RANKRIDGE IIT JEE/NEET JUNIOR COLLEGE (LONGTERM)

TELANGANA

STREAM: JR MPC
Time: 3:00 Hours

WEEKEND TEST-04

Date: 05-07-2025
Max Marks: 300

SYLLABUS

MATHEMATICS : Transformations, periodicity and extreme values

PHYSICS : Relative velocity & Applications, Freely falling body & numericals, Body projected vertically up & Numericals, Projection from the top of a tower & Numericals

CHEMISTRY : Schordinger'equation,radial probability curves,quantum numbers, shape of orbitals, aufbau, hund's, pauli's exclusion principle, electronic configuration

MATHEMATICS

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) 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. $\cos 48^0 . \cos 12^0 =$

(A) $\frac{1-\sqrt{5}}{8}$ (B) $\frac{\sqrt{5}+3}{8}$

(C) $\frac{\sqrt{5}-1}{8}$ (D) $\frac{\sqrt{5}+1}{8}$

2. $\cos x + \cos y = \frac{4}{5}, \cos x - \cos y = \frac{2}{7}$

$\Rightarrow 14\tan\left(\frac{x-y}{2}\right) + 5\cot\left(\frac{x+y}{2}\right) =$

(A) 0 (B) 1/4

(C) 5/4 (D) 3/4

3. $\sin 24^0 + \cos 6^0 =$

(A) $\frac{\sqrt{15}+\sqrt{3}}{4}$ (B) $\frac{\sqrt{15}+3}{4}$

(C) $\frac{\sqrt{15}-3}{4}$ (D) $\frac{\sqrt{15}-\sqrt{3}}{4}$

4. $\cos x + \cos y = \frac{1}{3}, \sin x + \sin y = \frac{1}{4}$

$\Rightarrow \sin(x+y) =$

(A) $\frac{7}{25}$ (B) $\frac{25}{24}$

(C) $\frac{25}{7}$ (D) $\frac{24}{25}$

5. $\cos\alpha + \cos\beta = a, \sin\alpha + \sin\beta = b,$

$\alpha - \beta = 2\theta \Rightarrow \frac{\cos 3\theta}{\cos\theta} =$

(A) $3 - a^2 - b^2$ (B) $\frac{a^2+b^2}{4}$

(C) $a^2 + b^2 - 1$ (D) $a^2 + b^2 - 3$

6. $\frac{\sin(n+1)A + 2\sin nA + \sin(n-1)A}{\cos(n-1)A - \cos(n+1)A} =$

(A) $\tan A/2$ (B) $\cot A/2$

(C) $\tan A$ (D) $\cot A$

7. If $\alpha = \frac{2\pi}{7}$, then

$\tan\alpha\tan 2\alpha + \tan 2\alpha\tan 4\alpha + \tan 4\alpha\tan\alpha =$

(A) -1 (B) -3

(C) -5 (D) -7

8. The value of the expression

$\frac{1 - 4\sin 10^0 \sin 70^0}{2\sin 10^0}$

(A) 1/2 (B) 1

(C) 2 (D) 1/3

9. The value of $\frac{3 + \cot 76^0 \cot 16^0}{\cot 76^0 + \cot 16^0}$ is

(A) $\tan 44^0$ (B) $\cot 46^0$

(C) $\tan 2^0$ (D) $\tan 46^0$

10. The value of

$\sin 47^0 + \sin 61^0 - \sin 11^0 - \sin 25^0$ is

(A) $\sin 7^0$ (B) $\cos 7^0$

(C) $\sin 14^0$ (D) $\cos 14^0$

11. If $\cos A+\cos B+\cos C=0$ then $\cos 3A+\cos 3B+\cos 3C$
(A) $4\cos A\cos 3B\cos 3C$
(B) $12\cos A\cos B\cos C$
(C) $8\cos A\cos B\cos C$
(D) $10\cos A\cos B\cos C$

