RANKRIDGE IIT JEE/NEET JUNIOR COLLEGE (LONGTERM)

TELANGANA

STREAM: JR MPC
Time: 3:00 Hours

WEEKEND TEST-03

Date: 28-06-2025
Max Marks: 300

SYLLABUS

MATHEMATICS : Multiples and sub multiples
PHYSICS : Kinematic equations in one dimensions, Applications & Problems
CHEMISTRY : **Atomic structure:** Bohr's Atomic model, Summerfeld extension of the Bohr's model De broglies wave theory Heisenbergs uncertainty principle

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. $4\cos^3 40^0 - 3\sin 50^0 =$

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

2. If $x+\frac{1}{x}=2\cos 20^0$, then the value of $x^3+\frac{1}{x^3}=$

(A) $1/4$ (B) $1/2$
(C) 1 (D) $1/8$

3. $\cos^6 A+\sin^6 A=1-k\sin^2(2A)\Rightarrow k=$

(A) $\frac{1}{4}$ (B) $\frac{1}{2}$
(C) $\frac{3}{4}$ (D) 1

4. The value of $\sin^2 46^0+\sin^2 14^0+\sin 46^0\sin 14^0=$

(A) $\frac{1}{4}$ (B) $\frac{3}{4}$
(C) $\frac{5}{4}$ (D) $\frac{1}{2}$

5. If $180^0<\theta<270^0, \sin\theta=-\frac{3}{5}$, then $\cos\frac{\theta}{2}=$

(A) $\frac{-1}{\sqrt{10}}$ (B) $\frac{1}{\sqrt{10}}$
(C) $\frac{1}{10}$ (D) 10

6. $\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2}}}}}=$

(A) $\cos\frac{\pi}{32}$ (B) $2\cos\frac{\pi}{32}$
(C) $2\cos\frac{\pi}{64}$ (D) $\cos\frac{\pi}{64}$

7. The value of the expression $\tan^6 20^0-33\tan^4 20^0+27\tan^2 20^0$ is

(A) 0 (B) 1
(C) 2 (D) 3

8. If $\cos\alpha+\cos\beta=a$, $\sin\alpha+\sin\beta=b$ and $\alpha-\beta=2\theta$, then $\frac{\cos 3\theta}{\cos\theta}=$

(A) a^2+b^2-2 (B) a^2+b^2-3
(C) $3-a^2-b^2$ (D) $(a^2+b^2)/4$

9. If $\sec\theta-\cos\theta=1$, then $\tan^2\frac{\theta}{2}=$

(A) $\sqrt{5}+2$ (B) $\sqrt{5}-2$
(C) $2-\sqrt{5}$ (D) 0

10. $\cos\frac{\pi}{11}\cos\frac{2\pi}{11}\cos\frac{3\pi}{11}\cos\frac{4\pi}{11}\cos\frac{5\pi}{11}=$

(A) $\frac{1}{4}$ (B) $\frac{1}{8}$

(C) $\frac{1}{16}$ (D) $\frac{1}{32}$

11. If A lies in the third quadrant and $3\tan A - 4 = 0$ then $5\sin 2A + 3\sin A + 4\cos A =$

(A) 0 (B) $-\frac{24}{5}$

(C) $\frac{24}{5}$ (D) $\frac{48}{5}$

12. $(\cos\alpha - \cos\beta)^2 + (\sin\alpha - \sin\beta)^2 =$

$k\sin^2\left(\frac{\alpha-\beta}{2}\right) \Rightarrow k =$

(A) 4 (B) 3

(C) $\frac{3}{2}$ (D) $\frac{1}{4}$

13. $\cos^4\frac{\pi}{8} + \cos^4\frac{3\pi}{8} + \cos^4\frac{5\pi}{8} + \cos^4\frac{7\pi}{8} =$

