

FIITJEE INTERNAL TEST

FIRST YEAR 2020-22

JEE MAINS

Time: 3 hours

Maximum Marks: 360

INSTRUCTIONS:

04th June 2020

Instructions to the Candidates

1. This Test Booklet consists of **90 questions**.
Use **Blue/Black ball Point Pen only** for writing particulars. Use Pencil for all responses in OMR sheet.
2. For each correct answer **4 Marks** will awarded and for each wrong answer **1 Mark** will be deducted.
3. Attempt all questions.
4. In case you have not darkened any bubble you will be awarded 0 mark for that question.
5. Use of calculator/logarithmic table is not permitted.

Don't write / mark your answers in this question booklet.

If you mark the answers in question booklet, you will not be allowed to continue the exam.

NAME:

ENROLLMENT NO.:

MATHEMATICS

1. The set of values of x for which $\frac{x-3}{4} - x < \frac{x-1}{2} - \frac{x-2}{3}$, $2-x > 2x-8$ is
 (A) $\left[-1, \frac{10}{3}\right]$ (B) $\left(-1, \frac{10}{3}\right)$ (C) $\left(2, \frac{15}{3}\right)$ (D) \mathbb{R}
2. The set of values of x for which $\frac{(x-1)^3(2-x)^5}{(x-3)^7} \geq 0$ is
 (A) $(-\infty, 1] \cup [2, 3]$ (B) $(-\infty, 2] \cup (3, \infty)$ (C) $(-\infty, 1] \cup [2, 4)$ (D) $(-\infty, 1] \cup [2, 3)$
3. If $a < b$, then the solution of $x^2 + (a+b)x + ab < 0$ is given by
 (A) (a, b) (B) $(-\infty, a) \cup (b, \infty)$ (C) $(-b, -a)$ (D) $(-\infty, -b) \cup (-a, \infty)$
4. The solution set of $\frac{x^2 - 3x + 4}{x+1} > 1$ is
 (A) $(3, \infty)$ (B) $(-1, 1) \cup (3, \infty)$ (C) $[-1, 1] \cup [3, \infty)$ (D) \mathbb{R}
5. If $\frac{\log x}{a-b} = \frac{\log y}{b-c} = \frac{\log z}{c-a}$, then xyz is equal to
 (A) 0 (B) 1 (C) -1 (D) 2
6. $7\log_{10} \frac{16}{15} + 5\log_{10} \frac{25}{24} + 3\log_{10} \frac{81}{80}$ equal to
 (A) $\log_{10} 2$ (B) $\log_{10} 3$ (C) $\log_{10} 5$ (D) $\log_{10} 10$
7. The set of values of x for which $\log_3(x^2 + x + 5) + \log_3(5x - x^2 - 6)$ is defined is
 (A) $[2, 3]$ (B) $(-\infty, 2] \cup [3, \infty)$ (C) $(-\infty, 2) \cup (3, \infty)$ (D) $(2, 3)$
8. If x, y, z are distinct positive numbers each different from '1' such that
 $(\log_y x \cdot \log_z x - \log_x x) + (\log_x y \cdot \log_z y - \log_y y) + (\log_y z \cdot \log_x z - \log_z z) = 0$, then the value of xyz is
 (A) 1 (B) 0 (C) -1 (D) 2
9. The value of $7^{\sqrt{\log_7 5}} - 5^{\sqrt{\log_5 7}} + 8^{\frac{1}{\log_7 8}} - 25^{\log_5 3} + \log_{0.1} \left(\frac{1}{10}\right)$ is
 (A) 0 (B) 1 (C) 2 (D) -1
10. The value of $\log_{20} 6$ lies in
 (A) $\left(\frac{1}{3}, \frac{1}{2}\right)$ (B) $\left(\frac{1}{2}, 1\right)$ (C) $(2, 3)$ (D) $(1, 2)$
11. The sum of solutions of the equation $\log_4(x^2 - 3x - 5) = \log_4(7 - 2x)$ is
 (A) 4 (B) -3 (C) 1 (D) -1

