

TEST ID : 111
MAX. MARKS : 300
EXAM DURATION : 3 HOURS

Roll No.

Name :

Exam Date :

M-STAR[★]

Momentum Scholarship Test for Admission & Rewards

8th Edition, 2023-24

Talent HUNT Exam



Class XI Studying Students (JEE Aspirants)
Physics, Chemistry & Mathematics

INSTRUCTIONS FOR CANDIDATE

1. This booklet is your Question Paper. Do not open this booklet before being instructed to do so by the invigilator.
2. You may complete Your Name, Roll No. on the cover page.
3. Blank spaces and blank pages are provided in this booklet for your rough work. No Additional sheet will be provided for rough work.
4. Blank papers, clipboards, log tables, slide rules, calculators, cameras, cellular phones, pagers and electronic gadgets are NOT allowed inside the examination hall.
5. **Using a Blue/Black Pen, Darken the bubbles on the OMR sheet**
6. DO NOT TAMPER WITH/MUTILATE THE OMR OR THE BOOKLET
7. In the booklet, check that all the 90 questions and corresponding answer choices are legible.
8. Write your name, class and the Father's name in the boxes provided on the right part of the OMR. Do not write any of this information anywhere else. Darken the appropriate bubble under each digit of your Roll Number and Test ID Number.
9. The question paper consists of three parts. **Part - I** consists of **Physics**, **Part - II** consists of **Chemistry** and **Part - III** consists **Mathematics**.
10. **Part - I Physics** contain 30 multiple choice questions in which 25 questions need to attempt **Part - II Chemistry** contain 30 multiple choice questions in which 25 questions need to attempt and **Part - III Mathematics** contains 30 multiple choices questions out of that 25 questions are to be attempted.
11. Marking Scheme: **+4** for correct answer, **0** for unattempted and **-1** for wrong attempt.
12. On completion of the test, the candidate must hand over the **OMR** Sheet to the invigilator on duty in the Room/Hall.



MOMENTUM

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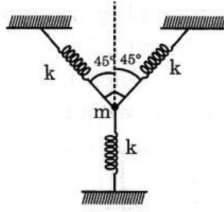


PART-I : PHYSICS

SECTION (A)

Single Type Questions

- A particle of mass m is acted upon by a force F given by the empirical law $F = \frac{R}{t^2} v(t)$. If this law is to be tested experimentally by observing the motion starting from rest, the best way is to plot:
 - $\log v(t)$ against $\frac{1}{t}$
 - $v(t)$ against t^2
 - $\log v(t)$ against $\frac{1}{t^2}$
 - $\log v(t)$ against t
- A cylinder rolls without slipping down an inclined plane, the number of degrees of freedom it has, is
 - 2
 - 3
 - 5
 - 1
- In changing the state of thermodynamics from A to B state, the heat required is Q and the work done by the system is W . The change in its internal energy is
 - $Q + W$
 - $Q - W$
 - Q
 - $\frac{Q-W}{2}$
- For a planet having mass equal to mass of the earth but radius is one fourth of radius of the earth. The escape velocity for this planet will be :
 - 11.2 km/s
 - 22.4 km/s
 - 5.6 km/s
 - 44.8 km/s
- A boat takes two hours to travel 8 km and back in still water. If the velocity of water 4 kmh^{-1} , the time taken for going ups tream 8km and coming back is
 - 2h
 - 2 h 40 min
 - 1 h 20 min
 - Cannot be estimated with the information given
- A particle is dropped from rest from a large height. Assume g to be constant throughout the motion. The time taken by it to fall through successive distance of 1 m each will be
 - All equal, being equal to $\sqrt{2/g}$ second
 - In the ratio of the square roots of the integers 1, 2, 3, ...,
 - In the ratio of the difference in the square root of the integers, i.e., $\sqrt{1}, (\sqrt{2} - \sqrt{1}), (\sqrt{3} - \sqrt{2}), (\sqrt{4} - \sqrt{3}), \dots$
 - In the ratio of the reciprocals of the square roots of the integers, i.e., $\frac{1}{\sqrt{1}}, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{3}}, \dots$
- A body of mass M at rest explodes into three pieces, in the ratio of masses 1:1:2. Two smaller pieces fly off perpendicular to each other with velocities of 30 ms^{-1} and 40 ms^{-1} respectively The velocity of the third piece will be:
 - 15 ms^{-1}
 - 25 ms^{-1}
 - 35 ms^{-1}
 - 50 ms^{-1}
- A ball of mass 150 g, moving with an acceleration 20 m/s^2 , is hit by a force, which acts on it for 0.1 sec. The impulsive force is
 - 0.5 N
 - 0.1 N
 - 0.3 N
 - 1.2 N
- A light particle of mass m is in equilibrium as shown, now mass m is displaced vertically downward by x , then time period of its SHM will be :

