# MHT CET 2019 PCM May 3 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 2019**, 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.** In amplitude modulation, the amplitude of carrier wave is $A_c$ and that of the modulating signal is $A_m$. In practice, the ratio of $A_m$ to $A_c$ is kept less than or equal to one, to avoid

(A) distortion
(B) attenuation
(C) fading
(D) noise

**2.** A pipe open at both ends and a pipe closed at one end have same length. The ratio of frequencies of their $P^{\text{th}}$ overtone is

(A) $\frac{p+1}{2p}$
(B) $\frac{p+1}{2p+1}$
(C) $\frac{2(p+1)}{2p+1}$
(D) $\frac{p}{2p+1}$

**3.** Glass has refractive index $\mu$ with respect to air and the critical angle for a ray of light going from glass to air is $\theta$. If a ray of light is incident from air on the glass with angle of incidence $\theta$, corresponding angle of refraction is

(A) $\sin^{-1}(\mu)$
(B) $\sin^{-1}(\frac{1}{\mu^2})$
(C) $\sin^{-1}(\frac{1}{\sqrt{\mu}})$
(D) $\sin^{-1}(\frac{1}{\mu})$

**4.** Maximum kinetic energy gained by the charged particle in the cyclotron is independent of

(A) radius of the dees
(B) charge
(C) mass
(D) frequency of revolution

**5.** A molecule of water on the surface experiences a net

(A) downward resultant unbalanced adhesive force
(B) upward resultant unbalanced cohesive force
(C) downward resultant unbalanced cohesive force
(D) upward resultant unbalanced adhesive force

**6.** The magnifying power of a telescope is nine. When it is adjusted for parallel rays, the distance between the objective and eyepiece is 20 cm . The focal length of objective and eyepiece are respectively

(A) 10 cm, 10 cm
(B) 18 cm, 2 cm
(C) 15 cm, 5 cm
(D) 11 cm, 9 cm

**7.** The SI unit and dimensions of Stefan's constant $\sigma$ in case of Stefan's law of radiation is

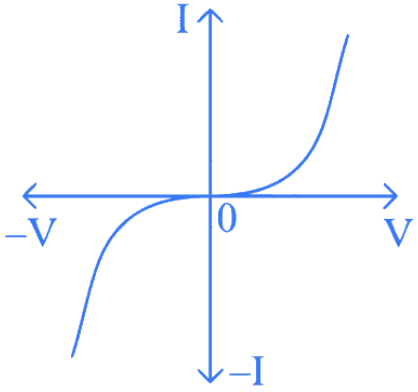
(A) $\frac{\text{J}}{\text{m}^3\,\text{s}^4}$, $[M^1L^0T^{-3}K^{-4}]$
(B) $\frac{\text{J}}{\text{m}^2\,\text{s}^4\,\text{K}}$, $[M^1L^0T^{-3}K^3]$
(C) $\frac{\text{J}}{\text{m}^3\,\text{s}\,\text{K}^4}$, $[\text{M}^1\text{L}^0\ \text{T}^{-3}\ \text{K}^4]$
(D) $\frac{\text{J}}{\text{m}^2\,\text{s}\,\text{K}^4}$, $[\text{M}^1\ \text{L}^0\ \text{T}^{-3}\ \text{K}^{-4}]$

**8.** In a hydrogen atom, an electron of charge $e$ revolves in a orbit of radius $r$ with speed $v$. Then, magnetic moment associated with electron is

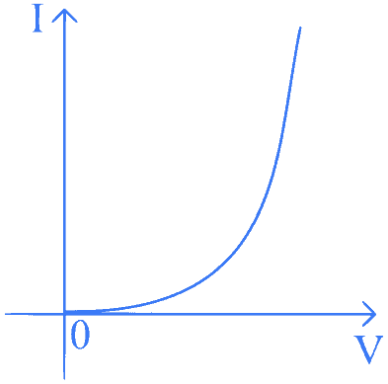
(A) $\frac{evr}{2}$
(B) 2 evr
(C) evr
(D) $\frac{evr}{3}$

**9.** $V - I$ characterstics of LED is shown correctly by graph

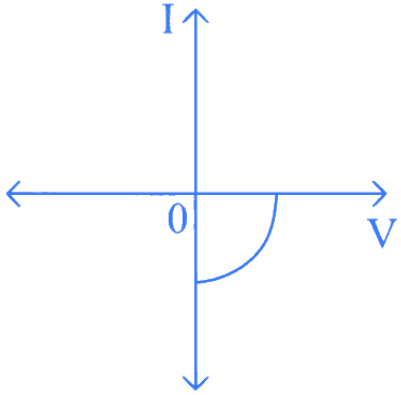
(A)



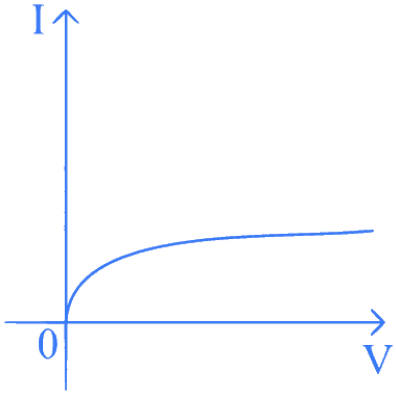

(B)




(C)




(D)




**10.** The stopping potential of the photoelectrons, from a photo cell is

(A) directly proportional to intensity of incident light

(B) directly proportional to frequency of incident light

(C) inversely proportional to frequency of incident light

(D) Inversely proportional to intensity of incident light

**11.** The refractive index of the material of crystal is 1.68 and that of castor oil is 1.2. When a ray of light passes from oil to glass, its velocity will change by a factor

