JEE Main – 2025

28th JANUARY 2025 (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 **5 Numerical Value Type Questions**. The answer to each question is an **integer** ranging from 0 to 999.
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. Let S be the set of all the words that can be formed by arranging all the letters of the word GARDEN. From the set S, one word is selected at random. The probability that the selected word will **NOT** have vowels in alphabetical order is:

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

2. Let f be a real valued continuous function defined on the positive real axis such that $g(x)=\int_0^x tf(t)\,dt$. If $g(x^3)=x^6+x^7$, then value of $\sum_{r=1}^{15} f(r^3)$ is:

(1) 340 **(2)** 320 **(3)** 310 **(4)** 270

3. If $\alpha+i\beta$ and $\gamma+i\delta$ are the roots of $x^2-(3-2i)x-(2i-2)=0,\ i=\sqrt{-1},$, then $\alpha\gamma+\beta\delta$ is equal to:

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

4. Let $[x]$ denote the greatest integer less than or equal to x. Then the domain of $f(x)=\sec^{-1}(2[x]+1)$ is:

(1) $(-\infty,-1]\cup[1,\infty)$ **(2)** $(-\infty,-1]\cup[0,\infty)$

(3) $(-\infty,\infty)-\{0\}$ **(4)** $(-\infty,\infty)$

5. If A and B are the points of intersection of circle $x^2+y^2-8x=0$ and the hyperbola $\frac{x^2}{9}-\frac{y^2}{4}=1$ and a point P moves on the line $2x-3y+4=0$, then the centroid of ΔPAB lies on the line:

(1) $6x-9y=20$ **(2)** $4x-9y=12$ **(3)** $x+9y=36$ **(4)** $9x-9y=32$

6. If $f(x)=\int\frac{1}{x^{1/4}(1+x^{1/4})}dx, f(0)=-6$, then $f(1)$ is equal to:

(1) $2-\log_e 2$ **(2)** $\log_e 2+2$ **(3)** $4(\log_e 2-2)$ **(4)** $4(\log_e 2+2)$

7. For positive integers n, if $4a_n=(n^2+5n+6)$ and $S_n=\sum_{k=1}^{n}\left(\frac{1}{a_k}\right)$, then the value of $507s_{2025}$ is:

(1) 675 **(2)** 540 **(3)** 1350 **(4)** 135

8. The square of the distance of the point $\left(\frac{15}{7},\frac{32}{7},7\right)$ from the line $\frac{x+1}{3}=\frac{y+3}{5}=\frac{z+5}{7}$ in direction of the vector $\hat{i}+4\hat{j}+7\hat{k}$ is:

(1) 44 **(2)** 41 **(3)** 54 **(4)** 66

9. The area of the region bounded by the curves $x(1+y^2)=1$ and $y^2=2x$ is:

(1) $\frac{1}{2}\left(\frac{\pi}{2}-\frac{1}{3}\right)$ **(2)** $\frac{\pi}{4}-\frac{1}{3}$ **(3)** $2\left(\frac{\pi}{2}-\frac{1}{3}\right)$ **(4)** $\frac{\pi}{2}-\frac{1}{3}$

10. Let A, B, C be three points in xy-plane, whose position vector are by $\sqrt{3}\hat{i}+\hat{j}, \hat{i}+\sqrt{3}\hat{j}$ and $a\hat{i}+(1-a)\hat{j}$ respectively with respect to the origin O. If the distance of the point C from the line bisecting the angle between the vectors $\overrightarrow{OA}$ and $\overrightarrow{OB}$ is $\frac{9}{\sqrt{2}}$, then the sum of all the possible values of a is :

(1) 2 **(2)** 1 **(3)** 0 **(4)** $\frac{9}{2}$

11. Let $f:\mathbb{R}-\{0\}\to(-\infty,1)$ be a polynomial of degree 2, satisfying $f(x)f\left(\frac{1}{x}\right)=f(x)+f\left(\frac{1}{x}\right)$. If $f(K)=-2K$, then the sum of squares of all possible values of K is:

(1) 7 **(2)** 1 **(3)** 6 **(4)** 9

12. Two equal sides of an isosceles triangle are along $-x+2y=4$ and $x+y=4$. If m is the slope of its third side, then the sum, of all possible distinct values of m, is:

(1) 6 **(2)** –6 **(3)** $-2\sqrt{10}$ **(4)** 12

13. If the component of $\vec{a}=\alpha\hat{i}+\beta\hat{j}+\gamma\hat{k}$ along and perpendicular to $\vec{b}=3\hat{i}+\hat{j}-\hat{k}$ respectively, are $\frac{16}{11}(3\hat{i}+\hat{j}-\hat{k})$ and $\frac{1}{11}(-4\hat{i}-5\hat{j}-17\hat{k})$, then $\alpha^2+\beta^2+\gamma^2$ is equal to :

(1) 16 **(2)** 26 **(3)** 23 **(4)** **18**

14. Let $f:\mathbb{R}\to\mathbb{R}$ be a twice differentiable function such that $f(2)=1$. If $F(x)=xf(x)$ for all $x\in\mathbb{R}$, $\int_0^2 xF'(x)dx=6$ and $\int_0^2 x^2F''(x)dx=40$, then $F'(2)+\int_0^2 F(x)dx$ is equal to :

(1) 11 **(2)** 13 **(3)** 9 **(4)** 15

15. If $\sum_{r=1}^{13}\left\{\frac{1}{\sin\left(\frac{\pi}{4}+(r-1)\frac{\pi}{6}\right)\sin\left(\frac{\pi}{4}+\frac{r\pi}{6}\right)}\right\}=a\sqrt{3}+b, a,b\in\mathbb{Z}$, then a^2+b^2 is equal to:

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

16. Let $A=\begin{bmatrix}\frac{1}{\sqrt{2}} & -2\\ 0 & 1\end{bmatrix}$ and $P=\begin{bmatrix}\cos\theta & -\sin\theta\\ \sin\theta & \cos\theta\end{bmatrix}, \theta>0$. If $B=PAP^T, C=P^TB^{10}P$ and the sum of the diagonal elements of C is $\frac{m}{n}$, where $\gcd(m,n)=1$, then $m+n$ is:

(1) 65 **(2)** 127 **(3)** 258 **(4)** 2049

17. Let the coefficients of three consecutive terms T_r, T_{r+1} and T_{r+2} in the binomial expansion of $(a+b)^{12}$ be in a *G.P.* and let p be the number of all possible values of r. Let q be the sum of all rational terms in the binomial expansion of $\left(\sqrt[4]{3}+\sqrt[3]{4}\right)^{12}$. Then $p+q$ is equal to:

(1) 287 **(2)** 283 **(3)** 299 **(4)** 295

18. Bag B_1 contains 6 white and 4 blue balls, Bag B_2 contains 4 white and 6 blue balls, and Bag B_3 contains 5 white and 5 blue balls. One of the bags is select at random and a ball is drawn from it. If the ball is white, then the probability, that the ball is drawn from Bag B_2, is:

(1) $\frac{4}{15}$ **(2)** $\frac{2}{5}$ **(3)** $\frac{1}{3}$ **(4)** $\frac{2}{3}$

19. If the midpoint of a chord of the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ is $\left(\sqrt{2},\frac{4}{3}\right)$, and the length of the chord is $\frac{2\sqrt{\alpha}}{3}$, then α is:

(1) 26 **(2)** 18 **(3)** 20 **(4)** 22

20. Let $f:[0,3]\to A$ be defined by $f(x)=2x^3-15x^2-36x+7$ and $g:[0,\infty)\to B$ be defined by $g(x)=\frac{x^{2025}}{x^{2025}+1}$. If both the functions are onto and $S=\{x\in\mathbb{Z}:x\in A \text{ or } x\in B\}$, then $n(S)$ is equal to :

(1) 30 **(2)** 31 **(3)** 36 **(4)** 29

SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

21. The interior angles of a polygon with n sides, are in A.P. with common difference 6°. If the largest interior angle of the polygon is 219°, then n is equal to _____.

22. Let $f(x)=\lim\limits_{n\to\infty}\sum\limits_{r=0}^{n}\left(\frac{\tan(x/2^{r+1})+\tan^3(x/2^{r+1})}{1-\tan^2(x/2^{r+1})}\right)$. Then $\lim\limits_{x\to 0}\frac{e^x-e^{f(x)}}{(x-f(x))}$ is equal to_____.

