29-Jan.-2024 (Morning) : PCM

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

1. If in a G.P. of 64 terms, the sum of all the terms is 7 times the sun of the odd terms of the G.P, then the common ratio of the G.P. is equal to

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

2. In an A.P., the sixth terms $a_6 = 2$. If the $a_1a_4a_5$ is the greatest, then the common differnce of the A.P., is equal to

(A) $\frac{3}{2}$ (B) $\frac{8}{5}$ (C) $\frac{2}{3}$ (D) $\frac{5}{8}$

3. If $f(x)=\begin{cases}2+2x, -1\le x<0\\ 1-\frac{x}{3}, 0\le x\le 3\end{cases}$; $g(x)\begin{cases}-x, -3\le x\le 0\\ x, 0\le x\le 1\end{cases}$, then range of (fog(x)) is

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

4. A fair die is thrown until 2 appears. Then the probability, that 2 appears in even number of throws, is

(A) $\frac{5}{6}$ (B) $\frac{1}{6}$ (C) $\frac{5}{11}$ (D) $\frac{6}{11}$

5. If $z=\frac{1}{2}-2i$, is such that $|z+1| = \alpha z + \beta(1+i)$, $i=\sqrt{-1}$ and $\alpha, \beta \in R$, then $\alpha+\beta$ is equal to

(A) –4 (B) 3 (C) 2 (D) –1

6. $\lim\limits_{x\to\frac{\pi}{2}}\left(\frac{1}{\left(x-\frac{\pi}{2}\right)^2}\int_{x^3}\left(\frac{\pi}{2}\right)^3\cos\left(\frac{1}{t^3}\right)dt\right)$ is equal to

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

7. In a ABC, suppose y = x is the equation of the bisector of the angle B and the equation of the side AC is 2x – y = 2. If 2AB = BC and the point A and B are respectively (4, 6) and (α, β), then $\alpha+2\beta$ is equal to

(A) 42 (B) 39 (C) 48 (D) 45

8. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three non-zero vectors such that $\vec{b}$ and $\vec{c}$ are non-collinear if $\vec{a}+5\vec{b}$ is collinear with $\vec{c}$, $\vec{b}+6\vec{c}$ is collinear with $\vec{a}$ and $\vec{a}+\alpha\vec{b}+\beta\vec{c}=\vec{0}$, then $\alpha+\beta$ is equal to

(A) 35 (B) 30
(C) –30 (D) –25

9. Let $\left(5, \frac{a}{4}\right)$, be the circumcenter of a triangle with vertices A (a, –2), B(a, 6) and C$\left(\frac{a}{4}, 2\right)$. Let α denote the circumaradius, β denote the area and γ denote the permiter of the triangle. The $\alpha+\beta+\gamma$ is

(A) 60 (B) 53 (C) 62 (D) 30

10. For $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, if $y(x)=\int \frac{\operatorname{cosec} x+\sin x}{\operatorname{cosec} x \sec x+\tan x \sin^2 x} dx$ and $\lim\limits_{x \to \left(\frac{\pi}{2}\right)} y(x)=0$ then $y\left(\frac{\pi}{4}\right)$ is equal to

(A) $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$ (B) $\frac{1}{2}\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$

(C) $-\frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$ (D) $\frac{1}{\sqrt{2}}\tan^{-1}\left(-\frac{1}{2}\right)$

11. If α, $-\frac{\pi}{2}<\alpha<\frac{\pi}{2}$ is the solution of $4\cos\theta+5\sin\theta=1$, then the value of $\tan\alpha$ is

(A) $\frac{10-\sqrt{10}}{6}$ (B) $\frac{10-\sqrt{10}}{12}$ (C) $\frac{\sqrt{10}-10}{12}$ (D) $\frac{\sqrt{10}-10}{6}$

12. A function y = f(x) satisfies f (x) sin 2x + sin x –(1 + cos 2x) f '(x) = 0 with condition f(0) = 0 . Then $f\left(\frac{\pi}{2}\right)$ is equal to