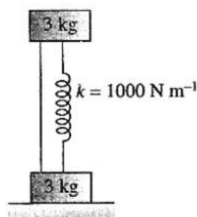


 - $T = 2\pi\sqrt{\frac{m}{k}}$
 - $T = 2\pi\sqrt{\frac{m}{4k}}$
 - $T = 2\pi\sqrt{\frac{2m}{k}}$
 - $T = 2\pi\sqrt{\frac{m}{2k}}$

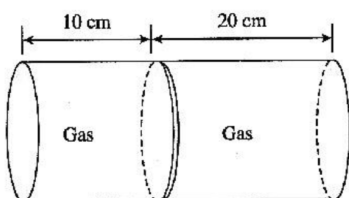
SECTION (B)

Integer Type Questions

21. A system consists of two identical cubes, each of mass 3 kg, linked together by a compressed weightless spring of force constant 1000 N m^{-1} . The cubes are also connected by a thread which is burnt at a certain moment. At what minimum value of initial compression x_0 (in cm) of the spring will the lower cube bounce up after the thread is burnt through?

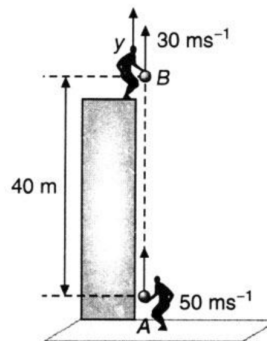


22. A whistle of frequency $f_0 = 1300 \text{ Hz}$ is dropped from a height $H = 505 \text{ m}$ above the ground. At the same time, a detector is projected upwards with velocity $v = 50 \text{ ms}^{-1}$ along the same line. If the velocity of sound is $v = 300 \text{ ms}^{-1}$, if f_{app} is the frequency (in Hz) detected by the detector after $t = 5 \text{ s}$. Find $(f_{\text{app}}/500)$.
23. Given figure shows a horizontal cylindrical container of length 30 cm, which is partitioned by a tight-fitting separator. The separator is in the state shown in the figure. The temperature of left part of cylinder is 100 K. Initially the separator is in equilibrium. As heat is conducted from right to left part, separator displaces to the right. If x is the displacement of separator (in cm) after a long when gases on the two parts of cylinder are in thermal equilibrium. Find $x/5$.



24. Acceleration of particle moving rectilinearly is $a = 4 - 2x$ (where x is position in metre and a in ms^{-2}). It is at instantaneous rest at $x = 0$. At what position x (in meter) will the particle again come to instantaneous rest?

25. Two balls A and B of equal masses are projected upward simultaneously, one from the ground with speed 50 ms^{-1} and other from a lower of height 40m above the first ball with initial speed 30 ms^{-1} . If x is the maximum height attained by their centre of mass in metre. Find $x/20$.



26. If force F , velocity v and time T are taken as fundamental units. Find the dimension of force in the dimensional formula of pressure.
27. A uniform disk of mass $M = 40 \text{ g}$ and radius $R = 0.5 \text{ cm}$ is pivoted so that it can rotate freely about a horizontal axis through its centre and normal to the plane of the disk. A small particle of mass $m = 5 \text{ g}$ is attached to the rim of the disk at the top directly above the pivot. The system is given a gentle start and the disk begins to rotate. What is the angular velocity of the disk, in rad s^{-1} , when the particle is at its lowest point?
28. A police jeep is chasing a culprit going on a motor bike. The motor bike crosses a turning at a speed of 72 kmh^{-1} . The jeep follows it a speed of 90 kmh^{-1} crossing the turning ten seconds later than the bike. Assuming that they travel at constant speeds, how far from the turning will the jeep catch up with the bike? (in km)
29. A particle on a stretched string supporting a travelling wave, takes 5.0 ms to move from its mean position to the extreme position. The distance between two consecutive particles, which are at their mean positions, is 3.0 cm . Find the wave speed (in m/s).
30. Two vectors \vec{A} and \vec{B} are defined as $\vec{A} = a\hat{i}$ and $\vec{B} = a(\cos \omega t \hat{i} + \sin \omega t \hat{j})$ where a is a constant and $\omega = \frac{\pi}{6} \text{ rad s}^{-1}$. If $|\vec{A} + \vec{B}| = \sqrt{3}|\vec{A} - \vec{B}|$ at time $t = \tau$ for the first time, the value of τ , in seconds, is _____.

