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

1. The value of $k \in \mathbb{N}$ for which the integral $I_n = \int_0^1 (1 - x^k)^n \, dx$, $n \in \mathbb{N}$, satisfies $147 \, I_{20} = 148 \, I_{21}$ is :

   (A) 10   (B) 8   (C) 14   (D) 7

2. The sum of all the solutions of the equation $(8)^{2x} - 16 \cdot (8)^x + 48 = 0$ is :
   (A) $1 + \log_6(8)$ (B) $\log_8(6)$ (C) $1 + \log_8(6)$ (D) $\log_8(4)$

3. Let the circles $C_1 : (x - \alpha)^2 + (y - \beta)^2 = r_1^2$ and $C_2 : (x - 8)^2 + \left(y - \dfrac{15}{2}\right)^2 = r_2^2$ touch each other externally

   at the point (6, 6). If the point (6, 6) divides the line segment joining the centres of the circles C_1 and C_2 internally in the ratio 2 : 1, then $(\alpha + \beta) + 4(r_1^2 + r_2^2)$ equals

   (A) 110   (B) 130   (C) 125   (D) 145

4. Let P(x, y, z) be a point in the first octant, whose projection in the xy-plane is the point Q. Let OP = γ; the angle between OQ and the positive x-axis be θ; and the angle between OP and the positive z-axis be ϕ, where O is the origin. Then the distance of P from the x-axis is :

   (A) $\gamma\sqrt{1 - \sin^2\phi \cos^2\theta}$ (B) $\gamma\sqrt{1 + \cos^2\theta \sin^2\phi}$

   (C) $\gamma\sqrt{1 - \sin^2\theta \cos^2\phi}$ (D) $\gamma\sqrt{1 + \cos^2\phi \sin^2\theta}$

5. The number of critical points of the function $f(x) = (x - 2)^{2/3}(2x + 1)$ is :
   (A) 2   (B) 0   (C) 1   (D) 3

6. Let f(x) be a positive function such that the area bounded by $y = f(x)$, $y = 0$ from $x = 0$ to $x = a > 0$ is $e^{-a} + 4a^2 + a - 1$. Then the differential equation, whose general solution is $y = c_1 f(x) + c_2$, where c_1 and c_2 are arbitrary constants, is :

   (A) $(8e^x - 1)\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx} = 0$ (B) $(8e^x + 1)\dfrac{d^2y}{dx^2} - \dfrac{dy}{dx} = 0$

   (C) $(8e^x + 1)\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx} = 0$ (D) $(8e^x - 1)\dfrac{d^2y}{dx^2} - \dfrac{dy}{dx} = 0$

7. Let $f(x) = 4\cos^3 x + 3\sqrt{3}\cos^2 x - 10$. The number of points of local maxima of f in interval $(0, 2\pi)$ is :
   (A) 1   (B) 2   (C) 3   (D) 4

8. Let $A = \begin{bmatrix} 2 & a & 0 \\ 1 & 3 & 1 \\ 0 & 5 & b \end{bmatrix}$. If $A^3 = 4A^2 - A - 21I$, where I is the identity matrix of order 3 × 3, then 2a + 3b is

   equal to :
   (A) −10   (B) −13   (C) −9   (D) −12

9. If the shortest distance between the lines

$L_1 : \vec{r} = (2 + \lambda)\hat{i} + (1 - 3\lambda)\hat{j} + (3 + 4\lambda)\hat{k}, \ \lambda \in \mathbb{R}$

$L_2 : \vec{r} = 2(1 + \mu)\hat{i} + 3(1 + \mu)\hat{j} + (5 + \mu)\hat{k}, \ \mu \in \mathbb{R}$

is $\dfrac{m}{\sqrt{n}}$, where gcd (m, n) = 1, then the value of m + n equals

(A) 384   (B) 387   (C) 377   (D) 390

10. Let the sum of two positive integers be 24. If the probability, that their product is not less than $\dfrac{3}{4}$ times

their greatest positive product, is $\dfrac{m}{n}$, where gcd(m, n) = 1, then n – m equals :

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

11. If $\sin x = -\dfrac{3}{5}$, where $\pi < x < \dfrac{3\pi}{2}$, then $80(\tan^2 x - \cos x)$ is equal to :

(A) 109   (B) 108   (C) 18   (D) 19

12. Let $I(x) = \displaystyle\int \dfrac{6}{\sin^2 x(1 - \cot x)^2}\,dx$. If $I(0) = 3$, then $I\left(\dfrac{\pi}{12}\right)$ is equal to :

(A) $\sqrt{3}$ (B) $3\sqrt{3}$ (C) $6\sqrt{3}$ (D) $2\sqrt{3}$

13. The equations of two sides AB and AC of a triangle ABC are 4x + y = 14 and 3x – 2y = 5, respectively.

The point $\left(2, \ -\dfrac{4}{3}\right)$ divides the third side BC internally in the ratio 2 : 1. The equation of the side BC is :

