MHT CET 2020 PCM Oct 16 Shift 1 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. An ammeter of resistance 20Ω gives full scale deflection, when 1 mA current flows through it. What is the maximum current that can be measured by connecting 4 resistors each of 16Ω in parallel with the ammeter?

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

2. An alternating emf of 0.2 V is applied across an L-C-R series circuit having $R = 4\Omega, C = 80\mu$F and $L = 200$ mH. At resonance the voltage drop across the inductor is

(A) 10V (B) 2.5V
(C) 1V (D) 5V

3. An electron (e) is revolving in a circular orbit of radius r in hydrogen atom. The angular momentum of the electron is ($M =$ magnetic dipole moment associated with it and $m =$ mass of electron)

(A) $\frac{mM}{e}$ (B) $\frac{3Mm}{e}$
(C) $\frac{2mM}{e}$ (D) $\frac{4mM}{e}$

4. In non-uniform circular motion, the ratio of tangential to radial acceleration is ($r =$ radius, $\alpha =$ angular acceleration and $v =$ linear velocity)

(A) $\frac{r\alpha}{v}$ (B) $\frac{v^2}{ra}$
(C) $\frac{r\alpha^2}{v^2}$ (D) $\frac{r^2\alpha}{v^2}$

5. In common emitter amplifier, input resistance is 1000Ω, peak value of input signal voltage is 5 mV and $\beta = 60$. The peak value of output current is

(A) 3×10^{-4} A (B) 0.5×10^{-4} A
(C) 2×10^{-5} A (D) 1×10^{-5} A

6. A simple pendulum of length L has mass m and it oscillates freely with amplitude A. At extreme position, its potential energy is ($g =$ acceleration due to gravity)

(A) $\frac{mgA}{L}$ (B) $\frac{mgA}{2l}$
(C) $\frac{mgA^2}{L}$ (D) $\frac{mgA^2}{2L}$

7. The extension in a wire obeying Hooke's law is x. The speed of sound in the stretched wire is v. If the extension in the wire is increased to $4x$, then the speed of sound in a wire is

(A) 2.5v (B) 2v
(C) 1.5v (D) v

8. Let force $F = A\sin(Ct) + B\cos(Dx)$, where x and t are displacement and time, respectively. The dimensions of $\frac{C}{D}$ are same as dimensions of

(A) angular velocity (B) velocity
(C) angular momentum (D) velocity gradient

9. Two vectors of same magnitude have a resultant equal to either of the two vectors. The angle between two vectors is

(A) $\cos^{-1}(-0.5)$ (B) $\cos^{-1}(-0.4)$
(C) $\cos^{-1}(-0.3)$ (D) $\cos^{-1}(-0.6)$

10. If there is a change of angular momentum from 1j-s to 4j-s in 4 s, then the torque

(A) $(\frac{5}{4})$J (B) $(\frac{3}{4})$J
(C) 1 J (D) $(\frac{4}{3})$J

11. For a gas, $\frac{R}{C_V} = 0.4$, where R is universal gas constant and C_V is the molar specific heat at constant volume. The gas is made up of molecules, which are

(A) polyatomic (B) rigid diatomic
(C) monoatomic (D) non-rigid diatomic

12. The maximum velocity of the photoelectron emitted by the metal surface is v. Charge and mass of the photoelectron is denoted by e and m, respectively. The stopping potential in volt is

(A) $\frac{v^2}{2(\frac{e}{m})}$ (B) $\frac{v^2}{(\frac{m}{e})}$

(C) $\frac{v^2}{2(\frac{m}{e})}$ (D) $\frac{v^2}{(\frac{e}{m})}$

13. Energy of the incident photon on the metal surface is $3W$ and then $5W$, where W is the work function for that metal. The ratio of velocities of emitted photoelectrons is

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

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

14. Water rises in a capillary tube of radius r upto a height h. The mass of water in a capillary is m. The mass of water that will rise in a capillary of radius

$$\frac{r}{4}$$

will be

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

(C) m (D) $\frac{4}{m}$

15. Two waves

$$Y_1 = 0.25\sin 316t$$

and

$$Y_2 = 0.25\sin 310t$$

are propagating along the same direction. The number of beats produced per second are

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

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

16. A small metal sphere of mass M and density d_1 when dropped in a jar filled with liquid moves with terminal velocity after sometime. The viscous force acting on the sphere is ($d_2 =$ density of liquid and $g =$ gravitational acceleration)

(A) $Mg(\frac{d_1}{d_2})$ (B) $Mg(1-\frac{d_2}{d_1})$

(C) $Mg(\frac{d_2}{d_1})$ (D) $Mg(1-\frac{d_1}{d_2})$

17. The capacitance of a parallel plate capacitor with air as medium is 3μF. With the introduction of a dielectric medium between the plates, the capacitance becomes 15μF. The permittivity of the medium in SI unit is [$\varepsilon_0 = 8.85\times10^{-12}$SI unit]

(A) 8.845×10^{-11} (B) 0.4425×10^{-10}

(C) 15 (D) 5

18. The mass of earth is 81 times the mass of the moon and the distance between their centres is R. The distance from the centre of the earth, where gravitational force will be zero is

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

(C) $\frac{9R}{10}$ (D) $\frac{R}{81}$

19. A coil of n turns and resistance $R\Omega$ is connected in series with a resistance

$$\frac{R}{2}$$

. The combination is moved for time t second through magnetic flux ϕ_1 to ϕ_2. The induced current in the circuit is

(A) $\frac{n(\varrho_1-\varrho_2)}{3Rt}$ (B) $\frac{2n(\varrho_1-\varrho_2)}{3Rt}$

