MHT CET 2020 PCM Oct 14 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. A vector $\vec{A}$ when added to the sum of the vectors $(\hat{i}-2\hat{j}+2\hat{k})$ and $(-2\hat{i}+\hat{j}-\hat{k})$ gives a unit vector along y -axis. The magnitude of the vector $\vec{A}$ is

(A) $\sqrt{3}$ (B) $\sqrt{6}$
(C) $\sqrt{8}$ (D) $\sqrt{10}$

2. The angle between two forces of equal magnitude R, if the magnitude of their resultant is $\frac{R}{2}$

(A) $\cos^{-1}\left(-\frac{7}{8}\right)$ (B) $\cos^{-1}\left(-\frac{5}{7}\right)$
(C) $\cos^{-1}\left(-\frac{3}{7}\right)$ (D) $\cos^{-1}\left(-\frac{3}{4}\right)$

3. The refractive index of the medium is $\mu = A + \frac{B}{\lambda^2}$, where A and B are constants and λ is the wavelength of light. The dimensions of B are same as that of

(A) Velocitv. (B) area.
(C) wavelength. (D) Volume.

4. Let the inductance and resistance be denoted by 'L' and 'R' respectively. The dimensions of $\left(\frac{L}{R}\right)$ are

(A) $\left[L^1M^0\ T^1\right]$ (B) $\left[L^0M^0\ T^0\right]$
(C) $\left[L^0M^1\ T^0\right]$ (D) $\left[L^0M^0\ T^1\right]$

5. The angular speed of the minute hand of a clock in degrees per second is

(A) $0\cdot01$ (B) $0\cdot1$
(C) 1 (D) 10

6. Two stones of masses m and 3 m are whirled in horizontal circles, the heavier one in radius $\left(\frac{r}{3}\right)$ and lighter one in radius ' r'. The tangential speed of lighter stone is 'n' times that of the value of heavier stone, when they experience same centripetal force. The value of n is

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

7. A body initially at rest is acted upon by a constant force (F) for time (t). The kinetic energy at time t is

(A) $\frac{F^2t^2}{m}$ (B) $\left(\frac{Ft}{m}\right)^2$
(C) $\frac{Ft}{2\,m}$ (D) $\frac{F^2t^2}{2\,m}$

8. The motion of a rocket in upward direction with high speed is based on the principle of conservation of

(A) Kinetic energy. (B) mass.
(C) angular momentum. (D) linear momentum.

9. A satellite of mass 'm', revolving round the earth of radius 'r' has kinetic energy (E). Its angular momentum is

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

10. Let M and L be the mass and length of thin uniform rod respectively. In 1^{st} case, axis of rotation is passing through centre and perpendicular to its length. In 2^{nd} case, axis of rotation is passing through one end and perpendicular to its length. The ratio of radius of gyration in first case to second case is

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

11. The moment of inertia of a thin uniform rod about a perpendicular axis passing through one of its ends is 'I'. Now, the rod is bent in a ring and its moment of inertia about diameter is ' I_1'. Then $\frac{I}{I_1}$ is

(A) $\frac{8\pi^2}{3}$ (B) $\frac{11\pi^2}{3}$
(C) $\frac{4\pi^2}{3}$ (D) $\frac{\pi^2}{3}$

12. Two rings of radius 'R' and 'nR' made of same material have the ratio of moment of inertia about an axis passing through its centre and perpendicular to the plane as 1 : 8. The value of 'n' is (mass per unit length is constant)

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

13. The escape velocity from the surface of earth of mass 'M' and radius 'R' is 'Ve'. The escape velocity from the surface of a planet whose mass and radius are 3 times that of the earth, will be

(A) $q\mathbf{V}_e$ (B) 3Ve
(C) $\mathbf{V}e$ (D) 12Ve

14. The density and bulk modulus of a metal bar is ' e ' and ' K ' respectively. When pressure 'P' is applied from all sides to that metal bar, the increase in its density is

(A) $\frac{QP}{(K+P)}$ (B) $\frac{QP}{(K-P)}$
(C) $\frac{K-P}{Q}$ (D) $\frac{\mathrm{K+P}}{\mathrm{Q}}$

15. Two wires of same length and material are stretched by same force. If their masses are in the ratio 3 : 4, then the ratio of their elongations is

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

16. A large vessel completely filled with water has two holes ' A ' and ' B ' at depths 'h' and '4h' from the top. Hole 'A' is a square of side 'L' and hole 'B' is circle of radius 'R'. If from both the holes same quanitity of water is flowing per second, then side of square hole is

(A) $2\pi R$ (B) $\sqrt{2\pi \mathbf{R}}$
(C) $\sqrt{2\pi} \cdot \mathrm{R}$ (D) $\frac{R}{2}$

17. The excess pressure inside the first soap bubble of radius ' R_1 ' is two times, that inside the second soap bubble of radius ' R_2 '. The ratio of volumes of the first bubble to that of second bubble is

(A) 1 : 4 (B) 1 : 1
(C) 1 : 2 (D) 1 : 8

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

(A) 1:1000 (B) 1:1
(C) 1 : 10 (D) 1 : 100

19. Heat is applied to a rigid diatomic gas at constant pressure. The ratio $\Delta \mathrm{Q} : \Delta \mathrm{U} : \Delta \mathrm{W}$ is

(A) 5 : 7 : 2 (B) 7 : 5 : 2
(C) 2 : 5 : 7 (D) 5: 2: 7

20. Let the r.m.s. velocity of molecule of a given mass of gas be C_1 at temperature 27°C. When the temperature is increased to 327°C, the r.m.s. velocity is C_2. Then the ratio $\frac{\mathrm{C}_2}{\mathrm{C}_1}$ is

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

21. A small mass 'm' is suspended at the end of a wire having (negligible mass) length 'L' and cross-sectional area 'A'. The frequency of oscillation for the S.H.M. along the vertical line is (Y = Young's modulus of the wire)