(A) $\frac{1}{2}$ (B) $\frac{3}{2}$

(C) $\frac{1}{4}$ (D) $\frac{3}{4}$

14. If $\cos(\theta-\alpha), \cos\theta, \cos(\theta+\alpha)$ are in H.P, then $\cos\theta \sec\frac{\alpha}{2} =$

(A) $\pm\frac{1}{\sqrt{2}}$ (B) $\pm\sqrt{2}$

(C) ± 1 (D) $\pm\frac{1}{2}$

15. If $\tan\frac{\alpha}{2}, \tan\frac{\beta}{2}$ are the roots of $8x^2 - 26x + 15 = 0$ then $\cos(\alpha+\beta) =$

(A) $\frac{627}{725}$ (B) $\frac{547}{715}$

(C) $\frac{-547}{715}$ (D) $\frac{-627}{725}$

16. Value of $\sin^6 7\frac{1}{2}^\circ + \cos^6 7\frac{1}{2}^\circ$ is

(A) $\frac{3\sqrt{3}+2}{8}$ (B) $\frac{3\sqrt{3}-5}{16}$

(C) $\frac{10+3\sqrt{3}}{16}$ (D) $\frac{5+3\sqrt{3}}{16}$

17. Let $f_n(\theta) = \tan\frac{\theta}{2}(1+\sec\theta)(1+\sec 2\theta)(1+\sec 4\theta)$ $\ldots\ldots(1+\sec 2^n\theta)$, then

$f_2\left(\frac{\pi}{16}\right) + f_3\left(\frac{\pi}{32}\right) + f_4\left(\frac{\pi}{64}\right) + f_5\left(\frac{\pi}{128}\right) =$

18. $16\sin(20^\circ)\sin(40^\circ)\sin(80^\circ)$ is equal to

(A) $\sqrt{3}$ (B) $2\sqrt{3}$

(C) 3 (D) $4\sqrt{3}$

19. The value of $36(4\cos^2 9^\circ - 1)(4\cos^2 27^\circ - 1)(4\cos^2 81^\circ - 1)(4\cos^2 243^\circ - 1)$ is

(A) 54 (B) 18

(C) 27 (D) 36

20. $\operatorname{cosec} 18^\circ$ is a root of the equation

(A) $x^2 + 2x - 4 = 0$

(B) $4x^2 + 2x - 1 = 0$

(C) $x^2 - 2x - 4 = 0$

(D) $x^2 - 2x + 4 = 0$

UMERICAL 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 $\operatorname{cosec}\frac{\pi}{18} - 4\sin\frac{7\pi}{18}$ is

22. $3\sin x + 4\cos x = 5 \Rightarrow 6\tan\frac{x}{2} - 9\tan^2\frac{x}{2} =$

23. $\tan x + \tan\left(x+\frac{\pi}{3}\right) + \tan\left(x+\frac{2\pi}{3}\right) = 3$

$\Rightarrow \tan 3x =$

24. $\tan 9^\circ - \tan 27^\circ - \tan 63^\circ + \tan 81^\circ =$

25. The value of the expression

$\frac{\sin 9^\circ}{\cos 27^\circ} + \frac{\sin 27^\circ}{\cos 81^\circ} + \frac{\sin 81^\circ}{\cos 243^\circ} + \frac{\sin 243^\circ}{\cos 729^\circ}$ is

PHYSICS

(SINGLE CORRECT ANSWER TYPE)

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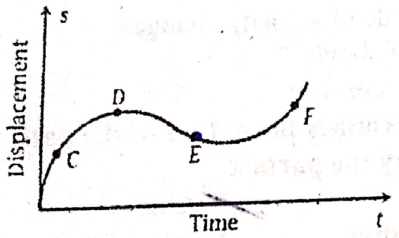
26. **A bullet travelling horizontally looses 1/20th of its velocity while piercing a wooden plank. Then the number of such planks required to stop the bullet is**

A) 6 B) 9
C) 11 D) 13

27. **An automobile travelling with a speed of 60km/h can brake to stop within a distance of 20m. If the car is going twice as fast i.e., 120km/h the stopping distance will be**

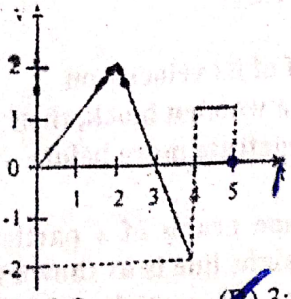
A) 20 m B) 40 m
C) 60 m D) 80 m

28. **The displacement-time graph of a moving particle is shown in Fig. The instantaneous velocity of the particle is negative at the point**



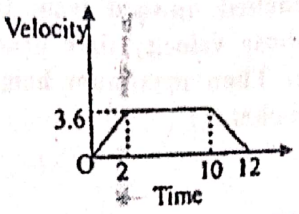
A) D B) F
C) C D) E

29. **The velocity versus time graph of a body moving along a straight line is as shown in figure. The ratio of displacement and distance covered by body in 5 second is:-**