(C) $\frac{2n(\varrho_1-\varrho_2)}{Rt}$ (D) $\frac{n(\varrho_1-\varrho_2)}{Rt}$

20. Two identical bar magnets each of magnetic moment M, separated by some distance are kept perpendicular to each other. The magnetic induction at a point at the same distance d from the centre of magnets, is ($\mu_0 =$ permeability of free space)

(A) $\frac{\mu_0}{4\pi}(\sqrt{3})\frac{M}{d^3}$ (B) $\frac{\mu_0}{4\pi}(\sqrt{2})\frac{M}{d^3}$

(C) $\frac{\mu_0}{4\pi}(\sqrt{5})\frac{M}{d^3}$ (D) $(\frac{2\mu_0}{\pi})\frac{M}{d^3}$

21. A bullet of mass m moving with velocity v is fired into a wooden block of mass M, If the bullet remains embedded in the block, the final velocity of the system is

(A) $\frac{m+M}{m}$ (B) $\frac{M+m}{mv}$

(C) $\frac{mv}{m+M}$ (D) $\frac{v}{m(M+m)}$

22. In diffraction experiment, from a single slit, the angular width of the central maxima does not depend upon

(A) ratio of wavelength and slit width (B) distance of the slit from the screen

(C) wavelength of light used (D) width of the slit

23. A vehicle of mass m is moving with momentum p on a rough horizontal road. The coefficient of friction between the tyres and the horizontal road is μ. The stopping distance is ($g =$ acceleration due to gravity)

(A) $\frac{p^2}{2\mu m^2}$ (B) $\frac{p^2}{2\mu g m^2}$

(C) $\frac{p^2}{\mu g m^2}$ (D) $\frac{p^2}{2\mu g}$

24. In Young's double slit experiment green light is incident on the two slits. The interference pattern is observed on a screen. Which one of the following changes would cause the observed fringes to be more closely spaced?

(A) Moving the screen away from the slits

(B) Using blue light instead of green light

(C) Using red light instead of green light

(D) Reducing the separation between the slits

25. Two identical strings of length l and $2l$ vibrate with fundamental frequencies N Hz and $1.5N$ Hz, respectively. The ratio of tensions for smaller length to large length is

(A) 1 : 3 (B) 1 : 9

(C) 3 : 1 (D) 9 : 1

26. In amplitude modulation,

(A) amplitude remains constant but frequency . changes according to information signal

(B) amplitude of carrier wave changes according to information signal

(C) both amplitude and frequency changes according to information signal

(D) both amplitude and frequency do not change according to information signal

27. When a photon enters glass from air, which one of the following quantity does not change?

(A) Velocity (B) Wavelength

(C) Momentum (D) Energy

28. Two wires A and B of equal lengths are connected in left and right gap of a meter bridge, null point is obtained at 40 cm from left end. Diameters of the wire A and B are in that ratio 3 : 1. The ratio of specific resistance of A to the of B is

(A) 4 : 1 (B) 3 : 1

(C) 6 : 1 (D) 8 : 1

29. When a small amount of impurity atoms are added to a semiconductor, then generally its resistivity

(A) may increase or decrease depending upon the percentage of doping

(B) increases

(C) decreases

(D) does not change

30. When open pipe is closed from one end third overtone of closed pipe is higher in frequency by 150 Hz, then second overtone of open pipe. The fundamental frequency of open end pipe will be

(A) 400 Hz (B) 200 Hz

(C) 500 Hz (D) 300 Hz

31. A ray of light is incident at an angle i on one face of prism of small angle A and emerges normally from the other surface. μ is the refractive index of the material of the prism. The angle of incidence is

(A) $\frac{A}{2\mu}$ (B) $A\mu$

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

32. Two small drops of mercury each of radius r coalesce to form a large single drop. The ratio of the total surface energies before and after the change is

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

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

33. A solid cylinder of radius r and mass M rolls down an inclined plane of height h. When it reaches the bottom of the plane, then its rotational kinetic energy is ($g =$ acceleration due to gravity)

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

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

34. A potentiometer wire is 4 m long and potential difference of 3 V is maintained between the ends. The emf of the cell, which balances against a length of 100 cm of the potentiometer wire is

(A) 0.60 V (B) 0.50 V

(C) 0.25 V (D) 0.75 V

35. A charged particle is moving in a uniform magnetic field in a circular path of radius R. When the energy of the particle becomes three times the original, the new radius will be

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

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

36. The density of a metal at normal pressure p is ρ. When it is subjected to an excess pressure, the density becomes ρ'. If K is the bulk modulus of the metal, then the ratio

$$\frac{\rho'}{\rho}$$

is

(A) $\frac{1}{1-\frac{K}{p}}$ (B) $1+\frac{K}{p}$

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

37. For a particle performing SHM when displacement is x, the potential energy and restoring force acting on it is denoted by E and F, respectively. The relation between x, E and F is

(A) $\frac{E}{F}+x=0$ (B) $\frac{2E}{F}-x=0$

(C) $\frac{2E}{F}+x=0$ (D) $\frac{E}{F}-x=0$

38. Surface density of charge on a charged conducting sphere of radius R in terms of electric field intensity E at a distance r in free space is ($r>R, \varepsilon_0 =$ permittivity of free space)

(A) $\epsilon_0 E(\frac{R}{r})^2$ (B) $\epsilon_0 E\frac{R}{r}$

(C) $\epsilon_0 E(\frac{r}{R})^2$ (D) $\epsilon_0 E\frac{r}{R}$

39. A body is thrown from the surface of the earth velocity v/s. The maximum height above the earth's surface upto which it will reach is ($R =$ radius of earth, $g =$ acceleration due to gravity)

