FIITJEE

Maharashtra Science Talent Search Examination

(only for Maharashtra State Students)

SAMPLE PAPER

Code	1002

Time: 180 minute (10:00 am - 01:00 pm) **Maximum Marks: 270**

Please read the instructions carefully. Additional 30 minutes (09:30 am - 10:00 am) will be provided for Reading the Examination Instructions and filling up the information on the ORS Sheet.

INSTRUCTIONS

A: General :

1. Please check this Question Paper contains all 90 questions in serial order. If not so, exchange for the correct Question Paper Booklet.

2. Please Immediately fill in the particulars on this page of the Test Booklet with Blue/Black Ball point pen.

3. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed.

4. The answer sheet, a machine-gradable Objective Response Sheet (ORS) is provided separately.

5. Do not Tamper/mutilate the **ORS** or this booklet.

6. No additional sheets will be provided for rough work.

7. On completion of this test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. *However, the candidates are allowed to take away this Test Booklet with them.*

B: Questions paper format & Marking Schema:

1. The question paper consists of **FOUR** Parts:**PART I** (IQ), **II** (Physics), **III** (Chemistry), **IV** (Mathematics)

2. PART I contains **30**single choice correct type questions. Each question has four choices (A), (B), (C) and (D) of which one and only one is correct.

3. PART II, III and IV each has got **20**single choice correct type questions in Physics. Each question has four choices (A), (B), (C) and (D) of which one and only one is correct.

4. **You are advised to devote 1 hour on PART I and 2 hours on PART II, III & IV.**

5. For each question, in all four PARTs**,** you will be awarded **3 marks** if you darken the bubble corresponding to the correct answer **ONLY** and **zero (0) marks** if no bubbles are darkened. In all other cases, **minus one (−1) mark** will be awarded.

Registration No. :

Name of Candidate : _____

Test Centre: _____

PART – I: IQ

SECTION A   **Single Correct Choice Type**

Each question has 4 choices (A), (B) (C) and (D) for its answer, out of which **ONLY ONE** is correct.

1. In a Certain code language 'me lo po' means 'Anu weds Vinay' and 'Pe to Lo' means 'Vinay come here', which word in that language means 'come' ?
(A) Pe   (B) to
(C) me   (D) either (a) or (b)

2. Find the next term in the series
A, Z, D, Y, G, X, ? , ?
(A) W, J   (B) J, W
(C) W, K   (D) K, W

3. Find the next term in the series
A, D, E, H, I, L, ?, ?
(A) M, P   (B) M, N
(C) M, O   (D) M, Q

4. U, B, I, P, W, ?
(A) D   (B) F
(C) Q   (D) Z

5. What was the day on 2nd July 1984?
(A) Wednesday   (B) Tuesday
(C) Monday   (D) Thursday

6. If the day after tomorrow is a Sunday, what was it day before yesterday?
(A) Wednesday   (B) Thursday
(C) Friday   (D) Saturday

Directions (Q. No 7 to 9)
Read the following information carefully and answer the questions which follow
(i)   'P x Q' means 'P is brother of Q
(ii) 'P – Q' means 'P' is mother of Q
(iii) 'P + Q' means 'P' is father of Q
(iv) 'P ÷ Q' means 'P is sister of Q

7. Which of the following means 'm' is niece of N' ?
(A) M x R – N   (B) N ÷ J + M ÷ D
(C) N ÷ J + M   (D) N x J – M

8. Which of the following means 'B' is the grandfather of F' ?
(A) B + J – F   (B) B – J + F
(C) B x T – F   (D) B ÷ T + F
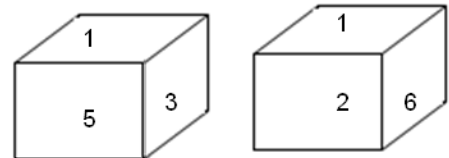
SPACE FOR ROUGH WORK

9. How is M related to K in the expression 'B + K ÷ T x M' ?
    (A) Son   (B) Daughter
    (C) Son or Daughter   (D) cannot be determined

10. How many triangles are there in the given figure?
    (A) 28   (B) 24
    (C) 25   (D) 26

11. By looking in a mirror, it appears that it is 6.30 in the clock. What is the real time?
    (A) 6:30   (B) 5:30
    (C) 6:00   (D) 5:50

