

Physics

1. Two cars A and B are travelling in the same direction with velocities v_A and v_B ($v_A > v_B$). When the car is at a distance s behind car B, then the driver of the car A applies the brakes producing a uniform retardation a , there will be no collision when
 - (a) $s \leq \frac{v_A - v_B}{2}$
 - (b) $s \leq \frac{(v_A - v_B)^2}{2a}$
 - (c) $s \leq (v_A - v_B)^2$
 - (d) $s = \frac{(v_A - v_B)^2}{a}$
2. A point moves along X-axis initially at rest. Its acceleration is $a = (6t + 5) \text{ m/s}^2$. The distance covered in 2 s, if it starts from origin is given by
 - (a) 6 m
 - (b) 12 m
 - (c) 16 m
 - (d) 18 m
3. A ball released from the top of a tower falls $11/36$ of the height of the tower in the last second of its fall. The height of the tower is
 - (a) 180 m
 - (b) 120 m
 - (c) 140 m
 - (d) 110 m
4. A person throws a ball with speed 10 m/s at an angle of 30° with horizontal from the top of 10 m high tower. The distance of ball from the foot of the tower after falling on the ground will be
 - (a) 7 m
 - (b) 8.6 m
 - (c) 9.6 m
 - (d) 10 m
5. A 1 kg mass is tied to a light inextensible string of length $l = \frac{10}{3} \text{ m}$, is wheeled in circular path of radius 1 m in a vertical plane. The ratio of maximum to the minimum tension in the string is 4. The speed of stone at the highest point of circle is
 - (a) 5 m/s
 - (b) 10 m/s
 - (c) 15 m/s
 - (d) 20 m/s
6. The spheres of masses 2 kg and 4 kg are situated at the opposite end of a wooden bar of length 9 m. Where does the center of mass of the system lie
 - (a) 6 m from 2 kg sphere
 - (b) 2 m from 4 kg sphere
 - (c) 3 m from 2 kg sphere
 - (d) 6 m from 4 kg sphere
7. Assuming the expression for the pressure exerted by the gas, it can be shown that pressure is
 - (a) $\left(\frac{3}{2}\right)$ rd times kinetic energy per unit volume of gas
 - (b) $\left(\frac{1}{3}\right)$ rd of kinetic energy per unit volume of a gas
 - (c) $\left(\frac{3}{4}\right)$ th of kinetic energy per unit volume of a gas
 - (d) $\left(\frac{2}{3}\right)$ rd of kinetic energy per unit volume of a gas
8. Out of the following which statement is NOT true about black body radiation?

- (a) A black body emits all wavelengths.
 (b) Intensity is less for longer wavelengths.
 (c) Intensity is same for all wavelengths.
 (d) Intensity is more for shorter wavelengths.

9. An ideal gas ($\gamma = 1.5$) is expanded adiabatically. How many times has the gas to be expanded to reduce root mean square velocity of molecules two times?

- (a) 8 times (b) 20 times
 (c) 16 times (d) 12 times

10. An ideal gas having pressure p , volume V and temperature T undergoes a thermodynamic process in which $dW = 0$ and $dQ < 0$. Then, for the gas

- (a) p may increase or decrease (b) T will decrease
 (c) V will increase (d) T will increase

11. A particle executing SHM has velocities v_1 and v_2 at distances x_1 and x_2 respectively, from the mean position. Its time-period is

- (a) $2\pi \sqrt{\frac{x_2^2 - x_1^2}{v_2^2 - v_1^2}}$ (b) $2\pi \sqrt{\frac{x_1^2 - x_2^2}{v_2^2 - v_1^2}}$
 (c) $2\pi \sqrt{\frac{x_1 x_2}{v_2^2 - v_1^2}}$ (d) $2\pi \sqrt{\frac{x_1 + x_2}{v_1 v_2}}$

12. A spring of force constant 400 N/m is loaded with a mass 0.25 kg. The amplitude of oscillations is 4 cm. When mass comes to equilibrium position. Its velocity is

- (a) 16 m/s (b) 1.6 m/s
 (c) 0.16 m/s (d) 0.016 m/s

13. A progressive wave of frequency 500 Hz is travelling with a velocity of 360 m/s. How far apart are two points 60° out of phase?

- (a) 0.05 m (b) 0.10 m
 (c) 0.12 m (d) 0.72 m

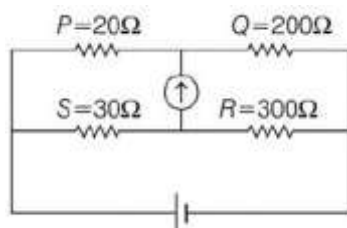
14. A body sends waves 100 mm long through medium P and 0.25 m long in medium Q. If the velocity of wave in medium P is 80 cm s^{-1} . The velocity of wave in medium Q is

- (a) 1 ms^{-1} (b) 2 ms^{-1}
 (c) 5 ms^{-1} (d) 7 ms^{-1}

15. Separation between the plates of parallel plate capacitor is d and the area of each plate is A . When a slab of material of dielectric constant k and thickness t ($t < d$) is introduced between the plates, its capacitance becomes (ϵ_0 = permittivity of free space)

- (a) $\frac{A\epsilon_0}{2d-t\left[1-\frac{1}{k}\right]}$ (b) $\frac{A\epsilon_0}{d+t\left[1+\frac{1}{k}\right]}$
 (c) $\frac{A\epsilon_0}{d-t\left[1-\frac{1}{k}\right]}$ (d) $\frac{A\epsilon_0}{d-t\left[1+\frac{1}{k}\right]}$

16. Figure below shows a balanced Wheatstone's network. If it is disturbed by changing P to 22Ω , then which of the following steps will bring the bridge again in balanced state?