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

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

(C) $\frac{5}{6}$

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

**12.** Consider a particle of mass $m$ suspended by a string at the equator. Let $R$ and $M$ denote radius and mass of the earth. If $\omega$ is the angular velocity of rotation of the earth about its own axis, then the tension on the string will be $(\cos 0^\circ = 1)$

(A) $\frac{GMm}{R^2}$

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

(C) $\frac{GMm}{2R^2} + m\omega^2 R$

(D) $\frac{GMm}{R^2} - m\omega^2 R$

**13.** Six very long insulated copper wires are bound together to form a cable. The currents carried by the wires are $I_1 = +10$ A, $I_2 = -13$ A, $I_3 = +10$ A, $I_4 = +7$ A, $I_5 = -12$ A and $I_6 = +18$ A. The magnetic induction at a perpendicular distance of 10 cm from the cable is $(\mu_0 = 4\pi \times 10^{-7}$ Wb/A – m$)$

(A) $40\mu$ T

(B) $37.5\mu$ T

(C) $30\mu$ T

(D) $35\mu$ T

**14.** The fundamental frequency of sonometer wire increases by 9 Hz , if its tension is increased by 69%, keeping the length constant. The frequency of the wire is

(A) 42 Hz

(B) 24 Hz

(C) 30 Hz

(D) 36 Hz

**15.** In case of dimensions of electric field and electric dipole moment the power of mass is reswpectively,

(A) 1, 1

(B) 1, 0

(C) 0, 1

(D) 0, 0

**16.** A potentiometer wire has length $L$ For given cell of emf $E$, the balancing length is $\frac{L}{3}$ from the positive end of the wire. If the length of potentiometer wire is increased by 50%, then for the same cell, the balance point is obtained at length

(A) $\frac{L}{2}$ from positive end (B) $\frac{L}{5}$ from positive end

(C) $\frac{L}{3}$ from positive end (D) $\frac{L}{4}$ from positive end

**17.** For homogeneous isotropic material, which one of the following cannot be the value of Poisson's ratio?

(A) 0.1 (B) $-1$

(C) 0.5 (D) 0.8

**18.** A mass is whirled in a circular path with constant angular velocity and its linear velocity is $v$. If the string is now halved keeping the angular momentum same, the linear velocity is

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

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

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

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

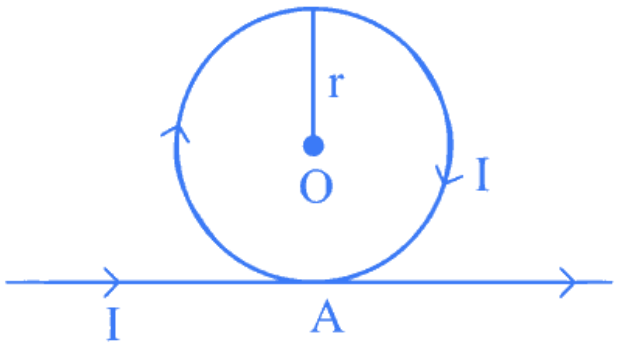
(C) $\pi$ (D) $\frac{4}{\pi}$

**20.** In Young's double slit experiment fifth dark fringe is formed opposite to one of the slit. IID is the distance between the slits and the screen and $d$ is the separation between the slits, then the wavelength of light used is

(A) $\frac{d^2}{5D}$ (B) $\frac{d^2}{9D}$

(C) $\frac{d^2}{6D}$ (D) $\frac{d^2}{15D}$

**21.** Figure show the circular coil carrying current $I$ kept very close but not touching at a point $A$ on a straight conductor carrying the same current $I$. The magnitude of magnetic induction at the centre of the circular coil will be




(A) $\frac{\mu_0 I}{2r}(1+\frac{1}{\pi})$ (B) $\frac{\mu_0 I}{2\pi r}$

(C) $\frac{\mu_0 I}{2r}$ (D) zero

**22.** A 220 V input is supplied to a transformer. The output circuit draws a current of 2.0 A at 440 V . If the ratio of output to input power is 0.8 , then the current drawn by primary winding is

(A) 3.6 A (B) 5.0 A

(C) 2.5 A (D) 2.8 A

**23.** A sonometer wire is in unison with a tuning fork, when it is stretched by weight $w$ and the corresponding resonating length is $L_4$. If the weight is reduced to $\left(\frac{w}{4}\right)$, the corresponding resonating length becomes $L_2$. The ratio $\left(\frac{L_1}{L_2}\right)$ is

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

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

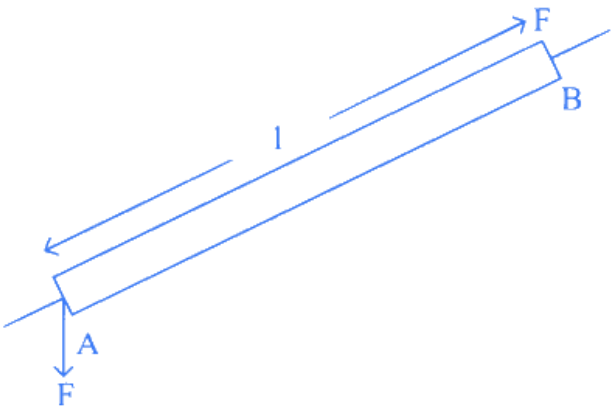
**24.** If the speed of an electron of hydrogen atom in the ground state is $2.2 \times 10^6$ m/s, then its speed in the third excited state will be

(A) $5.5 \times 10^6$ m/s (B) $5.5 \times 10^5$ m/s

(C) $8.8 \times 10^5$ m/s (D) $6.8 \times 10^6$ m/s

**25.** A rod $l$ m long is acted upon by a couple as shown in the figure. The moment of couple is $\tau$ Nm. If the force at each end of the rod, then magnitude of each force is

