,10,10

121. Which of the following metals is used in photoelectric cell?

(A) Na
(B) Li
(C) Rb
(D) Cs

122. Strong heating of an aqueous solution of aluminium chloride to dryness will give

(A) $Al(OH)Cl_2$
(B) Al_2O_3
(C) Al_2Cl_6
(D) $AlCl_3$

123. The alloy used in the construction of aircrafts is

(A) Mg-Al
(B) Mg-Zn
(C) Mg-Sn
(D) Mg-Mn

124. Match the ores (Column A) with the metals (Column B):

(Column A)		**(Column B)**
(I)	Siderite	(a) Zinc
(II)	Kaolinite	(b) Copper
(III)	Malachite	(c) Iron
(IV)	Calamine	(d) Aluminium

(A) (I) –(a); (II) – (b); (III) –(c); (IV) – (d)
(B) (I) –(c); (II) – (d); (III) –(b); (IV) – (a)
(C) (I) –(c); (II) – (d); (III) –(a); (IV) – (b)
(D) (I) –(b); (II) – (c); (III) –(d); (IV) – (a)

125. Which one of the following substances has the highest proton affinity?

(A) H_2S
(B) NH_3
(C) PH_3
(D) H_2O

126. Which of the following has maximum number of lone pairs associated with Xe?

(A) XeF_4
(B) XeF_6
(C) XeF_2
(D) XeO_3

127. Which of the following does **NOT** show +4 oxidation state?

(A) Dy
(B) Ce
(C) Eu
(D) Tb

128. Which one of the following is paramagnetic?

(A) $[Fe(H_2O)_6]^{3+}$
(B) $[Ni(CN)_4]^{2-}$
(C) $[Co(CN)_6]^{3-}$
(D) $[Ni(CO)_4]$

129. The compound used in the treatment of lead poisoning is

(A) D-penicillamine
(B) Desferrioxime B
(C) Cis-Platin
(D) EDTA

130. Which of the following gases will have least volume, if 5 g of each gas is taken at the same temperature and pressure?

(A) N_2
(B) O_2
(C) HCl
(D) SO_2

131. What will be the standard molar volume of Ne, if its density is 0.8999 g/L at STP?

(A) 11.2 L
(B) 5.6 L
(C) 2.8 L
(D) 22.4 L

132. How many electrons are associated with the quantum number $n = 4$?

(A) 32
(B) 64
(C) 16
(D) 8

133. Salvarsan, which is used for the syphilis treatment, contains

(A) phosphorus
(B) arsenic
(C) antimony
(D) iron

134. The crystal field stabilization energy (CFSE) for an octahedral complex; $[CoCl_6]^{4-}$ is 18000 cm^{-1}. The CFSE for tetrahedral $[CoCl_4]^{2-}$ will be

(A) greater than that of $[CoCl_6]^{4-}$
(B) 15000 cm^{-1}
(C) equal to that of $[CoCl_6]^{4-}$
(D) 8000 cm^{-1}

135. Hybridization of $[Fe(CN)_6]^{3-}$

(A) sp^3d^2
(B) sp^3d
(C) d^2sp^3
(D) dsp^3

MATHEMATICS UG
(SHIFT – II **FINAL**)

136. The number of words that can be formed from the letters a,b,c,d,e,f taken 3 at a time, each word continuing at least one vowel is

(A) 84
(B) 96
(C) 102
(D) 112

137. The number of ordered triples (x, y, z) such that x, y, z are primes and $x^y + 1 = z$ is

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

138. If n is an integer between 0 and 21, then the minimum value of $n!(21-n)!$ is

(A) $9!\,21!$
(B) $10!\,11!$
(C) $20!$
(D) $21!$

139. The sum of the rational terms in the expansion of $\left(\sqrt{2}+\sqrt[5]{3}\right)^{10}$ is

(A) 9
(B) 31
(C) 32
(D) 41

140. Let p,q,r be three real numbers. Then the system $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$, $\frac{x^2}{a^2}-\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$, $-\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ has

(A) no solution
(B) unique solution
(C) finitely many solution
(D) infinitely many solution

141. The system of equations $kx+2y-z=1,\ (k-1)y-2z=2$ and $(k+2)z=3$ have only one solution when

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

142. If $S=\sum_{n=0}^{\infty}\frac{(\log x)^{2n}}{(2n)!}$, then S is equal to

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

143. For $p,q\in Z,\ p\mid q$ means p is a factor of q. Then '$\mid$' is

(A) reflexive and symmetric
(B) symmetric and transitive
(C) reflexive and not transitive
(D) reflexive, transitive but not symmetric

144. Let $\sim$ be the binary relation defined on $\mathbb{R}$ defined by $a\sim b$ if and only if $a-b+\sqrt{3}$ is an irrational number. Then $\sim$ is

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

145. One ticket is selected at random from 50 tickets numbered $00, 01, .., 49$. Then the probability that the sum of the digits on the selected ticket is 8, given that the product of these digits is zero, equals

(A) $\frac{1}{7}$

(B) $\frac{1}{14}$

(C) $\frac{5}{14}$

(D) $\frac{5}{7}$

146. A number n is chosen at random from $\{1, 2, 3, ..., 1000\}$. The probability that n is a number that bears remainder 1 when divided by 7 is

(A) $\frac{71}{500}$

(B) $\frac{143}{1000}$

(C) $\frac{72}{500}$

(D) $\frac{71}{1000}$

147. The value of $\cos A \cdot \cos(60° - A) \cos(60° + A)$ is

(A) $\frac{1}{2}\cos 3A$

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

(C) $\cos 3A$

(D) 1

148. If $\sin x+\cos x=\frac{\sqrt{7}}{2}$ where $x\in\left[0,\frac{\pi}{4}\right]$, then $\tan\frac{x}{2}$ is equal to

(A) $\frac{3+\sqrt{7}}{2}$

(B) $\frac{3-\sqrt{7}}{2}$

(C) $\frac{4-\sqrt{7}}{3}$

(D) $\frac{\sqrt{7}-2}{3}$

149. The maximum value of $\sin\left(x+\frac{\pi}{6}\right)+\cos\left(x+\frac{\pi}{6}\right)$ in the interval $\left(0,\frac{\pi}{2}\right)$ is attained at

(A) $\frac{\pi}{12}$

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

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

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

150. The number of values of $\theta\in[0,5\pi]$ satisfying the equation $3\cos 2\theta-10\cos\theta+7=0$ is

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

151. Let ABC be a triangle with $\tan\frac{A}{2}$ and $\tan\frac{B}{2}$ are roots of $bx^2-5x+1=0$. Then the triangle is

(A) equilateral
(B) isosceles
(C) right angled
(D) a triangle with the largest angle $70°$

152. The lines of regression of y on x and x on y are respectively $y = x$ and $4x - y - 3 = 0$ and the second moment about the origin of x is 2. The variance of y is

(A) 9
(B) 8
(C) 5
(D) 4

153. The ranges of k for which the circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 4kx + 9 = 0$ have two common tangents, are

(A) $k < \frac{13}{8}$

(B) $1 < k < \frac{13}{8}$

(C) $k > \frac{13}{8}$ or $k < -\frac{13}{8}$

(D) $k \in \left(-\frac{13}{8}, \frac{13}{8}\right)$

154. Let $f(x) = \sin x$, $g(x) = 2x$ and $h(x) = \cos x$. If $\phi(x) = (g \circ fh)(x)$, then $\phi''\left(\frac{\pi}{4}\right) =$

(A) 2
(B) –2
(C) –4
(D) 4

155. The inverse of the function $f(x) = \frac{3^x - 3^{-x}}{3^x + 3^{-x}}$ is

(A) $\frac{1}{2}\log_3\left(\frac{1-x}{1+x}\right)$

(B) $\frac{1}{3}\log_e\left(\frac{1-x}{1+x}\right)$

(C) $\frac{1}{2}\log_3\left(\frac{1+x}{1-x}\right)$

(D) $\frac{1}{3}\log_e\left(\frac{1+x}{1-x}\right)$

156. $\lim_{x\to 0}\dfrac{\log\left(1+x+x^2\right)+\log\left(1-x+x^2\right)}{\sec x-\cos x}=$

(A) 0
(B) ∞
(C) 1
(D) -1

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

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

158. If $\int\log\left(1+x^2\right)dx=x\log\left(1+x^2\right)-k+c$, where c is a constant, then the value of k is

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

159. Let $I=\int_0^1\dfrac{\sin t}{1+t}dt$. Then $\int_{4\pi-2}^{4\pi}\dfrac{\sin t/2}{4\pi+2-t}dt=$

(A) $2I$
(B) $-2I$
(C) I
(D) $-I$

160. The differential equation $\dfrac{dy}{dx}=\dfrac{x\left(1+y^2\right)}{y\left(1+x^2\right)}$ represents

(A) straight line
(B) hyperbola
(C) circle
(D) ellipse

161. The number of real solutions of the equation $\frac{6-x}{x^2-4}=2+\frac{x}{x+2}$ is

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

162. The number of integral solutions of $\frac{x+2}{x^2+1}>\frac{1}{2}$ is

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

163. If $3^{49}(x+iy)=\left(\frac{3}{2}+\frac{\sqrt{3}}{2}i\right)^{100}$ and $x=ky$, then k is

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

164. The equation **NOT** representing a circle is given by

(A) $\text{Re}\left(\frac{1+z}{1-z}\right)=0$
(B) $z\bar{z}+iz-i\bar{z}+1=0$
(C) $\arg\left(\frac{z-1}{z+1}\right)=\frac{\pi}{2}$
(D) $\left|\frac{z-1}{z+1}\right|=1$

165. If $\frac{1}{1^4}+\frac{1}{2^4}+...+\infty=\frac{\pi^4}{90}$, then $\frac{1}{1^4}+\frac{1}{3^4}+\frac{1}{5^4}+...\infty$ is equal to

(A) $\frac{\pi^4}{96}$

(B) $\frac{\pi^4}{45}$

(C) $\frac{89\pi^4}{90}$

(D) $\frac{\pi^4}{46}$

166. The sum of first n terms of the series $1^2+2\cdot2^2+3^2+2\cdot4^2+5^2+2\cdot6^2+...$ is $\frac{n(n+1)^2}{2}$ when n is even. When n is odd, the sum is

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

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

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

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

167. The sum of the series $1+\frac{3}{2}+\frac{7}{4}+\frac{15}{8}+\frac{31}{16}+...$ to n terms is equal to

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

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

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

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

168. If the value of k for which the equation $3x^2+2\left(k^2+1\right)x+\left(k^2-3k+2\right)=0$ possesses roots of opposite sign lies in

(A) $(-\infty,1)$
(B) $(-\infty,0)$
(C) $(1,2)$
(D) $\left(\frac{3}{2},2\right)$

169. Let α and β be roots of the equation $x^2+x\sqrt{\alpha}+\beta=0$. Then

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

170. Consider the region $5x+y\le 100,\ x+y\le 60,\ x\ge 0,\ y\ge 0$. Then the point (25, 40)

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

171. If α and β are the roots of the equation $x^2+x+1=0$, then the equation whose roots are α^{19} and β^7 is

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

172. Let $(1+i)(1+2i)(1+3i)\ \ldots\ (1+20i)=a+ib$. Then $2.5.10.\ \ldots\ .401$ is equal to

(A) $a-bi$
(B) ab
(C) a^2-b^2
(D) a^2+b^2

173. If $f(x)=\log|x|, x\neq 0$ then $f'(x)$ equals

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

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

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

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

174. $\int\frac{dx}{x\sqrt{x^6-16}}$ is equal to

(A) $\frac{1}{3}\sec^{-1}\left(\frac{x^3}{4}\right)+c$

(B) $\cosh^{-1}\left(\frac{x^3}{4}\right)+c$

(C) $\frac{1}{12}\sec^{-1}\left(\frac{x^3}{4}\right)+c$

(D) $\sec^{-1}\left(\frac{x^3}{4}\right)+c$

175. The solution of the differential equation $x+y\frac{dy}{dx}=0$ is a family of

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

176. Assume that z satisfies the condition that the imaginary part of $\frac{3z}{iz+1}$ is -1. Then the locus of z is

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

177. Given that a, b, c are in Arithmetic Progression and $|a|,|b|,|c|<1$.
Let p = $1 + a + a^2 + \ldots + \infty$, $q = 1 + b + b^2 + \ldots + \infty$ and
$r = 1 + c + c^2 + \ldots + \infty$. Then p, q, r are in

(A) AP
(B) GP
(C) HP
(D) equal

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

(A) $\sqrt{3}y = 3x + 1$

(B) $\sqrt{3}y = -(x+3)$

(C) $\sqrt{3}y = x + 3$

(D) $\sqrt{3}y = -(3x+1)$

179. Which of the following is a contradiction?

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

180. The length of the straight line $x - 3y - 1 = 0$ intercepted by the hyperbola $x^2 - 4y^2 = 1$ is

(A) $\frac{6}{5}\sqrt{10}$

(B) $\frac{6}{7}\sqrt{10}$

(C) $\sqrt{10}$

(D) $\frac{6}{5}$

181. If P represents $z = x + iy$ in the argand plane and $|z - 1|^2 + |z + 1|^2 = 4$, then the locus of P is

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

(B) $x^2 + y^2 = 1$

(C) $x^2 + y^2 = 4$

(D) $x + y = 2$

182. If $y = x - x^2$, then the derivative of y^2 with respect to x^2 is

(A) $2x^2 - 3x + 1$

(B) $2x^2 + 3x + 1$

(C) $2x^2 - 3x - 1$

(D) $2x^2 - 6x + 1$

183. The range of the function $e^x + e^{f(x)} = e$ is

(A) $(-\infty, 1]$
(B) $[1,\infty)$
(C) $(1,\infty)$
(D) $(-\infty, 1)$

184. The points on the curve $y^2 = 4a\left(x + a + \sin\frac{x}{a}\right)$ at which the tangent is parallel to x-axis, lie on

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

185. The least integer value of m such that $(m - 2)x^2 + 8x + m + 4 > 0$ for all $x \in R$ is

(A) 10
(B) 2
(C) 12
(D) 5

186. Let $R = \{(3, 3), (6, 6), (9, 9), (12, 12), (6, 12), (3, 9), (3, 12), (3, 6)\}$ be a relation on the set $A = \{3, 6, 9, 12\}$. Then the relation R is

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

187. The total number of solutions of $\sin^4 x + \cos^4 x = \sin x.\cos x$ in $[0, 2\pi]$ is equal to

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

188. Let a, b, c be distinct non-native numbers. If the vectors $a\hat{i} + a\hat{j} + c\hat{k}$, $\hat{i} + \hat{k}$ and $c\hat{i} + c\hat{j} + b\hat{k}$ lie in a plane, then c is

(A) the harmonic mean of a and b
(B) equal to 0
(C) the arithmetic mean of a and b
(D) the geometric mean of a and b

189. The angle between the straight line $\vec{r} = \left(2\vec{i} + 3\vec{j} + \vec{k}\right) + t(\hat{i} - \hat{j} + \hat{k})$ and the plane $2x - y + z = 5$ is

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

(B) $\sin^{-1}\left(\frac{2\sqrt{3}}{3}\right)$

(C) $\cos^{-1}\left(\frac{3}{2\sqrt{3}}\right)$

(D) $\cos^{-1}\left(\frac{2}{3}\right)$

190. The number of variety of salads can be made from cucumber, tomatoes, apples, oranges and bananas is

(A) 16
(B) 31
(C) 32
(D) 62

191. If the three points $U(1, 6)$, $V(3, -4)$ and $W(a, b)$ are collinear, then the equation satisfying by a and b is

(A) $5a+b-11=0$
(B) $5a+13b+5=0$
(C) $5a-13b+5=0$
(D) $13a-5b+5=0$

192. Two n bit binary strings, S_1 and S_2 are chosen randomly with uniform probability. The probability that the Hamming distance between these strings (the number of bit positions where the two strings differ) is equal to

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

(B) $\frac{nC_d}{2^d}$

(C) $\frac{nC_d}{2^n}$

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

193. The value of the integral $\int_C \frac{\cos(2\pi z)}{(2z-1)(z-3)}dx$ where C is a closed curve given by $|z|=1$ is

(A) πi
(B) $-\pi i$
(C) $\frac{\pi i}{5}$
(D) $\frac{2\pi i}{5}$

194. The angle between the line $\frac{x+1}{2}=\frac{y}{3}=\frac{z-3}{6}$ and the plane $3x+y+z=7$ is

(A) $\sin^{-1}\left(\frac{7\sqrt{11}}{15}\right)$

(B) $\sin^{-1}\left(\frac{15}{7\sqrt{11}}\right)$

(C) $\cos^{-1}\left(\frac{7\sqrt{11}}{15}\right)$

(D) $\cos^{-1}\left(\frac{15}{7\sqrt{11}}\right)$

195. A solution to $\sqrt{x-5}-\sqrt{9-x}>1,\ x\in\mathbb{Z}$ is

(A) 4
(B) 9
(C) 5
(D) 8

196. If α,β,γ are the roots of the equation $x^3+4x+1=0,$ then the value of $(\alpha+\beta)^{-1}+(\beta+\gamma)^{-1}+(\gamma+\alpha)^{-1}$ is

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

197. The locus of $\mathrm{Re}(z+1)=|z-1|$ is

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

198. The sum of the series $\sum_{k=1}^{360}\left(\frac{1}{k\sqrt{k+1}+(k+1)\sqrt{k}}\right)$ is

(A) $\frac{17}{19}$

(B) $\frac{18}{19}$

(C) $\frac{16}{19}$

(D) $\frac{20}{19}$

199. Let $f(x)$ be a polynomial of degree 3 such that $f(3)=1,\ f'(3)=-1,\ f''(3)=0$ and $f'''(3)=12$. Then the value of $f'(1)$ is

(A) 12
(B) 23
(C) -13
(D) 0

200. The value of the integral $\int_{a}^{a+\frac{\pi}{2}}\left(|\sin x|+|\cos x|\right)dx$ is

(A) $a\pi$
(B) $2a\pi$
(C) $\frac{a\pi}{2}$
(D) independent of a

201. Consider the equation $y-y_1=m\left(x-x_1\right)$. In this equation, if m and x_1 are fixed and different lines are drawn for different values of y_1, then

(A) the lines will pass through a single point
(B) there will be one possible line only
(C) there will be a set of parallel lines
(D) there are at least two lines

202. If the standard deviation of a set of observations is 4 and if each observation is divided by 4, the standard deviation of the new set of observations will be

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

203. The period of the function $f(x)=\sqrt{\tan x}$ is

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

204. The number of solutions of the equation $z^2+|z|^2=0$, where $z\in\mathbb{C}$, is

(A) one
(B) two
(C) three
(D) infinitely many

205. If $n\in\mathbb{N}$, then $10^n+3\left(4^{n+2}\right)+5$ is divisible by

(A) 7
(B) 5
(C) 9
(D) 17

206. Let $f(x+y)=f(x)f(y)$ for all x, y where $f(0)\neq 0$. If $f'(0)=2$, then $f(x)$ is equal to

(A) Ae^x
(B) Ae^{2x}
(C) $2x$
(D) Ae^{-2x}

207. The exponent of 3 in 100! is

(A) 40
(B) 48
(C) 50
(D) 45

208. Out of 10 consonants and 4 vowels, the number of words that can be formed such that each containing 3 consonants and 2 vowels is

(A) 86500
(B) 86800
(C) 86400
(D) 86300

209. The remainder when $x = 5^{5^{5^{\cdot^{\cdot^{\cdot^{5}}}}}}$ (24 times 5), is divisible by 24, is

(A) 4
(B) 24
(C) 5
(D) 6

210. If $ax^2 + bx + c = 0,\ a, b, c \in R$ has no real roots, and if $c < 0$, then

(A) $a < 0$
(B) $a + b + c > 0$
(C) $a > 0$
(D) $a = c$

211. A pair of fair dice is rolled together till a sum of either 5 or 7 is obtained. If P denotes the probability that 7 comes before 5, then $15P$ is equal to

(A) 8
(B) 1
(C) 3
(D) 9

212. If common chord of the circle C with centre at (2, 1) and of radius r and the circle $x^2 + y^2 - 2x - 6y + 6 = 0$ is a diameter of the second circle, then value of r is

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

213. The ratio of the coefficient of x^{15} to the term independent of x in the expansion of $\left(x^2 + \frac{2}{x}\right)^{15}$ is

(A) 1 : 8
(B) 1 : 12
(C) 1 : 16
(D) 1 : 32

214. Maximum value of 2997 sin x + 3996 cos x is equal to

(A) 4998
(B) 4932
(C) 4900
(D) 4995

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

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

216. The remainder when 2^{2003} is divided by 17 is

(A) 1
(B) 2
(C) 8
(D) 3

217. The value of $\frac{\log_2 24}{\log_{96} 2} - \frac{\log_2 192}{\log_{12} 2}$ is

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

218. If $z_n = \left(1 + i\sqrt{3}\right)^n$, find the value of $\sqrt{3}\,\mathrm{Im}\left(z_5\,\overline{z}_4\right)$

(A) 1536
(B) 1436
(C) 1578
(D) 1565

219. The diagonal of a parallelogram $PQRS$ are along the lines $x + 3y = 4$ and $6x - 2y = 7$, then $PQRS$ must be a

(A) rectangle
(B) square
(C) cyclic quadrilateral
(D) rhombus

220. A line is drawn through the point $P(3, 11)$ to cut the circle $x^2 + y^2 = 9$ at A and B. Then $PA \cdot PB$ is equal to

(A) 9
(B) 121
(C) 205
(D) 139

221. $P(\sin\theta, \cos\theta)$ and $Q(\cos\theta, \sin\theta)$ are two points whose mid point is at the origin. $R(\sin 2\theta, \cos\theta)$ is a point on the plane whose distance from the origin is

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

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

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

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

222. The number of points (p,q) such that $p,q \in \{1,2,3,4\}$ and the equation $px^2+qx+1=0$ has real roots is

(A) 7
(B) 8
(C) 9
(D) 16

223. If A and B are two square matrices such that $B=-A^{-1}BA$, then $(A+B)^2$ is equal to

(A) 0
(B) A^2+B^2
(C) $A^2+2AB+B^2$
(D) $A+B$

224. Vertices of a triangle are (0, 0) , $(41a, 37)$ and $(-37, 41b)$ where a and b are the roots of the equation $3x^2-16x+15=0$. The area of the triangle is equal to

(A) 4678
(B) 4356
(C) 4887
(D) 4879

225. Let R be a relation on the set L of lines defined by $l_1 R l_2$ if l_1 is perpendicular to l_2. Then the relation R is

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

FINAL ANSWER KEY									
TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT II									
SI No.	**Key**	**SI No.**	**Key**	**SI No.**	**Key**	**SI No.**	**Key**	**SI No.**	**Key**
1	A	31	A	61	C	91	B	121	D
2	D	32	A	62	A	92	B	122	B
3	C	33	B	63	D	93	A	123	A
4	B	34	D	64	C	94	A	124	B
5	B	35	D	65	C	95	A	125	D
6	B	36	A	66	B	96	B	126	C
7	C	37	C	67	D	97	A	127	C
8	C	38	C	68	B	98	B	128	A
9	A	39	B	69	A	99	B	129	D
10	C	40	B	70	D	100	C	130	D
11	B	41	D	71	B	101	C	131	D
12	D	42	D	72	C	102	C	132	B
13	D	43	C	73	D	103	A	133	B
14	A	44	C	74	D	104	B	134	D
15	D	45	A	75	A	105	B	135	C
16	B	46	C	76	C	106	C	136	B
17	B	47	A	77	A	107	A	137	B
18	C	48	B	78	D	108	C	138	B
19	C	49	C	79	D	109	B	139	D
20	B	50	C	80	A	110	C	140	B
21	D	51	B	81	D	111	D	141	B
22	D	52	C	82	C	112	C	142	C
23	A	53	C	83	C	113	B	143	D
24	B	54	C	84	A	114	A	144	D
25	C	55	C	85	C	115	B	145	B
26	A	56	B	86	A	116	C	146	A
27	B	57	C	87	D	117	C	147	C
28	D	58	C	88	B	118	D	148	D
29	D	59	A	89	D	119	B	149	A
30	B	60	D	90	D	120	B	150	D

SI No.	Key	SI No.	Key	SI No.	Key
151	C	181	B	211	D
152	D	182	A	212	A
153	C	183	D	213	D
154	C	184	D	214	D
155	C	185	D	215	A
156	C	186	A	216	C
157	B	187	A	217	A
158	B	188	D	218	A
159	D	189	B	219	D
160	B	190	B	220	B
161	D	191	A	221	C
162	C	192	C	222	A
163	D	193	D	223	B
164	D	194	B	224	C
165	A	195	B	225	D
166	A	196	C		
167	D	197	C		
168	C	198	B		
169	B	199	B		
170	A	200	D		
171	C	201	B		
172	D	202	D		
173	D	203	A		
174	C	204	D		
175	B	205	C		
176	B	206	B		
177	C	207	B		
178	C	208	C		
179	D	209	C		
180	A	210	A		

TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT II

PHYSICS UG – SHIFT III
(FINAL)

1. A particle of mass m is tied to a light string and rotated with a speed v along a circular path of radius r. If T represents the tension in the string and mg represents the gravitational force acting on the particle, then actual/real forces acting on the particle are

(A) mg and T only

(B) mg, T and an additional force of mv^2/r directed inwards

(C) mg, T and an additional force of mv^2/r directed outwards

(D) only a force mv^2/r directed inwards

2. If V_m and V_d represent the velocity of sound in moist air and dry air at the same temperature, which one of the following is **TRUE**?