- (a) By increasing S by 3Ω (b) By increasing Q by 20Ω
 (c) By increasing R by 30Ω (d) Both (a) and (b)
17. Two circular coils A and B are made from the same wire but the radius of coil A is twice that of coil B. If the magnetic fields at their centres are the same, then the ratio of potential differences applied across A to that of B is
- (a) 1:4 (b) 4:1
 (c) 2:1 (d) 1:2
18. A bar magnet of magnetic moment M_1 is cut into two pieces along its axis. The pieces are kept perpendicular to each other with their unlike poles in contact. The magnetic moment of the arrangement is M_2 . The ratio of M_1/M_2 is
- (a) $1/2\sqrt{2}$ (b) 1
 (c) $\sqrt{2}$ (d) $1/\sqrt{2}$
19. Frequency of the series limit of Balmer series of hydrogen atom of Rydberg's constant R and velocity of light c is
- (a) $4 Rc$ (b) $\frac{4}{Rc}$
 (c) Rc (d) $\frac{Rc}{4}$
20. A spherical solid ball of volume V is made up of a material of density ρ_1 . It is falling through a liquid of density ρ_2 ($\rho_2 < \rho_1$). Assume that, the liquid applies a viscous force on the ball that is proportional to the square of the speed v_t , i.e., $F_{\text{viscous}} = K v_t^2$, then the terminal speed of ball is (g = acceleration due to gravity)

- (a) $\sqrt{\frac{K(\rho_1 - \rho_2)}{Vg}}$ (b) $\sqrt{\frac{Vg(\rho_1 - \rho_2)}{K}}$
 (c) $\sqrt{\frac{Vg(\rho_1 - \rho_2)}{K}}$ (d) $\sqrt{\frac{Vg(\rho_1 - \rho_2)}{2K}}$

21. A charge of magnitude $3e$ and mass $2m$ is moving in an electric field E. The acceleration imparted to the charge is

- (a) $\frac{3Ee}{2m}$ (b) $\frac{3m}{2Ee}$
 (c) $\frac{2Ee}{3m}$ (d) $\frac{2m}{3Ee}$

22. In a two -input logic gate, when one input is 1 and the other is 0 the output is 1. But even if both inputs are 0, the outputs is 1. The logic gate is

- (a) a X-OR gate (b) an AND gate
(c) a NOR gate (d) a NAND gate

23. The angular separation of the central maximum in the Fraunhofer diffraction pattern is measured the slit is illuminated by the light of wavelength 6000Å. If the slit is illuminated by light of another wavelength, the angular separation decreases by 30%. The wavelength of light used is

- (a) 6000Å (b) 3500Å
(c) 4200Å (d) 4700Å

24. A series L – C – R circuit is connected to a source of alternating emf of 50 V and the potential difference across inductor and capacitor is 90 V and 60 V, respectively. The potential difference across the resistor is

- (a) 70 V (b) 60 V
(c) 40 V (d) 80 V

25. A particle of mass 5 kg moves in a circle of radius 20 cm. Its linear speed at a time t is given by $v = 4t$, t is in second and v is in ms^{-1} . Find the net force acting on the particle at $t = 0.5$ s.

- (a) 20 N (b) $20\sqrt{23}$ N
(c) $20\sqrt{26}$ N (d) 10 N

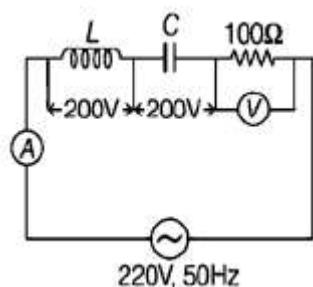
26. A 1 kg stone attached to the end of a 60 cm chain is revolving at the rate of 3rev/s. If after 30 s, it is making only 1rev/s. Find the mean torque acting on it.

- (a) 0.15 N – m (b) 0.32 N – m
(c) 0.25 N – m (d) 0.20 N – m

27. A toroid is a long coil of wire wound over a circular core. Major radius and cross-sectional radius of toroid is R and r, respectively. The coefficient of mutual induction of the toroid is (The magnetic field in it is uniform, N = number of turns, $R \gg r$, μ_0 = permeability of free space)

- (a) $\frac{\mu_0 NR}{2r}$ (b) $\frac{\mu_0 N^2 R^2}{2r}$
(c) $\frac{\mu_0 Nr}{2R}$ (d) $\frac{\mu_0 N^2 r^2}{2R}$

28. The readings of ammeter and voltmeter in the given circuit are respectively



- (a) 2.2 A, 220 V (b) 2 A, 200 V
(c) 2.5 A, 200 V (d) 2 A, 220 V

29. Let E_e and E_p represent kinetic energy of electron and photon, respectively. If de-Broglie wavelength λ_p of a photon is twice the deBroglie wavelength λ_e of an electron, then $\frac{E_p}{E_e}$ is (speed of electron $= \frac{c}{100}$, c = velocity of light)

- (a) 10^{-1} (b) 10^2
(c) 10^{-2} (d) 10^4

30. A nucleus of rest splits into two nuclear parts having radii in the ratio 1: 2. Their velocities are in the ratio

- (a) 1: 8 (b) 1: 4
(c) 4: 1 (d) 8: 1

31. For a common-emitter amplifier, the voltage gain is 40. Its input and output impedances are 100Ω and 400Ω , respectively. The power gain of the CE amplifier will be

- (a) 450 (b) 400
(c) 300 (d) 500

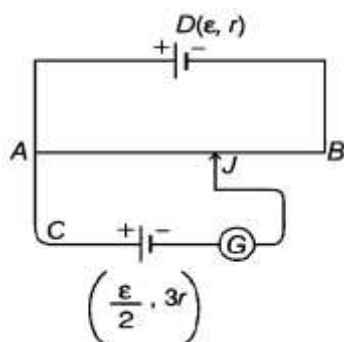
32. Two particles A and B having same mass have charge $+q$ and $+4q$, respectively. When they are allowed to fall from rest through same electric potential difference the ratio of their speeds v_A to v_B will become