$(\sin 30^\circ = \cos 60^\circ = 0.5)$




(A) $\frac{\tau}{l}$ (B) $\frac{l}{2\tau}$

(C) $\frac{2\tau}{l}$ (D) $\frac{2}{\tau}$

**26.** The vectors $(\mathbf{A}+\mathbf{B})$ and $(\mathbf{A}-\mathbf{B})$ are at right. angles to each other. This is possible under the condition

(A) $|A| = |B|$ (B) $A \cdot B = 0$

(C) $A \cdot B = 1$ (D) $A \times B = 0$

**27.** A coil has inductance 2 H . The ratio of its reactance, when it is connected first to an $AC$ source and then to DC source, is

(A) zero (B) 1

(C) less than 1 (D) infinity

**28.** A person measures a time period of a simple pendulum inside a stationary lift and finds it to be $T$. If the lift starts accelerating upwards with an acceleration $\left(\frac{g}{3}\right)$, the time period of the pendulum will be

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

(C) $\sqrt{3}T$ (D) $\frac{T}{3}$

**29.** A charged conductor produces an electric field of intensity $10^3$ V/m just outside its surface in vacuum. Then, it produces the electric field of intensity E just outside its surface, when it is placed in a medium of dielectric constant 4. The value of $E$ will be

(A) 400 V/m (B) 450 V/m

(C) 250 V/m (D) 150 V/m

**30.** In damped SHM, the SI unit of damping constant is

(A) $\frac{\text{N}}{\text{s}}$ (B) $\frac{\text{kg}}{\text{s}}$

(C) $\frac{\text{kg}}{\text{m}}$ (D) $\frac{N}{m}$

**31.** A wire of length $L$ and radius $r$ is rigidly fixed at one end. On stretching the other end of the wire with a force $F$, the increase in length is $I$ . If another wire of the same material but double the length and radius is stretched with a force $2F$, then increase in length is

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

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

**32.** When certain metal surface is illuminated with a light of wavelength $\lambda$, the stopping potential is $V$, When the same surface is illuminated by light of wavelength $2\lambda$, the stopping potential is $\left(\frac{V}{3}\right)$. The threshold wavelength for the surface is

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

(C) $4\lambda$ (D) $6\lambda$

**33.** Which of the following regions of a transistors are, respectively, heavily dopped and lightly dopped?

(A) Collector and emitter (B) Base and emitter

(C) Emitter and base (D) Emitter and collector

**34.** A hole is drilled half way to the centre of the earth. A body weighs 300 N on the surface of the earth. How much will, it weigh at the bottom of the hole?

(A) 200 N (B) 250 N

(C) 120 N (D) 150 N

**35.** Eight identical drops of water falling through air with uniform velocity of 10 cm/s combine to form a single drop of big size, then terminal velocity of the big drop will be

(A) 80 cm/s (B) 10 cm/s

(C) 30 cm/s (D) 40 cm/s

**36.** A solid sphere rolls down from top of inclined plane, 7 m high, without slipping. Its linear speed at the foot of plane is $\left(g = 10\ \text{m/s}^2\right)$

(A) $\sqrt{70}$ m/s (B) $\sqrt{\frac{140}{3}}$ m/s

(C) $\sqrt{\frac{280}{3}}$ m/s (D) $\sqrt{100}$ m/s

**37.** A body of mass $m$ is performing a UCM in a circle of radius $r$ with speed $v$. The work done by the centripetal force in moving it through $\left(\frac{2}{3}\right)$ rd of the circular path is

(A) zero
(B) $mv^2\pi r$
(C) $\frac{2\pi mv^2 r}{3}$
(D) $\frac{2mv^2\pi}{3}$

**38.** Which of the following is the dimensional formula for electric polarisation?

(A) $[M^0L^{-2}T^1I^1]$
(B) $[M^{-1}L^{-2}T^1I^{-1}]$
(C) $[M^0L^{-1}T^{-1}I^1]$
(D) $[M^1L^{-2}T^1I^1]$

**39.** The phenomenon of interference is based on

(A) conservation of momentum
(B) quantum nature of light
(C) conservation of energy
(D) conservation of charge

**40.** A vector $P$ has $X$ and $Y$ components of magnitude 2 units and 4 units respectively. A vector $Q$ along negative $X$-axis has magnitude 6 units. The vector $(\mathbf{Q}-\mathbf{P})$ will be

(A) $4(2\hat{i}-\hat{j})$
(B) $-4(2\hat{\mathbf{i}}-\hat{\mathbf{j}})$
(C) $4(2\hat{i}+\hat{j})$
(D) $-4(2\hat{i}+\hat{j})$

**41.** A magnetizing field of 5000 A/m produces a magnetic flux of $4\times10^{-5}$ Wb in an iron rod of cross-sectional area 0.4 $cm^2$. The permeabilit of the rod in Wb/A-m, is

(A) $4\times10^{-6}$
(B) $1\times10^{-3}$
(C) $2\times10^{-4}$
(D) $3\times10^{-5}$

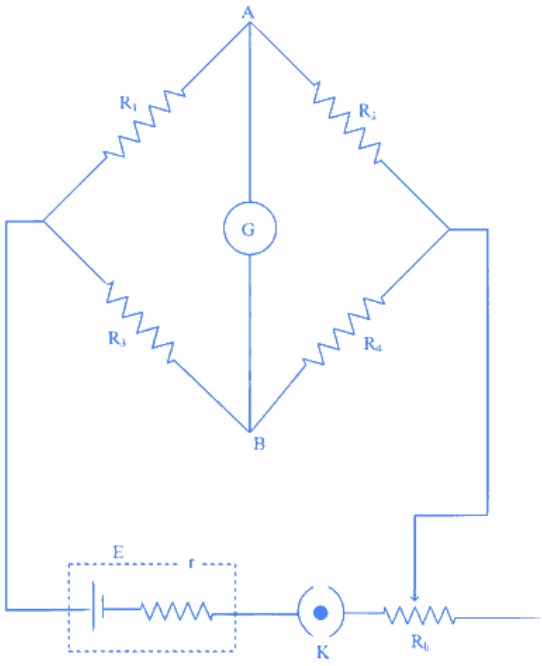
**42.** When a large bubble rises from bottom of a water lake to its surface, then its radius doubles. If the atmospheric pressure is equal to the pressure of height $H$ of a certain water column, then the depth of lake will be