12. A watch reads 4:30. If the minute hand points east, in which direction will the hour hand point?
    (A) South - East   (B) North - East
    (C) North   (D) North West

13. Of the five villages P, Q, R, S, and T situated close to each other, P is the west of Q, R is to the south of P, T is to the north of Q and S is to the east of T. Then in which direction R is with respect to S?
    (A) North-East   (B) South-East
    (C) North-West   (D) none of these

14. 1, 0, 5, 8, 17, 24, 37 ?
   (A) 40   (B) 43
    (C) 50   (D) none of these

Directions (Q. No 15 to 16)
In each of the following questions one of the terms in the number series in wrong. Find out the wrong term
15. 3, 10, 19, 30, 42, 58, 75
    (A) 10   (B) 42
    (C) 19   (D) 58

16. 3, 4, 9, 33, 136, 685, 4116
    (A) 33   (B) 136
    (C) 9   (D) 685

17. How many times do the hands of a clock coincide in a day?
    (A) 24   (B) 22
    (C) 21   (D) 20

18. What number will come at the opposite of 1 in the following dice?
    (A) 4   (B) 5
    (C) 3   (D) 2

SPACE FOR ROUGH WORK

19.
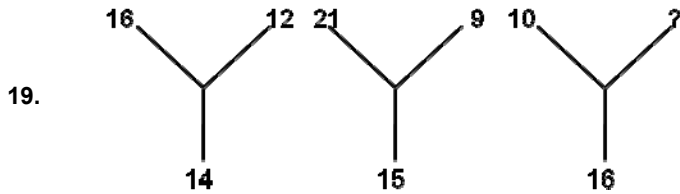
(A) +21	(B) 12
(C) 32	(D) 22

20. A clock buzzes 1 time at 10 clock, 2 times at 2' clock 3 times at 3' o clock and so on. What will be the total number of buzzer in a day?

(A) 150	(B) 100
(C) 78	(D) none of these

21. In the certain code RABBIT is RBDEMY then HBRSISY is the code of

(A) HAPPENS	(B) HATTERS
(C) HAPPINESS	(D) HAMBUGS

22. How is my sister's husband's father's wife's only daughter in law's father related to me?

(A) Brother	(B) Uncle
(C) Father	(D) none of these

Directions (Q. No 23 to 24)
These questions are based on the following information
Five men A, B, C, D and E read a newspaper the one who reads first give it to C. The one reads last had taken it from A. E was not the first or the last to read. There are two readers between B and A

23. B passed the newspaper to whom?

(A) A	(B) D
(C) E	(D) none of these

24. Who reads the newspaper last?

(A) A	(B) C
(C) B	(D) none of these

SPACE FOR ROUGH WORK

Directions (Q. No 25 to 28)
A cube of 4 cm has been painted on its surfaces in such a way that two opposite surfaces have been painted blue and two adjacent surfaces have painted red. Two remaining surfaces have been left unpainted. Now the cube is cut into smaller cubes of side 1cm each

25. How many cubes will have none of the sides' painted?
    (A) 18   (B) 16
    (C) 22   (D) 8

26. How many cubes will have at least red colour on its surfaces?
    (A) 20   (B) 22
    (C) 28   (D) 32

27. How many cubes will have atleast blue colour on its surfaces?
    (A) 20   (B) 8
    (C) 24   (D) 32

28. How many cubes will have only two surfaces painted with red and blue colors respectively?
    (A) 8   (B) 12
    (C) 24   (D) 30

29. A professor by mistake forgot to write the multiplication sign between 2 three digit number (So he wrote a six digit number on the board) He ask his student to find the initial 2 three digit numbers but gave a hint that the written six digit number interestingly was seven times bigger than actual product of those 3 digit numbers then the sum of the initial 2 three digit number is
    (A) 286   (B) 252
    (C) 734   (D) 526

30. ab, cd, ef and gh are four two digit number such that their sum is 256. All the digits from 1-9 are used in this. Which digit from 1-9 is not used in the sum if all a, b, c, d, e f, g, h are distinct digits
    (A) 3   (B) 5
    (C) 7   (D) none of these

SPACE FOR ROUGH WORK

PART – II: Physics

Each question has 4 choices (A), (B) (C) and (D) for its answer, out of which **ONLY ONE** is correct.

