

# Sri Chaitanya IIT Academy.,India.

✧ A.P ✧ T.S ✧ KARNATAKA ✧ TAMILNADU ✧ MAHARASTRA ✧ DELHI ✧ RANCHI

*A right Choice for the Real Aspirant*

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.S60\_Elite, Target & LIIT-BTs

JEE-MAIN

Date: 01-01-2025

Time: 09.00Am to 12.00Pm

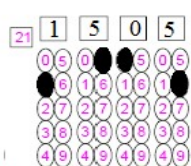
GTM-12/07

Max. Marks: 300

## IMPORTANT INSTRUCTION:

1. Immediately fill in the Admission number on this page of the Test Booklet with **Blue/Black Ball Point Pen** only.
2. The candidates should not write their Admission Number anywhere (except in the specified space) on the Test Booklet/ Answer Sheet.
3. The test is of **3 hours** duration.
4. The Test Booklet consists of **75 Questions**. The maximum marks are **300**.
5. There are **three** parts in the question paper 1,2,3 consisting of **Mathematics, Physics and Chemistry** having **25 Questions** in each subject and subject having **two sections**.  
(I) **Section –I** contains **20 Multiple Choice Questions** with only one correct option.  
**Marking scheme: +4** for correct answer, **0** if not attempt and **-1** in all other cases.  
(II) **Section-II** contains **05 Numerical Value Type Questions**.  
■ The Answer should be within **0 to 9999**. If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i.e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).  
To cancel any attempted question bubble on the question number box.  
For example: To cancel attempted Question 21. Bubble on 21 as shown below

**For More Material Join: @JEEAdvanced\_2025**

**Question Answered for Marking****Question Cancelled for Marking****Marking scheme: +4** for correct answer, **0** if **not attempt** and **-1** in all other cases.

6. Use **Blue / Black Point Pen only** for writing particulars / marking responses on the Answer Sheet. **Use of pencil is strictly prohibited.**
7. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electron device etc, except the Identity Card inside the examination hall.
8. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
9. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Hall.  
**However, the candidate are allowed to take away this Test Booklet with them.**
10. **Do not fold of make any stray marks on the Answer Sheet**

Name of the Candidate (in Capital): \_\_\_\_\_

Admission Number:

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Candidate's Signature: \_\_\_\_\_

Invigilator's Signature: \_\_\_\_\_

**01-01-2025\_Sr.S60\_Elite, Target & LIIT-BTs\_Jee-Main-GTM-12/07\_Test Syllabus****MATHEMATICS : TOTAL SYLLABUS****PHYSICS : TOTAL SYLLABUS****CHEMISTRY : TOTAL SYLLABUS**

**MATHEMATICS****Max Marks: 100****SECTION-I (SINGLE CORRECT ANSWER TYPE)**

This section contains **20 Multiple Choice Questions**. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

**Marking scheme: +4 for correct answer, 0 if not attempted and -1 in all other cases.**

1. Let  $P = \begin{bmatrix} 3 & -1 & -2 \\ 2 & 0 & \alpha \\ 3 & -5 & 0 \end{bmatrix}$ , where  $\alpha \in \mathbb{R}$ . Suppose  $Q = [q_{ij}]$  is a matrix satisfying  $PQ = kI_3$  for

some non-zero  $k \in \mathbb{R}$ , If  $q_{23} = -\frac{k}{8}$  and  $|Q| = \frac{k^2}{2}$ , then  $\alpha^2 + k^2$  is equal to

- 1) 13                      2) 15                      3) 17                      4) 21

2. Statement – I: If  $\alpha = \cos\left(\frac{2\pi}{7}\right) + i \sin\left(\frac{2\pi}{7}\right)$ ,  $p = \alpha + \alpha^2 + \alpha^4$ ,  $q = \alpha^3 + \alpha^5 + \alpha^6$ , then the equation

whose roots are p and q is  $x^2 + x + 2$ .

Statement – II: If  $\alpha$  is a root of  $Z^7 = 1$ , then  $1 + \alpha + \alpha^2 + \dots + \alpha^6 = 0$

- 1) Statement 1 is true, Statement – 2 is true  
2) Statement 1 is false, Statement – 2 is false  
3) Statement 1 is true, Statement – 2 is false  
4) Statement 1 is false, Statement – 2 is true

3. The letters of the word 'MANKIND' are written in all possible orders and arranged in serial order as in an English dictionary. Then the serial number of the word 'MANKIND' is

- 1) 1492                      2) 1493                      3) 1490                      4) 1491

4. Match the following

Column 1		Column - 2	
A)	Number of triangle that can be made using the vertices of a polygon of 10 sides as their vertices and having exactly one side common with the polygon is	p)	75
B)	Number of triangle that can be made using the vertices of a polygon of 10 sides as their vertices and having exactly 2 sides common with the polygon is	q)	110
C)	Number of quadrilaterals that can be made using the vertices of a polygon of 10 sides as their vertices and having exactly 2 sides common with the polygon is	r)	60
D)	Number of quadrilaterals that can be made using the vertices of a polygon of 10 sides as their vertices had having 3 sides common with the polygon is	s)	10

1) A-r, B-s, C-p, D-q

2) A-s, B-r, C-p, D-s

3) A-r, B-s, C-p, D-s

4) None of these

5. Let there be three independent events  $E_1$ ,  $E_2$  and  $E_3$ . The probability that only  $E_1$  occurs is  $\alpha$ , only  $E_2$  occurs is  $\beta$  and only  $E_3$  occurs is  $\gamma$ . Let 'p' denote the probability of none of events occurs that satisfies the equation  $(\alpha - 2\beta)p = \alpha\beta$  and  $(\beta - 3\gamma)p = 2\beta\gamma$ . All the given probabilities are assumed to lie in the interval (0,1).