(A) $\frac{vR}{2gR-v}$ (B) $\frac{2gA}{v^2(R-1)}$

(C) $\frac{vR^2}{gR-v}$ (D) $\frac{v^2R}{2gR-v^2}$

40. Using Bohr's quantisation condition, what is the rotational energy in the second orbit for a diatomic molecule? ($I =$ moment of inertia of diatomic molecule and, $h =$ Planck's constant)

(A) $\frac{h}{2I\pi^2}$ (B) $\frac{h^2}{2I\pi^2}$

(C) $\frac{h^2}{2I^2\pi^2}$ (D) $\frac{h}{2I^2\pi}$

41. A monoatomic gas of pressure p having volume V expands isothermally to a volume $2V$ and then adiabatically to a volume 16 V. The final pressure of the gas is (ratio of specific heats $=\frac{5}{3}$)

(A) $\frac{p}{8}$ (B) $\frac{p}{16}$

(C) $\frac{p}{64}$ (D) $\frac{p}{32}$

42. A particle is moving in a radius R with constant speed v. The magnitude of average acceleration after half revolution is

(A) $\frac{2\pi}{Rv^2}$ (B) $\frac{2R}{\pi v}$

(C) $\frac{2v^2}{\pi R}$ (D) $\frac{2V}{\pi R^2}$

43. The magnifying power of a telescope is high, if its objective and eyepiece have respectively

(A) small focal lengths (B) large focal lengths

(C) small and large focal length (D) large and small focal length

44. The ratio of speed of an electron in the ground state in the Bohr's first orbit of hydrogen atom to velocity of light (c) is ($h =$ Planck's constant, $\varepsilon_0 =$ permittivity of free space, $e =$ charge on electron)

(A) $\frac{2\theta^2\epsilon_0}{hc}$ (B) $\frac{e^3}{2\epsilon_0 hc}$

(C) $\frac{e^2}{2\epsilon_0 hc}$ (D) $\frac{2\epsilon_0 hc}{e^2}$

45. A charge q moves with velocity v through electric field E as well as magnetic field (B). Then, the force acting on it is

(A) $q(E\times v)$ (B) $q(B\times v)$

(C) $qE+q(v\times B)$ (D) $q(v\times B)$

46. The force acting on the electrons in hydrogen atom (Bohr's theory) is related to the principle quantum number n as

(A) n^{-4} (B) n^4

(C) n^{-2} (D) n^2

47. A body of mass 2 kg is acted upon by two forces each of magnitude 1 N and inclined at 60° with each other. The acceleration of the body in m/s is [

$$\cos 60^\circ = 0.5$$

]

(A) $\sqrt{0.75}$ (B) $\sqrt{0.65}$

(C) $\sqrt{0.20}$ (D) $\sqrt{0.35}$

48. Two rods of same material and volume having circular cross-section are subjected to tension T. Within the elastic limit, same force is applied to both the rods. Diameter of the first rod is half of the second rod, then the extensions of first rod to second rod will be in the ratio

(A) 4 : 1 (B) 32 : 1

(C) 16 : 1 (D) 2 : 1

49. An iron rod is placed parallel to magnetic field of intensity 2000 A/m. The magnetic flux through the rod is 6×10^{-4} Wb and its cross-sectional area is 3 cm^2. The magnetic permeability of the rod in

$$\frac{\text{Wb}}{\text{A} - \text{m}}$$

is

(A) 10^{-1} (B) 10^{-2}

(C) 10^{-4} (D) 10^{-3}

50. A moving body is covering distances which are proportional to square of the time. Then, the acceleration of the body is

(A) zero (B) increasing

(C) constant but not zero (D) decreasing

51. A sample of gas absorbs 4000 kJ of heat and surrounding does 2000 J of work on sample. What is the value of ΔU ?

(A) 4002 kJ (B) 6000 kJ
(C) 4000 kJ (D) 2000 kJ

52. What is the value of $C-O-H$ bond angle in CH_3-OH ?

(A) 107° (B) 108.9°
(C) 109.5° (D) 110°

53. What is the molarity of solution containing 3.2 g of NaOH (molar mass 40 g mol^{-1}) in 250 cm^3 of water?

(A) 0.032 mol dm^{-3} (B) 0.02 mol dm^{-3}
(C) 0.32 mol dm^{-3} (D) 0.512 mol dm^{-3}

54. A metallic element crystallises in simple cubic lattice. If edge length of the unit cell is $3\,\mathring{A}$, with density 8 g/cc, what is the number of unit cells in 100 g of the metal?
(Molar mass of metal $= 108$ g/mol)

(A) 1.33×10^{20} (B) 2.7×10^{22}
(C) 2×10^{24} (D) 5×10^{23}

55. Which among the following compounds belongs to lipids?

(A) BHA (B) Novestrol
(C) Terpenes (D) Cloroxylenol

56. Which of the following alcohols needs acidic $KMnO_4$ to convert it into aldehyde or ketone?

(A) Propan-2-ol (B) Propan-1-ol
(C) Ethanol (D) 2-methyl propan-2-ol

57. What is the bond order of B_2 molecule?

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

58. Which among the following polymers is obtained from styrene and 1-3-butadiene?

(A) SBR (B) PHBV
(C) Buna- N (D) Butyl rubber

59. What is the oxidation number of As in H_3AsO_3 ?

(A) + 4 (B) + 3
(C) − 3 (D) + 2

60. Identify the product 'A' in the following reaction.

$$\text{Aniline} \xrightarrow[\text{Pyridine}]{(CH_3CO)_2O} A$$

(A) Sulphanilic acid (B) Benzenediazonium chloride
(C) Acetanilide (D) p-nitroacetanilide