- (a) 2: 1 (b) 1: 4
(c) 4: 1 (d) 1: 2

33. The potential at a point x (measured in μm) due to some charges situated on the X-axis is given by $v(x) = \frac{20}{(x^2-4)} \text{ V}$ The electric field E at $x = 4\mu\text{m}$ is given by

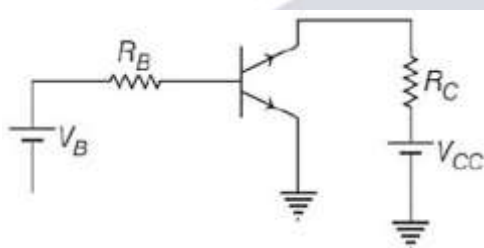
- (a) $\frac{5}{2} \text{ V}/\mu\text{m}$ and in the - ve x -direction
(b) $\frac{5}{2} \text{ V}/\mu\text{m}$ and in the + ve x -direction
(c) $\frac{10}{9} \text{ V}/\mu\text{m}$ and in the - ve x -direction
(d) $\frac{10}{9} \text{ V}/\mu\text{m}$ and in the + ve x -direction

34. A potentiometer wire AB having length L and resistance $12r$ is joined to a cell D of emf ϵ and internal resistance r . A cell C having emf $\frac{\epsilon}{2}$ and internal resistance $3r$ is connected the length AJ at which galvanometer as shown in figure shows no deflection is



- (a) $\frac{5}{12} L$ (b) $\frac{11}{12} L$
(c) $\frac{13}{24} L$ (d) $\frac{11}{24} L$

35. A common emitter amplifier circuit built using an $n - p - n$ transistor is shown in figure. Its DC current gain is 300, $R_C = 4k\Omega$ and $V_{CC} = 20V$. What is the minimum base current for V_{CE} to reach saturation?



- (a) $40\mu A$ (b) $26.66\mu A$
(c) $16.66\mu A$ (d) $10\mu A$

36. A satellite is revolving round a planet in a circular orbit close to its surface and ρ is mean density and R is the radius of planet, then the period of (G = universal constant of gravitation)

- (a) $\sqrt{\frac{3\pi}{\rho G}}$ (b) $\sqrt{\frac{\pi}{\rho G}}$
(c) $\sqrt{\frac{2\pi}{\rho G}}$ (d) $\sqrt{\frac{4\pi}{\rho G}}$

37. Halley's Comet revolves around the sun with time period of 76 years. The aphelion distance if perihelion is given by $8.9 \times 10^{10} m$, will be (Take, mass of sun = $2 \times 10^{30} kg$ and $G = 6.67 \times 10^{-11} N m^2/kg^2$)

- (a) $4.7 \times 10^{11} m$ (b) $3.23 \times 10^{12} m$
(c) $5.3 \times 10^{12} m$ (d) $7.63 \times 10^{11} m$

38. 540 g of ice at $0^\circ C$ is mixed with 540 g of water at $80^\circ C$. The final temperature of the mixture will be

- (a) 53.3°C (b) 56.6°C
(c) 60.6°C (d) 62.3°C

39. The temperature of a liquid drops from 365 K to 361 K in 2 min. Find the time during which temperature of the liquid drops from 344 K to 342 K. (Take, room temperature = 293 K)

- (a) 72 s (b) 66 s
(c) 60 s (d) 84 s

40. The speed of sound in a mixture of 1 mole of He and 2 mole of oxygen at 27°C is

- (a) 400 m/s (b) 401 m/s
(c) 402 m/s (d) 403 m/s

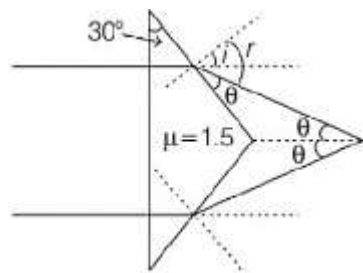
41. The lower half of a concave mirror is covered with opaque material. Then,

- (a) the magnification will be halved
(b) the intensity of the image will be reduced
(c) the distance of the image will increase
(d) All of the above

42. An LED is placed at a depth h below the water surface. An opaque disc is floating on the surface of water such that the bulb is not visible from the surface. The minimum radius of the disc will be

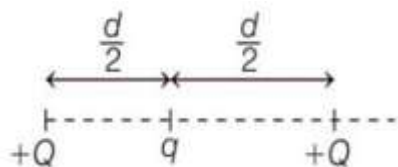
- (a) $\frac{2h}{\mu}$ (b) $\frac{h}{\sqrt{\mu-1}}$
(c) $\frac{h}{2\mu-1}$ (d) $\frac{\mu}{2h}$

43. For the prism given below. Two light rays are incident normally on the surface of the prism. The angle between emergent rays will be



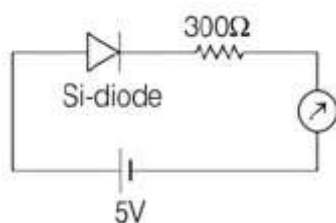
- (a) 27° (b) 32°
(c) 37° (d) 42°

44. Three charges are arranged as the configuration given below. If net force experienced by $+Q$ placed at $x = 0$ is zero, then the value of q is



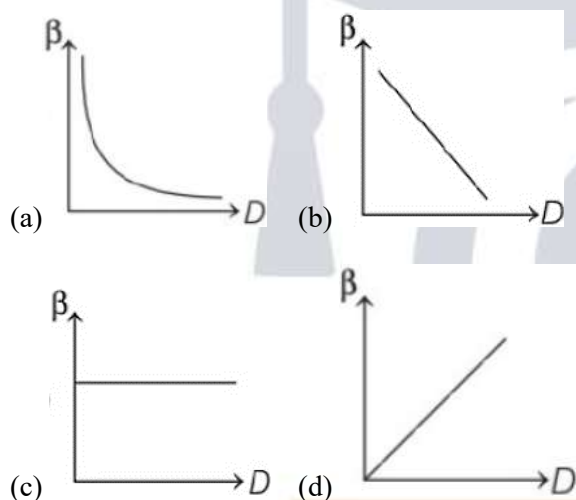
- (a) $\frac{-Q}{4}$ (b) $\frac{Q}{2}$
(c) $\frac{-Q}{2}$ (d) $\frac{Q}{4}$

45. What will be the reading in the ammeter for the circuit given below?



- (a) 12.3 Ma (b) 12.3 mA
(c) 11.3 mA (d) 14.3 mA

46. In Young's double slit experiment, which of the following graph represents correct variation of fringe width β versus distance D between sources and screen?



