MOMENTUM

IIT (JEE Main & Advanced)

Momentum (A Division of Momentum Education Pvt. Ltd)

DATE : **DURATION: 3 HRS.** **MARKS: 280**

MTSE
(MODEL PAPER)

MTSE
MOMENTUM TALENT SEARCH EXAM

TEST ID-2106

CLASS: 11 (MOVING TO CLASS 12) (IIT) **TEST NO - 1**

INSTRUCTIONS

A. GENERAL

1. **Please read the Instructions carefully, You are allotted 10 minutes specially for this purpose.**
2. Blank papers, clip boards, log tables, slide rule, calculators, mobiles or any other electronic instrument in any form is **"NOT PERMISSIBLE".**
3. Before starting the paper, fill up the required details in the blank spaces provided in the answersheet.
4. Using a **Blue/ Black Pen,** darken the bubbles on the **OMR sheet**.
5. **DO NOT TAMPER WITH/MUTILATE THE OMR OR THE BOOKLET.**
6. No rough sheets will be provided by the invigilators. All the rough work is to be done in the blank space povided in the question paper.

B. FILLING THE RIGHT PART OF THE OMR

7. Write your name, Bach 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 Student ID Number and Test ID Number.
8. Do not fold or make any stray marks on the Answer Sheet.
9. On completion of the test, the candidate must hand over the Answer Sheet & Test Booklet to the Invigilator on duty in the Room / Hall.
10. Follow instructions by invigilator/Centre Superintendent (If any).
11. **Please fill in all the correct information on back page of this paper.**

C. QUESTION PAPER FORMAT :

This Question Paper consists of 70 objective type questions.

D. MARKING SCHEME :

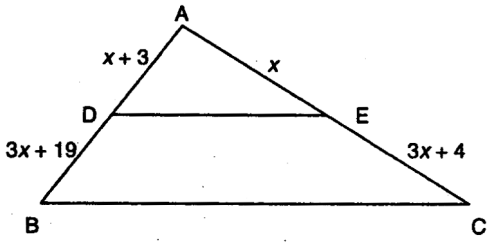
- 4 Marks will be awarded for each Correct Answer.
- 1 Mark will be deducted for each incorrect Answer.
- 0 Marks will be awarded for unattempted Questions

Name of the Candidate	Candidate ID
I have read all the instructions and shall abide by them ..... Signature of the Candidate	I have verified all the information filled in by the Candidate ..... Signature of the Invigilator

Question No. 01 to 30 Only one Correct Answer

1. If $\sqrt{5}$ and $-\sqrt{5}$ are two zeroes of the polynomial $x^3 + 3x^2 - 5x - 15$, hen its third zero is
   (a) 3 (b) –3
   (c) 5 (d) –5

2. In figure, the value of x for which DE || AB is



   (a) 4 (b) 1
   (c) 3 (d) 2

3. $\dfrac{\cot\theta}{\cot\theta - \cot 3\theta} + \dfrac{\tan\theta}{\tan\theta - \tan 3\theta}$ is equal to
   (a) 0 (b) 1
   (c) –1 (d) 2

4. If $a\cos\theta - b\sin\theta = c$, then $a\sin\theta + b\cos\theta =$
   (a) $\pm\sqrt{a^2 + b^2 + c^2}$ (b) $\pm\sqrt{a^2 + b^2 - c^2}$
   (c) $\pm\sqrt{c^2 - a^2 - b^2}$ (d) none of these

5. If $u_1 = \dfrac{x_i - 25}{10}, \sum f_i u_i = 20, \sum f_i = 100,$ then $\overline{x} =$
   (a) 23 (b) 24
   (c) 27 (d) 25

Space for rough work

6. The value of $\sqrt{6+\sqrt{6+\sqrt{6+}}....}$ is
(a) 4 (b) 3
(c) –2 (d) 3.5

7. If the sum of the roots of the equation $x^2 – (k + 6) x + 2 (2k – 1) = 0$ is equal to half of their product, then k =
(a) 6 (b) 7
(c)1 (d) 5