12. If $\log_{12} 27 = a$, then $\log_6 8$ is
 (A) $3\left(\frac{3+a}{3-a}\right)$ (B) $3\left(\frac{3-a}{3+a}\right)$ (C) $2\left(\frac{3-a}{3+a}\right)$ (D) $3\left(\frac{a-3}{a+3}\right)$
13. The solution set of $\frac{x^2 - 6x + 8}{\sqrt{3-x}} \leq 0$ is
 (A) $[2, 4]$ (B) $[2, 3]$ (C) $(2, 3)$ (D) $[2, 3)$
14. The number of solutions of the equation $\sqrt{\log(-x)} = \log\sqrt{x^2}$ is
 (A) 0 (B) 1 (C) 2 (D) Infinite
15. If $\log_4 5 = a$ and $\log_5 6 = b$, then $\log_3 2$ is equal to
 (A) $2ab - 1$ (B) $2ab + 1$ (C) $\frac{1}{2ab + 1}$ (D) $\frac{1}{2ab - 1}$
16. The number of integral solutions of $\frac{x+2}{x^2+1} > \frac{1}{2}$ is
 (A) 4 (B) 5 (C) 3 (D) 6
17. Solution set of the inequality $\frac{1}{2^x - 1} > \frac{1}{1 - 2^{x-1}}$ is
 (A) $(1, \infty)$ (B) $(-1, \infty)$
 (C) $\left(0, \log_2\left(\frac{4}{3}\right)\right)$ (D) $\left(0, \log_2\left(\frac{4}{3}\right)\right) \cup (1, \infty)$
18. Solution set of $\frac{(x-2)^2(x-4)^2(x-6)^2(x+4)^3(x+5)^7}{(x^2+x+1)(x^2-x+1)^9} < 0$ is
 (A) $(-\infty, -5) \cup (-4, \infty)$ (B) $(-5, -4)$
 (C) $(-5, -4) \cup (2, 4)$ (D) $(-5, -4) \cup (2, 4) \cup (4, 6)$
19. If $3^{x+1} = 6^{\log_2 3}$, then x is
 (A) 3 (B) 2 (C) $\log_2 3$ (D) $\log_3 2$
20. The set of values of x which satisfy the inequations $5x + 2 < 3x + 8$ and $\frac{x+2}{x-1} < 4$ is
 (A) $(-\infty, 1)$ (B) $(2, 3)$ (C) $(-\infty, 3)$ (D) $(-\infty, 1) \cup (2, 3)$
21. The digits of the year 2000 added to get 2
 Let $S = \{\text{set of all years whose sum of the digits is 2 upto this year 2020}\}$.
 Then $n(S) = \underline{\hspace{2cm}}$
 (A) 3 (B) 6 (C) 9 (D) 10
22. Given that $0 < a < b < c < d$ which of the following is the largest
 (A) $\frac{a+d}{b+c}$ (B) $\frac{c+d}{a+b}$ (C) $\frac{b+c}{a+d}$ (D) $\frac{a+b}{c+d}$

23. Let $E(n)$ denote the sum of even digits. For example $E(5681) = 6 + 8 = 14$.
Find $E(1) + E(2) + E(3) + \dots + E(100)$
(A) 200 (B) 360 (C) 400 (D) 900
24. If $x = \frac{1}{\frac{1}{2003} + \frac{1}{2004} + \dots + \frac{1}{2009}}$ then find the value of $[x]$, where $[x]$ is greatest integer less than or equal to x
(A) 284 (B) 285 (C) 286 (D) 287
25. If $x = \frac{(1 + \sqrt{3})^4}{4}$ then the value of $[x]$ is
(A) 13 (B) 14 (C) 15 (D) 16
26. If x and y are real number for which $|x| + x + 5y = 2$ and $|y| - y + x = 7$ then the value of $x + y$ is ____
(A) -3 (B) -1 (C) 1 (D) 3
27. If $|5 - |x - 5|| = k$ have exactly 3 solutions for x then the value of $\left\{\frac{k}{2}\right\}$ is ____ where $\{x\}$ is fractional part of x
(A) 0.3 (B) 0.4 (C) 0.5 (D) 0.6
28. In a school, all 300 students study either Geography, Biology or both Geography and Biology. If 80% study Geography and 50% study Biology then how many students study both Geography and Biology
(A) 30 (B) 60 (C) 80 (D) 90
29. How many positive integers n less than 2020 can we find such that $\left[\frac{n}{2}\right] + \left[\frac{n}{3}\right] + \left[\frac{n}{6}\right] = n$ where $[x]$ is greatest integer less than or equal to x
(A) 334 (B) 335 (C) 336 (D) 337
30. Let $p = 2^{3009}$, $q = 3^{2006}$ and $r = 5^{1003}$. Which of the following statement is true
(A) $p < q < r$ (B) $p < r < q$ (C) $q < p < r$ (D) $r < p < q$