31. A force of 5N acts on a body of weight 9.8N. What is the acceleration produced in m/s^2?
(A) 49
(B) 5
(C) 1.96
(D) 0.91

32. A body of mass 5 kg is supported by a light cord. Find the tension on the cord. (g = $10m/s^2$)
(A) 20 N
(B) 30 N
(C) 50 N
(D) 40 N

33. A bullet of mass 0.04 kg moving with a speed of 90 m/s enters a wooden block and is stopped after a distance of 60 cm. The average resistive force exerted by the block on the bullet is
(A) 100 N
(B) 270 N
(C) 50 N
(D) 290 N

34. A body of mass 0.05 kg is observed to fall with an acceleration of $9.5\ m/s^2$. The resistive force by air on the body is $\left(g = 9.8\ m/s^2\right)$
(A) 0.015 N
(B) 0.15 N
(C) 0.030 N
(D) zero

35. A lift is moving upwards with uniform velocity v in which a body of mass m is lying. The frictional force offered by the block when coefficient of the frictional is μ will be.
(A) zero
(B) mg
(C) μ mg
(D) 2μmg

36. A body of mass 2 kg is projected vertically upwards with a speed of 3 m/s. The maximum gravitational potential energy of the body is:
(A) 18 J
(B) 45 J
(C) 9 J
(D) 2.25 J

37. Work done by force of friction can be
(A) Positive
(B) negative
(C) Zero
(D) all the above

38. An electric meter creates a tension of 4500 N in hosting a cable and reels it at a rate of 2 m/s. The power of the meter is.
(A) 25 kw
(B) 9 kw
(C) 225 kw
(D) 90 kw

39. Two particles of masses 1 kg & 4 kg have equal KEs. What is the ratio of their speeds?
(A) 2 : 1
(B) 4 : 1
(C) 8 : 1
(D) 16 : 1

SPACE FOR ROUGH WORK

FIITJEE Limited, FIITJEE House, 29-A, Kalu Sarai, Sarvapriya Vihar, New Delhi- 110 016, Ph 011 46106000, 26569493 Fax: 26513942
MSTSE Helpline (Mumbai 022-42738100) (Thane: 022-41617777) (Vashi 022-41581500) (Pune: 020-41418686) (Nagpur: 0712-6454947)
Web: www.fiitjee.com ●MSTSE Website:http://mstse.fiitjee.com

40. When a ball is dropped from a height of 40 cm, it rebounds to a height of 16 cm. What is the percentage loss of energy?
(A) 40%
(B) 60%
(C) 50%
(D) none of these

41. Joule/Coulomb is same as
(A) Watt
(B) Volt
(C) Ampere
(D) Ohm

42. A voltmeter is used to measure.
(A) Potential difference
(B) electric current
(C) Electric Power
(D) Resistance

43. On which of the following no 'plus' or 'minus' sign is marked?
(A) Cell
(B) ammeter
(C) Voltmeter
(D) resistors

44. A current of 1.5 A flow through a wire of $8\,\Omega.$ Find the amount of heat produced in 10 s.
(A) 90 J
(B) 180 J
(C) 270 J
(D) 360 J

45. A 12 V battery connected to a bulb carries a current of 2A through it. Find the energy supplied by the battery in 10 minutes.
(A) 1.44 kJ
(B) 14.4 kJ
(C) 144 kJ
(D) none of these

46. A magnetic field line is used to find the direction of?
(A) South-North
(B) bar magnet
(C) Compare needle
(D) magnetic field

47. The magnetic field lines due to a long straight wire carrying a current are.
(A) Straight
(B) Circular
(C) Parabolic
(D) elliptical

48. Which of the following describes the common domestic power supplied in India?
(A) 220V, 100 Hz
(B) 110V, 100 Hz
(C) 220V, 50 Hz
(D) 110V, 50 Hz

49. Which of the following particles will describe the largest circle when projected with the same velocity perpendicular to a magnetic field?
(A) e^-
(B) P^+ (proton)
(C) He^+
(D) Li^+

50. The potential at a point is 10V. The work done in bringing a charge of 0.5C from infinity to the point will be
(A) 20 J
(B) 10 J
(C) 5J
(D) 40 J

SPACE FOR ROUGH WORK

PART – III: Chemistry

Each question has 4 choices (A), (B) (C) and (D) for its answer, out of which **ONLY ONE** is correct.