61. Which of the following molecule contain 50% p-character of hybrid orbital in C atom?

(A) Acetylene (B) Methane
(C) Ethane (D) Propene

62. The reaction $2R-Cl+CoF_2 \longrightarrow 2R-F+CoCl_2$ is an example of ..... .

(A) Swarts reaction (B) Sandmeyer's reaction
(C) Wurtz-fittig reaction (D) Finkelstein reaction

63. What is the effective atomic number of Zn in $[Zn(NH_3)_4]SO_4$?

(A) 30 (B) 27
(C) 28 (D) 36

64. Alkyl cynides on reduction by sodium and ethanol give primary amines. This reaction is called as

(A) Hell-Vohlard-Zelinsky reaction (B) Clemmensen reduction
(C) Wolff-Kishner reduction (D) Mendius reduction

65. Which among the following compounds has highest boiling point?

(A) $CH_3-CH_2-CH_2-CH_2-OH$
(B) $CH_3-CH_2-CH_2-CHO$
(C) CH_3-CH_2-COOH
(D) $CH_3-CH_2-COCH_3$

66. Identify the product obtained, when benzamide is treated with bromine and aqueous sodium hydroxide.

(A) Bromobenzene
(B) Phenol
(C) Aniline
(D) Benzyl alcohol

67. Which among the following methods is not suitable for the preparation of alkyl chlorides?

(A) Addition of HCl to alkene
(B) Treating alcohols with Lucas reagent
(C) By heating alcohols with thionyl chloride
(D) Chlorination of alkanes in presence of sunlight

68. A solution has an osmotic pressure of 'x' kPa at 300 K having 1 mole of solute in 10.5 m^3 of solution. If it's osmotic pressure is reduced to $\left(\frac{1}{10}\right)$ th of it's initial value, what is the new volume of solution?

(A) 11.0 m^3
(B) 105 m^3
(C) 30 m^3
(D) 110 m^3

69. Identify the catalyst X used in following reaction.

$$CH_3CH_2Br + 2[H] \xrightarrow{X} CH_3 - CH_3 + HBr$$

(A) $K_2Cr_2O_7$
(B) $KMnO_4$
(C) CaO, Δ
(D) Zn-Cu couple in alcohol

70. Which of the following statements is true for carbonyl group?

(A) The carbonyl bond is weaker as compared to double bond in alkene.
(B) $C - C - O$ bond angle is 90°.
(C) Carbon atom forms three sigma bonds.
(D) Carbon atom is sp^3 hybridised.

71. Mixture of iodine and sodium sulphate is separated by ..... .

(A) differential extraction
(B) chromatography
(C) sublimation
(D) distillation

72. If concentration of reactant 'A' is increased by 10 times the rate of reaction becomes 100 times. What is the order of reaction, if rate law is, rate $= k[A]^x$?

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

73. Which among the following is non-poisonous in nature?

(A) Phosgene
(B) Gaseous chlorine
(C) Red phosphorus
(D) Phosphine

74. A compound has fcc structure. If density of unit cell is 3.4 g cm^{-3}, what is the edge length of unit cell? (Molar mass $= 98.99$)

(A) 8.780 $\mathring{A}$
(B) 6.083 $\mathring{A}$
(C) 5.783 $\mathring{A}$
(D) 7.783 $\mathring{A}$

75. Identify the element having highest enthalpyot atomisation from following.

(A) Sc($Z = 21$)
(B) Fe($Z = 26$)
(C) Zn($Z = 30$)
(D) Cu($Z = 29$)

76. What type of inter molecular force is present between magnesium chloride and water?

(A) Dipole-induced dipole interaction
(B) Dipole-dipole interaction
(C) Hydrogen bonding
(D) Ion-dipole interaction

77. Xenon crystallises in fcc lattice and the edge length of unit cell is 620 pm. What is the radius of Xe atom?

(A) 438.5 pm
(B) 219.2 pm
(C) 265.5 pm
(D) 536.9 pm

78. How many electrons are involved in the reaction, when 0.40 F of electricity is passed through an electrolytic solution?

(A) 6.642×10^{25}
(B) 1.505×10^{24}
(C) 6.022×10^{23}
(D) 2.4088×10^{23}

79. Which among the following lanthanoids, shows only +3 oxidation state?

(A) Cerium
(B) Gadolinium
(C) Terbium
(D) Neodynium

80. Which among the following is used as refrigerants and for air conditioning?

(A) Trichloromethane
(B) Dichloromethane
(C) Dichloro difluoromethane
(D) Carbon tetrachloride

81. Identify the tetradentate ligand from the following.

(A) Triethylene tetramine
(B) Ethylene diamine tetracetato
(C) Dimethyl glyoximato
(D) Oxalato

82. If 38.55 kJ of heat is absorbed, when 6.0 of O_2 react CIF according to reaction.

$$2ClF(g) + O_2(g) \longrightarrow Cl_2(g) + OF_2(g)$$

What is the standard enthalpy of reaction?

(A) 102.8 kJ
(B) 49.80 kJ
(C) 72.28 kJ
(D) 205.6 kJ

83. A first order reaction has rate constant $1 \times 10^{-2}\ s^{-1}$. What time will, it take for 20 g or reactant to reduce to 5 g ?