23. The number of natural numbers, between 212 and 999, such that the sum of their digits is 15, is _____.

24. If $y=y(x)$ is the solution of the differential equation, $\sqrt{4-x^2}\frac{dy}{dx}=\left(\left(\sin^{-1}\left(\frac{x}{2}\right)\right)^2-y\right)\sin^1\left(\frac{x}{2}\right)$, $-2\le x\le 2, y(2)=\frac{\pi^2-8}{4}$, then $y^2(0)$ is equal to _____.

25. Let A and B be the two points of intersection of the line $y+5=0$ and the mirror image of the parabola $y^2=4x$ with respect to the line $x+y+4=0$. If d denotes the distance between A and B, and a denotes the area of ΔSAB, where S is the focus of the parabola $y^2=4x$, then the value of $(a+d)$ is _____.

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.

26. In a long glass tube, mixture of two liquids A and B with refractive indices 1.3 and 1.4 respectively, forms a convex refractive meniscus towards A. If an object placed at 13 cm from the vertex of the meniscus in A forms an image with a magnification of '–2' then the radius of curvature of meniscus is:

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

27. A concave mirror produces an image of an object such that the distance between the object and image is 20 cm. If the magnification of the image is '–3', then the magnitude of the radius of curvature of the mirror is:

(1) 30 cm **(2)** 7.5 cm **(3)** 3.75 cm **(4)** 15 cm

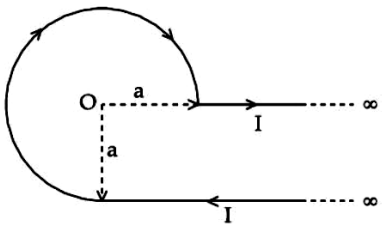
28. The frequency of revolution of the electron in Bohr's orbit varies with n, the principal quantum number as:

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

29. A body of mass 4 kg is placed on a plane at a point P having coordinate (3, 4) m. Under the action of force $\vec{F}=(2\hat{i}+3\hat{j})N$, it moves to a new point Q having coordinates (6, 10) m in 4 sec. The average power and instantaneous power at the end of 4 sec are in the ratio of:

(1) 6 : 13 **(2)** 4 : 3 **(3)** 1 : 2 **(4)** 13 : 6

30.



An infinite wire has a circular bends of radius a, and carrying a current I as shown in figure. The magnitude of magnetic field at the origin O of the arc is given by:

(1) $\frac{\mu_0}{4\pi}\frac{I}{a}\left[\frac{\pi}{2}+1\right]$ **(2)** $\frac{\mu_0}{2\pi}\frac{I}{a}\left[\frac{\pi}{2}+2\right]$ **(3)** $\frac{\mu_0}{4\pi}\frac{I}{a}\left[\frac{3\pi}{2}+1\right]$ **(4)** $\frac{\mu_0}{4\pi}\frac{I}{a}\left[\frac{3\pi}{2}+2\right]$

31. Match **List – I** with **List – II** .

List – 1		List – II	
(A)	Angular Impulse	(I)	$[M^0L^2T^{-2}]$
(B)	Latent Heat	(II)	$[ML^2T^{-3}A^{-1}]$
(C)	Electrical resistivity	(III)	$[ML^2T^{-1}]$
(D)	Electromotive force	(IV)	$[ML^3T^{-3}A^{-2}]$

Choose the **correct** answer from the options given below ;

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

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

32. A balloon and its content having mass M is moving up with an acceleration 'a'. The mass that must be released from the content so that the balloon starts moving up with an acceleration '$3a$' will be

(Take 'g' as acceleration due to gravity)

(1) $\frac{3Ma}{2a-g}$ **(2)** $\frac{2Ma}{3a+g}$ **(3)** $\frac{2Ma}{3a-g}$ **(4)** $\frac{3Ma}{2a+g}$

33. The kinetic energy of translation of the molecules in 50 g of CO_2 gas at 17°C is:

(1) 3582.7 J **(2)** 3986.3 J **(3)** 4205.5 J **(4)** 4102.8 J

34. Which of the following phenomena can not be explained by wave theory of light?

(1) Compton effect **(2)** Refraction of light

(3) Reflection of light **(4)** Diffraction of light

35. The magnetic field of an E.M. wave is given by $\vec{B}=\left(\frac{\sqrt{3}}{2}\hat{i}+\frac{1}{2}\hat{j}\right)30\ \sin\left[\omega\left(t-\frac{z}{c}\right)\right]$ (S.I. Units). The corresponding electric field in S.I. units is:

(1) $\vec{E}=\left(\frac{1}{2}\hat{i}+\frac{\sqrt{3}}{2}\hat{j}\right)30c\ \sin\left[\omega\left(t+\frac{z}{c}\right)\right]$ **(2)** $\vec{E}=\left(\frac{3}{4}\hat{i}+\frac{1}{4}\hat{j}\right)30c\ \cos\left[\omega\left(t-\frac{z}{c}\right)\right]$

(3) $\vec{E}=\left(\frac{1}{2}\hat{i}-\frac{\sqrt{3}}{2}\hat{j}\right)30c\ \sin\left[\omega\left(t-\frac{z}{c}\right)\right]$ **(4)** $\vec{E}=\left(\frac{\sqrt{3}}{2}\hat{i}-\frac{1}{2}\hat{j}\right)30c\ \sin\left[\omega\left(t+\frac{z}{c}\right)\right]$

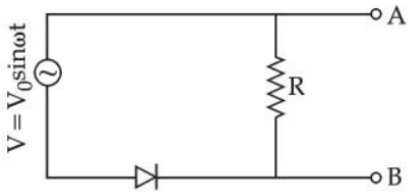
36. The ratio of vapour densities of two gases at the same temperature is $\frac{4}{25}$, then the ratio of r.m.s. velocities will be:

(1) $\frac{25}{4}$ **(2)** $\frac{4}{25}$ **(3)** $\frac{2}{5}$ **(4)** $\frac{5}{2}$

37. A uniform magnetic field of 0.4 T acts perpendicular to a circular copper disc 20 cm in radius. The disc is having a uniform angular velocity of $10\pi rad\,s^{-1}$ about an axis through its centre and perpendicular to the disc. What is the potential difference developed between the axis of the disc and the rim? ($\pi=3.14$)

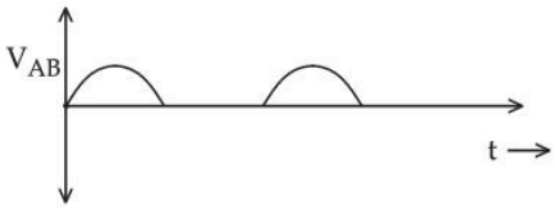
(1) 0.5024 V **(2)** 0.1256 V **(3)** 0.2512 V **(4)** 0.0628 V

38.

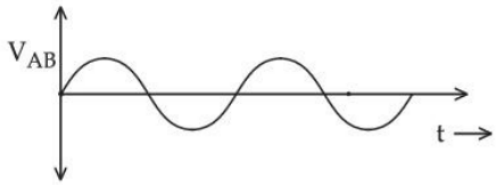


In the circuit shown here, assuming threshold voltage of diode is negligibly small, then voltage V_{AB} is correctly respresented by :

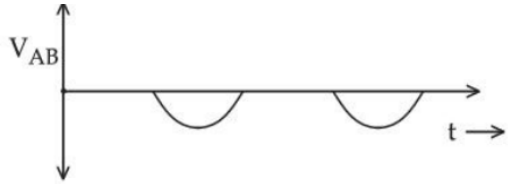
(1)



(2)



(3)



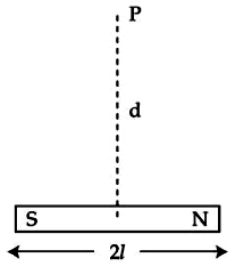
(4) V_{AB} would be zero at all times

39. A 400 g solid cube having an edge of length 10 cm floats in water. How much volume of the cube is outside the water ?

(Given: density of water = 1000 $kg\ m^{-3}$)

(1) $400 cm^3$ **(2)** $1400 cm^3$ **(3)** $600\ cm^3$ **(4)** $4000\ cm^3$

40.



A bar magnet has total length $2l = 20$ units and the field point P is at a distance d = 10 units from the centre of the magnet. If the relative uncertainty of length measurement is 1%, then uncertainty of the magnetic field at point P is:

(1) 10 % **(2)** 4 % **(3)** 3% **(4)** 5%

41. A parallel plate capacitor of capacitance 1 μF is charged to a potential difference of 20 V. The distance between plates is 1 μm . The energy density between plates of capacitor is:

(1) $2\times10^2 J/m^3$ **(2)** $1.8\times10^3 J/m^3$ **(3)** $2\times10^{-4} J/m^3$ **(4)** $1.8\times10^5 J/m^3$

