JEE Main – 2024

29th JANUARY 2024 (Evening Shift)

General Instructions

1. The test is of **3 hours** duration and the maximum marks is **300.**
2. The question paper consists of **3 Subjects** (Subject I: **Mathematics**, Subject II: **Physics**, Subject III: **Chemistry**). Each Part has **two** sections (Section 1 & Section 2).
3. **Section 1** contains **20 Multiple Choice Questions**. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE CHOICE** is correct.
4. **Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. You will NOT be allowed to attempt the sixth question. If you wish to attempt any other question apart from the five already attempted, then you will have to delete any one response from the five previously answered and then proceed to answer the new one.**
   The answer to each question should be **rounded off to the nearest integer**.
5. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.
6. On completion of the test, the candidate must hand over the Answer Sheet to the **Invigilator** on duty in the Room/Hall. **However, the candidates are allowed to take away this Test Booklet with them**.

Marking Scheme

1. **Section – 1:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.
2. **Section – 2:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.

SUBJECT I: MATHEMATICS	MARKS: 100

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

1. If R is the smallest equivalence relation on the set $\{1, 2, 3, 4\}$ such that $\{(1,2),(1,3)\} \subset R$, then the number of elements in R is _____.

(1) 10 **(2)** 8 **(3)** 12 **(4)** 15

2. If the mean and variance of five observations are $\frac{24}{5}$ and $\frac{194}{25}$ respectively and the mean of the first four observations is $\frac{7}{2}$, then the variance of the first four observations in equal to:

(1) $\frac{105}{4}$ **(2)** $\frac{5}{4}$ **(3)** $\frac{77}{12}$ **(4)** $\frac{4}{5}$

3. Let $y = \log_e\left(\frac{1-x^2}{1+x^2}\right), -1 < x < 1$. Then at $x = \frac{1}{2}$, the value of $225(y' - y'')$ is equal to:

(1) 746 **(2)** 742 **(3)** 732 **(4)** 736

4. The function $f(x) = \frac{x}{x^2 - 6x - 16}, x \in R - \{-2, 8\}$.

(1) decreases in $(-\infty, -2) \cup (-2, 8) \cup (8, \infty)$

(2) increases in $(-\infty, -2) \cup (-2, 8) \cup (8, \infty)$

(3) decreases in $(-\infty, -2)$ and increases in $(8, \infty)$

(4) decreases in $(-2, 8)$ and increases in $(-\infty, -2) \cup (8, \infty)$

5. If $\int \frac{\sin^{\frac{3}{2}} x + \cos^{\frac{3}{2}} x}{\sqrt{\sin^3 x \cos^3 x \sin(x-\theta)}} dx = A\sqrt{\cos\theta \tan x - \sin\theta} + B\sqrt{\cos\theta - \sin\theta \cot x} + C$, where C is the integration constant, then AB is equal to:

(1) $2\sec\theta$ **(2)** $4\sec\theta$ **(3)** $8\,\text{cosec}(2\theta)$ **(4)** $4\,\text{cosec}(2\theta)$

6. The function $f(x) = 2x + 3(x)^{\frac{2}{3}}, x \in R$ has:

(1) exactly one point of local minima and no point of local maxima

(2) exactly one point of local maxima and no point of local minima

(3) exactly two points of local maxima and exactly one point of local minima

(4) exactly one point of local maxima and exactly one point of local minima

7. If $\log_e a, \log_e b, \log_e c$ are in an A.P. and $\log_e a - \log_e 2b, \log_e 2b - \log_e 3c, \log_e 3c - \log_e a$ are also in an A.P., then $a : b : c$ is equal to:

(1) 25 : 10 : 4 **(2)** 6 : 3 : 2 **(3)** 16 : 4 : 1 **(4)** 9 : 6 : 4

8. Let $A=\begin{bmatrix}2 & 1 & 2\\ 6 & 2 & 11\\ 3 & 3 & 2\end{bmatrix}$ and $P=\begin{bmatrix}1 & 2 & 0\\ 5 & 0 & 2\\ 7 & 1 & 5\end{bmatrix}$. The sum of the prime factors of $\left|P^{-1}AP-2I\right|$ is equal to:

(1) 26 **(2)** 27 **(3)** 66 **(4)** 23

9. The distance of the point (2, 3) from the line $2x - 3y + 28 = 0$, measured parallel to the line $\sqrt{3}x-y+1=0$, is equal to:

(1) $4\sqrt{2}$ **(2)** $4+6\sqrt{3}$ **(3)** $3+4\sqrt{2}$ **(4)** $6\sqrt{3}$

10. If each term of a geometric progression $a_1, a_2, a_3, \ldots\ldots$ with $a_1=\frac{1}{8}$ and $a_2 \neq a_1$, is the arithmetic mean of the next two terms and $S_n = a_1 + a_2 + \ldots.. + a_n$, then $S_{20} - S_{18}$ is equal to:

(1) -2^{15} **(2)** 2^{15} **(3)** 2^{18} **(4)** -2^{18}

11. An integer is chosen at random from the integers l, 2. 3 ...., 50. The probability that the chosen integer is a multiple of atleast one of 4, 6 and 7 is:

(1) $\frac{21}{50}$ **(2)** $\frac{14}{25}$ **(3)** $\frac{8}{25}$ **(4)** $\frac{9}{50}$

12. Number of ways of arranging 8 identical books into 4 identical shelves where any number of shelves may remain empty is equal to:

(1) 16 **(2)** 12 **(3)** 18 **(4)** 15

13. Let $P(3, 2, 3)$, $Q(4, 6, 2)$ and $R(7, 3, 2)$ be the vertices of ΔPQR. Then, the angle $\angle QPR$ is:

(1) $\frac{\pi}{3}$ **(2)** $\cos^{-1}\left(\frac{1}{18}\right)$ **(3)** $\frac{\pi}{6}$ **(4)** $\cos^{-1}\left(\frac{7}{18}\right)$

14. Let a unit vector $\hat{u}=x\hat{i}+y\hat{j}+z\hat{k}$ make angles $\frac{\pi}{2}, \frac{\pi}{3}$ and $\frac{2\pi}{3}$ with the vectors $\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{k}, \frac{1}{\sqrt{2}}\hat{j}+\frac{1}{\sqrt{2}}\hat{k}$ and $\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}$ respectively. If $\vec{v}=\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{k}+\frac{1}{\sqrt{2}}\hat{j}$, then $\left|\hat{u}-\vec{v}\right|^2$ is equal to:

(1) $\frac{11}{2}$ **(2)** 9 **(3)** $\frac{5}{2}$ **(4)** 7

15. Let $\overrightarrow{OA}=\vec{a}, \overrightarrow{OB}=12\vec{a}+4\vec{b}$ and $\overrightarrow{OC}=\vec{b}$, where O is the origin. If S is the parallelogram with adjacent sides OA and OC, then $\frac{\text{area of the quadrilateral } OABC}{\text{area of } S}$ is equal to _____.

(1) 10 **(2)** 7 **(3)** 6 **(4)** 8

16. The sum of the solutions $x \in R$ of the equation $\frac{3\cos 2x+\cos^3 2x}{\cos^6 x-\sin^6 x}=x^3-x^2+6$ is:

(1) 1 **(2)** 0 **(3)** –1 **(4)** 3

17. Let $x=\frac{m}{n}$ (m, n are co-prime natural numbers) be a solution of the equation $\cos(2\sin^{-1}x)=\frac{1}{9}$ and let $\alpha, \beta (\alpha > \beta)$ be the roots of the equation $mx^2 - nx - m + n = 0$. Then the point (α, β) lies on the line.

(1) $5x + 8y = 9$ **(2)** $5x - 8y = -9$ **(3)** $3x + 2y = 2$ **(4)** $3x - 2y = -2$

18. Let A be the point of intersection of the lines $3x + 2y = 14$, $5x - y = 6$ and B be the point of intersection of the lines $4x + 3y = 8$, $6x + y = 5$. The distance of the point $P(5, -2)$ from the line AB is:

(1) $\frac{5}{2}$ **(2)** 6 **(3)** 8 **(4)** $\frac{13}{2}$

19. Let r and θ respectively be the modulus and amplitude of the complex number $z = 2 - i\left(2\tan\frac{5\pi}{8}\right)$, then (r, θ) is equal to:

(1) $\left(2\sec\frac{3\pi}{8}, \frac{5\pi}{8}\right)$ **(2)** $\left(2\sec\frac{5\pi}{8}, \frac{3\pi}{8}\right)$ **(3)** $\left(2\sec\frac{3\pi}{8}, \frac{3\pi}{8}\right)$ **(4)** $\left(2\sec\frac{11\pi}{8}, \frac{11\pi}{8}\right)$

20. If $\sin\left(\frac{y}{x}\right) = \log_e|x| + \frac{\alpha}{2}$ is the solution of the differential equation $x\cos\left(\frac{y}{x}\right)\frac{dy}{dx} = y\cos\left(\frac{y}{x}\right) + x$ and $y(1) = \frac{\pi}{3}$, then α^2 is equal to:

(1) 4 **(2)** 12 **(3)** 9 **(4)** 3

SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. The answer to each question should be **rounded off to the nearest integer**.

21. Let the area of the region $\{(x,y): 0 \le x \le 3, 0 \le y \le \min\{x^2+2, 2x+2\}\}$ be A. The $12A$ is equal to _____.

22. Remainder when $64^{32^{32}}$ is divided by 9 is equal to _____.

23. Let α, β be the roots of the equations $x^2 - \sqrt{6}x + 3 = 0$ such that $\text{Im}(\alpha) > \text{Im}(\beta)$. Let α, β be integers not divisible by 3 and n be a natural number such that $\frac{\alpha^{99}}{\beta} + \alpha^{98} = 3^n(a+ib), i = \sqrt{-1}$. Then $n + a + b$ is equal to _____.

24. Let the set $C = \left\{(x,y) \middle| x^2 - 2^y = 2023, x, y \in N\right\}$. Then $\sum\limits_{(x,y)\in C} (x+y)$ is equal to _____.

25. If $\int\limits_{\frac{\pi}{6}}^{\frac{\pi}{3}} \sqrt{1-\sin 2x}\,dx = \alpha + \beta\sqrt{2} + \gamma\sqrt{3}$, where α, β and γ are rational numbers, then $3\alpha + 4\beta - \gamma$ is equal to _____.

26. Let $f(x) = \sqrt{\lim\limits_{r\to x}\left\{\frac{2r^2\left[(f(r)^2 - f(x)f(r))\right]}{r^2 - x^2} - r^3 e^{\frac{f(r)}{r}}\right\}}$ be differentiable in $(-\infty, 0) \cup (0, \infty)$ and $f(x) = 1$. Then the value of ea, such that $f(a) = 0$, is equal to:

27. Let for any three distinct consecutive terms a, b, c of an A.P. the lines $ax + by + c = 0$ be concurrent at the point P and $Q(\alpha, \beta)$ be a point such that the system of equations

$x + y + z = 6$

$2x + 5y + \alpha z = \beta$ and

$x + 2y + 3z = 4$, has infinitely many solutions. The $(PQ)^2$ is equal to _____.

28. Let the slope of the line $45x + 5y + 3 = 0$ be $27r_1 + \frac{9r_2}{2}$ for some $r_1, r_2 \in R$.

Then $\lim\limits_{x\to 3}\left(\int\limits_3^x \frac{8t^2}{\frac{3r_2 x}{2} - r_2 x^2 - r_1 x^3 - 3x}dt\right)$ is equal to _____.

29. Let O be the origin, and M and N be the points on the lines $\frac{x-5}{4} = \frac{y-4}{1} = \frac{z-5}{3}$ and $\frac{x+8}{12} = \frac{y+2}{5} = \frac{z-11}{9}$ respectively such that MN is the shortest distance between the given lines. Then $\overrightarrow{OM}.\overrightarrow{ON}$ is equal to _____.

30. Let $P(\alpha, \beta)$ be a point on the parabola $y^2 = 4x$. If P also lies on the chord of the parabola $x^2 = 8y$ whose mid-point is $\left(1, \frac{5}{4}\right)$, then $(\alpha - 28)(\beta - 8)$ is equal to _____.