(A) $\frac{1}{2\pi}\left(\frac{\mathrm{YA}}{\mathrm{mL}}\right)^{\frac{1}{2}}$ (B) $\frac{2\pi \mathrm{YA}}{\mathrm{mL}}$
(C) $\frac{\mathrm{YA}}{2\pi \mathrm{ml}}$ (D) $2\pi\left(\frac{\mathrm{YA}}{\mathrm{mL}}\right)^{\frac{1}{2}}$

22. The ratio of frequencies of oscillations of two simple pendulums is 3 : 4, then their lengths are in the ratio

(A) 16 : 9 (B) 9 : 16
(C) $\sqrt{3} : \sqrt{4}$ (D) $\sqrt{4} : \sqrt{3}$

23. The displacement of the particle executing linear S.H.M. is $\mathrm{x} = 0.25\sin(11\mathrm{t} + 0.5)\mathrm{m}$. The period of S.H.M. is $\left(\pi = \frac{22}{7}\right)$

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

24. A progressive wave of frequency 50 Hz is travelling with velocity 350 m/s through a medium. The change in phase at a given time interval of $0 \cdot 01$ s is

(A) $\frac{\pi}{2}$rad (B) π rad
(C) $\frac{\pi}{4}$ rad (D) $\frac{3\pi}{2} rad$

25. A sonometer wire resonates with a given tuning fork forming standing wave with 5 antinodes between two bridges when mass of 9 kg is suspended from the wire. When mass 'm' is suspended from the wire, with same fork and same length between two bridges 3 antinodes are formed. Mass M is

(A) 25Kg (B) 20Kg
(C) 15Kg (D) 10Kg

26. Two wires of same material are vibrating under the same tension. If the first overtone of first wire is equal to the second overtone of second wire and radius of first wire is twice the radius of the second then the ratio of length of first wire to second wire is

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

27. Two open organ pipes of fundamental frequencies n_1 and n_2 are joined in series. The fundamental frequency of the new pipe is

(A) $n_1 - n_2$ (B) $\frac{n_1 n_2}{(n_1+n_2)}$

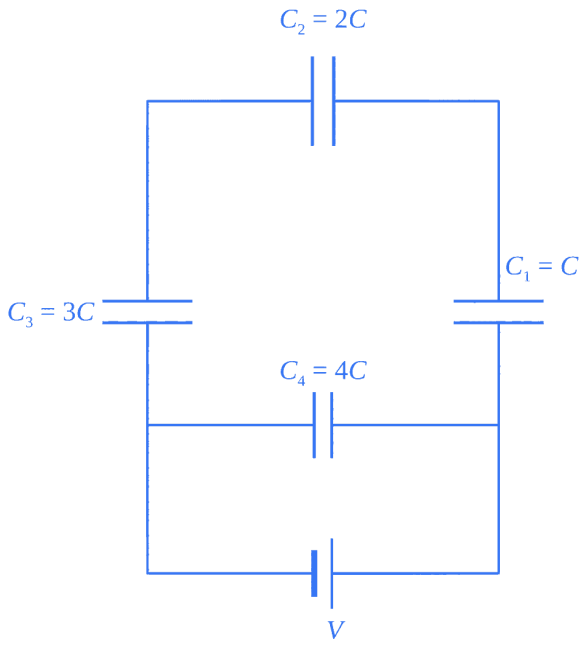
(C) $\frac{1}{n_1 n_2}$ (D) $\frac{n_1+n_2}{n_1 n_2}$

28. An air filled parallel plate capacitor has a uniform electric field 'E' in the space between the plates. If the distance between the plates is 'd' and area of each plate is ' A', the energy stored in the capacitor is (ϵ_0 = permittivity of free space)

(A) $\frac{1}{2} \in_0 E^2 Ad$ (B) $E^2 \frac{Ad}{\epsilon_0}$

(C) $\frac{1}{2} \in_0 E^2$ (D) $E_0 EAd$

29. A network of 4 capacitors is connected to a battery as shown. The ratio of the charges on capacitors C_2 and C_4 is



(A) $\frac{3}{13}$ (B) $\frac{3}{19}$

(C) $\frac{3}{17}$ (D) $\frac{3}{22}$

30. If the number of turns in the coil of galvanometer are decreased then the resistance of galvanometer

(A) may increase Or decrease. (B) increaseS.

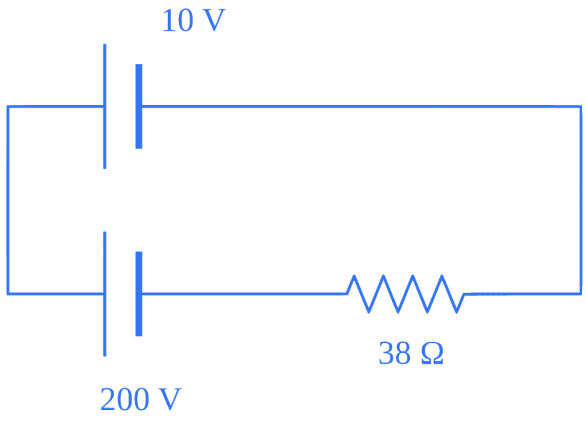
(C) remains the same (D) decreases.

31. In potentiometer experiment, cells of e.m.f. E and E 2 are connected in series ($E_1 > E_2$), the balancing length is 64 cm of the wire. If the polarity of E_2 is reversed, the balancing length becomes 32 cm. The ratio $\frac{E_1}{E_2}$ is

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

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

32. Using Kirchhoff's law, find the current flowing through the given circuit.



(A) $7 \cdot 5$ A (B) 5 A

(C) $10A$ (D) $3A$

33. When a resistance of 200Ω is connected in series with a galvanometer of resistance 'G' its range is ' V'. To triple its range, a resistance of 2000Ω is connected in series. The value of G is

(A) 700Ω (B) 900Ω

(C) 400Ω (D) 600Ω

34. An electron revolving in circular orbit of radius 'r' with velocity 'V' and frequency 'v' has orbital magnetic moment 'M'. If the frequency of revolution is doubled then the new magnetic moment will be

(A) $\frac{M}{4}$ (B) 2 N

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

35. An electron is projected along the axis of circular conductor carrying current 1 . Electron will experience

(A) a force at an angle of 30° with the axis. (B) no force.