(A) 693.0 s
(B) 138.6 s
(C) 238.6 s
(D) 346.5 s

84. Which of the following salt contain interstitial water molecule in it?

(A) $BaCl_2 \cdot 2H_2O$
(B) $[Cu(H_2O)_2(NH_3)_5]Cl_2$
(C) $CuSO_4 \cdot 5H_2O$
(D) $[Cr(H_2O)_6]^{3+} \cdot 3Cl^-$

85. Which of the following is not present in baking powder?

(A) Potassium hydrogen tartrate
(B) Sodium hydrogen carbonate
(C) Starch
(D) Sodium carbonate

86. Identify the enzyme that catalyses the reaction of CO_2 with water in huma body.

(A) Carbonic anhydrase
(B) Ferroxidase
(C) Nitrogenase
(D) Catalase

87. Which among the following pairs of halogen forms the interhalogen compound of the type XX'_7 ?

(A) Cl and F
(B) I and F
(C) I and Cl
(D) Br and F

88. Which among the following is a biodegradable polymer?

(A) Polythene
(B) Teflon
(C) PVC
(D) Dextron

89. Which among the following ore is concentrated by froth floatation process?

(A) Bauxite
(B) Dolomite
(C) Galena
(D) Diaspore

90. Which of the following is called as mandelonitrile?

(A) Acetaldehyde cyanohydrine
(B) Acetone cyanohydrine
(C) Formaldehyde cyanohydrine
(D) Benzaldehyde cyanohydrine

91. Which among the following group-15 elements does not react with concentrated sulphuric acid?

(A) Phosphorus
(B) Arsenic
(C) Antimony
(D) Nitrogen

92. What will be the concentration of NaCl solution, if the molar conductivity and conductivity of NaCl solution is $124.3\Omega^{-1}\ cm^2\ mol^{-1}$ and $1.243 \times 10^{-4}\Omega^{-1}\ cm^2$ respectively?

(A) $0.1\ mol\ L^{-1}$
(B) $0.001\ mol\ L^{-1}$
(C) $0.01\ mol\ L^{-1}$
(D) $0.02\ mol\ L^{-1}$

93. Which among the following is an example of allylic alcohol?

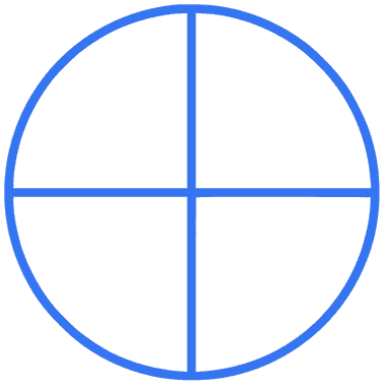
(A) Propane-1, 3-diol
(B) 2-methylbut-3-en-2-ol
(C) Propane-1, 2, 3-triol
(D) 2-phenyl propane-2-ol

94. Which among the following amino acids has lowest molar mass?

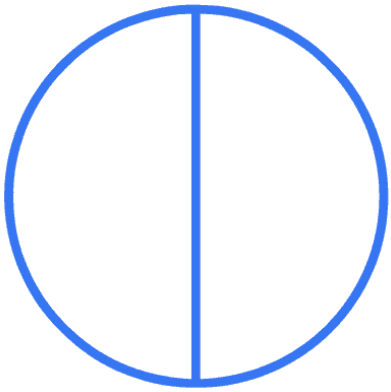
(A) Arginine
(B) Aspartic acid
(C) Asparagine
(D) Alanine

95. Identify the symbol used for water according to Dalton's atomic theory?

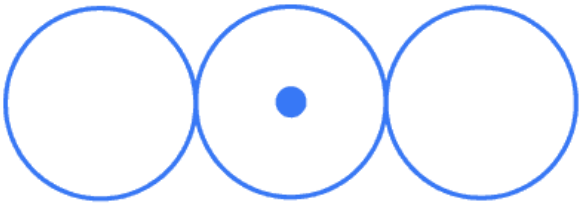
(A)



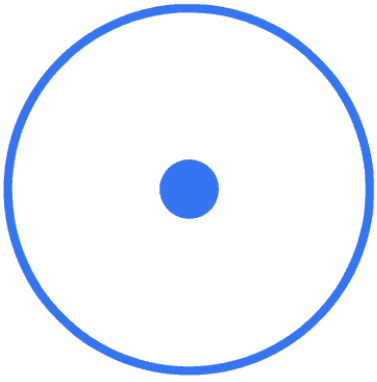
(B)



(C)



(D)



96. An ideal gas expands isothermally and reversibly from 10 m^3 to 20 m^3 at 300 K, performing 5.187 kJ of work on surrounding, calculate number of moles of gas used.

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

97. Which among the following type of linkages is present in cellulose?

(A) $1 \rightarrow 6\beta$-glycosidic linkages
(B) $1 \rightarrow 4\alpha$-glycosidic linkages
(C) $1 \rightarrow 6\alpha$-glycosidic linkages
(D) $1 \rightarrow 4\beta$-glycosidic linkages

98. Zirconium is refined by

(A) liquation process
(B) Mond process
(C) electrolytic refining process
(D) van Arkel method

99. If a centimolal aqueous solution of $K_3[Fe(CN)_6]$ has degree of dissociation 0.78. What is the value of van't Hoff factor?