Then  $\frac{\text{probability of occurrence of } E_1}{\text{probability of occurrence of } E_3}$  is equal to

1) 9

2) 3

3) 7

4) 6

6. Let the circumcenter of a triangle with vertices A(a, 3), B(b, 5) and C(a, b),  $ab > 0$  be P(1, 1). If the line AP intersects the line BC at the point  $Q(k_1, k_2)$ , then  $k_1 + k_2$  is equal to

1) 2

2)  $\frac{4}{7}$

3)  $\frac{2}{7}$

4) 4

7. The number of real solutions of the equation  $e^{4x} + 4e^{3x} - 58e^{2x} + 4e^x + 1 = 0$  is

1) 4

2) 6

3) 2

4) 8



8. A wire of length 20 m is to be cut into two pieces. A piece of length  $\ell_1$  is bent to make a square of area  $A_1$  and the other piece of length  $\ell_2$  is made into a circle of area  $A_2$ . If  $2A_1 + 3A_2$  is minimum then  $(\pi\ell_1) : \ell_2$  is equal to
- 1) 6 : 1                      2) 3 : 1                      3) 1 : 6                      4) 4 : 1
9. Let  $f(x) = 4x^3 - 11x^2 + 8x - 5, x \in R$ . Then f :
- 1) has a local minima at  $x = \frac{1}{2}$ .                      2) has a local minima at  $x = \frac{3}{4}$
- 3) is increasing in  $\left(\frac{1}{2}, \frac{3}{4}\right)$                       4) is decreasing in  $\left(\frac{1}{2}, \frac{3}{4}\right)$
10. Let for a triangle ABC,
- $$\overrightarrow{AB} = -2\hat{i} + \hat{j} + 3\hat{k}$$
- $$\overrightarrow{CB} = \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$$
- $$\overrightarrow{CA} = 4\hat{i} + 3\hat{j} + \delta\hat{k}$$
- If  $\delta > 0$  and area of the triangle ABC is  $5\sqrt{6}$ , Then  $\overrightarrow{CB} \cdot \overrightarrow{CA}$  is equal to
- 1) 60                      2) 120                      3) 108                      4) 54
11. If the shortest distance between the lines  $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{\lambda}$  and  $\frac{x-2}{1} = \frac{y-4}{4} = \frac{z-5}{5}$  is  $\frac{1}{\sqrt{3}}$ , then the sum of all possible values of  $\lambda$  is :
- 1) 16                      2) 6                      3) 12                      4) 15
12. If  $15\sin^4 \alpha + 10\cos^4 \alpha = 6$ , for  $\alpha \in R$ , then the value of  $27\sec^6 \alpha + 8\operatorname{cosec}^6 \alpha$  is equal to:
- 1) 350                      2) 250                      3) 400                      4) 500
13. Let  $S_1 = \left\{x \in R - \{1, 2\} : \frac{(x+2)(x^2+3x+5)}{-2+3x-x^2} \geq 0\right\}$  and  $S_2 = \{x \in R : 3^{2x} - 3^{x+1} - 3^{x+2} + 27 \leq 0\}$ . Then,  $S_1 \cup S_2$  is equal to
- 1)  $(-\infty, -2] \cup (1, 2)$     2)  $(-\infty, -2] \cup [1, 2]$     3)  $(-2, 1] \cup (2, \infty)$     4)  $(-\infty, 2]$



14. The integral  $\int \left( \frac{x}{x \sin x + \cos x} \right)^2 dx$  is equal to (where C is a constant integration):
- 1)  $\tan x - \frac{x \sec x}{x \sin x + \cos x} + C$       2)  $\sec x + \frac{x \tan x}{x \sin x + \cos x} + C$   
 3)  $\sec x - \frac{x \tan x}{x \sin x + \cos x} + C$       4)  $\tan x + \frac{x \sec x}{x \sin x + \cos x} + C$
15. The area of the region  $S = \{(x, y) : y^2 \leq 8x, y \geq \sqrt{2}x, x \geq 1\}$  is
- 1)  $\frac{13\sqrt{2}}{6}$       2)  $\frac{11\sqrt{2}}{6}$       3)  $\frac{5\sqrt{2}}{6}$       4)  $\frac{19\sqrt{2}}{6}$
16. Let  $y = y(x), y > 0$  be a solution curve of the differential equation  $(1+x^2)dy = y(x-y)dx$ . If  $y(0) = 1$  and  $y(2\sqrt{2}) = \beta$ , then
- 1)  $e^{3\beta^{-1}} = e(3+2\sqrt{2})$       2)  $e^{\beta^{-1}} = e^{-2}(5+\sqrt{2})$   
 3)  $e^{\beta^{-1}} = e^{-2}(3+2\sqrt{2})$       4)  $e^{3\beta^{-1}} = e(5+\sqrt{2})$
17. The number of terms common to the two A.P.'s 3, 7, 11, ..., 407 and 2, 9, 16, ..., 709 is \_\_\_\_.
- 1) 7      2) 14      3) 21      4) 28
18. Consider the following frequency distribution:
- |            |     |      |       |       |       |
|------------|-----|------|-------|-------|-------|
| Class:     | 0-6 | 6-12 | 12-18 | 18-24 | 24-30 |
| Frequency: | a   | b    | 12    | 9     | 5     |
- If mean =  $\frac{309}{22}$  and median = 14, then the value  $(a-b)^2$  is equal to \_\_\_\_.
- 1) 2      2) 6      3) 4      4) 8
19. Let  $\bigcup_{i=1}^{50} X_i = \bigcup_{i=1}^n Y_i = T$ , where each  $X_i$  contains 10 elements and each  $Y_i$  contains 5 elements. If each element of the set T is an element of exactly 20 of sets  $X_i$ 's and exactly 6 of sets  $Y_i$ 's then n is equal to
- 1) 15      2) 50      3) 45      4) 30