12. Period of $\cos(x+2x+3x+\ldots+nx)$ is
(A) $\frac{2\pi}{n(n+1)}$ (B) $\frac{4\pi}{n(n+1)}$
(C) $\frac{\pi}{n(n+1)}$ (D) $\frac{6\pi}{n(n+1)}$

13. Sine function whose period is 6 is
(A) $\sin\frac{2\pi x}{3}$ (B) $\sin\frac{\pi x}{3}$
(C) $\sin\frac{\pi x}{6}$ (D) $\sin\frac{3\pi x}{2}$

14. The period of $\sin^3 x+\cos^3 x$ is
(A) $\frac{\pi}{3}$ (B) π
(C) 2π (D) $\frac{2\pi}{3}$

15. The minimum and maximum values of $8\cos 3x-15\sin 3x$ are
(A) -7, 7 (B) -23, 23
(C) -17,17 (D) -15, 8

16. If the period of $\frac{\cos(\sin(nx))}{\tan\left(\frac{x}{n}\right)}, n\in N$ is 6π then $n=$
(A) 3 (B) 2
(C) 6 (D) 1

17. The minimum and maximum values of $\cos x+3\sqrt{2}\sin\left(x+\frac{\pi}{4}\right)+6$ are
(A) 1, 11 (B) 11, -1
(C) 6, 5 (D) 5, 6

18. $A=\sin^8\theta+\cos^{14}\theta$, then for all values of θ
(A) $0<A\le 1$ (B) $1<2A\le 3$
(C) $A\ge 1$ (D) $0\le A\le\frac{1}{2}$

19. $\cos^2 x+\sin^4 x\in$
(A) $\left[\frac{1}{2},1\right]$ (B) $\left[1,\frac{3}{2}\right]$
(C) $\left[\frac{3}{2},2\right]$ (D) $\left[\frac{3}{4},1\right]$

20. For all values of θ, the values of $3-\cos\theta+\cos\left(\theta+\frac{\pi}{3}\right)$ lie in the interval
(A) $[-2,3]$ (B) $[-2,1]$
(C) $[2,4]$ (D) $[1,5]$

(NUMERICAL VALUE TYPE)

Section-II contains 5 **Numerical Value Type** questions.
Marking scheme: +4 for correct answer, 0 if **not attempt** and **-1** in all other cases

21. The value of $\sin^2 12^0+\sin^2 21^0+\sin^2 39^0+\sin^2 48^0-\sin 9^0-\sin^2 18^0$ is _____.

22. $\sin^2 x+4\sin x+5\in[k,5k]\Rightarrow k=$ _____

23. Period of $\tan\left(\frac{3\pi x}{4}\right)-2\sec\left(\frac{\pi x}{3}\right)+5\sin\left(\frac{2\pi x}{5}\right)$ is _____

24. If $\sin^2(10^0)\sin(20^0)\sin(40^0)\sin(50^0)\sin(70^0)=\propto\frac{1}{16}\sin(10^0)$, then $16+\propto^{-1}$ is equal to _____.

25. The value of $\frac{\sin 1^0+\sin 3^0+\sin 5^0+\sin 7^0}{\cos 1^0.\cos 2^0.\sin 4^0}$ is _____.

PHYSICS

(SINGLE CORRECT ANSWER TYPE)

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26. A body is released from the top of the tower of height H. It takes t time to reach the ground. Where is the body $\frac{t}{2}$ time after release :-
(A) At $\frac{H}{2}$ metres from ground

(B) At $\frac{H}{4}$ metres from ground

(C) At $\frac{3H}{4}$ metre from the ground

(D) At $\frac{H}{6}$ metres from the ground

27. A freely falling body takes 't' second to travel first $(1/x)^{th}$ distance. Then, time of descent is

(A) $\frac{t}{\sqrt{x}}$ (B) $t\sqrt{x}$

(C) $\frac{\sqrt{x}}{t}$ (D) $\frac{1}{t\sqrt{x}}$

28. A ball is dropped on the floor from a height of 10m. It rebounds to a height of 2.5m. If the ball is in contact with the floor for 0.01 s, then the average acceleration during contact is nearly