(C) a force along the axis. (D) a force perpendicular to the axis.

36. The magnetic moment produced in a sample of 2 gram is $8 \times 10^{-7}\ \mathrm{A/m^2}$. If its density is $4\ \mathrm{g/cm^3}$, then the magnetization of the sample is

(A) 1.2 (B) 1.8

(C) 1.4 (D) 1.6

37. The magnetic field due to a short bar magnet at an axial point at a distance 'r' from its centre is 'B'. If this axis is moved towards the equator of the magnet along a circular path of radius 'r' then the magnetic field 'B' will

(A) not Change. (B) go on increasing.

(C) increase from zero to infinity. (D) go on decreasing.

38. A coil of radius 'r' is placed on another coil (whose radius is 'R' and current flowing through it is changing) so that their centres coincide. ($\mathrm{R} \gg \mathrm{r}$) If both the coils are coplanar then the mutual inductance between them is proportional to

(A) $\frac{r}{R}$ (B) $\frac{R}{r}$

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

39. When light enters glass from vacuum then the wavelength of light

(A) remains constant. (B) becomes zero.

(C) decreases. (D) increases.

40. In the case of spherical mirrors, the images formed on the side of the object and images formed on the opposite side are respectively

(A) virtual and real. (B) Virtual and vintual.

(C) real and real. (D) real and virtual.

41. A ray of light travels from air to water to glass and again from glass to air. Refractive index of water with respect to air is ' x', glass with respect to water is ' y' and air with respect to glass is 'z'. Which one of the following is correct?

(A) xz=v (B) $\mathbf{z = x}$

(C) $\mathrm{xyz} = 1$ (D) $\mathrm{x}y = \mathbf{z}$

42. Two coherent sources of intensities $\mathrm{l_1}$ and $\mathrm{I_2}$ produce an interference pattern on screen. The maximum intensity in the interference pattern is

(A) $\left[\sqrt{\mathrm{I_1}} + \sqrt{\mathrm{I_2}}\right]^2$ (B) $\mathrm{I_1 + I_2}$

(C) $(\mathrm{I_1 + I_2})^2$ (D) $\mathrm{I_1^2 + I_2^2}$

43. A double slit experiment is immersed in water of refractive index $1 \cdot 33$. The slit separation is 1 mm, distance between slit and screen is $1 \cdot 33$ m. The slits are illuminated by a light of wavelength 6300Å. The fringewidth is

(A) 6.9×10^{-4} m (B) 6.3×10^{-4} m

(C) $5 \cdot 8 \times 10^{-4} m$ (D) 8.6 x 10^{-4} m

44. A metal surface having work function ' $\mathrm{w_0}$' emits photoelectrons when photons of energy 'E' are incident on it. The electron enters the uniform magnetic field (B) in perpendicular direction and moves in circular path of radius 'r'. Then 'r' is equal to (m and e be the mass and charge of electron respectively).

(A) $\frac{\sqrt{m(E-W_0)}}{eB}$ (B) $\frac{m(\mathrm{E-W_O})}{\mathrm{eB}}$

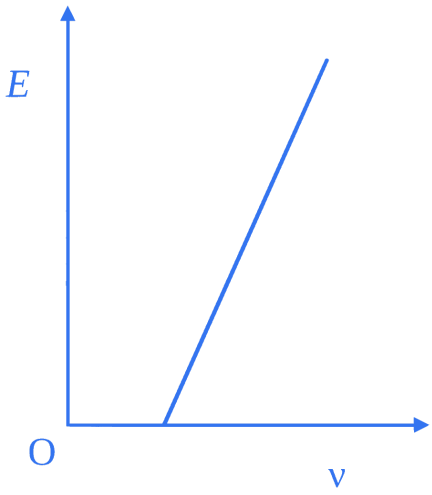
(C) $\frac{\sqrt{2m(E-W_0)}}{\mathbf{eB}}$ (D) $\frac{2m(E-w_0)}{eB}$

45. An electron and photon are accelerated through the same potential difference. The ratio of the de-Broglie wavelength λ_p to λ_e is [$\mathrm{m_e}$ = mass of electron, $\mathrm{m_p}$ = mass of proton]

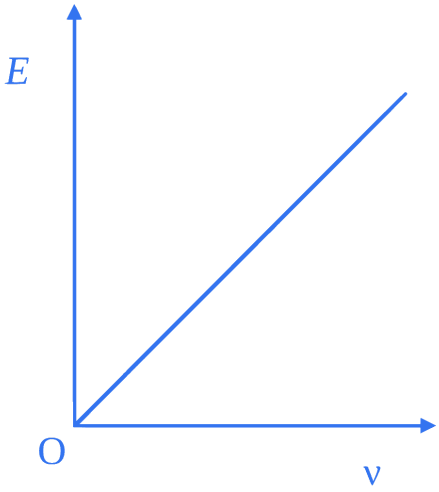
(A) $\left(\frac{m_p}{m_e}\right)^{\frac{1}{2}}$ (B) $\left(\frac{m_e}{m_p}\right)^{\frac{1}{2}}$

(C) $\left(\frac{m_e}{m_p}\right)$ (D) $\left(\frac{m_p}{m_e}\right)$

46. Using Einstein's photoelectric equation, the graph between the K-E.(E) of photoelectrons emitted and the frequency of incident radiation (ν) is shown correctly in figure (A)