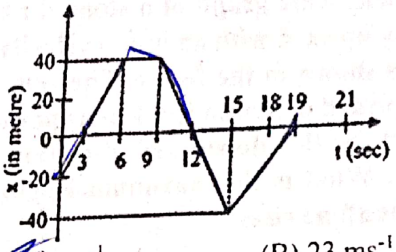
(A) 2:3 (B) 3:5
(C) 1:1 (D) 1.5 : 5

30. **An elevator is going up. The variation in the velocity of the elevator is as given in the graph. What is the height to which the elevator takes the passengers**



A) 3.6 m B) 28.8 m
C) 36.0 m D) 72.0 m

31. **A person walks along an east-west street and a graph of his displacement from home is shown in figure. His average velocity for the whole time interval is :-**

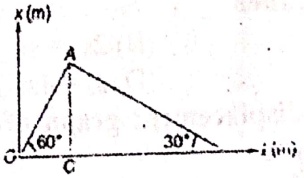


(A) 0 ms^{-1} (B) 23 ms^{-1}
(C) 8.4 ms^{-1} (D) None of above

32. **For a uniform motion**

A) the velocity - time graph is a straight line parallel to time axis
B) the position - time graph is a parabola
C) the acceleration - time graph is a straight line inclined with time axis
D) the position - time graph is a straight line

33. **In displacement time graph, two straight lines make angles 60° and 30° with time axis. The ratio of magnitudes of the velocities represented by them is**



(A) 1:2 (B) 1:3
(C) 2:1 (D) 3:1

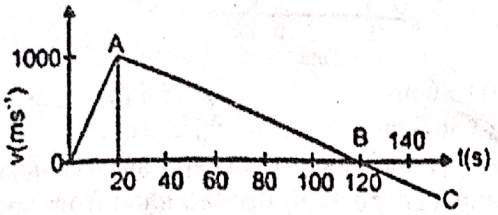
34. **The relation $3t = \sqrt{3x+6}$ describes the displacement of a particle in one direction where x is in meters and t in seconds. The displacement, when velocity is zero, is :-**

A) 24 m B) 12 m
C) 5 m D) zero

35. **Velocity of a body moving with uniform acceleration of $3m/s^2$ is changed through 30m/s in certain time. Average velocity of body during this time is 30m/s. Distance covered by it during this time is**

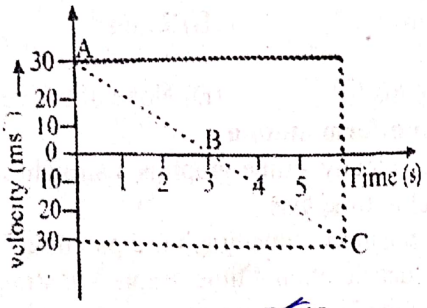
A) 300 m B) 200 m
C) 400 m D) 250 m

36. A rocket is launched upward from the earth surface whose velocity time graph shown in figure. Then maximum height attained by the rocket is :



(A) 1 km (B) 10 km
(C) 20 km (D) 60 km

37. The velocity-time graph of a stone thrown vertically upward with an initial velocity of $30ms^{-1}$ is shown in the figure. The velocity in the upward direction is taken as positive and that in the downward direction as negative. What is the maximum height to which the stone rises?



A) 30 m B) 45 m
C) 60 m D) 90 m

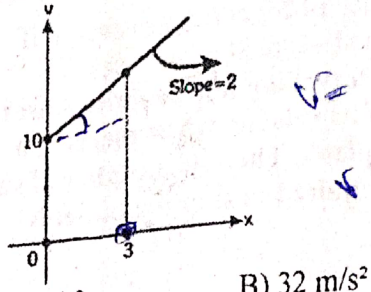
38. A particle experiences constant acceleration for 20 seconds after starting from rest. If it travels a distance s_1 in the first 10 seconds and distance s_2 in the next 10 seconds, then
(A) $s_2 = s_1$ (B) $2s_2 = s_1$
(C) $s_2 = 3s_1$ (D) $s_2 = 4s_1$

39. Velocity - displacement graph of a freely falling body is
A) straight line passing through the origin
B) straight line intersecting 'x' and 'y' axes
C) parabola D) hyperbola

40. A body moves from one corner of an equilateral triangle of side 10 cm to the same corner along the sides. Then the distance and displacement are respectively
A) 30 cm & 10 cm B) 30 cm & 0 cm
C) 0 cm & 30 cm D) 30 cm & 30 cm.