(A) $500\sqrt{2}m/s^2$ upwards

(B) $1800\sqrt{2}m/s^2$ downwards

(C) $1500\sqrt{2}m/s^2$ upwards

(D) $1500\sqrt{2}m/s^2$ downwards

29. The splash of sound was heard 5.35s after drop-ping a stone into a well 122.5m deep. Velocity of sound in air is

(A) 350 cm/s (B) 350 m/s

(C) 392 cm/s (D) 0 cm/s

30. A balloon is going upwards with velocity 12 m/sec. It releases a packet when it is at a height of 65 m from the ground. How much time the packet will take to reach the ground (g= 10m /sec^2)

(A) 5 sec (B) 6 sec

(C) 7 sec (D) 8 sec

31. A ball is dropped from the top of a building 100 m high. At the same instant another ball is thrown upwards with a velocity of $40ms^{-1}$ from the bottom of the building. The two balls will meet after.

(A) 5 s (B) 2.5 s.

(C) 2s (D) 3 s

32. A stone projected vertically up from the ground reaches a height y in its path at t_1 seconds and after further t_2 seconds reaches the ground. The height y is equal to

(A) $\frac{1}{2}g(t_1+t_2)$ (B) $\frac{1}{2}g(t_1+t_2)^2$

(C) $\frac{1}{2}gt_1t_2$ (D) gt_1t_2

33. A body thrown up with some initial velocity reaches a maximum height of 50m. Another body with double the mass thrown up with double the initial velocity will reach a maximum height of

(A) 100m (B) 200m

(C) 400m (D) 50m

34. A ball thrown vertically upwards with an initial velocity of 1.4 m/s returns in 2s. The total displacement of the ball is

(A) 22.4 cm (B) zero

(C) 44.8 m (D) 33.6m

35. A ball is dropped from a building of height 45m. Simultaneously another ball is thrown up with a speed 40m/s. The rate of change of relative speed of the balls is

(A) $20ms^{-1}$ (B) $40ms^{-1}$

(C) $30ms^{-1}$ (D) $0ms^{-1}$

36. A body is thrown vertically upwards with an initial velocity 'u' reaches a maximum height in 6s. The ratio of the distance travelled by the body in the first second to the seventh second is

(A) 1:1 (B) 1:1

(C) 1:2 (D) 1:11

37. A ball dropped from 9th stair of a multistoried building reaches the ground in 3 sec. In the first second of its free fall, it passes through 'n' stare then 'n' equal to

(A) 1 (B) 2

(C) 3 (D) 4

38. At the maximum height of a body thrown vertically up

(A) velocity is not zero but acceleration is zero

(B) acceleration is not zero but velocity is zero

(C) both acceleration and velocity are zero

(D) both acceleration and velocity are not zero

39. An object projected upward acquires a velocity of $9.8ms^{-1}$, when it reaches half of the maximum height. The maximum height reached is :-

(A) 4.9 m (B) 7.8 m

(C) 8.8 m (D) 9.8 m

40. A boy throws n balls per second at regular time intervals. When the first ball reaches the maxi-mum height he throws the second

one vertically up. The maximum height reached by each ball is

(A) $\frac{g}{2(n-1)^2}$ (B) $\frac{g}{2n^2}$

(C) $\frac{g}{n^2}$ (D) $\frac{g}{n}$

41. The velocity of A and B are $\vec{V_A} = 2\hat{i} + 4j$ and $\vec{V_B} = 3\hat{i} - 7j$. Velocity of B as observed by A is

(A) $5\hat{i} - 3j$ (B) $\hat{i} - 11j$

(C) $-\hat{i} + 11j$ (D) $2\hat{i} - 3j$

42. A body is projected verticaiiy up with u. Its velocity at half its maximum height is

(A) $\frac{u}{2}$ (B) $\frac{u^2}{2}$

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

43. A body falls from rest in the gravitational field of the earth. The distance travelled in the fifth second of its motion is ($g = 10 m/s^2$)