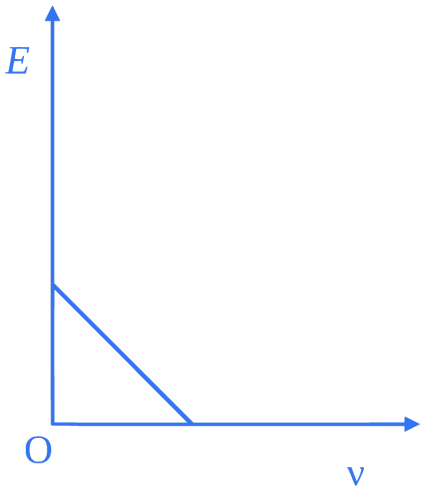


(B)

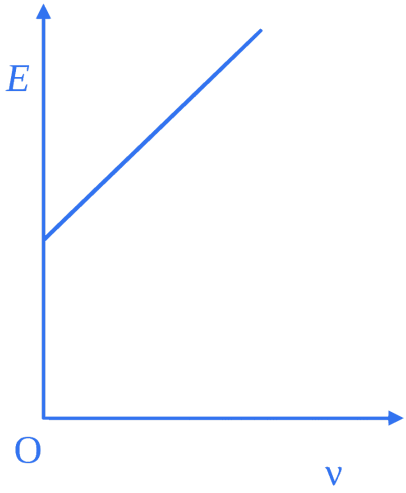


(C)

46. (continued)



(D)



(A) (C)

(B) (A)

(C) (D)

(D) (B)

47. In any Bohr orbit of hydrogen atom, the ratio of K.E to P.E of revolving electron at a distance ' r′ from the nucleus is

(A) -1

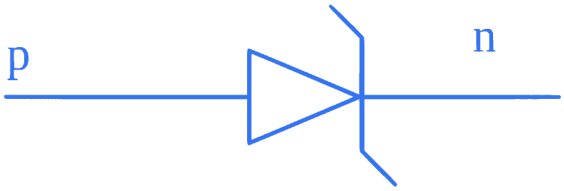
(B) $+\frac{1}{2}$

(C) 1

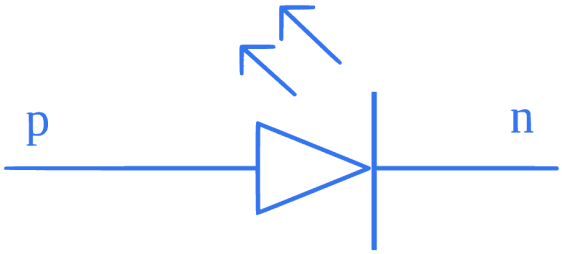
(D) $-\frac{1}{2}$

collegedunia

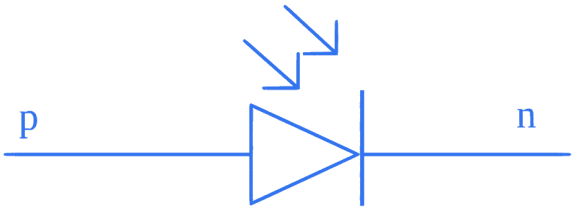
48. Which one of the following symbols represents a photodiode? (A)



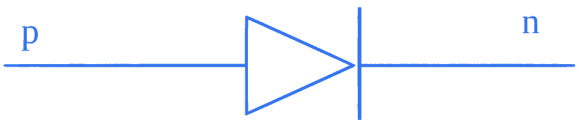
(B)



(C)



(D)



(A) (B)
(B) (A)
(C) (C)
(D) (D)

49. For which logic gate the following statement is true? The output is high if and only if all inputs are high.

(A) AND
(B) OR
(C) NOR
(D) NAND

50. According to theoretical study of radiation from a same linear antenna, the power radiated is proportional to [λ = wavelength]

(A) λ^{-2}
(B) λ^{-1}
(C) λ^{2}
(D) λ

collegedunia

51. A solution is $0 \cdot 25\%$ by mass. What is the weight of solvent containing 1.25 g solute?

(A) $498.75g$ (B) 300g

(C) 600g (D) 200g

52. What is the mass percentage of carbon in urea? (mol. mass of urea $= 60$ g mol^{-1})

(A) $28 \cdot 0\%$ (B) $20 \cdot 0\%$

(C) 26.67% (D) 46.67%

53. Which of the following oxides is NOT volatile?

(A) AS_2O_3 (B) ZnO

(C) P_2O_5 (D) SO_2

54. What is the symbol of element if it's atomic number is 116?

(A) UuS (B) Uut

(C) Uuh (D) Uun

55. What type of hybridisation results in tetrahedral geometry?

(A) Sp^2 (B) Sp

(C) sp^3 (D) dsp^2

56. Which type of overlap is involved in formation of $0 - H$ bonds in water molecule?

(A) $sp^2 - p$ (B) $sp^3 - s$

(C) $sp - s$ (D) $sp^2 - s$

57. A certain mass of a gas occupies a volume of $2dm^3$ at STP. At what temperature the volume of gas becomes double, keeping the pressure constant?