41. A bus starts from rest with a constant acceleration of $5 m/s^2$. At the same time a car travelling with a constant velocity 50 m/s over takes and passes the bus. How fast is the bus travelling when they are side by side?
A) 10 m/s B) 50 m/s
C) 100 m/s D) 150m/s

42. A particle is moving along a straight line whose velocity position graph is as shown in figure The acceleration of particle when it is at x = 3m is



A) $20 m/s^2$ B) $32 m/s^2$
C) $16 m/s^2$ D) $40 m/s^2$

43. The displacement of a particle starts from rest is proportional to the square of time, then the particle travels with
A) uniform acceleration
B) uniform velocity
C) increasing acceleration
D) decreasing velocity

44. Acceleration of a particle changes when
A) direction of velocity changes
B) magnitude of velocity changes
C) either of above
D) speed is constant

45. What determines the nature of the path followed by the particle
A) speed B) velocity
C) acceleration D) none of these

NUMERICAL VALUE TYPE)

Section-II contains 5 **Numerical Value Type** questions.
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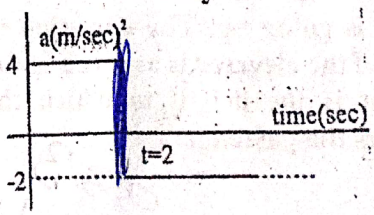
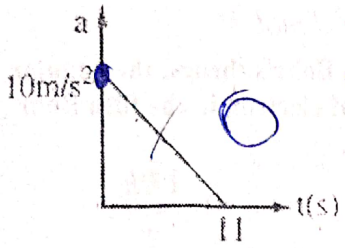
46. If a body looses half of its velocity on penetrating 3cm in a wooden block, then how much will it penetrate more before coming to rest

47. The acceleration-time graph of a particle moving along a straight line is as shown in figure. At what time the particle acquires its initial velocity?

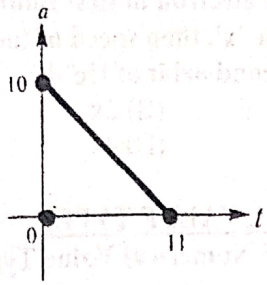


48. For a train that travels from one station to another at a uniform speed of 40 kmh^{-1} and returns to initial station at speed of 60kmh^{-1}, then its average speed is

49. A particle starts from rest. Its acceleration (a) versus time(t) is as shown in the figure. The maximum speed of the particle will be



50. A particle starts from rest. Its acceleration versus time graph is as shown in the figure. The maximum speed of the particle will be



CHEMISTRY

(SINGLE CORRECT ANSWER TYPE)

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51. **Which statement is true?**
(A) Spacing between energy levels n = 1 and n = 2 in hydrogen atom is greater than that of n = 2 and n = 3
(B) Spacing between energy levels n = 1 and n = 2 hydrogen atom is equal to that n = 2 and n = 3 in
(C) Spacing between energy-levels n = 1 and n = 3 in hydrogen atom is less than that of n = 2 and n = 3
(D) None

52. **If velocity of an electron in 1st Bohr orbit of hydrogen atom is x, its velocity in 3rd orbit will be**
(A) $\frac{x}{3}$ (B) $3x$
(C) $9x$ (D) $\frac{1}{9}$

53. **Ionisation energy of He^+ is 19.6×10^{-18} J $atom^{-1}$. The energy of the first stationary state (n = A) of Li^{2+} is**
(A) 4.41×10^{-16} J $atom^{-1}$
(B) -4.41×10^{-17} J $atom^{-1}$
(C) -2.2×10^{-15} J $atom^{-1}$
(D) 8.82×10^{17} J $atom^{-1}$

54. **An electron is moving with a kinetic energy of 4.55×10^{-25} J. What will be de Broglie wavelength for this electron?**
(A) $5.28\times10^{-7}m$ (B) $7.28\times10^{-7}m$
(C) $2\times10^{-10}m$ (D) $3\times10^{-5}m$

55. **The de Broglie wavelength of a tennis ball mass 60 g moving with a velocity of 10 m per second is approximately:**
(A) 10^{-16}m (B) 10^{-33}m
(C) 10^{-25}m (D) 10^{-31}m

56. **Velocity of de Broglie wave is given by:**
(A) $\frac{c^2}{v}$ (B) $\frac{hv}{mc}$
(C) $\frac{mc^2}{h}$ (D) $v\lambda$

57. **The de Broglie wavelength of 1 mg grain of sand blown by a 20ms^{-1} wind is:**
(A) $3.3\times10^{-29}m$ (B) $3.3\times10^{-21}m$
(C) $3.3\times10^{-49}m$ (D) $3.3\times10^{-42}m$

58. **Minimum de-Broglie wavelength is associated with**
(A) Electron (B) Proton
(C) CO_2 molecule (D) SO_2 molecule