8. If $\frac{1}{x+2}, \frac{1}{x+3}, \frac{1}{x+5}$ are in A.P. Then x =
(a) 5 (b) 3
(c) 1 (d) 2

9. If $\frac{5+9+13+...\text{to n terms}}{7+9+11+...\text{to}(n+1)\text{terms}} = \frac{17}{16}$, then n =
(a) 8 (b) 7
(c) 10 (d) 11

10. If the n^{th} terms of an A.P. is 2n + 1, then the sum of first n terms of the A.P. is
(a) n(n – 2) (b) n(n + 2)
(c) n(n + 1) (d) n(n – 1)

11. If in an A.P., $S_n = n^2p$, where S_r denotes the sum of r terms of the A.P., then S_p is equal to
(a) $\frac{1}{2} p^3$ (b) mn p
(c) p^3 (d) $(m + n) p^2$

12. It is found that on walking x meters towards a chimney in a horizontal line through its base, the elevation of its top changes from 30^o to 60^o. The height of the chimney is
(a) $3\sqrt{2}\,x$ (b) $2\sqrt{3}\,x$
(c) $\frac{\sqrt{3}}{2}x$ (d) $\frac{2}{\sqrt{3}}x$

Space for rough work

13. The probability of throwing a number greatr than 2 with a fair dice is

(a) $\frac{3}{5}$ (b) $\frac{2}{5}$

(c) $\frac{2}{3}$ (d) $\frac{1}{3}$

14. What is the probability that a leap year has 52 Mondays?

(a) $\frac{2}{7}$ (b) $\frac{4}{7}$

(c) $\frac{5}{7}$ (d) $\frac{6}{7}$

15. If the line segment joining the points (3, –4) and (1, 2) is trisected at points P(a, –2) and $Q\left(\frac{5}{3}, b\right)$. Then,

(a) $a = \frac{8}{3}, b = \frac{2}{3}$ (b) $a = \frac{7}{3}, b = 0$

(c) $a = \frac{1}{3}, b = 1$ (d) $a = \frac{2}{3}, b = \frac{1}{3}$

16. It the area of the triangle formed by the points (a, 2x), (–2, 6) and (3, 1) is 5 square units, then x = 0

(a) $\frac{2}{3}$ (b) $\frac{3}{5}$

(c) 3 (d) 5

17. The number of solutions of the equation tan x + sec x = 2 cos x lying in the interval $[0, 2\pi]$ is

(a) 0 (b) 1

(c) 2 (d) 3

18. Length of the median from B on AC where, A(–1, 3), B(1, –1), C(5, 1) is

(a) $\sqrt{18}$ (b) $\sqrt{10}$

(c) $2\sqrt{3}$ (d) 4

19. The number of common tangents that can be drawn to the circles $x^2 + y^2 - 4x - 6y - 3 = 0$ and $x^2 + y^2 + 2x + 2y + 1 = 0$ is

(a) 1 (b) 2

(c) 3 (d) 4

20. If $x^y \cdot y^x = 16$, then $\frac{dy}{dx}$ at (2, 2) is

(a) –1 (b) 0

(c) 1 (d) none of these

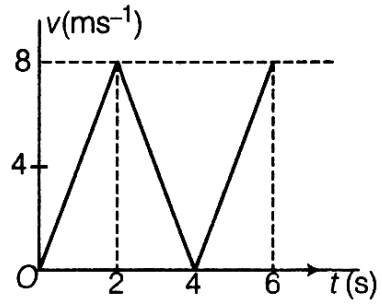
Space for rough work

Question No. 31 to 60 Only One Correct Answer

21. The dimensions of gravitational constant G and the moment of inertia are, respectively
(a) $[ML^3T^{-2}]$, $[ML^2T^0]$ (b) $[M^{-1}L^3T^{-2}]$, $[ML^2T^0]$
(c) $[M^{-1}L^3T^{-2}]$, $[M^{-1}L^2T]$ (d) $[M^3L^{-2}]$, $[M^{-1}L^2T]$

22. If 3.8×10^{-6} is added to 4.2×10^{-5} giving due regard to significant figures, then the result will be
(a) 4.58×10^{-5} (b) 4.6×10^{-5} (c) 4.5×10^{-5} (d) None of these

