1-Feb.-2024 (Morning) : PCM

MATHEMATICS **Section - A (Single Correct Answer)**

1. A bag contains 8 balls, whose colours are either white or black. 4 balls are drawn at random without replacement and it was found that 2 balls are white and other 2 balls are black. The probability that the bag contains equal number of white and black balls is :

(A) $\frac{2}{5}$ (B) $\frac{2}{7}$ (C) $\frac{1}{7}$ (D) $\frac{1}{5}$

2. The value of the integral $\int_0^{\frac{\pi}{4}} \frac{x\,dx}{\sin^4(2x)+\cos^4(2x)}$ equals :

(A) $\frac{\sqrt{2}\pi^2}{8}$ (B) $\frac{\sqrt{2}\pi^2}{16}$ (C) $\frac{\sqrt{2}\pi^2}{32}$ (D) $\frac{\sqrt{2}\pi^2}{64}$

3. If $A=\begin{bmatrix}\sqrt{2} & 1\\ -1 & \sqrt{2}\end{bmatrix}$, $B=\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}$, $C=ABA^T$ and $X=A^TC^2A$, then det X is equal to :

(A) 243 (B) 729 (C) 27 (D) 891

4. If $\tan A=\frac{1}{\sqrt{x(x^2+x+1)}}$, $\tan B=\frac{\sqrt{x}}{\sqrt{x^2+x+1}}$ and $\tan C=(x^{-3}+x^{-2}+x^{-1})^{\frac{1}{2}}$, $0<A, B, C<\frac{\pi}{2}$, then A + B is equal to :

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

5. If n is the number of ways five different employees can sit into four indistinguishable offices where any office may have any number of persons including zero, then n is equal to :

(A) 47 (B) 53 (C) 51 (D) 43

6. Let $S=\{z\in C:|z-1|=1 \text{ and } (\sqrt{2}-1)(z+\bar{z})-i(z-\bar{z})=2\sqrt{2}\}$.

Let $z_1, z_2 \in S$ be such that $|z_1|=\max_{z\in x}|z|$ and $|z_2|=\min_{z\in x}|z|$. Then $|\sqrt{2}z_1-z_2|^2$ equals :

(A) 1 (B) 4

(C) 3 (D) 2

7. Let the median and the mean deviation about the median of 7 observation 170, 125, 230, 190, 210, a, b be 170 and $\frac{205}{7}$ respectively. Then the mean deviation about the mean of these 7 observations is :

(A) 31 (B) 28 (C) 30 (D) 32

8. Let $\vec{a} = -5\hat{i} + \hat{j} - 3\hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 4\hat{k}$ and $\vec{c} = (((\vec{a} \times \vec{b}) \times \hat{i}) \times \hat{i}) \times \hat{i}$. Then $\vec{c} \cdot (-\hat{i} + \hat{j} + \hat{k})$ is equal to

(A) –12 (B) –10 (C) –13 (D) –15

9. Let $S = \{x \in R : (\sqrt{3} + \sqrt{2})^x + (\sqrt{3} - \sqrt{2})^x = 10\}$. Then the number of elements in S is :

(A) 4 (B) 0 (C) 2 (D) 1

10. The area enclosed by the curves xy + 4y = 16 and x + y = 6 is equal to :

(A) 4 (B) 0 (C) 2 (D) 1

11. Let f : **R** → **R** and g : **R** → **R** be defined as $f(x) = \begin{cases} \log_e x, & x > 0 \\ e^{-x}, & x \le 0 \end{cases}$ and $g(x) = \begin{cases} x, & x \ge 0 \\ e^x, & x < 0 \end{cases}$.

Then gof : **R** → **R** is :

(A) one-one but not onto (B) neither one-one nor onto

(C) onto but not one-one (D) both one-one and onto

12. If the system of equations

$2x + 3y - z = 5$

$x + \alpha y + 3z = -4$

$3x - y + \beta z = 7$

has infinitely many solutions, then 13 $\alpha\beta$ is equal to

(A) 1110 (B) 1120 (C) 1210 (D) 1220

13. For $0 < \theta < \pi/2$, if the eccentricity of the hyperbola $x^2 - y^2 \operatorname{cosec}^2\theta = 5$ is $\sqrt{7}$ times eccentricity of the ellipse $x^2 \operatorname{cosec}^2\theta + y^2 = 5$, then the value of θ is :

(A) $\frac{\pi}{6}$ (B) $\frac{5\pi}{12}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