(A) 25 m (B) 45 m

(C) 90 m (D) 125 m

44. A stone is dropped into a well in which the level of water is h below the top of the well. If v is velocity of sound, the time T after which the splash is heard is given by

(A) $T = 2h/v$ (B) $T = \sqrt{\frac{2h}{g}} + \frac{h}{v}$

(C) $T = \sqrt{\frac{2h}{g}} + \frac{h}{2v}$ (D) $T = \sqrt{\frac{h}{2g}} + \frac{2h}{v}$

45. The ratio of the distances travelled by a freely falling body in the 1st, 2nd, 3rd and 4th second:

(A) 1:4:9:16 (B) 1:3:5:7

(C) 1:1:1:1 (D) 1:2:3:4

NUMERICAL VALUE TYPE)

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46. A boy standing at the top of a tower of 20 m height drops a stone Assuming $g = 10 ms^{-2}$, the velocity with which it hits the ground is

47. A body falling from rest has a velocity 'v' after it falls through a distance 'h'. The distance it has to fall down further, for its velocity to be-come double, is ..... times 'h'.

48. At a metro station, a girl walks up a stationary escalator in 20 s. If she remains stationary on the escalator, then the escalator, take her up in 30 s. The time taken by her to walk up on the moving escalator will be

49. A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is: ($g = 10 m/s^2$)

50. A very large number of balls are thrown vertically upwards in quick succession in such a way that the next ball is thrown when the previous one is at the maximum height. If the maximum height is 5m, the number of ball thrown per minute is (Take $g = 10 ms^{-2}$)

CHEMISTRY

(SINGLE CORRECT ANSWER TYPE)

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51. The correct order of decreasing energy for the electrons whose quantum numbers n and I are given below, is

A. n = 5 and l = 2 B. n = 5 and l = 0

C. n = 4 and l = 3 D. n = 4 and l = 1

(A) A > C > B > D (B) A > B > C > D

(C) C > A > D > B (D) A > B > D > C

52. From the following sets of quantum numbers, which set is possible?

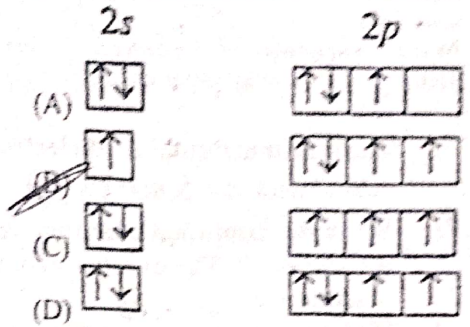
(A) $n = 1, l = 0, m_1 = +1, m_2 = -\frac{1}{2}$

(B) $n = 1, l = 1, m_1 = 0, m_2 = +\frac{1}{2}$

(C) $n = 3, l = 1, m_1 = 0, m_2 = +\frac{1}{2}$

(D) $n = 3, l = 3, m_1 = -3, m_2 = +\frac{1}{2}$

53. The orbital diagram in which the Aufbau principle violated is:



54. The number of nodal planes in a p_x orbital is
(A) one (B) two
(C) three (D) zero

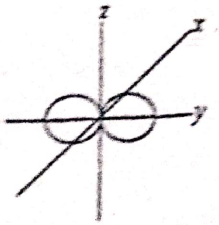
55. The number of d-electrons retained in Fe^{2+} ion is:
(A) 5 (B) 6
(C) 3 (D) 4

56. If the nitrogen atom has electronic configuration $1s^7$, it would have energy lower than that of the normal ground state configuration $1s^2 2s^2 2p^3$, because the electrons would be closer to the nucleus. Yet $1s^7$ is not observed because it violates.
(A) Heisenberg uncertainty principle
(B) Hund's rule
(C) Pauli exclusion principle
(D) Bohr postulate of stationary orbits

