MHT CET 2020 PCM Oct 15 Shift 2 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

Time Allowed: 180 Minutes **Total Questions: 150** **Maximum Marks: 200**

General Instructions

(i) This **PCM** paper is from **MHT CET 2020**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

(ii) Answer all **150 multiple choice questions**: **50 Physics**, **50 Chemistry** and **50 Mathematics**.

(iii) Each question offers **four choices**, with **one correct answer**.

(iv) Allow **90 minutes for Physics and Chemistry together**, followed by **90 minutes for Mathematics**. The first group closes before the second opens.

(v) Correct answers earn **1 mark in Physics and Chemistry** and **2 marks in Mathematics**.

(vi) There is **no negative marking**. Unanswered questions score zero.

1. If $\vec{A} = a_1\hat{\imath} + a_2\hat{\jmath}$ and $\vec{B} = b_1\hat{\imath} + b_2\hat{\jmath}$ are perpendicular to each other then

(A) $\frac{b_2}{a_1} = -\frac{a_2}{b_1}$ (B) $\frac{a_1}{b_2} = +\frac{a_2}{b_1}$
(C) $\frac{b_2}{a_1} = +\frac{a_2}{b_1}$ (D) $\frac{a_1}{b_2} = -\frac{a_2}{b_1}$

2. The SI unit of $\frac{G}{g}$ is (g = acceleration due to gravity, G = constant of gravitation)

(A) $\frac{\mathrm{kg}}{\mathrm{m}^2}$ (B) $\frac{\mathrm{m}^2}{\mathrm{kg}}$
(C) $\frac{\mathrm{m}}{\mathrm{kg}}$ (D) $\frac{\mathrm{kg}}{\mathrm{m}}$

3. A vehicle moving with 15 km/hr comes to rest by covering 5 m distance by applying brakes. If the same vehicle moves at 45 km/hr, then by applying brakes, it will come to rest by covering a distance

(A) 15 m (B) 45 m
(C) 60 m (D) 30 m.

4. Two cars of masses m_1 and m_2 are moving in circles of radii r_1 and r_2 respectively. Their speeds are such that they make complete circles in the same time t. The ratio of their centripetal force is

(A) $\mathrm{m_1 : m_2}$ (B) $\mathrm{r_1 : r_2}$
(C) 1 : 1 (D) $\mathrm{m_1 r_1 : m_2 r_2}$

5. What should be the velocity of earth due to rotation about its own axis so that the weight at equator becomes $\left(\frac{3}{5}\right)^{\mathrm{th}}$ of initial value? (Radius of earth on equator $= 6400$ km, $\mathrm{g} = 10\frac{\mathrm{m}}{\mathrm{s}^2}$, $\cos 0^\circ = 1$)

(A) $3 \cdot 5 \times 10^{-4}\frac{\mathrm{rad}}{\mathrm{s}}$ (B) $7 \cdot 91 \times 10^{-4}\frac{\mathrm{rad}}{\mathrm{s}}$
(C) $6 \cdot 5 \times 10^{-4}\frac{\mathrm{rad}}{\mathrm{s}}$ (D) $2 \cdot 5 \times 10^{-4}\frac{\mathrm{rad}}{\mathrm{s}}$

6. A block of mass m is moving on a rough horizontal surface. The coefficient of kinetic friction between block and surface is μ_k, The net force exerted by the surface on the block is (g = acceleration due to gravity)

(A) $\mathrm{mg}(1+\mu_\mathrm{k})^{1/2}$ (B) $[\mathrm{mg}(1+\mu_\mathrm{k})]^{1/2}$
(C) $\mathrm{mg}\left(1+\mu_\mathrm{k}^2\right)$ (D) $\mathrm{mg}\left(1+\mu_\mathrm{k}^2\right)^{1/2}$

7. A force $(5\hat{\imath} - 2\hat{\jmath} + 3\hat{k})$N acts on a body of mass 2 kg and displaces it from $(3\hat{\imath} + 2\hat{\jmath} - \hat{k})$m to $(6\hat{\imath} - \hat{\jmath} + 4\hat{k})$m. The work done is

(A) 27 J (B) 18 J
(C) 36 J (D) 9 J

8. For a perfectly elastic collision, the coefficient of restitution e is

(A) zero (B) 1
(C) 0.75 (D) 0.5

9. A metal ball released from height 'h' makes perfectly elastic collision with ground. The frequency of periodic vibratory motion is (g = acceleration due to gravity)

(A) $\frac{1}{2\pi}\sqrt{\frac{g}{2h}}$ (B) $\frac{1}{2}\sqrt{\frac{g}{2h}}$
(C) $\frac{1}{2}\sqrt{\frac{2h}{g}}$ (D) $\frac{1}{2\pi}\sqrt{\frac{2h}{g}}$

10. A uniform rod AB of mass ' m' and length ' ℓ' is at rest on a smooth horizontal surface. An impulse ' P' is applied to the end B. The time taken by the rod to turn through a right angle is

(A) $\frac{\pi}{12}\frac{\mathrm{m}\ell}{\mathrm{P}}$ (B) $\frac{\pi \mathrm{P}}{\mathrm{m}\ell}$
(C) $2\pi\frac{\mathrm{m}\ell}{\mathrm{P}}$ (D) $2\frac{\pi \mathrm{P}}{\mathrm{m}\ell}$

11. A metal wire of length ' L ' is bent to form a circular coil of number of turns 'n'. The coil is placed in magnetic field 'B' and current is passed through the coil. The maximum torque acting on the coil is

(A) $\frac{\mathrm{BIL}^2}{4\pi \mathrm{n}}$ (B) $\frac{\mathrm{BIL}^2}{2\pi \mathrm{n}}$
(C) $\frac{\mathrm{B}^2\mathrm{IL}}{2\pi \mathrm{n}}$ (D) $\frac{\mathrm{B}^2\mathrm{IL}}{4\pi \mathrm{n}}$