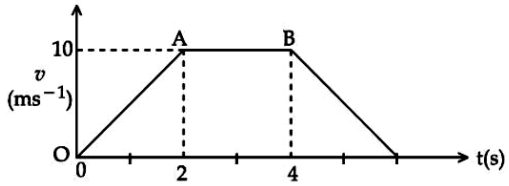
42. Earth has mass 8 times and radius 2 times that of a planet. If the escape from the earth is 11.2 km/s, the escape velocity in km/s from the planet will be:

(1) 8.4 **(2)** 5.6 **(3)** 11.2 **(4)** 2.8

43. A uniform rod of mass 250 g having length 100 cm is balanced on a sharp edge of 40 cm mark. A mass of 400 g is suspended at 10 cm mark. To maintain the balance of the rod, the mass to be suspended at 90 cm mark, is:

(1) 300 g **(2)** 290 g **(3)** 190 g **(4)** 200 g

44. The velocity-time graph of an object moving along a straight line is shown in figure. What is the distance covered by the object between $t = 0$ to $t = 4$s?



(1) 13 m **(2)** 30 m **(3)** 10 m **(4)** 11 m

45. Given below are two statements. One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : Knowing initial position x_0 and initial momentum p_0 is enough to determine the position and momentum at any time t for a simple harmonic motion with a given angular frequency ω.

Reason (R) : The amplitude and phase can be expressed in terms of x_0 and p_0.

In the light of the above statements, choose the **correct** answer from the option given below:

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

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

(3) **(A)** is false but **(R)** is true

(4) **(A)** is true but **(R)** is false

SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

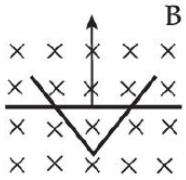
46. A thin transparent film with refractive index 1.4, is held on circular ring of radius 1.8 *cm*. The fluid in the film evaporates such that transmission through the film at wavelength 560 *nm* goes to a minimum every 12 seconds. Assuming that the film is flat on its two sides, the rate of evaporation is _____ $\pi \times 10^{-13} m^3 / s$.

47. An electric dipole of dipole moment 6×10^{-6} *cm* is placed in uniform electric field of magnitude 10^6 *V/m*. Initially, the dipole moment is parallel to electric field. The work that needs to be done on the dipole to make its dipole moment opposite to the field, will be _____ *J*.

48. The volume contraction of a solid copper cube of edge length 10 *cm*, when subjected to a hydraulic pressure of 7×10^6 *Pa*, would be _____ mm^3.

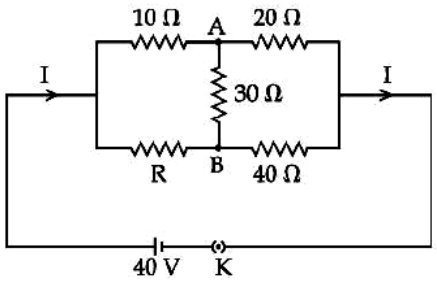
(Given bulk modulus of copper = 1.4×10^{11} Nm^{-2})

49.



A conducting bar moves on two conducting rails as shown in the figure. A constant magnetic field *B* exists into the page. The bar starts to move from the vertex at time $t = 0$ with a constant velocity. If the induced EMF is $E \propto t^n$, then value of n is _____.

50. The value of current I in the electrical circuit as given below, when potential at A is equal to the potential at B, will be _____ A.



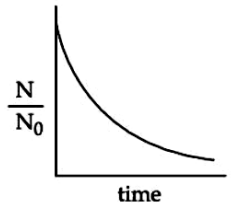
SUBJECT III: CHEMISTRY	MARKS: 100

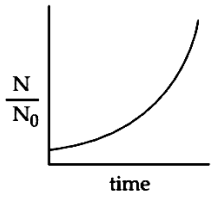
SECTION-1

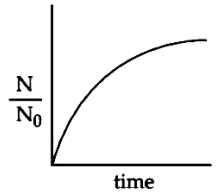
This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which ONLY ONE CHOICE is correct.

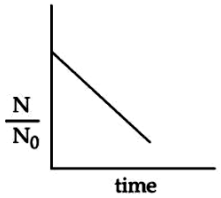
51. For bacterial growth in a cell culture, growth law is very similar to the law of radioactive decay. Which of the following graphs is most suitable to represent bacterial colony growth?