(A) x – 6y – 10 = 0   (B) x – 3y – 6 = 0   (C) x + 3y + 2 = 0   (D) x + 6y + 6 = 0

14. Let [t] be the greatest integer less than or equal to t. Let A be the set of al prime factors of 2310 and

$f : A \to \mathbb{Z}$ be the function $f(x) = \left[\log_2\left(x^2 + \left[\dfrac{x^3}{5}\right]\right)\right]$. The number of one-to-one functions from A to the

range of f is :

(A) 20   (B) 120   (C) 25   (D) 24

15. Let z be a complex number such that |z + 2| = 1 and $\text{Im}\left(\dfrac{z+1}{z+2}\right) = \dfrac{1}{5}$. Then the value of $\left|\text{Re}\left(\overline{z+2}\right)\right|$ is :

(A) $\dfrac{\sqrt{6}}{5}$ (B) $\dfrac{1+\sqrt{6}}{5}$ (C) $\dfrac{24}{5}$ (D) $\dfrac{2\sqrt{6}}{5}$

16. If the set $R = \{(a, b); a + 5b = 42, a, b \in \mathbb{N}\}$ has m elements and $\displaystyle\sum_{n=1}^{m}(1 + i^{n!}) = x + iy$, where $I = \sqrt{-1}$,

then the value of m + x + y is :

(A) 8   (B) 12

(C) 4   (D) 5

17. For the function $f(x) = (\cos x) - x + 1$, $x \in \mathbb{R}$, between the following two statements

    (S1) $f(x) = 0$ for only one value x is $[0, \pi]$.

    (S2) $f(x)$ is decreasing in $\left[0, \dfrac{\pi}{2}\right]$ and increasing in $\left[\dfrac{\pi}{2}, \pi\right]$.

    (A) Both (S1) and (S2) are correct
    (B) Only (S1) is correct
    (C) Both (S1) and (S2) are incorrect
    (D) Only (S2) is correct

18. The set of all α, for which the vector $\vec{a} = \alpha t\hat{i} + 6\hat{j} - 3\hat{k}$ and $\vec{b} = t\hat{i} - 2\hat{j} - 2\alpha t\hat{k}$ are inclined at an obtuse aangle for all $t \in \mathbb{R}$ is :

    (A) $[0, 1)$ (B) $(-2, 0]$

    (C) $\left(-\dfrac{4}{3}, 0\right]$ (D) $\left(-\dfrac{4}{3}, 1\right)$

19. Let $y = y(x)$ be the solution of the differential equation $(1 + y^2)e^{\tan x}\,dx + \cos^2 x(1 + e^{2\tan x})dy = 0$, $y(0) = 1$.

    Then $y\left(\dfrac{\pi}{4}\right)$ is equal to :

    (A) $\dfrac{2}{e}$ (B) $\dfrac{1}{e^2}$

    (C) $\dfrac{1}{e}$ (D) $\dfrac{2}{e^2}$

20. Let $H : \dfrac{-x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ be the hyperbola, whose eccentricity is $\sqrt{3}$ and the length of the latus rectum is $4\sqrt{3}$. Suppose the point $(\alpha, 6)$, $\alpha > 0$ lies on H. If β is the product of the focal distances of the point $(\alpha, 6)$, then $\alpha^2 + \beta$ is equal to :

    (A) 170   (B) 171   (C) 169   (D) 172

SECTION-B

21. Let $A = \begin{bmatrix} 2 & -1 \\ 1 & 1 \end{bmatrix}$. If the sum of the digonal elements of A^{13} is 3^n, then n is equal to _____.

22. If the orthocentre of the triangle formed by the lines $2x + 3y - 1 = 0$, $x + 2y - 1 = 0$ and $ax + by - 1 = 0$, is the centroid of another triangle, whose circumecentre and orthocentre respectively are $(3, 4)$ and $(-6, -8)$, then the value of $|a - b|$ is

23. Three balls are drawn at random from a bag containing 5 blue and 4 yellow balls. Let the random variables X and Y respectively denote the number of blue and Yellow balls. If $\overline{X}$ and $\overline{Y}$ are the means of X and Y respectively, then $7\overline{X} + 4\overline{Y}$ is equal to_____.

24. The number of 3-digit numbers, formed using the digits 2, 3, 4, 5 and 7, when the repetition of digits is not allowed, and which are not divisible by 3, is equal to_____.

25. Let the positive integers be written in the form :

$$1$$
$$2 \quad 3$$
$$4 \quad 5 \quad 6$$
$$7 \quad 8 \quad 9 \quad 10$$

If the kth row contains exactly k numbers for every natural number k, then the row in which the number 5310 will be, is_____.