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

**43.** A block of mass $M$ is pulled along a smooth horizontal surface with a rope of mass $m$ by force $F$. The acceleration of the block will be

(A) $\frac{F}{(M-m)}$
(B) $\frac{F}{(M+m)}$
(C) $\frac{F}{m}$
(D) $\frac{F}{M}$

**44.** In the network shown cell E has internal resistance $r$ and the galvanometer shows zero deflection. If the cell is replaced by a new cell of emf $2E$ and internal resistance $3r$ keeping everything else identical, then




(A) The galvanometer will show deflection of 10 divisions.
(B) The galvanometer show zero deflection,
(C) Current will flow from $B$ to $A$.
(D) Current will flow from $A$ to $B$.

**45.** In hydrogen emission spectrum, for any series, the principal quantum number is $n$. Corresponding maximum wavelength $\lambda$ is ( $R=$ Rydberg's constant)

(A) $\frac{R(2n+1)}{n^2(n+1)}$
(B) $\frac{n^2(n+1)^2}{R(2n+1)}$
(C) $\frac{n^2(n+1)}{R(2n+1)}$
(D) $\frac{R(2n+1)}{n^2(n+1)^2}$

**46.** $\left[\mathrm{L^2M^1\ T^{-2}}\right]$ are the dimensions of

(A) torque
(B) force
(C) angular acceleration
(D) angular momentum

**47.** For formation of beats, two sound notes must have

(A) different amplitudes and different frequencies
(B) exactly equal frequencies only
(C) exactly equal amplitudes only
(D) nearly equal frequencies and equal amplitudes

**48.** If the radius of the circular path and frequency of revolution of a particle of mass $m$ are doubled, then the change in its kinetic energy will be ($E_i$ and $E_1$ are the initial and final kinetic energies of the particle respectively,)

(A) 12 $E_f$ (B) 13 $E_i$

(C) 8 $E_f$ (D) 15 $E_i$

**49.** The total energy of a simple harmonic oscillaior is proportional to

(A) square of this ampitude (B) square root of displacement

(C) amplitude (D) frequency

**50.** The rms speed of oxygen molecule in a gas is $u$, If the temperature is doubled and the molecules dissociates into two atoms, the rms speed will be

(A) 4u (B) u

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

**51.** .What is the shape and magnetic nature of permanganate ion?

(A) Pyramidal diamagnetic
(B) Tetrahedral, diamagnetic
(C) Tetrahedral, paramagnetic
(D) Planar, paramagnetic

**52.** Which of the following oxides can act both as an oxidising agent as well as reducing agent?

(A) $N_2O$
(B) $SO_2$
(C) $SO_3$
(D) $P_2O_5$

**53.** "The mass and energy both are conserved in an isolated system", is the statement of

(A) second law of thermodynamics
(B) third law of thermodynamics
(C) modified first law of thermodynamics
(D) first law of thermodynamics

**54.** Which among the following is correct for electrolysis of brine solution?

(A) $O_2$ gas is liberated at cathode
(B) Sodium metal is collected at anode
(C) $H_2$ gas is liberated at cathode
(D) $Cl_2$ gas is liberated at cathode

**55.** The number of pi-bonds present in benzoic acid molecule are

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

**56.** The elevation in boiling point of 0.25 molal aqueous solution of a substance is $\left(K_o = 0.52 \text{ K kg mol}^{-1}\right)$

(A) 0.15 K
(B) 0.50 K
(C) 0.13 K
(D) 2.08 K

**57.** The combining ratios of hydrogen and oxygen in water and hydrogen peroxide are 1 : 8 and 1 : 16. Which law is illustrated in this example?

(A) Law of definite proportions
(B) Law of conservation of mass
(C) Gay Lussac's law of combining volumes of gases
(D) Law of multiple proportions

**58.** If a metal crystallises in bcc structure with edge length of unit cell $4.29 \times 10^{-8}$ cm the radius of metal atom is

(A) $3.2 \times 10^{-7}$ cm
(B) $1.86 \times 10^{-8}$ cm
(C) $1.07 \times 10^{-7}$ cm
(D) $1.07 \times 10^{-8}$ cm

**59.** The temperature of $32^\circ$C is equivalent to

(A) $89.6^\circ$F
(B) $85.6^\circ$F
(C) $70^\circ$F
(D) $69^\circ$F

**60.** The element which does not belong to group 15 is

(A) As
(B) P
(C) Bi
(D) Se

**61.** The precipitation power of an electrolyte increases with

(A) rise in temperature
(B) atomic radii
(C) ionic radii
(D) charge of an ion

**62.** In leaching of alumina from bauxite by Bayer's process, then ore is treated with

(A) $NaOH(aq)$
(B) $NaCN(aq)$
(C) $KCN(aq)$
(D) $Na_2CO_3(aq)$

**63.** The diagonal relationship in Be and Al is due to

(A) similar ionisation enthalpy
(B) similar metallic character
(C) similar ionic size and charge/radius ratio
(D) similar electronegativity

**64.** Carbolic acid is oxidised by acidified sodium dichromate to give

(A) acetone
(B) ethyl methyl ketone
(C) benzoquinone
(D) anthraquinone

**65.** The highest oxidation state in plutonium (At. no. = 94) is

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

**66.** In the electrolysis of aqueous sodium chloride with inert electrodes the products obtained at anode and cathode respectively are

(A) $Cl_2$ and Na
(B) $O_2$ and Na
(C) $Cl_2$ and $H_2$
(D) Na and $Cl_2$

**67.** What type of hybridisation is present in carbocation formed during the alkaline hydrolysis of 1 - bromo-1-phenyl ethane?