12. A molecule consists of two atoms each of mass ' m' and separated by a distance ' d'. At room temperature the average rotational kinetic energy is 'E', then its angular frequency is

(A) $\frac{2}{d}\sqrt{\frac{E}{m}}$ (B) $\sqrt{\frac{m}{Ed}}$
(C) $\frac{d}{2}\sqrt{\frac{m}{E}}$ (D) $\sqrt{\frac{Ed}{m}}$

13. From a disc of mass 'M' and radius 'R' a circular hole of diameter R is cut whose rim passes through the centre. The moment of inertia of the remaining part of the disc about perpendicular axis passing through the centre is

(A) $\frac{11\mathrm{MR}^2}{32}$ (B) $\frac{7\mathrm{MR}^2}{32}$
(C) $\frac{9\mathrm{MR}^2}{32}$ (D) $\frac{13\mathrm{MR}^2}{32}$

14. A lift is tied with thick iron ropes having mass 'M'. The maximum acceleration of the lift is 'a' m/s^2 and maximum safe stress is 's' N/m^2. The minimum diameter of the rope is (g = acceleration due to gravity)

(A) $\left[\frac{2M(g+a)}{\pi s}\right]^{\frac{1}{2}}$ (B) $\left[\frac{2M(g-a)}{\pi s}\right]^{\frac{1}{2}}$

(C) $\left[\frac{4M(g+a)}{\pi s}\right]^{\frac{1}{2}}$ (D) $\left[\frac{4M(g-a)}{\pi s}\right]^{\frac{1}{2}}$

15. A wire of length 'L' and radius ' r ' is loaded with a weight ' Mg '. If ' Y ' and ' σ ' denote the Young's modulus and poisson's ratio of the material of the wire respectively, then the decrease in the radius of the wire (Δr) is given by

(A) $\frac{MgY}{\pi r\sigma}$ (B) $\frac{Mg\sigma}{\pi rY}$

(C) $\frac{\sigma\pi r}{MgY}$ (D) $\frac{Mgr}{\sigma\pi Y}$

16. Water rises to a height 3 cm in a capillary tube. If cross-sectional area of capillary tube is reduced to $\frac{1}{0}$ th initial area then water will rise to a height of

(A) 9 cm (B) 6 cm

(C) 7 cm (D) 8 cm

17. Due to surface tension, the excess pressure inside a smaller drop is 9 units. If 27 smaller drops combine, then the excess pressure inside the bigger drop is

(A) 2 units (B) 1 unit

(C) 3 units (D) 4 units

18. The ratio of specific heat at constant pressure to specific heat at constant volume (γ) for a gas is $\left(1+\frac{2}{f}\right)$ where f is the number of degrees of freedom of a molecule of a gas. The ratio of ' γ_d ' for rigid diatomic to ' γ_m ' for monoatomic is

(A) $\frac{14}{23}$ (B) $\frac{25}{21}$

(C) $\frac{21}{25}$ (D) $\frac{23}{14}$

19. If a gas is compressed isothermally then the r.m.s. velocity of the molecules

(A) remains the same. (B) increases.

(C) decreases. (D) first decreases and then increases.

20. A simple harmonic progressive wave is represented as $Y = A\sin 2\pi\left(nt - \frac{x}{\lambda}\right)$ cm. If the maximum particle velocity is four times the wave velocity, then the wavelength of the wave is

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

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

21. A particle of mass ' m ' is executing simple harmonic motion about its mean position. If $'A'$ is the amplitude and ' T ' is the period of S.H.M., then the total energy of the particle is

(A) $\frac{4\pi^2\, mA^2}{T^2}$ (B) $\frac{8\pi^2\, mA^2}{T^2}$

(C) $\frac{2\pi^2\, mA^2}{T^2}$ (D) $\frac{\pi^2\, mA^2}{T^2}$

22. Time period of a simple pendulum will be doubled if we

(A) increase the length two times. (B) decrease the length two times.

(C) decrease the length four times. (D) increase the length four times.

23. In an experiment of the measurement of 'g' using simple pendulum, the time period was measured with an accuracy of $0\cdot 2\%$ while the length was measured with an accuracy of 0.5%. The percentage accuracy in the value of ' g ' thus obtained is

(A) $0\cdot 7\%$ (B) $0\cdot 3\%$

(C) $0\cdot 9\%$ (D) $0\cdot 1\%$

24. In the case of conical pendulum, if T is the tension in the string and θ is the semivertical angle of cone, then the component of tension which balances the centrifugal force in equilibrium position is

(A) $T\sin\theta$ (B) $\frac{(T\sin\theta)}{2}$

(C) $T\tan\theta$ (D) $T\cos\theta$

25. A pipe closed at one end has lengh $0\cdot 8$ cm. At its open end a 0.5 m long uniform string is vibrating in its second harmonic and it resonates with the fundamental frequency of the pipe. If the tension in the wire is 50 N and the speed of sound is 320 m/s, the mass of the string is

(A) 8 gram (B) 2 gram

(C) 10 gram (D) 4 gram

26. A uniform metal wire of length 'L', mass ' M' and density ' 0 ' is under a tension ' T′ '. If the speed of transverse wave along the wire is ' V', then area of cross-section of the wire is

(A) $\frac{V}{Te}$ (B) $\frac{T}{V^2}Q$

(C) $\frac{T^2}{V_Q}$ (D) $\frac{V^2}{Te}$

27. The 3^{rd} overtone of a closed organ pipe is in unison with 3^{rd} overtone of an open pipe. The ratio of the length of the closed pipe to length of open pipe is

(A) $\frac{7}{8}$ (B) $\frac{4}{3}$

(C) $\frac{6}{5}$ (D) $\frac{7}{9}$

28. Two condensers of capacities ' C′ and ′2C′ are connected in parallel and then in series with 3^{rd} condenser of capacity '3C'. The combination is charged to 'V' volt. The charge on the condenser of capacity 'C' is