Where N - Number of bacteria at any time, N_0 – Initial number of Bacteria.

(1) 

(2) 

(3) 

(4) 

52. Given below are two statements:

Statement (I): According to the Law of Octaves, the elements were arranged in the increasing order of their atomic number.

Statement (II): Meyer observed a periodically repeated pattern upon plotting physical properties of certain elements against their respective atomic numbers.

In the light of the above statements, choose the **correct** answer 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

53. Identify correct conversion during acidic hydrolysis from the following:

(A) starch gives galactose.

(B) cane sugar gives equal amount of glucose and fructose.

(C) milk sugar gives glucose and galactose.

(D) amylopectin gives glucose and fructose

(E) amylose gives only glucose.

Choose the **correct** answer from the options given below:

(1) (B), (C) and (E) only **(2)** (C), (D) and (E) only

(3) (A), (B) and (C) only **(4)** (B), (C) and (D) only

54. The purification method based on the following physical transformation is:

$$\underset{(X)}{\text{Solid}} \xrightarrow{\text{Heat}} \underset{(X)}{\text{Vapour}} \xrightarrow{\text{Cool}} \underset{(X)}{\text{Solid}}$$

(1) Distillation **(2)** Crystallization

(3) Extraction **(4)** Sublimation

55. Identify correct statements:

(A) Primary amines do not give diazonium salts when treated with $NaNO_2$ in acidic condition.

(B) Aliphatic and aromatic primary amines on heating with $CHCl_3$ and ethanolic KOH form carbylamines.

(C) Secondary and tertiary amines also give carbylamine test.

(D) Benzenesulfonyl chloride is known as Hinsberg's reagent.

(E) Tertiary amines reacts with benzenesulfonyl chloride very easily.

Choose the **correct** answer from the options given below:

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

(3) (B) and (D) only **(4)** (D) and (E) only

56. Assume a living cell with 0.9% (ω/ω) of glucose solution (aqueous). This cell is immersed in another solution having equal mole fraction of glucose and water.

(Consider the data upto first decimal place only)

The cell will :

(1) show no change in volume since solution is 0.9% (ω/ω)

(2) shrink since solution is 0.45% (ω/ω) as a result of association of glucose molecules (due to hydrogen bonding)

(3) swell up since solution is 1% (ω/ω)

(4) shrink since solution is 0.5% (ω/ω)

57. Match **List-I** with **List-II.**

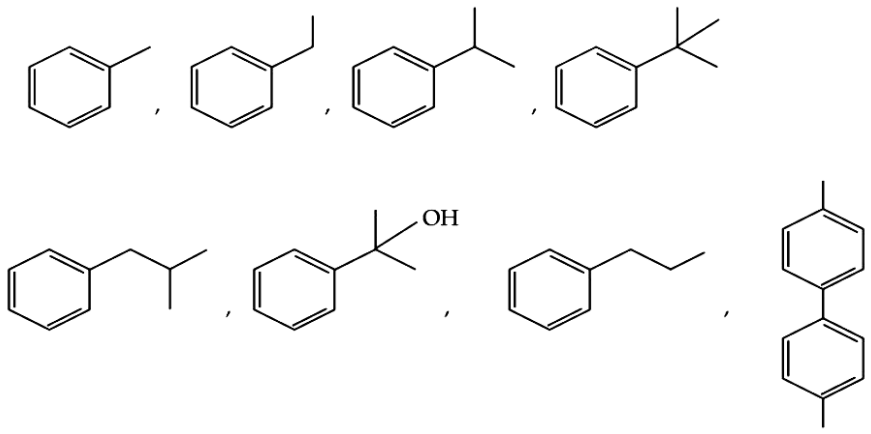
List-I (Complex)		**List – II (Hybridisation of central metal ion)**	
(A)	$[CoF_6]^{3-}$	(I)	d^2sp^3
(B)	$[NiCl_4]^{2-}$	(II)	sp^3
(C)	$[Co(NH_3)_6]^{3+}$	(III)	sp^3d^2
(C)	$[Ni(CN)_4]^{2-}$	(III)	dsp^2

Choose the **correct** answer from the options given below:

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

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

58. The total number of compounds from below when treated with hot $KMnO_4$ giving benzoic acid is:



(1) 5 **(2)** 4 **(3)** 3 **(4)** 6

59. Which of the following is/are not correct with respect to energy of atomic orbitals of hydrogen atom?

(A) 1s < 2p < 3d < 4s **(B)** 1s < 2s = 2p < 3s = 3p

(C) 1s < 2s < 2p < 3s < 3p **(D)** 1s < 2s < 4s < 3d

Choose the **correct** answer from the options given below:

(1) (A) and (C) only **(2)** (B) and (D) only

(3) (C) and (D) only **(4)** (A) and (B) only

60. Concentrated nitric acid is labelled as 75% by mass. The volume in mL of the solution which contains 30 g of nitric acid is _____.