14. Let y = y(x) be the solution of the differential equation $\frac{dy}{dx} = 2x(xy)^3 - x(x+y) - 1,\ y(0) = 1.$

Then, $\left(\frac{1}{\sqrt{2}} + y\left(\frac{1}{\sqrt{2}}\right)\right)^2$ equals :

(A) $\frac{4}{4+\sqrt{e}}$ (B) $\frac{3}{3-\sqrt{e}}$

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

15. Let f : R → R be defined as $f(x) = \begin{cases} \frac{a - b\cos 2x}{x^2} & ; \quad x < 0 \\ x^2 + cx + 2 & ; \quad 0 \le x \le 1 \\ 2x + 1 & ; \quad x > 1 \end{cases}$

If f is continuous everywhere in R and m is the number of points where f is NOT differential then m + a + b + c equals :

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

16. Let $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1,\ a>b$ be an ellipse, whose eccentricity is $\frac{1}{\sqrt{2}}$ and the length of the latus rectum is $\sqrt{14}$.

Then the square of the eccentricity of $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is

(A) 3 (B) 7/2 (C) 3/2 (D) 5/2

17. Let 3, a, b, c be in A.P. and 3, a – 1, b + l, c + 9 be in G.P. Then, the arithmetic mean of a, b and c is :

(A) –4 (B) –1 (C) 13 (D) 11

18. Let C : $x^2 + y^2 = 4$ and C' : $x^2 + y^2 – 4\lambda x + 9 = 0$ be two circles.

If the set of all values of λ so that the circles C and C' intersect at two distinct points, is **R** – [a, b], then the point (8a + 12, 16b – 20) lies on the curve.

(A) $x^2 + 2y^2 – 5x + 6y = 3$ (B) $5x^2 – y = –11$

(C) $x^2 – 4y^2 = 7$ (D) $6x^2 + y^2 = 42$

19. If $5f(x)+4f\left(\frac{1}{x}\right)=x^2-2,\ \forall x\neq 0$ and $y = 9x^2 f(x)$, then y is strictly increasing in :

(A) $\left(0,\ \frac{1}{\sqrt{5}}\right)\cup\left(\frac{1}{\sqrt{5}},\ \infty\right)$ (B) $\left(-\frac{1}{\sqrt{5}},\ 0\right)\cup\left(\frac{1}{\sqrt{5}},\ \infty\right)$

(C) $\left(-\frac{1}{\sqrt{5}},\ 0\right)\cup\left(0,\ \frac{1}{\sqrt{5}}\right)$ (D) $\left(-\infty,\ \frac{1}{\sqrt{5}}\right)\cup\left(0,\ \frac{1}{\sqrt{5}}\right)$

20. If the shortest distance between the lines $\frac{x-\lambda}{2}=\frac{y-2}{1}=\frac{z-1}{1}$ and $\frac{x-\sqrt{3}}{1}=\frac{y-1}{-2}=\frac{z-2}{1}$ is 1, then the sum of all possible value of λ is :

(A) 0 (B) $2\sqrt{3}$ (C) $3\sqrt{3}$ (D) $-2\sqrt{3}$

Section - B (Numerical Value Type)

21. If x = x(t) is the solution of the differential equation $(t + 1)dx = (2x + (t + 1)^4)\,dt$, x(0) = 2, then, x(1) equals _____.

22. The number of elements in the set $S=\{(x,\ y,\ z):x,\ y,\ z\in \mathbf{Z},\ x+2y+3z=42,\ x,\ y,\ z\geq 0\}$ equal _____

23. If the Coefficient of x^{30} in the expansion of $\left(1+\frac{1}{x}\right)^6(1+x^2)^7(1-x^3)^8$; $x\neq 0$ is α, then $|\alpha|$ equals _____

24. Let 3, 7, 11, 15, ..., 403 and 2, 5, 8, 11, ..., 404 be two arithmetic progressions. Then the sum, of the common terms in them, is equal to _____.

25. Let {x} denote the fractional part of x and $f(x)=\frac{\cos^{-1}(1-\{x\}^2)\sin^{-1}(1-\{x\})}{\{x\}-\{x\}^3}$, $x\neq 0$. If L and R respectively denotes the left hand limit and the right hand limit of f(x) at x = 0, then $\frac{32}{\pi^2}(L^2+R^2)$ is equal to _____.