51.   Which of the following weighs the least?
      (A) 24 gram of magnesium
      (B) 0.9 moles of nitric oxide
      (C) 22.4 litres of N_2 at STP
      (D) 6.02×10^{24} molecules of oxygen

52.   The ions present in the aqueous solution of potash alum are
      (A) NH_4^+, Al^{3+}, SO_4^{2-}
      (B) K^+, Al^{3+}, SO_4^{2-}
      (C) K^+, NH_4^+, SO_4^{2-}
      (D) K^+, Al^{3+}, CO_3^{2-}

53.   Select the wrong statement
      (A) Aqueous solution of NaCl is called true solution.
      (B) Milk is an example of homogeneous solution
      (C) Amorphous solids are isotropic in nature.
      (D) Crystalline solids have sharp melting point.

54.   When alpha particles are sent through a thin metal foil, most of them go straight through the foil because
      (A) alpha particles are much heavier than electrons
      (B) alpha particles are positively charged
      (C) most part of the atom is empty space
      (D) alpha particles move with very high velocity

55.   Formula of sulphide of X is X_2S_3, and formula of chloride of Y is YCl_2. then the formula of the oxide when both the elements X and Y combined with oxygen?
      (A) XY_2O_4
      (B) X_2YO_4
      (C) X_2YO_3
      (D) XYO_3

56.   Nucleus of an atom contains 25% more neutrons than protons. Number of electrons present in its di positive ion contains 50% of protons. Then the correct representation of that atomic nuclide ($_z^AX$ where X is the symbol of the element and Z= number of protons, A= number of protons and neutrons)
      (A) $_4^9Be$
      (B) $_6^{12}C$
      (C) $_3^7Li$
      (D) $_8^{16}O$

SPACE FOR ROUGH WORK

57. Which of the following aqueous salt solution P^H will be greater than 7
   (A) Na_2SO_4 (B) NH_4Cl
   (C) CH_3COONa (D) $NaCl$

58. The correctly balanced coefficients for the following reaction will be $FeS_2 + O_2 \rightarrow Fe_2O_3 + SO_2$
   (A) 2, 1, 1, 4   (B) 2, 3, 2, 4
   (C) 4, 4, 2, 2   (D) 4, 11, 2, 8

59. If the ionic product of water (Kw) is equal to 10^{-18} at low temperature , then the nature aqueous solution whose pH is 8 will be
   (A) Acidic   (B) Basic
   (C) Neutral   (D) Data insufficient

60. The following reaction is an example of a $4\ NH_{3\ (g)} + 5\ O_{2\ (g)} \rightarrow 4\ NO_{(g)} + 6\ H_2O_{(g)}$

   (i) Displacement reaction   (ii) Combination reaction
   (iii) Redox reaction   (iv) Neutralization reaction
   (A) (i) and (iv)   (B) (ii) and (iii)
   (C) (i) and (iii)   (D) (iii) and (iv)

61. Ortho phosphoric acid is
   (A) Monobasic   (B) Dibasic
   (C) Tribasic   (D) Tetra basic

62. 18g of glucose ($C_6H_{12}O_6$) contains
   (A) 3.022×10^{23} Molecules of glucose
   (B) 12 g of hydrogen
   (C) Same number of carbon, hydrogen and oxygen atoms
   (D) 40% of carbon

63. Which of the following is incorrect statement?
   (A) Mixture of NaCl and camphor separated by sublimation
   (B) Constituents of milk separated by centrifugation
   (C) Mixture of acetone and water separated by distillation
   (D) Immiscible liquids are separated by centrifugation