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

**68.** The integrated rate equation for first order reaction, $A \rightarrow$ product, is

(A) $k = \frac{1}{t}\ln\frac{[A]_t}{[A]_0}$
(B) $k = \frac{2.303}{t} + \log_{10}\frac{[A]_0}{[A]_t}$
(C) $k = -\frac{1}{t}\ln\frac{[A]_t}{[A]_0}$
(D) $k = 2.303t\log_{10}\frac{[A]_0}{[A]_t}$

**69.** Calculate E.M.F. of following cell at 298 K $Zn(s)\,|ZnSO_4(0.01M)|\,|CuSO_4(1.0M)|\,Cu(s)$ if $E^\circ$ cell $= 2.0$ V

(A) 2.0 V
(B) 2.0592 V
(C) 2.0296 V
(D) 1.0508 V

**70.** Which mixture is used for respiration by deep sea divers?

(A) $Ne + O_2$
(B) $Kr + O_2$
(C) $Ar + O_2$
(D) $He + O_2$

**71.** Which element among the following is not present in saccharine?

(A) C
(B) N
(C) P
(D) S

**72.** Which among the following statements is true about Schottky defect?

(A) In this defect cation and anion are lacking in stoichiometric proportion
(B) Formation of metal alloy is example of this defect
(C) In this cation or anion moves from regular site to place between lattice site
(D) In this regular cation is replaced by different cation

**73.** Which among the following salts, solubility decreases with increase in temperature?

(A) $Na_2SO_4$
(B) NaBr
(C) NaCl
(D) KCl

**74.** Soaps are the sodium or potassium salts of higher fatty acids, containing number of carbon atoms more than,

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

**75.** Oxidation state of nitrogen in nitric oxide is

(A) +2
(B) +3
(C) +4
(D) −2

**76.** Which of the following does not give yellow solid on treatment with sodium hypoiodite?

(A) Acetophenone
(B) Pentan-3-one
(C) Pentan-2-one
(D) Ethanal

**77.** The shape of $BrF_5$ molecule is

(A) trigonal pyramidal
(B) square pyramidal
(C) trigonal bipyramidal
(D) square planar

**78.** The alkane formed on heating sodium butanoate with sodalime is

(A) methane
(B) ethane
(C) propane
(D) butane

**79.** A gas performs 0.320 kJ work on surrounding and absorbs 120 J of heat from the surrounding. Hence, change in internal energy is

(A) 200 J
(B) 120.32 J
(C) −200 J
(D) 440 J

**80.** For the elementary reaction, $3H_2(g) + N_2(g) \longrightarrow 2NH_3(g)$ identify the correct relation among the following relations:

(A) $\frac{-3}{2}\frac{d[H_2(g)]}{dt} = \frac{d[NH_3(g)]}{dt}$
(B) $\frac{-2}{3}\frac{d[H_2(g)]}{dt} = \frac{d[NH_3(g)]}{dt}$
(C) $\frac{d[NH_3(g)]}{dt} = \frac{-1}{3}\frac{d[H_2(g)]}{dt}$
(D) $\frac{-d[H_2(g)]}{dt} = \frac{d[NH_3(g)]}{dt}$

**81.** Natalite is a mixture of

(A) acetic acid and diethyl ether
(B) ethyl bromide and diethyl ether
(C) ethyl alcohol and dimethyl ether
(D) diethyl ether and ethyl alcohol

**82.** In which among the following compounds, oxidation number of nitrogen is +5 ?

(A) $N_2O$
(B) $N_2O_3$
(C) $NO_2$
(D) $HNO_3$

**83.** 18 gram glucose (Molar mass = 180 ) is dissolved in 100 ml of water at 300 K . If $R = 3$ 0.0821 $L-atm\ mol^{-1}\ K^{-1}$ what is the osmotic pressure of solution?

(A) 2.463 atm
(B) 24.63 atm
(C) 8.21 atm
(D) 0.821 atm

**84.** A flavouring agent found in oil of wintergreen is

(A) methyl salicylate
(B) acetophenone
(C) vanillin
(D) menthol

**85.** Which of the following is not the mineral of iron?

(A) Limonite
(B) Magnetite
(C) Corundum
(D) Haematite

**86.** Which of the following metal halide is more covalent?

(A) $SnCl_2$
(B) $PbCl_2$
(C) $SbCl_3$
(D) $SbCl_5$

**87.** How many primary amines are possible for molecular formula $C_3H_9N$ ?

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

**88.** The conversion of 2-methylpropan-1-ol to 2-methylpropan-2-ol is

(A) addition reaction
(B) rearrangement reaction
(C) substitution reaction
(D) elimination reaction

**89.** A polymer which becomes soft on heating and hard on cooling, belongs to class of

(A) fibers
(B) thermosetting polymer
(C) elastomer
(D) thermoplastic polymer

**90.** The effective atomic number of Iron$(z = 26)$ in $[Fe(CN)_6]^{-3}$ is

(A) 36
(B) 33
(C) 35
(D) 34

**91.** Which bond in a molecule of ethyl magnesium bromide is ionic in nature?

(A) C – C bond
(B) C – Mg bond
(C) Mg – Br bond
(D) C – H bond

**92.** Based on first law of thermodynamics which of the following is correct

(A) for an isobaric process, $q_p = \Delta U + w$
(B) for an adiabatic process, $\Delta U = -w$
(C) for an isochoric process, $\Delta U = -q_v$
(D) for an isothermal process, $q = +w$