26. Let the line $L:\sqrt{2}x+y=\alpha$ pass through the point of the intersection P (in the first quadrant) of the circle $x^2+y^2=3$ and the parabola $x^2=2y$. Let the line L touch two circles C_1 and C_2 of equal radius $2\sqrt{3}$.

If the centres Q_1 and Q_2 of the circles C_1 and C_2 lie on the y-axis, then the square of the area of the triangle PQ_1Q_2 is equal to _____.

27. Let $P=\{z\in\mathbb{C};\ |z+2-3i|\le 1\}$ and $Q=\{z\in\mathbb{C};\ z(1+i)+\bar{z}(1-i)\le -8\}$.

Let in $P\cap Q$, $|z-3+2i|$ be maximum and minimum at z_1 and z_2 respectively. If $|z_1|^2+2|z|^2=\alpha+\beta\sqrt{2}$, where α, β are integers, then $\alpha+\beta$ equals _____.

28. If $\int_{-\pi/2}^{\pi/2}\frac{8\sqrt{2}\cos x\,dx}{(1+e^{\sin x})(1+\sin^4 x)}=\alpha\pi+\beta\log_e(3+2\sqrt{2})$, where α, β are integers, then $\alpha^2+\beta^2$ equals _____

29. Let the line of the shortest distance between the lines

$$L_1:\vec{r}=(\hat{i}+2\hat{j}+3\hat{k})+\lambda(\hat{i}-\hat{j}+\hat{k}) \text{ and } L_2:\vec{r}=(4\hat{i}+5\hat{j}+6\hat{k})+\mu(\hat{i}+\hat{j}-\hat{k})$$

intersect L_1 and L_2 at P and Q respectively.

If (α, β, γ) is the midpoint of the line segment PQ, then $2(\alpha+\beta+\gamma)$ is equal to _____.

30. Let A= {1, 2, 3, ... 20}. Let R_1 and R_2 two relation on A such that

R_1 = {(a, b) : b is divisible by a}

R_2 = {(a, b) : a is an integral multiple of b}.

Then, number of elements in $R_1 - R_2$ is equal to _____.

PHYSICS Section - A (Single Correct Answer)

31. With rise in temperature, the Young's modulus of elasticity

(A) changes erratically (B) decreases

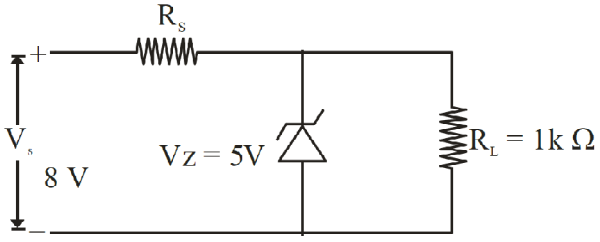
(C) increases (D) remains unchanged

32. If R is the radius of the earth and the acceleration due to gravity on the surface of earth is $g=\pi^2$ m/s^2, then the length of the second's pendulum at a height h = 2R from the surface of earth will be,:

(A) $\frac{2}{9}$m (B) $\frac{1}{9}$m

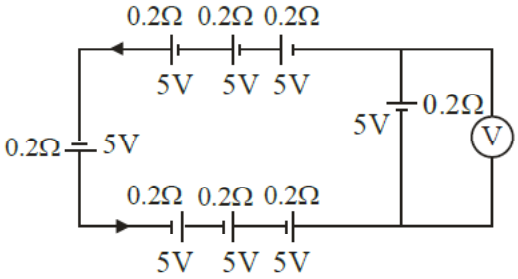
(C) $\frac{4}{9}$m (D) $\frac{8}{9}$m

33. In the given circuit if the power rating of Zener diode is 10 mW, the value of series resistance R_s to regulate the input unregulated supply is :



(A) 5 kΩ (B) 10 Ω (C) 1 kΩ (D) 10 kΩ

34. The reading in the ideal voltmeter (V) shown in the given circuit diagram is :



(A) 5V (B) 10V (C) 0 V (D) 3V

35. Two identical capacitors have same capacitance C. One of them is charged to the potential V and other to the potential 2V. The negative ends of both are connected together. When the positive ends are also joined together, the decrease in energy of the combined system is :

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

(C) $\frac{1}{2}CV^2$ (D) $\frac{3}{4}CV^2$

36. Two moles a monoatomic gas is mixed with six moles of a diatomic gas. The molar specific heat of the mixture at constant volume is :