Given: Density of nitric acid solution is 1.25 g/mL.

(1) 32 **(2)** 45 **(3)** 40 **(4)** 55

61. Match **List-I** with **List-II.**

List-I (Saccharides)		**List – II (Glycosidic-linkages found)**	
(A)	Sucrose	(I)	α 1 – 4
(B)	Maltose	(II)	α 1 – 4 and α 1 – 6
(C)	Lactose	(III)	α 1 – β 2
(C)	Amylopectin	(III)	β 1 – 4

Choose the **correct** answer from the options given below:

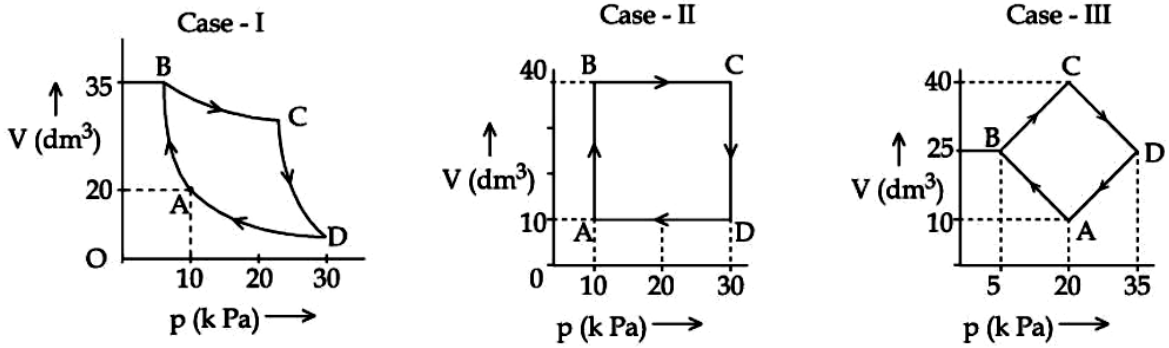
(1) (A)-(IV), (B)-(II), (C)-(I), (D)-(III) **(2)** (A)-(I), (B)-(II), (C)-(III), (D)-(IV)

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

62. The amphoteric oxide among V_2O_3, V_2O_4 and V_2O_5, upon reaction with alkali leads to formation of an oxide anion. The oxidation state of V in the oxide anion is:

(1) + 3 **(2)** + 4 **(3)** + 5 **(4)** + 7

63.



An ideal gas undergoes a cyclic transformation starting from the point A and coming back to the same point by tracing the path A → B → C → D → A as shown in the three cases above.

Choose the **correct** option regarding ΔU:

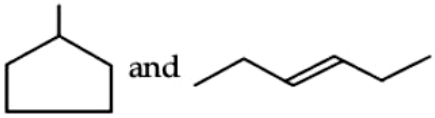
(1) ΔU (Case-I) > ΔU (Case-II) > ΔU (Case-III)

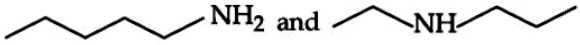
(2) ΔU (Case-I) = ΔU (Case-II) = ΔU (Case-III)

(3) ΔU (Case-III) > ΔU (Case-II) > ΔU (Case-I)

(4) ΔU (Case-I) > ΔU (Case-III) > ΔU (Case-II)

64. Given below are two statements:

Statement (I):  are isomeric compounds.

Statement (II):  are functional group isomers.