(A) $V_m = V_d$

(B) $V_m > V_d$

(C) $V_m < V_d$

(D) $V_m = 2V_d$

3. The stress required to double the length of a wire of Young's modulus Y is

(A) Y

(B) $2Y$

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

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

4. A platinum resistance thermometer records the temperature as 0°C and 100°C when the resistance of the platinum wire is 80 Ω and 90 Ω. Find the temperature read by the thermometer when the resistance of the platinum wire is 86 Ω.

(A) 10°C
(B) 20°C
(C) 30°C
(D) 60°C

5. On which one of the following scales of temperature, the temperature is never negative?

(A) Kelvin
(B) Fahrenheit
(C) Celcius
(D) Reaumur

6. A real gas behaves as an ideal gas at

(A) very low pressure and high temperature
(B) high pressure and low temperature
(C) high pressure and high temperature
(D) low pressure and low temperature

7. Which one of the following is the defining equation for uniform circular motion? (Symbols have usual meaning.)

(A) $V = \omega r$
(B) $V = \frac{\omega}{r}$
(C) $V = \omega^2 r$
(D) $V = \frac{r}{\omega}$

8. Which one of the following is **TRUE** for a conductor?

(A) The resistivity of a conducting wire is proportional to its length
(B) The resistivity of a conducting wire is inversely proportional to its area of cross section
(C) The resistivity of a conducting wire is dependent both on its length and area of cross section
(D) The resistivity is a property of the material which does not depend on dimensions of the conductor but depends on nature and temperature of the conductor

9. The magnetic flux (in Webers) linked with a coil is given by the equation $\varphi = 3t^2 + 4t + 9$. Then the magnitude of the induced emf at time $t = 2s$ will be

(A) 2 V
(B) 4 V
(C) 8 V
(D) 16 V

10. An electromagnetic wave is propagating in a certain medium with a velocity V in the positive x direction. The instantaneous oscillating electric field of this wave is along the $+y$ direction. Then the direction of the oscillating magnetic field of the wave will be

(A) $-y$ direction
(B) $+z$ direction
(C) $-z$ direction
(D) $-x$ direction

11. A common emitter transistor amplifier has a current gain of 50. If the input resistance and the load resistance of the amplifier circuit are 500 Ω and 4 kΩ respectively, the voltage gain of the amplifier is

(A) 100
(B) 200
(C) 300
(D) 400

12. In the following nuclear reaction

$$p + {}_3Li^7 \rightarrow 2\ {}_2He^4$$

if the binding energy per nucleon of the Li and He nuclei are 5.6 and 7.06 MeV, estimate what must be the energy of the proton?

(A) 39.2 MeV
(B) 28.24 MeV
(C) 17.28 MeV
(D) 1.46 MeV

13. A double convex lens of focal length 20 cm with same radius of curvature for both the faces needs to manufactured. If the refractive index of the glass is 1.55, the radius of curvature required will be

(A) 10 cm
(B) 17.5 cm
(C) −17.5 cm
(D) 22 cm

14. The velocity of a particle in time t is given by $v(t) = a + bt + ct^4$. What will be the dimension of 'c'?

(A) T^{-2}
(B) L^2
(C) LT^{-4}
(D) LT^{-5}

15. A man of weight $W = mg$ is standing on a lift which is moving upward with an acceleration $\frac{a}{2}$. If g is the acceleration due to gravity, the apparent weight of the man is

(A) $W\left(1+\frac{a}{g}\right)$
(B) $W\left(1-\frac{a}{g}\right)$
(C) $W\left(1+\frac{a}{2g}\right)$
(D) $W\left(1-\frac{a}{2g}\right)$

16. The centripetal force acting on a coin weighing 0.1 kg place 0.1 m from the centre of a disc rotating at 600 rpm is

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

17. Bernoulli theorem represents the law of conservation of

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

18. If the Young's modulus of the material of a rod is 1.5×10^{11} n/m^2 and its density is 6000 kg m^{-3}, the time taken by a sound wave to traverse 1 m of the rod will be

(A) 2×10^{-4} s
(B) 2×10^{-2} s
(C) 10^{-4} s
(D) 10^{-2} s

19. Two spherical rain drops reach the surface of the earth with terminal velocities having ratio 16 : 9. The ratio of their surface area is

(A) 4 : 3
(B) 16 : 9
(C) 9 : 16
(D) 3 : 4

20. In Carnot's engine, efficiency is 50% at hot reservoir temperature T. For efficiency 40%, what will be the temperature of hot reservoir?

(A) $\frac{2T}{5}$
(B) $6T$
(C) $\frac{6T}{5}$
(D) $\frac{5T}{6}$

21. A parallel plate capacitor is made by stacking 5 identical equally spaced metallic plates having the same dielectric between the plates. The alternate plates are then connected. If the capacitor formed by two neighbouring plates has a capacitance C, the total capacitance of the combination is

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

22. The magnetic susceptibility of a paramagnetic material at −73°C is 0.0075. Its value at −173°C will be

(A) 0.0150
(B) 0.0075
(C) 0.0045
(D) 0.0030

23. When a charged particle moves perpendicular to a uniform magnetic field, its

(A) energy changes but momentum remains unchanged
(B) momentum changes but energy remains unchanged
(C) energy and momentum both remain unchanged
(D) both energy and momentum are changed

24. When a wave travels from air into glass, there is no change in its

(A) frequency
(B) velocity
(C) amplitude
(D) wavelength

25. If the radius of nucleus of ^{27}Al is 3.6 Fermi, the approximate nuclear radius of ^{64}Cu in Fermi is

(A) 1.2
(B) 2.4
(C) 3.6
(D) 4.8

26. The earth's magnetic field is approximately

(A) 2×10^{5} T
(B) 2×10^{-5} T
(C) 4×10^{-5} T
(D) 8×10^{-5} T

27. The frequency of rotation of water molecules is about

(A) 2.45 GHz
(B) 2.45 MHz
(C) 2.45 Hz
(D) 0.245 Hz

28. Consider a telescope whose objective has a focal length of 100 cm and the eyepiece has a focal length of 1 cm. The magnifying power of this telescope is

(A) 100
(B) 200
(C) 10
(D) 5

29. In the hydrogen spectrum, Paschen and Brackett series are

(A) infrared region
(B) UV region
(C) visible region
(D) microwave region

30. 1 curie is equal to

(A) 3.7×10^{10} Bq
(B) 2.7×10^{8} Bq
(C) 1.7×10^{6} Bq
(D) 3.7×10^{-10} Bq

31. A pair of forces of equal magnitude but acting in opposite directions with different lines of action is known as a

(A) stretching
(B) compression
(C) torque
(D) bending

32. What is the length of a simple pendulum?

(A) 1 m
(B) 0.5 m
(C) 0.25 m
(D) 0.125 m

33. A rubber ball is dropped from a height of 5 m on a plane. On bouncing it rises to 1.8 m. The ball loses its velocity on bouncing by a factor of

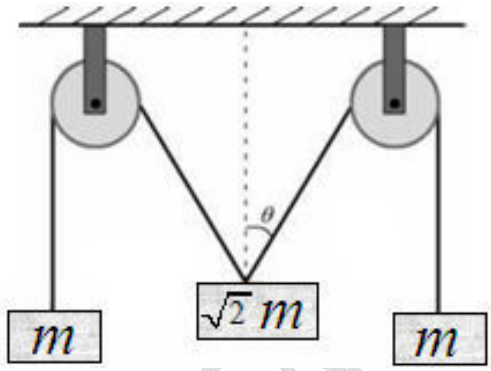
(A) $\frac{3}{5}$

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

(C) $\frac{16}{25}$

(D) $\frac{9}{25}$

34. The pulleys and strings shown below are smooth and of negligible mass. For the system to remain in equilibrium, the angle of θ should be



(A) 30°
(B) 45°
(C) 90°
(D) 60°

35. Which of the following methods can be used to measure the speed of light in laboratory?

(A) Roemer method
(B) Fizeau method
(C) Foucault method
(D) Michelson method

36. A ballet dancer stretches her hands out for a slowing down; this is based on the principle of

(A) conservation of force
(B) conservation of energy
(C) conservation of linear momentum
(D) conservation of angular momentum

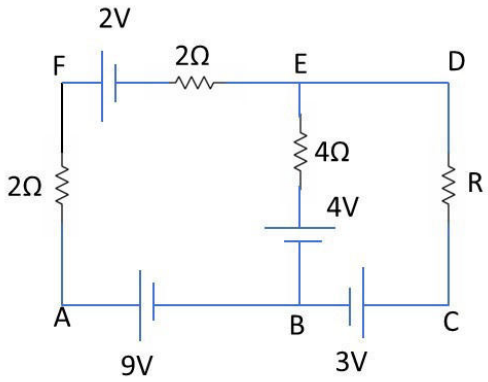
37. As the wavelength is increased from violet to red, the luminosity of a source

(A) continuously increases
(B) continuously decreases
(C) decreases then increases
(D) increases then decreases

38. Which wavelength of the radiation from sun is used for conversion into electrical energy?

(A) Radio waves
(B) Infrared waves
(C) Visible light
(D) Micro waves

39. In the electric network shown, when no current flows through the 4 Ω resistor in the arm *EB* the potential difference between the points *A* and *D* will be



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

40. Two balls each of radius *R*, equal mass and density are placed in contact, then the force of gravitation between them is proportional to

(A) $F \propto \frac{1}{R^2}$

(B) $F \propto R$

(C) $F \propto R^4$

(D) $F \propto \frac{1}{R}$

41. A hollow metallic sphere of radius 10 cm is charged such that the potential of its surface becomes 70 V. The potential at the centre of the sphere is

(A) 100 V
(B) 35 V
(C) 70 V
(D) 7 V

42. Emission of β rays in radioactive decay results in the change of

(A) mass but not in charge
(B) charge but not in mass
(C) both mass and charge
(D) either mass or charge

43. When you make ice cubes, the entropy of water

(A) increases
(B) decreases
(C) does not change
(D) either increase or decrease depending on the process

44. A steel ball weighing 1 Kg is dropped from the Leaning tower of Pisa. It starts form rest and falls freely. The position after 1 sec is (g is 9.8 m/s^2)

(A) 4.9 m
(B) –9.8 m
(C) –4.9 m
(D) 19.6 m

45. Kinetic energy of a body of mass m and momentum p is given by

(A) p^2m
(B) $\frac{m^2}{2p}$
(C) mp
(D) $\frac{p^2}{2m}$

46. Helium gas is filled in a closed vessel (having negligible thermal expansion coefficient). When it is heated from 300 K to 600 K then average kinetic energy of helium atoms will be

(A) Half
(B) unchanged
(C) two times
(D) $\sqrt{2}$ times

47. The frequency of LC circuit is

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

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

(C) $\frac{1}{2\pi}\frac{\sqrt{L}}{C}$

(D) $\frac{1}{2\pi}\sqrt{\frac{1}{LC}}$

48. If the horizontal and vertical components of the earth's magnetic field are equal at a certain place, then the angle of dip at that place will be

(A) 90°
(B) 60°
(C) 45°
(D) 0°

49. If in a moving coil galvanometer, a current i produces a deflection θ, then

(A) i is proportional to $\tan\theta$
(B) i is proportional to θ
(C) i is proportional to θ^2
(D) i is proportional to $\sqrt{\theta}$

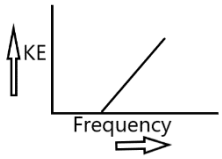
50. An achromatic combination of lenses is formed by joining

(A) 2 convex lenses
(B) 2 concave lenses
(C) 1 convex and 1 concave lens
(D) 1 convex lens and a plane mirror

51. A material with overlapping conduction and valance bands will be

(A) an insulator
(B) a semiconductor
(C) a metal
(D) a superconductor

52. For the photoelectric effect, the maximum kinetic energy KE of the emitted photoelectrons is plotted against the frequency ν of the incident photons as shown in the figure below. The slope of the curve gives



(A) charge of the electron
(B) work function of the metal
(C) Plank's constant
(D) ratio of the Plank's constant to electronic charge

53. A particle starts with an initial velocity 2.50 m/s along the positive x direction and it accelerates uniformly at the rate 0.50 m/s^2. The distance traveled by it in the first 2 seconds is

(A) 2.0 m
(B) 4.0 m
(C) 6.0 m
(D) 8.0 m

54. A toy car of 1 kg mass moves with circular speed in a horizontal circular groove, with vertical side walls, of radius 25 cm. The toy car takes 2.0 seconds to complete one round. The normal contact force by the side wall of the groove is

(A) 0.025 N
(B) 0.247 N
(C) 2.47 N
(D) 24.7 N

55. A particle of mass 0.50 kg undergoes a simple harmonic motion under a force $F = -(50\ \text{N/m})x$. If it crosses the centre of oscillation with the speed of 10 m/s, find the amplitude of the motion.

(A) 0.5 m
(B) 1 m
(C) 5 m
(D) 50 m

56. The displacement of a particle of a string carrying a travelling wave is $y = (3.0\ \text{cm}) \sin 6.28(0.50\ x - 50\ t)$, where x is in centimetre and t is in second. The speed of the wave is

(A) 100 m/s
(B) 10 m/s
(C) 100 cm/s
(D) 10 cm/s

57. A vessel of volume 2000 cm^3 contains 0.1 mole of oxygen and 0.2 mole of carbon dioxide. If the temperature of the mixture is 300 K, find its pressure.

(A) 1.25×10^5 Pa
(B) 2.50×10^5 Pa
(C) 3.75×10^5 Pa
(D) 7.50×10^5 Pa

58. A resistor develops 400 J of thermal energy in 10 s when a current of 2 A is passed through it. Find its resistance.

(A) 10 Ω
(B) 20 Ω
(C) 200 Ω
(D) 400 Ω

59. A transistor is used in common-emitter mode in an amplifier circuit. When a signal of 20 mV is added to the base-emitter voltage, the base current changes by 20 μA and the collector current changes by 2 mA. If the load resistance is 5 kΩ, find the β factor.

(A) 1
(B) 10
(C) 100
(D) 1000

60. A stone of mass 1.3 kg slides on ice with velocity of 3.12 m/s. The stone stops due to friction in 10 seconds. Assuming the force of friction to be a constant, it is

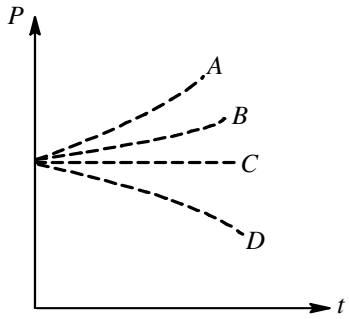
(A) –0.41 N
(B) 0.41 N
(C) –0.82 N
(D) 0.82 N

61. Regarding diffraction and interference phenomena consider the following statements:

(i) In diffraction phenomena, the interfering beams originate from a continuous distribution of sources and interference phenomena, the interfering beams originate from a discrete number of sources.
(ii) In the far-field (or Fraunhofer) diffraction as the viewing screen is moved relative to the aperture, the size of the diffraction scales uniformly, but the shape of the diffraction pattern does not change.
(iii) In the near field (or Fresnel) diffraction both the shape and size of the diffraction pattern depend on the distance between the aperture and the screen. As the screen is moved away from the aperture, the image of the aperture passes through the forms predicted in turn by geometrical optics, near-field diffraction and far-field diffraction

(A) (i) only is correct
(B) (i), (ii) only are correct
(C) (ii), (iii) only are correct
(D) (i), (ii), (iii) are correct

62. A battery of emf E and negligible internal resistance is connected to a resistor R. Taking the heating effect of current and its further effects on circuit into the considerations, indicate which of the plots shown in figure best represents the rate of production of thermal energy in the resistor.



(A) *A*
(B) *B*
(C) *C*
(D) *D*

63. A positive charge enters in a magnetic field and travels opposite the field and it experiences

(A) an upward force
(B) a downward force
(C) an accelerated force
(D) no force

64. Two pure inductors each of self inductance L are connected in series, the net inductance is

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

65. What is the force between two charged spheres having charges of 2×10^{-7} C and 3×10^{-7} C placed 30 cm apart in air?

(A) 6×10^{4} N
(B) 6×10^{-3} N
(C) 4×10^{-4} N
(D) 4×10^{-3} N

66. The ratio of contributions made by electric field and magnetic field components to the intensity of an electromagnetic wave is, (c being the velocity of light)

(A) 1 : 1
(B) c : 1
(C) c^2 : 1
(D) $\sqrt{c}$: 1

67. A transverse wave travels along the z-axis. The particles of the medium must move

(A) along the z-axis
(B) along the y-axis
(C) along the x-axis
(D) in the x-y plane

68. Kepler's second is a consequence of

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

69. A reverse bias PN junction has

(A) very narrow depletion layer
(B) almost no current
(C) very low resistance
(D) large current flow

70. The moment of inertia of a uniform semicircular wire of mass M and radius r about a line passing through its ends is

(A) Mr^2
(B) $\frac{1}{2}Mr^2$
(C) $\frac{1}{4}Mr^2$
(D) $\frac{2}{5}Mr^2$

71. A particle is moving in a circle with uniform speed. Its motion is

(A) not periodic
(B) periodic and simple harmonic
(C) periodic but not simple harmonic
(D) simple harmonic

72. Analogue of mass in rotational motion is

(A) moment of inertia
(B) torque
(C) radius of gyration
(D) angular momentum

73. The displacement of a particle in simple harmonic motion is always measured from

(A) extreme position
(B) mean position
(C) midpoint of mean and extreme position
(D) yield point

74. Can an ideal gas be liquefied?

(A) Yes
(B) No
(C) Can be liquefied at low pressure
(D) Can be liquefied at high temperature

75. Specific resistance is numerically equal to the resistance offered by

(A) 1 cm length of a conductor
(B) A conductor of unit cross-section
(C) 1 cm length of conductor of 1 cm^2 of cross-section
(D) 1 cm^3 of a conductor

CHEMISTRY (UG)– **SHIFT III**
(FINAL)

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

(A) $\Delta H > \Delta U$
(B) $\Delta H < \Delta U$
(C) $\Delta H = \Delta U$
(D) $\Delta U = \Delta H = 0$

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

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

78. Two platinum electrodes were immersed in a solution of copper sulphate and electric current was passed till copper sulphate is completely electrolysed. The resultant solution contains

(A) Platinum sulphate
(B) Copper hydroxide
(C) Only water
(D) Dilute sulphuric acid

79. For a spontaneous reaction, the Gibbs free energy change (ΔG), the equilibrium constant (K) and E^{o}_{cell} will be respectively

(A) –ve, > 1, +ve
(B) +ve, > 1, –ve
(C) –ve, < 1, –ve
(D) –ve, > 1, –ve

80. A pressure cooker reduces cooking time for food because

(A) heat is more easily distributed in the cooking space
(B) the higher pressure inside the cooker crushes the food material
(C) boiling point of water involved in cooking is increased
(D) cooking involves chemical changes helped by a rise in temperature

81. The molar conductances of NaCl, HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and 91 $Ohm^{-1}\ cm^2\ mol^{-1}$, respectively. The molar conductance of acetic acid at infinite dilution is

(A) 590.71 $ohm^{-1}\ cm^2\ mol^{-1}$
(B) 698.28 $ohm^{-1}\ cm^2\ mol^{-1}$
(C) 217.45 $ohm^{-1}\ cm^2\ mol^{-1}$
(D) 390.71 $ohm^{-1}\ cm^2\ mol^{-1}$

82. In salt bridge, KCl is used because

(A) KCl is present in the calomel electrode
(B) K^+ and Cl^- ions have same transport number
(C) K^+ and Cl^- ions are isoelectronic
(D) KCl is a strong electrolyte

83. $E^o_{Ag^+/Ag}$ =0.80 V and $E^o_{Ni^{2+}/Ni}$ =-0.25 V. The EMF of the cell Ni-Ag is

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

84. For a first order reaction, $t_{0.75}$ is 138.6 sec. Its specific rate constant (in sec) is

(A) 10^{-2}
(B) 10^{-4}
(C) 10^{-5}
(D) 10^{-6}

85. The number of atoms in 100 g of fcc crystal with density d = 10 g cm^3 and cell edge equal to 100 pm is

(A) 4×10^{25}
(B) 3×10^{25}
(C) 2×10^{25}
(D) 1×10^{25}

86. 40 mg of pure sodium hydroxide is dissolved in 10 litre of distilled water. The pH of the solution is

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

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

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

88. Electrode potentials are reported with reference to

(A) standard hydrogen electrode
(B) normal calomel electrode
(C) glass electrode
(D) silver-silver chloride electrode

89. The value of diffusion coefficient of methane at a given temperature is half of a gas X. The molecule weight of X is

(A) 4
(B) 32
(C) 8
(D) 64

90. An electrochemical cell can behave like an electrolytic cell when

(A) $E_{cell} = 0$
(B) $E_{cell} > E_{ext}$
(C) $E_{ext} > E_{cell}$
(D) $E_{cell} = E_{ext}$

91. A current of 9.65 A flowing for 10 min deposits 3.0 g of a metal. The equivalent of the metal is

(A) 10
(B) 30
(C) 50
(D) 96.5

92. The vapour pressure of pure liquid solvent A is 0.80 atm. When non-volatile substance B is added to the solvent its vapour pressure drops to 0.40 atm. What is the mole fraction of B in solution?

(A) 0.50
(B) 0.28
(C) 0.75
(D) 0.40

93. If the rate of reaction is equal to the rate constant, the order of the reaction is

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

94. What is the molar solubility, s, of $Ba_3(PO_4)_2$ in terms of K_{sp}?

(A) $s = K_{sp}^{1/2}$
(B) $s = K_{sp}^{1/5}$
(C) $s = [K_{sp}/27]^{1/5}$
(D) $s = [K_{sp}/108]^{1/5}$

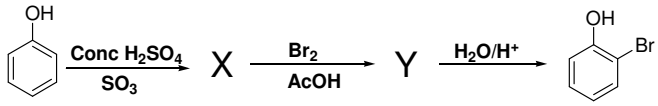
95. The region at which the probability density function reduces to zero is called as

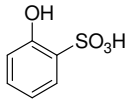
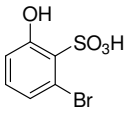
(A) Density region
(B) Nodal surfaces
(C) Orientation surfaces
(D) Wave function

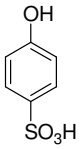
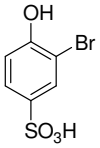
96. Identify the compound having sp, sp^2 and sp^3 hybridized carbons.