47. An electron in hydrogen atom have energy of -3.4 eV. The difference of its kinetic and potential energy is

- (a) 10.2 eV (b) -10.2 eV
(c) -13.6 eV (d) Both (a) and (b)

48. In most liquids, with rise in temperature, surface tension of a liquid

- (a) remains unchanged
(b) decreases
(c) increases
(d) first decreases and then increases

49. Three identical thin rods each of length l and mass M are joined together to form a letter H. What is the moment of inertia of the system about one of the sides of H?

- (a) $\frac{MI^2}{4}$ (b) $\frac{2MI^2}{3}$
(c) $\frac{4MI^2}{3}$ (d) $\frac{MI^2}{3}$

50. One thousand small water drops of equal radii combine to form a big drop. The ratio of final surface energy to the total initial surface energy is

- (a) 1000:1 (b) 1:10
(c) 10:1 (d) 1:1000

Chemistry

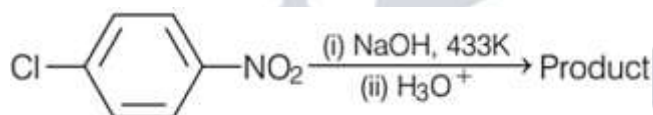
51. Identify the last element in lanthanoid series.

- (a) Nd (b) Tm
(c) Lu (d) Tb

52. 0.05F electricity is passed through CuSO_4 solution. Calculate the mass of Cu produced at cathode? (molar mass of Cu = 63.5 g mol^{-1})

- (a) 3.17 g (b) 2.54 g
(c) 0.795 g (d) 1.59 g

53. Identify the product obtained in the following reaction.



- (a) o-nitrophenol (b) m-nitrophenol
(c) p-nitrophenol (d) None of these

54. Formation of gluconic acid from glucose by oxidation using Br_2 water

- (a) glucose contains five hydroxyl groups.
(b) the presence of aldehyde group in glucose.
(c) glucose contains one primary alcoholic group.
(d) the six carbon atoms of glucose are in a straight chain

55. What is the density of potassium, if it has bcc structure with edge length $4\text{\AA}$? (Atomic mass of K = 39)

- (a) 3 g cm^{-3} (b) 2 g cm^{-3}
(c) 5 g cm^{-3} (d) 4 g cm^{-3}

56. Which formula from following is used to determine molar mass of solute from depression in freezing point?

$$(a) M_2 = \frac{1000 \times K_f \times W_1}{\Delta T_f \times W_2} \quad (b) M_2 = \frac{1000 \times K_f \times W_2}{\Delta T_f \times W_1}$$

$$(c) M_2 = \frac{1000 \times \Delta T_f \times W_2}{K_f \times W_1} \quad (d) M_2 = \frac{1000 \times \Delta T_f \times W_1}{K_f \times W_2}$$

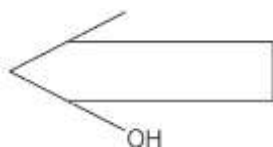
57. A gas is heated from 273 K to 373 K at 1atm pressure. If the initial volume of the gas is 10L its final volume would be

- (a) 20 d m³ (b) 13.66 d m³
(c) 10dm³ (d) 7.32 d m³

58. The ratio between the root mean square velocity of H₂ at 50 K and that of O₂ at 800 K is

- (a) 4 (b) 2
(c) 1 (d) 0.25

59. What is the IUPAC name of following compound?



- (a) 1-methylcyclopentan-3-ol
(b) 3 -hydroxy-1-methyl cyclopentane
(c) 3-methyl cyclopentanol
(d) 3-methylpentan-1-ol

60. An organic compound on analysis gave C = 42.8%, H = 7.2% and N = 50%. Volume of 1 g of the compound was found to be 50 mL at STP. Molecular formula of the compound is

- (a) C₂H₄ N₂ (b) C₁₂H₂₄ N₁₂
(c) C₁₆H₃₂ N₁₆ (d) C₄H₈ N₄

61. How much BaCl₂ · 2H₂O and pure water are to be mixed to prepare 50g of 12.0% (by mass) BaCl₂ solution?

- (a) 40.4 g (b) 42.9 g
(c) 52.7 g (d) 50.0 g

62. What is enthalpy of formation of NH₃, if bond enthalpies as

(N ≡ N) = -941 kJ/mol, (H - H) = 436 kJ/mol and

(N - H) = 389 kJ/mol?

- (a) -84.5 kJ/mol (b) -63.45 kJ/mol
(c) -21.25 kJ/mol (d) -42.5 kJ/mol

63. The enthalpy change that accompanies a reaction in which 1 mole of its standard state is formed from its elements in their standard states

- (a) bond enthalpy of reaction
- (b) standard enthalpy of formation
- (c) standard enthalpy of reaction.
- (d) standard enthalpy of combustion

64. What is the SI unit of conductivity?

- (a) Ω^{-1}
- (b) $\Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$
- (c) $\text{Sm}^2 \text{ mol}^{-1}$
- (d) Sm^{-1}

65. What is rate constant of a first order reaction, if 0.08 mole of reactant reduces to 0.02 mole in 23.03 minute?

- (a) 1.6021 min^{-1}
- (b) 0.2303 min^{-1}
- (c) 0.4031 min^{-1}
- (d) 0.06020 min^{-1}

66. Which of the following statement is not true for a reaction having rate law $r = k[\text{H}_2][\text{I}_2]$?

- (a) Overall order of reaction is 2.
- (b) The reaction is first order in H_2 .
- (c) The reaction is first order in I_2
- (d) Overall order of reaction is 1

67. At room temperature, polonium crystallises in a primitive cubic unit cell. If $a = 3.36 \text{ \AA}$. Calculate the theoretical density of polonium. [Its atomic weight is 209 g/mol.]