23. The v - t graph for a particle is as shown. The distance travelled in the first 4 s is



(a) 12 m (b) 16 m (c) 20 m (d) 24 m

24. The component of vector $A = (a_x\hat{i} + a_y\hat{j} + a_z\hat{k})$ along the direction of $(\hat{i} - \hat{j})$ is
(a) $a_x - a_y + a_z$ (b) $z_x - z_y$ (c) $(a_x - a_y)/\sqrt{2}$ (d) $a_x + a_y + a_z$

Space for rough work

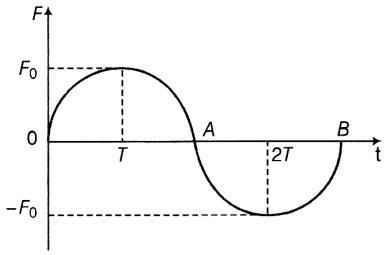
25. A body is just being revolved in a vertical circle of radius R with a uniform speed. The string breaks when the body is at the highest point. The horizontal distance covered by the body after the string breaks is

(a) 2R (b) R (c) $R\sqrt{2}$ (d) 4R

26. Two bodies are projected from the same point with equal speeds in such directions that they both strike the same point on a plane whose inclination is β. If α be the angle of projection of the first body with the horizontal the ratio of their times of flight is

(a) $\frac{\cos\alpha}{\sin(\alpha+\beta)}$ (b) $\frac{\sin(\alpha+\beta)}{\cos\alpha}$ (c) $\frac{\cos\alpha}{\sin(\alpha-\beta)}$ (d) $\frac{\sin(\alpha-\beta)}{\cos\alpha}$

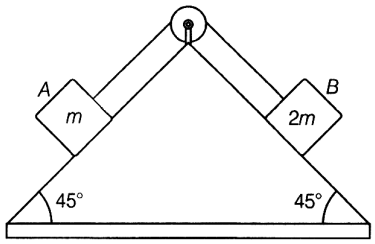
27. A unidirectional force F varying with time t as shown in the figure acts on a body initially at rest for a short duration 2T. Then, the velocity acquired by the body is



(a) $\frac{\pi F_0 T}{4m}$ (b) $\frac{\pi F_0 T}{2m}$ (c) $\frac{F_0 T}{4m}$ (d) zero

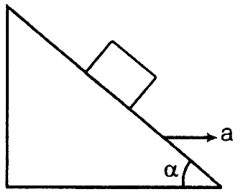
Space for rough work

28. Block A of mass m and block B of mass 2m are placed on a fixed triangular wedge by means of a massless, inextensible string and a frictionless pulley as shown in figure. The wedge is inclined at 45° to the horizontal on both the sides. The coefficient of friction between the block A and the wedge is 2/3 and that between the block B and the wedge is 1/3 and both the blocks A and B are released from rest, the acceleration of A will be



(a) –1 (b) 1.2 (c) 0.2 (d) zero

29. A block is kept on a frictionless inclined surface with angle of inclination α. The incline is given an acceleration a to keep the block stationary. Then, a is equal to



(a) g/tanα (b) g cosec α (c) g (d) g tan α

30. A ball is released from the top of a tower. The ratio of work done by force of gravity in 1st, 2nd and 3rd of the motion of the ball is

(a) 1 : 2 : 3 (b) 1 : 4 : 9 (c) 1 : 3 : 5 (d) 1 : 5 : 3

Space for rough work

31. The potential energy as a function of distance between two atoms in a diatomic molecules is given by $U(x)=\frac{A}{x^{12}}-\frac{B}{x^{6}}$, where A and B are positive constants and x refers to the distance between atoms. The position of stable equilibrium for the system of the two atoms is given as

(a) $x=\frac{A}{B}$ (b) $x=\sqrt{\frac{A}{B}}$ (c) $x=\frac{\sqrt{3A}}{B}$ (d) $x=\left(\frac{2A}{B}\right)^{\frac{1}{6}}$

32. A mass m moves with a velocity v and collides inelastically with another identical mass. After collision the 1st mass moves with velocity $\frac{v}{\sqrt{3}}$ in a direction perpendicular to the initial direction of motion. Find the speed of the second mass after collision.