(A) $540.15^{\circ}C$ (B) $400.15^{\circ}C$

(C) $546 \cdot 15^{\circ}$ C (D) 273.15° C

58. Which is true for heat and temperature?

(A) Extensive and intensive properties respectively (B) Intensive and extensive properties respectively

(C) Both are extensive properties (D) Both are intensive properties

59. Energy required to dissociate 16 g$O_{2(g)}$ into free atoms is x kJ. The value of bond enthalpy of $O = O$ bond is

(A) $2xKJ$ (B) $\frac{x}{2}$**KJ**

(C) $4xkJ$ (D) 16xKJ

60. Heat of combustion of $C_{(s)}, H_{2(g)}$ and $C_2H_{6(g)}$ are $-x_1, -x_2$ and $-x_3$ respectively. Hence heat of formation of $C_2H_{6(g)}$ is

(A) $-x_1 - x_2 + x_3$ (B) $-2x_1 - 3x_2 + x_3$

(C) $x_1 + x_2 - x_3$ (D) $-x_3 + 2x_1 + 3x_2$

61. When SO_2 is passed through acidified K_2Cr_20, the process that takes place is

(A) the solution turns blue (B) the solution is decolourised

(C) SO_2 is reduced (D) green $Cr_2(SO_4)_3$ is formed

62. Identify the oxidation state of Cr in $K_3[Cr(C_2O_4)_3]$

(A) +3 (B) +2

(C) +6 (D) +5

63. Caesium is used in

(A) devising photo electric cells (B) air conditioning plants

(C) extraction of boron (D) fast breeder nuclear reactors

64. What is IUPAC name of 3 - chloropropyl ethyl ether?

(A) 3- Chloro-1-propoxyethane (B) 3 - Chloro-1-ethoxypropane

(C) 1- Chloro-3-propoxyethane (D) 1 - Chloro-3-ethoxypropane

65. Which among following compounds contains phantom atom?

(A) CH_3COOH (B) CH_3CH_2Cl

(C) $CH_3CH_2NH_2$ (D) $CH_3CH_2CH_2OH$

66. How many optical isomers are possible for a compound having four asymmetric carbon atoms?

(A) 16 (B) 8

(C) 12 (D) 4

67. Resonance is NOT exhibited by

(A) cyclohexane (B) aniline

(C) nitrobenzene (D) phenol

68. Among the following isomeric amines, an amine having highest boiling point is

(A) diethylamine (B) n − b*utylamine*

(C) tert - butylamine (D) ethyldimethylamine

69. What is IUPAC name of mesityl oxide?

(A) 4 −*Methylbenzaldehyde*

(B) 2 - Bromohexan-3-one

(C) 4 - Methylpent-3-en-2-one

(D) 1- Phenylbutan-2-one

70. The edge length of fcc type unit cell of copper having atomic radius 127.6pm is equal to

(A) 295pm (B) 361 pm

(C) 331pm (D) 378pm

71. What is the number of atoms present per unit cell of aluminium having edge length 4 A° ? (If density of Al $= 2 \cdot 7$ g cm^{-3}, At. mass of Al $= 27$)

(A) 8 (B) 1

(C) 2 (D) 4

72. Lithium crystallises into body centered cubic structure. What is the radius of lithium if edge length of it's unit cell is 351pm ?

(A) 151.98pm (B) 300.50pm

(C) 75.50pm (D) 240.80pm

73. Which among following is true for the value of Henry's law constant K?

(A) is greater for gases with higher solubilities (B) first increases and then decreases with increase in temperature

(C) increases with increase in temperature (D) is same for all gases

74. Osmotic pressure of one molar solution at 27°C is (R $= 0.082$)

(A) $2 \cdot 46$ atm (B) $12 \cdot 1$ atm

(C) $24 \cdot 6$ atm (D) $1 \cdot 21$ atm

75. What is the molar conductivity at infinite dilution of $CaCl_2$, if the molar conductivity of Ca^{2+} ion and Cl^- ion at infinite dilution is 119 and $71\Omega^{-1}$ cm^2 mol^{-1}

(A) $431 \cdot 0\Omega^{-1}$ cm^2 mol^{-1}

(B) $341 \cdot 0\Omega^{-1}$ cm^2 mol^{-1}

(C) $261 \cdot 0\Omega^{-1}$ cm^2 mol^{-1}

(D) $126 \cdot 0\Omega^{-1}$ cm^2 mol^{-1}

76. What is the cell constant of $\frac{N}{10}$KCl solution at 25°C, if conductivity and resistance of a solution is $0.0112\Omega^{-1}$ cm^{-1} and $55 \cdot 0\Omega$ respectively?

(A) 0.616 cm^{-1} (B) $0 \cdot 491$ cm^{-1}

(C) $2 \cdot 0$ cm^{-1} (D) $0 \cdot 2$ cm^{-1}

77. The rate law for the reaction A + B + C $\longrightarrow$ Product is expressed as Rate $=$ K[A]^2[B]^1[C]^0. What is the overall order of the reaction?

(A) 3 (B) 0

(C) 1 (D) 2

78. For the reaction $4NH_3 + 50_2 \rightarrow 4NO + 6H_2O$ if the rate of disappearance of NH_3 is 3.6×10^{-3}M/s. What is the rate of formation of water?

(A) 4.0×10^4M/S (B) 3.6×10^{-3}M/S

(C) 6.0×10^{-4}M/S (D) 5.4×10^{-3}M/S

79. Which of the following can form colloidal sol with water?

(A) Common salt (B) Starch

(C) Glucose (D) Ammonium sulphate

80. What is the product formed when bauxite ore is treated with sodium hydroxide?

(A) Sodium meta aluminate (B) Aluminium hydroxide

(C) Sodium aluminate (D) Sodium hydrogen carbonate

81. Which of the following halogens combine with dihydrogen at lowest temperature?

(A) Iodine (B) Flürine

(C) Bromine (D) Chlorine

82. Which among the following is powerful bleaching and oxidising agent?

(A) Cl_2 (B) SO_2

(C) HI (D) PH_3

83. Which among the following halogen does not form polyhalide ion?

(A) G (B) Br

(C) I (D) F

84. Identify correct decreasing order of ionic radii of lanthanoids.

(A) Sm > Gd > Ce > Pm

(B) Gd > Pm > Ce > Sm

(C) Ce > Pm > Sm > Gd

(D) Pm > Sm > Ce > Gd

85. Which statement from following is true for a complex hexamine cobalt (III) chloride?

(A) In this coordination number of cobalt is 9

(B) In this oxidation state of cobalt is $+3$

(C) It is a heteroleptic complex

(D) It is an anionic complex

86. Which among the following complexes is a heteroleptic and cationic in nature?

(A) $[Ni(CO)_4]$ (B) $[Co(NH_3)_4Cl_2)]Cl$

(C) $[Pt(NH_3)_2Cl_2)]$ (D) $K_4[Fe(CN)_6]$

87. Identify product ' C ' in following reaction. Propylene dibromide

$$\text{Zn. } \Delta \text{ Alcohol} \longrightarrow A \xrightarrow{HBr} B \xrightarrow[\text{ether}]{Na} C$$