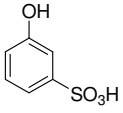
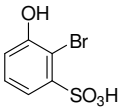
(A) 2,3-pentadiene
(B) 1,3-butadiene
(C) 2-heptyne
(D) phenylacetylene

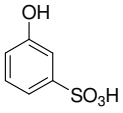
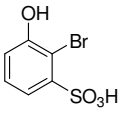
97. Identify X and Y in the following chemical steps



(A) X =  Y = 

(B) X =  Y = 

(C) X =  Y = 

(D) X =  Y = 

98. What is the main chemical component of oil of wintergreen?

(A) Methyl salicylate
(B) Menthol
(C) Benzaldehyde
(D) Camphor

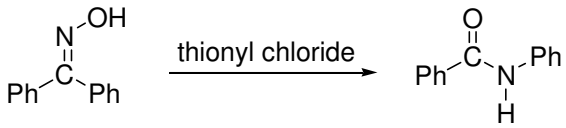
99. Lindlar Catalyst is

(A) $NaBH_4$
(B) NH_2NH_2
(C) $HCl/ZnCl_2$
(D) $Pd/BaSO_4$ poisoned with Quinoline

100. Which among the following methods is **NOT** suitable for preparing phenol under mild conditions?

(A) Treatment of chlorobenzene with NaOH in water
(B) Hydrolysis of phenyl acetate
(C) Treatment of methoxybenzene (anisole) with 57% HI
(D) Treatment of cumene hydroperoxide with dil. HCl

101. Thionyl chloride mediated rearrangement of benzophenone oxime to benzanilide is an example for

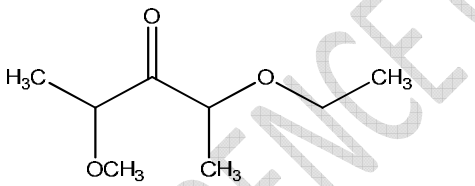


(A) Hofmann rearrangement
(B) Curtius rearrangement
(C) Schmidt rearrangement
(D) Beckmann rearrangement

102. Among the following, the amino acid which does not have aromatic/heteroaromatic ring residue is

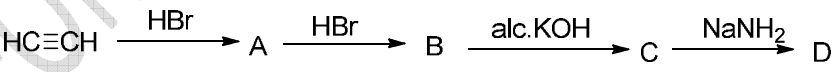
(A) Tyrosine
(B) Asparagine
(C) Tryptophan
(D) Histidine

103. IUPAC name for the following compound is



(A) 2-methoxy-4-ethoxy-3-pentanone
(B) 2-ethoxy-4-methoxy-3-pentanone
(C) 2-ethoxy-3-methoxy-3-pentanone
(D) None of the above

104. In the following sequence of reactions, the product 'D' is



(A) Ethanol
(B) Ethyne
(C) Ethylamine
(D) Ethene

105. Aniline is selectively converted to 4-bromoaniline in high yields by

(A) treatment with bromine water
(B) conversion to acetanilide by treatment with acetic anhydride followed by bromination and hydrolysis
(C) treatment with bromine in the presence of a halogen carrier
(D) treatment with bromine in CCl_4 in the presence of light

106. Maltose is a disaccharide made up of

(A) α-D-glucose only
(B) one each of α- and β-D-glucose units
(C) β-D-glucose and D-fructose
(D) two D-fructose units only

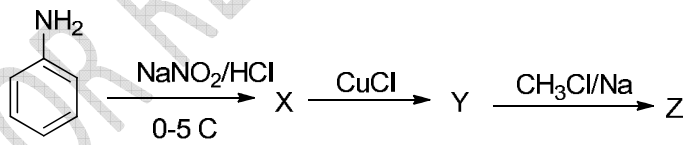
107. Dynel, polymer used for hair wigs, is a

(A) copolymer of butadiene and styrene
(B) copolymer of vinyl chloride and acrylonitrile
(C) polyamide resin
(D) cross linked polystyrene

108. Which among the following statements is **incorrect** about Hunsdiecker reaction?

(A) It proceeds through a carbocation intermediate
(B) Silver salts of carboxylic acids are used in this reaction
(C) One equivalent of CO_2 is liberated in this reaction
(D) It is not suitable for the generation of alkyl fluoride

109. In the following reaction sequence, the major product 'Z' is

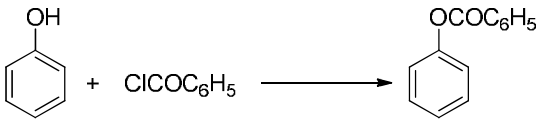


(A) toluene
(B) biphenyl
(C) 4-chlorotoluene
(D) N-methylaniline

110. Which of the following is Lucas Reagent?

(A) Ammonical silver nitrate
(B) Br_2/CCl_4
(C) Anhy. $ZnCl_2$/conc. HCl
(D) Alk. $KMnO_4$

111. The following reaction is called



(A) Wurtz reaction
(B) Kolbe's reaction
(C) Reimer-Tiemann reaction
(D) Schotten-Baumann reaction

112. A 1 : 1 mixture of benzaldehyde and formaldehyde on heating with concentrated aq NaOH solution gives

(A) sodium benzoate and methyl alcohol
(B) methyl benzoate
(C) disodium salt of phthalic acid
(D) benzyl alcohol and sodium formate

113. Reaction of CH_3-CH_2-CH_2-Cl with KCN in acetonitrile to give CH_3-CH_2-CH_2-CN proceeds predominantly by

(A) Nucleophilic Substitution bimolecular
(B) Nucleophilic Substitution unimolecular
(C) Radical Substitution bimolecular
(D) Radical Substitution unimolecular

114. **Oxides of nitrogen and sulphur, formed by burning fossil fuels, combine with oxygen in the presence of sun light to form**

(A) dioxins
(B) thiourea
(C) smog
(D) ammonium sulphate nano particles

115. Carbocation intermediates are involved in

(A) S_N1 and S_N2 substitution reaction
(B) E1 and E2 elimination reaction
(C) S_N2 substitution and E2 elimination
(D) S_N1 substitution and E1 elimination

116. Which is the correct order of second ionization potential of C, N, O, and F in the following?

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

117. In the following the correct bond order sequence is

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

118. Which of the following ions has the lowest ionic conductivity in aqueous solution?

(A) Na^{+}
(B) Rb^{+}
(C) Li^{+}
(D) K^{+}

119. The element that shows greater ability to form pπ-pπ multiple bonds, is

(A) Sn
(B) C
(C) Ge
(D) Si

120. The form of iron obtained from blast furnace is

(A) Steel
(B) Cast iron
(C) Pig iron
(D) Wrought iron

121. The element that can be refined by distillation is

(A) Nickel
(B) Zinc
(C) Tin
(D) Gallium

122. XeF_6 on partial hydrolysis with water produces a compound '*x*'. The same compound '*x*' is formed when XeF_6 reacts with silica. The compound '*x*' is

(A) XeF_2
(B) XeF_4
(C) $XeOF_4$
(D) XeO_3

123. Which of the following arrangements does **NOT** represent the correct order of the property stated against it?

(A) $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour
(B) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size
(C) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution
(D) Sc < Ti < Cr < Mn : number of oxidation states

124. The correct order of atomic radii is

(A) Nd > Dy > Ce > Yb
(B) Nd > Ce > Dy > Yb
(C) Ce > Dy > Yb > Nd
(D) Ce > Nd > Dy > Yb

125. Photon of which light has maximum energy?

(A) Red
(B) Blue
(C) Violet
(D) Green

126. Which of the following is the correct set with reference to molecular formula, hybridisation of central atom and shape of the molecule?

(A) CO_2, sp^2, bent
(B) H_2O , sp^2, bent
(C) $BeCl_2$, sp^2, linear
(D) H_2O, sp^3, bent

127. The covalent energy is maximised in

(A) Heteronuclear molecule of AB type
(B) Heteronuclear molecule of A^+B^- type
(C) Homonuclear diatomic molecule
(D) None of the above

128. Which one of the following characteristics of the transition metals is associated with higher catalytic activity?

(A) High enthalpy of atomisation
(B) Paramagnetic behaviour
(C) Colour of hydrate ions
(D) Variable oxidation states

129. The oxidation number of cobalt in $K[Co(CO)_4]$ is

(A) +1
(B) +3
(C) −1
(D) −3

130. The correct electronic configuration and spin only magnetic moment of Gd^{+3} are

(A) [Xe] $4f^7$ and 7.9BM
(B) [Xe] $4f^7$ and 8.9BM
(C) [Xe] $4f^6$ $5d^1$ and 7.9BM
(D) [Xe] $5f^7$ and 7.9BM

131. How many moles of O_2 can be produced during electrolytic decomposition of 90 g of water?

(A) 1.25 moles
(B) 2.5 moles
(C) 5.0 moles
(D) 3.5 moles

132. Orbital angular momentum depends on the quantum number/s

(A) *l*
(B) *n* and *l*
(C) *n* and *m*
(D) *m* and *s*

133. Crystal field stabilization energy (CFSE) of a high spin octahedral iron(III) complex (atomic number of iron = 26)

(A) −20 Dq
(B) 0
(C) −6 Dq
(D) −4 Dq

134. What is the most important factor which makes Li strong reducing agent?

(A) Sublimation energy
(B) Ionization energy
(C) Hydration energy
(D) Electron gain enthalpy

135. Which of the following complex of M (atomic number 26) will be most stable?

(A) $[M(CO)_5]$
(B) $[M(CO)_4]$
(C) $[M(CO)_5]^-$
(D) $[M(CO)_6]$

MATHEMATICS UG
(SHIFT – III **FINAL**)

136. Nishi has 5 coins each of the different denomination. The number of different sums of money, she can form, is

(A) 25
(B) 30
(C) 31
(D) 32

137. The number of ordered pairs (m,n), $m,n \in \{1,2,...,50\}$ such that $6^n + 9^m$ is a multiple of 5, is

(A) 2500
(B) 1500
(C) 1250
(D) 750

138. In a decimal system of numeration, the number of exactly 6-digit numbers in which the sum of the digits is divisible by 5 is

(A) 180000
(B) 210000
(C) 360000
(D) 540000

139. Let $A = \begin{bmatrix} 2 & 1 \\ 4 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix}$. Then $tr(A) + tr\left(\frac{ABC}{2}\right) + tr\left(\frac{A(BC)^2}{4}\right) + tr\left(\frac{A(BC)^3}{8}\right) + ...\infty$ where $tr(A)$ is the trace of A, is equal to

(A) 6
(B) 9
(C) 12
(D) 16

140. The determinant $\begin{vmatrix} a & b & a\alpha+b \\ -b & c & b\alpha+c \\ a\alpha+b & b\alpha+c & 0 \end{vmatrix} = 0$, if

(A) $b^3 = ac$

(B) $ab = c^3$

(C) $x-\alpha$ is a factor of $bx^2+2ax+c$

(D) $x-\alpha$ is a factor of $ax^2+2bx+c$

141. $\frac{2}{3!}+\frac{4}{5!}+\frac{6}{7!}+\ldots$ will be equal to

(A) $2e^{-2}$

(B) e^{-2}

(C) e^{-1}

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

142. If $x = 1+2+\frac{4}{2!}+\frac{8}{3!}+\frac{16}{4!}+\ldots$, then x^{-1} is equal to

(A) e^{-2}

(B) e^{2}

(C) $e^{1/2}$

(D) $e^{-1/2}$

143. Let $f(x) = \left[\frac{1}{\sin\{x\}}\right]$ where $\{.\}$ and $[.]$ respectively denote the fractional part and greatest integer. Then range of f is

(A) real numbers
(B) negative integers
(C) natural numbers
(D) rationals

144. Two die are thrown simultaneously to get the coordinates of a point on $x-y$ plane. Then the probability that this point lies inside or on the region bounded by $|x|+|y|\le 3$ is

(A) $\frac{2}{14}$

(B) $\frac{3}{14}$

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

(D) $\frac{4}{14}$

145. A pair of fair dice is thrown independently three times. The probability of getting a score of exactly a twice is

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

(B) $\frac{1}{729}$

(C) $\frac{8}{243}$

(D) $\frac{8}{729}$

146. If $\sin\theta = n\left(\sin(\theta+2\alpha)\right)$, then $\tan(\theta+\alpha)$ is equal to

(A) $n\tan\alpha$

(B) $\frac{1-n}{1+n}\tan\alpha$

(C) $\tan\alpha$

(D) $\frac{1+n}{1-n}\tan\alpha$

147. If $S = \cos^2 \frac{\pi}{n} + \cos^2 \frac{2\pi}{n} + ... + \cos^2 \frac{(n-1)\pi}{n}$, then S is equal to

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

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

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

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

148. If $\operatorname{cosec} A + \cot A = \frac{9}{2}$, then $\tan A$ is

(A) $\frac{77}{36}$

(B) $\frac{36}{77}$

(C) $\frac{18}{77}$

(D) $\frac{77}{72}$

149. If $\tan^2 x + \sec x - a = 0$ has atleast one solution, then the complete set of values of 'a' is

(A) $(-\infty, 2)$

(B) $(-1, 1)$

(C) $[-1, 1]$

(D) $[-1, \infty)$

150. The values of 'λ', for which the equation $\cos^4 x-(\lambda+2)\cos^2 x-(\lambda+3)=0$ possesses a solution, lies in

(A) $[-3,-1]$

(B) $[-3,-2]$

(C) $[0,2]$

(D) $(0,3)$

151. Let $\sin^{-1} x-\cos^{-1} x=\frac{\pi}{6}$. Then x is

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

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

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

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

152. The sum of 10 terms is 12 and the sum of their squares is 17. Then the standard deviation will be

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

(B) $\frac{6}{5}$

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

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

153. If the circle $x^2+y^2+4x+22y+c=0$ bisects the circumference of the circle $x^2+y^2-2x+8y-d=0$, then $c+d$ is equal to

(A) 60
(B) 40
(C) 80
(D) 50

154. The second order derivative of $a\sin^3 t$ with respect to $a\cos^3 t$ at $t=\frac{\pi}{4}$ is

(A) $\frac{4\sqrt{2}}{3a}$

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

(C) $\frac{4}{3a}$

(D) $\frac{4}{a\sqrt{2}}$

155. The period of the function $f(x)=\cos\left(\frac{\pi x}{n!}\right)-\sin\left(\frac{\pi x}{(n+1)!}\right)$ is

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

156. If $f(x)=\begin{cases}\frac{\sin(\cos x)-\cos x}{(\pi-2x)^2}, & x\neq \pi/2\\ k, & x=\pi/2\end{cases}$ is continuous at $x=\pi/2$ then $k=$

(A) 0

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

(C) 1

(D) -1

157. On the interval $[0,1]$, the function $x^{25}\cdot(1-x)^{75}$ takes its maximum value at the point

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

(B) 0

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

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

158. Solutions of the equation $3^{x^2-x}+4^{x^2-x}=25$ are

(A) $-1,-2$

(B) $-1,2$

(C) $1,-2$

(D) $1,2$

159. $\int_{-\pi/2}^{\pi/2}\left(x^3+x\cos x+\tan^5 x+1\right)dx=$

(A) 0

(B) 2

(C) π

(D) 1

160. If $a_i>0$ for $i=1,2,...,n$ and $a_1a_2...a_n=1$, then the minimum value of $(1+a_1)(1+a_2)...(1+a_n)$ is

(A) $2^{n/2}$

(B) 2^n

(C) 2^{2n}

(D) 1

161. If $\log_4 5 = a$ and $\log_5 6 = b$, then $\log_3 2$ is equal to

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

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

(C) $2ab+1$

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

162. For positive numbers a, b, c, the least value of $\left(a^2+b^2+c^2\right)\left(\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}\right)$ is

(A) 3

(B) 9

(C) $\frac{27}{4}$

(D) $\frac{27}{2}$

163. The value of $4+5\left(-\frac{1}{2}+i\frac{\sqrt{3}}{2}\right)^{334}-3\left(\frac{1}{2}+i\frac{\sqrt{3}}{2}\right)^{365}$ is equal to

(A) $1-i\sqrt{3}$

(B) $-1+i\sqrt{3}$

(C) $4\sqrt{3}i$

(D) $-i\sqrt{3}$

164. For the equation $3x^2+px+3=0$, $p>0$, if one of the root is square of the other, then p is equal to

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

(B) 1

(C) 3

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

165. If the roots of the cubic equation $x^3 - px^2 + qx - r = 0$ are in G.P., then

(A) $q^3 = p^3 r$

(B) $p^3 = q^3 r$

(C) $pq = r$

(D) $pr = q$

166. If $H_n = 1 + \frac{1}{2} + \ldots \frac{1}{n}$, then the value of $1 + \frac{3}{2} + \frac{5}{3} + \ldots + \frac{2n-1}{n}$ is

(A) $H_n + n$

(B) $2n - H_n$

(C) $(n-1) + H_n$

(D) $H_n + 2n$

167. A student read common difference of an A.P. as -3 instead of 3 and obtained the sum of first 10 terms as -30. Then, the actual sum of the first 10 terms is equal to

(A) 120
(B) 240
(C) 180
(D) 300

168. If the roots of the equation $x^2 - 2kx + k^2 + k - 3 = 0$ are real and less than 3, then

(A) $k > 4$

(B) $2 \le k \le 3$

(C) $3 < k \le 4$

(D) $k < 2$

169. Let $x = 2 + 2^{1/3} + 2^{2/3}$. Then the value of $x^3 - 6x^2 + 6x$ is

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

170. The average age of A, B and C, whose ages are integers x, y and z ($x \le y \le z$) respectively, is 30. If the age of B is exactly 5 more than that of A, then the minimum possible value of z is

(A) 31
(B) 33
(C) 35
(D) 37

171. If the median of 21 observations is 40 and if the observations greater than the median are increased by 5, then the median of the new data will be

(A) 45
(B) 40
(C) $40+\frac{50}{21}$
(D) $40-\frac{50}{21}$

172. Let a, b, c, be positive numbers such that $a + b + c = 1$ and $(1 - a)(1 - b)(1 - c) \ge kxyz$. Then k is equal to

(A) 4
(B) 8
(C) 6
(D) 0

173. The inverse of the point (1, 2) with respect to the circle $x^2 + y^2 - 4x - 6y + 9 = 0$, is

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

174. The differential equation of all straight lines touching the circle $x^2 + y^2 = a^2$ is

(A) $\left(y - \frac{dy}{dx}\right)^2 = a^2\left[1 + \left(\frac{dy}{dx}\right)^2\right]$

(B) $\left(y - x\frac{dy}{dx}\right)^2 = a^2\left[1 + \left(\frac{dy}{dx}\right)^2\right]$

(C) $\left(y - x\frac{dy}{dx}\right) = a^2\left[1 + \frac{dy}{dx}\right]$

(D) $\left(y - \frac{dy}{dx}\right) = a^2\left[1 - \frac{dy}{dx}\right]$

175. If $f(x) = |x-2|$ and $g(x) = f[f(x)]$, then $g'(x)$ for $x > 20$ is

(A) ∞
(B) 1
(C) 2
(D) -1

176. The complex number z satisfying the equations $|z| - 4 = |z - i| - |z - 5i| = 0$ is

(A) $\sqrt{3} - i$

(B) $2\sqrt{3}$

(C) $-2\sqrt{3} - 2i$

(D) 0

177. An ellipse has OB as semi-minor axis, F and F' its foci and the angle FBF' is a right angle. Then, the eccentricity of the ellipse is

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

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

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

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

178. If $\int_1^2 e^{x^2}\,dx = a$, then the value of $\int_e^{e^4} \sqrt{\log_e x}\,dx$ is

(A) $e^4 - e$
(B) $e^4 - a$
(C) $2e^4 - a$
(D) $2e^4 - e - a$

179. Given that the curves $x^2 + y^2 + kx + 4y + 2 = 0$ and $2(x^2 + y^2) - 4x - 3y + k = 0$ cut orthogonally. Then the value of k is

(A) 1
(B) $\frac{1}{3}$
(C) $\frac{10}{3}$
(D) $-\frac{10}{3}$

180. Let a, b, c be three positive real numbers such that $a + b \geq c$. Then

(A) $\frac{a}{1+a} + \frac{b}{1+b} \geq \frac{c}{1+c}$
(B) $\frac{a}{1+a} + \frac{b}{1+b} < \frac{c}{1+c}$
(C) $\frac{a}{1+a} + \frac{b}{1+b} > \frac{1+c}{c}$
(D) $\frac{a}{1+a} + \frac{b}{1+b} \leq \frac{1+c}{c}$

181. The centre of a regular hexagon is at the point $z = i$. If one of the vertices is at $2 + i$, then the adjacent vertices of $2 + i$ are at the points

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

182. If $y = f(t)\sin t + f'(t)\cos t$ and $x = f(t)\cos t - f'(t)\sin t$, then $\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2$ is equal to

(A) $[f(t) - f''(t)]^2$

(B) $[f(t) + f''(t)]^2$

(C) $[f(t) + f'(t)]^2$

(D) $[f(t) - f'(t)]^2$

183. The value of integer n for which the function $f(x) = \frac{\sin nx}{\sin \frac{x}{n}}$ has 4π as its period is

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

184. If $f(x) = 2x^3 + 9x^2 + \lambda x + 20$ is a decreasing function of x in the largest possible interval $(-2,-1)$, then λ is equal to

(A) 6
(B) −6
(C) 12
(D) −12

185. A seven digit number made up of all distinct digits 8, 7, 6, 4, 2, x and y is divisible by 3. Then possible number of ordered pair (x, y) is

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

186. If X follows a binomial distribution with parameters $n = 100$ and $p = \frac{1}{3}$, then $P(X = r)$ is maximum when r is equal to

(A) 16
(B) 32
(C) 33
(D) 44

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

(A) ∞
(B) -1
(C) 0
(D) 1

188. The slopes of the lines represented by $x^2 + 2hxy + 2y^2 = 0$ are in the ratio 1 : 2. Then the value of h is

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

189. The equation of the sphere described on the line joining the points (2, −1, 4) and (−2, 2, −2) as diameter is

(A) $2x^2 - x + z = 0$
(B) $x^2 + y^2 + z^2 + x - y + z + 7 = 0$
(C) $x^2 + y^2 + z^2 - y - 2z - 14 = 0$
(D) $x^2 + y^2 + z^2 = 0$

190. Consider the circle $|z-5-5i|=2$ in the complex plane (x, y) with $z=x+iy$. Then the minimum distance from the origin to the circle is

(A) $5\sqrt{2}-2$

(B) $5\sqrt{2}$

(C) $\sqrt{34}$

(D) $\sqrt{54}$

191. Given that two roots of the nonlinear equation $x^3-6x^2+11x-6=0$ are 1 and 3. The third root will be

(A) j
(B) $-j$
(C) 2
(D) –2

192. Let $A=\begin{pmatrix}2 & 3\\ x & y\end{pmatrix}$. If the eigen values of A are 4 and 8, then (x, y) =

(A) (4,10)
(B) (5,8)
(C) (–3,9)
(D) (–4,10)

193. The value of $\oint_C \frac{z^2+8}{0.5z-1.5j}dz$, where $j=\sqrt{-1}$ and C is described by $x^2+y^2=16$, is

(A) $4\pi j$
(B) $-4\pi j$
(C) $2\pi j$
(D) $-2\pi j$

194. If $\vec{r}=x\vec{i}+y\vec{j}+z\vec{k}$, then $(div\,\vec{r}, curl\,\vec{r})$ is

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

195. The value of $\sqrt{6+\sqrt{6+\sqrt{6+...\infty}}}$ is

(A) 3
(B) 6
(C) –4
(D) 2

196. The minimum height from any point on the curve $y = x^2 - 4x + 6$ to the x-axis is

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

197. If $\left(\sqrt{8}+i\right)^{50} = 3^{49}\left(a+ib\right)$, then the value of a^2+b^2 is

(A) 3
(B) 9
(C) 27
(D) 81

198. If $4x+3|y| = y$, then y as a function of x is

(A) not continuous at $x = 0$
(B) not defined for all real x
(C) $\frac{dy}{dx} = \frac{1}{2}$ for $x < 0$
(D) differentiable at $x = 0$

199. If $f(x)$ be a differentiable function such that $f(xy) = f(x) + f(y)$ for all x and y, then $f(e) + f\left(\frac{1}{e}\right) =$

(A) 1
(B) 0
(C) –1
(D) ∞

200. The order of differential equation $x=1+\left(\frac{dy}{dx}\right)+\frac{1}{2!}\left(\frac{dy}{dx}\right)^2+\frac{1}{3!}\left(\frac{dy}{dx}\right)^3+\ldots\frac{1}{n!}\left(\frac{dy}{dx}\right)^n$ is

(A) 3
(B) 1
(C) n
(D) not defined

201. If a straight line through $C\left(-\sqrt{8},\sqrt{8}\right)$ making an angle of $135°$ with the x-axis and cuts the circle $x=5\cos\theta,\ y=5\sin\theta$ at points A and B, then the length of AB is