20. Let the function

$$f(x) = \begin{cases} \frac{\log_e(1+5x) - \log_e(1+\alpha x)}{x} & ; \text{if } x \neq 0 \\ 10 & ; \text{if } x = 0 \end{cases}$$

Be continuous at  $x = 0$ . Then absolute value of ' $\alpha$ ' is equal to

- 1) 2                      2) 3                      3) 4                      4) 5

### SECTION-II (NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions**. The Answer should be within **0 to 9999**. If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i.e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).

**Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases.**

21. Consider a matrix  $A = \begin{bmatrix} \alpha & \beta & \lambda \\ \alpha^2 & \beta^2 & \lambda^2 \\ \beta + \lambda & \lambda + \alpha & \alpha + \beta \end{bmatrix}$  where  $\alpha, \beta, \lambda$  are three distinct natural numbers.

If  $\frac{\det(\text{adj}(\text{adj}(\text{adj}(\text{adj}A))))}{(\alpha - \beta)^{16}(\beta - \gamma)^{16}(\gamma - \alpha)^{16}} = 2^{32} \times 3^{16}$ , then the number of such 3-triples  $(\alpha, \beta, \gamma)$  is \_\_\_\_\_.

22. The probability distribution of X is:

X	0	1	2	3
P(X)	$\frac{1-d}{4}$	$\frac{1+2d}{4}$	$\frac{1-4d}{4}$	$\frac{1+3d}{4}$

For the minimum possible value of d, sixty times the mean of X is equal to \_\_\_\_\_.

23. If the system of equations

$$x + y + z = 16$$

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

$$x + 2y + 3z = 14$$

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

24. If the length of the latus rectum of the ellipse  $x^2 + 4y^2 + 2x + 8y - \lambda = 0$  is 4, and  $l$  is the length of its major axis, then  $\lambda + l$  is equal to:

25. If the length of the perpendicular drawn from the point  $(a, 4, 2)$ ,  $a > 0$  on the line

$$\frac{x+1}{2} = \frac{y-3}{3} = \frac{z-1}{-1} \text{ is } 2\sqrt{6} \text{ units and } Q(\alpha_1, \alpha_2, \alpha_3) \text{ is the image of the point P on this line, then}$$

$$a + \sum_{i=1}^3 \alpha_i \text{ is equal to}$$

**PHYSICS****Max Marks: 100****SECTION-I (SINGLE CORRECT ANSWER TYPE)**

This section contains **20 Multiple Choice Questions**. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

**Marking scheme: +4 for correct answer, 0 if not attempted and -1 in all other cases.**

26. If force (F), Velocity (V) and time (T) are considered as fundamental physical quantity, then dimensional formula of density will be:
- 1)  $FV^{-2}T^2$       2)  $FV^{-4}T^{-2}$       3)  $FV^4T^{+2}$       4)  $F^2V^{-2}T^6$
27. A projectile is fired with velocity  $v$  at angle of  $\theta$  with horizontal. Find the radius of curvature of path at highest point.
- 1)  $\frac{v^2 \cos^2 \theta}{g}$       2)  $\frac{v^2}{g \cos \theta}$       3)  $\frac{v^2 \cos \theta}{g}$       4)  $\frac{v^2 \cos^2 \theta}{2g}$
28. **Statement 1** : If an electric dipole of dipole moment  $30 \times 10^{-5}$  cm is enclosed by a closed surface, the net flux coming out of the surface will be zero.
- Statement 2** : electric dipole consists of two equal and opposite charges.
- 1) Statement-1 is True, Statement-2 is True; Statement -2 is a correct explanation for Statement-1
- 2) Statement-1 is True, Statement-2 is True; Statement -2 is NOT a correct explanation for Statement-1.
- 3) Statement -1 is True, Statement-2 is False.
- 4) Statement -1 is False, Statement-2 is True.
29. A particle of mass  $m$  moves towards a smooth vertical wall with a speed  $u$  (relative to the ground) and collides elastically with the wall; the wall moving towards the particle with a speed  $2u$  (also relative to the ground). Assuming that the wall is extremely massive, the magnitude of impulse delivered to the particle equals
- 1)  $5 mu$       2)  $6 mu$       3)  $4 mu$       4)  $2 mu$





30. The electric field of an electromagnetic wave in free space is represented by

$\vec{E} = E_0 \cos(\omega t - kz) \hat{i}$  The corresponding magnetic induction vector will be