**93.** IUPAC name of the complex $Ba[\ CuCl_4]$ is

(A) barium tetrachlorocuprate (II)
(B) tetrachlorobariumcuprate (III)
(C) barium tetrachlorocuprate (III)
(D) tetrachlorobarium copper (II)

**94.** Hinsberg's reagent is

(A) benzene sulphonyl chloride
(B) benzene sulphonic acid
(C) sodium benzene sulphonate
(D) benzene sulphonamide

**95.** Which among the following polymer does not show cross linking in it ?

(A) Nylon-6
(B) Bakelite
(C) Melamine
(D) Vulcanised Rubber

**96.** The vitamin that belongs to aromatic series is

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

**97.** Which of the following is not present in DNA?

(A) Thymine
(B) Guanine
(C) Adenine
(D) Uracil

**98.** The SI unit of electrochemical equivalent is

(A) $J\ s^{-1}$
(B) $kg\ C^{-1}$
(C) $kg\ ms^{-2}$
(D) $kg\ m^{-1}\ s^{-2}$

**99.** The correct order of boiling points of alkyl halides is

(A) RI > RBr > RF > RCl
(B) RI > RCl > RBr > RF
(C) RI > RBr > RCl > RF
(D) $R$ F > RBr > RCl > RI

**100.** The molar conductivities at infinite dilution for sodium acetate, HCl and NaCl are 91 S $cm^2$ $mol^{-1}$, 425.9 S $cm^2$ $mol^{-1}$ and 12.6.4 S $cm^2$ $mol^{-1}$ respectively. The molar conductivity of acetic acid at infinite dilution is

(A) 390.5 S $cm^2$ $mol^{-1}$ (B) 530.9 S $cm^2$ $mol^{-1}$

(C) 300.5 S $cm^2$ $mol^{-1}$ (D) 930.5 S $cm^2$ $mol^{-1}$

**101.** The vector equation of the plane $\mathbf{r} = (2\hat{\mathbf{i}} + \hat{\mathbf{k}}) + \lambda(\hat{\mathbf{i}}) + \mu(\hat{\mathbf{i}} + 2\hat{\mathbf{j}} - 3\hat{\mathbf{k}})$ in scalar product form is $\mathbf{r} \cdot (3\hat{\mathbf{i}} + 2\hat{\mathbf{k}}) = \alpha$, then $\alpha = \ldots$

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

**102.** . Area of the region bounded by $y = \cos x, x = 0, x = \pi$ and $X$-axis is ... sq. units.

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

**103.** The length of the latusrectum of an ellipse is $\frac{18}{5}$ and eccentricity is $\frac{4}{5}$, then equation of the ellipse is .....

(A) $\frac{x^2}{25} + \frac{y^2}{8} = 1$ (B) $\frac{x^2}{25} + \frac{y^2}{9} = 1$
(C) $\frac{x^2}{25} + \frac{y^2}{16} = 1$ (D) $\frac{x^2}{16} + \frac{y^2}{9} = 1$

**104.** Let $a : \sim (p \wedge \sim r) \vee (\sim q \vee s)$ and $b : (p \vee s) \leftrightarrow (q \wedge r)$. If the truth values of $p$ and $q$ are true and that of $r$ and $s$ are false, then the truth values of $a$ and $b$ are respectively.....

(A) F, F (B) T, T
(C) T, F (D) F, T

**105.** 5. "If two triangles are congruent, then their areas are equal" is the given statement then the contrapositive of, the inverse of the given statement is

(A) If areas of two triangles are not equal then they are congruent
(B) If two triangles are not congruent then their areas are equal
(C) If two triangles are not congruent then their areas are not equal
(D) If areas of two triangles are equal then they are congruent

**106.**

$$\int \log x \cdot [\log(ex)]^{-2} dx = \ \ldots$$

(A) $\frac{x}{1+\log x} + c$ (B) $x(1 - \log x) + c$
(C) $x(1 + \log x) + c$ (D) $\frac{x}{1-\log x} + c$

**107.** If $y = \log\left[\frac{x+\sqrt{x^2+25}}{\sqrt{x^2+25}-x}\right]$ then $\frac{dy}{dx} = \ldots\ldots$

(A) $\frac{1}{\sqrt{x^2+25}}$ (B) $\frac{2}{\sqrt{x^2+25}}$
(C) $\frac{-1}{\sqrt{x^2+25}}$ (D) $\frac{-2}{\sqrt{x^2+25}}$

**108.** If the scalar triple product of the vectors $-3\hat{\mathbf{i}} + 7\hat{\mathbf{j}} - 3\hat{\mathbf{k}}, 3\hat{\mathbf{i}} - 7\hat{\mathbf{j}} + \lambda\hat{\mathbf{k}}$ and $7\hat{\mathbf{i}} - 5\hat{\mathbf{j}} - 3\hat{\mathbf{k}}$ is 272 then $\lambda = \ldots\ldots$

(A) 9 (B) 11
(C) 8 (D) 10

**109.** - The edge of a cube is decreasing at the rate of 0.04 cm/sec. If the edge of the cube is 10 cms , then rate of decrease of surface area of the cube is...

(A) 4.8 $\text{cm}^2/\text{sec}$ (B) 4.08 $\text{cm}^2/\text{sec}$
(C) 48 $\text{cm}^2/\text{sec}$ (D) 4.008 $\text{cm}^2/\text{sec}$

**110.** The joint equation of lines passing through origin and having slopes $(1 + \sqrt{2})$ and $\frac{-1}{1+\sqrt{2}}$ is .....