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

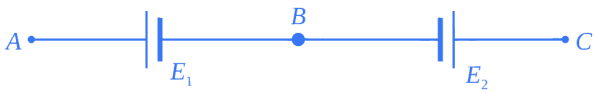
(C) $2CV$ (D) CV

29. Two identical parallel plate air capacitors are connected in series to a battery of e..m.f. ′V′. If one of the capacitor is inserted in liquid of dielectric constant 'K′, then potential difference of the other capacitor will become

(A) $\frac{K}{V(K+1)}$ (B) $\frac{KV}{K+1}$

(C) $\frac{K+1}{KV}$ (D) $\frac{K}{V(1-K)}$

30. A potentiometer is used to measure the potential difference between A and B, the null point is obtained at 0.9 m. Now potential difference between A and C is measured, the null point is obtained at $0 \cdot 3$ m. The ratio $\frac{E_2}{E_1}$ is $(E_1 > E_2)$



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

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

31. The unknown resistances are connected in two gaps of a metre bridge. The null point is at 20 cm from zero end. A resistance of 15Ω is connected in series with the smaller of the two. The null point shifts to 40 cm. The smaller resistance is

(A) 9Ω (B) 7Ω

(C) 3Ω (D) 5Ω

32. Two galvanometers ' G_1 ' and ' G_2 ' require 2 mA and 3 mA respectively to produce the same deflection. Then

(A) G_1 and G_2 are equally sensitive. (B) G_1 is more sensitive than G_2.

(C) G_1 is less sensitive than G_2 (D) sensitivity of G_2 is $\frac{3}{2}$ times that of G_1.

33. The magnetic moment is NOT associated with

(A) accelerated charge. (B) charge moving with constant velocity.

(C) stationary charge. (D) retarded charge.

34. A circular current carrying coil has radius R. At what distance from the centre of the coil on the axis, the magnetic induction will become $\frac{1}{8}$ th of its value at the centre of the coil?

(A) $\frac{2R}{\sqrt{3}}$ (B) $R\sqrt{3}$

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

35. A cylindrical magnetic rod has length 5 cm and diameter 1 cm. It has uniform magnetization $5 \cdot 3 \times 10^3 \frac{A}{m^3}$. Its net magnetic dipole moment is nearly $\left(\pi = \frac{22}{7}\right)$

(A) $2 \cdot 5 \times 10^{-2} \frac{J}{T}$ (B) $0 \cdot 5 \times 10^{-2} \frac{J}{T}$

(C) $2 \times 10^{-2} \frac{J}{T}$ (D) $10^{-2} \frac{J}{T}$

36. A circular and a square coil is prepared from two identical metal wires and a current is passed through them. Ratio of magnetic dipole moment associated with circular coil to that with square coil is

(A) $\frac{\pi}{2}$ (B) $\frac{4}{\pi}$

(C) π (D) $\frac{2}{\pi}$

37. Alternating current of peak value $\left(\frac{2}{\pi}\right)$ A flows through the primary coil of transformer. The coefficient of mutual inductance between primary and secondary coil is 1H. The peak e.m.f. induced in secondary coil is (Frequency of a.c. = 50 Hz)

(A) 400 V (B) 200 V

(C) 300 V (D) 100 V

38. An alternating e.m.f. is given by e $= e_0$ sin wt. In what time the e.m.f. will have half its maximum value, if 'e' starts from zero? (T = Time period)

$\left(\sin 30^\circ = \cos 60^\circ = 0 \cdot 5, \cos 30^\circ = \sin 60^\circ = \frac{\sqrt{3}}{2}\right)$

(A) $\frac{T}{12}$ (B) $\frac{T}{16}$

(C) $\frac{T}{8}$ (D) $\frac{T}{4}$

39. A ray of light passes through equilateral prism such that the angle of incidence is equal to angle of emergence and each of these angles is equal to $\left(\frac{3}{4}\right)^{\text{th}}$ the angle of prism. The angle of deviation is

(A) 35° (B) 40°

(C) 20° (D) 30°

40. In Young's double slit experiment, the resultant intensity of light at a point on the screen is 'I' when the path difference is λ' '. When the path difference is $\frac{\lambda}{4}$, the intensity at a point will be ($\lambda =$ wavelength of light, $\cos 180^\circ = -1$, $\cos 45^\circ = \frac{1}{\sqrt{2}}$)

(A) Zero (B) I

(C) $\frac{\mathrm{I}}{2}$ (D) $\frac{\mathrm{I}}{4}$

41. In biprism experiment, if 5^{th} bright band with wavelength $'\lambda_1'$ coincides with 6^{th} dark band with wavelength $'\lambda_2$ ' then the ratio $\left(\frac{\lambda_2}{\lambda_1}\right)$ is

(A) $\frac{10}{11}$ (B) $\frac{7}{9}$

(C) $\frac{11}{10}$ (D) $\frac{9}{7}$

42. The polarising angle for a transparent medium is 'θ' and 'V' is the speed of light in that medium, then relation between ' θ ' and ' V ' is (c = velocity of light)

(A) $\theta = \sin^{-1}\left(\frac{\mathrm{V}}{\mathrm{c}}\right)$ (B) $\theta = \tan^{-1}\left(\frac{\mathrm{V}}{\mathrm{c}}\right)$

(C) $\theta = \cot^{-1}\left(\frac{\mathrm{v}}{\mathrm{c}}\right)$ (D) $\theta = \cos^{-1}\left(\frac{\mathrm{V}}{\mathrm{c}}\right)$

43. Light of incident frequency 2 times the threshold frequency is incident on a photosensitive material. If the incident frequency is made $\left(\frac{1}{3}\right)^{\text{rd}}$ and intensity is doubled then the photoelectric current will

(A) decrease. (B) increase.

(C) be halved. (D) be zero.