(A) 2 - Bromobutane (B) Isobutane

(C) 2,3 - dimethyl butane (D) $1,2-$ dibromo butane

88. Which among the following is true for Balz-Schiemann reaction?

(A) In this $Ar - Cl$ is obtained from $Ar - N_2^+X^-$

(B) It is useful for preparation of nitrobenzene from benzene diazonium salts

(C) In this Ar - CN is obtained from $Ar - N_2^+X^-$

(D) In this $Ar - F$ is obtained from $Ar - N_2^+X^-$

89. What is the relative rate of SN^1 reaction for $(CH_3)_2CH - Br$?

(A) 10^6 (B) Less than 10^{-4}

(C) 0.02 (D) 1.0

90. Which among the following is a dihydric phenol?

(A) P -cresol (B) Phloroglucinol

(C) Catechol (D) Pyrogallol

91. When Butan - 2 -ol is dehydrated using sulphuric acid, the concentration of acid and temperature needed respectively is

(A) 60% Conc. and 373 K

(B) 20% conc. and 373 K

(C) 20% conc. and 363 K

(D) 95% conc. and 373 K

92. Which among following compounds in obtained when calcium formate is dry distilled alone?

(A) Methanoic acid (B) Methanal

(C) Methanol (D) Methoxy methane

93. Which of the following compounds is obtained when benzoic acid is treated with conc. H_2SO_4 and conc. HNO_3

(A) 2,4,6 trinitrobenzoic acid

(B) O-Nitrobenzoic acid

(C) m-Nitrobenzoic acid

(D) p - Nitrobenzoic acid

94. Identify product B obtained in following reaction. $CH_3 - CH_3 \xrightarrow{HNO_2} A_{\Delta} \xrightarrow[\text{ether}]{LiAlH_4} B$

(A) Ethanoic acid (B) Ethanal

(C) Ethanol (D) Ethanamine

95. If side chain group $-R$ for amino acid is $-CH_2OH$ identify the amino acid from following?

(A) Arginine (B) Tyrosine

(C) Serine (D) Proline

96. Which among the following regents is used for conversion of glucose to glucoxime?

(A) HCN (B) Br_2 water

(C) Hydroxylamine (D) dilute Nitric acid

97. Which among the following is a cross-linked polymer?

(A) PVC (B) Orlon

(C) Vulcanised rubber (D) Polypropylene

98. Which among the following polymer is used to make crockeries?

(A) Melamine (B) HDPE

(C) Buna $- S$ (D) Buna $- N$

99. Which of the following is used as an antiseptic in soap?

(A) Iodoform (B) Boric acid

(C) Tincture iodine (D) Bithional

100. The compound which causes antidepressant action on central nervous system is

(A) phenelzine (B) penicillin

(C) Chloroxylenol (D) terpineol

101. If $f(x) = [x]^2 - 5[x] + 6 = 0$, where $[x]$ denotes greatest integer function then $x \in$

(A) $(2, 4]$ (B) $[2, 4]$

(C) $[2, 4)$ (D) $(2, 4)$

102. If $f(x) = \frac{2x+3}{3x-2}, x \neq \frac{2}{3}$ then f of is

(A) an even function (B) not defined for all $x \in R$

(C) a constant function (D) an odd function

103. The general solution of $\tan 3x = 1$ is

(A) $x = n\pi, n \in Z$

(B) $x = n\left(\frac{\pi}{3}\right) + \frac{\pi}{12}, n \in Z$

(C) $x = n\pi + \frac{\pi}{4}, n \in Z$

(D) $x = n\pi \pm \frac{\pi}{4}, n \in Z$

104. $\cos\left(\frac{3\pi}{4} + x\right) - \sin\left(\frac{\pi}{4} - x\right) =$

(A) $-\sqrt{2}\cos x$ (B) $-\sqrt{2}\sin x$

(C) $\sqrt{2}\cos x$ (D) $\sqrt{2}\sin x$

105. If $\frac{1-\tan\theta}{1+\tan\theta} = \frac{1}{\sqrt{3}}$, where $\theta \in \left(0, \frac{\pi}{2}\right)$, then $\theta =$

(A) $\frac{\pi}{12}$ (B) $\frac{\pi}{4}$

(C) $\frac{\pi}{6}$ (D) $\frac{\pi}{3}$

106. If $\operatorname{cosec}\theta + \cot\theta = 5$, then $\sin\theta =$

(A) $\frac{1}{5}$ (B) $\frac{5}{26}$

(C) $\frac{5}{13}$ (D) $\frac{1}{13}$

107. If m_1 and m_2 are slopes of the lines represented by $\left(\sec^2\theta - \sin^2\theta\right)x^2 - 2\tan\theta xy + \sin^2\theta y^2 = 0$, then $|m_1 - m_2| =$

(A) 1 (B) 2

(C) 4 (D) 3

108. For a sequence (t_n) if $s_n = 7(3^n - 1)$, then $t_n =$

(A) $(7)3^{n-1}$ (B) $(14)\ 3^{n+1}$

(C) $(14)3^{n-1}$ (D) $(7)3^{n+1}$

109. The length of the perpendicular from the point $P(a, b)$ to the line $\frac{x}{a} + \frac{y}{b} = 1$ is

(A) $\left|\frac{\sqrt{a^2+b^2}}{ab}\right|$ units (B) $\left|\frac{ab}{\sqrt{a^2+b^2}}\right|$ units