(A) $\frac{9}{4}R$ (B) $\frac{7}{4}R$ (C) $\frac{3}{2}R$ (D) $\frac{5}{2}R$

37. A ball of mass 0.5 kg is attached to a string of length 50 cm. The ball is rotated on a horizontal circular path about its vertical axis. The maximum tension that the string can bear is 400 N. The maximum possible value of angular velocity of the ball in rad/s is :

(A) 1600 (B) 40 (C) 1000 (D) 20

38. A parallel plate capacitor has a capacitance C = 200 pF. It is connected to 230 V ac supply with an angular frequency 300 rad/s. The rms value of conduction current in the circuit and displacement current in the capacitor respectively are :

(A) 1.38 μA and 1.38 μA (B) 14.3 μA and 143 μA

(C) 13.8 μA and 138 μA (D) 13.8 μA and 13.8 μA

39. The pressure and volume of an ideal gas are related as $PV^{3/2} = K$ (Constant). The work done when the gas is taken from state A (P_1, V_1, T_1) to state B (P_2, V_2, T_2) is :

(A) $2(P_1V_1 - P_2V_2)$ (B) $2(P_2V_2 - P_1V_1)$

(C) $2\left(\sqrt{P_1}V_1 - \sqrt{P_2}V_2\right)$ (D) $2\left(P_2\sqrt{V_2} - P_1\sqrt{V_1}\right)$

40. A galvanometer has a resistance of 50 Ω and it allows maximum current of 5 mA. It can be converted into voltmeter to measure upto 100 V by connecting in series a resistor of resistance

(A) 5975 Ω (B) 20050 Ω

(C) 19950 Ω (D) 19500 Ω

41. The de Broglie wavelengths of a proton and an α particle are λ and 2 λ respectively. The ratio of the velocities of proton and α particle will be :

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

42. 10 divisions on the main scale of a Vernier calliper coincide with 11 divisions on the Vernier scale. If each division on the main scale is of 5 units, the least count of the instrument is :

(A) 1/2 (B) 10/11 (C) 50/11 (D) 5/11

43. In series LCR circuit, the capacitance is changed from C to 4C. To keep the resonance frequency unchanged, the new inductance should be :

(A) reduced by $\frac{1}{4}$L (B) increased by 2L

(C) reduced by $\frac{3}{4}$L (D) increased to 4L

44. The radius (r), length (l) and resistance (R) of a metal wire was measured in the laboratory as
r = (0.35 ± 0.05) cm
R = (100 ± 10) ohm
l = (15 ± 0.2) cm
The percentage error in resistivity of the material of the wire is :
(A) 25.6% (B) 39.9% (C) 37.3% (D) 35.6%

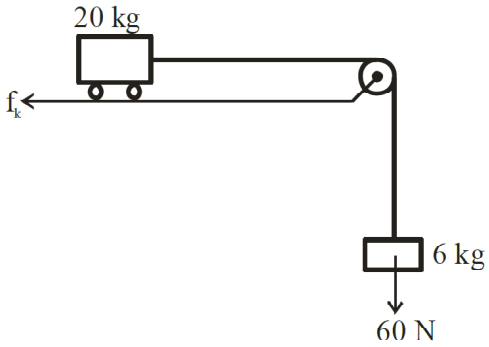
45. The dimensional formula of angular impulse is :
(A) [M L^{-2} T^{-1}] (B) [M L^2 T^{-2}] (C) [M L T^{-1}] (D) [M L^2 T^{-1}]

46. A simple pendulum of length 1 m has a wooden bob of mass 1 kg. It is struck by a bullet of mass 10^{-2} kg moving with a speed of 2×10^2 ms^{-1}. The bullet gets embedded into the bob. The height to which the bob rises before swinging back is :
(Use : g = 10 m/s^2)
(A) 0.30 m (B) 0.20 m (C) 0.35 m (D) 0.40 m

47. A particle moving in a circle of radius R with uniform speed takes time T to complete one revolution. If this particle is projected with the same speed at an angle θ to the horizontal, the maximum height attained by it is equal to 4R. The angle of projection θ is then given by :

(A) $\sin^{-1}\left[\frac{2gT^2}{\pi^2R}\right]^{\frac{1}{2}}$ (B) $\sin^{-1}\left[\frac{\pi^2R}{2gT^2}\right]^{\frac{1}{2}}$ (C) $\cos^{-1}\left[\frac{2gT^2}{\pi^2R}\right]^{\frac{1}{2}}$ (D) $\cos^{-1}\left[\frac{\pi^2R}{2gT^2}\right]^{\frac{1}{2}}$