(A) 1.2
(B) 4.0
(C) 3.34
(D) 2.5

100. Which among the following is antioxident?

(A) Pentaerythrityl stearate
(B) Penicillin
(C) BHA
(D) Aspirin

101. In a triangle ABC with usual notations, if
$$\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$$
, then area of triangle ABC with
$$a = \sqrt{6}$$
is

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

(C) $\frac{5\sqrt{3}}{2}$ sq units (D) $\frac{\sqrt{3}}{2}$ sq units

102. If
$$\frac{x}{\sqrt{1+x}} + \frac{y}{\sqrt{1+y}} = 0, x \neq y$$
, then
$$(1+x)^2\frac{dy}{dx} =$$

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

(C) -1 (D) 0

103. If
$$\int \frac{\sin\theta}{\sin 3\theta}d\theta = \frac{1}{2k}\log\left|\frac{k+\tan\theta}{k-\tan\theta}\right| + c$$
, then
$$k =$$

(A) $\sqrt{7}$ (B) $\sqrt{5}$

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

104. The probability that bomb will miss the target is 0.2. Then, the probability that out of 10 bombs dropped exactly 2 will hit the target is

(A) $\frac{288}{5^9}$ (B) $\frac{144}{5^{10}}$

(C) $\frac{288}{5^{10}}$ (D) $\frac{144}{5^9}$

105. The polar co-ordinates of the point whose cartesian co-ordinates are $(-2,-2)$, are given by

(A) $(2\sqrt{2}, \frac{\pi}{4})$ (B) $(2\sqrt{2}, \frac{7\pi}{6})$

(C) $(2\sqrt{2}, \frac{3\pi}{4})$ (D) $(2\sqrt{2}, \frac{5\pi}{4})$

106. If
$$\int \sqrt{x-\frac{1}{x}}\left(\frac{x^2+1}{x^2}\right)dx = \frac{2}{3}\left(x-\frac{1}{x}\right)^k + c$$
, then value of k is

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

(C) $\frac{5}{2}$ (D) $\frac{2}{5}$

107.
$$\int_0^a \sqrt{\frac{x}{a-x}}dx =$$

(A) πa (B) $2\pi a$

(C) $(\frac{\pi}{4})a$ (D) $(\frac{\pi}{2})a$

108. The minimum value of
$$Z = 5x + 8y$$
subject to $x + y \geq 5, 0 \leq x \leq 4, y \geq 2, x \geq 0, y \geq 0$ is

(A) 40 (B) 36

(C) 20 (D) 31

109. The sum of the cofactors of the elements of second row of the matrix
$$\begin{bmatrix} 1 & 3 & 2 \\ -2 & 0 & 1 \\ 5 & 2 & 1 \end{bmatrix}$$
is

(A) 5 (B) -23

(C) 3 (D) 23

110. If the foot of perpendicular drawn from the origin to the plane is $(3,2,1)$, then the equation of plane is

(A) $3x + 2y - z = 12$ (B) $3x - 2y - z = 12$

(C) $3x + 2y - z = 14$ (D) $3x + 2y + z = 14$

111. If
$$f(x) = \log(\sin x), x \in \left[\frac{\pi}{6}, \frac{5\pi}{6}\right]$$
, then value of 'c' by applying LMVT is

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

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

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

(A) $\cos^{-1}(\frac{1}{2})$ (B) $\cos^{-1}(-\frac{\sqrt{3}}{2})$

(C) $\cos^{-1}(-\frac{1}{2})$ (D) $\sin^{-1}(-\frac{1}{2})$

113. If $p \to (\sim p \vee q)$ is false, then the truth values of p and q are respectively

(A) F, F (B) F, T

(C) T, F (D) T, T

114. If the equation
$$kxy + 5x + 3y + 2 = 0$$
represents a pair of lines, then
$$k =$$
(A) $\frac{15}{2}$ (B) 15
(C) $0, -\frac{15}{2}$ (D) $1, \frac{15}{2}$

115. If
$$(a, -2a), a > 0$$
is the mid-point of a line segment intercepted between the co-ordinate axes, then the equation of the line is
(A) $x - 2y + 4a = 0$ (B) $2x - y = 4a$
(C) $x - 2y = 5a$ (D) $2x - y + 4a = 0$

116. If the vectors
$$\hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}}, \hat{\mathbf{i}} - \hat{\mathbf{j}} + \hat{\mathbf{k}}$$
and $2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + m\hat{\mathbf{k}}$ are coplanar, then
$$m =$$
(A) 3 (B) 2
(C) -3 (D) -2

117. The letters of the word 'LOGARITHM' are arranged at random. The probability that arrangement starts with vowel and end with consonant is
(A) $\frac{1}{9}$ (B) $\frac{7!}{9!}$
(C) $\frac{18}{9!}$ (D) $\frac{1}{4}$

118. If
$$\sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} = 4$$
, then
$$\frac{dy}{dx} =$$
(A) $\frac{7y-x}{y-7x}$ (B) $\frac{y-7x}{7x-y}$
(C) $\frac{y+7x}{7y-x}$ (D) $\frac{7x+y}{x-7y}$

119. If
$$x\cos\theta + y\sin\theta = 5, x\sin\theta - y\cos\theta = 3$$
, then the value of
$$x^2 + y^2 =$$
(A) 34 (B) 12
(C) 8 (D) 17

120. The area of the region bounded by the curve
$$y = 4x^3 - 6x^2 + 4x + 1$$
and the lines
$$x = 1, x = 5$$
and X-axis is
(A) 334 sq units (B) 400 sq units
(C) 428 sq units (D) 378 sq units

121.
$$\int_2^3 \frac{x}{x^2 - 1} dx =$$
(A) $(\frac{1}{3})\log(\frac{8}{3})$ (B) $(-\frac{1}{3})\log(\frac{8}{3})$
(C) $(\frac{1}{2})\log(\frac{8}{3})$ (D) $(-\frac{1}{2})\log(\frac{8}{3})$