SUBJECT II: PHYSICS	MARKS: 100

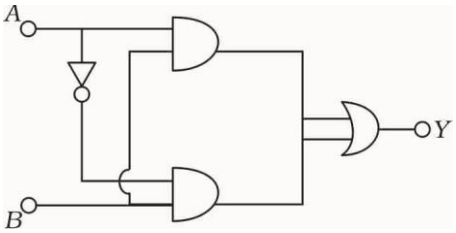
SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

31. N moles of a polyatomic gas (f = 6) must be mixed with two moles of a monoatomic gas so that the mixture behaves as a diatomic gas. The value of N is:

(1) 4 **(2)** 2 **(3)** 3 **(4)** 6

32. The truth table for this given circuit is:



(1)

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(2)

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

(3)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

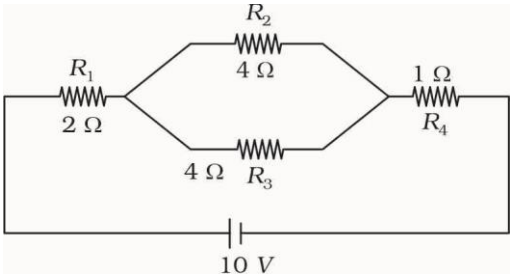
(4)

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

33. Two particles X and Y having equal charges are being accelerated through the same potential difference. Thereafter they enter normally in a region of uniform magnetic field and describes circular paths of radii R_1 and R_2 respectively. The mass ratio of X and Y is:

(1) $\left(\frac{R_1}{R_2}\right)$ **(2)** $\left(\frac{R_1}{R_2}\right)^2$ **(3)** $\left(\frac{R_2}{R_1}\right)^2$ **(4)** $\left(\frac{R_2}{R_1}\right)$

34. In the given circuit, the current in resistance R_3 is:



(1) 1.5 A **(2)** 2.5 A **(3)** 2 A **(4)** 1 A

35. In Young's double slit experiment, light from two identical sources are superimposing on a screen. The path difference between the two lights reaching at a point on the screen is $\frac{7\lambda}{4}$. The ratio of intensity of fringe at this point with respect to the maximum intensity of the fringe is:

(1) $\frac{1}{2}$ **(2)** $\frac{3}{4}$ **(3)** $\frac{1}{3}$ **(4)** $\frac{1}{4}$

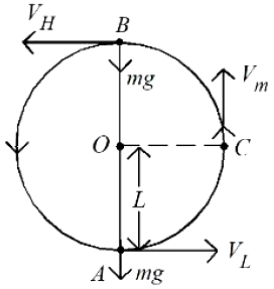
36. An electric field is given by $\left(6\hat{i}+5\hat{j}+3\hat{k}\right)\text{N/C}$. The electric flux through a surface area $30\hat{i}\,m^2$ lying in YZ-plane (in SI unit) is:

(1) 180 **(2)** 150 **(3)** 90 **(4)** 60

37. A plane electromagnetic wave of frequency 35 MHz travels in free space along the *X*-direction. At a particular point (in space and time) $\vec{E} = 9.6\hat{j}\,V/m$. The value of magnetic field at this point is:

(1) $9.6\,\hat{j}T$ **(2)** $3.2\times10^{-8}\,\hat{i}\,T$ **(3)** $9.6\times10^{-8}\,\hat{k}\,T$ **(4)** $3.2\times10^{-8}\hat{k}\,T$

38. A bob of mass '*m*' is suspended by a light string of length '*L*'. It is imparted a minimum horizontal velocity at the lowest point A such that it just completes half circle reaching the top most position *B*. The ratio of kinetic energies $\frac{(K.E.)_A}{(K.E.)_B}$ is:



(1) 5 : 1 **(2)** 3 : 2 **(3)** 1 : 5 **(4)** 2 : 5

39. A wire of length *L* and radius *r* is clamped at one end. If its other end is pulled by a force *F*, its length increases by *l*. If the radius of the wire and the applied force both are reduced to half of their original values keeping original length constant. the increase in length will become:

(1) 2 times **(2)** $\frac{3}{2}$ times **(3)** 4 times **(4)** 3 times

40. If the distance between object and its two times magnified virtual image produced by a curved mirror is 15 *cm*. the focal length of the mirror must be:

(1) –12 *cm* **(2)** 15 *cm* **(3)** 10/3 *cm* **(4)** –10 *cm*

41. The bob of a pendulum was released from a horizontal position. The length of the pendulum is 10 m. If it dissipates 10% of its initial energy against air resistance, the speed with which the bob arrives at the lowest point is:

[Use, $g : 10 ms^{-2}$]

(1) $6\sqrt{5}\,ms^{-1}$ **(2)** $2\sqrt{5}\,ms^{-1}$ **(3)** $5\sqrt{6}\,ms^{-1}$ **(4)** $5\sqrt{5}\,ms^{-1}$

42. A physical quantity *Q* is found to depend on quantities a, b, c by the relation $Q = \frac{a^4b^3}{c^2}$. The percentage error in *a*, *b* and *c* are 3%. 4% and 5% respectively, Then, the percentage error in *Q* is:

(1) 43% **(2)** 66% **(3)** 34% **(4)** 14%

43. Given below are two statements:

Statement I : Most of the mass of the atom and all its positive charge are concentrated in a tiny nucleus and the electrons revolve around it, is Rutherford's model.

Statement II : An atom is a spherical cloud of positive charges with electrons embedded in it, is a special case of Rutherford's model.

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

(1) Statement I is false but Staten1ent II is true

(2) Statement I is hue but Statement II is false

(3) Both Statement I and Statement II are true

(4) Both statement I and statement II are false

44. stone of mass 900g is tied to a string and moved in a vertical circle of radius 1 m making 10 rpm. The tension in the string, when the stone is at the lowest point is (if $\pi^2 = 9.8$ and $g = 9.8 m/s^2$):

(1) 9.8 N **(2)** 8.82 N **(3)** 97 N **(4)** 17.8 N

45. A small liquid drop of radius R is divided into 27 identical liquid drops. If the surface tension is T, then the work done in the process will be:

(1) $\frac{1}{8}\pi R^2 T$ **(2)** $4\pi R^2 T$ **(3)** $8\pi R^2 T$ **(4)** $3\pi R^2 T$

46. Two sources of light emit with a power of 200 W. The ratio of number of photons of visible light emitted by each source having wavelengths $300nm$ and $500nm$ respectively, will be:

(1) 1 : 3 (2) 1 : 5 (3) 5 : 3 (4) 3 : 5

47. The temperature of a gas having 2.0×10^{25} molecules per cubic meter at 1.38 atm $(\text{Give}, k = 1.38\times10^{-23} JK^{-1})$

(1) 100 K **(2)** 300 K **(3)** 200 K **(4)** 500 K

48. A planet takes 200 days to complete one revolution around the Sun. If the distance of the planet from Sun is reduced to one fourth of the original distance, how many days will it take to complete one revolution:

(1) 25 **(2)** 50 **(3)** 20 **(4)** 100

49. A particle is moving in a straight line. The variation of position 'x' as a function of time 't' is given as $x = (t^3 - 6t^2 - 20t + 15)m$. The velocity of the body when its acceleration becomes zero is:

(1) 4 m/s **(2)** 6 m/s **(3)** 8 m/s **(4)** 10 m/s

50. In an a.c. circuit, voltage and current are given by:

V = 100 sin(100 t) V and

$I = 100\sin(100t + \frac{\pi}{3})mA$ respectively.

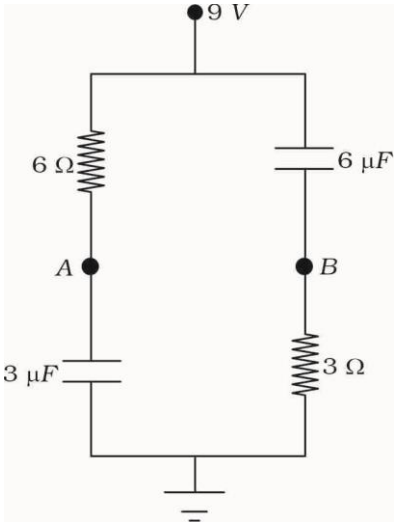
The average power dissipated in one cycle is:

(1) 2.5 W **(2)** 10 W **(3)** 5 W **(4)** 25 W

SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. The answer to each question should be **rounded off to the nearest integer**.