44. When a photosensitive surface is irradiated by lights of wavelengths λ_1 and λ_2, kinetic energies of emitted photoelectrons are E_1 and E_2 respectively. The work function of the photosensitive surface is

(A) $\frac{\lambda_2 E_2 - \lambda_1 E_1}{\lambda_2 - \lambda_1}$ (B) $\frac{\lambda_1 E_1 + \lambda_2 E_2}{\lambda_2 + \lambda_1}$

(C) $\frac{\lambda_1 E_1 - \lambda_2 E_2}{\lambda_2 - \lambda_1}$ (D) $\frac{\lambda_2 E_1 + \lambda_2 E_2}{\lambda_2 - \lambda_1}$

45. Let the series limit for Balmer series be $'\lambda_1'$ and the longest wavelength for Brackett series be $'\lambda_2'$. Then λ_1 and λ_2 are related as

(A) $\lambda_2 = 0 \cdot 09\lambda_1$ (B) $\lambda_1 = 0 \cdot 09\lambda_2$

(C) $\lambda_1 = 1 \cdot 11\lambda_2$ (D) $\lambda_2 = 1 \cdot 11\lambda_1$

46. The magnitude of total energy and angular momentum of an electron in the n^{th} orbit of a Bohr atom is denoted by E_n and L_n respectively. Then

(A) $\mathrm{E_n} \propto \mathrm{L_n}$ (B) $\mathrm{E_n} \propto \mathrm{L_n^3}$

(C) $\mathrm{E_n} \propto \frac{1}{\mathrm{L_n^2}}$ (D) $\mathrm{E_n} \propto \frac{1}{\mathrm{L_n}}$

47. Photodiode is a device

(A) in which photo current is dependent on the reverse bias.

(B) which is always operated in forward bias.

(C) in which photo current is independent of incident radiation.

(D) which is always operted in reverse bias.

48. In energy band diagram of insulators, a band gap and the conduction band is respectively

(A) very high, empty.

(B) very low, partially filled.

(C) very high, completely filled.

(D) very low, empty.

49. In communication system, the range for line of sight propagation in case of earth is 'd', for the height of antenna (h). If 'h' is doubled then the new range is

(A) $\frac{\mathrm{d}}{\sqrt{2}}$ (B) $\frac{\sqrt{2}}{\mathrm{d}}$

(C) $\frac{\mathrm{d}}{2}$ (D) $\sqrt{2}\,\mathrm{d}$

50. A glass convex lens is of refractive index $1 \cdot 55$ with both faces of same radius of curvature. What will be the radius of curvature if focal length is to be 20 cm ?

(A) 22 cm (B) 21 cm

(C) 18 cm (D) 20 cm

51. An organic compound was found to contain 40.0%C and 6.66%H. Find it's molecular formula (molar mass = 180)

(A) $C_{22}H_{24}O_{11}$ (B) $C_2H_4O_2$
(C) CH_2O (D) $C_6H_{12}O_6$

52. Which among the following elements has highest number of atoms in 1 g each ? (at. no. Au = 197, Na = 23, Cu = 63 · 5, Fe = 56)

(A) $Cu_{(s)}$ (B) $Na_{(s)}$
(C) $Au_{(s)}$ (D) $Fe_{(s)}$

53. What will be the volume of oxygen gas produced, If the reaction $2KClO_{3(s)} \longrightarrow 2KCl_{(s)} + 3O_{2(g)} \Delta H^\circ = -78kJ$ is carried out at S.T.P.?

(A) 48.0 L (B) 44.8 L
(C) 22.4 L (D) 67.2 L

54. In PCl_5 molecule, the angle Cl-P-Cl present in a plane is equal to

(A) 180° (B) 120°
(C) 90° (D) 104°

55. Which of the following is true for the compound AB, if it is formed by transfer of an electron from *A* to *B* ?

(A) B is divalent (B) A is divalent
(C) AB forms electrovalent bond (D) AB forms covalent bond

56. According to Andrews isothermals, the minimum temperature at which carbon dioxide gas obeys Boyles law is

(A) 32 · 5°C (B) 31 · 1°C
(C) 48 · 1°C (D) 35.5°C

57. An ideal gas expands from $1 \times 10^{-3}\ m^3$ to $1 \times 10^{-2}\ m^3$ at 300 K against a constant external pressure of $1 \times 10^5\ nm^{-2}$, work done is

(A) -9×10^2 J (B) -9×10^3 J
(C) -0.7×10^3 J (D) -1×10^3 J(a)

58. When a system absorbs 8 kJ of heat and does 2 · 2 kJ of work on surrounding calculate the internal energy change?

(A) −10 · 2 kJ (B) 10 · 8 kJ
(C) 8 · 0 kJ (D) 5 · 8 kJ

59. What is the oxidation number of Cr in $K_2Cr_2O_7$?

(A) +2 (B) +12
(C) −6 (D) +6

60. What is the oxidation state of chlorine atom in chloric acid?

(A) +3 (B) −1
(C) +5 (D) +1

61. What is oxidation number of Ru in $[Ru(NH_3)_5H_2O]Cl_2$?

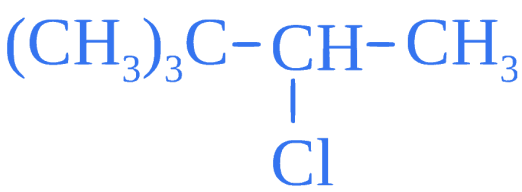
(A) +6 (B) +5
(C) +1 (D) +2

62. The increasing order of reactivity of alkaline earth metals with water is

(A) Mg < Sr < Ca < Ba
(B) Ba < Mg < Ca < Sr
(C) Ba < Sr < Ca < Mg
(D) Mg < Ca < Sr < Ba

63. Identify the neohexyl chloride from the following

(A) $(CH_3)_3C - CH_2 - CH_2 - Cl$
(B) $CH_3 - (CH_2)_4 - CH_2 - Cl$
(C) $(CH_3)_2CH - CH_2 - CH_2 - CH_2 - Cl$



(D)