122. The angles between the lines
$$\mathbf{r} = (\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}) + \lambda(\hat{\mathbf{i}} + \hat{\mathbf{j}} + 2\hat{\mathbf{k}})$$
and $\mathbf{r} = (3\hat{\mathbf{i}} + \hat{\mathbf{k}}) + \lambda'(2\hat{\mathbf{i}} + \hat{\mathbf{j}} - \hat{\mathbf{k}}), \lambda, \lambda' \in \mathbf{R}$
is
(A) $\cos^{-1}(\frac{1}{5})$ (B) $\cos^{-1}(\frac{2}{3})$
(C) $\cos^{-1}(\frac{1}{3})$ (D) $\cos^{-1}(\frac{1}{6})$

123. The p.d.f of c.r.v X is given by
$$f(x) = \frac{x+2}{18}$$
, if
$$-2 < x < 4 = 0$$
, otherwise
$$= 0$$
, then
$$P[|x| < 1] =$$
(A) $\frac{2}{9}$ (B) $\frac{4}{9}$
(C) $\frac{1}{9}$ (D) $\frac{1}{18}$

124. The approximate value of the function
$$f(x) = x^3 - 3x + 5$$
at
$$x = 1.99$$
is
(A) 7.91 (B) 7.94
(C) 6.94 (D) 6.91

125. If for an arithmetic progression, 9 times nineth term is equal to 13 times thirteenth term, then value of twenty second term is
(A) 5 (B) 0
(C) 4 (D) 2

126. If
$$A = \begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$$
and
$$A^{-1} = \begin{bmatrix} 3 & -1 & 1 \\ \alpha & 6 & -5 \\ \beta & -2 & 2 \end{bmatrix}$$
, then the values of α and β are, respectively.
(A) $-15, -5$ (B) $-15, 5$
(C) $15, -5$ (D) $15, 5$

127. The differential equation obtained from the function

$$y = a(x-a)^2$$

is

(A) $8y^2 = (\frac{dy}{dx})^2[x + \frac{1}{4y}(\frac{dy}{dx})^2]^2$

(B) $4y^2 = (\frac{dy}{dx})^2[x - \frac{1}{4y}(\frac{dy}{dx})^2]^2$

(C) $2y^2 = (\frac{dy}{dx})^2[x - \frac{1}{4y}(\frac{dy}{dx})^2]^2$

(D) $8y^2 = (\frac{dy}{dx})^2[x - \frac{1}{4y}(\frac{dy}{dx})^2]^2$

128. In a quadrilateral $ABCD$, M and N are the mid-points of the sides AB and CD respectively. If

$$\mathbf{AD + BC} = t\mathbf{MN}$$

, then

$$t =$$

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

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

129. If

$$f(x) = \log(\sec x + \tan x)$$

, then

$$f'\left(\frac{\pi}{4}\right) =$$

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

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

130. If

$$f(x) = \frac{2x+3}{3x-2}, x \neq \frac{2}{3}$$

, then the function f of is

(A) a constant function (B) an exponential function

(C) an even function (D) an identity function

131.

$$\int \cot x \cdot \log[\log(\sin x)]dx =$$

(A) $\log(\sin x)[\log(\log(\sin x)) - 1] + c$

(B) $\log(\sin x)[\log(\log(\sin x)) + 1] + c$

(C) $\log(\sin x)[\log(\sin x)) + 1] + c$

(D) $\log(\sin x)[\log(\sin x) - 1] + c$

132. If

$$\sin\theta = -\frac{12}{13}, \cos\phi = -\frac{4}{5}$$

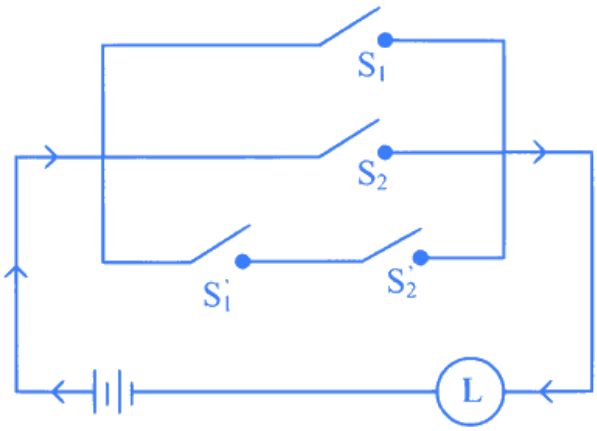
and θ, ϕ lie in the third quadrant, then

$$\tan(\theta - \phi) =$$

(A) $-\frac{56}{33}$ (B) $\frac{33}{56}$

(C) $-\frac{33}{56}$ (D) $\frac{56}{33}$

133. The symbolic form of the following circuit is (where p, q represents switches S_1 and s_2 closed respectively)



(A) $(p \wedge q) \wedge (\sim p \wedge \sim q) \equiv I$

(B) $p \wedge [q \wedge (\sim p \wedge \sim q) \equiv I$

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

(D) $p \vee [q \wedge (\sim p \wedge \sim q) \equiv I$

134. The differential equation of all lines perpendicular to the line

$$5x + 2y + 7 = 0$$

is

(A) $2dy - 5dx = 0$ (B) $5dy - 2dx = 0$

(C) $2dy - 3dx = 0$ (D) $3dy - 2dx = 0$

135.

$$\int_0^{\frac{\pi}{2}} \log\left[\sqrt{\frac{1-\cos 2x}{1+\cos 2x}}\right]dx =$$