(A) 3
(B) 7
(C) 10
(D) 5

202. If 25% of the items are less than 20 and 25% are more than 40, the quartile deviation is

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

203. The function $f(x)=\sec\left[\log\left(x+\sqrt{1+x^2}\right)\right]$ is

(A) even
(B) odd
(C) constant
(D) periodic

204. If $x^2-x+1=0$, then the value of x^{3n} is

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

205. The remainder when $1! + 2! + 3! + \cdots + 49!$ is divided by 10 is

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

206. If a, b, c are positive numbers in A.P. such that their product is 64, then the minimum value of b is

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

207. The number of zeros in the product $5^6 \cdot 6^7 \cdot 7^8 \cdot 8^9 \cdot 9^{10} \cdots 30^{31}$ is

(A) 130
(B) 132
(C) 137
(D) 136

208. The number of ways in which the number 94864 can be resolved as a product of two factors

(A) 22
(B) 24
(C) 23
(D) 26

209. The maximum number of different elements required to form a symmetric matrix of order 12 is

(A) 72
(B) 78
(C) 75
(D) 70

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

(A) 48200
(B) 14106
(C) 28300
(D) 30240

211. If $a^2 - 2a\cos x + 1 = 674$ and $\tan\left(\frac{x}{2}\right) = 7$ then the integral value of a is

(A) 25
(B) 49
(C) 67
(D) 74

212. If the length of the semi major axis of an ellipse is 68 and the eccentricity is $\frac{1}{2}$ then the area of the rectangle formed by joining the vertices of the latera recta of the ellipse is equal to

(A) 6846
(B) 6936
(C) 6676
(D) 7244

213. If A and B are two distinct matrices such that $A^3 = B^3$ and $A^2B = B^2A$, then $\det(A^3 + B^3)$ is equal to

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

214. If the point (3, 4) lies on the locus of the point of intersection of the lines $x\cos\alpha + y\sin\alpha = a$ and $x\sin\alpha - y\cos\alpha = b$, ($\alpha$ is a variable), and the point (a, b) lies on the line $3x - 4y = 0$, then $9a^4 + 16b^4 + 34$ is equal to

(A) 3634
(B) 3684
(C) 3845
(D) 3874

215. If A denotes the area enclosed by $3|x| + 4|y| \le 12$, then $4A^2 + A + 1$ is equal to

(A) 2341
(B) 2329
(C) 2420
(D) 2429

216. Suppose a matrix A satisfies $A^2 - 5A + 7I = 0$. If $A^8 = aA + bI$, then $a =$

(A) 1265
(B) 5299
(C) 1259
(D) 5432

217. The largest term in the expansion of $(3+2x)^{50}$, where $x = \frac{1}{5}$ is

(A) 5^{th}
(B) 6^{th}
(C) 8^{th}
(D) 9^{th}

218. If $\log_3 x + \log_3 y = 2 + \log_3 2$ and $\log_3(x+y) = 2$, then

(A) $x = 1, y = 8$
(B) $x = 1, y = 1$
(C) $x = 3, y = 6$
(D) $x = 9, y = 3$

219. The equation of the circle which passes through the origin has its centre on the line $x + y = 4$ and cuts the circle $x^2 + y^2 - 4x + 2y + 4$ orthogonally, is

(A) $x^2 + y^2 - 2x - 6y = 0$
(B) $x^2 + y^2 - 6x - 3y = 0$
(C) $x^2 + y^2 - 4x - 4y = 0$
(D) $x^2 + y^2 + 4x + 4y = 0$

220. The number of integral roots of the equation $x^4 + \sqrt{x^4 + 20} = 22$ is

(A) 0
(B) 2
(C) 4
(D) 8

221. If $x = 9$ is the chord of contact of the hyperbola $x^2 - y^2 = 9$, then the equation of the corresponding pair of tangents is

(A) $9x^2 - 8y^2 + 18x - 9 = 0$

(B) $9x^2 - 8y^2 - 18x + 9 = 0$

(C) $9x^2 - 8y^2 - 18x - 9 = 0$

(D) $9x^2 - 8y^2 + 18x + 9 = 0$

222. The lines joining the origin to the points of intersection of $x^2 + y^2 + 2gx + c = 0$ and $x^2 + y^2 + 2fy - c = 0$ are at right angles. Then

(A) $g^2 + f^2 = c$

(B) $g^2 - f^2 = c$

(C) $g^2 - f^2 = 2c$

(D) $g^2 + f^2 = c^2$

223. If m is a natural number such that $m \leq 5$, then the probability that the quadratic equation $x^2 + mx + \frac{1}{2} + \frac{m}{2} = 0$ has real roots is

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

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

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

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

224. The line $x + y = 1$ meets the lines represented by the equation $y^3 - xy^2 - 14x^2y + 24x^3 = 0$ at the points A, B, C. If O is the origin, then $OA^2 + OB^2 + OC^2$ is equal to

(A) $\frac{22}{9}$

(B) $\frac{85}{72}$

(C) $\frac{181}{72}$

(D) $\frac{221}{72}$

225. By definition $a * b = b * a = 1, \forall\ a, b \in R$. Also $(a * b) * c = (1 * c) = 1$ and $a * (b * c) = a * (1) = 1, \forall\ a, b, c \in R$. Then R is

(A) only commutative
(B) only associative
(C) reflexive and commutative
(D) commutative and associative

FINAL ANSWER KEY									
TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT III									
SI No.	**Key**	**SI No.**	**Key**	**SI No.**	**Key**	**SI No.**	**Key**	**SI No.**	**Key**
1	A	31	C	61	C	91	C	121	B
2	B	32	A	62	D	92	A	122	C
3	A	33	B	63	D	93	A	123	A
4	D	34	B	64	B	94	D	124	D
5	A	35	C	65	B	95	B	125	C
6	A	36	D	66	A	96	A	126	D
7	A	37	D	67	D	97	B	127	C
8	D	38	B	68	C	98	A	128	D
9	D	39	C	69	B	99	D	129	C
10	B	40	C	70	B	100	A	130	A
11	D	41	C	71	C	101	D	131	B
12	C	42	B	72	A	102	B	132	A
13	D	43	B	73	B	103	D	133	B
14	D	44	C	74	B	104	B	134	C
15	C	45	D	75	C	105	B	135	A
16	D	46	C	76	B	106	A	136	C
17	C	47	D	77	B	107	B	137	C
18	A	48	C	78	D	108	A	138	A
19	B	49	B	79	A	109	A	139	A
20	D	50	C	80	C	110	C	140	D
21	B	51	C	81	D	111	D	141	C
22	A	52	C	82	B	112	D	142	A
23	B	53	C	83	B	113	A	143	C
24	A	54	C	84	A	114	C	144	C
25	D	55	B	85	A	115	D	145	C
26	C	56	C	86	B	116	B	146	D
27	A	57	C	87	C	117	C	147	C
28	A	58	A	88	A	118	C	148	B
29	A	59	C	89	A	119	B	149	D
30	A	60	A	90	C	120	C	150	B

SI No.	Key	SI No.	Key	SI No.	Key
151	B	181	D	211	A
152	C	182	B	212	B
153	D	183	A	213	C
154	A	184	C	214	A
155	C	185	D	215	B
156	A	186	C	216	A
157	A	187	D	217	B
158	B	188	A	218	C
159	C	189	C	219	C
160	B	190	A	220	B
161	D	191	C	221	B
162	B	192	D	222	C
163	C	193	B	223	C
164	C	194	B	224	D
165	A	195	A	225	D
166	B	196	D		
167	B	197	B		
168	D	198	C		
169	C	199	B		
170	B	200	B		
171	B	201	C		
172	B	202	D		
173	C	203	A		
174	B	204	C		
175	B	205	A		
176	C	206	B		
177	D	207	C		
178	D	208	C		
179	D	209	B		
180	A	210	D		

TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT IV

PHYSICS UG SHIFT IV
(FINAL)

1. A flywheel experiencing a torque τ by an external motor rotates with an angular velocity ω. Then which one of the following is **TRUE**?

(A) ω is proportional to τ

(B) ω is proportional to $\frac{1}{\tau}$

(C) ω is proportional to $\sqrt{\tau}$

(D) ω is proportional to $\frac{1}{\sqrt{\tau}}$

2. Two satellites of masses m_1 and m_2 ($m_1 > m_2$) are revolving round the earth in circular orbits of radius r_1 and r_2 ($r_1 > r_2$) respectively. Which one of the following is true of their speeds v_1 and v_2 ?

(A) $v_1 = v_2$

(B) $v_1 > v_2$

(C) $v_1 < v_2$

(D) $\frac{v_1}{r_1} = \frac{v_2}{r_2}$

3. According to Hookes's law of elasticity, if the stress is increased to 4 times its previous value, the ratio of stress to strain

(A) increases by 4 times
(B) increases by 2 times
(C) remains unchanged
(D) depends on the material property

4. The coefficient of linear expansion of a crystalline substance in the x, y and z directions are 1×10^{-4}/°C, 2×10^{-4}/°C and 3×10^{-4}/°C respectively. The coefficient of cubical expansion of the crystal is equal to

(A) 36×10^{-4}/°C

(B) 6×10^{-4}/°C

(C) 10^{-4}/°C

(D) 2×10^{-4}/°C

5. In an adiabatic expansion of a gas, the gas does 25 J of work. Then the difference in the internal energy in the process is

(A) 25 J
(B) –25 J
(C) Zero
(D) 50 J

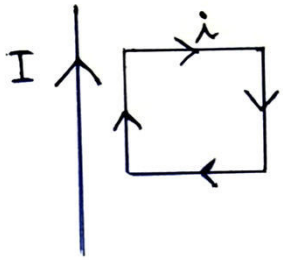
6. The equation of state for 8 g of O_2 molecule will be

(A) $PV = 8RT$
(B) $PV = \frac{RT}{4}$
(C) $PV = RT$
(D) $PV = \frac{RT}{2}$

7. A ball of mass 5 kg is taken to a height of 3 m above the ground. Then the potential energy stored by the ball is about

(A) 121.2 J
(B) 147. 15 J
(C) 227.31 J
(D) 182. 21 J

8. A rectangular loop carrying a current i is placed near a long straight wire carrying a steady current I such that the wire is parallel to one of the side of the loop and is in plane of the loop, as shown in the figure below.



The loop then the

(A) rotates about an axis parallel to the long wire
(B) moves away from the wire
(C) moves towards the wire
(D) remains stationary

9. The self inductance of a coil is L. Keeping the length and area same, the number of turns in the coil is increased to four times. The self inductance of the coil will be

(A) $\frac{1}{4}$L

(B) L

(C) $4L$

(D) $16L$

10. The average electric field of electromagnetic waves in certain region of free space is $9 \times 10^{-4}\ NC^{-1}$. Then the average magnetic field in the same region is of the order of

(A) $27 \times 10^{-4}\ T$

(B) $3 \times 10^{-12}\ T$

(C) $3 \times 10^{-4}\ T$

(D) $\frac{1}{3} \times 10^{-4}\ T$

11. The colour code on a resistor is red, red, black. The value of its resistance is

(A) $(22 \pm 2.2)\ \Omega$
(B) $22\ \Omega$
(C) $(22 \pm 0.44)\ \Omega$
(D) $(22 \pm 4.4)\ \Omega$

12. An unstable heavy nucleus at rest breaks into two daughter nuclei which move away with velocities in the ratio 9 : 27. The ratio of the radii of the nuclei (assuming them to be spherical) is

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

13. The focus of all particles in a medium vibrating in the same phase is called

(A) wavelet
(B) wavefront
(C) wave train
(D) wave function

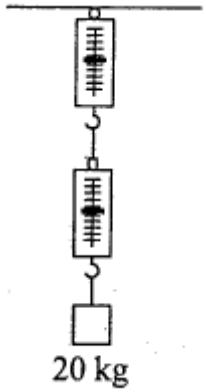
14. A stone dropped from the top of a tower hits the ground after 6 s. How much time does it take to cover the first one-third of the distance from the top of the tower?

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

15. A cube of ice is floating in water contained in a vessel. When the ice melts, the level of water in the vessel

(A) falls
(B) rises
(C) remains unchanged
(D) falls at first and then rises

16. A 20 kg block is suspended by two light spring balances as shown in the figure. What will be reading of both scales?



(A) 20 kg, 20 kg
(B) 10 kg, 10 kg
(C) 0 kg, 20 kg
(D) 20 kg, 0 kg

17. Two circular loops *A* and *B* of radii *R* and *NR* respectively are made from a uniform wire. The moment of inertia of *B* about its axis is 3 times the moment of inertia of *A* about its axis. The value of *N* is

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

18. In Young's double slit experiment, the central point on the screen is

(A) dark
(B) bright
(C) first bright and then dark
(D) first dark and then bright

19. The root mean square speed of the molecule of an enclosed gas is v. If the pressure is doubled keeping the temperature constant, the root mean square speed will be

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

20. Two uniform aluminium rods A and B of length l and $2l$ and radius r and $2r$ respectively are heated to same temperature. The ratio of the increase in the length of A to that of B is

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

21. A milliammeter of resistance 40 Ω has a range of 0-30 mA. What will be the resistance used in series to convert it into a voltmeter of range 0-15 V?

(A) 300 Ω
(B) 360 Ω
(C) 400 Ω
(D) 460 Ω

22. The magnetic field in a travelling electromagnetic wave has a peak value of 40 nT. The peak value of electric field strength is

(A) 1 V/m
(B) 4 V/m
(C) 8 V/m
(D) 12 V/m

23. Two circular current carrying coils of radii 2 cm and 3 cm are equivalent to magnetic dipoles having equal magnetic moments. The ratio of currents through the coils are

(A) $\frac{4}{9}$

(B) $\frac{9}{4}$

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

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

24. The time taken by light to pass through a glass slab of thickness 5 mm and refractive index 1.5 is

(A) 2.5×10^{-13} s

(B) 3×10^{-13} s

(C) 2.5×10^{-11} s

(D) 3×10^{-11} s

25. The collector current in a transistor is 4 mA and the base current is 200 μA. The current gain for the common base configuration is

(A) 0.95
(B) 0.90
(C) 0.85
(D) 0.80

26. The television uses the …….... to generate magnetic fields needed

(A) solenoid
(B) toroid
(C) both solenoid and toroid
(D) solar cell

27. Which one of the following ***cannot*** be used for detection of X-Rays?

(A) Photographic film
(B) Photocells
(C) Geiger tubes
(D) Ionisation chamber

28. A microscope …… objects and produces their larger image

(A) magnifies
(B) resolves
(C) capture
(D) reduce

29. The ground state energy of hydrogen atom is

(A) 13.6 eV
(B) 27.2 eV
(C) −13.6 eV
(D) infinity

30. β-decay emits

(A) electrons or positrons
(B) proton
(C) phonon
(D) hole

31. A cylinder is stretched by two equal forces applied normal to its cross-sectional area. The restoring force per unit area in this case is called

(A) Poisson ratio
(B) Compressive strength
(C) Tensile stress
(D) Micro strain

32. A particle starts rotating from rest according to $\theta = \frac{3t^3}{20} - \frac{t^2}{3}$, then the angular acceleration at the end of 5 seconds is

(A) 7.92 rad/sec
(B) 3.83 rad/sec^2
(C) 5.48 rad/sec
(D) 8.23 rad/sec^2

33. If Young's double slit apparatus is immersed in a liquid of refractive index μ, the fringe width β'

(A) reduces to $\frac{\beta}{\mu}$

(B) increases to $\mu\beta$

(C) remains constant

(D) increases to $(\mu + 1)\beta$

34. Air is pushed into a soap bubble of radius r to double its radius. If the surface tension of the soap solution is S, the work done in the process is

(A) $8\pi r^2 S$

(B) $24\pi r^2 S$

(C) $16\pi r^2 S$

(D) $4\pi r^2 S$

35. How much water a pump of 2 kW can raise in one minute to a height of 10 m? (Take $g = 9.8 m/s^2$)

(A) 1000 litres

(B) 100 litres

(C) 1200 litres

(D) 2000 litres

36. The moment of inertia of a circular loop of radius R at a distance of $\frac{R}{2}$ around a rotating axis parallel to horizontal diameter of loop is

(A) MR^2

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

(C) $2MR^2$

(D) $\frac{3}{4}MR^2$

37. Longitudinal waves **CANNOT**

(A) have a unique wavelength
(B) have a unique wave velocity
(C) transmit energy
(D) be polarized

38. The charge of a parallel plate capacitor is varying as $q = q_0 \sin 2\pi vt$. The plates are very large and close together. Neglecting edge effects, the displacement current through the capacitor is

(A) $\frac{q}{A\varepsilon_0}$

(B) $\frac{q_0}{\varepsilon_0} \sin 2\pi vt$

(C) $2\pi v q_0 \cos 2\pi vt$

(D) $\frac{2\pi v q_0}{\varepsilon_0} \cos 2\pi vt$

39. Mechanism of light transmission in optical fibers are based on

(A) total internal reflection
(B) scattering
(C) refraction
(D) absorption

40. A charge q is placed at the centre of the line joining two equal positive charges Q. The system of the three charges will be in equilibrium, if q is equal to

(A) $-\frac{Q}{2}$
(B) $-\frac{Q}{4}$
(C) $+\frac{Q}{2}$
(D) $+\frac{Q}{4}$

41. A particle is moving in a circle of radius r under the action of a force $F = \alpha r^2$ which is directed towards centre of the circle. Total mechanical energy (which is sum of kinetic energy and potential energy), of the particle is (Take potential energy is = 0 for $r = 0$)

(A) $\frac{1}{2}\alpha r^3$

(B) $\frac{5}{6}\alpha r^3$

(C) $\frac{4}{3}\alpha r^3$

(D) αr^3

42. Two identical particles move towards each other with velocities $2v$ and v respectively. The velocity of their centre of mass will be

(A) v

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

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

(D) $2v$

43. Choose the **INCORRECT** statement.

(A) Newton proposed corpuscular theory of light
(B) Huygens replaced Newton's theory by wave theory of light
(C) Einstein put forward quantum theory of light
(D) de Broglie gave the concept of dual nature of matter

44. In a carnival ride, a passenger travel in a merry-go-around at constant speed in a circle of radius 5 m and he took 4 sec to complete. The acceleration is

(A) 12 m/s^2

(B) 49 m/s^2

(C) 3 m/s^2

(D) 8 m/s^2

45. A dancer on a turn table if suddenly folds her hands, then the speed of the turntable

(A) decreases
(B) remain unchanged
(C) increases
(D) None of the above

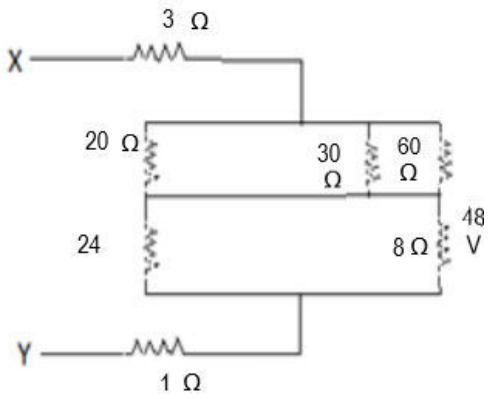
46. An isochoric process is one which takes place at

(A) constant internal energy
(B) constant entropy
(C) constant volume
(D) constant pressure

47. Two simple harmonic motions in the *x*-*y* plane are described by $x = A\cos\omega t$ and $y = A\cos(\omega t + \varphi)$. The superposition of these two motions is a straight line. The value of φ would then be

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

48. The potential difference across 8 Ω resistance is 48 V as shown in the figure. The value of potential difference across *X* and *Y* points will be



(A) 160 V
(B) 128 V
(C) 80 V
(D) 62 V

49. An electron and a proton enter a magnetic field perpendicularly. Both have same kinetic energy. Which of the following is **TRUE**?

(A) Trajectory of electron is less curved
(B) Trajectory of proton is less curved
(C) Both trajectories are equally curved
(D) Both move on straight path

50. The refractive index of the water is 1.33. What will be the speed of light in water?

(A) $3 \times 10^8 \text{ ms}^{-1}$
(B) $2.25 \times 10^8 \text{ ms}^{-1}$
(C) $4 \times 10^8 \text{ ms}^{-1}$
(D) $1.33 \times 10^8 \text{ ms}^{-1}$

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

(A) second line of Paschen series
(B) second line of Lyman series
(C) second line of Balmer series
(D) first line of Pfund series

52. Zener diode is used as a

(A) amplifier
(B) voltage regulator
(C) rectifier
(D) oscillator

53. A ball is dropped from a balloon going up with a uniform velocity of 5.0 m/s. If the balloon was 50 m high when the ball was dropped, find its height when the ball hits the ground.

(A) 50.0 m
(B) 63.3 m
(C) 68.5 m
(D) 74.4 m

54. An elevator weighing 500 kg is to be lifted up at a constant velocity of 0.20 m/s. The minimum power of the motor that required is

(A) 500 W
(B) 1000 W
(C) 1500 W
(D) 10000 W

55. The density of air near earth's surface is 1.3 kg/m^3 and the atmospheric pressure is 1×10^5 N/m^2. If the atmosphere had uniform density, same as that observed at the surface of the earth, what would be the height of the atmosphere to exert the same pressure?

(A) 10^5 m
(B) 8848 m
(C) 7692 m
(D) 4231 m

56. A sound wave of frequency 10 kHz is travelling in air with a speed of 340 m/s. Find the minimum separation between two points where the phase difference is 60°.

(A) 340.00 cm
(B) 57.00 cm
(C) 3.40 cm
(D) 0.57 cm

57. The internal energy of a monoatomic ideal gas is 1.5 nRT. One mole of helium is kept in a cylinder of cross-section 8.5 cm^2. The cylinder is closed by a light frictionless piston. The gas is heated slowly in a process during which a total of 42 J heat is given to the gas. If the temperature rises through 2°C, find the distance moved by the piston. (Atmospheric pressure = 100 kPa)

(A) 0.2 m
(B) 0.4 m
(C) 0.6 m
(D) 0.8 m

58. A battery of emf 2 V and internal resistance 0.5 Ω is connected across a resistance of 9.5 Ω. How many electrons cross through a cross-section of the resistance in 1 second?