26. If the range of $f(\theta) = \dfrac{\sin^4 \theta + 3\cos^2 \theta}{\sin^4 \theta + \cos^2 \theta}$, $\theta \in \mathbb{R}$ is $[\alpha, \beta]$, then the sum of the infinite G.P., whose first term

is 64 and the common ratio is $\dfrac{\alpha}{\beta}$, is equal to _____.

27. Let $\alpha = \displaystyle\sum_{r=0}^{n} (4r^2 + 2r + 1)^n C_r$ and $\beta = \left(\displaystyle\sum_{r=0}^{n} \dfrac{^nC_r}{r+1} \right) + \dfrac{1}{n+1}$. If $140 < \dfrac{2\alpha}{\beta} < 281$, then the value of n is _____.

28. Let $\vec{a} = 9\hat{i} - 13\hat{j} + 25\hat{k}$, $\vec{b} = 3\hat{i} + 7\hat{j} - 13\hat{k}$ and $\vec{c} = 17\hat{i} - 2\hat{j} + \hat{k}$ be three given vectors. If $\vec{r}$ is a vector such

that $\vec{r} \times \vec{a} = (\vec{b} + \vec{c}) \times \vec{a}$ and $\vec{r} \cdot (\vec{b} - \vec{c}) = 0$, then $\dfrac{|593\vec{r} + 67\vec{a}|^2}{(593)^2}$ is equal to _____.

29. Let the area of the region enclosed by the curve $y = \min\{\sin x, \cos x\}$ and the x-axis between $x = -\pi$ to $x = \pi$ be A. Then A^2 is equal to _____.

30. The value of $\displaystyle\lim_{x \to 0} 2 \left(\dfrac{1 - \cos x \sqrt{\cos 2x} \sqrt[3]{\cos 3x} \ldots \sqrt[10]{\cos 10x}}{x^2} \right)$ is _____.

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

31. Three bodies A, B and C have equal kinetic energies and their masses are 400 g, 1.2 kg and 1.6 kg respectively. The ratio of their linear momenta is :

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

32. Average force exerted on a non-reflecting surface at normal incidence is 2.4×10^{-4} N. If 360 W/cm^2 is the light energy flux during span of 1 hour 30 minutes. Then the area of the surface is:

    (A) 0.2 m^2 (B) 0.02 m^2 (C) 20 m^2 (D) 0.1 m^2

33. A proton and an electron are associated with same de-Broglie wavelength. The ratio of their kinetic energies is: (Assume $h = 6.63 \times 10^{-34}$ J s, me $= 9.0 \times 10^{-31}$ kg and $m_p = 1836$ times m_e)

    (A) $1 : 1836$ (B) $1 : \dfrac{1}{1836}$ (C) $1 : \dfrac{1}{\sqrt{1836}}$ (D) $1 : \sqrt{1836}$

34. A mixture of one mole of monoatomic gas and one mole of a diatomic gas (rigid) are kept at room temperature (27°C). The ratio of specific heat of gases at constant volume respectively is:

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

35. In an expression $a \times 10^b$:

(A) a is order of magnitude for $b \leq 5$ (B) b is order of magnitude for $a \leq 5$

(C) b is order of magnitude for $5 < a \leq 10$ (D) b is order of magnitude for $a \geq 5$

36. In the given circuit, the terminal potential difference of the cell is :
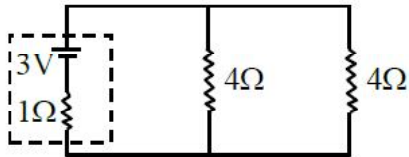
(A) 2 V   (B) 4 V   (C) 1.5 V   (D) 3 V

37. Binding energy of a certain nucleus is 18×10^8 J. How much is the difference between total mass of all the nucleons and nuclear mass of the given nucleus:

(A) 0.2 μg   (B) 20 μg   (C) 2 μg   (D) 10 μg

38. Paramagnetic substances:

A. align themselves along the directions of external magnetic field.

B. attract strongly towards external magnetic field.

C. has susceptibility little more than zero.

D. move from a region of strong magnetic field to weak magnetic field.

Choose the **most appropriate** answer from the options given below:

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

39. A clock has 75 cm, 60 cm long second hand and minute hand respectively. In 30 minutes duration the tip of second hand will travel x distance more than the tip of minute hand. The value of x in meter is nearly (Take $\pi = 3.14$) :

(A) 139.4   (B) 140.5   (C) 220.0   (D) 118.9

40. Young's modulus is determined by the equation given by $Y = 49000 \dfrac{m}{l} \dfrac{dyn}{cm^2}$ where M is the mass and l is the extension of wire used in the experiment. Now error in Young modules(Y) is estimated by taking data from M-l plot in graph paper. The smallest scale divisions are 5 g and 0.02 cm along load axis and extension axis respectively. If the value of M and l are 500 g and 2 cm respectively then percentage error of Y is :