(A) $x^2 + 2xy - y^2 = 0$
(B) $x^2 - 2\sqrt{2}\ xy - y^2 = 0$
(C) $x^2 - 2\sqrt{2}xy + y^2 = 0$
(D) $x^2 + 2xy + y^2 = 0$

**111.** If $r$ is the radius of spherical balloon at time $t$ and the surface area of balloon changes at a constant rate $K$, then.....

(A) $4\pi r^2 = \frac{Kt^2}{2} + c$ (B) $8\pi r^2 = Kt + c$
(C) $\pi r^2 = \frac{Kt^2}{2} + c$ (D) $4\pi r^2 = \dot{K}t + c$

**112.**

$$\int_0^{\frac{\pi}{2}} \sqrt{\cos\theta} \cdot \sin^3\theta d\theta =$$

.....

(A) $\frac{-20}{21}$ (B) $\frac{-8}{21}$
(C) $\frac{20}{21}$ (D) $\frac{8}{21}$

**113.** If $\omega$ is a complex cube root of unity and $A = \begin{bmatrix} \omega & 0 & 0 \\ 0 & \omega^2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ then $A^{-1} = \ldots$

(A) $\begin{bmatrix} \omega^2 & 0 & 0 \\ 0 & \omega & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
(C) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & \omega^2 & 0 \\ 0 & 0 & \omega \end{bmatrix}$ (D) $\begin{bmatrix} 0 & 0 & \omega \\ 0 & \omega^2 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

**114.** If $A$ and $B$ are square matrices of order 3 such that $|A| = 2, |B| = 4$, then $|A(\text{adj } B)| = \ldots$

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

**115.** If $\int \frac{1}{1-\cot x} dx = Ax + B \log|\sin x - \cos x| + c$ then $A + B = \ldots\ldots$

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

**116.** The polar co-ordinates of $P$ are $\left(2, \frac{\pi}{6}\right)$. If $Q$ is the image of $P$ about the $X$-axis then the polar co-ordinates of $Q$ are.....

(A) $(2, \frac{5\pi}{6})$ (B) $(2, \frac{\pi}{6})$
(C) $(2, \frac{\pi}{3})$ (D) $(2, \frac{11\pi}{6})$

**117.** $\mathbf{a}$ and $\mathbf{b}$ are non-collinear vectors. If $\mathbf{c} = (x-2)\mathbf{a} + \mathbf{b}$ and $\mathbf{d} = (2x+1)\mathbf{a} - \mathbf{b}$ are collinear vectors, then the value of $x = \ldots\ldots$

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$
(C) $\frac{1}{5}$ (D) $\frac{1}{3}$

**118.** Let $X$ be the number of successes in ' $n$ ' independent Bernoulli trials with probability of success $p = \frac{3}{4}$. The least value of ' $n$ ' so that $P(X \geq 1) \geq 0.9375$ is .....

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

**119.** The slope of normal to the curve $x = \sqrt{t}$ and $y = t - \frac{1}{\sqrt{t}}$ at $t = 4$ is .....

(A) $\frac{-17}{4}$ (B) $\frac{4}{17}$
(C) $\frac{-4}{17}$ (D) $\frac{17}{4}$

**120.** Which of the following statement pattern is a tautology?

(A) $(p \to q) \vee q$ (B) $p \to (q \vee p)$
(C) $(p \vee q) \to q$ (D) $p \vee (q \to p)$

**121.** The acute angle between lines $x - 3 = 0$ and $x + y = 19$ is.....

(A) $60^\circ$ (B) $30^\circ$
(C) $90^\circ$ (D) $45^\circ$

**122.** In $\triangle ABC$, with the usual notations, if $\left(\tan\frac{A}{2}\right)\left(\tan\frac{B}{2}\right) = \frac{3}{4}$ then $a + b = \ldots\ldots$

(A) 4c (B) 2c
(C) 7c (D) 3c

**123.** If sum of the slopes of the lines given by $x^2 - 4pxy + 8y^2 = 0$ is three times their product then $p =$ .....

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

**124.**
$$\frac{1 - 2[\cos 60^\circ - \cos 80^\circ]}{2 \sin 10^\circ} = \ldots \ldots$$

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

**125.** The order of the differential equation of all circles which lie in the first quadrant and touch both the axes is.....

(A) two (B) three
(C) one (D) four

**126.** If $f(x)$ is continuous at $x = 3$, where
$f(x) = ax + 1$, for $x \leq 3$
$= bx + 3$, for $x > 3$ then

(A) $a + b = \frac{-2}{3}$ (B) $a - b = \frac{-2}{3}$
(C) $a - b = \frac{2}{3}$ (D) $a + b = \frac{2}{3}$

**127.** The probability that three cards drawn from a pack of 52 cards, all are red is

(A) $\frac{1}{17}$ (B) $\frac{4}{17}$
(C) $\frac{3}{17}$ (D) $\frac{2}{17}$

**128.** For any non zero vector, a, b, c $\mathbf{a} \cdot [(\mathbf{b} + \mathbf{c}) \times (\mathbf{a} + \mathbf{b} + \mathbf{c})] =$ .....

(A) 0 (B) $2[abc]$
(C) $[abc]$ (D) [acb]

**129.** The domain of the real valued function $f(x) = \sqrt{\frac{x-2}{3-x}}$ is.....

(A) $(2, 3]$ (B) $[2, 3)$
(C) $(2, 3)$ (D) $[2, 3]$

**130.** If $y = \tan^{-1}\left(\frac{1-\cos 3x}{\sin 3x}\right)$, then $\frac{dy}{dx} =$ .....

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

**131.** If $z = ax + by; a, b > 0$ subject to $x \leq 2, y \leq 2, x + y \geq 3, x \geq 0, y \geq 0$ has minimum value at $(2, 1)$ only, then.....