(A) 1.25×10^{18}
(B) 3.25×10^{18}
(C) 1.25×10^{15}
(D) 3.25×10^{15}

59. The magnitude of a vector E is 5 unit, F has a magnitude of 6 unit and the cross product of E and F has a magnitude of 15 units. The angle between E and F is

(A) 0°
(B) 30°
(C) 60°
(D) 90°

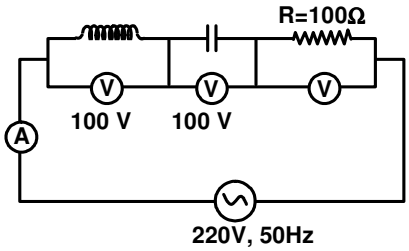
60. A ball starts from rest and falls on ground vertically from a height of 20 m. The distance traveled by the ball during the last 0.3 s is

(A) 2.35 m
(B) 4.85 m
(C) 5.65 m
(D) 7.25 m

61. The angle of contact at the interface of water-glass is 0°, Ethylalcohol-glass is 0°, mercury-glass is 140° and Methyl iodide-glass is 30°. A glass capillary is put in a trough containing one of these four liquids. It is observed that the meniscus is convex upward. The liquid in the trough is

(A) water
(B) ethyl alcohol
(C) mercury
(D) methyl iodide

62. What will be the reading of the voltmeter across the resistance and ammeter in the circuit shown in the figure?



(A) 300 V, 2A
(B) 800 V, 2A
(C) 100 V, 2A
(D) 220 V, 2.2A

63. A current carrying loop is placed in a uniform magnetic field. The torque acting on it does not depend upon

(A) area of the loop
(B) value of the current
(C) the magnetic field
(D) shape of the loop

64. When current in a coil changes from 5 A to 2 A in 0.1 s, average voltage of 50 V is produced. The self-inductance of the coil is

(A) 1.67 H
(B) 6 H
(C) 3 H
(D) 0.67 H

65. What is the charge on sphere with diameter of 2.4 m and has a surface charge density of 80 $\mu C/m^2$?

(A) 1.45×10^{-3} C
(B) 2.35×10^{-3} C
(C) 1.35×10^{-3} C
(D) 1.45×10^{-5} C

66. The magnification of an image by a convex lens is positive only when the object is placed

(A) at its focus F
(B) between F and 2F
(C) at 2F
(D) between F and optical centre

67. A sine wave is travelling in a medium. The minimum distance between the two particles always having same speed is

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

68. When a copper ball is heated, the largest percentage increase will occur in its

(A) diameter
(B) area
(C) volume
(D) density

69. At absolute temperature, an intrinsic semiconductor has

(A) a few free electrons
(B) many holes
(C) many free electrons
(D) no holes or free electrons

70. If a solid sphere, disc and hollow cylinder are allowed to roll down an inclined plane without slipping from the same height,

(A) the cylinder will reach the bottom first
(B) the disc will reach the bottom first
(C) the sphere will reach the bottom first
(D) all will reach the bottom at the same time

71. The phase difference between the displacement and acceleration of a particle executing simple harmonic motion is

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

72. Work-Energy theorem is valid in the case of

(A) external forces only
(B) internal forces only
(C) conservation forces only
(D) all types of forces

73. Optical fibers for communication use are mostly fabricated from

(A) Plastic
(B) Silica or multicomponent glass
(C) Ceramics
(D) Copper

74. Which of the following is smallest unit?

(A) Millimetre
(B) Angstrom
(C) Fermi
(D) Micrometre

75. In a metallic conductor, electric current is generally due to the movement of

(A) Ions
(B) Phonons
(C) Electrons
(D) Protons

CHEMISTRY (UG) – **SHIFT IV**
(FINAL)

76. The most suitable coagulating agent for ferric hydroxide sol is

(A) potassium ferricyanide
(B) potassium chloride
(C) potassium oxalate
(D) potassium sulphate

77. The relation between K_p and K_c of a reversible reaction is

(A) $K_c = K_p(RT)^{\Delta n}$
(B) $K_p = K_c(RT)^{\Delta n}$
(C) $K_c = K_p$
(D) $K_p = 1/K_c$

78. Find out the **WRONG** statement.

(A) A non-volatile solute dissolved in water lowers vapor pressure
(B) A non-volatile solute dissolved in water raises boiling point
(C) A non-volatile solute dissolved in water raises density
(D) A non-volatile solute dissolved in water lowers osmotic pressure

79. The standard reduction potentials of three metallic ions *X*, *Y*, *Z* are 0.52 V, –3.03 V, –1.18 V respectively. The order of reducing power of the corresponding metals is

(A) $Y > Z > X$
(B) $X > Y > Z$
(C) $Z > Y > X$
(D) $Z > X > Y$

80. For a monoatomic gas, the specific heat ratio is

(A) 0
(B) 1.40
(C) 1.67
(D) 1.33

81. What is the solubility of AgCl in water if $K_{sp} = 1.6 \times 10^{-10}$?

(A) 1.6×10^{-5}
(B) 3.2×10^{-10}
(C) 1.3×10^{-5}
(D) 1.6×10^{-10}

82. The half-life period of a first order reaction which takes 40 min for 30% decomposition is

(A) 77.7 min
(B) 52.5 min
(C) 22.7 min
(D) 46.2 min

83. How many coulombs of electricity is required to reduce 1 mole of $Cr_2O_7^{2-}$ in acidic medium?

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

84. van't Hoff factor of 0.005M aqueous solution of KCl is 1.95. The degree of ionization is

(A) 0.94
(B) 0.96
(C) 0.95
(D) 0.59

85. What is the degree of dissociation of 0.1 M acetic acid? ($K_a = 10^{-5}$)

(A) 10^{-3}
(B) 10^{-2}
(C) 10^{-1}
(D) 1.0

86. In a zero-order reaction for every 10°C rise of temperature the rate is doubled. If the temperature is increased from 10°C to 100°C the rate of the reaction will be

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

87. For a second-order reaction, what is the unit of the rate of the reaction?

(A) s^{-1}

(B) $mol\ L^{-1} s^{-1}$

(C) $mol^{-1}\ L\ s^{-1}$

(D) $mol^{-2}\ L^{2}\ s^{-1}$

88. The role of a catalyst is to lower the

(A) Gibbs energy of reaction
(B) enthalpy of reaction
(C) activation energy of reaction
(D) equilibrium constant

89. **The equivalent conductance of Ba^{2+} and Cl^{-} are respectively 127 and 76 $ohm^{-1} cm^{-1} eq^{-1}$ at infinite dilution. The equivalent conductance of $BaCl_2$ at infinite dilution will be**

(A) 139.5
(B) 203
(C) 279
(D) 101.5

90. Consider the cell reaction Cd(s)| Cd^{2+}(1.0 M) || Cu^{2+} (1.0 M) | Cu(s). The voltage can be lowered by

(A) increasing the concentration of Cd^{2+} and Cu^{2+}

(B) increasing only the concentration of Cd^{2+} to 2.0 M

(C) increasing only the concentration of Cu^{2+} to 2.0 M

(D) increasing the concentration of Cd^{2+} 2.0 M and decreasing the concentration of Cu^{2+} 0.1 M

91. The value for Henry's constant for helium, hydrogen, nitrogen and oxygen at 293 K are 144.97 kbar, 69.16 kbar, 76.48 kbar and 34.86 kbar respectively. Which of the gas will be having maximum solubility?

(A) Hydrogen
(B) Oxygen
(C) Helium
(D) Nitrogen

92. Calculate the osmotic pressure associated with 50.0 g of an enzyme of molecular weight 98,000 g/mol dissolved in water to give 2600 mL of solution at 30.0°C.

(A) 3.71 torr
(B) 1.68 torr
(C) 1.96 torr
(D) 2.48 torr

93. An azeotropic solution of two liquids has boiling point lower than either when it

(A) shows a negative deviation from Raoult's law
(B) shows no deviation from Raoult's law
(C) shows positive deviation from Raoult's law
(D) is saturated

94. The density of a metal which crystallises in bcc lattice with unit cell edge length 300 pm and molar mass 50 g mol^{-1} will be

(A) 10 g cm^{-3}

(B) 14.2 g cm^{-3}

(C) 6.15 g cm^{-3}

(D) 9.32 g cm^{-3}

95. Fe_3O_4 (magnetite) is an example of

(A) normal spinel structure
(B) inverse spinel structure
(C) fluorite structure
(D) antifluorite structure

96. Which among the following is an example for Diels-Alder reaction?

(A) Reaction of benzene with acetyl chloride in the presence of anhydrous $AlCl_3$ to give acetophenone
(B) Reaction between 1,3-butadiene and ethene to give cyclohexene
(C) Anhydrous $AlCl_3$ catalyzed rearrangement of phenyl acetate to give a mixture of 2- and 4-hydroxyacetophenones
(D) Acid catalyzed rearrangement of 1,2-diols to give ketones

97. Pick the statement that is **TRUE** for E2 eliminations.

(A) Follows unimolecular kinetics
(B) Follows bimolecular kinetics
(C) Involves free radical intermediates
(D) It is catalyzed by weak acids

98. Which among the following pigments is predominantly present in photosystem II of land plants?

(A) Chlorophyll *a*
(B) Chlorophyll *b*
(C) *β*-carotene
(D) Xanthophyll

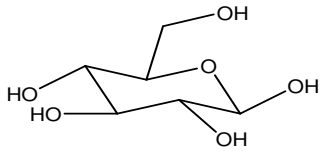
99. Which among following compounds, fails to undergo Cannizzaro reaction?

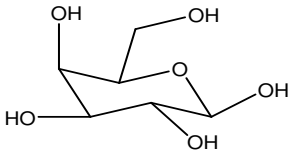
(A) Benzaldehyde
(B) Trichloroacetaldehyde
(C) 2,2-dimethylpropanal
(D) Formaldehyde

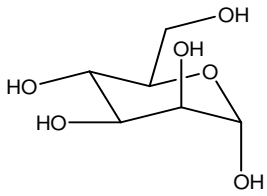
100. Which among the following natural amino acids is achiral?

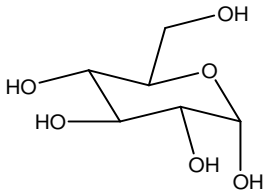
(A) Threonine
(B) Tyrosine
(C) Alanine
(D) Glycine

101. β-D-Glucose is represented as:

(A) 

(B) 

(C) 

(D) 

102. Atropisomerism in stereoisomerism originating due to

(A) restricted rotation around a single bond
(B) four groups attached to carbon are different
(C) helical nature of polymers
(D) sheet like geometry of polymers

103. Choose the weakest base among the following

(A) 4-chloroaniline
(B) 4-methylaniline
(C) 4-methoxyaniline
(D) 4-nitroaniline

104. Mono nitration of which among the following compounds is expected to yield the corresponding meta nitro derivative as the major product?

(A) C_6H_5-CH_3
(B) C_6H_5-CH_2Cl
(C) C_6H_5-$CHCl_2$
(D) C_6H_5-CCl_3

105. Methyl isocyanate ($CH_3-N=C=O$), the chemical responsible for Bhopal gas tragedy is an intermediate involved in

(A) reaction between methylamine and carbon dioxide
(B) reaction of acetamide (CH_3CONH_2) with Br_2 in presence of NaOH
(C) reaction between methylamine and formaldehyde
(D) reaction of ammonium formate (HCO_2NH_4) with methanol

106. Free radical intermediates are involved in

(A) Hydroboration-oxidation of propene to give propan-1-ol
(B) Hunsdiecker Reaction
(C) Hell Volhard Zelinsky Reaction
(D) Chlorination of benzene in the presence of Cl_2 and a halogen carrier

107. Styrene-butadiene rubber finds application in

(A) Styrofoam
(B) Bubble gums
(C) Flame retardant coatings
(D) High-performance elastomer for space application

108. Which among the following is an example of Sandmeyer reaction?

(A) $C_6H_5N_2^+Cl^- \xrightarrow{CuCl/HCl} C_6H_5Cl$

(B) $C_6H_5N_2^+Cl^- \xrightarrow{H_2O/\Delta} C_6H_5OH$

(C) $C_6H_5N_2^+Cl^- \xrightarrow{HBF_4} C_6H_5F$

(D) $C_6H_5N_2^+Cl^- \xrightarrow{KI/warm} C_6H_5I$

109. 2-Hydroxybenzaldehyde can be prepared by treating Phenol with

(A) Formaldehyde in the presence of anhydrous aluminium chloride
(B) Carbon dioxide under pressure in sodium hydroxide solution
(C) Chloroform and concentrated sodium hydroxide
(D) Carbon monoxide and 5N HCl

110. The reaction between sodium alkoxide and alkyl halide to give the corresponding ether is called

(A) Wurtz reaction
(B) Kolbe's reaction
(C) Williamson's synthesis
(D) Zeisel reaction

111. Benzene diazonium chloride on treatment with phenol in the presence of NaOH gives

(A) diphenyl ether
(B) 4-hydroxybiphenyl
(C) an azo dye
(D) polyaniline, a conducting polymer

112. Among vitamins A, C, and E, which is/are considered as dietary antioxidant/s?

(A) Vitamin C only
(B) Vitamins A and C only
(C) Vitamins C and E only
(D) Vitamins A, C and E

113. The chemical reaction between aldehydes and Borche's reagent (2,4-dinitrophenylhydrazine) to give an orange coloured precipitate is an example of

(A) Condensation reaction
(B) Addition reaction
(C) Substitution reaction
(D) Polymerization reaction

114. **Formation of phenol-formaldehyde resin involves the reaction between**

(A) three equivalents of formaldehyde with one equivalent of phenol
(B) one equivalent of formaldehyde with three equivalents of phenol
(C) one equivalent of formaldehyde with one equivalent of phenol
(D) six equivalents of formaldehyde with one equivalent of phenol

115. Which among the following food additives is effective in controlling rancidity of unsaturated edible oils?

(A) Butylated hydroxytoluene (BHT)
(B) Monosodium glutamate (MSG)
(C) Sodium nitrate
(D) Caramel

116. If the magnetic moment of a dioxygen species is 1.73 B.M, it may be

(A) O_2^- or O_2^+
(B) O_2 or O_2^+
(C) O_2 or O_2^-
(D) O_2, O_2^- or O_2^+

117. Which of the following has highest solubility in water?

(A) KF
(B) LiF
(C) NaF
(D) RbF

118. The decreasing order of catenation is

(A) C > Sn > Si > Ge
(B) C > Si > Ge > Sn
(C) Si > Sn > C > Ge
(D) Ge > Sn > Si > C

119. The electrolytes usually used in the electroplating of gold and silver, respectively are

(A) $[Au(CN)_2]^-$ and $[Ag(CN)_2]^-$
(B) $[Au(CN)_2]^-$ and$[Ag(Cl)_2]^-$
(C) $[Au(OH)_4]^-$ and$[Ag(OH)_2]^-$
(D) $[Au(NH_3)_2]^-$ and$[Ag(CN)_2]^-$

120. Trigonal bipyramidal geometry is shown by

(A) XeO_2F_2
(B) XeO_3F_2
(C) $FXeOSO_2F$
(D) $[XeF_8]^{2-}$

121. Which of the following ions has the maximum magnetic moment?

(A) Mn^{2+}
(B) Fe^{2+}
(C) Ti^{2+}
(D) Cr^{2+}

122. The elements *x*, *y* and *z* are present in one period of the periodic table. Chemically their oxides are acidic, amphoteric and basic respectively. Arrange the elements in order of increasing atomic number.

(A) *x*, *y*, *z*
(B) *z*, *y*, *x*
(C) *y*, *z*, *x*
(D) *y*, *x*, *z*

123. Which of the following has the least bond angles?

(A) NH_3
(B) PH_3
(C) AsH_3
(D) SbH_3

124. The **WRONG** statement among the following is

(A) Nitrogen atom and nitride ion have same atomic number
(B) Aluminium atom and its ion have same mass number
(C) Iron atom and ferrous ion have same electron configuration
(D) Nuclear charge is same in both chlorine atom, chloride ion

125. A double bond resulting in O_2 molecule is from

(A) two σ bonding electrons
(B) four π-bonding electrons
(C) two π-bonding and two π-anti bonding electrons
(D) two σ bonding, four π-bonding and two π-anti bonding electrons

126. According to VSEPR theory

(A) bp-bp > lp-bp > lp-lp
(B) bp-lp > bp-bp > lp-lp
(C) lp-lp > lp-bp > bp-bp
(D) lp-lp < lp-bp < bp-bp

where bp is bond pair and lp is lone pair.

127. Which of the following is most stable in aqueous solution?

(A) Mn^{2+}
(B) Cr^{3+}
(C) V^{3+}
(D) Ti^{3+}

128. The complex that absorbs light of shortest wavelength is

(A) $[CoF_6]^{3-}$
(B) $[Co(H_2O)_6]^{+3}$
(C) $[Co(NH_3)_6]^{+3}$
(D) $[Co(ox)_3]^{3-}$

(ox = oxalate ion)

129. The characteristics of the blue solution of sodium in liquid ammonia is /are

(a) diamagnetic
(b) paramagnetic
(c) reducing in nature
(d) conducts electricity

(A) (a) only
(B) (b), (c) and (d) only
(C) (b) and (c) only
(D) (a), (c) and (d) only

130. In the manufacture of sulphuric acid by contact process Tyndall box is used to

(A) convert SO_2 and SO_3
(B) test the presence of dust particles
(C) filter dust particles
(D) remove impurities

131. Electronic configuration of a transition element X in +3 oxidation state is $[Ar]3d^5$. What is its atomic number?

(A) 25
(B) 26
(C) 27
(D) 24

132. What is the weight of CuO, that will react with 2.6 L of hydrogen at NTP (molar mass of CuO is 79.5 g)?

(A) 79.5 g
(B) 2.2 g
(C) 9.23 g
(D) 11.2 g

133. The third line of Balmer series in the emission spectrum of hydrogen atom is due to the transition from

(A) fifth Bohr orbit to the second Bohr orbit
(B) fourth Bohr orbit to the first Bohr orbit
(C) sixth Bohr orbit to the third Bohr orbit
(D) eight Bohr orbit to the fourth Bohr orbit

134. How many orbitals have the values n = 4, l = 2 and ml = −2?

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

135. For a complex, the order of energy of d orbitals, $d_{z^2} = d_{x^2-y^2} > d_{xy} = d_{xz} = d_{yz}$. The complex has

(A) octahedral structure
(B) square planar structure
(C) tetrahedral structure
(D) square pyramidal structure

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SHIFT IV - (FINAL)

136. If A is a matrix of order 3, then det (kA) is

(A) k^3 det (A)
(B) 3 det (A)
(C) det (A)
(D) $3k$ det (A)

137. If the rank of the matrix $\begin{pmatrix} \lambda & -1 & 0 \\ 0 & \lambda & -1 \\ -1 & 0 & \lambda \end{pmatrix}$ is 2, then λ is

(A) 2
(B) 3
(C) 1
(D) any real number

138. The value of $\lim_{n\to\infty}\left[\frac{1}{1-n^4}+\frac{8}{1-n^4}+...+\frac{n^3}{1-n^4}\right]$ is

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

139. If A is a square matrix of order n, then | adj A | is

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

140. If $\binom{n}{4}, \binom{n}{5}$ and $\binom{n}{6}$ are in Arithmetic progression, then the value of n can be

(A) 6
(B) 7
(C) 8
(D) 9

141. Given $f(x)=\begin{cases} x^2; & 0<x<2 \\ x+2; & 2\le x\le 5 \end{cases}$ and $f(x+5)=f(x)$ for all x. Then $\dfrac{f(11)-f(-11)}{f(11)+f(-11)}=$

(A) $\dfrac{-5}{7}$

(B) $\dfrac{-7}{5}$

(C) $\dfrac{7}{5}$

(D) $\dfrac{15}{7}$

142. Sum of the series $S=1^2-2^2+3^2-4^2=\ldots-2008^2+2009^2$ is

(A) 2019045
(B) 1005004
(C) 2000506
(D) 2026042

143. If $\log_4\left[\log_3\left[\log_2 x\right]\right]=1$, then x is

(A) 2^{64}
(B) 9
(C) 24
(D) 2^{81}

144. Let 'f' and 'g' be two bijective functions defined on a set A and such that $f(x)=2x+1$ and $(g\circ f)(x)=3x+2$. Then $g(x)$ is

(A) $\frac{3}{2}x-\frac{5}{2}$

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

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

(D) $5x+3$

145. If in a triangle ABC, $\tan A+\tan B+\tan C=3\sqrt{3}$, then the triangle is

(A) right-angled but not isosceles
(B) right-angled and isosceles
(C) equilateral
(D) isosceles but not right-angled

146. If $|\vec{a}|=2,|\vec{b}|=5$ and $|\vec{a}\times\vec{b}|=8$ then $|\vec{a}.\vec{b}|$ is equal to

(A) 4
(B) 6
(C) 5
(D) 8

147. The difference of a whole number consisting of two digits from the number formed by inter changing the digits is always divisible by

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

148. Let $f:\mathbb{R}\to\mathbb{R}$ be any function. Define $g:\mathbb{R}\to\mathbb{R}$ by $g(x)=|f(x)|$ for all x. Then which of following is true?

(A) g is 1 – 1 if f is 1 – 1
(B) g may be bounded even if f is unbounded
(C) g is continuous if f is continuous
(D) g is differentiable if f is differentiable

149. If $e^{x+y} = x^y$, then $\frac{dy}{dx}$ is

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

(B) $\frac{\log x - 1}{(\log x + 1)^2}$

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

(D) 1

150. The value of $\lim_{x \to 0} \frac{e^{x^2} - \cos x}{x^2}$ is equal to

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

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

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

(D) 2

151. $\lim_{x \to \frac{\pi}{2}} (\cos x)^{\cos x}$ is

(A) 1

(B) 0

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

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

152. Let $a_1, a_2, ...a_{10}$ be in Arithmetic Progression and $h_1, h_2, ..., h_{10}$ be in harmonic Progression. If $a_1 = h_1 = 2$ and $a_{10} = h_{10} = 3$ then $a_4 h_7$ is

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

153. Let $g(x)$ be a function satisfying $g'(x) = g(x)$ with $g(0) = 1$ and $f(x)$ be a function that satisfies $f(x) + g(x) = x^2$. Then the value of the integral $\int_0^1 f(x)\ g(x)\,dx$ is

(A) $\frac{e-7}{4}$

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

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

(D) $e + \frac{e^2+3}{2}$

154. The locus of the point of intersection of the lines $x\sin\theta + (1-\cos\theta)y = a\sin\theta$ and $x\sin\theta - (1+\cos\theta)y + a\sin\theta = 0$ is

(A) $x^2 - y^2 = a^2$

(B) $x^2 + y^2 = a^2$

(C) $y^2 = ax$

(D) $y^2 - x^2 = a^3$

155. If $I_1 = \int_e^{e^2} \frac{1}{\log x}dx$ and $I_2 = \int_1^2 \frac{e^x}{x}dx$, then

(A) $I_1 = 2I_2$

(B) $2I_1 = I_2$

(C) $I_1 + I_2 = 0$

(D) $I_1 - I_2 = 0$

156. The equation of a common tangent to the curves $y^2 = 8x$ and $xy = -1$ is

(A) $3y = 9x + 2$

(B) $y = 2x + 1$

(C) $2y = x + 8$

(D) $y = x + 2$

157. If $f(x) = A \cdot 2^x + B$ and such that $f'(x) = 2$ and $\int_0^3 f(x)\,dx = 7$, then B is

(A) $1 - \left(\frac{1}{\log_e 2}\right)^2$

(B) $\frac{7}{3}\left[1 - (\log_2 e)^2\right]$

(C) $\frac{7}{3}\left[1 + (\log_2 e)^2\right]$

(D) $\frac{7}{3}\left[1 - (\log_2 e)\right]$

158. Let A^T be the transpose of A. If $A = \begin{pmatrix} x & 3 & 2 \\ -3 & y & -7 \\ -2 & 7 & 0 \end{pmatrix}$ and $A = -A^T$ then $x + y$ is equal to

(A) 2
(B) −1
(C) 0
(D) 12

159. If $\frac{dy}{dx} = x + \int_0^1 y(x)\ dx$, $y(0) = 1$, then $\int_0^1 xy(x)dx$ is

(A) $\frac{13}{36}$

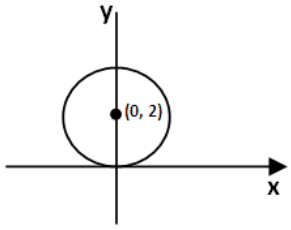
(B) $\frac{19}{48}$

(C) $\frac{7}{36}$

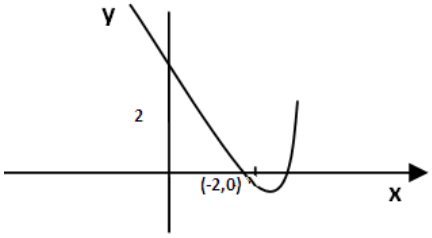
(D) $\frac{101}{72}$

160. The graph of $f(x)=\sqrt{4-(x-2)^2}$ is

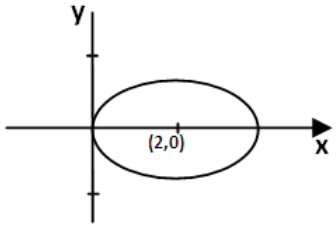
(A)



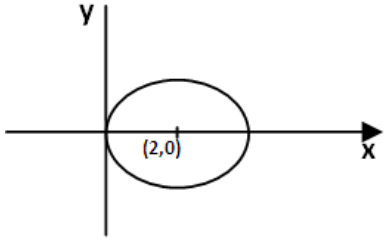
(B)



(C)



(D)



161. If $\int_0^{\infty}\frac{dx}{\left(x^2+4\right)\left(x^2+9\right)}=k\pi$ then the value of k is

(A) $\frac{1}{60}$

(B) $\frac{1}{80}$

(C) $\frac{1}{40}$

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

162. The value of the k which makes $f(x)=\begin{cases}\dfrac{\sin 5x}{x}, & x\neq 0\\ k, & x=0\end{cases}$ continuous at $x=0$ is

(A) 1
(B) 2
(C) 5
(D) 6

163. The number of words that can be formed by using the letters of the word MATHEMATICS that start as well as end with T is

(A) 80720
(B) 90720
(C) 20860
(D) 37258

164. Two finite sets have m and n elements respectively. The total number of subsets of first set is 56 more than the total number of subsets of the second set. The values of m and n respectively are

(A) 7, 6
(B) 6, 3
(C) 5, 1
(D) 8, 7

165. If the acute angle between the lines $x+ky+3=0$ and $2x+y-7=0$ is $\tan^{-1}\left(\dfrac{3}{4}\right)$, then ' k ' is

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

166. Let $f(x)=\dfrac{\log\left(1+x^2\right)}{x^4-26x^2+25}$. Then

(A) f is continuous on [6, 10]
(B) f is continuous on [−2, 2]
(C) f is continuous on [−6, 6]
(D) f is continuous on [1, 7]

167. The complex number $z = x + iy$ which satisfy the equation $\left|\frac{z-5i}{z+5i}\right| = 1$ lie on

(A) the x-axis
(B) the straight line $y = 5$
(C) a circle passing through the origin
(D) the line $x = y$