(A) 1 (B) 0 (C) –1 (D) 2

13. Let O be the origin and the position vector of A and B be $2\hat{i}+2\hat{j}+\hat{k}$ and $2\hat{i}+4\hat{j}+4\hat{k}$ respectively. If the internal bisector of $\angle AOB$ meets the line AB at C, then the length of OC is

(A) $\frac{2}{3}\sqrt{31}$ (B) $\frac{2}{3}\sqrt{24}$ (C) $\frac{3}{4}\sqrt{34}$ (D) $\frac{3}{2}\sqrt{31}$

14. Consider the function $f:\left[\frac{1}{2}, 1\right] \to R$ defined by $f(x)=4\sqrt{2}x^3-3\sqrt{2}x-1$. Consider the statements

(I) The curve y = f(x) intersects the x-axis exactly at one point

(II) The curve y = f(x) intersects the x-axis at $x=\cos\frac{\pi}{12}$

Then

(A) Only (II) is correct (B) Both (I) and (II) are incorrect

(C) Only (I) is correct (D) Both (I) and (II) are correct

15. Let $A=\begin{bmatrix}1 & 0 & 0\\ 0 & \alpha & \beta\\ 0 & \beta & \alpha\end{bmatrix}$ and $|2A|^3 = 2^{21}$ where $\alpha, \beta \in Z$, Then a value of α is

(A) 3 (B) 5 (C) 17 (D) 9

16. Let PQR be a triangle with R(–1, 4, 2) . Suppose M(2, 1, 2) is the mid point of PQ. The distance of the centroid of ΔPQR from the point of intersection of the line $\frac{x-2}{0}=\frac{y}{2}=\frac{z+3}{-1}$ and $\frac{x-1}{1}=\frac{y+3}{-3}=\frac{z+1}{1}$ is

(A) 69 (B) 9

(C) $\sqrt{69}$ (D) $\sqrt{99}$

17. Let R be a relation on Z × Z defined by (a, b) R(c, d) if and only if ad – bc is divisible by 5. Then R is

(A) Reflexive and symmetric but not transitive

(B) Reflexive but neither symmetric not transitive

(C) Reflexive, symmetric and transitive

(D) Reflexive and transitive but not symmetric

18. If the value of the integral $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\left(\frac{x^2\cos x}{1+\pi^x}+\frac{1+\sin^2 x}{1+e^{\sin x^{2023}}}\right)dx=\frac{\pi}{4}(\pi+a)-2,$ then the value of a is :

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

19. Suppose $f(x)=\frac{(2^x+2^{-x})\tan x\sqrt{\tan^{-1}(x^2-x+1)}}{(7x^2+3x+1)^3}$, Then the value of f '(0) is equal to

(A) π (B) 0

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

20. Let A be a square matrix such that $AA^T = I$. Then $\frac{1}{2}A[(A+A^T)^2+(A-A^T)^2]$ is equal to

(A) $A^2 + I$ (B) $A^3 + I$ (C) $A^2 + A^T$ (D) $A^3 + A^T$

Section - B (Numerical Value Type)

21. Equation of two diameters of a circle are 2x – 3y = 5 and 3x – 4y = 7. The line joining the points $\left(-\frac{22}{7},\ -4\right)$ and $\left(-\frac{1}{7},\ 3\right)$ intersects the circle at only one point P(α, β). Then 17β – α is equal to

22. All the letters of the word "GTWENTY" are written in all possible ways with or without meaning and these words are written as in a dictionary. The serial number of the word "GTWENTY" IS

23. Let α, β be the roots of the equation $x^2 – x + 2 = 0$ with Im(α) > Im(β). Then $\alpha^6 + \alpha^4 + \beta^4 – 5\alpha^2$ is equal to

24. Let $f(x) = 2^x – x^2,\ x \in R$. If m and n are respectively the number of points at which the curves y = f(x) and y = f '(x) intersects the x-axis, then the value of m + n is

25. If the points of intersection of two distinct conics $x^2 + y^2 = 4b$ and $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ lie on the curve $y^2 = 3x^2$, then $3\sqrt{3}$ times the area of the rectangle formed by the intersection points is _____