(a) v (b) $\sqrt{3v}$ (c) $\frac{2}{\sqrt{3}}v$ (d) $\frac{v}{\sqrt{3}}$

33. Two bodies of 6 kg and 4 kg masses have their velocities $5\hat{i}-2\hat{j}+10\hat{k}$ and $10\hat{i}-2\hat{j}+5\hat{k}$ respectively. Then the velocity of their centre of mass is

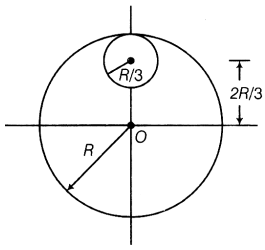
(a) $5\hat{i}+2\hat{j}-8\hat{k}$ (b) $7\hat{i}+2\hat{j}-8\hat{k}$ (c) $7\hat{i}-2\hat{j}+8\hat{k}$ (d) $5\hat{i}-2\hat{j}+8\hat{k}$

Space for rough work

34. The ratio of the radii of gyration of a circular disc about a tangential axis in the plane of the disc and of a circular ring of the same radius about a tangential axis in the plane of the ring is

(a) $\sqrt{3}:\sqrt{5}$ (b) $\sqrt{12}:\sqrt{3}$ (c) $1:\sqrt{3}$ (d) $\sqrt{5}:\sqrt{6}$

35. From a circular disc of radius R and mass 9M, a small disc of radius R/3 is removed from the disc. The moment of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through O is



(a) $4MR^2$ (b) $\frac{40}{9}MR^2$ (c) $10MR^2$ (d) $\frac{37}{9}MR^2$

36. A circular disc rolls down an inclined plane. The ratio of rotational kinetic energy to total kinetic energy is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{3}{4}$

Space for rough work

37. If M is the mass of the earth and R its radius, the ratio of the gravitational acceleration and the gravitational constant is

(a) $\frac{R^2}{M}$ (b) $\frac{M}{R^2}$ (c) MR^2 (d) $\frac{M}{R}$

38. A geostationary satellite is revolving around the earth. To make it escape from gravitational field of earth, its velocity must be increased

(a) 100% (b) 41.4% (c) 50% (d) 59.6%

39. A wire elongates by l mm when a load w is hanged from it. If the wire goes over a pulley and two weights w each are hung at the two ends, the elongation of the wire will be (in mm)

(a) l (b) $2l$ (c) zero (d) $\frac{l}{2}$

40. When a big drop of water is formed from n small drops of water, the energy loss is 3E, where E is the energy of the bigger drop. If R is the radius of the bigger drop and r is the radius of the smaller drop, then number of smaller drops (n) is

(a) $\frac{4R}{r^2}$ (b) $\frac{4R}{r}$ (c) $\frac{2R^2}{r}$ (d) $\frac{4R^2}{r^2}$

Space for rough work

Question No. 61 to 90 Only One Correct Answer

41. Which has maximum number of molecules
(a) 7 g N_2 (b) 2 g H_2 (c) 16 g NO_2 (d) 16 g O_2

42. The equivalent mass of an acid is equal to
(a) molecular mass/basicity (b) molecular mass × basicity
(c) molecular mass × acidity (d) molecular mass/acidity

43. Equal masses of oxygen (O_2), hydrogen (H_2) and methane (CH_4) are taken in identical conditions. The ratio of the volumes of three gases is
(a) 1 : 2 : 1 (b) 1 : 16 : 2 (c) 1 : 8 : 1 (d) 11 : 16 : 2

44. Boyle's law and Charles' law are applicable at.... process respectively
(a) Isochoric and isobaric (b) Isothermal and isobaric
(c) Isobaric and isochoric (d) Isothermal and isochoric

45. The excluded volume of a molecule in motion is..... times the actual volume of a molecule in rest
(a) 2 (b) 4 (c) 3 (d) 0.5

46. Which one of the following atoms has no neutron in its nucleus ?
(a) Lithium (b) Helium (c) Protium (d) Tritium

47. Which of the following expression gives the de Broglie relationship
(a) $\lambda = \frac{h}{mp}$ (b) $\lambda = \frac{h}{mv}$ (c) $\frac{h}{mv} = P$ (d) $\lambda m = \frac{v}{p}$