- (a) 9.15 g/cm^3
- (b) 10.33 g/cm^3
- (c) 6.22 g/cm^3
- (d) 9.74 g/cm^3

68. The vapour pressure of 100 g of water reduces from 17.53 mm to 17.22 mm when 17.10 g of substance X is dissolved in it. Substance X can be

- (a) methanol
- (b) glucose
- (c) carbon dioxide
- (d) cannot predict

69. The process by which sites of adsorbent are made free so, that more adsorbent can occupy them is called

- (a) sorption
- (b) desorption
- (c) unbalanced distribution
- (d) dissociation

70. Starch is an example of which of the following type of colloid?

- (a) Macromolecular colloid
- (b) Associated colloid
- (c) Molecular colloid
- (d) Electrolytic solution

71. Hybridisation of $[\text{Ni}(\text{CN})_4]^{2-}$ is

- (a) dsp^2
- (b) $\text{sp}^3 \text{ d}^2$
- (c) $\text{d}^2 \text{sp}^3$
- (d) sp^3

72. The IUPAC name of the coordination compound $[\text{Co}(\text{H}_2\text{O})_2(\text{NH}_3)_4]\text{Cl}_3$ is

- (a) tetraamminediaquacobalt (III) chloride
 (b) cobalt (III) tetraamminediaquachloride
 (c) diaquatetraammine cobalt (III) chloride
 (d) tetraammine diaquacobalt (II) chloride

73. The 3d -block elements that exhibits maximum number of oxidation states is

- (a) Sc (b) Ti
 (c) Mn (d) Zn

74. Which one of the following does not have sp^3 hybridisation?

- (a) CH_4 (b) XeF_4
 (c) H_2O (d) NH_3

75. Identify the molecule having dipole moment.

- (a) BF_3 (b) CH_4
 (c) $CHCl_3$ (d) CCl_4

76. The major product obtained in the following reaction is Chlorobenzene + Chlorine

Anhydrous



product (Major)

- (a) 1,2 -dichlorobenzene (b) 1, 3, 5-trichlorobenzene
 (c) 1, 4-dichlorobenzene (d) 1, 3-dichlorobenzene

77. Which among the following compounds is not a colourless gas?

- (a) ClF_3 (b) ClF
 (c) IF_7 (d) IF_3

78. ${}_6^{14}C$ and ${}_8^{16}O$ are the examples of

- (a) isotopes (b) isobars
 (c) isoelectronic species (d) isotones

79. Which of the following series of transition of hydrogen spectrum falls in visible region?

- (a) Lyman series (b) Balmer series
 (c) Paschen series (d) Brackett series

80. Among the following order, which one is correct order of reactivity of group 16 elements?

- (a) $O > S > Se > Te > Po$ (b) $O > Se > Te > S > Po$
 (c) $Po > Te > Se > S > O$ (d) $S > O > Se > Te > Po$

81. Identify the product formed in following reaction $\text{C}_6\text{H}_5\text{CH}_2 - \text{CH}_3 \xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) AlkKMO}_4}$

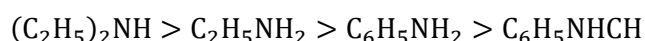
- (a) $\text{C}_6\text{H}_5\text{OH}$ (b) $\text{C}_6\text{H}_5\text{COOH}$
(c) $\text{C}_6\text{H}_5\text{CH}_2\text{COOH}$ (d) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{COOH}$

82. Identify electron withdrawing group from following when attached with π -bond

- (a) $-\text{COOH}$ (b) $-\text{OR}$
(c) $-\text{Cl}$ (d) $-\text{OH}$

83. Which of the following is incorrectly matched?

(a) Decreasing order of pK_b values:



(b) Decreasing order of basic strength:



(c) Increasing order of basic strength: p-nitroaniline < aniline < p-toluidine

(d) Increasing order of solubility in water: $\text{C}_6\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_2\text{NH} < \text{C}_2\text{H}_5\text{NH}_2$

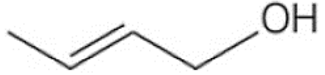
84. Consider the following reactions.



Identify the compound formed C in the above reaction.

- (a) Nitrobenzene (b) Aniline
(c) Chloro benzene (d) Phenol

85. The bond line structure of crotonyl alcohol is

- (a) 
(b) 
(c) 
(d) 

86. Which among the following compounds has highest melting point?

- (a) Phenol (b) p-cresol
(c) p-nitrophenol (d) O-nitrophenol

87. Which of the following alkenes on oxidation by KMnO_4 in dil. H_2SO_4 forms adipic acid?

- (a) Hex-2-ene (b) Hex-1-ene

- (c) Cyclohexene (d) Hex-3-ene

88. Which of the following species is amphoteric in nature?

- (a) HCl (b) H₂O
(c) CH₃COOH (d) NaOH

89. Identify the reaction in which carbonyl group of aldehydes and ketones is reduced to methylene group on treatment with zinc-amalgam and conc. HCl.

- (a) Wolf-Kishner reduction (b) Clemmensen reduction
(c) Stephen reduction (d) Etard reaction

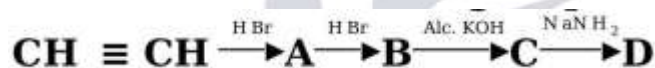
90. Which of the following is an example of green chemistry?