PHYSICS

31. What is the angle between $\hat{i} + \hat{j} + \hat{k}$ and with positive x-axis?
 (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) none of these
32. Two vectors \vec{A} and \vec{B} are inclined to each other at angle θ . If $3|\vec{A} \times \vec{B}| + 4|\vec{A} \cdot \vec{B}| = 0$, then θ is
 (A) 45° (B) 53° (C) 127° (D) 0°
33. Which of the sets given below may represent the magnitudes of three vectors adding to give null vector.
 (A) 2, 4, 8 (B) 4, 8, 16 (C) 1, 2, 1 (D) 0.5, 1, 2
34. The sum and difference of two vectors \vec{A} and \vec{B} are mutually perpendicular if
 (A) \vec{A} and \vec{B} are parallel to each other and $|\vec{A}| = |\vec{B}|$
 (B) \vec{A} and \vec{B} are perpendicular to each other
 (C) \vec{A} and \vec{B} are perpendicular but their magnitudes are different
 (D) \vec{A} and \vec{B} are equal and their directions are arbitrary
35. If two forces of 20 N towards north and 12 N towards south are acting on an object. What will be resultant force?
 (A) 32 N toward north (B) 20 N towards north (C) 32 N towards south (D) 8 N towards north
36. The resultant of \vec{A} and \vec{B} makes an angle α and \vec{A} and β with \vec{B}
 (A) $\alpha < \beta$ always (B) $\alpha < \beta$ if $A < B$ (C) $\alpha < \beta$ if $A > B$ (D) $\alpha < \beta$ if $A = B$
37. A vector \vec{A} when added to the vector $\vec{B} = 3\hat{i} + 4\hat{j}$ yields a resultant vector that is in the positive y-direction and has a magnitude equal to that of \vec{B} . Find the magnitude of \vec{A}
 (A) 5 (B) 10 (C) $\sqrt{10}$ (D) $\sqrt{15}$
38. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} - \hat{k}$ then $(\vec{a} + \vec{b}) \times (\vec{a} - \vec{b})$ is
 (A) $4\hat{i} + 4\hat{j}$ (B) $-4\hat{j} + 4\hat{k}$ (C) $4\hat{j} - 4\hat{k}$ (D) $-4\hat{j} + 4\hat{i}$
39. If the vectors $\vec{P} = a\hat{i} + a\hat{j} + 3\hat{k}$ and $\vec{Q} = a\hat{i} - 2\hat{j} - \hat{k}$ are perpendicular to each other, then the positive value of a is
 (A) 3 (B) 2 (C) 1 (D) 0
40. A force $\vec{F} = 6\hat{i} + 2\hat{j} - 3\hat{k}$ acts on a particle and produces a displacement of $\vec{s} = 2\hat{i} - 3\hat{j} - x\hat{k}$. If the work done is zero, the value of x is
 (A) $-\frac{1}{2}$ (B) -2 (C) 6 (D) 5
41. A vector of magnitude 20 units is inclined at an angle of 30° with positive y-axis in the x-y plane. Then X-component of the vector has a magnitude of
 (A) 10 units (B) $10\sqrt{3}$ units (C) 20 units (D) $20\sqrt{3}$ units