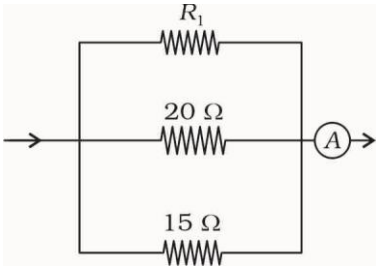
51. In the given figure, the charge stored in $6\mu F$ capacitor. when points A and B are joined by a connecting: wire is _____ μC.



52. Two metallic wires P and Q have same volume and are made up of same material. If their area of cross sections are in the ratio 4: 1 and force F_1 is applied to P, an extension of Δl is produced. The force which is required to produce same extension in Q is F_2.

The value of $\frac{F_1}{F_2}$ is _____.

53. In the given circuit, the current flowing through the resistance 20Ω is 0.3 A, while the ammeter reads 0.9 A. The value of R_1 is _____ Ω.



54. A simple harmonic oscillator has an amplitude A and time period 6π second.

Assuming the oscillation starts from its mean position. the time required by it to travel from $x = A$ to $x = \frac{\sqrt{3}}{2}A$ will be $\frac{\pi}{x}$ s, where x = _____.

55. In a single slit diffraction pattern, a light of wavelength $6000\,\text{Å}$ is used. The distance between the first and third minima in the diffraction pattern is found to be 3 mm when the screen in placed 50 cm away from slits. The width of the slit is _____ $\times 10^{-4}\,m$.

56. A particle is moving in a circle of radius 50 cm in such a way that at any instant the normal and tangential components of it's acceleration arc equal. If its speed at $t = 0$ is 4 m/s, the time taken to complete the first revolution will be $\frac{1}{\alpha}[1 - e^{-2\pi}]$ s.

where α = _____.

57. A charge of $4.0\mu C$ is moving with a velocity of $4.0\times10^{6}ms^{-1}$ along the positive y-axis under a magnetic field $\bar{B}$ of strength $(2\hat{k})T$. The force acting on the charge is $x\hat{i}\,N$. The value of x is _____.

58. A horizontal straight wire 5 m long extending from east to west falling freely at right angle to horizontal component of earths magnetic field $0.60\times10^{-4}wBm^{-2}$. The instantaneous value of emf induced in the wire when its velocity is $10ms^{-1}$ is _____ $\times10^{-3}V$.

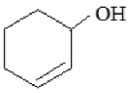
59. A body of mass 5 kg moving with a uniform speed $3\sqrt{2}\,ms^{-1}$ in X-Y plane along the line $y=x+4$. The angular momentum of the particle about the origin will be _____ $kgm^{2}s^{-1}$.

60. Hydrogen atom is bombarded with electrons accelerated through a potential difference of V, which causes excitation of hydrogen atoms. If the experiment is being performed at $T = 0$ K, the minimum potential difference needed to observe any Balmer series lines in the emission spectra will be $\frac{\alpha}{10}V$. where α = _____.

SUBJECT III: CHEMISTRY	MARKS: 100

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

61. According to IUPAC system, the compound  is named as:

(1) Cyclohex-1-en-2-ol **(2)** Cyclohex-1-en-3-ol

(3) Cyclohex-2-en-1-ol **(4)** 1-Hydroxyhex-2-ene

62. Match List I with List II.

LIST I (Spectral Series for Hydrogen)		**LIST II (Spectral Region/Higher Energy State)**	
A.	Lyman	**I.**	Infrared region
B.	Balmer	**II.**	UV region
C.	Paschen	**III.**	Infrared region
D.	Pfund	**IV.**	Visible region

Choose the correct answer from the options given below:

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

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

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

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

63. Alkyl halide is converted into alkyl isocyanide by reaction with:

(1) NH_4CN **(2)** AgCN **(3)** KCN **(4)** NaCN

64. Match List I with List II.

LIST I (Compound)		**LIST II (pK_a Value)**	
A.	Ethanol	**I.**	10.0
B.	Phenol	**II.**	15.9
C.	m-Nitrophenol	**III.**	7.1
D.	p-Nitrophenol	**IV.**	8.3

Choose the correct answer from the options given below:

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

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

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

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

65. A reagent which gives brilliant red precipitate with Nickel ions in basic medium is:

(1) dimethyl glyoxime **(2)** sodium nitroprusside

(3) meta-dinitrobenzene **(4)** neutral $FeCl_3$

66. Given below are two statements:

Statement I : Fluorine has most negative electron gain enthalpy in its group.