59. **Calculate the uncertainty in velocity of a cricket ball of mass 150 g if the uncertainty in its position is 1 Å**
$\left(h=6.6\times10^{-34}Kgm^2s^{-1}\right)$
(A) $3.5\times10^{-24}ms^{-1}$ (B) $4.5\times10^{-24}ms^{-1}$
(C) $3.5\times10^{-24}cms^{-1}$ (D) $4.5\times10^{-24}cms^{-1}$

60. **The uncertainty in position and velocity of the particle are 0.1 nm and 5.27×10^{-27} ms^{-1} respectively. Then the mass of the particle is: (h = 6.625×10^{-34} Js)**
(A) 200 g (B) 300 g
(C) 100 g (D) 1000 g

61. **The uncertainty in position and velocity of a particle in motion are $1\times10^{-8}m$ and $6.627\times10^{-20}m/s$, respectively. The mass of the particle is $\left(h=6.627\times10^{-34}Js\right)$**

(A) $\frac{10^{-4}}{2\pi} kg$ (B) $\frac{10^{-4}}{4\pi} kg$

(C) $\frac{10^{-6}}{2\pi} kg$ (D) $\frac{10^{-6}}{4\pi} kg$

62. Given the ratio of kinetic energy of electron in two orbitals is 16: 9. Calculate the ratio of wavelength of electron waves?
(A) 4:3 (B) 9:16
(C) 3:4 (D) 16:9

63. The product of uncertainty in the position and uncertainty in velocity of a particle is $5.79\times10^{-5} m^2 s^{-1}$ If uncertainty in the position is 1 nm, what is the uncertainty in the measurement of its velocity in ms^{-1}?
(A) 579×10^{7} (B) 579×10^{5}
(C) 579×10^{-5} (D) 579×10^{4}

64. The speed of the electron (in ms^{-A}) in the third orbit of hydrogen atom is approximately (mass of electron $=9.1\times10^{-31} kg$)
(A) 3.6×10^{5} (B) 2.18×10^{5}
(C) 7.26×10^{5} (D) 2.18×10^{5}

65. The wavelength (in m) of a particle of mass 11.043×10^{-26} kg moving with a velocity of $6.0\times10^{7} ms^{-1}$ is
(A) 1.0×10^{16} (B) 6.0×10^{-16}
(C) 1.0×10^{-16} (D) 6.0×10^{16}

66. When uncertainty in position and momentum are equal, then the uncertainty in velocity is
(A) $\sqrt{\frac{h}{\pi}}$ (B) $\frac{1}{2}\sqrt{\frac{h}{\pi}}$
(C) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$ (D) $2m\sqrt{\frac{h}{\pi}}$

67. If the kinetic energy of an electron is increased 4 times, the wavelength of the de Broglie wave associated with it would becomes:
(A) 4 times (B) 2 times
(C) 1/2 times (D) 1/4 times

68. The ionisation energy of hydrogen atom $1.312\times10^{6} Jmol^{-1}$. The energy required to excite the electron in the atom from $n_1 = 1, n_2 = 2$ is
A) $8.51\times10^{5} Jmol^{-1}$
B) $6.56\times10^{5} Jmol^{-1}$
C) $7.56\times10^{5} Jmol^{-14}$
D) $9.84\times10^{5} Jmol^{-1}$

69. According to Bohr's theory, the angular momentum of electron in the fifth Bohr orbit is?
(A) $\frac{25h}{\pi}$ (B) $\frac{1.0h}{\pi}$
(C) $\frac{10h}{\pi}$ (D) $\frac{2.5h}{\pi}$

70. If the speed of electron in first Bohr orbit of hydrogen be 'x', then speed of the electron in second orbit of He^{+} is:
(A) x/2 (B) 2x
(C) x (D) 4x

(NUMERICAL VALUE TYPE)

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71. Ionisation energy of H-atom in the ground state is 25 times the ionization energy when it is in nth state. What is value of 'n'

72. The maximum no. of emission lines when the excited electron of a H-atom in n = 4 drops to the ground state.

73. According Bohr's theory, the angular momentum of an electron in 10th orbit is $\frac{xh}{\pi}$ Then the value of x = ____.

74. Uncertainty in position of a particle of 25grams in space is $10^{-5} m$. Hence, uncertainty in velocity $\left(ms^{-1}\right)$ is (Plank's constant $h = 6.6\times10^{-34} JS$) is 2.1×10^{-x} then 'x' is

75. If the value of E= -78.4 Kcal/mole, the of order of the orbit in hydrogen atom is ___.

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