26. If the solution curve y = y(x) of the differential equation $(1 + y^2)(1 + \log_e x)\,dx + x\,dy = 0$, $x > 0$ passes through the point (1, 1) and $y(e) = \dfrac{\alpha - \tan\left(\frac{3}{2}\right)}{\beta + \tan\left(\frac{3}{2}\right)}$, then $\alpha + 2\beta$ is

27. If the mean and variance of the data 65, 68, 58, 44, 48, 45, 60, a,p,60 where $\alpha > \beta$ are 56 and 66.2 respectively, then $\alpha^2 + \beta^2$ is equal to

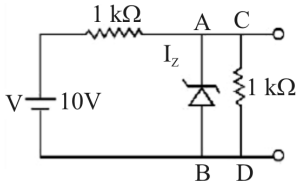
28. The area (in sq. units) of the part of circle $x^2 + y^2 = 169$ which is below the line $5x - y = 13$ is $\dfrac{\pi\alpha}{2\beta} - \dfrac{65}{2} + \dfrac{\alpha}{\beta}\sin^{-1}\left(\dfrac{12}{13}\right)$ where α, β are coprime numbers. Then $\alpha + \beta$ is equal to

29. If $\dfrac{{}^{11}C_1}{2} + \dfrac{{}^{11}C_2}{3} + \ldots\ldots + \dfrac{{}^{11}C_9}{10} = \dfrac{n}{m}$ with gcd(n, m) = 1, then n + m is equal to

30. A line with direction ratios 2, 1, 2 meets the lines x = y + 2 = z and x + 2 = 2y = 2z respectively at the point P and Q. if the length of the perpendicular from the point (1, 2, 12) to the line PQ is l, then l^2 is

PHYSICS Section - A (Single Correct Answer)

31. In the given circuit, the breakdown voltage of the Zener diode is 3.0 V. What is the value of I_z ?



(A) 3.3 mA (B) 5.5 mA (C) 10 mA (D) 7 mA

32. The electric current through a wire varies with time as $I = I_0 + \beta t$. where I_0 = 20 A and β = 3 A/s. The amount of electric charge crossed through a section of the wire in 20 s is :

(A) 80 C (B) 1000 C (C) 800 C (D) 1600 C

33. Given below are two statements:

Statement I : If a capillary tube is immersed first in cold water and then in hot water, the height of capillary rise will be smaller in hot water.

Statement II : If a capillary tube is immersed first in cold water and then in hot water, the height of capillary rise will be smaller in cold water.

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

(A) Both Statement I and Statement II are true

(B) Both Statement I and Statement II are false

(C) Statement I is true but Statement II is false

(D) Statement I is false but Statement II is true

34. A convex mirror of radius of curvature 30 cm forms an image that is half the size of the object. The object distance is :

(A) – 15 cm (B) 45 cm (C) – 45cm (D) 15 cm

35. Two charges of 5Q and – 2Q are situated at the points (3a, 0) and (– 5a, 0) respectively. The electric flux through a sphere of radius '4a' having center at origin is :

(A) $2Q/\varepsilon_0$ (B) $5Q/\varepsilon_0$ (C) $7Q/\varepsilon_0$ (D) $3Q/\varepsilon_0$

36. A body starts moving from rest with constant acceleration covers displacement S_1 in first (p – 1) seconds and S_2 in first p seconds. The displacement $S_1 + S_2$ will be made in time :

(A) $(2p + 1)s$ (B) $\sqrt{(2p^2 - 2p + 1)}s$ (C) $(2p - 1)s$ (D) $(2p^2 - 2p + 1)s$

37. The potential energy function (in J) of a particle in a region of space is given as $U = (2x^2 + 3y^3 + 2z)$. Here x, y and z are in meter. The magnitude of x - component of force (in N) acting on the particle at point P (1, 2, 3) m is :