64. Identify the gas used in gas chromatography?

(A) Helium (B) Argon
(C) Hydrogen (D) Neon

65. Which alkane is secreted by cockroaches to attract opposite gender of it's species?

(A) Octane (B) Nonane

(C) Undecane (D) Decane

66. The coordination number of the sphere in cubic close packed (ccp) structure is

(A) 6 (B) 4

(C) 12 (D) 8

67. What is the coordination number of cation in ionic compound if the type of hole occupied by cation is cubic?

(A) 3 (B) 4

(C) 8 (D) 6

68. Dry ice is an example of

(A) covalent solid (B) ionic solid

(C) molecular solid (D) metallic solid

69. Identify the correct relation between depression in freezing point and freezing point of pure solvent?

(A) $T^\circ = T \times \Delta T_f$ (B) $T^\circ = \Delta T_f - T$

(C) $T^\circ = T - \Delta T_f$ (D) $T^\circ = \Delta T_f + T$

70. Which of the following is NOT used as semi-permeable membrane?

(A) Cellulose nitrate (B) Copper ferrocyanide

(C) Ammonium chloride (D) Cellulose

71. What is the standard free energy change for the cell, having following cell reaction?

$2Ag^+_{(aq.)} + Cd_{(s)} \longrightarrow 2Ag_{(s)} + Cd^{2+}_{(aq)}$,

$E^\circ cell = 1 \cdot 20\ V$

(A) $-231 \cdot 6$ kJ (B) $-160 \cdot 8$ kJ

(C) $-115 \cdot 8$ kJ (D) $-260 \cdot 8$Kj

72. For the following cell, standard potential of copper electrode in 0.337 V and standard cell potential is 0.463 V $Cu|Cu^{2+}(1M)||Ag^+(1M)|Ag$ What is the standard potential of silver electrode?

(A) -0.126 V (B) 0.800 V

(C) -0.463 V (D) 0.126 V

73. What is the order of reaction for decomposition of gaseous acetaldehyde?

(A) 1 (B) 2

(C) 1.5 (D) 0

74. For first order reaction the slope of the graph of $\log_{10}[A]_t$ Vs. time is equal to

(A) k (B) $-k/2.303$

(C) $-k$ (D) $k/2.303$

75. Which among the following ionic species has least precipitating power?

(A) Cl^- (B) SO_4^{-2}

(C) Mg^{+2} (D) Al^{+3}

76. Which among the following elements is obtained in pure form by zone refining process?

(A) Germanium (B) Tin

(C) Copper (D) Bismuth

77. Which following method is used for refining of impure zirconium?

(A) Liquation (B) Zone refining

(C) Polling (D) Van Arkel method

78. Which of the following oxide of nitrogen is coloured?

(A) N_2O (B) NO

(C) NO_2 (D) N_2O_4

79. Which among the following is an alloy of antimony, tin and copper?

(A) Babbitt metal (B) Spiegeleisen

(C) Duralumin (D) Stainless steel

80. What is the value of effective magnetic moment found in +3 oxidation state of Chromium ($Z = 24$)?

(A) 1.73BM (B) 3.87BM

(C) 4.90BM (D) 2.84BM

81. How many water molecules are hydrogen bonded in following molecular formula $[Cu(H_20)_4]^{2+}SO_4{}^{2-} \cdot H_2O$?

(A) 4 (B) 3

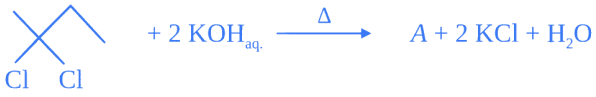
(C) 1 (D) 5

82. Which among the following is a correct formula of Barium tetrachlorocuprate(II)?

(A) $Cu[BaCl_2]Cl_2$ (B) $Ba[CuCl_2]Cl_2$

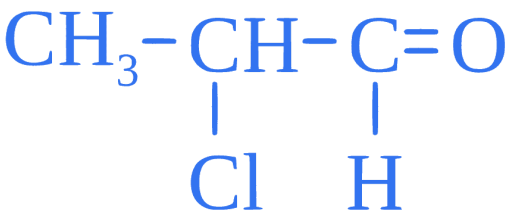
(C) $Cu[BaCl_4]$ (D) $Ba[CuCl_4]$

83. Identify the product A in the following reaction.

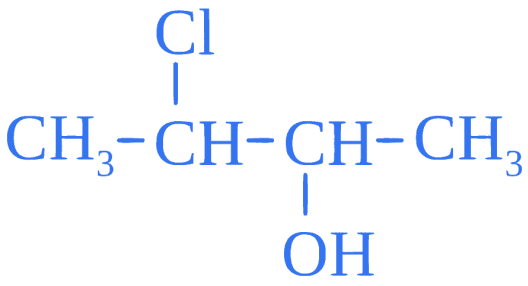




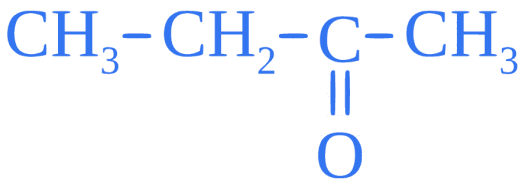
(A)



(B)



(C)



(D)

84. Which of the following is dihydric phenol?

(A) Resorcinol (B) m-Cresol
(C) Phloroglucinol (D) Pyrogallol

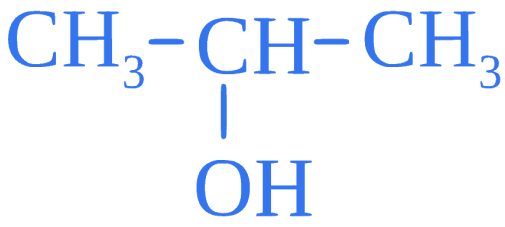
85. Identify ' B′ in the following series of reactions Ethanol $\xrightarrow[H_2SO_4,\Delta]{NaBr} A \xrightarrow[\text{Dry ether}]{Mg} B$