48. Consider a block and trolley system as shown in figure. If the coefficient of kinetic friction between the trolley and the surface is 0.04, the acceleration of the system in ms^{-2} is : (Consider that the string is massless and unstretchable and the pulley is also massless and frictionless) :



(A) 3 (B) 4 (C) 2 (D) 1.2

49. The minimum energy required by a hydrogen atom in ground state to emit radiation in Balmer series is nearly :
(A) 1.5 eV (B) 13.6 eV (C) 1.9 eV (D) 12.1 eV

50. A monochromatic light of wavelength 6000 Å is incident on the single slit of width 0.01 mm. If the diffraction pattern is formed at the focus of the convex lens of focal length 20 cm, the linear width of the central maximum is :
(A) 60 mm (B) 24 mm (C) 120 mm (D) 12 mm

Section - B (Numerical Value Type)

51. A regular polygon of 6 sides is formed by bending a wire of length 4 π meter.

    If an electric current of $4\pi\sqrt{3}$ A is flowing through the sides of the polygon, the magnetic field at the centre of the polygon would be x × 10^{-7} T. The value of x is _____.

52. A rectangular loop of sides 12 cm and 5 cm, with its sides parallel to the x-axis and y-axis respectively moves with a velocity of 5 cm/s in the positive x axis direction, in a space containing a variable magnetic field in the positive z direction.

    The field has a gradient of 10^{-3} T/cm along the negative x direction and it is decreasing with time at the rate of 10^{-3} T/s. If the resistance of the loop is 6 mΩ, the power dissipated by the loop as heat is _____ × 10^{-9} W.

53. The distance between object and its 3 times magnified virtual image as produced by a convex lens is 20 cm. The focal length of the lens used is _____ cm.

54. Two identical charged spheres are suspended by strings of equal lengths. The strings make an angle θ with each other. When suspended in water the angle remains the same. If density of the material of the sphere is 1.5 g/cc, the dielectric constant of water will be _____.

    [Take density of water = 1 g/cc]

55. The radius of a nucleus of mass number 64 is 4.8 fermi. Then the mass number of another nucleus having radius of 4 fermi is 1000/x, where x is _____.

56. The identical spheres each of mass 2M are placed at the corners of a right angled triangle with mutually perpendicular sides equal to 4 m each.

    Taking point of intersection of these two sides as origin, the magnitude of position vector of the centre of mass of the system is $\frac{4\sqrt{2}}{x}$, where the value of x is _____.

57. A tuning fork resonates with a sonometer wire of length 1 m stretched with a tension of 6 N. When the tension in the wire is changed to 54 N, the same tuning fork produces 12 beats per second with it. The frequency of the tuning fork is _____ Hz.

58. A plane is in level flight at constant speed and each of its two wings has an area of 40 m^2. If the speed of the air is 180 km/h over the lower wing surface and 252 km/h over the upper wing surface, the mass of the plane is _____ kg.

    [Take air density to be 1 kg m^{-3} and g = 10 ms^{-2}]

59. The current in a conductor is expressed as $I = 3t^2 + 4t^3$, where I is in Ampere and t is in second.

    The amount of electric charge that flows through a section of the conductor during t = 1s to t = 2s is _____C.

60. A particle is moving in one dimension (along x axis) under the action of a variable force. It's initial position was 16 m right of origin.

    The variation of its position (x) with time (t) is given as $x = -3t^3 + 18t^2 + 16t$, where x is in m and t is in s. The velocity of the particle when its acceleration becomes zero is _____ m/s.

CHEMISTRY Section - A (Single Correct Answer)

61. If one strand of a DNA has the sequence ATGCTTCA, sequence of the bases in complementary strand is :

    (A) CATTAGCT (B) TACGAAGT (C) GTACTTAC (D) ATGCGACT

62. Given below are two statements :

one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : Haloalkanes react with KCN to form alkyl cyanides as a main product while with AgCN form isocyanide as the main product.

Reason (R) : KCN and AgCN both are highly ionic compounds.