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

38. The resistance $R = \frac{V}{I}$ where $V = (200 \pm 5)V$ and $I = (20 \pm 0.2)A$, the percentage error in the measurement of R is :

(A) 3.5% (B) 7% (C) 3% (D) 5.5%

39. A block of mass 100 kg slides over a distance of 10 m on a horizontal surface. If the co-efficient of friction between the surfaces is 0.4, then the work done against friction (in J) is :

(A) 4200 (B) 3900 (C) 4000 (D) 4500

40. Match List I with List II

List I		List II	
A.	$\oint \vec{B} \cdot \vec{dl} = \mu_0 i_c + \mu_0 \varepsilon_0 \frac{d\phi}{dt}$	I.	Gauss' law for electricity
B.	$\oint \vec{E} \cdot \vec{dl} = \frac{d\phi_B}{dt}$	II.	Gauss' law for magnetism
C.	$\oint \vec{E} \cdot \overrightarrow{dA} = \frac{Q}{\varepsilon_0}$	III.	Faraday law
D.	$\oint \vec{B} \cdot \overrightarrow{dA} = 0$	IV.	Ampere - Maxwell law

Chose the correct answer from the options given below

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

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

41. If the radius of curvature of the path of two particles of same mass are in the ratio 3 : 4, then in order to have constant centripetal force, their velocities will be in the ratio of :

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

42. A galvanometer having coil resistance 10 Ω shows a full scale deflection for a current of 3mA. For it to measure a current of 8A, the value of the shunt should be:

(A) 3×10^{-3} Ω (B) 4.85×10^{-3} Ω

(C) 3.75×10^{-3} Ω (D) 2.75×10^{-3} Ω

43. The de-Broglie wavelength of an electron is the same as that of a photon. If velocity of electron is 25% of the velocity of light, then the ratio of K.E. of electron and K.E. of photon will be:

(A) 1/1 (B) 1/8 (C) 8/1 (D) 1/4

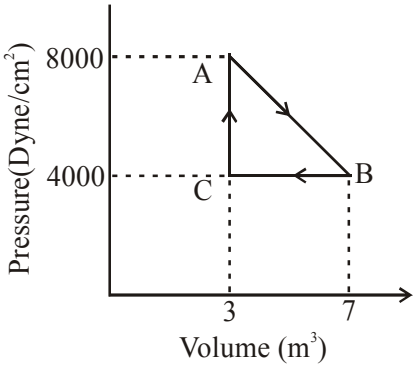
44. The deflection in moving coil galvanometer falls from 25 divisions to 5 division when a shunt of 24Ω is applied. The resistance of galvanometer coil will be :

(A) 12Ω (B) 96Ω (C) 48Ω (D) 100Ω

45. A biconvex lens of refractive index 1.5 has a focal length of 20 cm in air. Its focal length when immersed in a liquid of refractive index 1.6 will be:

(A) – 16 cm (B) – 160 cm (C) + 160 cm (D) + 16 cm

46. A thermodynamic system is taken from an original state A to an intermediate state B by a linear process as shown in the figure. It's volume is then reduced to the original value from B to C by an isobaric process. The total work done by the gas from A to B and B to C would be :



(A) 33800 J (B) 2200 J (C) 600 J (D) 1200 J

47. At what distance above and below the surface of the earth a body will have same weight, (take radius of earth as R.)

(A) $\sqrt{5}R - R$ (B) $\frac{\sqrt{3}R - R}{2}$ (C) R/2 (D) $\frac{\sqrt{5}R - R}{2}$

48. A capacitor of capacitance 100 μF is charged to a potential of 12 V and connected to a 6.4 mH inductor to produce oscillations. The maximum current in the circuit would be :

(A) 3.2 A (B) 1.5 A (C) 2.0 A (D) 1.2 A

49. The explosive in a Hydrogen bomb is a mixture of ${}_1H^2$, ${}_1H^3$ and ${}_3Li^6$ in some condensed form. The chain reaction is given by

$${}_3Li^6 + {}_0n^1 \rightarrow {}_2He^4 + {}_1H^3$$
$${}_1H^2 + {}_1H^3 \rightarrow {}_2He^4 + {}_0n^1$$

During the explosion the energy released is approximately

[Given : M(Li) = 6.01690 amu. M (${}_1H^2$) = 2.01471 amu.