(A) Ethyl magnesium bromide (B) Ethyl bromide
(C) Sodium ethoxide (D) Ethene

86. Identify Z in the following sequence of reactions?

$$CH_3-CH_2-CH_2-OH \xrightarrow{PCl_3} X \xrightarrow[\Delta]{\text{alco.KOH}} Y \xrightarrow[\text{H-OH/heat}]{\text{conc.}H_2SO_4} Z$$

(A) $CH_3-CH_2-CH_2-OH$
(B) $(CH_3)_2CH-CH_2-OH$
(C) $CH_3-CH=CH_2$



(D)

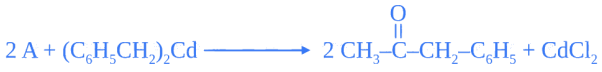
87. Identify 'A' in the following reaction $C_2H_5OH + HCl \xrightarrow{A} C_2H_5Cl + H_2O$

(A) anhydrous $ZnCl_2$ (B) pyridine
(C) conc. H_2SO_4 (D) $NaNO_2$

88. Which of the following alcohol is more acidic?

(A) $(CH_3)_3C-OH$ (B) $(CH_3)_2CH-OH$
(C) CH_3OH (D) CH_3-CH_2-OH

89. Identify 'A' in the following reaction



(A) $CH_3-Mg-Cl$ (B) $C_6H_5-CO-Cl$
(C) $CH_3-CO-Cl$ (D) $C_6H_5-CH_2-Cl$

90. Which of the following does NOT give yellow precipitate when reacted with $(NaOH + I_2)$ mixture?

(A) Acetophenone (B) Benzaldehyde
(C) Acetone (D) Acetaldehyde

91. Which of the following does NOT give carbylamine test?

(A) Ethylamine (B) Sec. butylamine
(C) Isopropylamine (D) Dimethylamine

92. Ketoxime on reduction with sodium in ethanol forms

(A) 1° amine
(B) 2° amine
(C) 1° and 2° amine
(D) 3° amine

93. Which of the following reagents is used in Hoffmann elimination reaction of amines

(A) $NaNO_2 + HCl$
(B) CH_3COCl
(C) $Ag_2O/H_2O, \Delta$
(D) $CHCl_3 + KOH$

94. Which among the following vitamins belongs to the aliphatic series?

(A) Vitamin C
(B) Vitamin A
(C) Vitamin K
(D) Vitamin B complex

95. Which among the following is a globular protein?

(A) Insulin
(B) Myosin
(C) Collagen
(D) Fibroin

96. Which of the following compounds is present in natural rubber as a monomer?

(A) 1, 3-Butadiene
(B) 2-Chloro-1,3-butadiene
(C) Styrene
(D) 2-Methyl-1,3-butadiene

97. Which polymer among the following does NOT contain ester linkage in it?

(A) Dacron
(B) PHBV
(C) Dacron
(D) Nylon-2-nylon-6

98. Identify the catalyst used in the manufacture of high density polythene.

(A) MnO_2
(B) Co-Th alloy
(C) $TiCl_4$ along with $Al(C_2H_5)_3$
(D) V_2O_5

99. Which of the following is synthetic estrogen derivative?

(A) Tegamet
(B) Norethindrone
(C) Novestrol
(D) Ranitidine

100. Which among the following elements is not present in salvarsan?

(A) P
(B) O
(C) N
(D) As

101. The number of solutions of the equation $\tan x + \sec x = 2\cos x$ lying in the interval $[0, 2\pi]$ is

(A) 0 (B) 2

(C) 3 (D) 1

102. If $f(x) = 2x^2 + bx + c, f(0) = 3$ and $f(2) = 1$, then $(fof)(1) =$

(A) 0 (B) 2

(C) 1 (D) 3

103. If A, B, C are angles of a $\triangle ABC$, then $\tan 2A + \tan 2B + \tan 2C =$

(A) $\tan 2A \tan 3B \tan 2C$

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

(C) $\tan A \tan B \tan C$

(D) $\tan 3A \tan 2B \tan 2C$

104. If $A + B + C = 180°$, then the value of $\tan\left(\frac{A}{2}\right)\tan\left(\frac{B}{2}\right) + \tan\left(\frac{B}{2}\right)\tan\left(\frac{C}{2}\right) + \tan\left(\frac{C}{2}\right)\tan\left(\frac{A}{2}\right)$ is

(A) 1 (B) -1

(C) -2 (D) 2

105. If $\sin(y + z - x)$, $\sin(z + x - y)$ and $\sin(x + y - z)$ are in A.P., then

(A) $2\tan y = \tan x - \tan z$

(B) $\tan y = \tan x + \tan z$

(C) $2\tan y = \tan x + \tan z$

(D) $\tan y = \tan x - \tan z$

106. $\sqrt{2 + \sqrt{2 + 2\cos 4\theta}} =$

(A) $2\cos\theta$ (B) $\frac{\cos\theta}{2}$

(C) $\frac{\cos\theta}{\sqrt{2}}$ (D) $\sqrt{2} \cdot \cos\theta$

107. If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2\cos^6 x + \cos^4 x$ is

(A) 3 (B) 2

(C) 1 (D) 4

108. If the A.M. and G.M. of the roots of a quadratic equation in x are p and q respectively, then its equation is

(A) $x^2 + 2px + q^2 = 0$ (B) $x^2 + px + q^2 = 0$

(C) $x^2 - px + q^2 = 0$ (D) $x^2 - 2px + q^2 = 0$

109. The acute angle between the lines given by $y - \sqrt{3}x + 1 = 0$ and $\sqrt{3}y - x + 7 = 0$ is

(A) 75° (B) 60°

(C) 45° (D) 30°

110. The joint equation of the lines through the origin trisecting angles in first and third equadrant is

(A) $\sqrt{3}\left(x^2 - y^2\right) + 4xy = 0$

(B) $\sqrt{3}\left(x^2 + y^2\right) - 4xy = 0$

(C) $\sqrt{3}\left(x^2 + y^2\right) + 4xy = 0$

(D) $\sqrt{3}\left(x^2 - y^2\right) - 4xy = 0$

111. If the sum of slopes of the pair of lines given by $4x^2 + 2\,\mathrm{h}xy - 7y^2 = 0$ is equal to the product of the slopes, then h is