- (a) Recycled carpet
(b) A product made on Earth's day
(c) A sublimation reaction
(d) Bio-plastics or bio-diesel

91. Which of the following alkyl halide is treated with sodium metal to obtain 2, 2, 3, 3-tetramethyl butane?

- (a) sec-butyl bromide (b) n-propyl bromide
(c) n-butyl bromide (d) tert-butyl bromide

92. Consider the following sequence of reactions



- (a) Ethanol (b) Ethane
(c) Ethyne (d) Ethanal

93. Identify the polymer used in making floor tiles.

- (a) PVC (b) LDPE
(c) HDPE (d) PETE

94. Which of the following is a thermosetting polymer?

- (a) Polythene (b) Bakelite
(c) Polystyrene (d) Poly vinyls

95. A sample of air turns lime water milky and also turns acidified potassium dichromate green in aqueous solution has low pH. This is due to the presence of pollutants.

- (a) CO₂ (b) SO₂
(c) Both (a) and (b) (d) None of these

96. Solubility product of AgBr is 4.9×10^{-13} . What is its solubility?

- (a) $2.4 \times 10^{-7} \text{ mol d m}^{-3}$ (b) $7.0 \times 10^{-7} \text{ mol d m}^{-3}$
(c) $4.9 \times 10^{-7} \text{ mol d m}^{-3}$ (d) $3.2 \times 10^{-7} \text{ mol d m}^{-3}$

97. Consider the following reaction



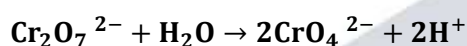
Here, 'A' and 'B' are respectively

- (a) glucose oxime and saccharic acid
- (b) gluconic acid and saccharic acid
- (c) saccharic acid and sorbitol
- (d) gluconic acid and sorbitol

98. Which of the following has maximum solubility?

- (a) BeF_2 (b) MgF_2
- (c) CaF_2 (d) SrF_2

99. Which of the following explanation is correct about the given below reaction?



- (a) Cr is reduced
- (b) Cr is oxidised
- (c) Oxidation number of Cr has neither decreased nor increased
- (d) Hydrogen is reduced

100. Aldehydes are readily oxidised to yield carboxylic acids but ketones are inert to oxidation. Which is the most likely explanation regarding this difference in reactivity?

- (a) Aldehydes have a proton attached to the carbonyl that is abstracted during oxidation. Ketones lack this proton and so, cannot oxidised.
- (b) Reducing agents like HNO_3 are sterically hindered by ketone's carbonyl carbon.
- (c) Aldehydes and ketones are of similar hybridisation.
- (d) The rate of the forward oxidation reaction is equal to the rate of the reverse reduction reaction in ketones.

Mathematics

101. With usual notations, in any $\triangle ABC$, if $a \cos B = b \cos A$, then the triangle is

- (a) an isosceles triangle (b) an equilateral triangle
- (c) a right angled triangle (d) a scalene triangle

102. If θ lies in the first quadrant and $5 \tan \theta = 4$, then $\frac{5 \sin \theta - 3 \cos \theta}{\sin \theta + 2 \cos \theta}$ is equal to

- (a) $\frac{5}{14}$ (b) $\frac{3}{14}$
- (c) $\frac{1}{14}$ (d) 0

103. If $\cos^{-1} x > \sin^{-1} x$, then

- (a) $\frac{1}{\sqrt{2}} < x \leq 1$ (b) $0 \leq x \leq \frac{1}{\sqrt{2}}$
 (c) $-1 \leq x < \frac{1}{\sqrt{2}}$ (d) $x > 0$

104. The value of $\tan 3A - \tan 2A - \tan A$ is

- (a) $\tan 3A \tan 2A \tan A$
 (b) $-\tan 3A \tan 2A \tan A$
 (c) $\tan A \tan 2A - \tan 2A \tan 3A$
 (d) $\tan 3A \tan A - \tan 2A \tan 3A$

105. The three straight lines $ax + by = c$, $bx + cy = a$ and $cx + ay = b$ are collinear, if

- (a) $b + c = a$ (b) $c + a = b$
 (c) $a + b + c = 0$ (d) $a + b = c$

106. A line through the point $A(2, 0)$ which makes an angle of 30° with the positive direction of X-axis is rotated about A in clockwise direction through an angle of 15° . Then, the equation of the straight line in the new position is

- (a) $(2 - \sqrt{3})x + y - 4 + 2\sqrt{3} = 0$
 (b) $(2 - \sqrt{3})x - y - 4 + 2\sqrt{3} = 0$
 (c) $(2 - \sqrt{3})x - y + 4 + 2\sqrt{3} = 0$
 (d) $(2 - \sqrt{3})x + y + 4 + 2\sqrt{3} = 0$

107. Find the value of $\cos\left(\frac{x}{2}\right)$, if $\tan x = \frac{5}{12}$ and x lies in third quadrant.

- (a) $\frac{5}{\sqrt{13}}$ (b) $\frac{5}{\sqrt{26}}$
 (c) $\frac{5}{13}$ (d) $\sqrt{\frac{1}{26}}$

108. The locus of a point which moves, so that the ratio of the length of the tangents to the circles $x^2 + y^2 + 4x + 3 = 0$ and $x^2 + y^2 - 6x + 5 = 0$ is 2:3, is

- (a) $5x^2 + 5y^2 - 60x + 7 = 0$
 (b) $5x^2 + 5y^2 + 60x - 7 = 0$
 (c) $5x^2 + 5y^2 - 60x - 7 = 0$
 (d) $5x^2 + 5y^2 + 60x + 7 = 0$

109. The circles $x^2 + y^2 + 6x + 6y = 0$ and $x^2 + y^2 - 12x - 12y = 0$

- (a) cut orthogonally (b) touch each other internally
 (c) intersect two points (d) touch each other externally