PART-II : CHEMISTRY

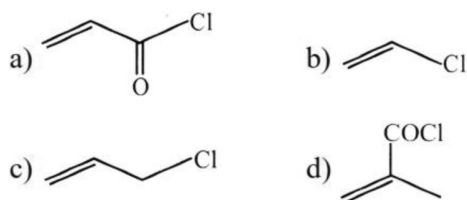
SECTION (A)

Single Type Questions

31. One litre N_2 , $\frac{7}{8}$ litre O_2 and 1 litre CO are taken in a mixture under identical conditions of P and T. The amount of gases present in mixture is given by:

- a) $w_{N_2} = w_{O_2} > w_{CO}$
 b) $w_{N_2} = w_{CO} > w_{O_2}$
 c) $w_{N_2} = w_{O_2} = w_{CO}$
 d) $w_{CO} > w_{N_2} > w_{O_2}$

32. Which of the following compounds will not undergo Friedel Craft's reaction with benzene ?



33. Which is incorrect statement?

- a) In solid state O^{2-} is stabilized by neighbouring cations
 b) Formation of O^{2-} from O^- is unfavourable in the gas phase
 c) Electron affinity of $O > S$
 d) All of the above are incorrect

34. At what temperature, the sample of neon gas would be heated to double of its pressure, if the initial volume of gas is/are reduced to 15% at $75^\circ C$

- a) $319^\circ C$ b) $592^\circ C$
 c) $128^\circ C$ d) $60^\circ C$

35. The planar structure of BF_3 can be explained by the fact that BF_3 is

- a) sp hybridized b) sp^2 hybridised
 c) sp^3 hybridised d) $sp^3 d$ hybridized

36. For the reaction $2Cl(g) \rightarrow Cl_2(g)$, the correct option is

- a) $\Delta_r H < 0$ and $\Delta_r S < 0$ b) $\Delta_r H > 0$ and $\Delta_r S > 0$
 c) $\Delta_r H > 0$ and $\Delta_r S < 0$ d) $\Delta_r H < 0$ and $\Delta_r S > 0$

37. X-rays cannot penetrate through a sheet of:

- a) Wood b) Paper
 c) Aluminium d) Lead

38. Hydrogen bonding is maximum in

- a) C_2H_5OH b) CH_3OCH_3
 c) $(CH_3)_2C=O$ d) CH_3CHO

39. The most unstable configuration of cyclohexane is

- a) Boat b) Chair
 c) Twist boat d) Half chair

40. Fire extinguishers contain H_2SO_4 and which one of the following ?

- a) $NaHCO_3$ and Na_2CO_3
 b) Na_2CO_3
 c) $NaHCO_3$
 d) $CaCO_3$

41. Which one of the following orders presents the correct sequence of the increasing basic nature of the given oxides

- a) $Al_2O_3 < MgO < Na_2O < K_2O$
 b) $MgO < K_2O < Al_2O_3 < Na_2O$
 c) $Na_2O < K_2O < MgO < Al_2O_3$
 d) $K_2O < Na_2O < Al_2O_3 < MgO$

42. An interhalogen compound is:

- a) IF_5 b) I_3^-
 c) CN^- d) $(CN)_2$

43. The reaction of toluene with chlorine in the presence of ferric chloride gives predominantly

- a) m-chlorotoluene
 b) Benzyl chloride
 c) Benzoyl chloride
 d) o and p-chlorotoluene

44. Which of the following metal carbonate is decomposed on heating

- a) $MgCO_3$ b) Na_2CO_3
 c) K_2CO_3 d) Rb_2CO_3

45. Absolute alcohol is prepared by

- (a) fractional distillation
 (b) kolbe's method
 (c) vacuum distillation
 (d) azeotropic distillation.

46. Water glass is
 a) Glass made up of water
 b) Sodium silicate
 c) Water gas
 d) Crystal carbonate
47. The reaction of ethyl magnesium bromide with water would give
 a) Ethane
 b) Ethyl alcohol
 c) Ethyl bromide
 d) Ethyl ether
48. H_2O_2 is:
 a) Diamagnetic
 b) Paramagnetic
 c) Ferromagnetic
 d) None of these
49. Number of isomers of C_4H_{10} is
 a) 2
 b) 3
 c) 4
 d) Isomerism not exist
50. Stability of the species Li_2 , Li_2^- and Li_2^+ increases in the order of
 a) $Li_2 < Li_2^+ < Li_2^-$
 b) $Li_2^- < Li_2^+ < Li_2$
 c) $Li_2 < Li_2^- < Li_2^+$
 d) $Li_2^- < Li_2 < Li_2^+$

SECTION (B)

Integer Type Questions

51. Borax is found to have tetrahedral unit(s).
52. How many lone pairs are associated with I in IF_7 ?
53. Number of s-electrons in Na^- is
54. Superoxide ion has electrons in anti-bonding molecular orbitals.