(A) -2 (B) -4

(C) 4 (D) -6

112. The co-ordinates of the mid-point of the chord cut off by theline $2x - 5y + 18 = 0$ by the circle $x^2 + y^2 - 6x + 2y - 54 = 0$ are

(A) $(1, 4)$ (B) $(2, 4)$

(C) $(4, 1)$ (D) $(1, 1)$

113. If CP and CD is a pair of semi-conjugate diameters of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then $CP^2 + CD^2 =$

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

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

114. The entries in the last column of the truth table for $\sim(\mathrm{p} \wedge \mathrm{q})$ are

(A) FFTT (B) TFFF

(C) FTTT (D) TTFF

115. Amongs the given statements below _____ is a tautology

(A) $\sim p \vee (\sim p \vee \sim q)$

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

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

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

116. If $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}, I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $A^2 = 8A + kI$, then the value of K is

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

(C) -7 (D) 7

117. If $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 0 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 \\ 2 & 1 \\ 0 & 1 \end{bmatrix}$, then $(AB)^{-1}$ is

(A) $\left(\frac{1}{5}\right)\begin{bmatrix} 5 & -5 \\ 4 & -5 \end{bmatrix}$ (B) $\left(\frac{1}{5}\right)\begin{bmatrix} 5 & -5 \\ -4 & 5 \end{bmatrix}$

(C) $\left(\frac{1}{5}\right)\begin{bmatrix} 5 & -5 \\ 4 & 5 \end{bmatrix}$ (D) $\left(\frac{1}{5}\right)\begin{bmatrix} 5 & -5 \\ -4 & -5 \end{bmatrix}$

118. If the function given by $f(x) = \left(\frac{4x+1}{1-4x}\right)^{\frac{1}{x}}$ for $x \neq o$ is continuous at $x = 0$, then the value of f(o) is

(A) e^8 (B) e^{10}

(C) e^{-8} (D) e^{-10}

119. If $2f(x) = f'(x)$ and $f(0) = 3$, then the value of $f(2)$ is

(A) $3e^2$ (B) $2e^3$

(C) $4e^3$ (D) $3e^4$

120. If f and g are differentiable functions satisfying $g'(a) = 2$, $g(a) = b$ and $fog = I$, where is an identity function, then $f'(b)$ is equal to

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

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

121. If $y = \tan^{-1}\left[\frac{x-\sqrt{1-x^2}}{x+\sqrt{1-x^2}}\right]$, then $\left(\frac{dy}{dx}\right) =$

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

(C) $\frac{1}{\sqrt{1-x^2}}$ (D) $\frac{x}{\sqrt{1-x^2}}$

122. The derivative of $f(\tan x)$ w.r.t. $g(\sec x)$ at $x = \frac{\pi}{4}$, where $f'(1) = 2$ and $g'(\sqrt{2}) = 4$ is

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

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

123. If rectangles are inscribed in a circle of radius r units. Then the dimensions of the rectangle which has maximum area are

(A) 2r units, r units, (B) 2r units, $\sqrt{2}$r units,

(C) r units, $\sqrt{2}$r units, (D) $\sqrt{2}$r units, $\sqrt{2}$r units

124. If the tangent to the curve given by $x = t^2 - 1$ and $y = t^2 - t$ is parallel to X - axis, then the value of t is

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

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

125. The approximate value of the function $f(x) = x^3 + 5x^2 - 7x + 10$ at $x = 1 \cdot 1$ is

(A) $7 \cdot 6$ (B) $8 \cdot 6$

(C) $6 \cdot 6$ (D) $9 \cdot 6$

126. $\int e^{\tan^{-1} x}\left(1 + \frac{x}{1+x^2}\right) dx$

(A) $\left(\frac{x}{2}\right) e^{\tan^{-1} x} + c$ (B) $xe^{\tan^{-1} x} + c$

(C) $\left(\frac{1}{2}\right) e^{\tan^{-1} x} + c$ (D) $e^{\tan^{-1} x} + c$

127. $\int 7^{7^{7x}} 7^{7^x} 7^x \, dx =$

(A) $7^{7^{7x}}(\log 7)^3 + C$ (B) $\frac{7^{7x}}{(\log 7)^2} + C$

(C) $\frac{7^{7x}}{(\log 7)} + C$ (D) $\frac{7^{77x}}{(\log 7)^3} + C$

128. $\int e^x \left(\frac{1-x}{1+x^2}\right)^2 dx =$

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

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

129. $\int_0^5 \frac{dx}{x^2+2x+10} =$

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{12}$

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

130. $\int_{-4}^{4} \log\left(\frac{8-x}{8+x}\right) dx =$

(A) -4 (B) 8

(C) 4 (D) 0

131. $\int_0^{\frac{\pi}{2}} \sin^2 x \, dx =$

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

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

132. The area of the region bounded by the curve $y = x^2 + 1$, the lines $x = 1$, $x = 2$ and the X - axis is

(A) $\frac{13}{3}$ sq. units (B) $\frac{10}{3}$ sq. units

(C) $\frac{16}{3}$ sq. units (D) $\frac{19}{3}$ sq. units

133. The growth of population is proportional to the number present. If the population of a colony doubles is 50 years, then the population will become triple in _____ years

(A) $5\left(\frac{\ell og2}{\ell og3}\right)$ yrs (B) $50\left(\frac{\log 3}{\ell og2}\right)$ yrs

(C) $5\left(\frac{\log 3}{\log 2}\right)$ yrs (D) $50\left(\frac{\log 2}{\ell og3}\right)$ yrs

134. The differential equation of the family of curves $y = e^x(A\cos x + B\sin x)$, where A and B are arbitrary constants is