(A) 0.2 %   (B) 0.02 %   (C) 2 %   (D) 0.5 %

41. Two different adiabatic paths for the same gas intersect two isothermal curves as shown in P-V diagram.

The relation between the ratio $\dfrac{V_a}{V_d}$ and the ratio $\dfrac{V_b}{V_c}$ is:
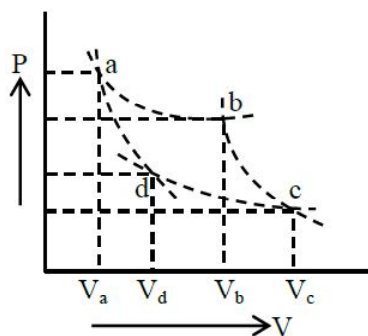
(A) $\dfrac{V_a}{V_d} = \left(\dfrac{V_b}{V_c}\right)^{-1}$ 　(B) $\dfrac{V_a}{V_d} \neq \dfrac{V_b}{V_c}$ 　(C) $\dfrac{V_a}{V_d} = \dfrac{V_b}{V_c}$ 　(D) $\dfrac{V_a}{V_d} = \left(\dfrac{V_b}{V_c}\right)^{2}$

42. Two planets A and B having masses m_1 and m_2 move around the sun in circular orbits of r_1 and r_2 radii respectively. If angular momentum of A is L and that of B is 3L, the ratio of time period $\left(\dfrac{T_A}{T_B}\right)$ is:

(A) $\left(\dfrac{r_2}{r_1}\right)^{\frac{3}{2}}$ 　(B) $\left(\dfrac{r_1}{r_2}\right)^{3}$ 　(C) $\dfrac{1}{27}\left(\dfrac{m_2}{m_1}\right)^{3}$ 　(D) $27\left(\dfrac{m_1}{m_2}\right)^{3}$

43. A LCR circuit is at resonance for a capacitor C, inductance L and resistance R. Now the value of resistance is halved keeping all other parameters same. The current amplitude at resonance will be now:
(A) Zero 　(B) double 　(C) same 　(D) halved

44. The output Y of following circuit for given inputs is :
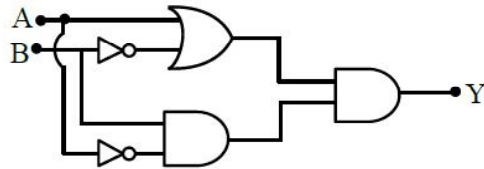
(A) A•B(A + B) 　(B) A•B 　(C) 0 　(D) $\overline{A}$•B

45. Two charged conducting spheres of radii a and b are connected to each other by a conducting wire. The ratio of charges of the two spheres respectively is:

(A) $\sqrt{ab}$ 　(B) ab 　(C) $\dfrac{a}{b}$ 　(D) $\dfrac{b}{a}$

46. Correct Bernoulli's equation is (symbols have their usual meaning) :

(A) $P + mgh + \dfrac{1}{2}mv^2 = $ constant 　(B) $P + \rho gh + \dfrac{1}{2}\rho v^2 = $ constant

(C) $P + \rho gh + \rho v^2 = $ constant 　(D) $P + \dfrac{1}{2}\rho gh + \dfrac{1}{2}\rho v^2 = $ constant

47. A player caught a cricket ball of mass 150 g moving at a speed of 20 m/s. If the catching process is completed in 0.1 s, the magnitude of force exerted by the ball on the hand of the player is:
(A) 150 N 　(B) 3 N 　(C) 30 N 　(D) 300 N

48. A stationary particle breaks into two parts of masses mA and mB which move with velocities v_A and v_B respectively. The ratio of their kinetic energies $(K_B : K_A)$ is :
(A) $v_B : v_A$ 　(B) $m_B : m_A$ 　(C) $m_B v_B : m_A v_A$ 　(D) 1 : 1

49. Critical angle of incidence for a pair of optical media is 45°. The refractive indices of first and second media are in the ratio:
(A) $\sqrt{2} : 1$ 　(B) 1 : 2 　(C) $1 : \sqrt{2}$ 　(D) 2 : 1

50. The diameter of a sphere is measured using a vernier caliper whose 9 divisions of main scale are equal to 10 divisions of vernier scale. The shortest division on the main scale is equal to 1 mm. The main scale reading is 2 cm and second division of vernier scale coincides with a division on main scale. If mass of the sphere is 8.635 g, the density of the sphere is:

(A) 2.5 g/cm³   (B) 1.7 g/cm³   (C) 2.2 g/cm³   (D) 2.0 g/cm³

SECTION - B

51. A uniform thin metal plate of mass 10 kg with dimensions is shown. The ratio of x and y coordinates of center of mass of plate in n/9. The value of n is_____.
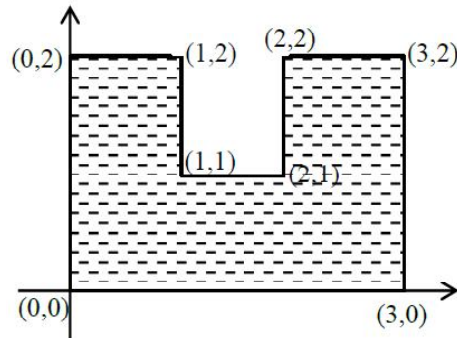
52. An electron with kinetic energy 5 eV enters a region of uniform magnetic field of 3 μT perpendicular to its direction. An electric field E is applied perpendicular to the direction of velocity and magnetic field. The value of E, so that electron moves along the same path, is_____ NC^{-1}. (Given, mass of electron = 9×10^{-31} kg, electric charge = 1.6×10^{-19} C)

53. A square loop PQRS having 10 turns, area 3.6×10^{-3} m² and resistance 100 Ω is slowly and uniformly being pulled out of a uniform magnetic field of magnitude B = 0.5 T as shown. Work done in pulling the loop out of the field in 1.0 s is _____ $\times 10^{-6}$ J.
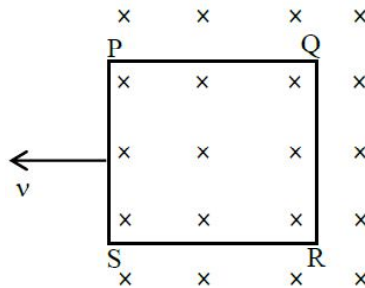
54. Resistance of a wire at 0 °C, 100 °C and t °C is found to be 10 Ω, 10.2 Ω and 10.95 Ω respectively. The temperature t in Kelvin scale is_____.

55. An electric field, $\vec{E} = \dfrac{2\hat{i} + 6\hat{j} + 8\hat{k}}{\sqrt{6}}$ passes through the surface of 4 m² area having unit vector $\hat{n} = \left(\dfrac{2\hat{i} + \hat{j} + \hat{k}}{\sqrt{6}} \right)$. The electric flux for that surface is _____ V m.

56. A liquid column of height 0.04 cm balances excess pressure of soap bubble of certain radius. If density of liquid is 8×10^3 kg m^{-3} and surface tension of soap solution is 0.28 Nm^{-1}, then diameter of the soap bubble is_____cm. (if g = 10 ms^{-2})

57. A closed and an open organ pipe have same lengths. If the ratio of frequencies of their seventh overtones is $\left(\dfrac{a-1}{a}\right)$ then the value of a is _____.

58. Three vectors $\overrightarrow{OP}$, $\overrightarrow{OQ}$ and $\overrightarrow{OR}$ each of magnitude A are acting as shown in figure. The resultant of the three vectors is $A\sqrt{x}$. The value of x is _____.
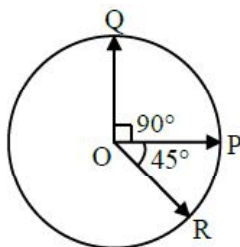
59. A parallel beam of monochromatic light of wavelength 600 nm passes through single slit of 0.4 mm width. Angular divergence corresponding to second order minima would be _____ $\times 10^{-3}$ rad.

60. In an alpha particle scattering experiment distance of closest approach for the α particle is 4.5×10^{-14} m. If target nucleus has atomic number 80, then maximum velocity of α-particle is _____ $\times 10^5$ m/s approximately. ($\dfrac{1}{4\pi\in_0} = 9 \times 10^9$ SI unit, mass of α particle = 6.72×10^{-27} kg)

CHEMISTRY   Section - A   (Single Correct Answer)

61. Given below are two statements:
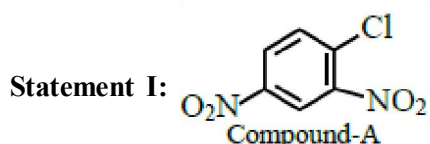
Statement I:

IUPAC name of Compound A is 4-chloro-1, 3 -dinitrobenzene:
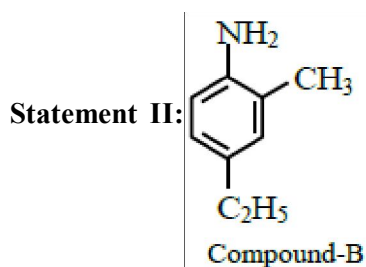
Statement II:

IUPAC name of Compound B is 4-ethyl-2-methylaniline.