168. If the points $(2a, a)$, $(a, 2a)$ and (a, a) enclose a triangle of area 72, then the coordinates of the centroid of the triangle is

(A) (16, 16)
(B) (4, 4)
(C) (12, 12)
(D) (–4, –4)

169. The value of k for which the points $A = (1, 0, 3)$, $B = (-1, 3, 4)$, $C = (1, 2, 1)$ and $D = (k, 2, 5)$ are coplanar is

(A) 1
(B) 2
(C) 0
(D) –1

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

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

171. The number of real solutions of $\frac{1}{x+1} + \frac{1}{x+5} = \frac{1}{x+2} + \frac{1}{x+4}$ is

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

172. If the points $P(h, k)$ and $Q(k, h)$ lie on $3x + 2y - 13 = 0$ and $4x - y - 5 = 0$ respectively, then the equation of PQ is

(A) $x - y = 6$
(B) $x + y = 5$
(C) $x - y + 5 = 0$
(D) $2x + 2y = 5$

173. A fair coin is tossed 100 times. The probability of getting tails an odd number of times is

(A) $\frac{1}{2}$
(B) $\frac{1}{8}$
(C) $\frac{3}{8}$
(D) None of the above

174. The equation of the directrix of the parabola $4y^2 + 12x - 12y + 39 = 0$ is

(A) $x = -\frac{7}{4}$
(B) $y = \frac{3}{4}$
(C) $x - y = 0$
(D) $2x - 3y = 0$

175. Consider an infinite geometric series with the first term a and the common ratio $r < 1$. If its sum is 4 and the second term is $\frac{3}{4}$, then

(A) $a = \frac{4}{7}, r = \frac{3}{7}$
(B) $a = 2, r = \frac{3}{8}$
(C) $a = \frac{3}{2}, r = \frac{1}{2}$
(D) $a = 3, r = \frac{1}{4}$

176. The projection of $\vec{a}$ on $\vec{b}$ is twice the projection of $\vec{b}$ on $\vec{a}$ if

(A) $\vec{a} = \vec{b}$

(B) $|\vec{a}| = |\vec{b}|$

(C) $|\vec{a}| - |\vec{b}| = |\vec{b}|$

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

177. A line which is parallel to the x-axis and crosses the curve $y = \sqrt{x}$ at an angle of 45° is

(A) $x = \frac{1}{4}$

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

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

(D) $y = 1$

178. A function, which is differentiable everywhere, is

(A) $f(x) = |x|$

(B) $f(x) = \frac{1}{x}$

(C) $f(x) = (x+3)^4$

(D) $f(x) = \ln x$

179. The equation of the horizontal tangent to the graph of the function $y = e^x + e^{-x}$ is

(A) $y = -2$

(B) $y = -1$

(C) $y = 2$

(D) $y = 1$

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

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

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

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

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

181. If a line OP through the origin O makes angles $\alpha, 45°$ and $60°$ with x, y and z axis respectively, then the direction cosines of OP are

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

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

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

(D) 1,1,1

182. The orthocentre of the triangle formed by the lines $xy = 0$ and $2x + 3y - 5 = 0$ is

(A) (2, 3)
(B) (3, 2)
(C) (0, 0)
(D) (5,–5)

183. Let $\vec{a} = \left(\vec{i} + \vec{j} + \vec{k}\right)$; $\vec{b} = \left(\vec{i} - \vec{j} + 2\vec{k}\right)$ and $\vec{c} = \left(x\vec{i} + (x-2)\vec{j} - \vec{k}\right)$. If the vector $\vec{c}$ lies in the plane of $\vec{a}$ and $\vec{b}$, then x equals to

(A) 0
(B) 1
(C) –4
(D) –2

184. The number of times the function $y=\left(x^2+1\right)^{80}$ is to be differentiated in order to get a polynomial of degree 50 is

(A) 70
(B) 80
(C) 110
(D) 30

185. If the centroid of the triangle with vertices $(3c + 2, 2, 0)$, $(2c, -1, -1)$ and $(c + 2, 3c + 1, c + 3)$ lies in the plane $z = c$, then the coordinates of the centroid are

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

(B) $\left(\frac{10}{3},\frac{5}{3},1\right)$

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

(D) $\left(\frac{2}{3},\frac{1}{3},-\frac{1}{3}\right)$

186. Three numbers are chosen at random without replacement from {1, 2, ..., 10}. The probability that minimum of the chosen number is 3 or their maximum is 7 is

(A) $\frac{11}{30}$

(B) $\frac{11}{40}$

(C) $\frac{1}{7}$

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

187. The length of the perpendicular drawn from the point (3, −1, 11) to the line $\frac{x}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ is

(A) $\sqrt{29}$
(B) $\sqrt{33}$
(C) $\sqrt{53}$
(D) $\sqrt{66}$

188. If $f(x+y)=f(xy)$ for all $x, y \in \mathbb{R}$ and $f(2003)=2003$, then $f(-2003)$ equals

(A) 2003
(B) 0
(C) −2003
(D) 4006

189. The three numbers are chosen from 1 to 30. Then the probability that they are not consecutive is

(A) $\frac{142}{145}$
(B) $\frac{144}{145}$
(C) $\frac{143}{145}$
(D) $\frac{1}{145}$

190. Let $f(x)=\lim_{n\to\infty}\frac{x}{1+(2\sin x)^{2n}}$. Then f is discontinuous at

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

191. The probability of drawing a diamond card in each of the two consecutive draws from a well shuffled pack of cards, if the card drawn is not replaced after the first draw, is

(A) $\frac{4}{17}$
(B) $\frac{13}{17}$
(C) $\frac{1}{17}$
(D) 0

192. If $x=-2$ and $\Delta=\begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{vmatrix}$, then the numerical value of Δ is equal to

(A) 8
(B) −8
(C) 4
(D) −4

193. If A and B are independent events of a random experiment such that $P(B)=\frac{2}{7}$ and $P\left(A\cup\bar{B}\right)=0.8$, then $P(A)$ is equal to

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

194. The interior angles of a polygon are in Arithmetic Progression. If the smallest angle is 100° and the common difference is 4°, then the number of sides is

(A) 5
(B) 7
(C) 36
(D) 44

195. A problem in Mathematics is given to three students A, B, C and their respective probability of solving the problem are $\frac{1}{2},\frac{1}{3},\frac{1}{4}$. Then the probability that the problem is solved is

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

196. The locus of the centre of a circle which touches the circle $|z-z_1|=a$ externally is

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

197. Let $f(x)$ be a function satisfying $f'(x)=f(x)$ and $f(0)=2$. Then $\int \frac{f(x)}{3+4f(x)}dx$ is equal to

(A) $\frac{1}{4}\log\left(3+8e^x\right)+C$

(B) $\frac{1}{2}\log\left(3+5e^x\right)+C$

(C) $\frac{1}{4}\log\left(3+4e^{2x}\right)+C$

(D) $C+\frac{1}{2x^3}\log(xe)$

198. Equation of the directrix of the parabola $y^2+4y+4x+2=0$ is

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

199. If $\int_e^x t\,f(t)\,dt=\sin x-x\cos x-\frac{x^2}{2}$ for all $x\in R-\{0\}$, then the value of $f\left(\frac{\pi}{6}\right)$ is

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

200. If $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\ldots=\frac{\pi}{4}$ then the value of $\frac{1}{1.3}+\frac{1}{5.7}+\frac{1}{9.11}+\ldots$ is

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

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

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

(D) $\frac{\pi}{34}$

201. The sum $\lim_{n\to\infty} S_n$ if $S_n=\frac{1}{2n}+\frac{1}{\sqrt{4n^2-1}}+\frac{1}{\sqrt{4n^2-4}}+\ldots+\frac{1}{\sqrt{3n^2+2n-1}}$ is

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

(B) 2

(C) 1

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

202. If $a+ib=\sum_{k=1}^{101} i^k$, then $(a,b)=$

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

203. The value of $1-\frac{\sin^2 A}{1+\cos A}+\frac{1+\cos A}{\sin A}-\frac{\sin A}{1-\cos A}$, is

(A) $\cos A$
(B) 0
(C) 1
(D) $\sin A$

204. If $\left(\frac{1+i}{1-i}\right)^n = -1,\ n \in N,$ then the least value of n is

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

205. The value of $\lim_{x\to 0} \frac{x\tan 2x - 2x\tan x}{(1-\cos 2x)^2}$ is

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

206. If $|z-1| = |z-2i| = |z+1|,$ then the value of $|z|$ is

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

207. Let α, β be roots of the equation $x^2 - px + r = 0$ and $\frac{\alpha}{2}, 2\beta$ be the roots of the equation $x^2 - qx + r = 0.$ Then the value of r is

(A) $\frac{2}{9}(p-q)(2q-p)$
(B) $\frac{2}{9}(q-p)(2p-q)$
(C) $\frac{2}{9}(q-2p)(2q-p)$
(D) $\frac{2}{9}(2p-q)(2q-p)$

208. The complex numbers $z = x + iy$ which satisfy the equation $\left|\frac{z-5i}{z+5i}\right| = 1$, lie on

(A) the x-axis
(B) the straight line $y = 5$
(C) a circle passing through origin
(D) $\mathrm{Re}(z) > 3$

209. A solution of the equation $x\frac{dy}{dx} = y(\log y - \log x + 1)$ is

(A) $y = xe^{cx}$

(B) $\frac{y^2}{x} = cx$

(C) $y^2 = cx \log x$

(D) $\log y = cx$

210. A value of θ for which $z = \frac{2 + 3i\sin\theta}{1 - 2i\sin\theta}$ is purely imaginary, is

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

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

(C) $\sin^{-1}\left(\frac{\sqrt{3}}{4}\right)$

(D) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

211. The number of complex numbers z such that $|z| < \frac{1}{3}$ and $\sum_{r=1}^{n} a_r z^r = 1$ where $|a_r| < 2$ is

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

212. If $4^x - 3^{x-\frac{1}{2}} = 3^{x+\frac{1}{2}} - 2^{2x-1}$, then value of x is

(A) $\frac{5}{2}$
(B) 2
(C) $\frac{3}{2}$
(D) $4\sqrt{7}$

213. If $A = \{4^n - 3n - 1 : n \in \mathbb{N}\}$ and $B = \{9n - 9, n \in \mathbb{N}\}$ then $A \cup B$ is equal to

(A) B
(B) A
(C) $\mathbb{N}$
(D) $A \cap B$

214. The least value of $\operatorname{cosec}^2 x + 25\sec^2 x$ is

(A) 26
(B) 28
(C) 36
(D) 0

215. Let S: If a number n is even, then n^2 is even.

Then the converse of S is

(A) if a number n^2 is even, then n is even
(B) neither n nor n^2 is even
(C) if n is not even, then n^2 is not even
(D) if a number n^2 is not even, then n is even

216. The number of integral solutions of $x^2 + y^2 = x^2y^2$ is

(A) 0
(B) 1
(C) infinite
(D) None of the above

217. Let f be defined on $[-5, 5]$ as $f(x)=\begin{cases} x \text{ if } (x) \text{ is rational} \\ -x \text{ if } (x) \text{ is irrational} \end{cases}$. Then

(A) $f(x)$ is continuous at every x, except $x = 0$
(B) $f(x)$ is discontinuous at every x, except $x = 0$
(C) $f(x)$ is continuous everywhere
(D) $f(x)$ is discontinuous everywhere

218. The order of -3 in the group $(Z,+)$ is

(A) 3
(B) 0
(C) 1
(D) ∞

219. If $y=a\log x+bx^2+x$ has its extreme values at $x=1$ and $x=2$, then the values of 'a' and 'b' are

(A) $a=-\frac{2}{3},\ b=-\frac{1}{6}$
(B) $a=-\frac{1}{6}, b=\frac{4}{3}$
(C) $a=-\frac{4}{3}, b=\frac{1}{6}$
(D) $a=\frac{4}{3}, b=-\frac{1}{6}$

220. If *a, b, c* are in Arithmetic Progression, *p, q, r* are in Harmonic Progression and *ap, bq, cr* are in Geometric Progression, then $\frac{p}{r}+\frac{r}{p}$ is equal to

(A) $\frac{a}{c}+\frac{c}{a}$
(B) $\frac{a}{c}-\frac{c}{a}$
(C) $\frac{b}{q}+\frac{q}{b}$
(D) $\frac{b}{q}-\frac{a}{p}$

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

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

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

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

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

222. The angles of elevation of the top of a tower from the top and bottom of a building 100 meters tall are 30° and 45°. The height of the tower is

(A) $100\sqrt{3}$ meters

(B) $50\left(3+\sqrt{3}\right)$ meters

(C) $50\left(\sqrt{3}+1\right)$ meters

(D) $100\left(\sqrt{3}+1\right)$ meters

223. If $|z| = 3$, the area of the triangle whose sides are $z, \omega z$ and $z+\omega z$ (here ω is a complex cube root of unity) is

(A) $\frac{9\sqrt{3}}{4}$

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

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

(D) $\frac{8\sqrt{3}}{3}$

224. Let $X = \left\{x : x = n^3 + 2n + 1, n \in \mathbb{R}\right\}$ and $Y = \left\{x : x = 3n^2 + 7, n \in \mathbb{R}\right\}$. Then $X \cap Y$ is a subset of

(A) $X = \{x : x = 3n + 5, n \in \mathbb{N}\}$

(B) $X = \left\{x : x = n^2 + n + 1, n \in \mathbb{N}\right\}$

(C) $X = \{x : x = 7n - 1, n \in \mathbb{N}\}$

(D) None of the above

225. If z_1, z_2, z_3 are the vertices of an isosceles triangle, right angled at the vertex z_2, then value of $(z_1 - z_2)^2 + (z_2 - z_3)^2$ is

(A) -1
(B) 0
(C) $(z_1 - z_3)^2$
(D) 1

FINAL ANSWER KEY									
TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT IV									
SI No.	**Key**	**SI No.**	**Key**	**SI No.**	**Key**	**SI No.**	**Key**	**SI No.**	**Key**
1	B	31	C	61	C	91	B	121	A
2	C	32	B	62	D	92	A	122	B
3	C	33	A	63	D	93	C	123	D
4	B	34	B	64	A	94	C	124	C
5	B	35	C	65	A	95	B	125	D
6	B	36	D	66	D	96	B	126	C
7	B	37	D	67	C	97	B	127	B
8	C	38	C	68	C	98	B	128	C
9	D	39	A	69	D	99	B	129	B
10	B	40	B	70	C	100	D	130	B
11	B	41	B	71	C	101	A	131	B
12	D	42	C	72	D	102	A	132	C
13	B	43	C	73	B	103	D	133	A
14	B	44	A	74	C	104	D	134	A
15	C	45	C	75	C	105	B	135	A
16	A	46	C	76	A	106	B	136	A
17	B	47	C	77	B	107	B	137	C
18	B	48	A	78	D	108	A	138	D
19	A	49	B	79	A	109	C	139	C
20	A	50	B	80	C	110	C	140	B
21	D	51	C	81	C	111	C	141	A
22	D	52	B	82	A	112	D	142	A
23	B	53	C	83	B	113	A	143	D
24	C	54	B	84	C	114	A	144	B
25	A	55	C	85	B	115	A	145	C
26	A	56	D	86	B	116	A	146	B
27	B	57	A	87	B	117	D	147	C
28	A	58	A	88	C	118	B	148	C
29	C	59	B	89	A	119	A	149	C
30	A	60	C	90	D	120	B	150	B

SI No.	Key	SI No.	Key	SI No.	Key
151	A	181	C	211	A
152	D	182	C	212	C
153	C	183	D	213	A
154	B	184	C	214	C
155	D	185	B	215	A
156	D	186	B	216	B
157	B	187	C	217	B
158	C	188	A	218	D
159	D	189	B	219	A
160	D	190	D	220	A
161	A	191	C	221	C
162	C	192	B	222	B
163	B	193	B	223	A
164	B	194	A	224	C
165	B	195	A	225	B
166	A	196	B		
167	A	197	A		
168	A	198	D		
169	D	199	C		
170	B	200	A		
171	B	201	D		
172	B	202	A		
173	A	203	A		
174	A	204	B		
175	D	205	C		
176	C	206	D		
177	C	207	D		
178	C	208	A		
179	C	209	A		
180	C	210	D		

TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT V

PHYSICS UG SHIFT V
(FINAL)

1. The closest length of the simple pendulum which ticks seconds (seconds pendulum) must be

(A) 1 m
(B) 1.5 m
(C) 2 m
(D) 10 cm

2. A force of 1 KN is applied to a wire of cross section $10\,\mu m^2$ results in an increase in its length by 0.1%. The Young's modulus of the wire will be

(A) $10^{12}\ Nm^{-2}$
(B) $10\ GNm^{-2}$
(C) $10^{11}\ Nm^{-2}$
(D) $10^{6}\ MNm^{-2}$

3. Which one of the following statements about soap bubble is **TRUE**?

(A) Excess pressure in a soap bubble is inversely proportional to surface tension
(B) Excess pressure in a soap bubble is directly proportional to its radius
(C) Excess pressure in a soap bubble is directly proportional to square of its radius
(D) Excess pressure in a soap bubble is directly proportional to surface tension

4. A hole is drilled on a copper sheet. The diameter of the hole at room temperature is 4.25 cm. The diameter of the hole when the sheet is heated to 70°C will be

(A) 4.25 cm only
(B) more than 4.25 cm
(C) less than 4.25 cm
(D) data insufficient to predict

5. A monoatomic gas at a certain pressure P_1 and volume V_1 is compressed adiabatically to one-eighth of its original volume. What is the final pressure of the gas? Given the γ of an ideal monatomic gas $= \frac{5}{3}$

(A) P_1

(B) $\frac{P_1}{8}$

(C) $64\ P_1$

(D) $32\ P_1$

6. If V_{rms} is the root mean square value of velocity, V_{av} is the average velocity and V_{mp} velocity of the molecules of a gas, which one of the following is true?

(A) $V_{rms} = V_{av} \neq V_{mp}$

(B) $V_{rms} < V_{av} < V_{mp}$

(C) $V_{rms} > V_{av} > V_{mp}$

(D) $V_{rms} \neq V_{av} = V_{mp}$

7. An electron of mass of the order of 10^{-31} kg carries a charge of the order of 10^{-19} Coulomb. Then the charge carried by 1 kg of electrons will be of the order of

(A) 10^{12} Coulomb

(B) 10^{-12} Coulomb

(C) 10^{-50} Coulomb

(D) 10^{50} Coulomb

8. Angle between equipotential surface and lines of force of an electric field is

(A) zero
(B) 90°
(C) 180°
(D) 45°

9. The magnetic susceptibility of a certain paramagnetic substance at −73°C is 6×10^{-3}. Its susceptibility at −173°C will be

(A) 1.2×10^{-2}

(B) 1.8×10^{-3}

(C) 3×10^{-3}

(D) 4.5×10^{-3}

10. Match List - I (Electromagnetic wave type) with List - II (its association/application) and select the correct match option from the choices given below:

List - I	List - II
(a) Infrared waves	(i) To treat muscular strain
(b) Radio waves	(ii) For broadcasting
(c) X-rays	(iii) To detect fracture of bones
(d) Ultraviolet rays	(iv) Absorbed by the ozone layer of the atmosphere

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

11. In hydrogen atom, an electron makes a transition from orbit $n = 4$ to $n = 2$. The wave number of the emitted radiation will be (R = Rydberg's constant)

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

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

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

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

12. An electric iron box of rating 1000 W was used for 5 hours per day for 20 days. The electrical energy utilized is then

(A) 200 kWh
(B) 120 kWh
(C) 100 kWh
(D) 500 kWh

13. The limit of resolution of a microscope is given by the formula (λ is wavelength, n is refractive index and θ is semi vertical angle)

(A) $\frac{\lambda}{2\sin\theta}$

(B) $\frac{1.22\lambda}{2\sin\theta}$

(C) $\frac{\lambda}{2n\sin\theta}$

(D) $\frac{1.22\lambda}{\sin\theta}$

14. A projectile thrown at an angle of 45° with horizontal attains a maximum height of h_1. Another projectile thrown with the same velocity, at an angle of 30° attains a maximum height h_2. The relation between h_1 and h_2 is

(A) $h_1 = \frac{h_2}{\sqrt{2}}$

(B) $h_1 = h_2$

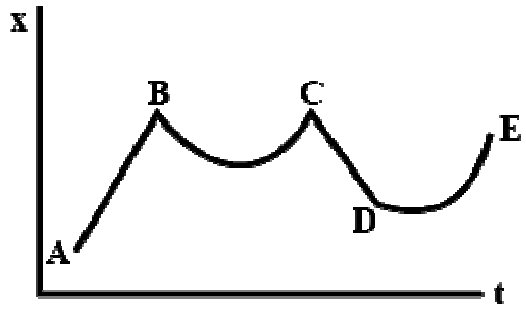
(C) $h_1 = \frac{h_2}{2}$

(D) $h_1 = 2h_2$

15. Which of the following quantities does **NOT** change periodically for a particle performing SHM?

(A) Velocity
(B) Acceleration
(C) Displacement
(D) Total energy

16. The following figure shows the displacement of a particle along the x-axis as a function of time. The force acting on the particle is zero in the regions



(A) AB, DE
(B) BC, CD
(C) AB, CD
(D) BC, DE

17. A square frame of each side L is dipped in a soap solution and taken out. If T is surface tension of soap solution, the force acting on the film formed is

(A) TL
(B) $2TL$
(C) $4TL$
(D) $8TL$

18. An unpolarised beam of intensity I_o is incident on a pair of Nicol prisms making an angle of 60° with each other. The intensity of light emerging from the pair is

(A) I_o
(B) $\frac{I_o}{2}$
(C) $\frac{I_o}{4}$
(D) $\frac{I_o}{8}$

19. If the temperature of a black body increases from 27°C to 327°C, then the rate of energy radiation increases by

(A) $\left(\frac{327}{27}\right)^4$
(B) 4
(C) 16
(D) 2

20. Pressure of an ideal gas is doubled keeping the temperature constant. The kinetic energy of the molecules

(A) becomes double
(B) becomes half
(C) remains the same
(D) may increase or decrease depending on the nature of gas

21. The smallest resistance that can be obtained by combining n resistors, each of resistance R is

(A) nR
(B) $\frac{R}{n}$
(C) n^2R
(D) $\frac{R}{n^2}$

22. The Power factor of R-L circuit is $\frac{1}{\sqrt{5}}$. What is the value of resistance if inductive reactance is 4 Ω?

(A) 2 Ω
(B) $\sqrt{2}$ Ω
(C) 4 Ω
(D) $\sqrt{5}$ Ω

23. If L, C and R represent inductance, capacitance and resistance respectively, which of the following combinations has the dimension of frequency?

(A) $\frac{C}{L}$

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

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

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

24. The threshold wavelength for a metal whose work function W is λ. What is the threshold wavelength of a wave function whose work function is $\frac{2W}{3}$?

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

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

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

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

25. How many NAND gates are used in an OR gate?

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

26. The value of Bohr magneton is

(A) $9.27 \times 10^{24}\ \text{Am}^2$

(B) $9.27 \times 10^{-24}\ \text{Am}^2$

(C) $6.27 \times 10^{-34}\ \text{Am}^2$

(D) $6.27 \times 10^{34}\ \text{Am}^2$

27. The SI unit of luminous intensity (I) is

(A) Candela
(B) Weber
(C) Henry
(D) Gauss's

28. Photo cells are used to measure the …… of light.

(A) intensity
(B) wavelength
(C) wave-number
(D) speed

29. The existence of discrete energy levels in an atom was directly verified in 1914 by

(A) James Franck and Gustav Hertz
(B) Stern Gerlach
(C) Heisenberg
(D) Langevin

30. Sonar technology works based on the principle of

(A) Photoelectric effect
(B) Total internal reflection of light
(C) Magnetic confinement of plasma
(D) Reflection of ultrasonic waves

31. Which law of Thermodynamics states that "Two systems in thermal equilibrium with a third system separately are in thermal equilibrium with each other"?

(A) Zeroth
(B) First
(C) Second
(D) Third

32. The electromagnetic force between charged particles arise due to the exchange of particles called

(A) Gravitons
(B) Vector Bosons
(C) Electrons
(D) Photons

33. A ball is kicked at an angle of 30° with the vertical. If the horizontal component of its velocity is 19.6 m/sec then the maximum height ball reached is

(A) 58.8 m
(B) 68.8 m
(C) 48.8 m
(D) 72.3 m

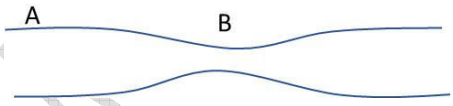
34. A ball is dropped from a spacecraft revolving around the earth at a height of 120 km. What will happen to the ball?