110. The mean and variance of n observations $x_1, x_2, x_3, \dots, x_n$ are 5 and 0, respectively. If $\sum_{i=1}^n x_i^2 = 400$, then the value of n is equal to

- (a) 80 (b) 25
(c) 20 (d) 16

111. The variance of first n natural numbers is

- (a) $\frac{n(n+1)}{2}$ (b) $\frac{(n+1)(n+5)}{12}$
(c) $\frac{(n+1)(n-5)}{12}$ (d) $\frac{(n^2-1)}{12}$

112. Out of 50 tickets numbered 00, 01, 02, ..., 49, one ticket is drawn randomly, the probability of the ticket having the product of its digits 7, given that the sum of the digits is 8, is

- (a) $\frac{1}{14}$ (b) $\frac{3}{14}$
(c) $\frac{1}{5}$ (d) None of these

113. The probability of India winning a test match against South Africa is $\frac{1}{2}$ assuming independence from match to match played the probability that in a match series India's second win occurs at the third day is

- (a) $\frac{1}{8}$ (b) $\frac{1}{2}$
(c) $\frac{1}{4}$ (d) $\frac{2}{3}$

114. Consider the following statements

r : If a number is a multiple of 9, then it is multiple of 3.

Let p and q denote the statements

p: A number is a multiple of 9.

q: A number is a multiple of 3.

Then, if p then q is the same as

- (a) p only if q (b) q is a necessary condition for p
(c) $\sim q$ implies $\sim p$ (d) All of the above

115. The negation of the statement 7 is greater than 4 or 6 is less than 7.

- (a) 7 is not greater than 4 and 6 is not less than 7
(b) 7 is not greater than 4 or 6 is not less than 7
(c) 7 is greater than 4 and 6 is less than 7
(d) None of the above

116. For an invertible matrix A , if $A(\text{adj } A) = \begin{vmatrix} 20 & 0 \\ 0 & 20 \end{vmatrix}$, then $|A| =$

- (a) 20 (b) -200

(c) 200 (d) -20

117. If matrix $A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$, then $A^2 - 4A + 5I$ is where I is a unit matrix.

- (a) Null matrix (b) Skew symmetric matrix
(c) symmetric Matrix (d) None of the above

118. If $f(x) = \begin{cases} \frac{3\sin \pi x}{5x} & x \neq 0 \\ 2k & x = 0. \end{cases}$ is continuous at $x = 0$, then the value of k is

- (a) $\frac{\pi}{10}$ (b) $\frac{3\pi}{10}$
(c) $\frac{3\pi}{2}$ (d) $\frac{3\pi}{5}$

119. If $f(x) = \begin{cases} \frac{\sin^3(\sqrt{3}) \cdot \log(1+3x)}{(\tan^{-1} \sqrt{x})^2 (e^{5\sqrt{3}} - 1)^x} & x \neq 0 \\ a & x = 0. \end{cases}$ is continuous in $[0,1]$ then a equals

- (a) 0 (b) $\frac{3}{5}$
(c) 2 (d) $\frac{5}{3}$

120. The differential equation of all parabolas having vertex at the origin and axis along positive Y-axis is

- (a) $x^2 \frac{dy}{dx} - y = 0$ (b) $x \frac{dy}{dx} + 2y = 0$
(c) $x \frac{dy}{dx} = 2y$ (d) $x^3 \frac{dy}{dx} = 3y$

121. The order and degree of the differential equation $\sqrt{\frac{dy}{dx}} - 4 \frac{dy}{dx} - 7x = 0$ are

- (a) 1 and $\frac{1}{2}$ (b) 2 and 1
(c) 1 and 1 (d) 1 and 2

122. The solution of the differential equation

$e^{-x}(y+1)dy + (\cos^2 x - \sin 2x)ydx = 0$ subjected to the condition that $y = 1$, when $x = 0$ is

- (a) $y + \log y + e^x \cos^2 x = 2$
(b) $\log(y+1) + e^x \cos^2 x = 1$
(c) $y + \log y = e^x \cos^2 x$
(d) $(y+1) + e^x \cos^2 x = 2$

123. $\int_{-1}^1 \frac{17x^5 - x^4 + 29x^3 - 31x + 1}{x^2 + 1} dx$ is equal to

- (a) $\frac{4}{5}$ (b) $\frac{5}{4}$

(c) $\frac{4}{3}$ (d) $\frac{3}{4}$

124. The number of ways of arranging letters of the 'HAVANA', so that V and N do not appear together, is

- (a) 60 (b) 80
(c) 100 (d) 120

125. Out of 7 consonants and 4 vowels, the number of words (not necessarily meaningful) that can be made, each consisting of 3 consonants and 2 vowels, is

- (a) 24800 (b) 25100
(c) 25200 (d) 25400

126. If $f(x) = \sin^2 x + \sin^2 \left(x + \frac{\pi}{3}\right) + \cos x \cos \left(x + \frac{\pi}{3}\right)$ and $g\left(\frac{5}{4}\right) = 1$, then $gof(x)$ is equal to

- (a) 1 (b) -1
(c) 2 (d) -2

127. Range of the function $f(x) = \frac{x}{1+x^2}$ is

- (a) $(-\infty, \infty)$ (b) $[-1, 1]$
(c) $\left[-\frac{1}{2}, \frac{1}{2}\right]$ (d) $[-\sqrt{2}, \sqrt{2}]$

128. The domain of $f(x) = \sin^{-1} \left[\log_2 \left(\frac{x}{2} \right) \right]$ is

- (a) $0 \leq x \leq 1$ (b) $0 \leq x \leq 4$
(c) $1 \leq x \leq 4$ (d) $4 \leq x \leq 6$

129. If $f(x) = \frac{k}{2^x}$ is a probability distribution of a random variable X that can take on the values $x = 0, 1, 2, 3, 4$. Then, k is equal to

- (a) $\frac{16}{15}$ (b) $\frac{15}{16}$
(c) $\frac{31}{16}$ (d) None of these

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

- (a) 0 (b) $\frac{1}{2}$
(c) 1 (d) $\frac{3}{2}$

131. Evaluate $\lim_{x \rightarrow \sqrt{2}} \frac{x^4 - 4}{x^2 + 3\sqrt{2}x - 8}$.

- (a) $\frac{8}{5}$ (b) $\frac{8}{3}$
(c) $\frac{5}{8}$ (d) $\frac{3}{8}$

132. What will be projection of the vector $4\hat{i} - 3\hat{j} + \hat{k}$ on the line joining the points $(2, 3, -1)$ and $(-2, -4, 3)$?