M (${}_2He^4$) = 4.00388amu, and 1 amu = 931.5 MeV]

(A) 28.12 MeV (B) 12.64 MeV

(C) 16.48 MeV (D) 22.22 MeV

50. Two vessels A and B are of the same size and are at same temperature. A contains 1g of hydrogen and B contains 1g of oxygen. P_A and P_B are the pressures of the gases in A and B respectively, then $\frac{P_A}{P_B}$ is :

(A) 16 (B) 8 (C) 4 (D) 32

Section - B (Numerical Value Type)

51. When a hydrogen atom going from n = 2 to n = 1 emits a photon, its recoil speed is x/5 m/s. Where x = _____ .

(**Use :** mass of hydrogen atom = 1.6×10^{-27} kg)

52. A ball rolls off the top of a stairway with horizontal velocity u. The steps are 0.1 m high and 0.1 m wide. The minimum velocity u with which that ball just hits the step 5 of the stairway will be $\sqrt{x}$ ms^{-1} where x = _____
[use g = 10 m/s^2]

53. A square loop of side 10 cm and resistance 0.7Ω is placed vertically in east-west plane. A uniform magnetic field of 0.20 T is set up across the plane in north east direction. The magnetic field is decreased to zero in 1 s at a steady rate. Then, magnitude of induced emf is x × 10^{-3}V.
The value of x is _____.

54. A cylinder is rolling down on an inclined plane of inclination 60°. It's acceleration during rolling down will be $\frac{x}{\sqrt{3}}$ m/s^2, where x = _____.
(use g = 10 m/s^2).

55. The magnetic potential due to a magnetic dipole at a point on its axis situated at a distance of 20 cm from its center is 1.5 × 10^{-5} Tm. The magnetic moment of the dipole is _____ Am^2.
(Given : $\frac{\mu_0}{4\pi} = 10^{-7}\,TmA^{-1}$)

56. In a double slit experiment shown in figure, when light of wavelength 400 nm is used, dark fringe is observed at P. If D = 0.2 m. the minimum distance between the slits S_1 and S_2 is _____ mm.

57. A 16Ω wire is bend to form a square loop. A 9V battery with internal resistance 1Ω is connected across one of its sides. If a 4μF capacitor is connected across one of its diagonals, the energy stored by the capacitor will be x/2 μJ. where x = _____.

58. When the displacement of a simple harmonic oscillator is one third of its amplitude, the ratio of total energy to the kinetic energy is x/8, where x = _____.

59. An electron is moving under the influence of the electric field of a uniformly charged infinite plane sheet S having surface charge density +σ. The electron at t = 0 is at a distance of 1 m from S and has a speed of 1 m/s.
The maximum value of σ if the electron strikes S at t = l s is $\alpha\left[\frac{m\in_0}{e}\right]\frac{C}{m^2}$ the value of α is

60. In a test experiment on a model aeroplane in wind tunnel, the flow speeds on the upper and lower surfaces of the wings are 70 ms^{-1} and 65 ms^{-1} respectively. If the wing area is 2 m^2 the lift of the wing is _____ N.
(Given density of air = 1.2 kg m^{-3})

CHEMISTRY Section - A (Single Correct Answer)

61. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : The first ionisation enthalpy decreases across a period.
Reason R : The increasing nuclear charge outweighs the shielding across the period.
In the light of the above statements, choose the most appropriate from the options given below.
(A) Both A and R are true and R is the correct explanation of A
(B) A is true but R is false
(C) A is false but R is true
(D) Both A and R are true but R is NOT the correct explanation of A

62. Match List I with List II.

	LIST-I (Substances)		LIST-II (Element Present)
A.	Ziegler catalyst	I.	Rhodium
B.	Blood Pigment	II.	Cobalt
C.	Wilkinson catalyst	III.	Iron
D.	Vitamin B	IV.	Titanium