(A) It will continue to move with the same speed along the original orbit of the spacecraft
(B) It will move with the same speed, tangentially to the spacecraft
(C) It will fall down to the earth gradually
(D) It will go very far in the space

35. The sum of all electromagnetic forces between different particles of a system of charged particles is zero.

(A) only if all the particles are positively charged
(B) only if all the particles are negatively charged
(C) only if half the particles are positively charged and half are negatively charged
(D) irrespective of the signs of the charges

36. Water flows in a horizontal tube as shown in figure. The pressure of water changes by 600 N/m^2 between *A* and *B* where the areas of cross section are 30 cm^2 and 15 cm^2 respectively. Then the rate of flow of water through the tube is



(A) 2300 $cm^3 s^{-1}$
(B) 1890 $cm^3 s^{-1}$
(C) 3200 $cm^3 s^{-1}$
(D) 1000 $cm^3 s^{-1}$

37. Consider the following two statements.

(I) Line spectra contain information about atoms
(II) Band spectra contain information about molecules

(A) Both (I) and (II) are wrong
(B) (I) is correct but (II) is wrong
(C) (II) is correct but (I) is wrong
(D) Both (I) and (II) are correct

38. When deuterium and helium are subjected to an accelerating field simultaneously then

(A) both acquire same energy
(B) deuterium accelerates faster
(C) helium accelerates faster
(D) neither of them accelerated

39. If the polarizing angle for air-glass interface is 56.3°, the angle of refraction in glass is

(A) 45°
(B) 123.7°
(C) 90°
(D) 33.7°

40. The maximum intensity in case of interferences of n identical coherent waves each of intensity I_o is

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

41. A proton has kinetic energy E = 100 eV which is equal to that of a photon. The wavelength of photon is λ_2 and that of proton is λ_1. The ratio of $\frac{\lambda_2}{\lambda_1}$ is proportional to

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

42. The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than the 2480 nm is incident on it. The band gap (in eV) for the semiconductor is

(A) 0.9
(B) 0.7
(C) 0.5
(D) 1.1

43. A thin rod of length L and mass M is bent at its midpoint into two halves so that the angle between them is 90°. The moment of inertia of the bent rod about an axis passing through the bending point and perpendicular to the plane defined by the two halves of the rod is

(A) $\frac{ML^2}{24}$

(B) $\frac{ML^2}{12}$

(C) $\frac{ML^2}{6}$

(D) $\frac{\sqrt{2}ML^2}{24}$

44. The potential energy of a conservative system is given by $PE = ay^2 - by$, where y represents the position of the particle and a as well as b are constants. What is the force acting on the system?

(A) $b - 2ay$
(B) $ay - b$
(C) $-by$
(D) $-ay$

45. A cricket ball of mass 250 g collides with a bat with velocity 10 ms^{-1} and returns with the same velocity with in 0.01 second. The force acting on the bat is

(A) 25 N
(B) 50 N
(C) 250 N
(D) 500 N

46. If the amplitude of sound is doubled and frequency reduced to one-fourth, the intensity of sound at the same point will be

(A) increasing by a factor of 2
(B) decreasing by a factor of 2
(C) decreasing by a factor of 4
(D) unchanged

47. If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by

(A) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

(B) $n = n_1 + n_2 + n_3$

(C) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

(D) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

48. A wire of resistance R is cut into n equal parts. These parts are then connected in parallel. The equivalent resistance of the combination will be

(A) nR

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

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

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

49. The powers of two electric bulbs are 100 W and 200 W. Both of them are connected to 220 V main. The ratio of resistance of 100 W and 200 W filaments will be

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

50. A ray of light from air is incident in water. Then, which property of light will not change in water?

(A) Velocity
(B) Frequency
(C) Colour
(D) Amplitude

51. Einstein's work on the photoelectric effect provided support for the equation

(A) $E = mc^2$

(B) $E = h\nu$

(C) $E = \frac{-Rhc}{n^2}$

(D) $KE = \frac{1}{2}mv^2$

52. Zener breakdown will occur if impurity level is

(A) low
(B) high
(C) less in *n* side
(D) less in *p* side

53. The force on a particle of mass 10 g is (10 i + 5 j) N. If it starts from rest, what would be its position at time $t = 5$s?

(A) (12500 i + 6250 j) m
(B) (1250 i + 625 j) m
(C) (12.5 i + 62.5 j) m
(D) (12.5 i – 62.5 j) m

54. A uniform sphere of mass 2000 g rolls without slipping on a plane surface so that its centre moves at a speed of 2.00 cm/s. Find its kinetic energy.

(A) 5.6×10^{-4} J

(B) 5.6×10^{-1} J

(C) 8×10^{-4} J

(D) 8×10^{-1} J

55. A load of 4.0 kg mass is suspended from a ceiling through a steel wire of radius 2.0 mm. Find the tensile stress developed in the wire when equilibrium is achieved.

(A) 2.00×10^6 N/m^2
(B) 3.18×10^6 N/m^2
(C) 8.00×10^6 N/m^2
(D) 16.18×10^6 N/m^2

56. In a Young's double slit experiment, the separation between the slits is 0.10 mm, the wavelength of light used is 600 nm and the interference pattern is observed on a screen 1.0 m away. Find the separation between the successive bright fringes

(A) 6.00 cm
(B) 6.00 mm
(C) 30.00 cm
(D) 3.00 cm

57. The light from the sun is found to have a maximum intensity near the wavelength of 470 nm. Assuming that the surface of a sun emits as a blackbody, calculate the temperature of the surface of the sun.

(A) 470 K
(B) 840 K
(C) 4128 K
(D) 6128 K

58. A beam of protons with a velocity of 4×10^5 m/s enters a uniform magnetic field of 0.3 T. The velocity makes an angle of 60° with the magnetic field. Find the radius of the helical path taken by the proton beam.

(A) 0.3 cm
(B) 1.2 cm
(C) 2.4 cm
(D) 9.6 cm

59. A player in a ground throws a cricket ball with a speed of 12.0 m/s at an angle of 45° with the horizontal. At what distance will it hit the ground?

(A) 6.6 m
(B) 8.3 m
(C) 11.2 m
(D) 14.4 m

60. In a coil, when the current is changed from 10.0 A in one direction to 10.0 A in the opposite direction in 0.5 s, the average induced emf is 0.4 V. The self inductance of the coil is

(A) 10.0 mH
(B) 5.0 mH
(C) 2.0 mH
(D) 0.5 mH

61. The dimensions of Planck's constant is same as that of

(A) angular momentum
(B) linear momentum
(C) work
(D) coefficient of viscosity

62. A nucleus ${}_zX^A$ emits a α-particle. The resultant nucleus emits a β^+ particle. The respective atomic and mass numbers of the final nucleus will be

(A) $z-3, A-4$
(B) $z-1, A-4$
(C) $z-2, A-4$
(D) $z, A-2$

63. The resistivity of certain metals or alloys drops to zero when they are cooled below a certain temperature, this phenomenon is known as

(A) Conductivity
(B) Partial conductivity
(C) Superconductivity
(D) Non-conductivity

64. Which among the following materials display higher magnetic susceptibility?

(A) Ferromagnetic material
(B) Paramagnetic material
(C) Diamagnetic material
(D) None of the above

65. Phase difference between voltage and current in a capacitor in an ac circuit is

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

66. The radii of first three Bohr orbits is in the ratio

(A) 1 : 2 : 3
(B) 2 : 4 : 6
(C) 1 : 4 : 9
(D) 1 : 3 : 5

67. The Earth revolves around the Sun in an elliptical orbit. Its speed

(A) goes on decreasing continuously
(B) is greatest when it is closest to the Sun
(C) is constant at the all the points on the orbit
(D) is greatest when it is farthest from the Sun

68. For the resultant of two vectors to be maximum. What must be the angle between them?

(A) 0°
(B) 60°
(C) 90°
(D) 180°

69. According to Hooke's law of elasticity, if stress is increased, the ratio of stress to strain

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

70. In semiconductor the forbidden energy gap lies

(A) just below the conduction band
(B) just above the conduction band
(C) either above or below the conduction band
(D) between the valence band and conduction band

71. The energy gap is much more in silicon than in germanium because

(A) it has less number of electrons
(B) it has high atomic mass number
(C) its crystal has much stronger bonds called ionic bonds
(D) its valence electrons are more tightly bound to their parent nuclei

72. If the volume of a gas is doubled at constant pressure, the average translational kinetic energy of its molecules will

(A) be doubled
(B) remain the same
(C) increase by a factor
(D) increase 4 times

73. Young's modulus of a material has the same unit as

(A) Pressure
(B) Strain
(C) Compressibility
(D) Force

74. When a stationary wave is formed by superposition, then its frequency is

(A) same as that of the individual waves
(B) twice that of the individual waves
(C) half that of the individual waves
(D) three fourth of the individual waves

75. The motion of planets in the solar system is an example of the conservation of

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

CHEMISTRY (UG)– **SHIFT V**
(FINAL)

76. Which of the following units of concentration is temperature dependent?

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

77. If the mean free path of atoms is doubled then the pressure of the gas will become

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

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

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

(D) P

78. **In what manner will increase of pressure affect the following equation?**

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

(A) Shift in the reverse direction
(B) Shift in the forward direction
(C) Increase in the yield of Hydrogen
(D) No effect

79. Silver halides generally show

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

80. To get n-type of semiconductor, Germanium should be doped with

(A) Gallium
(B) Arsenic
(C) Aluminium
(D) Boron

81. **If the dispersed phase is a liquid and the dispersion medium is solid, the colloid is known as**

(A) foam
(B) sol
(C) emulsion
(D) gel

82. Coordination number of FCC crystal is

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

83. What is the frequency of light having a wavelength of 4.50×10^{-6} cm?

(A) $2.84 \times 10^{-12}\ s^{-1}$
(B) $2.10 \times 10^{4}\ s^{-1}$
(C) $4.29 \times 10^{14}\ s^{-1}$
(D) $6.67 \times 10^{15}\ s^{-1}$

84. Which statement about the four quantum numbers that describe electrons in atoms is **INCORRECT**?

(A) n = principal quantum number, n = 1, 2, 3, ...
(B) l = subsidiary (or azimuthal) quantum number, l = 1, 2, 3, ... , $(n + 1)$
(C) m_l = magnetic quantum number, $m_l = (-l), \ldots, 0, \ldots, (+l)$
(D) m_s = spin quantum number, $m_s = +1/2$ or $-1/2$

85. Which of the following statement is **NOT** true regarding the effect of increasing temperature on the distribution of molecular motion in a gas?

(A) Most probable speed increases
(B) Distribution curve become broader
(C) The fraction of molecule with higher velocity increases
(D) Distribution is independent of temperature

86. The total pressure exerted by a number of non reacting gases is equal to the sum of the partial pressures of the gases under the same conditions is known as

(A) Boyle's law
(B) Charle's law
(C) Avogadro's law
(D) Dalton's law

87. $\frac{PV}{nRT}$ is known as

(A) Pressure factor
(B) Temperature factor
(C) Volume factor
(D) Compressibility factor

88. In which of the following thermodynamics process there is no flow of heat between the system and the surroundings?

(A) Isobaric
(B) Isochoric
(C) Adiabatic
(D) Isothermal

89. For an ideally dilute binary solution Raoult's law is valid for

(A) solute only
(B) solvent only
(C) both of the solute and the solvent
(D) none of the solute and the solvent

90. Stability of dispersion is associated with magnitude of

(A) asymmetry effect
(B) Coulomb repulsion
(C) zeta potential
(D) Yukawa potential

91. Addition of catalyst to a reaction at a particular temperature lowers

(A) the value of equilibrium constant
(B) the value of activation energy for the forward reaction
(C) the value of free energy change of reaction
(D) the value of frequency factor in Arrhenius equation

92. Which one is a correct relation?

(A) $\left(\frac{\partial P}{\partial V}\right)_T \left(\frac{\partial V}{\partial T}\right)_P \left(\frac{\partial T}{\partial P}\right)_V \geq 0$

(B) $\left(\frac{\partial P}{\partial V}\right)_T \left(\frac{\partial V}{\partial T}\right)_P \left(\frac{\partial T}{\partial P}\right)_V = 1$

(C) $\left(\frac{\partial P}{\partial V}\right)_T \left(\frac{\partial V}{\partial T}\right)_P \left(\frac{\partial T}{\partial P}\right)_V = -1$

(D) $\left(\frac{\partial P}{\partial V}\right)_T \left(\frac{\partial V}{\partial T}\right)_P \left(\frac{\partial T}{\partial P}\right)_V \leq 0$

93. Which of the following will increase the voltage of the cell with the cell reaction?

$$Sn(s) + 2Ag^+(aq) \rightarrow Sn^{2+}(aq) + 2Ag(s)$$

(A) Increase in concentration of both Sn^{2+} and Ag^+
(B) Increase in amount of Sn metal
(C) Increase in concentration of Sn^{2+}
(D) Increase in concentration of Ag^+ ions

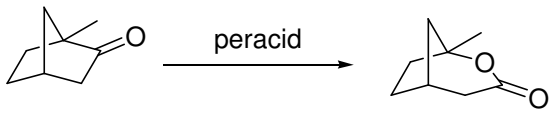
94. The quantity of electricity required to deposit 1.15 g of sodium from molten NaCl [given atomic weight : Na = 23, Cl = 35.5] is

(A) 1 F
(B) 0.5 F
(C) 0.05 F
(D) 1.5 F

95. The specific conductance of a 0.1 M KCl solution at 23°C is 0.012 $ohm^{-1}cm^{-1}$. The resistance of cell containing the solution at the same temperature was found to be 55 ohm. The cell constant is

(A) 6.6 cm^{-1}
(B) 0.66 cm^{-1}
(C) 0.066 cm^{-1}
(D) 0.12 cm^{-1}

96. Following reaction is an example for



(A) Baeyer-Villiger oxidation
(B) Epoxidation
(C) Fischer esterification
(D) Claisen reaction

97. Nitration of *t*-butylbenzene gives

(A) 2-nitro derivative exclusively
(B) 3-nitro derivative predominantly
(C) a 2:1 mixture of 2- and 4-nitro derivatives
(D) 4-nitro derivative almost exclusively

98. A simple Allene is a compound with the following chemical structure

$$H_2C{=}\underset{*}{C}{=}CH_2$$

What is the state of hybridization of the starred carbon (middle carbon)?

(A) sp^3
(B) sp^2
(C) alternates between sp^2 and sp
(D) sp

99. Adipic acid can be written as

where **n** equals to

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

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

(A) $ClCH_2CO_2H$
(B) CH_3CO_2H
(C) CF_3CO_2H
(D) C_2H_5OH

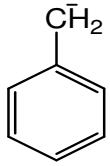
101. Nucleic acids are biopolymers containing

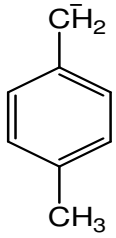
(A) phosphite linkers
(B) hexoses
(C) amino acids
(D) purine and pyrimidine bases

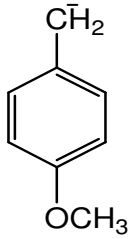
102. Which statement about the intermediate $[C_6H_6NO_2]^+$, formed during the mononitration of benzene, is correct?

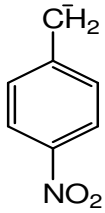
(A) It retains aromaticity
(B) It contains only one sp^3 hybridized carbon atom
(C) It is antiaromatic in nature
(D) It is nonaromatic, but planar in nature

103. Which among the following carbanions is most stable?

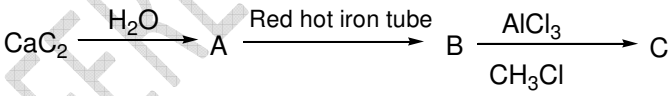
(A)  benzyl carbanion

(B)  4-methylbenzyl carbanion

(C)  4-methoxybenzyl carbanion

(D)  4-nitrobenzyl carbanion

104. In the following sequence B and C are



(A) Benzene and acetylene respectively
(B) Toluene and benzene respectively
(C) Benzene and toluene respectively
(D) Toluene and acetylene respectively

105. In order to distinguish between $C_6H_{13}NH_2$ and $C_6H_5NH_2$, which of the following reagents is useful?

(A) Hinsberg reagent
(B) Bromine water
(C) Solubility test in dilute acid
(D) Lucas reagent

106. Which among the following Vitamins helps to release energy from food?

(A) K
(B) A
(C) B
(D) D

107. Teflon coated cookware is losing popularity because

(A) Teflon is very expensive
(B) Teflon is highly carcinogenic
(C) PFOA used in creating Teflon coating is not good for human health
(D) Bakelite is a now emerging as a more economical alternative

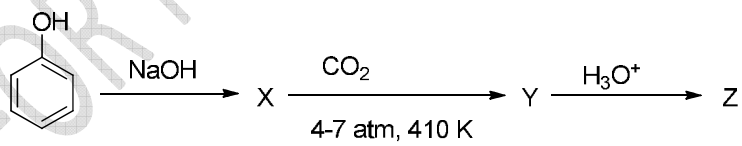
108. Which among the following name reactions will give a hydrocarbon as the end product?

(A) Hunsdiecker reaction
(B) Meerwein-Verley-Ponndorf reduction
(C) Wurtz-Fittig reaction
(D) Reformatzky reaction

109. The foul smelling compound formed by the action of alcoholic caustic potash on chloroform and aniline is

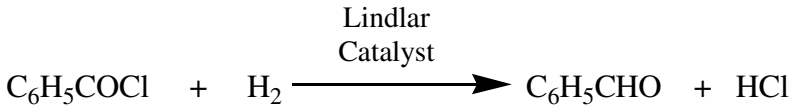
(A) Phenyl isocyanide (C_6H_5NC)
(B) Benzotrichloride ($C_6H_5CCl_3$)
(C) Benonitrile (C_6H_5CN)
(D) Phenyl isocyanate (C_6H_5NCO)

110. Identify the product 'Z' in the following sequence of reactions



(A) Aspirin
(B) Salicylaldehyde
(C) Benzoic acid
(D) Salicylic acid

111. The reaction given below is a typical example for



(A) Meerwein-Verley-Ponndorf reduction
(B) Clemmenson reduction
(C) Rosenmund reduction
(D) Wolff-Kishner reduction

112. An organic compound that readily undergoes Cannizaro reaction but does not give a positive test with Fehling's solution is

(A) methanal
(B) 2,2-dimethylpropanal
(C) benzaldehyde
(D) acetone

113. Selective method to convert pent-1-ene to pentan-1-ol is

(A) Acid catalyzed addition of water
(B) Oxymercuration-demercuration
(C) Hydroboration-oxidation
(D) Addition of HBr followed by treatment with NaOH in water

114. Oxidation state of Fe in cytochrome is/are

(A) +2 and +4 only
(B) +3 and +4 only
(C) +2, +3, and +4 in catalytic intermediates
(D) +4 only

115. Which among the following methods is best suited for the selective preparation of methyl *tert*-butyl ether?

(A) Acid catalyzed addition of methanol to propyne
(B) Williamson ether synthesis involving *tert*-butyl bromide and sodium salt of methanol
(C) Williamson ether synthesis involving sodium salt of *tert*-butanol and methyl iodide
(D) Selective methylation of dimethyl ether

116. $'A' + H_2O \rightarrow NaOH$; $'A' \xrightarrow[400°C]{O_2} 'B' \xrightarrow[\text{at } 25°C]{H_2O} NaOH + O_2$

'B' is used for oxygenating in submarine. 'A' and 'B' are respectively

(A) Na_2O_2 and Na_2O
(B) Na_2O and Na_2O_2
(C) Na_2O_2 and O_2
(D) NaO and O_2

117. The formation of atomic hydrogen from molecular hydrogen is favoured under what conditions of temperature and pressure?

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

118. In a sealed nickel vessel, Xe and F_2 taken in 1 : 20 volume ratio were heated to 400°C. The product obtained is

(A) XeF
(B) XeF_2
(C) XeF_4
(D) XeF_6

119. The number of P-O-P bonds in cyclic metaphosphoric acid is

(A) zero
(B) two
(C) three
(D) four

120. The maximum possible number of hydrogen bonds that can be formed by a water molecule is

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

121. Which is the correct increasing order of lone pair of electrons on the central atom?

(A) $IF_7 < XeF_2 < ClF_3 < IF_5$
(B) $IF_7 < IF_5 < ClF_3 < XeF_2$
(C) $IF_7 < ClF_3 < XeF_2 < IF_5$
(D) $IF_7 < XeF_2 < IF_5 < ClF_3$

122. The actinides which exhibit the +7 oxidation state are

(A) Pu, Am
(B) U, Np
(C) Am, Cm
(D) Np, Pu

123. The correct order of ionic radii of Y^{3+}, La^{3+}, Eu^{3+} and Lu^{3+} is

(A) $Y^{3+} < Lu^{3+} < Eu^{3+} < La^{3+}$
(B) $Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$
(C) $Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$
(D) $La^{3+} < Eu^{3+} < Lu^{3+} < Y^{3+}$

124. Maximum oxidation state is presented by

(A) CrO_2Cl_2 and MnO_4
(B) MnO_2
(C) $[Fe(CN)_6]^{3-}$ and $[Co(CN)_6]^{3-}$
(D) MnO

125. How much volume of CO_2 will be obtained by thermal decomposition of 25 g of calcium carbonate (molar mass of calcium carbonate = 100 g) ?

(A) 1.0 L
(B) 5.6 L
(C) 11.2 L
(D) 22.4 L

126. The number of radial nodes for the 4f orbital

(A) 3
(B) 4
(C) 0
(D) 1

127. Equanil is

(A) artificial sweetener
(B) tranquilizer
(C) antihistamine
(D) antifertility drug

128. What type of orbital is designated by n = 4, l = 2, ml = −2?

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

129. Balmer series of lines in the hydrogen spectrum are observed in

(A) UV region
(B) visible region
(C) infrared region
(D) far infrared region

130. Which of the following metal hydroxide is least basic?

(A) $Ca(OH)_2$
(B) $Mg(OH)_2$
(C) $Sr(OH)_2$
(D) $Ba(OH)_2$

131. Permanent hardness of water is due to the presence of

(A) sulphates of Na and K
(B) sulphates of Ca and Mg
(C) hydrogen carbonates of Ca and Mg
(D) carbonates of alkali metals in water

132. For the element with the electronic configuration $[Xe]4f^{14}\ 5d^{10}\ 6s^2\ 6p^1$, which is most stable oxidation state?

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

133. A surface ejects electrons when it is hit by green light; but does not eject electron when it is hit by yellow light. Will electrons be ejected if the surface is hit by red light?