55. Two identical vessels are connected by a tube with a valve letting the gas to pass from one vessel into the other if the pressure difference $\Delta P \geq 2.0$ atm. Initially, there was a vacuum in one vessel while the other contained ideal gas at a temperature 300 K and pressure 4.0 atm. Then both vessels were heated to a temperature 600 K. Up to what value will be the pressure (in atm) in the first vessel (which had a vacuum initially) increase ?
56. A sample of $SF_5OF(g)$ was contained in a glass vessel at $117^\circ C$ and a pressure of 380 mm. A quantity of N_2F_4 that was added brought the total pressure to 760 mm. The reaction that occurred produced a variety of products like NF_3 , NO , SiF_4 (by the reaction with glass), SF_6 , SO_2F_2 , SOF_4 , SF_5ONF_2 and NO_2 . The yield of SF_5ONF_2 was 40 mole percent with respect to the reactant SF_5OF . All of the SF_5OF and N_2F_4 were consumed in the reaction. What was the mass of SF_5ONF_2 produced (in g) if the volume of the vessel was 1.64 L ? ($F = 19$)
57. Based on redox predominance diagram, out of FeO_4^{2-} , Fe^{3+} , Fe^{2+} and Fe , best oxidising agent is the species with oxidation number of iron as
58. How much times the pressure of an ideal gas inside a cubic box of side l is affected, if side is reduced to $\frac{1}{2}$ and temperature is kept constant ?
59. 96 g of Mg is burnt in air in a closed chamber. On analysis 25% of Mg is converted into oxide and remaining Mg into other possible product. Residue is dissolving in H_2O and neutralised by H_2SO_4 . Number of moles of H_2SO_4 required is
60. If $\frac{a}{p_c b^2} = y^3$, then $y = ?$
 Where $P_c = \text{Critical pressure.}$

Space for rough work

SECTION (B)

Integer Type Questions

81. Let A and B be two sets having 3 elements in common. If $n(A) = 5$ and $n(B) = 4$, then $n[(A \times B) \cap (B \times A)]$ is equal to _____.
82. If the line $25x + 12y - 45 = 0$ meets the hyperbola $25x^2 - 9y^2 = 225$ at point $\left(5, -\frac{5\lambda}{3}\right)$, then the value of λ is _____.
83. If e_1 and e_2 are the eccentricities of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and its conjugate hyperbola, while $e_1^{-2} + e_2^{-2} = \lambda$, then the value of λ is _____.
84. In a ΔABC , if $A = 60^\circ$, then $\frac{b}{c+a} + \frac{c}{a+b}$ is equal to _____.
85. If number of selections of 6 different letters that can be made from the words 'SUMAN' and 'DIVYA' so that each selection contains 3 letters from each word is N^2 , then the value of N is _____.
86. Three faces of a fair dice are yellow, two faces are red and one face is blue. The dice is tossed three times. The probability that the colours, yellow, red, and blue appear in the first, second and third tosses respectively is $\frac{1}{P^2}$. Find P.
87. If $\left[i^{19} + \left(\frac{1}{i} \right)^{25} \right]^2 = -X$, find the value of X.
88. If the lines $x + y + 1 = 0$; $4x + 3y + 4 = 0$ and $x + \alpha y + \beta = 0$, where $\alpha^2 + \beta^2 = 2$, are concurrent then find the value of β .
89. The standard deviation of 9, 16, 23, 30, 37, 44, 51 is $k + 10$ where $k =$
90. The third term of a G.P. is 64. If the product of first five terms is 2^{13A+4} , Find the values of A.

Space for rough work

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Our Students Shine in JEE Advanced



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IIT Kanpur, Civil



SWETA CHANDRA
AIR - 2352
IIT Kharagpur, Civil



ANSHUMAN
AIR - 3359
NIT Patna, C.S



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AIR - 4294
IIT Hyderabad, C.S



VANSHIKA TULSYAN
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IIT Dhanbad

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IMS BHU, Varanasi



SHREYANSH JAISWAL
Score: 670 / 720
KGMU, Lucknow



SAWAI SUTHAR
Score: 651 / 720
Rabindranath Tagore
Medical College, Udaipur



AAKASH PANDEY
Score: 640 / 720
BRD Medical College,
Gorakhpur



PRAGATI MISHRA
Score: 635 / 720
Govt. Medical College
Ayudhya



MANVI VERSHANEY
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