42. If three unit vectors \hat{a} , \hat{b} and \hat{c} satisfy the condition, $\hat{a} - \hat{b} - \hat{c}$, then angle between \hat{a} and \hat{b} is
 (A) 30° (B) 60° (C) 90° (D) 120°
43. The resultant of two vectors \vec{a} and \vec{b} of magnitudes 9 units and 40 units has a magnitude of 41 units. Then the angle between \vec{a} and \vec{b} is
 (A) 37° (B) 53° (C) 90° (D) none of the above
44. The component (vector) of $\vec{a} = 3\hat{i} - 4\hat{j}$ in the direction of $\vec{b} = -5\hat{j}$ is
 (A) $3\hat{i} + 4\hat{j}$ (B) $4\hat{j}$ (C) $-4\hat{j}$ (D) none of the above
45. What is the angle between $(\vec{A} + \vec{B})$ and $(\vec{A} \times \vec{B})$?
 (A) 0 (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) π
46. $y = 3x^2 + 2x + 2$. Find $\left(\frac{dy}{dx}\right)$
 (A) $6x + 2$ (B) $6x$ (C) $2x + 2$ (D) none of these
47. If $y = \frac{1}{x}$, then $\frac{dy}{dx} =$
 (A) $-\frac{1}{x^2}$ (B) $\frac{1}{x^2}$ (C) x^2 (D) none of these
48. $y = \tan x - \cot x$, then $\frac{dy}{dx} =$
 (A) $\sin x + \cos x$ (B) $2\sin x + \cos x$ (C) $\sec^2 x + \operatorname{cosec}^2 x$ (D) $\tan x + \cot x$
49. If $y = x^2 + \sin x$ then $\frac{dy}{dx}$ is
 (A) $\sin x - \cos x + 2x$ (B) $2x + \cos x$ (C) $2x - \cos x$ (D) none of these
50. Value of $\tan 225^\circ$ is
 (A) 0.5 (B) -1 (C) 1 (D) none of these
51. $y = x \sin x$, then $\frac{dy}{dx} =$
 (A) $\sin x + 2x \cos x$ (B) $\sin x + x \cos x$ (C) $2\sin x + x \cos x$ (D) $2\sin x - x \cos x$
52. If $y = \tan(2x)$ then $\frac{dy}{dx} =$
 (A) $2\sec^2 2x$ (B) $\sec^2 2x$ (C) $\frac{\sec^2 2x}{2}$ (D) none of these

53. $y(x) = x^2 - 4x$. The minimum value of $y(x)$ is
(A) 0 (B) -4 (C) 4 (D) none of these
54. $y(x) = -2x^2 + 18x$. The maxima is at x equals to
(A) 2 (B) 3.5 (C) 4 (D) 4.5
55. The function $f(x) = x^2 - 3x + 2$ has
(A) 2 maxima (B) 2 minima
(C) 1 maxima, 1 minima (D) none of these
56. The function $f(x) = (x-4)(x-5)$ has a minima at $x =$
(A) 3 (B) 3.5 (C) 4 (D) 4.5
57. $\cos(A-B)$ is equal to
(A) $\sin A \cos B + \cos A \sin B$ (B) $\sin A \cos B - \cos A \sin B$
(C) $\cos A \cos B - \sin A \sin B$ (D) $\cos A \cos B + \sin A \sin B$
58. Local maximum value of $y = x^3 - 3x$ will be
(A) 2 (B) -2 (C) 1 (D) 0
59. If $y = 3x^2 + 5x + 2$ then how many local minima lie for the positive value of x
(A) 1 (B) 2 (C) 0 (D) 5
60. The difference between the local minimum values of $f_1(x) = x^2 + 5$ and $f_2(x) = x^2 + 3$ is
(A) 8 (B) 2 (C) 15 (D) $\sqrt{15}$