(C) $\left|\frac{b^2}{\sqrt{a^2+b^2}}\right|$ units (D) $\left|\frac{a^2}{\sqrt{a^2+b^2}}\right|$ units

110. The measure of the acute angle between the lines given by the equation $3x^2 - 4\sqrt{3}xy + 3y^2 = 0$ is

(A) 45° (B) 60°

(C) 70° (D) 30°

111. The centre and radius of a circle $x = 4a\left(\frac{1-t^2}{1+t^2}\right), y = \frac{8at}{1+t^2}$, are respectively

(A) $(0, 0)$ and $3a$ units (B) $(0, 0)$ and $4a$ units

(C) $(0, 0)$ and $2a$ units (D) $(0, 0)$ and a units

112. The eccentricity of the hyperbola $16x^2 - 3y^2 - 32x - 12y - 44 = 0$ is

(A) $\sqrt{\frac{19}{3}}$ (B) $\sqrt{\frac{13}{19}}$

(C) $\frac{\sqrt{19}}{3}$ (D) $\frac{13}{\sqrt{19}}$

113. The contrapositive of the statement 'If Raju is courageous, then he will join Indian Army', is

(A) If Raju does not join Indian Army, then he is courageous. (B) If Raju does not join Indian Army, then he is not courageous.

(C) If Raju join Indian Army, then he is not courageous (D) If Raju join Indian Army, then he is courageous.

114. The logical expression $[p \wedge (q \vee r)] \vee [\sim r \wedge \sim q \wedge p]$ is equivalent to

(A) q (B) $\sim q$

(C) $\sim$ p (D) p

115. A die is thrown 100 times, then the standard deviation of getting an even number is

(A) 10 (B) 5

(C) 20 (D) 15

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

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

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

117. $\sin^{-1}\left(\frac{1}{2}\right) + \cos^{-1}\left(\frac{\sqrt{3}}{2}\right) + \cot^{-1}\left(-\frac{1}{\sqrt{3}}\right) =$

(A) $\frac{2\pi}{3}$ (B) π

(C) $\frac{\pi}{6}$ (D) $\frac{\pi}{3}$

118. If $u = \tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ and $v = \tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$, then $\frac{du}{dv}$ at $x = 0$ is

(A) $\frac{1}{4}$ (B) $\frac{1}{8}$

(C) 1 (D) $\frac{-1}{8}$

119. With usual notations in ΔABC, if $C = 90^\circ$, then $\tan^{-1}\left(\frac{a}{b+c}\right) + \tan^{-1}\left(\frac{b}{c+a}\right) =$

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{6}$

(C) π (D) $\frac{\pi}{3}$

120. If the elements of matrix A are the reciprocals of elements of matrix $\begin{bmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{bmatrix}$, where ω is complex cube root of unity, then

(A) $A^{-1} = I$ (B) $A^{-1} = A^2$

(C) $A^{-1} = A$ (D) A^{-1}does not exits

121. If $A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & 1 & 3 \\ 0 & 3 & -5 \end{bmatrix}$, where A_{ij} is the cofactor of the element a_{ij} of matrix A, then $a_{21}A_{21} + a_{22}A_{22} + a_{23}A_{23} =$

(A) -26 (B) 0

(C) -2 (D) 26

122. If $f(x) = \frac{(81)^x-(9)^x}{(k)^x-1}$ if $x \neq 0 = 2$ if $x = 0$ is continuous at $x = 0$, then the value of k is

(A) 3 (B) 9

(C) 2 (D) 4

123. If $y\sqrt{1-x^2} + x\sqrt{1-y^2} = 1$, then $\frac{dy}{dx} =$

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

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

124. A metal wire 108 meters long is bent to form a rectangle. If the area of the rectangle is maximum, then its dimensions are

(A) 28 m, 28 m (B) 27 m, 27 m

(C) 25 m, 25 m (D) 26 m, 26 m

125. A particle moves according to the law $s = t^3 - 6t^2 + 9t + 25$. The displacement of the particle at the time when its acceleration is zero is

(A) 0 units (B) -27 units

(C) 27 units (D) 9 units

126. $\int \frac{x^2}{(x+1)(x+2)^2}dx =$

(A) $\log|x+1| + \frac{4}{x+2} + c$

(B) $\log|x+1| - \frac{4}{x+2} + \frac{3}{(x+2)^2} + c$

(C) $\log|x+1| + \frac{1}{x+2} + c$

(D) $\log|x+1| - \frac{4}{x+2} - \frac{3}{(x+2)^2} + c$

127. $\int \frac{e^x}{\sqrt{x}}(1+2x)dx =$

(A) $\frac{1}{\sqrt{x}}e^x + c$ (B) $2\sqrt{x}e^x + c$

(C) $\frac{\sqrt{x}}{2}e^x + c$ (D) $\sqrt{x}e^x + c$

128. If $\int x^x(1+\log x)dx = kx^x + c$, then $k =$

(A) $\log_e e$ (B) $\log_e\left(\frac{1}{e^2}\right)$

(C) $\log_e\left(e^2\right)$ (D) $\log_e\left(\frac{1}{e}\right)$

129. $\int_0^1 \tan^{-1}\left(\frac{2x}{1-x^2}\right)dx =$

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

(C) $\pi + \log 2$ (D) $\frac{\pi}{2} + \log 2$

130. $\frac{d^2y}{dx^2} = \sin x + e^x; y(0) = 3$ and $\frac{dy}{dx}$ at $x = 0$ is 4 , then the equation of the