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

(1) Both **Statement I** and **Statement II** is true

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

(3) Both **Statement I** and **Statement II** are false

(4) **Statement I** is true but **Statement II** is false

65. Consider an elementary reaction

$$A(g) + B(g) \rightarrow C(g) + D(g)$$

If the volume of reaction mixture is suddenly reduced to $\frac{1}{3}$ of its initial volume, the reaction rate will become 'x' times of the original reaction rate. The value of x is:

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

66. Identify product [A], [B] and [C] in the following reaction sequence.

$$CH_3 - C \equiv CH \xrightarrow[H_2]{Pd/C} [A] \xrightarrow[(ii)\ Zn,\ H_2O]{(i)\ O_3} [B] + [C]$$

(1) [A] : $CH_3 - CH = CH_2$, [B] : CH_3CHO, [C] : HCHO

(2) [A] : $CH_3 - CH = CH_2$, [B] : CH_3CHO, [C] : CH_3CH_2OH

(3) [A] : $CH_2 = CH_2$, [B] : $H_3C-\overset{\overset{O}{\|}}{C}-CH_3$, [C] : HCHO

(4) [A] : $CH_3CH_2CH_3$, [B] : CH_3CHO, [C] : HCHO

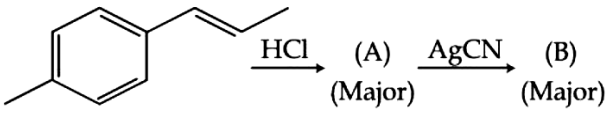
67. Arrange the following in increasing order of solubility product:

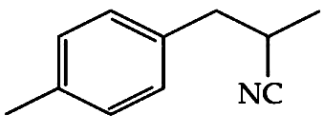
$Ca(OH)_2$, AgBr, PbS, HgS

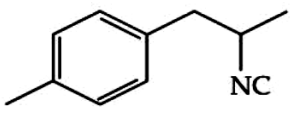
(1) HgS < PbS < AgBr < $Ca(OH)_2$ **(2)** $Ca(OH)_2$ < AgBr < HgS < PbS

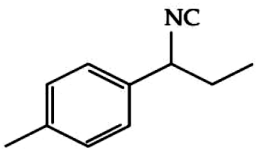
(3) PbS < HgS < $Ca(OH)_2$ < AgBr **(4)** HgS < AgBr < PbS < $Ca(OH)_2$

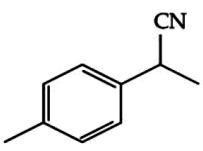
68. The product B formed in the following reaction sequence is:



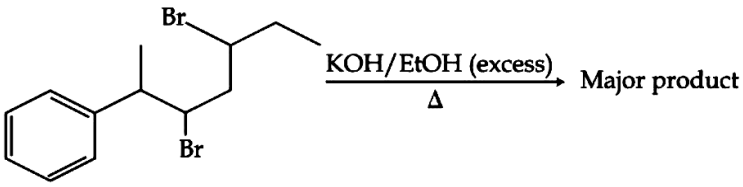
(1) 

(2) 

(3) 

(4) 

69. The major product of the following reaction is:



(1) 6-Phenylhepta-3,5-diene **(2)** 2-Phenylhepta-2,4-diene

(3) 6-Phenylhepta-2,4-diene **(4)** 2-Phenylhepta-2,5-diene

70. Identify the inorganic sulphides that are yellow in colour:

(A) $(NH_4)_2S$

(B) PbS

(C) CuS

(D) As_2S_3

(E) As_2S_5

Choose the **correct** answer from the options given below:

(1) (A) and (C) only **(2)** (D) and (E) only

(3) (A) and (B) only **(4)** (A), (D) and (E) only

SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

71. Consider the following data:

Heat of formation of $CO_2(g) = -393.5$ kJ mol^{-1}

Heat of formation of $H_2O(l) = -286.0$ kJ mol^{-1}

Heat of combustion of benzene $= -3267.0$ kJ mol^{-1}

The heat of formation of benzene is _____ kJ mol^{-1}.

(Nearest integer)

72. The spin only magnetic moment (μ) value (B.M.) of the compound with strongest oxidising power among Mn_2O_3, TiO and VO is _____ B.M. (Nearest integer).

73. Total number of molecules/species from following which will be paramagnetic is _____.

$O_2, O_2^+, O_2^-, NO, NO_2, CO, K_2[NiCl_4], [Co(NH_3)_6]Cl_3, K_2[Ni(CN)_4]$

74. Electrolysis of 600 mL aqueous solution of NaCl for 5 min changes the pH of the solution to 12. The current in Amperes used for the given electrolysis is _____. (Nearest integer).

75. A group 15 element forms dπ – dπ bond with transition metals. It also forms hydride, which is a strongest base among the hydrides of other group members that form dπ – dπ bond. The atomic number of the element is _____.