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 incorrect but Statement II is correct

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

(D) Both Statement I and Statement II are incorrect

62. Which among the following compounds will undergo fastest S_N2 reaction.

(A)   (B)   (C)   (D)
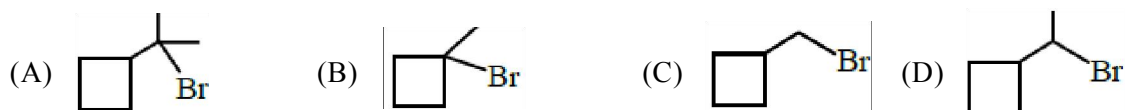
63. Combustion of glucose ($C_6H_{12}O_6$) produces CO_2 and water. The amount of oxygen (in g) required for the complete combustion of 900 g of glucose is: [Molar mass of glucose in g mol^{-1} = 180]

(A) 480   (B) 960   (C) 800   (D) 32

64. Identify the major products A and B respectively in the following set of reactions.

(A)

(B)

(C)

(D)
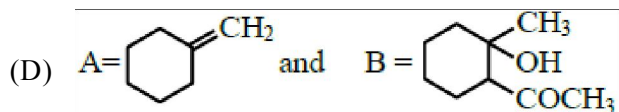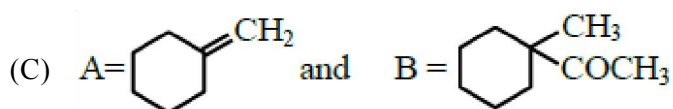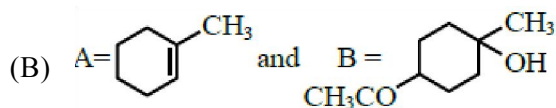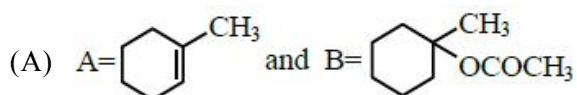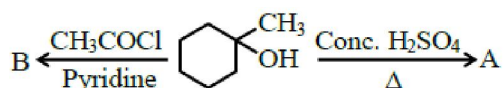
65. Given below are two statements : One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A : The stability order of +1 oxidation state of Ga, In and Tl is Ga < In < Tl.

Reason R : The inert pair effect stabilizes the lower oxidation state down the group.

In the light of the above statements, choose the correct answer 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) Both A and R are true but R is NOT the correct explanation of A.

(D) A is false but R is true.

66. Match List-I with List-II

List - I (Name of the test)	List - II (Reaction sequence involved [M is metal]
A. Borax bead test	I. $MCO_3 \rightarrow MO \xrightarrow[+\Delta]{Co(NO_3)} CoO.MO$
B. Charcoal cavity test	II. $MCO_3 \rightarrow MCl_2 \rightarrow M^{2+}$
C. Cobalt nitrate test	III. $MSO_4 \xrightarrow[\Delta]{Na_2B_4O_7} M(BO_2)_2 \rightarrow MBO_2 \rightarrow M$
D. Flame test	IV. $MSO_4 \xrightarrow[\Delta]{Na_2CO_3} MCO_3 \rightarrow MO \rightarrow M$

Choose the correct answer from the option below:

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

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

67. Match List-I and with List-II

List - I (Molecule)	List - II (Shape)
A. NH_3	I. Square pyramid
B. BrF_5	II. Tetrahedral
C. PCl_5	III. Trigonal pyramidal
D. CH_4	IV. Trigonal bipyramidal

Choose the correct answer from the option below:

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

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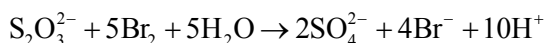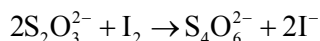
(C) A-III, B-I, C-IV, D-II

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

68. For the given hypothetical reactions, the equilibrium constants are as follows:

$X \rightleftharpoons Y$; $K_1 = 1.0$

$Y \rightleftharpoons Z$; $K_2 = 2.0$

$Z \rightleftharpoons W$; $K_3 = 4.0$
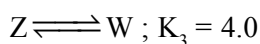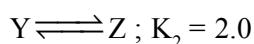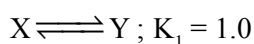
The equilibrium constant for the reaction $X \rightleftharpoons W$ is

(A) 6.0   (B) 12.0   (C) 8.0   (D) 7.0

69. Thiosulphate reacts differently with iodine and bromine in the reaction given below :

$2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$

$S_2O_3^{2-} + 5Br_2 + 5H_2O \rightarrow 2SO_4^{2-} + 4Br^- + 10H^+$

Which of the following statement justifies the above dual behaviour of thiosulphate?

(A) Bromine undergoes oxidation and iodine undergoes reduction by iodine in these reactions.