SPACE FOR ROUGH WORK

64. Which of the following are combination reactions?

(i)　　$2KClO_3 \xrightarrow{\text{heat}} 2KCl + 3O_2$

(ii)　　$MgO + H_2O \rightarrow Mg(OH)_2$

(iii)　$4Al + 3O_2 \rightarrow 2Al_2O_3$

(iv)　$Zu + FeSO_4 \rightarrow ZnSO_4 + Fe$

(A) (i) and (iii)　　　　　　　　　　　　(B) (iii) and (iv)
(C) (ii) and (iv)　　　　　　　　　　　　(D) (ii) and (iii)

65. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following is (are) true about slaking of lime and the solution formed?
(1) It is an endothermic reaction
(2) It is an exothermic reaction
(3) The pH of the resulting solution will be more than seven
(4) The pH of the resulting solution will be less than seven
(A) 1, 2　　　　　　　　　　　　　　　　(B) 2, 3
(C) 1, 4　　　　　　　　　　　　　　　　(D) 3, 4

66. Which among the following is acid?
(A) NaOH　　　　　　　　　　　　　　　(B) NH_4OH

(C) $Mg(OH)_2$　　　　　　　　　　　　　(D) $B(OH)_3$

67. Cake does not taste bitter due to presence of t?
(A) Sodium carbonate　　　　　　　　　(B) Tartaric acid
(C) Citric acid　　　　　　　　　　　　　(D) Sugar

68. The chemical species X and Y combine together to form a product P which contains both X and Y
　$X + Y \rightarrow P$
X and Y cannot be broken down into simpler substance by simple chemical reactions. Which of the following concerning the species X, Y and P are correct?
(i)　P is a compound
(ii)　X and Y are compounds
(iii)　X and Y are elements
(iv)　P has a fixed composition
(A) i, ii, iii　　　　　　　　　　　　　　　(B) i, ii, iv
(C) ii, iii, iv　　　　　　　　　　　　　　(D) i, iii, iv

69. Which of the following gases can be used for storage of fresh sample of an oil for a long time?
(A) Carbon dioxide or oxygen　　　　　(B) Nitrogen or Oxygen
(C) Carbon dioxide or helium　　　　　(D) Helium or Nitrogen

70. Which of the following solutions will have pH close to 1.0?
(A) 100 mL of 0.1 M HCl + 100 mL of 0.1 M NaOH　　(B) 55 mL of 0.1 M HCl + 45 mL of 0.1 M NaOH
(C) 10 mL of 0.1 M HCl + 90 mL of 0.1 M NaOH　　　(D) 75 mL of 0.1 M HCl + 25 mL of 0.1 M NaOH

SPACE FOR ROUGH WORK

PART – III: Mathematics

Each question has 4 choices (A), (B) (C) and (D) for its answer, out of which **ONLY ONE** is correct.

71. The value of $\sqrt{7 - 3\sqrt{5}}$ is equal to

(A) $\sqrt{7} - 2\sqrt{3}$

(B) $\dfrac{3 - \sqrt{5}}{\sqrt{2}}$

(C) $\dfrac{\sqrt{3} - \sqrt{7}}{2\sqrt{2}}$

(D) $\dfrac{\sqrt{5} + \sqrt{2}}{3}$

72. Find the smallest number which when divided by 8 or 13 leaves remainder of 5 in each case

(A) 104

(B) 213

(C) 70

(D) 109

73. If $\dfrac{\cos\theta - \sin\theta}{\cos\theta + \sin\theta} = \dfrac{1 - \sqrt{3}}{1 + \sqrt{3}}$ then acute angle $'\theta'$ is

(A) 30^0

(B) 45^0

(C) 60^0

(D) none

74. A dealer sells a toy for Rs 39 and gains as much percent as the cost price of the toy. Then cost price of the toy is

(A) 30 Rs

(B) 24 Rs

(C) 26 Rs

(D) 43 Rs

75. $\dfrac{\sin 30^0 - \sin 90^0 + 2\cos^0}{\tan 30^0 . \tan 60^0}$ is equal to

(A) $\dfrac{1}{2}$

(B) $\dfrac{3}{2}$

(C) $\sqrt{3}$

(D) $\dfrac{1}{3}$

76. The rain water from a roof of 22m x 20m drains into cylindrical vessel having diameter of base 2m and height 3.5 m. If the vessel is just full. Then rain fall in (cm) is.