- 1)  $\vec{B} = (E_0 C) \cos(\omega t - kz) \hat{j}$       2)  $\vec{B} = \left(\frac{E_0}{C}\right) \cos(\omega t - kz) \hat{j}$   
3)  $\vec{B} = E_0 \cos(\omega t + kz) \hat{j}$       4)  $\vec{B} = -\left(\frac{E_0}{C}\right) \cos(\omega t - kz) \hat{j}$

31. Assertion: The time period of a pendulum of infinite length whose bob hangs near the surface of the earth will be infinite. and

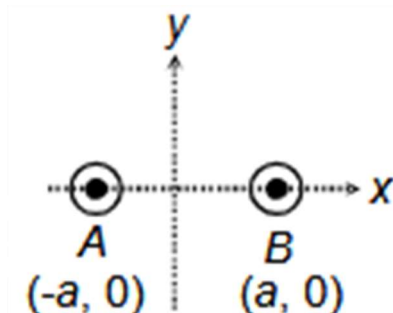
Reason: The time period of a pendulum of length  $L$  near the surface of the earth is  $2\pi\sqrt{\frac{L}{g}}$ , if  $L$  is reasonably small.

- 1) Assertion is True, Reason is True, Reason is correct explanation for Assertion  
2) Assertion is True, Reason is True, Reason is NOT a correct explanation for Assertion  
3) Assertion is True, Reason is false  
4) Assertion is False, Reason is True
32. A spherical drop of radius  $r$  and density  $n$  is falling in air with terminal velocity. The density of air is  $n_0$  and its coefficient of viscosity  $\mu$ . The power developed by gravity is
- 1)  $\frac{\pi r^5 n}{\mu} (n - n_0) g^2$     2)  $\frac{27}{8\mu} r^5 n (n - n_0) g^2$     3)  $\frac{8\pi r^5}{27\mu} n (n - n_0) g^2$     4)  $\frac{\pi r^5}{27\mu} n (n - n_0) g^2$
33. A particle moves according to the law  $x = a \cos \frac{\pi t}{2}$ . The distance covered by it in the time interval between  $t = 0$  to  $t = 3$  sec is
- 1)  $2a$                       2)  $3a$                       3)  $4a$                       4)  $a$
34. A heavy but uniform rope of length  $L$  is suspended from a ceiling. A particle is dropped from the ceiling at the instant when the bottom end is given a transverse wave pulse. Where will the particle meet the pulse

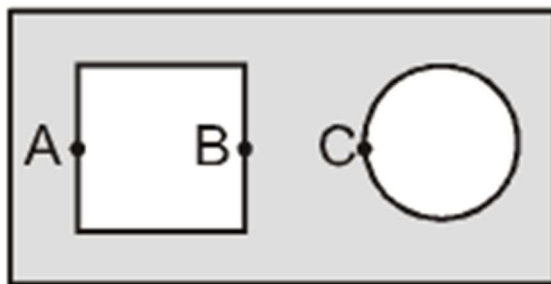


- 1) at a distance  $\frac{2L}{3}$  from the bottom    2) at a distance  $\frac{L}{3}$  from the bottom  
3) at a distance  $\frac{3L}{4}$  from the bottom    4) at a distance  $\frac{L}{2}$  from the bottom

35. Two very long current carrying wires A and B carrying current  $I_0$  (along z- axis) are placed at  $(-a, 0)$  and  $(a, 0)$  as shown. Find the value of magnetic field at  $(0, a)$



- 1)  $\frac{\mu_0 I_0}{\sqrt{2}\pi a}$     2)  $\frac{\mu_0 I_0}{2\pi a}$     3)  $\frac{\mu_0 I_0}{4\pi a}$     4)  $\frac{\mu_0 I_0}{2\sqrt{2}\pi a}$
36. Curie temperature is the temperature above which:
- 1) a ferromagnetic material becomes paramagnetic.  
2) a paramagnetic material becomes diamagnetic.  
3) a ferromagnetic material becomes diamagnetic.  
4) a paramagnetic material becomes ferromagnetic.
37. Two large holes are cut in a metal sheet as shown. If this is heated, which distance will decrease:



- 1) BC    2) AB    3) AC    4) None of these

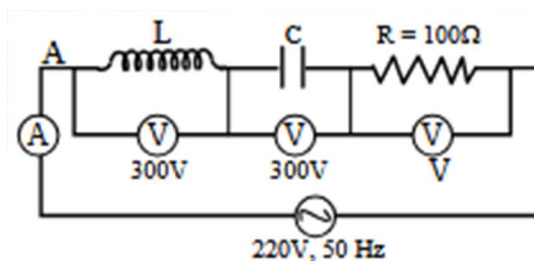


38. STATEMENT-1: Each molecule of a gas moves with rms speed if the temperature of gas is constant. and

STATEMENT-2: The rms speed of molecules of a gas is equal to  $\sqrt{\frac{3RT}{M}}$ , where T and M are the temperature and molecular mass of the gas. R is the ideal gas constant.

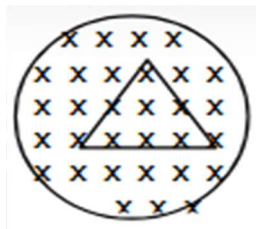
- 1) Statement-1 is True, Statement-2 is True; Statement -2 is a correct explanation for Statement-1.
- 2) Statement-1 is True, Statement-2 is True; Statement -2 is NOT a correct explanation for Statement-1.
- 3) Statement -1 is True, Statement-2 is False.
- 4) Statement -1 is False, Statement-2 is True.