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

(C) 0 (D) $\frac{\pi}{8}$

136. If $[\vec{a}\ \vec{b}\ \vec{c}\ ] \neq 0$, then

$$\frac{[\vec{a} + \vec{b}\ \vec{b} + \vec{c}\ \vec{c} + \vec{a}\ ]}{[\vec{b}\ \vec{c}\ \vec{a}\ ]} =$$

(A) 1 (B) 0

(C) 4 (D) 2

137. The cartesian co-ordinates of the point on the parabola

$$y^2 = x$$

whose parameter is

$$-\frac{4}{3}$$

are

(A) $(\frac{4}{9}, \frac{4}{3})$ (B) $(\frac{4}{9}, -\frac{2}{3})$

(C) $(\frac{4}{3}, \frac{4}{9})$ (D) $(\frac{4}{3}, -\frac{4}{3})$

138. The angle between the line

$$r = (\hat{\mathbf{i}} + \hat{\mathbf{j}} - \hat{\mathbf{k}}) + \lambda(3\hat{\mathbf{i}} + \hat{\mathbf{j}})$$

and the plane

$$\mathbf{r} \cdot (\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}) = 8$$

is

(A) $\sin^{-1}(\frac{2\sqrt{7}}{\sqrt{5}})$ (B) $\sin^{-1}(\frac{\sqrt{5}}{2\sqrt{7}})$

(C) $\sin^{-1}(\frac{3\sqrt{7}}{\sqrt{5}})$ (D) $\sin^{-1}(\frac{\sqrt{7}}{3\sqrt{5}})$

139. The bacteria increases at the rate proportional to the number of bacteria present. If the original number 'N' doubles in 4 h, then the number of bacteria in 12 h will be

(A) 4N (B) 8N

(C) 6N (D) 3N

140. If

$$A = \{x, y, z\}, B = \{1,2\}$$

, then the total number of relations from set A to set B are :

(A) 8 (B) 64

(C) 32 (D) 16

141. The equation of tangent at $P(-4, -4)$ on the curve

$$x^2 = -4y$$

is

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

(C) $3x - y + 8 = 0$ (D) $2x + y + 4 = 0$

142. The rate of decay of certain substance is directly proportional to the amount present at that instant. Initially, there are 27 gm of certain substance and 3 h later it is found that 8 gm are left, then the amount left after one more hour is

(A) $\frac{20}{3}$ gm (B) $\frac{16}{3}$ gm

(C) $\frac{19}{3}$ gm (D) $\frac{17}{3}$ gm

143. The direction cosines of a line which is perpendicular to lines whose direction ratios are $3, -2, 4$ and $1, 3, -2$ are

(A) $\frac{4}{\sqrt{297}}, \frac{5}{\sqrt{297}}, \frac{16}{\sqrt{297}}$ (B) $\frac{8}{\sqrt{285}}, \frac{10}{\sqrt{285}}, \frac{11}{\sqrt{285}}$

(C) $\frac{-8}{\sqrt{285}}, \frac{10}{\sqrt{285}}, \frac{11}{\sqrt{285}}$ (D) $\frac{-8}{\sqrt{285}}, \frac{-10}{\sqrt{285}}, \frac{11}{\sqrt{285}}$

144. The points of discontinuity of the function

$$f(x) = \frac{1}{x-1}, \text{ if } 0 \le x \le 2$$

$$= \frac{x+5}{x+3} \text{ if } 2 < x \le 4$$

in its domain are

(A) $x = 1, x = 2$ (B) $x = 0, x = 2$

(C) $x = 2$ only (D) $x = 4$ only

145. If the angle between the lines given by the equation

$$x^2 - 3xy + \lambda y^2 + 3x - 5y + 2 = 0, \lambda \ge 0$$

, is

$$\tan^{-1}\left(\frac{1}{3}\right)$$

, then

$$\lambda =$$

(A) $1, \frac{2}{5}$ (B) 10

(C) 2 (D) $\frac{2}{3}, 40$

146. If the p.m.f of a. r.v. X is given by

$$P(X = x) = \frac{{}^5C_x}{2^5}$$

if

$$x = 0,1,2, \ \ldots \ \ldots ..5 = 0$$

,

0 , otherwise,

then which of the following is not true?

(A) $P(X \le 2) = P(X \ge 3)$

(B) $P(X \le 1) = P(X \ge 4)$

(C) $P(X \le 2) \ge P(X \ge 4)$

(D) $P(X \le 3) \le P(X \ge 3)$

147. The radius of the circle passing through the points $(5, 7), (2, -2)$ and $(-2, 0)$ is

(A) 2 units (B) 5 units

(C) 3 units (D) 4 units

148. The integrating factor of the differential equation

$$(1 + x^2)dt = (\tan^{-1} x - t)dx$$

is

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

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

149. In a triangle ABC, if

$$\frac{\sin A - \sin C}{\cos C - \cos A} = \cot B$$

, then A, B, C, are in

(A) Geometric progression

(B) Arithmetic progression

(C) Arithmetic-Geometric progression

(D) Harmonic progression

150. If the lines given by

$$\frac{x-1}{2\lambda} = \frac{y-1}{-5} = \frac{z-1}{2}$$

and

$$\frac{x+2}{\lambda} = \frac{y+3}{\lambda} = \frac{z+5}{1}$$

are parallel, then the value of λ is

(A) $\frac{2}{5}$

(B) $-\frac{5}{2}$

(C) $-\frac{2}{5}$

(D) $\frac{5}{2}$

- End of Question Paper -

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