- (a) 1 (b) 2
(c) 3 (d) 4

133. If $\mathbf{a} = 3\hat{i} - 2\hat{j} + \hat{k}$ and $\mathbf{b} = 2\hat{i} - 4\hat{j} - 3\hat{k}$, then $|\mathbf{a} - 2\mathbf{b}|$ will be

- (a) 9 (b) $\sqrt{86}$
(c) $\sqrt{94}$ (d) 10

134. What will be the equation of plane passing through a point $(1, 4, -2)$ and parallel to the given plane $-2x + y - 3z = 9$?

- (a) $2x - y + 3z + 8 = 0$ (b) $2x = y + 3z + 8 = 0$
(c) $2x - 2y + 2z + 10 = 0$ (d) $2x + 2y - 3z + 8 = 0$

135. If the line joining two points $A(2, 0)$ and $B(3, 1)$ is rotated about A in anticlockwise direction through an angle of 15° , then the equation of the line in new position is

- (a) $y = -\sqrt{3}x + 2\sqrt{3}$ (b) $y = 3x - 6$
(c) $y = \frac{1}{\sqrt{3}}x - \frac{2}{\sqrt{3}}$ (d) $y = \sqrt{3}x - 2\sqrt{3}$

136. $\int \frac{(\log x)^2}{x} dx$

- (a) $\left(\frac{\log x}{x}\right)^3 + C$ (b) $\left(\frac{\log x}{3}\right)^3 + C$
(c) $\frac{(\log x)^3}{2} + C$ (d) $\frac{(\log x)^3}{3} + C$

137. $\int \frac{\tan^4 \sqrt{x} \sec^2 \sqrt{x}}{\sqrt{x}} dx =$

- (a) $\frac{-5}{2} [\tan \sqrt{x}]^5 + C$ (b) $[\tan \sqrt{x}]^5 + C$
(c) $\frac{2}{5} [\tan \sqrt{x}]^5 + C$ (d) $\frac{5}{2} [\tan \sqrt{x}]^5 + C$

138. The slant height of a right circular cone is 3 cm. The height of the cone for maximum volume is

- (a) 5 cm (b) $\sqrt{3}$ cm
(c) 3 cm (d) $\sqrt{5}$ cm

139. If $y = p[x(x - 2)]^2$ is an increasing function then the value of x is

- (a) 1, 2, 3 (b) 0, 1, 2
(c) 2, 3 (d) None of these

140. If $y = \tan^{-1} \sqrt{\frac{1+\cos x}{1-\cos x}}$, then $\frac{dy}{dx} =$

- (a) $\frac{3}{2}$ (b) 0

(c) 1 (d) $-\frac{1}{2}$

141. If $\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ w.r.t. $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ is

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$

(c) $\frac{3}{2}$ (d) $\frac{3}{4}$

142. The region represented by the inequation system $x, y \geq 0, y \leq 6, x + y \leq 3$ is

(a) unbounded in first quadrant

(b) unbounded in first and second quadrants

(c) bounded in first quadrant

(d) None of the above

143. The constraints $-x_1 + x_2 \leq 1, -x_1 + 3x_2 \leq 9$ and $x_1, x_2 \geq 0$ defines on

(a) bounded feasible space

(b) unbounded feasible space

(c) both bounded and unbounded feasible space

(d) None of the above

144. If $z = \frac{(\sqrt{3}+i)^3(3i+4)^2}{(8+6i)^2}$, then $|z|$ is equal to

(a) 8 (b) 2

(c) 5 (d) 4

145. If $\frac{3}{2+\cos\theta+i\sin\theta} = a + ib$, then $[(a-2)^2 + b^2]$ is equal to

(a) 0 (b) 1

(c) -1 (d) 2

146. A box contains 100 bulbs, out of which 10 are defective. A sample of 5 bulbs is drawn. The probability that none is defective, is

(a) $\frac{9}{10}$ (b) $\left(\frac{1}{10}\right)^5$

(c) $\left(\frac{9}{10}\right)^5$ (d) $\left(\frac{1}{2}\right)^5$

147. A random variable X has the probability distribution given below.

X	1	2	3	4	5
P(x = X)	K	2K	3K	2K	K

Its variance is

- (a) $\frac{16}{3}$ (b) $\frac{4}{3}$
(c) $\frac{5}{3}$ (d) $\frac{10}{3}$

148. The area (in sq. units) of the region bounded by the curves $y^2 = 4ax$ and $x^2 = 4ay$, $a > 0$ is

- (a) $\frac{16a^2}{3}$ (b) $\frac{14a^2}{3}$
(c) $\frac{13a^2}{3}$ (d) $16a^2$

149. The area in the positive quadrant enclosed by the circles $x^2 + y^2 = 4$, the line $x = y\sqrt{3}$ and x-axis is

- (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{3}$ (d) Π

150. $\int_{\pi/6}^{\pi/2} \frac{\operatorname{cosec} x \cdot \cot x}{1 + \operatorname{cosec}^2 x} dx =$

- (a) $\tan^{-1} 2$ (b) $\tan^{-1} \left(\frac{1}{3}\right)$
(c) $\tan^{-1} 1$ (d) $\frac{\pi}{4} - \tan^{-1} 2$