39. In the circuit shown below, what will be the reading of the voltmeter and ammeter?



- 1) 800 V, 2A      2) 300 V, 2A      3) 220 V, 2.2A      4) 0 V, 1A

40. An equilateral triangular loop having a resistance R and length of each side ' $\ell$ ' is placed in a magnetic field which is varying at  $\frac{dB}{dt} = 1$  T/s. The induced current in the loop will be

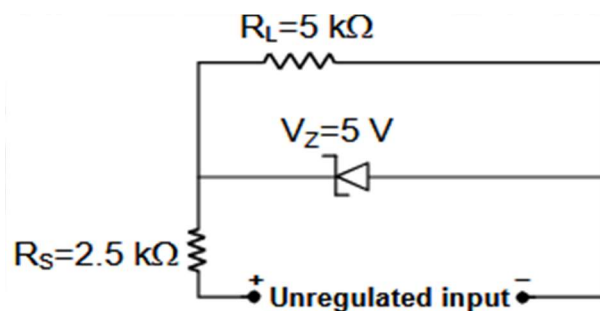


- 1)  $\frac{\sqrt{3}}{4} \frac{\ell^2}{R}$       2)  $\frac{4}{\sqrt{3}} \frac{\ell^2}{R}$       3)  $\frac{\sqrt{3}}{4} \frac{R}{\ell^2}$       4)  $\frac{4}{\sqrt{3}} \frac{R}{\ell^2}$

41. An electron in a hydrogen atom makes a transition  $n_1 \rightarrow n_2$ , where  $n_1$  and  $n_2$  are the principal quantum numbers of the two states. Assume Bohr model to be valid

Column-I		Column-II	
A)	The electron emits an energy of 2.55 eV	p)	$n_1 = 2, n_2 = 1$
B)	time period of the electron in the initial state is eight times that in the final state	q)	$n_1 = 4, n_2 = 2$
C)	Speed of electron become two times	r)	$n_1 = 5, n_2 = 3$
D)	Radius of orbit of electron becomes $4.77A^0$	s)	$n_1 = 6, n_2 = 3$
		t)	$n_1 = 8, n_2 = 4$

- 1) A  $\rightarrow$  p, B  $\rightarrow$  p,t, C  $\rightarrow$  p,q,t, D  $\rightarrow$  r  
 2) A  $\rightarrow$  p, B  $\rightarrow$  p,t, C  $\rightarrow$  p,q,s,t, D  $\rightarrow$  r  
 3) A  $\rightarrow$  q, B  $\rightarrow$  p,q,s,t, C  $\rightarrow$  p,q,s,t, D  $\rightarrow$  r,s  
 4) A  $\rightarrow$  r, B  $\rightarrow$  p, C  $\rightarrow$  p,q,s,t, D  $\rightarrow$  q
42. Radius of  ${}_{32}^{x}\text{Ge}$  (germanium) nucleus is measured to be twice the radius of  ${}_{4}^{9}\text{Be}$  nucleus. Number of neutrons in Ge are
- 1) 38                      2) 40                      3) 42                      4) 64
43. In the DC voltage regulator circuit shown, the Zener breakdown voltage  $V_Z = 5\text{ V}$ . If the unregulated input varies between 11 V to 15 V, maximum zener current (in mA) is



- 1) 1                      2) 2                      3) 3                      4) 0



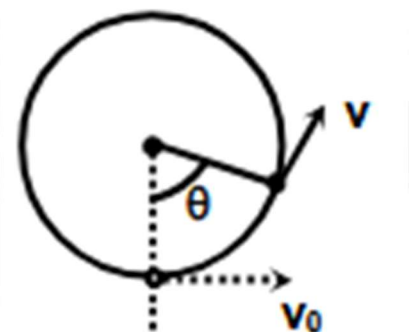
44. Assertion: Rolling without slipping cannot possible in absence of friction.  
Reason: During rolling without slipping, energy can remain conserved in absence of external applied force.
- 1) Assertion is True, Reason is True, Reason is correct explanation for Assertion
  - 2) Assertion is True, Reason is True, Reason is NOT a correct explanation for Assertion
  - 3) Assertion is True, Reason is false
  - 4) Assertion is False, Reason is True
45. In Young's double slit experiment the two slits act as coherent sources of equal amplitude  $A$  and wavelength  $\lambda$ . In another experiment with the same set-up the two slits are source of equal amplitude  $A$  and wavelength  $\lambda$ , but are incoherent. The ratio of the intensity of light at the midpoint of the screen in the first case to that is second case is
- 1) 1
  - 2) 2
  - 3) 3
  - 4) 4

### SECTION-II (NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions**. The Answer should be within **0 to 9999**. If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i.e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).

**Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases**

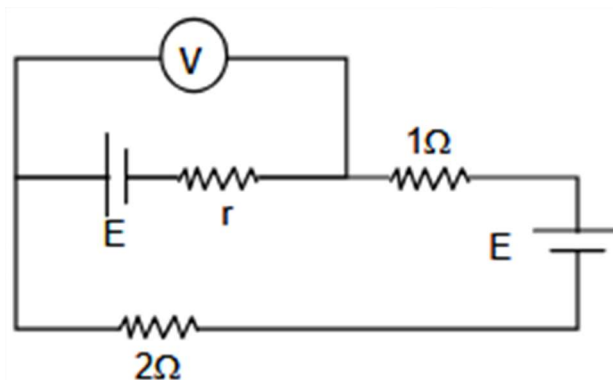
46. A pendulum of length  $\ell = 1$  m having a bob of mass  $m = 1$  kg is hanging from a rigid support. If the bob is projected horizontally with a velocity  $v_0 = \sqrt{35} \text{ m/s}$ . The tension in the string is  $6k$  Newton when angle made by the string is  $60^\circ$  from vertical as shown. Find the value of  $k$ .





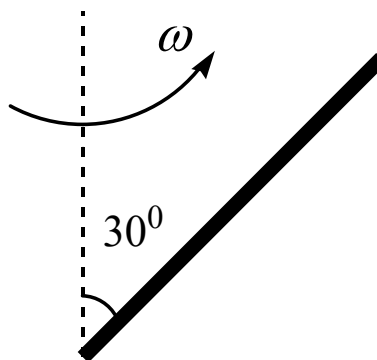
47. The electric field on axis of ring of charge 'Q' and radius 'R' is maximum at  $\frac{R}{\sqrt{2N}}$ . Find N.

48. In the given circuit the reading of ideal voltmeter is  $E/2$ . Find the internal resistance of the battery in  $\Omega$ .



49. For an equilateral prism, it is observed that when a ray strikes grazingly at one face it emerges grazingly at the other. Find the refractive index of the prism

50. The moment of inertia of rod shown in the figure is  $\frac{ML^2}{6N}$ . Find N.



**CHEMISTRY****Max Marks: 100****SECTION-I (SINGLE CORRECT ANSWER TYPE)**

This section contains **20 Multiple Choice Questions**. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

**Marking scheme: +4 for correct answer, 0 if not attempted and -1 in all other cases.**

- 51.** Amongst the following, the most stable complex is
- 1)  $[Fe(H_2O)_6]^{3+}$                       2)  $[Fe(NH_3)_6]^{3+}$   
 3)  $[Fe(C_2O_4)_3]^{3-}$                       4)  $[FeCl_6]^{3-}$
- 52.** Which of the following have square planar geometry-
- A)  $[NiCl_4]^{-2}$               B)  $[Cu(NH_3)_4]^{+2}$               C)  $[Ni(CO)_4]$               D)  $XeF_4$   
 1) b,c and d              2) a,b and c              3) b and d              4) All
- 53.** **Statement 1:** The second ionization energy of 'O' is greater than that of 'N'  
**Statement 2:** The half filled p-orbitals cause greater stability.
- 1) Statement 1 and Statement 2 both are correct and Statement 2 is the correct explanation of Statement 1  
 2) Statement 1 and Statement 2 both are correct, but Statement 2 is not the correct explanation of Statement 1  
 3) Statement 1 is true, but Statement 2 is false  
 4) Statement 1 and Statement 2 both are false
- 54.** Consider the reactions.
- $$2S_2O_3^{2-}(aq) + I_2(s) \longrightarrow S_4O_6^{2-}(aq) + 2I^-(aq)$$
- $$S_2O_3^{2-}(aq) + 2Br_2(l) + 5H_2O(l) \longrightarrow 2SO_4^{2-}(aq) + 4Br^-(aq) + 10H^+(aq)$$
- Why thiosulphate (reductant) react differently with iodine & Bromine?
- 1) Bromine is a stronger reducing agent than iodine  
 2) Thiosulphate undergoes reduction by bromine and oxidation by iodine  
 3) Bromine is a stronger oxidant than iodine  
 4) Bromine is weaker oxidizing agent than iodine



55. The quantum number of four electrons ( $e_1, e_2, e_3, e_4$ ) are given below:

	n	l	m	s
$e_1$	3	0	0	+1/2
$e_2$	4	0	1	+1/2
$e_3$	3	2	2	-1/2
$e_4$	3	1	-1	+1/2

Decreasing energy of these electrons in multi-electron species :

- 1)  $e_4 > e_3 > e_2 > e_1$                       2)  $e_2 > e_3 > e_4 > e_1$   
 3)  $e_3 > e_2 > e_4 > e_1$                       4)  $e_1 = e_2 = e_3 = e_4$

56. The heat evolved in combustion of rhombic sulphur ( $S_R$ ) and monoclinic sulphur ( $S_M$ ) are respectively, 70960 and 71030 cal/mol. What will be heat of conversion of rhombic sulphur to monoclinic sulphur.

- 1) 70960 cal              2) 71030 Cal              3) -70                      4) +70

57. Out of  $CO_2, SO_2, NH_3, I_3^-$  and  $I_3^+$  number of non-linear species are:

- 1) 1                      2) 3                      3) 2                      4) 4

58. **Statement A:** The Actinide contraction is more as compared to the lanthanide contraction.

**Statement B:** 5f electrons have much lower shielding effect as compared to 4f electrons because 5f-orbitals less diffused than 4f-orbitals.

**Statement C:** For f-block elements with increase in number of f-electrons, the radius decreases due to poor shielding of f-electrons.

**Statement D:** f-block elements belongs to 3<sup>rd</sup> group of long form of periodic table.

The correct statements are:

- 1) AB                      2) ABC                      3) ACD                      4) A only

59. **Assertion A:** Among the two O-H bonds in  $H_2O$  molecule, the energy required to break the first O-H bond and the other O-H bond is the same.