In the light of the above statement, choose the most appropriate answer from the options given below :

(A) (A) is correct but (R) is not correct

(B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(C) (A) is not correct but (R) is correct

(D) Both (A) and (R) are correct and (R) is the correct explanation of (A)

63. In acidic medium, $K_2Cr_2O_7$ shows oxidising action as represented in the half reaction.

$$Cr_2O_7^{2-} + XH^+ + Ye^- \rightarrow 2A + ZH_2O$$

X, Y, Z and A are respectively are :

(A) 8, 6, 4 and Cr_2O_3 (B) 14, 7, 6 and Cr^{3+}

(C) 8, 4, 6 and Cr_2O_3 (D) 14, 6, 7 and Cr^{3+}

64. Which of the following reactions are disproportionation reactions ?

A. $Cu^+ \rightarrow Cu^{2+} + Cu$

B. $3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$

C. $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$

D. $2MnO_4^- + 3Mn^{2+} + 2H_2O \rightarrow 5MnO_2 + 4H^+$

Choose the correct answer from the options given below :

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

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

65. In case of isoelectronic species the size of F^-, Ne and Na^+ is affected by :

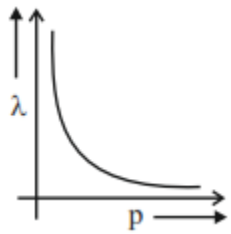
(A) Principal quantum number (n)

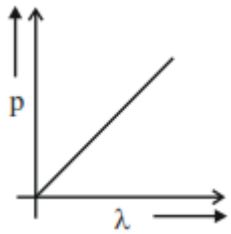
(B) None of the factors because their size is the same

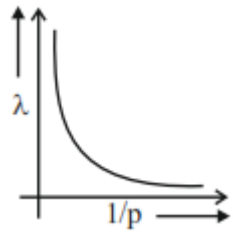
(C) Electron-electron interaction in the outer orbitals

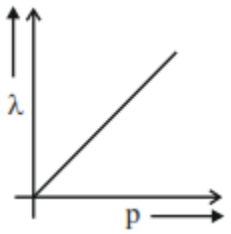
(D) Nuclear charge (z)

66. According to the wave-particle duality of matter by de-Broglie, which of the following graph plot presents most appropriate relationship between wavelength of electron (λ) and momentum of electron (p) ?

(A) 

(B) 

(C) 

(D) 

67. Given below are two statements :

Statement (I) : A solution of $[Ni(H_2O)_6]^{2+}$ is green in colour.

Statement (II) : A solution of $[Ni(CN)_4]^{2-}$ is colourless.

In the light of the above statements, choose the most appropriate answer from the options given below.

(A) Both Statement I and Statement II are incorrect

(B) Both Statement I and Statement II are correct

(C) Statement I is incorrect but Statement II is correct

(D) Statement I is correct but Statement II is incorrect

68. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : PH_3 has lower boiling point than NH_3.

Reason (R) : In liquid state NH_3 molecules are associated through vander waal's forces, but PH_3 molecules are associated through hydrogen bonding.

In the light of the above statements, choose the most appropriate answer from the options given below.

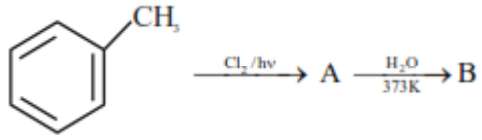
(A) Both (A) and (R) are correct and (R) is not the correct explanation of (A)

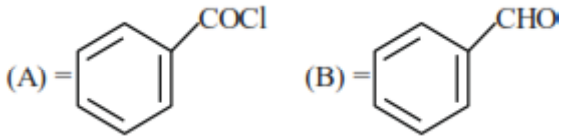
(B) (A) is not correct but (R) is correct

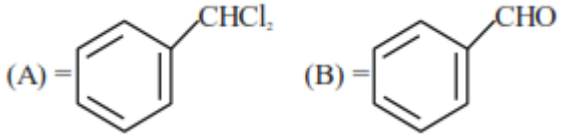
(C) Both (A) and (R) are correct but (R) is the correct explanation of (A)

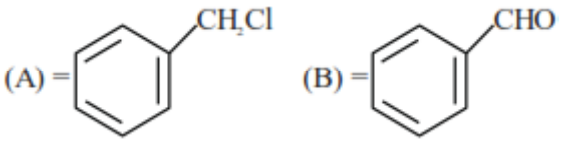
(D) (A) is correct but (R) is not correct

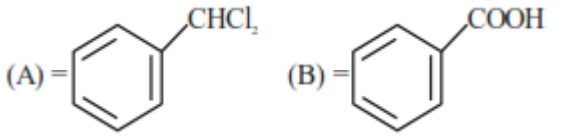
69. Identify A and B in the following sequence of reaction.