57. Which set of quantum number is not consistent with the quantum mechanical theory?
(A) n = 2 l = 1 , m = 1 , s = 1/2
(B) n = 4 l = 3 , m = 2 s = - 1/2
(C) n = 3 , l = 2 m = 3 s = 1/2
(D) n = 4 l = 3 , m = 3 s = 1/2

58. An electron has principal quantum number 3. The number of its (i) sub-shells and (ii) orbitals would be respectively
(A) 3 and 5 (B) 3 and 7
(C) 6 and 9 (D) 2 and 5

59. Which of the following orbitals are symmetric about the y-axis?



(A) p_z (B) p_y
(C) $d_{x^2-y^2}$ (D) d_{xy}

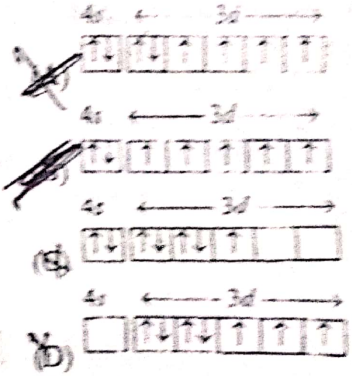
60. The four quantum numbers of the valence electron of potassium are
(A) 4, 1, 0 and $\frac{1}{2}$ (B) 4, 0, 1 and $\frac{1}{2}$
(C) 4, 0, 0 and $\frac{1}{2}$ (D) 4, 1, 1 and $\frac{1}{2}$

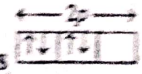
61. How many electrons can fit into the orbitals that comprise the 3rd quantum shell n = 3?
(A) 2 (B) 8
(C) 18 (D) 32

62. The possible value of l and m for the last electron in the Cl^- ion are:
(A) 1 and 2 (B) 2 and + 1
(C) 3 and -1 (D) 1 and -1

63. d_{z^2} orbital has:
(A) Two lobes along z-axis and a ring along xy-plane
(B) Two lobes along z-axis and two lobes along xy-plane
(C) Two lobes along z-axis and a ring along yz-plane
(D) Two lobes and a ring along z-axis

64. The manganese (Z=25) has the outer configuration



65. If the electronic structure of oxygen atom is written as  $1s^2, 2s^2$ it would violate
(A) Hund's rule
(B) Pauli's exclusion principle
(C) Both Hund's and Pauli's principles
(D) None of these

66. The quantum number not obtained from the Schrödinger's wave equation is
(A) n (B) l
(C) m (D) s

67. Which of the following statements about nodal planes is/are not true?
(A) A plane on which there is zero probability of finding an electron

(B) A plane on which there is maximum probability that the electron will be found
(C) Ψ^2 is zero at nodal plane
(D) None of these

68. **The electronic configurations of $_{24}Cr$ and $_{29}Cu$ are abnormal-**
(A) Due to extra stability of exactly half filled and exactly fully filled sub shells
(B) Because they belong to d-block
(C) Both (a) and (b)
(D) None of the above

69. **The quantum numbers +1/2 and -1/2 for the electron spin represent**
(A) Rotation of the electron in clockwise and anticlockwise direction respectively.
(B) Rotation of the electron in anticlockwise and clockwise direction respectively.
(C) Magnetic moment of the electron pointing up and down respectively.
(D) None of the above

70. **Given is the electronic configuration of element X**

K	L	M	N
2	8	11	2

The number of electrons present with $l=2$ in an atom of element X is
(A) 3 (B) 6
(C) 5 (D) 4

(NUMERICAL VALUE TYPE)

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71. **The maximum number of electrons in P-orbital with $n=5, m=1$ is ___.**
72. **When the azimuthal quantum number has the value of 2. The number of orbital possible are ___.**
73. **If highest magnetic quantum number of a given atom is represented by -3, what will be its principle quantum numbers?**
74. **For principle quantum number n=4, the total number of orbitals having $l=3$ is__.**
75. **The number of 2P-electrons having spin quantum numbers $S=-\frac{1}{2}$ are__.**

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BEST OF LUCK