Choose the correct answer from the options given below :

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

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

63. In chromyl chloride test for confirmation of Cl^- ion, a yellow solution is obtained. Acidification of the solution and addition of amyl alcohol and 10% H_2O_2 turns organic layer blue indicating formation of chromium pentoxide. The oxidation state of chromium in that is

(A) +6 (B) +5 (C) +10 (D) +3

64. The difference in energy between the actual structure and the lowest energy resonance structure for the given compound is

(A) electromeric energy

(B) resonance energy

(C) ionization energy

(D) hyperconjugation energy

65. Given below are two statements :

Statement I : The electronegativity of group 14 elements from Si to Pb gradually decreases.

Statement II : Group 14 contains non-metallic, metallic, as well as metalloid elements.

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

(A) Statement I is false but Statement II is true

(B) Statement I is true but Statement II is false

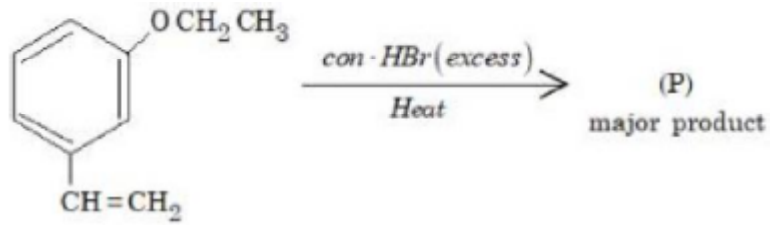
(C) Both Statement I and Statement II are true

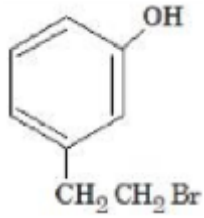
(D) Both Statement I and Statement II are false

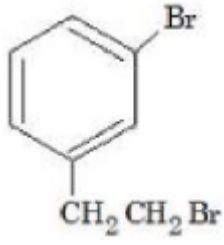
66. The correct set of four quantum numbers for the valence electron of rubidium atom (Z = 37) is :

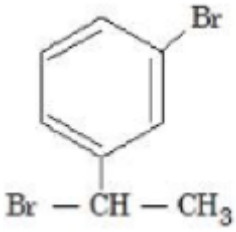
(A) $5, 0, 0, +\frac{1}{2}$ (B) $5, 0, 1, +\frac{1}{2}$ (C) $5, 1, 0, +\frac{1}{2}$ (D) $5, 1, 1, +\frac{1}{2}$

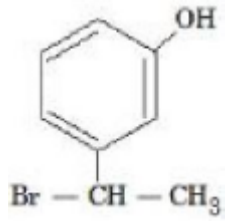
67. The major product (P) in the following reaction is



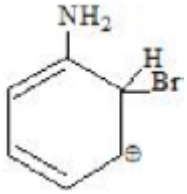
(A) 

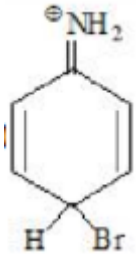
(B) 

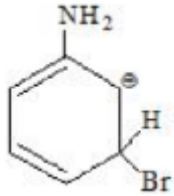
(C) 

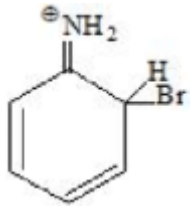
(D) 

68. The arenium ion which is not involved in the bromination of Aniline is

(A) 

(B) 

(C) 

(D) 

69. Appearance of blood red colour, on treatment of the sodium fusion extract of an organic compound with $FeSO_4$ in presence of concentrated H_2SO_4 indicates the presence of element/s.

(A) Br (B) N (C) N and S (D) S

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

Assertion A : Aryl halides cannot be prepared by replacement of hydroxyl group of phenol by halogen atom.

Reason R : Phenols react with halogen acids violently.