(A) 

(B) 

(C) 

(D) 

70. Given below are two statements :

Statement (I) : Aminobenzene and aniline are same organic compounds.

Statement (II) : Aminobenzene and aniline are different organic compounds.

In the light of the above statements, choose the most appropriate answer from the options given below.

(A) Both Statement I and Statement II are correct

(B) Statement I is correct but Statement II is incorrect

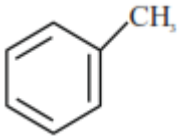
(C) Statement I is incorrect but Statement II is correct

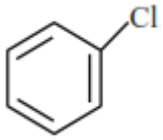
(D) Both Statement I and Statement II are incorrect

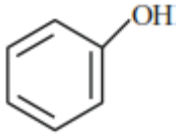
71. Which of the following complex is homoleptic ?

(A) $[Ni(CN)_4]^{2-}$ (B) $[Ni(NH_3)_2Cl_2]$ (C) $[Fe(NH_3)_4Cl_2]^+$ (D) $[Co(NH_3)_4Cl_2]^+$

72. Which of the following compound will most easily be attacked by an electrophile ?

(A)  (B) 

(C) 

(D) 

73. Ionic reactions with organic compounds proceed through :

A. Homolytic bond cleavage B. Heterolytic bond cleavage

C. Free radical formation D. Primary free radical

E. Secondary free radical

Choose the correct answer from the options given below.

(A) (A) only (B) (C) only (C) (B) only (D) (D) & (E) only

74. Arrange the bonds in order of increasing ionic character in the molecules. LiF, K_2O, N_2, SO_2 and ClF_3.

(A) $ClF_3 < N_2 < SO_2 < K_2O < LiF$ (B) $LiF < K_2O < ClF_3 < SO_2 < N_2$

(C) $N_2 < SO_2 < ClF_3 < K_2O < LiF$ (D) $N_2 < ClF_3 < SO_2 < K_2O < LiF$

75. We have three aqueous solutions of NaCl labelled as 'A', 'B' and 'C' with concentration 0.1 M, 0.01 M and 0.001 M, respectively. The value of van't Haft factor (i) for these solutions will be in the order.

(A) $i_A < i_B < i_C$ (B) $i_A < i_C < i_B$

(C) $i_A = i_B = i_C$ (D) $i_A > i_B > i_C$

76. In Kjeldahl's method for estimation of nitrogen, $CuSO_4$ acts as :

(A) Reducing agent (B) Catalytic agent

(C) Hydrolysis agent (D) Oxidising agent

77. Given below are two statements :

Statement (I) : Potassium hydrogen phthalate is a primary standard for standardisation of sodium hydroxide solution.

Statement (II) : In this titration phenolphthalein can be used as indicator.

In the light of the above statements, choose the most appropriate answer from the options given below.

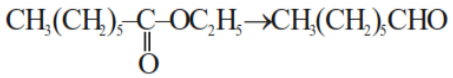
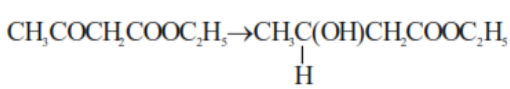
(A) Both Statement I and Statement II are correct

(B) Statement I is correct but Statement II is incorrect

(C) Statement I is incorrect but Statement II is correct

(D) Both Statement I and Statement II are incorrect

78. Match List-I with List-II.

	List-I (Reactions)		**List-II (Reagents)**
A.		I.	CH_3MgBr, H_2O
B.	$C_6H_5COC_6H_5 \rightarrow C_6H_5CH_2C_6H_5$	II.	Zn(Hg) and conc. HCl
C.	$C_6H_5CHO \rightarrow C_6H_5CH(OH)CH_3$	III.	$NaBH_4$, H^+
D.		IV.	DIBAL-H, H_2O

Choose the correct answer from options given below :

(A) A-(III), (B)-(IV), (C)-(I), (D)-(II) (B) A-(IV), (B)-(II), (C)-(I), (D)-(III)

(C) A-(IV), (B)-(II), (C)-(III), (D)-(I) (D) A-(III), (B)-(IV), (C)-(II), (D)-(I)

79. Choose the correct option for free expansion of an ideal gas under adiabatic condition from the following :

(A) $q = 0, \Delta T \neq 0, w = 0$ (B) $q = 0, \Delta T < 0, w \neq 0$

(C) $q \neq 0, \Delta T = 0, w = 0$ (D) $q = 0, \Delta T = 0, w = 0$

80 Given below are two statements :

Statement (I) : The NH_2 group in Aniline is ortho and para directing and a powerful activating group.