(B) Thiosulphate undergoes oxidation by bromine and reduction by iodine in these reaction

(C) Bromine is a stronger oxidant than iodine

(D) Bromine is a weaker oxidant than iodine

70. An octahedral complex with the formula $CoCl_3nNH_3$ upon reaction with excess of $AgNO_3$ solution given 2 moles of AgCl. Consider the oxidation state of Co in the complex is 'x'. The value of "x + n" is_____.
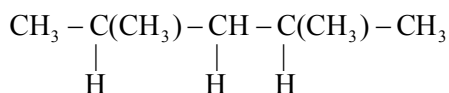
(A) 3   (B) 6   (C) 8   (D) 5

71.
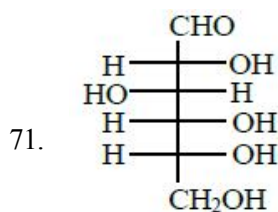
The incorrect statement regarding the given structure is

(A) Can be oxidized to a dicarboxylic acid with Br_2 water

(B) despite the presence of – CHO does not give Schiff's test

(C) has 4-asymmetric carbon atom

(D) will coexist in equilibrium with 2 other cyclic structure

72. In the given compound, the number of 2° carbon atom/s is_____

$$CH_3 - C(CH_3) - CH - C(CH_3) - CH_3$$
$$\quad\quad\quad | \quad\quad | \quad\quad |$$
$$\quad\quad\quad H \quad\quad H \quad\quad H$$

(A) Three   (B) One   (C) Two   (D) Four

73. Which of the following are aromatic?
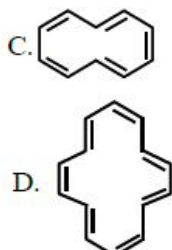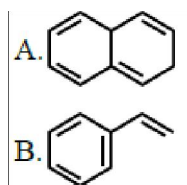
(A) B and D only   (B) A and C only   (C) A and B only   (D) C and D only

74. Among the following halogens F_2, Cl_2, Br_2 and I_2
    Which can undergo disproportionation reaction?

(A) Only I_2

(B) Cl_2, Br_2 and I_2

(C) F_2, Cl_2 and Br_2

(D) F_2 and Cl_2

75. Given below are two statements:

Statement I : $N(CH_3)_3$ and $P(CH_3)_3$ can act as ligands to form transition metal complexes.

Statement II: As N and P are from same group, the nature of bonding of $N(CH_3)_3$ and $P(CH_3)_3$ is always same with transition metals.

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

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

(B) Both Statement I and Statement II are correct

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

(D) Both Statement I and Statement II are incorrect

76. Match List I with List II

List-I (Elements)		List-II (Properties in their respective groups)
A	Cl,S	I.	Element with highest electronegativity
B.	Ge, As	II.	Elements with largest atomic size
C.	Fr,Ra	III.	Elements which show properties of both metals and non metal
D.	F, O	IV.	Elements with highest negative electron gain enthalpy

Choose the correct answer from the options given below :

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

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

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

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

77. Iron (III) catalyses the reaction between iodide and persulphate ions, in which

A. Fe^{3+} oxidises the iodide ion

B. Fe^{3+} oxidises the persulphate ion

C. Fe^{2+} reduces the iodide ion

D. Fe^{2+} reduces the persulphate ion

Choose the most appropriate answer from the options given below:

(A) B and C only   (B) B only   (C) A only   (D) A and D only

78. Match List-I with List-II

| List-I (Compound)		List-II (Colour)	
A	$Fe_4[Fe(CN)_6]_3.xH_2O$	I.	Violet
B.	$[Fe(CN_5NOS)]^{4-}$	II.	Blood Red
C.	$[Fe(SCN)]^{2+}$	III.	Prussian Blue
D.	$(NH_4)3PO_4.12MoO_3$	IV.	Yellow

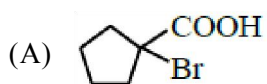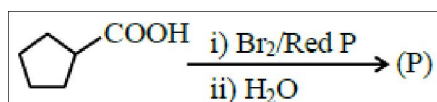Choose the correct answer from the options given below :

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

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

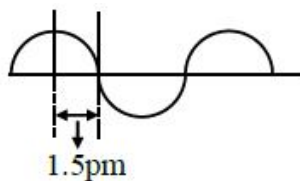79. Number of complexes with even number of electrons in t_{2g} orbitals is -

$[Fe(H_2O)_6]^{2+}$, $[Co(H_2O)_6]^{2+}$, $[Co(H_2O)_6]^{3+}$, $[Cu(H_2O)_6]^{2+}$, $[Cr(H_2O)_6]^{2+}$
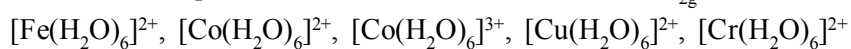
(A) 1   (B) 3   (C) 2   (D) 5

80. Identify the product (P) in the following reaction
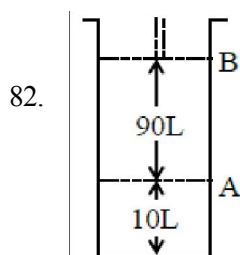

(A)   (B)

(C)   (D)
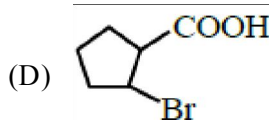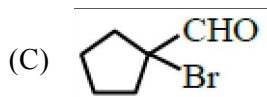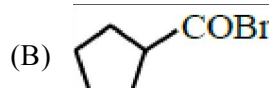
Section - B   (Numerical Value Type)

81. A hypothetical electromagnetic wave is show below.

1.5pm

The frequency of the wave is x × 10^{19} Hz.

x = _____ (Nearest integer)

82.