(A) 2 cm

(B) 2.5 cm

(C) 3 cm

(D) 5 cm

77. Solve for 'x' $\sqrt{\left(\dfrac{4}{7}\right)^{x+4}} = \dfrac{7}{4}$

(A) 3

(B) -2

(C) $\dfrac{1}{6}$

(D) -6

SPACE FOR ROUGH WORK

78. If the roots of the quadratic equation $x^2 + px + q = 0$ are $\tan 30^0$ and $\tan 15^0$ respectively then the value of $2 + q - p$ is

(A) 0   (B) 1

(C) 2   (D) 3

79. If $A + B = 45^0$ then $(1 + \tan A)(1 + \tan B)$ is equal to

(A) 0   (B) 1

(C) -1   (D) 2

80. Three circles of radii 1 cm each are drawn in an equilateral triangle $\triangle ABC$ such that all the circles touch one another. Find the area of the triangle.

(A) $2\sqrt{3}$

(B) $16\sqrt{3}$

(C) $2\sqrt{3} + 3$

(D) $4\sqrt{3} + 6$
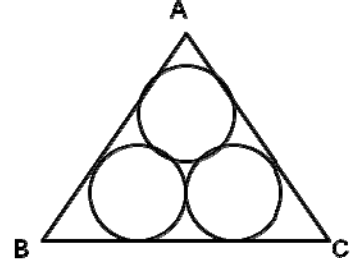
81. In $\triangle ABC$ and PQ is a straight line meeting AB in P and AC in Q. If AP = 1cm, PB = 3 cm, AQ = 1.5 cm, QC = 4.5 cm then $\text{ar}(\triangle ABC)$ is

(A) $3\,\text{ar}(\triangle APQ)$ (B) $9\,\text{ar}(\triangle APQ)$

(C) $8\,\text{ar}(\triangle APQ)$ (D) $16\,\text{ar}(\triangle APQ)$

82. I am three times as old as my son. Five years later, I shall be two and a half times as old as my son. How old is my son?

(A) 15 yrs   (B) 30 yrs

(C) 20 yrs   (D) 10 yrs

83. If $a + b + c = 0$ then $x^{a^2/bc} \cdot x^{b^2/ca} \cdot x^{c^2/ab}$ is equal to

(A) 0   (B) x

(C) x^3 (D) x^2

84. If $x = r\cos\alpha\cos\beta\cos\gamma$, $y = r\cos\alpha\cos\beta\sin\gamma$ $z = r\sin\alpha\cos\beta$ and $\mu = r\sin\beta$ then $x^2 + y^2 + z^2 + \mu^2$ is equal to

(A) 1   (B) 0

(C) r^4 (D) r^2

SPACE FOR ROUGH WORK

85. If the ratio of the roots $x^2 + bx + c = 0$ and $x^2 + qx + r = 0$ are the same, then

(A) $r^2c = qb^2$

(B) $r^2b = qc^2$

(C) $rb^2 = cq^2$

(D) $rc^2 = bq^2$

86. The value of 'b' in $3 + \sqrt{27} + \sqrt{75} = 3 + b\sqrt{3}$

(A) 3

(B) 8

(C) 5

(D) 7

87. If $\left(\dfrac{x}{x+3} \right)^3 = \dfrac{x-3}{x+6}$ then 'x' is

(A) $\dfrac{-3}{2}$

(B) 1

(C) -1

(D) $\dfrac{2}{3}$

88. Find the ratio of the areas of the regular hexagons inscribed in and circumscribed around a circle of radius 10 cm.

(A) 3:1

(B) 1:3

(C) 3:4

(D) 4:3

89. A conical vessel of radius 6 cm and height 8 cm is completely filled with water. A sphere is lowered into water and its size is such that when it touches the sides. It is just immersed. Then radius of the sphere is.

(A) 2

(B) 3

(C) 4

(D) $\dfrac{3}{2}$

90. If the equations $ax + by = 1$, $cx^2 + dy^2 = 1$ have only one solution then $\dfrac{a^2}{c} + \dfrac{b^2}{d}$ is equal to

(A) 1

(B) -1

(C) 0

(D) 2

SPACE FOR ROUGH WORK