(A) Yes
(B) No
(C) Yes if the red beam is quite intense
(D) Yes if the red beam continues to fall upon

134. Stable ionic solid MX is formed with

(A) metal having high electron affinity
(B) metal having high ionisation potential
(C) X having high electron affinity
(D) metal having low ionisation potential and X having high electron affinity

135. With respect to periodic properties the correct statement is

(A) Electron affinity order is: F > O > Cl
(B) First ionisation energy order is: Al > Mg > K
(C) Atomic radius order is: N > P > As
(D) Ionic radius order is: $K^{+} > Ca^{2+} > Mg^{2+}$

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136. The rank of the diagonal matrix $\begin{bmatrix} 2 & & & & \\ & -1 & & & \\ & & 0 & & \\ & & & 4 & \\ & & & & 0 \end{bmatrix}$ is

(A) 1
(B) 3
(C) 5
(D) 2

137. Let $\Delta = \begin{vmatrix} 1 & -4 & 20 \\ 1 & -2 & 5 \\ 1 & 2x & 5x^2 \end{vmatrix}$. The solution set of $\Delta = 0$ is

(A) $\{-2, 3\}$
(B) $\{-3, 4\}$
(C) $\{4, -6\}$
(D) $\{-2, -1\}$

138. If $f'(3) = 2$, then $\lim_{h \to 0} \frac{f\left(3+h^2\right) - f\left(3-h^2\right)}{2h^2}$ is

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

139. What is the sum of all two digit numbers?

(A) 4900
(B) 4895
(C) 4905
(D) 4985

140. For any real x, the range of the function $f(x)=3x^2+5x+7$ is

(A) $\left[\frac{59}{2},\infty\right)$

(B) $\left[\frac{59}{12},\infty\right)$

(C) $\left[-\infty,\frac{59}{12}\right)$

(D) $\left[-\infty,\frac{12}{59}\right)$

141. If a vertex of a triangle is (1, 1) and the mid points of two sides through this vertex are (−1, 2) and (3, 2) ,then the centroid of the triangle is

(A) $\left(1,\frac{7}{3}\right)$

(B) $\left(\frac{1}{3},\frac{7}{3}\right)$

(C) $\left(-1,\frac{7}{3}\right)$

(D) $\left(\frac{-1}{3},\frac{7}{3}\right)$

142. If $f(x)=2x^2-2x+4$ and $f(2\alpha)=4f(\alpha)$, then α is equal to

(A) 4
(B) 3
(C) 0
(D) –2

143. The value of $\frac{d}{dx}\left(\log_e(ax)^x\right)$ where a is a constant is equal to

(A) 1

(B) $\log_e ax$

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

(D) $\log_e(ax)+1$

144. The period of the function $f(x)=[x]+[2x]+[3x]+....[nx]-\frac{n(n+1)x}{2}$, where $n\in N$ and [ ] denotes the greatest integer function, is

(A) 1

(B) n

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

(D) $2n$

145. If one root of the equation $x^2+px+12=0$ is 4 and the equation $x^2+px+q=0$ has equal roots, then the value of q is

(A) 3

(B) 12

(C) $\frac{49}{4}$

(D) $\frac{39}{4}$

146. The points $(a,b+c),(b,c+a)$ and $(c,a+b)$ are

(A) vertices of an equilateral triangle
(B) concyclic
(C) vertices of a right angled triangle
(D) collinear

147. If $f(x)=\frac{3x+1}{3x-1}$, then the roots of the equation $f(x)+f\left(\frac{1}{x}\right)=0$ are

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

(B) $-3,\frac{1}{3}$

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

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

148. Let $\Delta = \begin{vmatrix} 1 & a & a^2 - bc \\ 1 & b & b^2 - ca \\ 1 & c & c^2 - ab \end{vmatrix}$. Then Δ is equal to

(A) 0

(B) $a+b+c$

(C) $\frac{1}{2}\left(a^2+b^2+c^2\right)$

(D) 3

149. $\lim_{x\to 0}\left(\frac{1^x+2^x+3^x+\ldots+n^x}{n}\right)^{1/x}$ is

(A) $n!$

(B) $(n-1)!$

(C) n

(D) $(n\ !)^{1/n}$

150. The set onto which the derivative of the function $f(x) = x(\log x - 1)$ maps the ray $[1, \infty)$ is

(A) $[1, \infty)$

(B) $(0, \infty)$

(C) $[0, \infty)$

(D) $(1, \infty)$

151. A point P (other than origin) on $y = 4x^3 - 2x^5$ such that the tangent at P passes through the origin is

(A) (1, 3)

(B) (1, 2)

(C) (−1, 2)

(D) (2, −32)

152. In a network of railways, a small island has 15 stations. The number of different types of tickets to be printed for each class, if every station must have tickets for other station, is

(A) 210
(B) 230
(C) 310
(D) 340

153. The differential equation representing a curve passing through (1, 2) is $\frac{dy}{dx} = \frac{2y}{x}$.

Then the equation of the curve is

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

154. The points with position vectors $60\vec{i} + 3\vec{j}$, $40\vec{i} - 8\vec{j}$, $a\vec{i} - 52\vec{j}$ are collinear if

(A) $a = -40$
(B) $a = 40$
(C) $a = 20$
(D) $a = -20$

155. The value of the integral $\int_0^1 \left(\frac{2-x}{1+x}\right) dx$ is

(A) 3 log 2
(B) 2 log 2 − 1
(C) 3 log 2 + 1
(D) 3 log 2 − 1

156. If $\omega(\neq 1)$ is a complex cube root of unity, the least value of $n \in \mathbb{N}$ for which $\left(1+\omega^2\right)^n = \left(1+\omega^4\right)^n$ is

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

157. If $\int_0^\infty \frac{x^2}{\left(x^2+a^2\right)\left(x^2+b^2\right)\left(x^2+c^2\right)}dx = \frac{\pi}{2(a+b)(b+c)(c+a)}$, then the value of $\int_0^\infty \frac{1}{\left(x^2+4\right)\left(x^2+9\right)}dx$ is

(A) $\frac{\pi}{60}$

(B) $\frac{\pi}{16}$

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

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

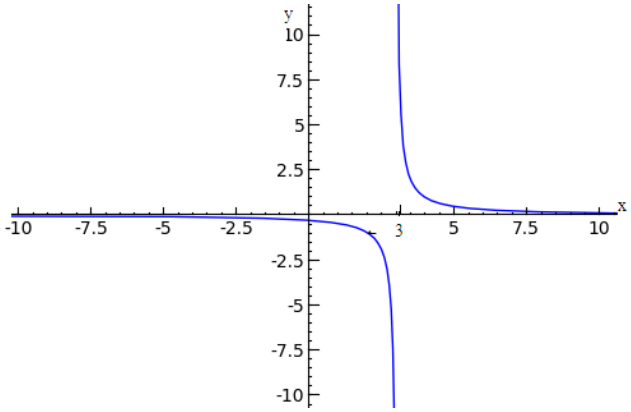
158. Let $f(x) = \frac{\log\left(1+x+x^2\right)+\log\left(1-x+x^2\right)}{\sec x - \cos x}$, $x \neq 0$. Then the value of $f(0)$ so that f is continuous at $x = 0$ is

(A) 1
(B) 0
(C) 2
(D) −1

159. The equation of the line passing through (3, 3) and making an angle of 60° with the positive direction of the x-axis is

(A) $x - \sqrt{3}y + 3 - 3\sqrt{3} = 0$
(B) $x + \sqrt{3}y + 3 - 3\sqrt{3} = 0$
(C) $\sqrt{3}x - y + 3 - 3\sqrt{3} = 0$
(D) $\sqrt{3}x - y - 3 + 3\sqrt{3} = 0$

160. Identify the function for the given below:



(A) $y = \frac{1}{x}$

(B) $y = \frac{1}{x-3}$

(C) $y = \frac{1}{x+3}$

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

161. The least value of n so that $y_n = y_{n+1}$ where $y = x^2 + e^x$ and y_n denotes the n^{th} order derivative of y, is

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

162. The ratio in which the line segment joining (2, −3) and (5, 6) is divided by the x-axis is

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

163. Sum of the roots of the equation $4^x - 3\left(2^{x+3}\right) + 128 = 0$ is

(A) 5
(B) 6
(C) 7
(D) 8

164. Let $\Delta = \begin{vmatrix} b+c & q+r & y+z \\ c+a & r+p & z+x \\ a+b & b+q & x+y \end{vmatrix}$ and $\Delta_1 = \begin{vmatrix} x & a & b \\ y & b & q \\ z & c & r \end{vmatrix}$. Then

(A) $\Delta = 2\Delta_1$
(B) $\Delta = -2\Delta_1$
(C) $\Delta = 4\Delta_1$
(D) $\Delta = -4\Delta_1$

165. If the area of triangle formed by the line $4x+3y+c=0$ and the axes of co-ordinates is 6, then c is equal to

(A) ± 18
(B) ± 16
(C) ± 12
(D) ± 8

166. If a, b, c are in A.P., then the line $ax + by + c = 0$ will always pass through the point

(A) (2, 1)
(B) (1, 2)
(C) (1, –2)
(D) (–2, –1)

167. The difference between the greatest and the least value of the function $F(x) = \int_0^x (t+1)dt$ on [2, 3] is

(A) 3
(B) 2
(C) $\frac{7}{2}$
(D) $\frac{3}{2}$

168. The point(s), at which the function given by $f(x)=\begin{cases}\frac{x}{|x|}, & x<0\\ -1, & x\geq 0\end{cases}$ is continuous

(A) $x\in R$
(B) $x=0$
(C) $x\in R-\{0\}$
(D) $x=-1$ and 1

169. If $E=\frac{1}{4}.\frac{2}{6}.\frac{3}{8}...\frac{30}{62}.\frac{31}{64}=8^x$, then the value of x is

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

170. If $u=e^{\left(\frac{x^2}{y^2}\right)}+e^{\left(\frac{y^2}{x^2}\right)}$, then $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=$

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

171. The area of the figure bounded by the lines $x=0,\ x=\frac{\pi}{2},\ f(x)=\sin x,\ g(x)=\cos x$ is

(A) $2\left(\sqrt{2}-1\right)$
(B) $\sqrt{3}-1$
(C) $2\left(\sqrt{3}-1\right)$
(D) $2\left(\sqrt{2}+1\right)$

172. The point on the y-axis whose perpendicular distance from the line $4x - 3y - 12 = 0$ is

(A) (0, 1)
(B) (0, 3)
(C) (0, –9)
(D) Both (A) and (C)

173. If A and B are two skew symmetric matrices of order n, then

(A) AB is a skew symmetric matrix
(B) AB is a symmetric matrix
(C) AB is a symmetric matrix if A and B commute
(D) AB is a singular matrix

174. The latus rectum of an ellipse is equal to half of its minor axis. Its eccentricity is

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

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

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

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

175. The number of subsets of the set $A = \{a_1, a_2, ..., a_n\}$ which contain even number of elements is

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

176. A set of direction cosines of the normal to the plane $6x - 3y - 2z = 10$ is

(A) $\left(\frac{6}{7}, \frac{-3}{7}, \frac{-2}{7}\right)$

(B) $(6,-3,-2)$

(C) $\left(\frac{6}{49}, \frac{-3}{49}, \frac{-2}{49}\right)$

(D) $\left(\frac{-6}{49}, \frac{3}{49}, \frac{2}{49}\right)$

177. Six boys and six girls sit in a row randomly. The probability that boys and girls sit alternatively is

(A) $\frac{1}{231}$

(B) $\frac{5}{462}$

(C) $\frac{1}{462}$

(D) $\frac{7}{101}$

178. A particular solution of $\log\frac{dy}{dx} = 3x + 4y,\ y(0) = 0$ is

(A) $e^{3x} + 3e^{-4y} = 4$

(B) $4e^{3x} - e^{-4y} = 3$

(C) $3e^{3x} + 5e^{4y} = 7$

(D) $4e^{3x} + 3e^{-4y} = 7$

179. If $x > 1$, $y > 1$, $z > 1$ are in Geometric Progression, then $\frac{1}{1+\ln x}, \frac{1}{1+\ln y}, \frac{1}{1+\ln z}$ are in

(A) Arithmetic Progression
(B) Geometric Progression
(C) Harmonic Progression
(D) both Arithmetic Progression and Harmonic Progression

180. The population $p(t)dt$ time 't' of a certain mouse species satisfies the differential equation $\frac{d}{dt}p(t) = 0.5\,p(t) - 450$. If $p(0) = 850$, then the time at which the population becomes zero is

(A) $\log 9$

(B) $\frac{1}{2}\log 18$

(C) $\log 18$

(D) $2\log 18$

181. The equation of the plane through (3, 4, −1) which is parallel to the plane $\vec{r} \bullet \left(2\vec{i} - 3\vec{j} + 5\vec{k}\right) + 7 = 0$ is

(A) $\vec{r} \bullet \left(2\vec{i} - 3\vec{j} + 5\vec{k}\right) + 11 = 0$

(B) $\vec{r} \bullet \left(3\vec{i} + 4\vec{j} - \vec{k}\right) + 11 = 0$

(C) $\vec{r} \bullet \left(3\vec{i} + 4\vec{j} - \vec{k}\right) + 7 = 0$

(D) $\vec{r} \bullet \left(2\vec{i} - 3\vec{j} + 5\vec{k}\right) - 7 = 0$

182. The function $f(x)$, where $f(x) = \int e^x (x-1)(x-2)dx$ decreases in the interval

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

183. The reflection of the point $A(1,0,0)$ in the line $\frac{x-1}{2} = \frac{y+1}{-3} = \frac{z+10}{8}$ is

(A) (3, −4, −2)
(B) (5, −8, −4)
(C) (1, −1, −10)
(D) (2, −3, 8)

184. The sum $\sum_{i=0}^{m}\binom{10}{i}\binom{20}{m-i}$ (where $\binom{p}{q}=0$ if $p<q$) is maximum when m is

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

185. The number of distinct real values of λ for which the lines $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z+3}{\lambda^2}$ and $\frac{x-3}{1}=\frac{y-2}{\lambda^2}=\frac{z-1}{2}$ are coplanar is

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

186. If $f(x)=\lim_{n\to\infty}\left[2x+4x^3+\ldots+2nx^{2n-1}\right](0<x<1)$, then $\int f(x)dx$ is equal to

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

187. Six dice are thrown simultaneously. Then the probability that all of them show the different faces is

(A) $\frac{1}{6^5}$
(B) $\frac{6!}{6^6}$
(C) $\frac{1}{6!}$
(D) $\frac{5!}{6^6}$

188. Two tangents are drawn from the origin to a circle with centre at $(2,-1)$. If the equation of one of the tangents is $3x + y = 0$, the equation of the other tangent is

(A) $3x - y = 0$
(B) $x + 3y = 0$
(C) $x - 3y = 0$
(D) $x + 2y = 0$

189. If $P(A) = \frac{1}{4}, P(B) = \frac{1}{2}, P(A \cup B) = \frac{5}{8}$, then $P(A \cap B) =$

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

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

(C) $\frac{2}{8}$

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

190. The point on the curve $y = x^2$ which is closest to the point $\left(4, \frac{-1}{2}\right)$ is

(A) (1, 1)
(B) (2, 4)
(C) $\left(\frac{2}{3}, \frac{4}{9}\right)$
(D) $\left(\frac{4}{3}, \frac{16}{9}\right)$

191. If A and B are independent events of a random experiment such that $P(A \cap B) = \frac{1}{6}$ and $P(\bar{A} \cap \bar{B}) = \frac{1}{3}$, then $P(A)$ is equal to

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

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

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

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

192. Let S be the set of integers. For $a, b \in S$, define aRb iff $|a-b| < 1$. Then

(A) R is not reflexive
(B) R is not symmetric
(C) R is an equivalence relation
(D) R is not an equivalence relation

193. There are four machines and it is known that exactly two of them are faulty. They are tested, one by one, in a random order till both the faulty machines are identified. Then the probability that only two tests are needed is

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

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

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

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

194. If $\int f(x)dx = -2\cos\sqrt{x} + c$, then $f(x)$ is equal to

(A) $\sin\sqrt{x}$

(B) $\dfrac{\sin\sqrt{x}}{\sqrt{x}}$

(C) $2\cos\sqrt{x}$

(D) $\cos\sqrt{x}$

195. $\int_{-2}^{2} |x-1|\,dx =$

(A) 0
(B) 5
(C) 1
(D) 4

196. If letters of the word SACHIN are arranged in all possible ways and are written out as in a dictionary, then the word SACHIN appears at serial number

(A) 603
(B) 602
(C) 601
(D) 600

197. If $\int_0^1 \dfrac{\sqrt{e^x}}{\sqrt{e^x + e^{-x}}}\,dx = \log\left(\dfrac{e+A}{1+\sqrt{2}}\right)$, then A is equal to

(A) e^2+1

(B) $\sqrt{e^2+1}$

(C) e^2

(D) e^2-1

198. Let f be a nonzero continuous function satisfying $f(x+y) = f(x)f(y)$ for all $x, y \in \mathbb{R}$. If $f(2) = 9$. Then $f(3)$ is

(A) 1
(B) 27
(C) 9
(D) 26

199. If $f(x)=(1+\tan x)\left(1+\tan\left(\frac{\pi}{4}-x\right)\right)$ and $g(x)$ is a function with domain R, then $\int_0^1 x^3(g\circ f)(x)dx$ is

(A) $\frac{1}{2}g\left(\frac{\pi}{2}\right)$

(B) $\frac{1}{4}g(2)$

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

(D) $g(1)$

200. If the product of the roots of the equation $x^2-5kx+2e^{4\ln k}-1=0$ is 31, then the sum of the roots is

(A) -10
(B) 5
(C) -8
(D) 10

201. $\int_{-1}^{1} e^{-x^2}dx=k$, then $\int_{-1}^{0} e^{-x^2}dx=$

(A) $-k$

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

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

(D) $2k$

202. Let $x=\frac{-1}{3}\left(1+i\sqrt{7}\right)$ and $y=\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}$. Let $\Delta=\begin{vmatrix}1 & x & x\\ 1 & x+y & y\\ 1 & x & x+y\end{vmatrix}$. Then Δ is equal to

(A) $-\sqrt{7}$
(B) $\sqrt{7}$
(C) i
(D) -1

203. The number of ways in which six '+' and four '−' signs can be arranged in a line so that no two '−' signs occur together is

(A) 30
(B) 35
(C) 6!5!
(D) 10!

204. If $z+2|z|=\pi+4i$, then $\text{Im}(z)$ equals

(A) π
(B) $\sqrt{\pi}$
(C) $\sqrt{\pi^2+16}$
(D) 4

205. If three positive real numbers *a, b, c* are in Arithmetic Progression such that *abc* = 4, then the minimum possible value of *b* is

(A) $2^{\frac{3}{2}}$
(B) $2^{\frac{2}{3}}$
(C) $2^{\frac{1}{3}}$
(D) $2^{\frac{5}{2}}$

206. The inequality $|z-4|<|z-2|$ represents the region given by

(A) $\mathrm{Re}(z)\geq 0$
(B) $\mathrm{Re}(z)<3$
(C) $\mathrm{Re}(z)\leq 0$
(D) $\mathrm{Re}(z)>3$

207. If $x=-9$ is a root of $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix}=0$, then the other two roots are

(A) 3, 7
(B) 2, 7
(C) 3, 6
(D) 2, 6

208. If $|z|=1$ and $z\neq\pm 1$, then all the values of $\frac{z}{1-z^2}$ lie on

(A) a line not passing through the origin
(B) $|z|=2$
(C) the x-axis
(D) the y-axis

209. If $\int \frac{\sin x}{\sin(x-\alpha)}dx=Ax+B\log(x-\alpha)+c$, then the value of (A, B) is

(A) $(-\sin\alpha,\cos\alpha)$
(B) $(\cos\alpha,\sin\alpha)$
(C) $(\sin\alpha,\cos\alpha)$
(D) $(-\cos\alpha,\sin\alpha)$

210. If $\frac{1}{3-4i}$ is a root of $ax^2+bx+c=0$, $(a,b,c\in\mathbb{R})$, then

(A) $b+6c=0$
(B) $b=6c$
(C) $a+25c=0$
(D) $b^2=c$

211. If ω is a complex cube root of unity, the matrix $A=\begin{pmatrix} 1 & \omega^2 & \omega \\ \omega^2 & \omega & 1 \\ \omega & 1 & \omega^2 \end{pmatrix}$ is a

(A) singular matrix
(B) non-singular matrix
(C) skew symmetric matrix
(D) symmetric matrix

212. The equation $e^{\sin x}-e^{-\sin x}=4$ has

(A) no real roots
(B) exactly one real root
(C) exactly four real roots
(D) infinite number of real roots

213. If $7\sin^2\theta+3\cos^2\theta=4$ and $0\le\theta\le\frac{\pi}{2}$, then the value of $\tan\theta$ is

(A) $\sqrt{\frac{3}{7}}$

(B) $\sqrt{\frac{2}{7}}$

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

(D) $\sqrt{\frac{1}{7}}$

214. For the equation $3x^2+px+3=0, p>0$, if one of the roots is square of the other, then p is equal to

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

(B) 1

(C) 3

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

215. The contrapositive of $p \to (q \to r)$ is logically equivalent to

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

216. If $z = \dfrac{7-i}{3-4i}$ then z^{14} equals

(A) 2^7
(B) 2_i^7
(C) -2_i^7
(D) -2^7

217. Let S be a non-empty subset of **R**. Consider the following statement:
P : There is a rational number $x \in S$ such that $x > 0$.
Then the negation of P is

(A) Every rational number $x \in S$ satisfies $x \le 0$
(B) $x \in S$ and $x \le 0 \Rightarrow x$ is not a rational number
(C) There is a rational number $x \in S$ such that $x \le 0$
(D) There is no rational number $x \in S$ such that $x \le 0$

218. If $\cos\theta + \sec\theta = 2$, then the value of $\cos^{68}\theta + \sec^{68}\theta$ equals

(A) 1
(B) 2
(C) 3
(D) 68

219. Value of $x = \sqrt{6+\sqrt{6+\sqrt{6+...\text{upto } \infty}}}$ is

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

220. The domain of the function $f(x)=\sin^{-1}\left(\log_3\left(\frac{\pi}{2}\right)\right)$ is

(A) $[-1, 9]$
(B) $[1, 9]$
(C) $[-9, 1]$
(D) $[3, 9]$

221. The equation $z^3=\overline{z}$ has

(A) no solution
(B) two solutions
(C) five solutions
(D) infinite number of solutions

222. Which of the following functions is not 1-1?

(A) $f:\mathbb{R}\to\mathbb{R}$ defined by $f(x)=2x+5$
(B) $f:[0,\pi]\to[-1,1]$ defined by $f(x)=\cos x$
(C) $f:\left[\frac{-\pi}{2},\frac{\pi}{2}\right]\to[1,7]$ defined by $f(x)=3\sin x+4$
(D) $f:\mathbb{R}\to[-1,]$ defined by $f(x)=\sin x$

223. The number of points at which the function $f(x)=\frac{1}{x-[x]}$ is not continuous is

(A) 1
(B) 2
(C) 3
(D) infinitely many

224. If A is a set with n elements, then the cardinality of $\{(x, y, z): x, y, z\in A, x\neq y, y\neq z, z\neq x\}$ is

(A) n^3
(B) $n(n-1)^2$
(C) $n^2(n-2)$
(D) n^3-3n^2+2n

225. Let $\Delta(x)=\begin{vmatrix}\cos^2(x) & \cos x\sin x & -\sin x\\ \cos x\sin x & \sin^2 x & \cos x\\ \sin x & -\cos x & 0\end{vmatrix}$. Then $\int_0^{\frac{\pi}{2}}[\Delta(x)+\Delta'(x)]dx$ equals

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

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

(C) 2π

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

FINAL ANSWER KEY									
TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT V									
SI No.	**Key**	**SI No.**	**Key**	**SI No.**	**Key**	**SI No.**	**Key**	**SI No.**	**Key**
1	A	31	A	61	A	91	B	121	B
2	C	32	D	62	A	92	C	122	D
3	D	33	A	63	C	93	D	123	A
4	B	34	A	64	A	94	C	124	A
5	D	35	D	65	B	95	B	125	B
6	C	36	B	66	C	96	A	126	C
7	A	37	D	67	B	97	D	127	B
8	B	38	D	68	A	98	D	128	C
9	A	39	D	69	B	99	D	129	B
10	D	40	B	70	D	100	C	130	B
11	C	41	D	71	D	101	D	131	B
12	C	42	C	72	A	102	B	132	D
13	C	43	B	73	A	103	D	133	B
14	D	44	A	74	A	104	C	134	D
15	D	45	D	75	C	105	B	135	D
16	C	46	C	76	B	106	C	136	B
17	D	47	A	77	B	107	C	137	D
18	C	48	D	78	A	108	C	138	B
19	C	49	B	79	C	109	A	139	C
20	C	50	B	80	B	110	D	140	B
21	B	51	B	81	D	111	C	141	A
22	A	52	B	82	C	112	C	142	B
23	C	53	A	83	D	113	C	143	D
24	D	54	A	84	B	114	C	144	A
25	A	55	B	85	D	115	C	145	C
26	B	56	B	86	D	116	B	146	D
27	A	57	D	87	D	117	B	147	D
28	A	58	B	88	C	118	D	148	A
29	A	59	D	89	B	119	C	149	D
30	D	60	A	90	C	120	C	150	C

SI No.	Key	SI No.	Key	SI No.	Key
151	B	181	A	211	A
152	A	182	C	212	A
153	A	183	B	213	C
154	A	184	C	214	C
155	D	185	C	215	A
156	C	186	D	216	C
157	A	187	B	217	A
158	A	188	C	218	B
159	C	189	A	219	A
160	B	190	A	220	B
161	B	191	D	221	C
162	C	192	C	222	D
163	C	193	B	223	D
164	A	194	B	224	D
165	C	195	B	225	B
166	C	196	C		
167	C	197	B		
168	A	198	B		
169	D	199	B		
170	D	200	D		
171	A	201	C		
172	D	202	C		
173	C	203	B		
174	C	204	D		
175	A	205	B		
176	A	206	D		
177	C	207	B		
178	D	208	D		
179	C	209	B		
180	D	210	A		