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

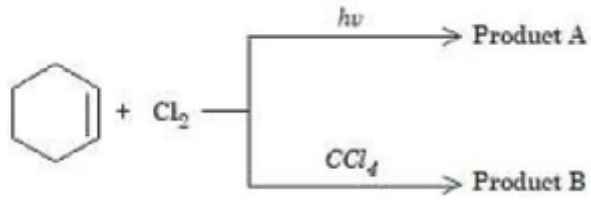
(A) Both A and R are true but R is NOT the correct explanation of A

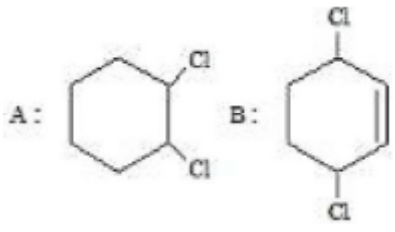
(B) A is false but R is true

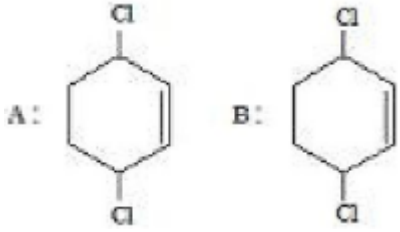
(C) A is true but R is false

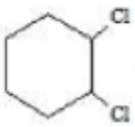
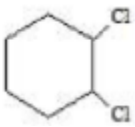
(D) Both A and R are true and R is the correct explanation of A

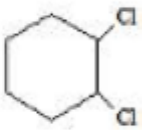
71. Identify product A and product B :



(A) 

(B) 

(C) A:  B: 

(D) A:  B: 

72. Identify the incorrect pair from the following :

(A) Fluorspar – BF_3 (B) Cryolite – Na_3AlF_6

(C) Fluoroapatite – $3Ca_3(PO_4)_2 \cdot CaF_2$ (D) Carnallite – $KCl \cdot MgCl_2 \cdot 6H_2O$

73. The interaction between π bond and lone pair of electrons present on an adjacent atom is responsible for

(A) Hyperconjugation (B) Inductive effect

(C) Electromeric effect (D) Resonance effect

74. $KMnO_4$ decomposes on heating at 513 K to form O_2 along with

(A) MnO_2 & K_2O_2 (B) K_2MnO_4 & Mn

(C) Mn & KO_2 (D) K_2MnO_4 & MnO_2

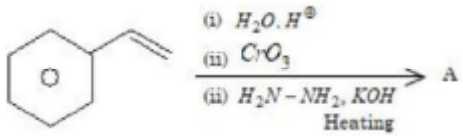
75 In which one of the following metal carbonyls, CO forms a bridge between metal atoms ?

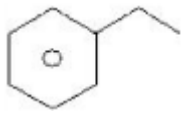
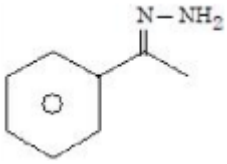
(A) $[Co_2(CO)_8]$ (B) $[Mn_2(CO)_{10}]$ (C) $[Os_3(CO)_{12}]$ (D) $[Ru_3(CO)_{12}]$

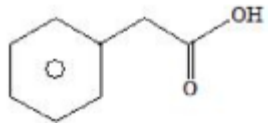
76 Type of amino acids obtained by hydrolysis of proteins is :

(A) β (B) α (C) δ (D) γ

77. The final product A formed in the following multistep reaction sequence is



(A)  (B) 

(C) 

(D) 

78. Which of the following is **not** correct ?

(A) ΔG is negative for a spontaneous reaction

(B) ΔG is positive for a spontaneous reaction

(C) ΔG is zero for a reversible reaction

(D) ΔG is positive for a non-spontaneous reaction

79. Chlorine undergoes disproportionation in alkaline medium as shown below :

$$a\ Cl_2(g) + b\ OH^-(aq) \rightarrow c\ ClO^-(aq) + d\ Cl^-(aq) + e\ H_2O(\ell)$$

The values of a, b, c and d in a balanced redox reaction are respectively :

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

(C) 3, 4, 4 and 2 (D) 2, 4, 1 and 3

80. In alkaline medium. MnO_4^- oxidises I to

(A) IO_4^- (B) IO^- (C) I_2 (D) IO_3^-

Section - B (Numerical Value Type)

81. Number of compounds with one lone pair of electrons on central atom amongst following is _____.

O_3, H_2O, SF_4, ClF_3, NH_3, BrF_5, XeF_4

82. The mass of zinc produced by the electrolysis of zinc sulphate solution with a steady current of 0.015 A for 15 minutes is _____ $\times 10^{-4}$ g.