(A) $\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right) + 2y = 0$

(B) $\frac{d^2y}{dx^2} - 2\left(\frac{dy}{dx}\right) - 2y = 0$

(C) $\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right) - 2y = 0$

(D) $\frac{d^2y}{dx^2} - 2\left(\frac{dy}{dx}\right) + 2y = 0$

135. The solution of the differential equation $\log\left(\frac{dy}{dx}\right) = 9x - 6y + 6$ is (given that $y = 1$ when $x = 0$)

(A) $3e^{6y} = 2e^{9x-6} + e^6$ (B) $3e^{6y} = 2e^{9x+6} + e^6$

(C) $3e^{6y} = 2e^{9x+6} - e^6$ (D) $3e^{6y} = 2e^{9x-6} - e^6$

136. Radium decomposes at a rate proportional to the amount present. If half the orignal amount disappears in 1600 yrs, then the percentage loss in 100 years is (Given $\log 2 = 0.6912 \& e^{-0\cdot04320} = 0\cdot9576$)

(A) $3\cdot24\%$ (B) $5\cdot24\%$

(C) $2\cdot24\%$ (D) $4\cdot24\%$

137. If a point P on the line segment joining the points $(3, 5, -1)$ and $(6, 3, -2)$ has its y - coordinate 2, then its z - coordinate is

(A) $\frac{2}{15}$ (B) $\frac{17}{3}$

(C) $\frac{15}{2}$ (D) $\frac{3}{17}$

138. The volume of a tetrahedron whose vertices are $A \equiv (-1, 2, 3)$, $B \equiv (3, -2, 1)$, $C \equiv (2, 1, 3)$ and $D \equiv (-1, -2, 4)$ is

(A) $\frac{14}{3}$ cu. units (B) $\frac{16}{3}$ cu. units

(C) $\frac{17}{3}$ cu. units (D) $\frac{15}{3}$ cu. units

139. If $\bar{a} = 2\hat{i} - \hat{j} + \hat{k}, \bar{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\bar{c} = 3\hat{i} + \lambda\hat{j} + 5\hat{k}$ are coplanar, then λ is the root of the equation

(A) $x^2 + 2x = 6$ (B) $x^2 + 2x = 4$

(C) $x^2 + 3x = 6$ (D) $x^2 + 3x = 4$

140. The perimeter of the triangle whose vertices have the position vectos $\hat{i} + \hat{j} + \hat{k}, 5\hat{i} + 3\hat{j} - 3\hat{k}$ and $2\hat{i} + 5\hat{j} + 9\hat{k}$ is

(A) $(\sqrt{15} - \sqrt{157})$ units (B) $(15 + \sqrt{157})$ units

(C) $(15 - \sqrt{157})$ units (D) $(\sqrt{15} + \sqrt{157})$ units

141. The distance of the point $(7, 5, 2)$ from the plane $3x + 4y + z - 8 = 0$ measured parallel to the line $\frac{x-1}{3} = \frac{y-2}{6} = \frac{z+1}{2}$

(A) $\sqrt{74}$ units (B) $\sqrt{47}$ units

(C) 6 units (D) 7 units

142. The angle between the two lines $\frac{x-4}{1} = \frac{y+4}{2} = \frac{z+1}{2}$ and $\frac{x+1}{2} = \frac{y+3}{2} = \frac{z-4}{-1}$ is

(A) $\cos^{-1}\left(\frac{4}{9}\right)$ (B) $\cos^{-1}\left(\frac{5}{9}\right)$

(C) $\cos^{-1}\left(\frac{1}{9}\right)$ (D) $\cos^{-1}\left(\frac{2}{9}\right)$

143. The distance of the point $(2, -1, 0)$ from the plane $2x + y + 2z + 8 = 0$ is

(A) $\frac{17}{3}$ units (B) $\frac{13}{3}$ units

(C) $\frac{7}{3}$ units (D) $\frac{11}{3}$ units

144. A line makes angles α, β, γ with the co-ordinate axes, then $\cos 2\propto + \cos 2\beta + \cos 2\gamma$ is equal to

(A) 2 (B) -1

(C) 1 (D) -2

145. The optimal solution of the L.P.P. Maximize : $Z = 8x + 3y$ subject to the constraints $x + y \leq 3, 4x + y \leq 6, x \geq 0, y \geq 0$ is

(A) $x = 0, y = 3$ (B) $x = 0, y = 0$

(C) $x = \frac{3}{2}, y = 0$ (D) $x = 1, y = 2$

146. If a fair coin is tossed 8 times, then the probability that it shows heads more than tails is

(A) $\frac{91}{256}$ (B) $\frac{97}{256}$

(C) $\frac{93}{256}$ (D) $\frac{95}{256}$

147. If the p.m.f. is given by $P(X) = k\binom{4}{x}$, for $x = 0, 1, 2, 3, 4$, $k > 0 = 0$, otherwise then the value of k is

(A) $\frac{3}{16}$ (B) $\frac{7}{16}$

(C) $\frac{1}{16}$ (D) $\frac{5}{16}$

148. If

$n(X) = 700, n(A) = 200, n(B) = 300,$

$n(A \cap B) = 100$

, where X is universal set and A and B are subsets of X, then $\mathrm{n}(\mathrm{A}' \cap \mathrm{B}') =$

(A) 300 (B) 400

(C) 340 (D) 240

149. For the probability distribution of X given below

$X = x$	-2	-1	0	1	2
$\mathrm{P(X} = x)$	$0 \cdot 2$	$0 \cdot 3$	$0 \cdot 1$	$0 \cdot 15$	$0 \cdot 25$

The variance of X is

(A) 2.4257 (B) 2.5427

(C) 2.5742 (D) 2.2475

150. In a single throw of three dice, the probability of getting a sum at least 5 is

(A) $\frac{53}{54}$ (B) $\frac{51}{54}$

(C) $\frac{1}{54}$ (D) $\frac{2}{3}$

- End of Question Paper -