48. The compound containing co-ordinate bond is
(a) SO_3 (b) H_2SO_4 (c) O_3 (d) All of these

Space for rough work

49. Which of the following has least bond energy ?
(a) F_2 (b) H_2 (c) N_2 (d) O_2

50. In the process, $O_2^+ \longrightarrow O_2^{+2} + e$ the electron lost in from....
(a) bonding π-orbital (b) antibonding π-orbital
(c) $2P_z$ orbital (d) $2P_x$ orbital

51. The heat of neutralisation will be highest in
(a) NH_4OH and CH_3COOH (b) NH_4OH and HCl
(c) KOH and CH_3COOH (d) KOH and HCl

52. Given that $C + O_2 \longrightarrow CO_2$; $\Delta H^o = -a$ kJ
$2CO + O_2 \longrightarrow 2CO_2$; $\Delta H^o = -b$ kJ
The heat of formation of CO is
(a) b – 2a (b) $\frac{2a-b}{2}$ (c) $\frac{b-2a}{2}$ (d) 2a – b

53. An imaginary process $X \longrightarrow Y$ takes place in three steps
$X \longrightarrow A$; $\Delta H = -q_1$
$A \longrightarrow B$; $\Delta H = +q_2$
$B \longrightarrow Y$; $\Delta H = +q_3$
if Hess's law is applicable, then the heat of the reaction is
(a) $q_1 - q_2 + q_3$ (b) $q_2 + q_3 - q_1$ (c) $q_1 - q_2 - q_3$ (d) $q_3 - q_2 + q_1$

54. A system is provided 50 joule of heat and work done on the system is 10 J. The change in internal energy during the process is
(a) 40 J (b) 60 J (c) 80 J (d) 50 J

Space for rough work

55. If K_1 and K_2 are equilibrium constants for reactions (i) and (ii) respectively for,

$N_2 + O_2 \rightleftharpoons 2NO$ ....(i)

$\frac{1}{2}N_2 + \frac{1}{2}O_2 \rightleftharpoons NO$ ....(ii)

Then

(a) $K_2 = K_1$ (b) $K_2 = \sqrt{K_1}$ (c) $K_1 = 2K_2$ (d) $K_1 = \frac{1}{2}K_2$

56. For which reaction, K_p is less than K_c

(a) $N_2O_4 \rightleftharpoons 2NO_2$ (b) $2HI \rightleftharpoons H_2 + I_2$

(c) $2SO_2 + O_2 \rightleftharpoons 2SO_3$ (d) $N_2 + O_2 \rightleftharpoons 2NO$

57. In an aqueous solution of volume 500 mL, when the reaction of $2Ag^+ + Cu \rightleftharpoons Cu^{2+} + 2Ag$ reached equilibrium the $[Cu^{2+}]$ was xM. When 500 mL of water is further added, at the equilibrium $[Cu^{2+}]$ will be

(a) 2xM (b) xM

(c) Between xM and $\frac{x}{2M}$ (d) Less than $\frac{x}{M}$

58. The pH of buffer solution formed by mixing 100 mL of 0.1 M NaOH and 150 mL of 0.4 M CH_3COOH is (pKa = 4.57)

(a) 4.6 (b) 4.75 (c) 4.25 (d) 3.87

59. Oxidation number of C in HNC is

(a) +2 (b) –3 (c) +3 (d) ZERO

60. Which of the following elements has the maximum electron affinity ?

(a) I (b) Br (c) Cl (d) F

Space for rough work

Reasoning [Part- IV]

61. If in a certain language MYSTIFY is coded as NZTUJG, how is NEMESIS coded in that language?

(a) MDLHRDR (b) OFNFTJT (c) ODNHTDR (d) PGOKUGU

62. In a certain code, FORGE is written as FPTJ1. How is CULPRIT written in that code?

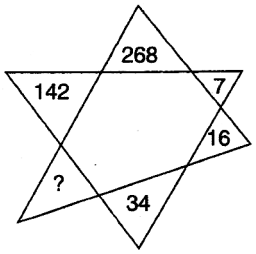
(a) CSJNPGR (b) CVMQSTU (c) CVNSVNZ (d) CXOSULW

63. 13, 17, 33, 97, 353, ...