Statement II : Oxygen has least negative electron gain enthalpy in its group.

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

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

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

(3) Both Statement I and Statement II are true

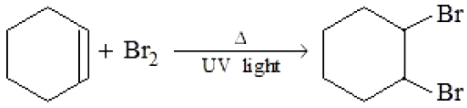
(4) Both Statement I and Statement II are false

67. Which of the following acts as a strong reducing agent? (Atomic number: Ce = 58, Eu = 63, Gd = 64, Lu = 71)

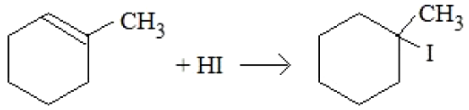
(1) Lu^{3+} **(2)** Ce^{4+} **(3)** Gd^{3+} **(4)** Eu^{2+}

68. Which of the following reaction is correct?

(1) $C_2H_5CONH_2 + Br_2 + NaOH \rightarrow C_2H_5CH_2NH_2 + Na_2CO_3 + NaBr + H_2O$

(2) 

(3) $CH_3CH_2CH_2NH_2 \xrightarrow[H_2O]{HNO_2, 0°C} CH_3CH_2OH + N_2 + HCl$

(4) 

69. On passing a gas, 'X', through Nessler's reagent, a brown precipitate is obtained. The gas 'X' is:

(1) Cl_2 **(2)** CO_2 **(3)** NH_3 **(4)** H_2S

70. Match List I with List II.

LIST I (Bio polymer)		**LIST II (Monomer)**	
A.	Starch	**I.**	nucleotide
B.	Cellulose	**II.**	α -glucose
C.	Nucleic acid	**III.**	β -glucose
D.	Protein	**IV.**	α -amino acid

Choose the correct answer from the options given below:

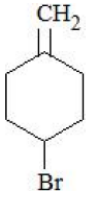
(1) A-I, B-III, C-IV, D-II

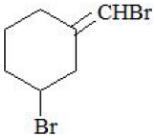
(2) A-II, B-I, C-III, D-IV

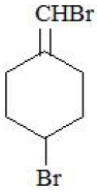
(3) A-IV, B-II, C-I, D-III

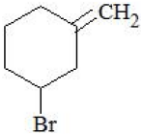
(4) A-II, B-III, C-I, D-IV

71. Which one of the following will show geometrical isomerism?

(1) 

(2) 

(3) 

(4) 

72. The correct IUPAC name of K_2MnO_4 is:

(1) Potassium tetraoxidomanganate (VI)

(2) Dipotassium tetraoxidomanganate (VII)

(3) Potassium tetraoxopermanganate (VI)

(4) Potassium tetraoxidomanganese (VI)

73. Phenol treated with chloroform in presence of sodium hydroxide, which further hydrolyzed in presence of an acid results.

(1) Benzene-1.2-diol **(2)** 2-Hydroxybenzaldehyde

(3) Benzene-1.3-diol **(4)** Salicylic acid

74. Chromatographic technique/s based on the principle of differential adsorption is/are:

A. Column chromatography

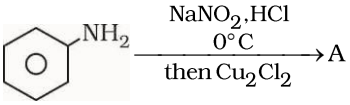
B. Thin layer chromatography

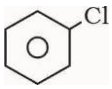
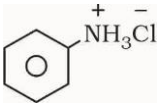
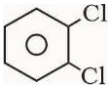
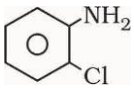
C. Paper chromatography

Choose the most appropriate answer from the options given below:

(1) A only **(2)** A and B only **(3)** B only **(4)** C only

75. The product A formed in the following reaction is:

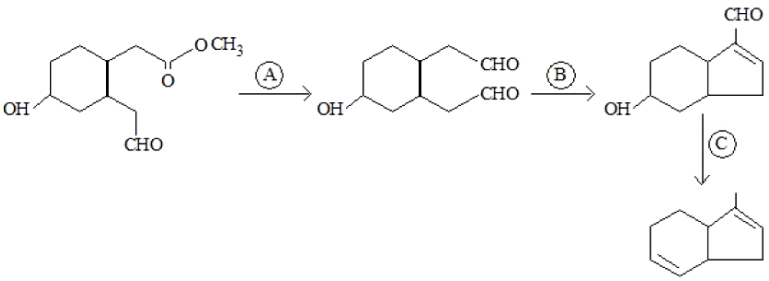


(1)  **(2)**  **(3)**  **(4)** 

76. The element having the highest first ionization enthalpy is:

(1) N **(2)** Al **(3)** Si **(4)** C

77. Identify the reagents used for the following conversion.



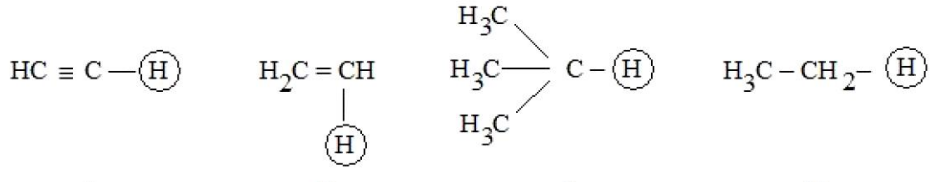
(1) $A = LiAlH_4, B = NaOH_{(alc)}, C = Zn / HCl$

(2) $A = DIBAL - H, B = NaOH_{(alc)}, C = Zn / HCl$

(3) $A = DIBAL - H, B = NaOH_{(aq)}, C = NH_2, NH_2 / KOH,$ ethylene glycol

(4) $A = LiAlH_4, B = NaOH_{(aq)}, C = NH_2 - NH_2 / KOH,$ ethylene glycol

78. The ascending acidity order of the following H atoms is:



A B C D

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

79. Which of the following statements are correct about Zn, Cd and Hg?

A. They exhibit high enthalpy of atomization as the d-subshell is full.

B. Zn and Cd do not show variable oxidation state while Hg shows +I and +II.

C. Compounds of Zn. Cd and Hg are paramagnetic in nature.

D. Zn, Cd and Hg are called soft metals.

Choose the most appropriate from the options given below:

(1) A, D only **(2)** B, D only **(3)** C, D only **(4)** B, C only

80. Anomalous behavior of oxygen is clue to its:

(1) small size and high electronegativity

(2) small size and low electronegativity

(3) large size and high electronegativity

(4) large size and low electronegativity

SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. The answer to each question should be **rounded off to the nearest integer**.

81. If 50 mL of 0.5M oxalic acid is required to neutralise 25 mL of NaOH solution, the amount of NaOH in 50 mL of given NaOH solution is ___ g.

82. A constant current was passed through a solution of $AuCl_4^-$ ion between gold electrodes. After a period of 10.0 minutes, the increase in mass of cathode was 1.314g. The total charge passed through the solution is _____$\times 10^{-2}$F.

(Given atomic mass of Au = 197)

83. The following concentrations were observed at 500K for the formation of NH_3 from N_2 and H_2, At equilibrium: $[N_2] = 2\times10^{-2}M, [H_2] = 3\times10^{-2}M$ and $[NH_3] = 1.5\times10^{-2}M$. Equilibrium constant for the reaction is _____.

84. The total number of anti bonding molecular orbitals. formed from 2s and 2p atomic orbitals in a diatomic molecule is _____.

85. Standard enthalpy of vapourisation for CCl_4 is 30.5 $kJ\,mol^{-1}$. Heat required for vapourisation of 284g of CCl_4 at constant temperature is ___ kJ.

(Given molar mass in $g\,mol^{-1}$: C = 12, Cl = 35.5)

86. The total number of 'Sigma' and 'Pi' bonds in 2-formylhex-4-enoic acid is _____.

87. The oxidation number of iron in the compound formed during brown ring test for NO_3^- ion is _____.

88. The total number of molecules with zero dipole moment among CH_4, BF_3, H_2O, HF, NH_3, CO_2 and SO_2 is _____.

89. The half-life of radioisotope bromine – 82 is 36 hours. The fraction which remains after one day is ___$\times 10^{-2}$.

(Given antilog 0.2006 = 1.587)

90. Molality of 0.8 M H_2SO_4 solution (density 1.06 $g\,cm^{-3}$) is _____ $\times 10^{-3}$m.