CHEMISTRY

61. The number of hydrogen atoms present in 51.2 gram of sucrose ($C_{12}H_{22}O_{11}$)?
 (A) 19.84×10^{23} (B) 22 (C) 9×10^{22} (D) 3.3×10^{23}
62. The formula of an acid is HXO_2 . The mass of 0.0484 moles of the acid is 3.314 gram. What is the atomic weight of X?
 (A) 35.5 (B) 80 (C) 19 (D) 71
63. Which of the following has minimum number of atoms of oxygen?
 (A) 25.6 gram of sucrose (B) 12.046×10^{23} CO_2 molecules
 (C) 0.1 mole of V_2O_5 (D) 24 gram of ozone (O_3)
64. Suppose two elements 'X' and 'Y' combine to form two compounds XY_2 and X_2Y_3 when 0.05 mole of XY_2 weighs 5 gram while 3.011×10^{23} molecules of X_2Y_3 weighs 85 gram. The atomic masses of X and Y are respectively
 (A) 20, 30 (B) 30, 40 (C) 40, 30 (D) 80, 60
65. Which of the following statements is incorrect?
 (A) Oxidation numbers of 'N' atoms in NH_4NO_3 are - 3 and + 5
 (B) $2KI + H_2O_2 \longrightarrow 2KOH + I_2$. In this reaction H_2O_2 act as oxidising agent
 (C) Molarity is independent of temperature
 (D) In CrO_5 chromium oxidation number is + 6
66. Vapour density of a compound is 14. It contains carbon and hydrogen atoms in the ratio of 1 : 2. Its molecular formula is
 (A) C_2H_2 (B) C_2H_4 (C) $C_{10}H_{22}$ (D) C_4H_8
67. For the redox reaction,
 $xMnO_4^- + yC_2O_4^{2-} + zH^+ \longrightarrow Mn^{+2} + CO_2 + H_2O$
 (x, y, z co-efficients of balanced equation) then which of the following statements is true?
 (A) Oxidation number of carbon in $C_2O_4^{2-}$ is + 4
 (B) MnO_4^- act as reducing agent
 (C) $y + z - x = 19$
 (D) The reaction is an example for disproportionation reaction
68. An aqueous solution 6.3 gram of HNO_3 is made up to 250 ml. The volume of 0.1 M KOH required to completely neutralize 10 ml of this solution is
 (A) 40 ml (B) 20 ml (C) 10 ml (D) 4 ml
69. The ratio between number of molecules in equal masses of Nitrogen and Ozone is
 (A) 12:7 (B) 7:12 (C) 7:8 (D) 8:7
70. Which of the following reaction is not decomposition reaction
 (A) $2HgO \longrightarrow 2Hg + O_2$ (B) $CH_4 + O_2 \longrightarrow CO_2 + 2H_2O$
 (C) $2KClO_3 \longrightarrow 2KCl + 3O_2$ (D) $H_2O_2 \longrightarrow H_2O + \frac{1}{2}O_2$

71. A compound contains atoms of three elements A, B and C. If the oxidation number of A is + 2, B is + 5 and that of c is – 2, the possible formula of the compound is
 (A) $A_3(BC_4)_2$ (B) $A_3(B_4C)_2$ (C) ABC_2 (D) $A_2(BC_3)_2$
72. Which of the following has the least mass
 (A) One gram atom of magnesium (B) 0.1 mole of H_2SO_4
 (C) 22.4 lit of Nitrogen gas at S.T.P (D) 6.023×10^{23} molecules of oxygen gas
73. When 0.1 mole of $BaCl_2$ is treated with 0.1 mole of Na_3PO_4 , the maximum number of moles of Barium Phosphate formed is $(Ba_3(PO_4)_2)$
 (A) 0.1 (B) 0.25 (C) 1 (D) 0.2
74. A mixture of Methane and ethylene in the volume ratio x : y has total volume of 30 ml. On complete combustion it gave 40 ml of CO_2 . If the ratio had been y : x instead of x : y. What volume of CO_2 could have been obtained
 (A) 50 ml (B) 100 ml (C) 25 ml (D) 75 ml
75. Which of the following statement is incorrect?
 (A) Oxidation number of oxygen in OF_2 is + 2
 (B) Oxidation number of hydrogen in NaH is + 1
 (C) $Cl_2 + NaOH \longrightarrow NaCl + NaClO_3$ is a disproportionation reaction
 (D) Molality is independent on temperature
76. The molarity of 0.5 N Na_2CO_3 is
 (A) 0.25 M (B) 1 M (C) 0.5 M (D) 0.125 M
77. On heating a litre of $\frac{M}{2}$ HCl solution 2.750 g of HCl is lost and the volume of solution becomes 750 ml. The molarity of resulting solution will be
 (A) 0.57 (B) 0.75 (C) 0.057 (D) 5.7
78. For the reaction, $Cr_2O_7^{2-} + I^- + H^+ \longrightarrow Cr^{+3} + I_2$
 The incorrect statement(s) in the balanced equation is
 (A) Stoichiometric co-efficient of H^+ is 10
 (B) Iodine is oxidised
 (C) In $Cr_2O_7^{2-}$, chromium oxidation stated is + 6
 (D) H_2O is one of the product
79. 15 ml of gaseous hydrocarbon required 45 ml of oxygen for complete combustion and 30 cm^3 of carbondioxide is fomed. The formula of the hydrocarbon is
 (A) C_3H_6 (B) C_2H_2 (C) C_4H_{10} (D) C_2H_4
80. The volume of 0.5 M H_2SO_4 required to dissolve 6.15 g of $CuCO_3$
 (A) 80 ml (B) 120 ml (C) 100 ml (D) 200 ml