Consider the figure provided.

1 mol of an ideal gas is kept in a cylinder, fitted with a piston, at the position A, at 18°C. If the piston is moved to position B, keeping the temperature unchanged, then 'x' L atm work is done in this reversible process.
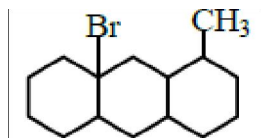
x =_____L atm. (nearest integer)

[Given : Absolute temperature = °C + 273.15, R = 0.08206 L atm mol^{-1} K^{-1}]

83. Number of amine compounds from the following giving solids which are soluble in NaOH upon reaction with Hinsberg's reagent is_____.
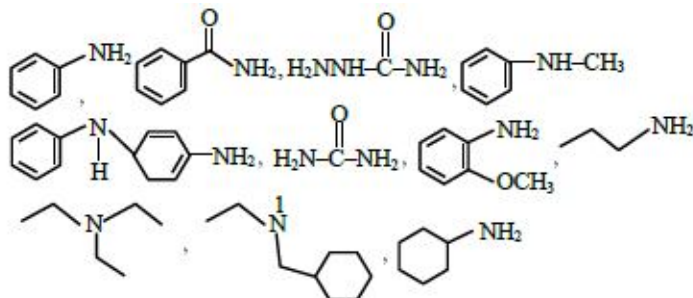
84. The number of optical isomers in following compound is :_____.

85. The 'spin only' magnetic moment value of MO_4^{2-} is ____ BM. (Where M is a metal having least metallic radii. among Sc, Ti, V, Cr, Mn and Zn).

(Given atomic number : Sc = 21, Ti = 22, V = 23, Cr = 24, Mn = 25 and Zn = 30)

86. Number of molecules from the following which are exceptions to octet rule is_____.

CO_2, NO_2, H_2SO_4, BF_3, CH_4, SiF_4, ClO_2, PCl_5, BeF_2, C_2H_6, $CHCl_3$, CBr_4

87. If 279 g of aniline is reacted with one equivalent of benzenediazonium chloride, the mximum amount of aniline yellow formed will be_____g. (nearest integer) (consider complete conversion)

88. Consider the following reaction

A + B → C
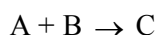
The time taken for A to become 1/4th of its initial concentration is twice the time taken to become 1/2 of the same. Also, when the change of concentration of B is plotted against time, the resulting graph gives a straight line with a negative slope and a positive intercept on the concentration axis.

The overall order of the reaction is ____.

89. Major product B of the following reaction has _____ π-bond.
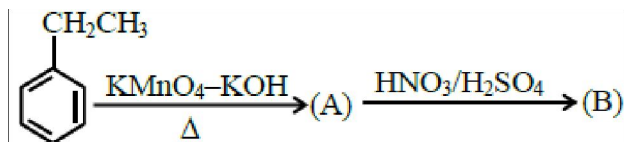
90. A solution containing 10g of an electrolyte AB_2 in 100g of water boils at 100.52°C. The degree of ionization of the electrolyte (α) is_____× 10^{-1}. (Nearest integer)

[Given : Molar mass of AB_2 = 200g mol^{-1}. K_b (molal boiling point elevation const. of water) = 0.52 K kg mol^{-1}, boiling point of water = 100°C ; AB_2 ionises as $AB_2 \rightarrow A^{2+} + 2B^-$]

☙ ☙ ☙

MATHEMATICS

Single Choice Correct

1.	D	2.	C	3.	B	4.	A	5.	A
6.	C	7.	B	8.	B	9.	B	10.	D
11.	A	12.	B	13.	C	14.	B	15.	D
16.	B	17.	B	18.	C	19.	C	20.	B

Numerical Value

21.	7	22.	16	23.	17	24.	36	25.	103
26.	96	27.	5	28.	569	29.	16	30.	55

PHYSICS

Single Choice Correct

31.	A	32.	B	33.	A	34.	C	35.	B
36.	A	37.	B	38.	D	39.	A	40.	C
41.	C	42.	C	43.	B	44.	C	45.	C
46.	B	47.	C	48.	A	49.	A	50.	D

Numerical Value

51.	15	52.	4	53.	3	54.	748	55.	12
56.	7	57.	16	58.	3	59.	6	60.	156

CHEMISTRY

Single Choice Correct

61.	B	62.	C	63.	B	64.	A	65.	A
66.	D	67.	C	68.	C	69.	C	70.	C
71.	A	72.	B	73.	A	74.	B	75.	C
76.	C	77.	D	78.	A	79.	B	80.	A

Numerical Value

81.	5	82.	55	83.	5	84.	32	85.	0
86.	6	87.	591	88.	1	89.	5	90.	5