(A) $a > b$ (B) $a = b$
(C) $a < b$ (D) $a = 1 + b$

**132.** The direction ratios of the normal to the plane passing through origin and the line of intersection of the planes $x+2y+3z=4$ and $4x+3y+2z=1$ are ……

(A) $2,3,1$ (B) $1,2,3$

(C) $3,1,2$ (D) $3,2,1$

**133.**

The pdf of a random variable $X$ is

$$f(x)=3\left(1-2x^2\right), \quad 0<x<1$$
$$=0 \quad \text{otherwise}$$

The $P\left(\frac{1}{4}<x<\frac{1}{3}\right)=\ldots$

(A) $\frac{179}{864}$ (B) $\frac{159}{864}$

(C) $\frac{169}{864}$ (D) $\frac{189}{864}$

**134.** The eccentricity of the hyperbola $25x^2-9y^2=225$ is .....

(A) $\frac{\sqrt{34}}{3}$ (B) 4

(C) $\sqrt{34}$ (D) $\frac{\sqrt{34}}{5}$

**135.** If $f(x)=x+\frac{1}{x}, x\neq 0$, then local maximum and minimum values of function $f$ are respectively.....

(A) $-1$ and 1 (B) $-2$ and 2

(C) 2 and $-2$ (D) 1 and $-1$

**136.** Derivative of $\sin^{-1}\left(\frac{t}{\sqrt{1+t^2}}\right)$ with respect to $\cos^{-1}\left(\frac{1}{\sqrt{1+t^2}}\right)$ is

(A) 1 (B) cot t

(C) tan t (D) 0

**137.** A player tosses 2 fair coins. He wins Rs. 5 if 2 heads appear, Rs. 2 If 1 head appear and Rs. 1 if no head appears, then variance of his winning amount is

(A) 6 (B) $\frac{5}{2}$

(C) $\frac{9}{4}$ (D) $\frac{17}{2}$

**138.** In $\triangle ABC$, with the usual notations, if $\sin B\sin C=\frac{bc}{a^2}$, then the triangle is. .....

(A) Right angled triangle (B) Obtuse angled triangle

(C) Equilateral triangle (D) Acute angled triangle

**139.** If $A=\left\{x\in R/x^2+5|x|+6=0\right\}$ then $n(A)=\ldots\ldots$

(A) 0 (B) 4

(C) 1 (D) 2

**140.**

$$\int \frac{dx}{(\sin x+\cos x)(2\cos x+\sin x)}=$$

(A) $\log|\sin x+\cos x|+c$ (B) $\log\left|\frac{\tan x+2}{\tan x+1}\right|+c$

(C) $\log\left|\frac{\sin x+\cos x}{2\cos x-\sin x}\right|+c$ (D) $\log\left|\frac{\tan x+1}{\tan x+2}\right|+c$

**141.** The solution of differential equation $\left(x^2+1\right)\frac{dy}{dx}+\left(y^2+1\right)=0$ is ...

(A) $x+y=c$

(B) $(x^2+1)(y^2+1)=c$

(C) $x^2=y^2+c$

(D) $\tan^{-1}x+\tan^{-1}y=c$

**142.** $\sin\left[3\sin^{-1}(0.4)\right]=\ldots\ldots$

(A) 0.466 (B) 0.256

(C) 0.944 (D) 0.764

**143.** If line $\frac{2x-4}{\lambda}=\frac{y-1}{2}=\frac{z-3}{1}$ and $\frac{x-1}{1}=\frac{3y-1}{\lambda}=\frac{z-2}{1}$ are perpendicular to each other then $\lambda=$ .....

(A) 7 (B) $-\frac{7}{6}$

(C) 6 (D) $-\frac{6}{7}$

**144.** For a sequence $(t_n)$, if $S_n=5\left(2^n-1\right)$ then $t_n=$ .....

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

(C) $5(2^{n-1})$ (D) $\frac{2\times(2^{n-1})}{5}$

**145.**

$$\text{If } f(x)=\left[\tan\left(\frac{\pi}{4}+x\right)\right]^{\frac{1}{x}}, \quad x\neq 0$$
$$=k, \quad x=0 \text{ is continuous}$$
$$x=0$$

Then $k=$

(A) $e^2$ (B) 1

(C) $e$ (D) $e^{-2}$

**146.** Which of the following function has period 2?

(A) $\cos[(\frac{\pi}{3})x]$ (B) $\cos[(\frac{\pi}{2})x]$

(C) $\cos(2\pi x)$ (D) $\cos(\pi x)$

**147.** Which of the following can not be the direction cosines of a line?

(A) $\sqrt{\frac{1}{5}}, -\sqrt{\frac{1}{2}}, \sqrt{\frac{3}{10}}$ (B) $\frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

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

**148.** If $A, B, C$ are $p^{\text{th}}, q^{\text{th}}$ and $r^{\text{th}}$ terms of a GP respectively then $A^{q-r} \cdot B^{r-p} \cdot C^{p-q} = \ldots\ldots$

(A) 0 (B) 1

(C) 3 (D) $-1$

**149.**

$$\int_{\frac{\pi}{18}}^{\frac{4\pi}{9}} \frac{2\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx = \ \ldots \ \ldots$$

(A) $\frac{7\pi}{36}$ (B) $\frac{5\pi}{36}$

(C) $\frac{7\pi}{18}$ (D) $\frac{5\pi}{18}$

**150.** The maximum value of $Z = 5x + 4y$, Subject to $y \leq 2x, x \leq 2y, x + y \leq 3, x \geq 0, y \geq 0$ is .....

(A) 14 (B) 12

(C) 13 (D) 18

**- End of Question Paper -**