81. An organic compound was analysed to give the following percentage composition by mass, C = 40%, H = 6.67 %, O = 53.33%. What can be the molecular formula of the compound
(A) $C_6H_{12}O_6$ (B) CH_3COOH (C) CH_3CHO (D) C_2H_5OH
82. A regular cube of metal measures exactly 10 cm on an edge and has density 8 gm/cc. If the cube contains 6×10^{25} atoms of the metal, then atomic weight of metal can be approximately _____
(A) 70 (B) 120 (C) 80 (D) 100
83. Find the empirical formula of a compound containing Fe, S and O in mass ratio 7 : 6 : 12
(A) $FeSO_4$ (B) $Fe_2S_2O_3$ (C) $Fe_2S_2O_7$ (D) $Fe_2S_3O_{12}$
84. The atomic masses of two elements A and B are 30 and 90 respectively. If 'a' gm of element A contains 'b' atoms, then number of atoms of B in '2a' gm is
(A) $\frac{2b}{3}$ (B) $\frac{3b}{2}$ (C) $\frac{b}{3}$ (D) $\frac{b}{4}$
85. (Mass/V) percentage and density of ethanol is 45% and 0.925 g/ml. Then mole fraction of solute and molality of solution are respectively
(A) 0.27 & 2.04 m (B) 0.27 & 20.4 m (C) 0.73 & 20.4 m (D) 2.7 & 20.4 m
86. SO_2Cl_2 (Sulphuryl chloride) reacts with water to give a mixture of H_2SO_4 and HCl. What volume of 0.25 M $Ba(OH)_2$ is required to neutralise completely 25 ml of 0.2 M SO_2Cl_2 solution
(A) 100 ml (B) 300 ml (C) 400 ml (D) 450 ml
87. 20 % pure, 80 g of NH_4NO_3 solid decomposes at high temperature to give nitrogen, oxygen and water. The mass of CH_4 that can be burnt completely by oxygen liberated from NH_4NO_3
(A) 2.1 g (B) 1.2 g (C) 10 g (D) 1 g
88. 4g of H_2SO_4 is required for complete neutralisation of 4g of a mixture of $CaCO_3$ and $MgCO_3$. What can be the mole fraction of $CaCO_3$ in the mixture
(A) 0.21 (B) 0.41 (C) 0.5 (D) 0.11
89. 50 ml of 5.6% KOH (W/V) is added to 50 ml of 5.6% HCl (W/V) solution. The resulting solution will be
(A) neutral (B) alkaline (C) acidic (D) none
90. It requires 20 ml of 1 M X^{3+} to titrate 10 ml of Sn^{+2} to Sn^{+4} . What is oxidation state of 'X' in the product
(A) + 1 (B) + 3 (C) + 2 (D) + 4

❖ *Wish You^{o/s} all the Best* ❖