**Reason R:** This is because the electronic environment around oxygen is the same even after breakage of one O-H bond.

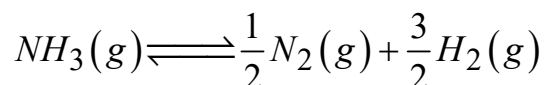
- 1) A and R both are correct and R is the correct explanation of A  
 2) A and R both are correct, but R is not the correct explanation of A  
 3) A is true, but R is false  
 4) A and R both are false





60. The value of  $K_c$  is 64 at 800 K for the reaction  $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

The value of  $K_c$  for the following reaction is :



- 1) 8                      2)  $\frac{1}{8}$                       3)  $\frac{1}{4}$                       4)  $\frac{1}{64}$

61. **Assertion A:** An aqueous solution of ammonium acetate can act as a buffer.

**Reason R:** Acetic acid is a weak acid and  $NH_4OH$  is a weak base.

- 1) Both A and R are true and R is the correct explanation of A  
 2) Both A and R are true but R is not the correct explanation of A  
 3) A is false but R is true  
 4) Both A and R are false

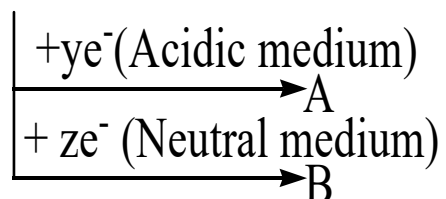
62. Which of the following carbohydrate is monosaccharide?

- 1) Glucose              2) Lactose              3) Cellulose              4) Maltose

63. Choose the correct example for a non-ideal solution?

- 1) Benzene + Toluene                      2) Hexane + Heptane  
 3) Chlorobenzene + Bromobenzene      4) Ethanol + Hexane

64.  $MnO_4^- + xe^- \rightarrow MnO_4^{2-}$



- 1) 1,2,3                      2) 1,5,3                      3) 1,3,5                      4) 5,3,1



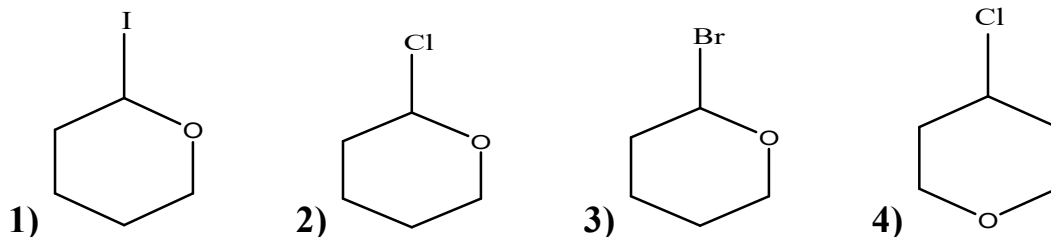
65. If  $X$  specific resistance of the electrolyte solution and  $Y$  is the molarity of the solution, then  $\wedge_m$  is given by:

- 1)  $\frac{1000X}{Y}$       2)  $1000 \frac{X}{Y}$       3)  $\frac{1000}{XY}$       4)  $\frac{XY}{1000}$

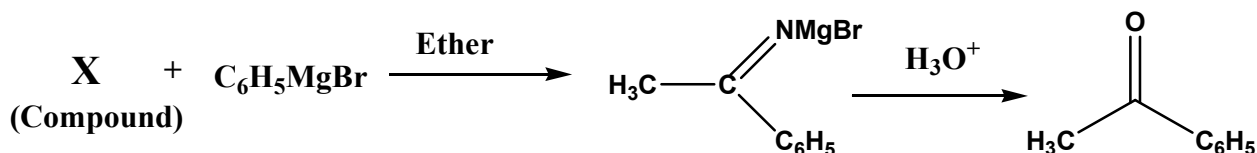
66. Two isomeric ketones, 3-pentanone and 2-pentanone can be distinguished by:

- 1)  $I_2 / NaOH$       2)  $NaSO_3H$   
3)  $NaCN / HCl$       4) 2,4-DNP

67. Which of the following compound will be most reactive for  $S_N1$  and  $S_N2$  reactions



68.



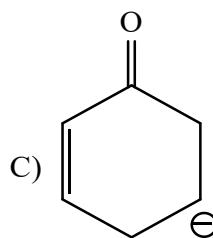
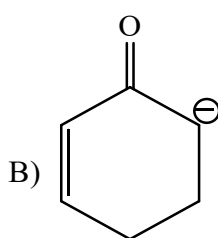
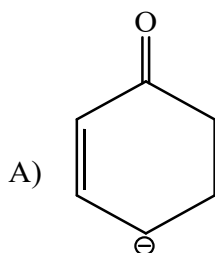
Compound (X) on reduction with  $\text{LiAlH}_4$  gives compound (Y).

Which of the following is incorrect about compound (Y).

- 1) Compound (Y) can undergo carbylamine reaction.  
2) Compound (Y) is  $2^\circ$ -amine.  
3) Compound (Y) is more basic than  $\text{NH}_3$ .  
4) Compound (Y) on reaction with  $\text{HNO}_2$  gives aliphatic Diazonium salts which liberate  $\text{N}_2$  gas and form alcohol.