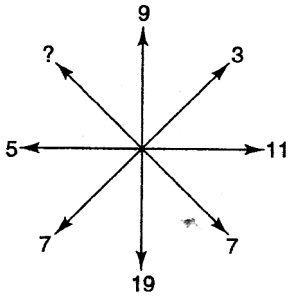
(a) 1377 (b) 653 (c) 712 (d) 1273

64. cccbb – aa – cc – bbbaa –

(a) acbc (b) baca (c) baba (d) acba

65. 

(a) 72 (b) 70 (c) 68 (d) 66

66. 

(a) 4 (b) 5 (c) 12 (d) 15

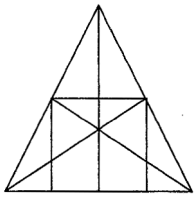
67. In the following series, how many such odd numbers are there which are divisible by 3 or 5, then followed by odd numbers and then also followed by even numbers?

12, 19, 21, 3, 25, 18, 35, 20, 22, 21, 45, 46, 47, 48, 9, 50, 52, 54, 55, 56.

(a) Nil (b) One (c) Two (d) Three

Space for rough work

68. How many straight lines are contained in the diagram given below?



(a) 9 (b) 10 (c) 11 (d) 12

69. Pointing to a man in the photograph, Ashmita said, "His mother's only daughter is my mother." How is Ashmita related to that man?

(a) Nephew (b) Sister (c) Wife (d) Niece

70 If a means 'plus', b means 'minus', c means 'multiplied by' and d means 'divided by' then 18 c 14 a 6 b 16 d 4 = ?

(a) 63 (b) 254 (c) 288 (d) 1208

Space for rough work

C. QUESTION PAPER FORMAT

The question paper consists of 4 parts I, II, III & IV Mathematics , Physics, Chemistry & Reasoning respectively.

D. MARKING SCHEME

There are three parts in the question paper. The distribution of marks subjectwise in each part is as under for each correct response :

PART	SUBJECT	QUESTION NO.	MARKS
Part - I	**MATHEMATICS**	01 to 20	**4**
Part - II	**PHYSICS**	21 to 40	**4**
Part - III	**CHEMISTRY**	41 to 60	**4**
Part - IV	**REASONING**	61 to 70	**4**

You must fill the bubble in OMR in following manner. For example if only 'b' choice is correct then

A ○ B ● C ○ D ○

If you fill the bubble for any option other than the correct option then, your response will be considered *incorrect. 1/4 (one Four) of allotted marks i.e. 1 mark* if a question carries 4 marks will be deducted for indicating incorrect response of each question. No. deduction from the total score will be made if no response is indicated for a question in the answer sheet.

GENERAL INFORMATION

Fill by the candidate :- Candidate ID : _____

1. Candidate Name :_____
2. Father's Name : _____
3. Mother's Name : _____
4. Category : ☐ GEN ☐ OBC ☐ SC ☐ ST
5. Mobile No. 1.(G) _____ 2. (P) _____
6. NTSE Qualified [Y] [N] 7. KVPY [Y] [N] 8. OLYMPIAD [Y] [N]
9. Board ☐ CBSE ☐ ICSE / ISC ☐ U.P. Others : _____
10. Last Class : _____%_____10th %_____12th %_____
11. Last School Name : _____City_____
12. Any other achievement : _____
13. Have you attempted any admission test before : [Y] [N] _____
14. Old student of Momentum or admitted : [Y] [N] If yes,St.Id_____/Batch_____

Disclamer :

I hereby solemnly and sincerely affirm that all the particulars stated by me in this form are true and correct. However, if any information furnished herein is found false, wrong, incorrect or inaccumate, I understand that my candidate for Admission Test-2021 will be cancelled and lead to cancellation of the test result.

Candidate Signature _____ Invigilator Signature_____

MOMENTUM

ABOVE AXIS BANK, BETIAHATA CHOWK, GORAKHPUR

PHONES : 6389138701, 02