Statement (II) : Aniline does not undergo Friedel-Craft's reaction (alkylation and acylation).

In the light of the above statements, choose the most appropriate answer from the options given below.

(A) Both Statement I and Statement II are correct

(B) Both Statement I and Statement II are incorrect

(C) Statement I is incorrect but Statement II is correct

(D) Statement I is correct but Statement II is incorrect

Section - B (Numerical Value Type)

81. Number of optical isomers possible for 2-chlorobutane _____.

82. The potential for the given half cell at 298 K is (-) _____ $\times 10^{-2}$ V.

$2H^+_{(aq)} + 2e^- \rightarrow H_2(g)$

$[H^+] = 1$ M, $P_{H_2} = 2$ atm

[**Given :** 2.303 RT/F = 0.06 V, log2 = 0.3]

83. The number of white coloured salts among the following is _____.

(A) $SrSO_4$ (B) $Mg(NH_4)PO_4$ (C) $BaCrO_4$

(D) $Mn(OH)_2$ (E) $PbSO_4$ (F) $PbCrO_4$

(G) AgBr (H) PbI_2 (I) CaC_2O_4

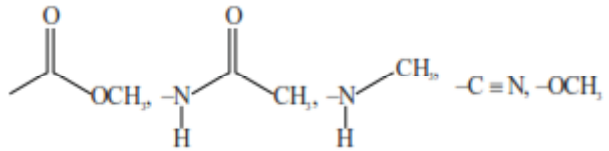
(J) $[Fe(OH)_2(CH_3COO)]$

84. The ratio of $\frac{^{14}C}{^{12}C}$ in a piece of wood is $\frac{1}{8}$ part that of atmosphere. If half life of ^{14}C is 5730 years, the age of wood sample is _____ years.

85. The number of molecules/ion/s having trigonal bipyramidal shape is _____.

PF_5, BrF_5, PCl_5, $[PtCl_4]^{2-}$, BF_3, $Fe(CO)_5$

86. Total number of deactivating groups in aromatic electrophilic substitution reaction among the following is



87. Lowest Oxidation number of an atom in a compound A_2B is –2. The number of an electron in its valence shell is

88. Among the following oxide of p-block elements, number of oxides having amphoteric nature is

Q_2O_7, CO, PbO_2, N_2O, NO, Al_2O_3, SiO_2, N_2O_5, SnO_2

89. Consider the following reaction :

$$3PbCl_2 + 2(NH_4)3PO_4 \rightarrow Pb_3(PO_4)_2 + 6NH_4Cl$$

If 72 mmol of $PbCl_2$ is mixed with 50 mmol of $(NH_4)_3PO_4$, then amount of $Pb_3(PO_4)_2$ formed is _____ mmol.

[nearest integer]

90. K_a for CH_3COOH is 1.8×10^{-5} and K_b for NH_4OH is 1.8×10^{-5}. The pH of ammonium acetate solution will be

● ● ●

1-Feb.-2024 (Morning) : PCM

MATHEMATICS

Single Choice Correct									
1.	B	2.	C	3.	B	4.	A	5.	C
6.	D	7.	C	8.	A	9.	C	10.	C
11.	B	12.	B	13.	C	14.	D	15.	D
16.	C	17.	D	18.	D	19.	B	20.	B
Numerical Value									
21.	14	22.	169	23.	678	24.	6699	25.	18
26.	72	27.	36	28.	8	29.	21	30.	46

PHYSICS

Single Choice Correct									
31.	B	32.	B	33.	Bonus	34.	C	35.	A
36.	A	37.	B	38.	D	39.	A or B	40.	C
41.	D	42.	D	43.	C	44.	B	45.	D
46.	B	47.	A	48.	C	49.	D	50.	B
Numerical Value									
51.	72	52.	216	53.	15	54.	3	55.	27
56.	3	57.	6	58.	9600	59.	22	60.	52

CHEMISTRY

Single Choice Correct									
61.	B	62.	A	63.	D	64.	A	65.	D
66.	A	67.	B	68.	D	69.	B	70.	B
71.	A	72.	D	73.	C	74.	C	75.	A
76.	B	77.	A	78.	B	79.	D	80.	A
Numerical Value									
81.	2	82.	1	83.	5	84.	17190	85.	3
86.	2	87.	6	88.	3	89.	24	90.	7