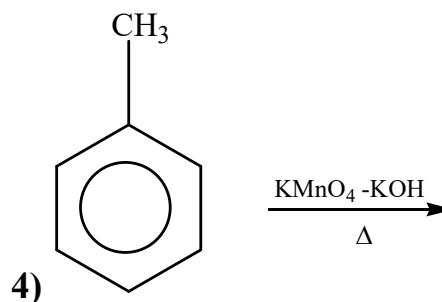
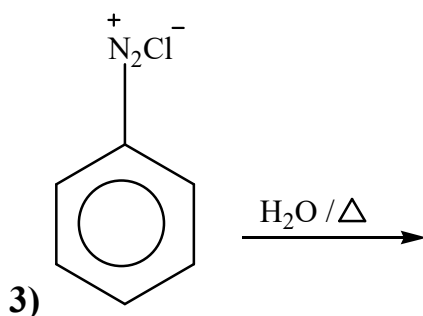
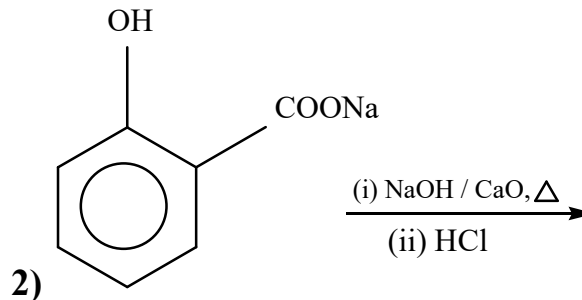
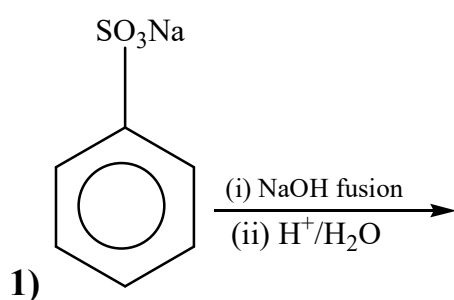


69. Compare basic strength of below compounds?



- 1)  $A > B > C$       2)  $B > A > C$       3)  $C > A > B$       4)  $C > B > A$

70. Which of the following sets of reaction will not give phenol?



### SECTION-II (NUMERICAL VALUE TYPE)

This section contains **5 Numerical Value Type Questions**. The Answer should be within **0 to 9999**. If the Answer is in **Decimal** then round off to the **Nearest Integer** value (Example i.e. If answer is above **10** and less than **10.5** round off is **10** and If answer is from **10.5** and less than **11** round off is **11**).

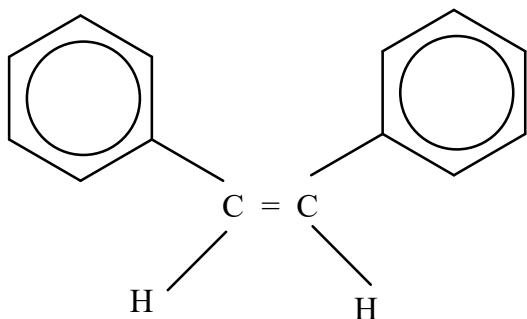
**Marking scheme: +4 for correct answer, 0 if not attempt and -1 in all other cases**

71. 29.2 % (w/w) HCl stock solution has density of 1.25 g/mL. The molecular weight of HCl is 36.5 g/mol. The volume (mL) of stock solution required to prepare a 100 mL solution of 0.4M HCl is \_\_\_\_

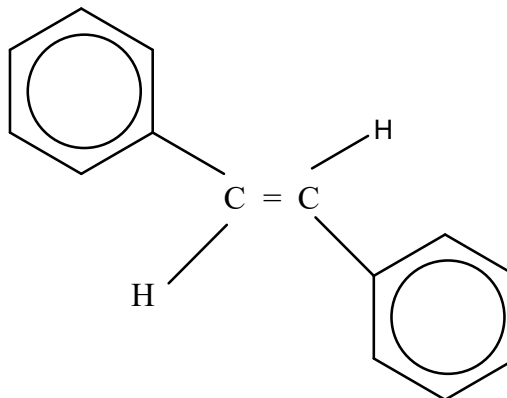


72. The average oxidation number of Br in  $Br_3O_8$  is 'x' and the average oxidation number of C in  $C_3O_2$  is 'y' then  $\frac{x}{y} = \underline{\hspace{2cm}}$

73. How many statements are true for the following pair of compounds?



Cis



Trans

- i) The dipole moment of trans isomer is zero
  - ii) The boiling point of cis isomer is more than trans isomer
  - iii) Cis isomer is more stable than the trans isomer
  - iv) These are also called configurational diastereomers
  - v) These are readily interconvertible under normal conditions
  - vi) The melting point of trans isomer is more than the cis isomer
  - vii) Trans isomer is more soluble than cis isomer in polar solvents
74. How many isomers of  $C_4H_{10}O$  reacts with Na metal evolve  $H_2$  gas? (excluding stereoisomers)
75. How many of the following are optically inactive?
- i)  $\text{trans} - [Co(en)_2 Cl_2]^{2+}$
  - ii)  $\text{cis} - [Co(en)_2 Br_2]^+$
  - iii)  $[Co(NH_3)_3 Cl_3]$
  - iv)  $\text{trans} - [Co(NH_3)_4 Cl_2]^+$
  - v)  $\text{trans} - [CoCl_2 (C_2O_4)_2]^{3-}$



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