(A) $y = 4 + 2x + e^x - \sin x$

(B) $y = 2 + 3x + e^x - \sin x$

(C) $y = 2 + 4x + e^x - \sin x$

(D) $y = 4 + 2x + e^x + \sin x$

131. $\int_{-\pi}^{\pi} \frac{2x}{1+\cos^2 x}dx =$

(A) π (B) 0

(C) 1 (D) $-\pi$

132. If $\int_0^1 \left(5x^2 - 3x + k\right)dx = 0$, then $k =$

(A) $\frac{1}{3}$ (B) $\frac{1}{6}$

(C) $\frac{-1}{3}$ (D) $\frac{-1}{6}$

133. The area of the region bounded by the curve $y = \log x, x$ -axis and the lines $x = 1, x = e$ is

(A) $\frac{1}{e}$ Sq. Units (B) 1 Sq. Units

(C) 4 sq. Units (D) $\frac{1}{2}$ Sq. Units

134. If the radius of a circle increases at the rate of 7 cm/ sec, then the rate of increase of its area after 10 minutes is

(A) $1,84,800$ cm^2/ sec (B) $1,64,800$ cm^2/ sec

(C) $1,88,400$ cm^2/ sec (D) $1,68,400$ cm^2/ sec

135. The general solution of the differential equation $\frac{dy}{dx} + \frac{1}{\sqrt{1-x^2}} = 0$ is

(A) $y^2 + 2\sin^{-1} x = c$ (B) $x + \sin^{-1} y = c$

(C) $y + \sin^{-1} x = c$ (D) $x^2 + 2\sin^2 y = c$

136. Bacteria increases at the rate proportional to the number of bacteria present. If the original number N doubles in 4 hours, then the number of bacteria will be 4 N in

(A) 2 hours (B) 4 hours

(C) 6 hours (D) 8 hours

137. $y = c^2 + \frac{c}{x}$ is the solution of the differential equation

(A) $x^4\left(\frac{dy}{dx}\right)^2 + x\left(\frac{dy}{dx}\right) - y = 0$

(B) $x^4\left(\frac{dy}{dx}\right)^2 - x\left(\frac{dy}{dx}\right) - y = 0$

(C) $x^4\left(\frac{dy}{dx}\right)^2 - x\left(\frac{dy}{dx}\right) + y = 0$

(D) $x^4\left(\frac{dy}{dx}\right)^2 + x\left(\frac{dy}{dx}\right) + y = 0$

138. If the population grows at the rate of 8% per year, then the time taken for the population to be doubled is (given $\log 2 = 0 \cdot 6912$)

(A) 8.64 years (B) 6.8 years

(C) 10.27 years (D) $4 \cdot 3$ years

139. If A$(-1, 2, 3)$, B$(3, -2, 1)$, C$(2, 1, 3)$ and D$(-1, -2, 4)$ are the vertices of a tetrahedron, then its volume is

(A) $\frac{16}{3}$ Cu. units (B) $\frac{13}{6}$ cu. units

(C) $\frac{16}{31}$ CU. units (D) $\frac{31}{6}$ cu. units

140. If the vectors $\bar{a}, \bar{b}, \bar{c}$ are non coplanar, then $\frac{[\bar{a}+2\bar{b}\bar{b}+2\bar{c}\bar{c}+2\bar{a}]}{[\bar{a}\bar{b}\bar{c}]} =$

(A) 8 (B) 3

(C) 9 (D) 6

141. If the planes $2x - 5y + z = 8$ and $2\lambda x - 15y + \lambda z + 6 = 0$ are parallel to each other, then value of λ is

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

(C) 2 (D) 3

142. If the lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ intersect, then $k =$

(A) $\frac{9}{2}$ (B) $\frac{2}{9}$

(C) $\frac{-9}{2}$ (D) $\frac{-2}{9}$

143. If the line $\bar{r} = (\hat{i} - 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + \hat{j} + 2\hat{k})$ is parallel to the plane $\bar{r} \cdot (3\hat{i} - 2\hat{j} - m\hat{k}) = 5$, then value of m is

(A) -2 (B) -3

(C) 2 (D) 3

144. The direction cosines of a line which lies in ZoX plane and makes an angle of 30° with Z-axis are

(A) $0, \frac{1}{2}, \pm\frac{\sqrt{3}}{2}$ (B) $\pm\frac{1}{2}, 0, \frac{\sqrt{3}}{2}$

(C) $0, \frac{\sqrt{3}}{2}, \pm\frac{1}{2}$ (D) $\frac{\sqrt{3}}{2}, 0, \pm\frac{1}{2}$

145. If the lines given by $\bar{r} = 2\hat{i} + \lambda(\hat{i} + 2\hat{j} + m\hat{k})$ and $\bar{r} = \hat{i} + \mu(2\hat{i} + \hat{j} + 6\hat{k})$ are perpendicular, then the value of m is

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

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

146. If the vectors $(2\hat{i} - q\hat{j} + 3\hat{k})$ and $(4\hat{i} - 5\hat{j} + 6\hat{k})$ are collinear, then the value of q is

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

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

147. The maximum value of $Z = 3x + 5y$, subject to $x + 4y \leq 24, y \leq 4, x \geq 0, y \geq 0$ is

(A) 20 (B) 120

(C) 72 (D) 44

148. The p. d. f. of a continuous random variable X is given by $f(x) = \frac{1}{2}$ if $0 < x < 2 = 0$ otherwise and if $a = P\left(X < \frac{1}{2}\right), b = P\left(X > \frac{3}{2}\right)$, then relation between a and b is

(A) $a - b = 0$ (B) $2a - b = 0$

(C) $3a - b = 0$ (D) $a - 2b = 0$

149. If P(A) $= \frac{2}{5}$, P(B) $= \frac{1}{4}$ and P(AUB) $= \frac{1}{2}$, then P$(A' \cup B') =$

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$

(C) $\frac{3}{20}$ (D) $\frac{17}{20}$

150. The cumulative distribution function of a continuous random variable X is given by $F(X = x) = \frac{\sqrt{x}}{2}$, then $P[X > 1]$ is

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

(C) $\frac{1}{2}$ (D) $\frac{1}{4}$

- End of Question Paper -