[Atomic mass of zinc = 65.4 amu]

83. For a reaction taking place in three steps at same temperature, overall rate constant $K = \frac{K_1K_2}{K_3}$. If Ea_1, Ea_2 and Ea_3 are 40, 50 and 60 kJ/mol respectively, the overall Ea is _____ kJ/mol.

84. For the reaction, $N_2O_4(g) \rightleftharpoons 2NO_2(g)$, K_p = 0.492 atm at 300 K. K_c for the reaction at same temperature is _____ $\times 10^{-2}$.

[**Given :** R = 0.082 L atm mol^{-1} K^{-1}]

85. A solution of H_2SO_4 is 31.4% H_2SO_4 by mass and has a density of 1.25 g/mL.The molarity of the H_2SO_4 solution is _____ M.

[Nearest integer] [Given molar mass of H_2SO_4 = 98 g mol^{-1}]

86. The osmotic pressure of a dilute solution is 7×10^5 Pa at 273 K. Osmotic pressure of the same solution at 283 K is _____ $\times 10^4$ Nm^{-2}.

87. Number of compounds among the following which contain sulphur as heteroatom is _____.

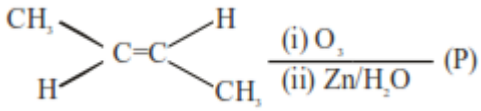
Furan, Thiophene, Pyridine, Pyrrole, Cysteine, Tyrosine

88. The number of species from the following which are paramagnetic and with bond order equal to one is _____.

H_2, He_2^+, O_2^+, N_2^{2-}, O_2^{2-}, F_2, Ne_2^+, B_2

89. From the compounds given below, number of compounds which give positive Fehling's test is _____.

Benzaldehyde, Acetaldehyde, Acetone, Acetophenone,Methanal, 4-nitrobenzaldehyde, cyclohexane carbaldehyde

90. 

Consider the given reaction.

The total number of oxygen atoms present per molecule of the product (P) is _____.

● ● ●

29-Jan.-2024 (Morning) : PCM

MATHEMATICS

Single Choice Correct									
1.	D	2.	B	3.	C	4.	C	5.	B
6.	C	7.	A	8.	A	9.	B	10.	D
11.	C	12.	A	13.	B	14.	D	15.	B
16.	C	17.	A	18.	A	19.	C	20.	D
Numerical Value									
21.	2	22.	553	23.	13	24.	5	25.	432
26.	3	27.	6344	28.	171	29.	2041	30.	65

PHYSICS

Single Choice Correct									
1.	B	32.	B	33.	C	34.	A	35.	B
36.	B	37.	C	38.	A	39.	C	40.	C
41.	A	42.	C	43.	B	44.	B	45.	B
46.	BONUS	47.	D	48.	B	49.	D	50.	A
Numerical Value									
51.	17	52.	2	53.	2	54.	10	55.	6
56.	0.20	57.	81	58.	9	59.	8	60.	810

CHEMISTRY

Single Choice Correct									
61.	**C**	62.	**D**	63.	**A**	64.	**B**	65.	**A**
66.	**A**	67.	**D**	68.	**C**	69.	**C**	70.	**C**
71.	**D**	72.	**A**	73.	**D**	74.	**D**	75.	**A**
76.	**B**	77.	**A**	78.	**B**	79.	**A**	80.	**D**
Numerical Value									
81.	**4**	82.	**46**	83.	**30**	84.	**2**	85.	**4**
86.	**73**	87.	**2**	88.	**1**	89.	**3**	90.	**1**