STUDY VAULT
committed to excellence

Class – X

ENTRANCE TEST CUM SCHOLARSHIP (SAMPLE PAPER-2)

[Time: 3 Hours] [Max Marks: 450]

A. General:

1. *This booklet is a Question Paper containing 150 questions.*
2. *Blank Papers, Clipboards, Log Tables, slide rules, calculators, cellular phones and electronic gadgets in any form are not allowed to be carried inside the examination hall.*
3. *The answer sheet, a machine-readable optical mark recognition sheet (OMR Sheet), is provided separately.*
4. *DO NOT TAMPER WITH THE OMR OR THE BOOKLET.*
5. *Please fill your roll number correctly in the OMR sheet (answer sheet).*
6. *Both Question Paper and OMR Answer Sheet will be submitted after completion of this examination.*

B. Question Paper Format and marking scheme:

1. *The Question Paper consists of five parts (Part I: MAT, Part II: Physics, Part III: Chemistry, Part IV: Mathematics).*
2. *Each Question carries +3 marks for correct answer and -1 mark for incorrect answer.*

MAT

1. In a certain code, 'PLEADING' is written as 'CHMOQMFB'. How is 'SHOULDER' written in that code?

(a) KCDQTIPV (b) QDCKVPIT (c) KCDQTIPV (d) TIPVQDCK

2. Which group of letter is different from others?

(a) PBQTX (b) DRYSN (c) MEWGN (d) CGHKV

3. In the following letter sequence, some of the letters are missing. These are given in order as one of the alternatives below. Choose the correct alternative.

_ b b c a _ b c c a _ a c _ a _c b

(a) abcba (b) acbab (c) bacab (d) bcaab

4. Find the next number in the sequence.

30, 120, 350, 720, ?

(a) 1150 (b) 1300 (c) 1200 (d) 1342

Directions (Q. Nos. 5-9) Read the following information carefully and answer the questions given below.

A, B, C, D, E, F and G are sitting around a circle facing at the centre having dinner not necessarily in same order. E is neighbour of A and D. G is not between F and C. F is to the immediate right of A.

5. Which of the following is not have the pair of persons sitting adjacent to each other?

(a) BA (b) CB (c) DE (d) GD

6. Which of the following pairs has the second person sitting immediately to the right of the first?

(a) AB (b) CB (c) EA (d) GC

7. What is the position of F?

(a) Third to the left of C (b) Second to the right of C

(c) To the immediate left of A (d) None of the above

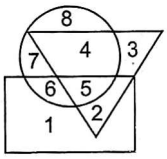
8. Who are the neighbours of B?

(a) A and B (b) C and D (c) F and C (d) None of these

9. Which of the following persons are sitting adjacent to each other from left to right in the order as shown?

(a) BGC (b) FBC (c) CDG (d) EDG

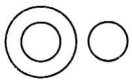
10. In the figure, triangle represents doctors, the circle represents players and rectangle represents artists.



Then, which number represents doctors who are neither players nor artists?

(a) 2 (b) 3 (c) 4 (d) 5

11. Which of the following diagram/set indicate the relation between citizen, educated and men?

(a)  (b)  (c)  (d) 

12. Question given below has a problem and two Statements I and II. Decide, if the information given in the statements is sufficient to answer the problem. Among Maddy, Nittu, Dev, Pinku and Kunal, who earns more than only the least earner among them

Statements

I. Nittu earns more than Maddy and Pinku but less than only Dev.

II. Maddy earns more than Pinku who earns less than Kunal.

(a) Data in Statement I alone is sufficient

(b) Data in Statement II alone is sufficient

(c) Data in both statements together is sufficient

(d) Data in both statements together is not sufficient

13. In question, the five letters represent five different digits. What are the actual figures? If there is no zero?

L M N K
+ M K N L
N N M A

(a) L = 4, M = 6, N = 2, K = 3, A = 7 (b) L = 6, M = 5, N = 2, K = 8, A = 7

(c) L = 4, M = 2, N = 6, K = 3, A = 7 (d) L = 6, M = 4, N = 7, K = 9, A = 2

14. Find the missing term in the series.

2, 4, 2, 6, 3, 12, ?, 40

(a) 8 (b) 6 (c) 11 (d) 5

15. In a group of cows and hens, the number of legs are 14 more than twice the number of heads. The number of cows is

(a) 5 (b) 7 (c) 10 (d) 12

16. What is the product of all the number in the dial of a telephone?

(a) 1,58, 480 (b) 1, 59, 450 (c) 1, 40, 680 (d) None of these

17. At the end of a business conference, the ten people present, all shake hands with each other once. How many hand shakes will there be all together?

(a) 60 (b) 45 (c) 55 (d) 90

18. Mohan is facing East. He turn 100° in the clockwise direction and then 145° in the anti-clockwise direction. Which direction is Mohan facing now?

(a) East (b) North-East (c) North (d) North-West

Directions (Q. Nos. 19-20) Take the given statement(s) are true and decide which of the conclusions logically follows from the statements.

19. **Statements** All desks are chairs. No chair is a table. Some tables are fans. Some fans are chairs.
Conclusions

I. Some desks are tables. II. Some fans are desks.

III. No desks is a table.

(a) Only Conclusion I follows (b) Only Conclusion II follows

(c) Only Conclusion III follows (d) All conclusions follow

20. **Statements** All vegetables are fruits. No vegetables are cereals. All cereals are fruits. Some cereals are healthy.

Conclusions

I. Some fruits are healthy.

II. No vegetable is healthy.

III. All healthy are fruits.

(a) Only Conclusion I follows

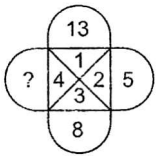
(b) Only Conclusion II follows

(c) Only Conclusion III follows

(d) Both Conclusions II and III follow

Directions (Q. Nos. 21-23) Find the missing number in the following questions.

21.

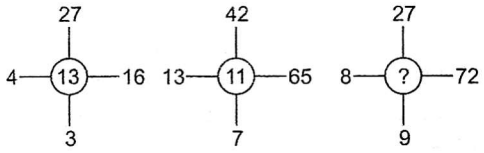


(a) 10 (b) 11 (c) 12 (d) 13

22.

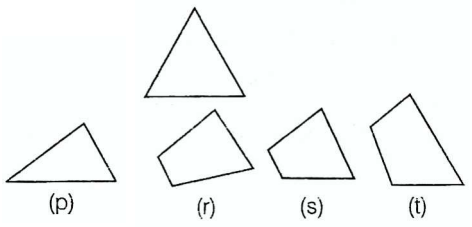
(a) 5 (b) 125 (c) 625 (d) 156

23.



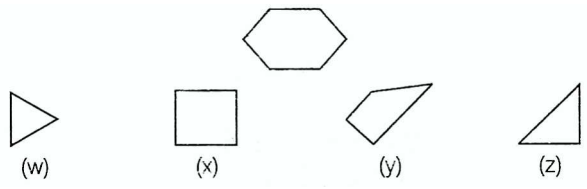
(a) 6 (b) 9 (c) 12 (d) 18

24. Identify which among the pieces given below will not be required to complete the triangular pattern shown below?



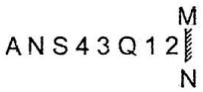
(a) p (b) t (c) r (d) s

25. A pattern is given below. You have to identify which among the following pieces will not be required to complete the pattern?



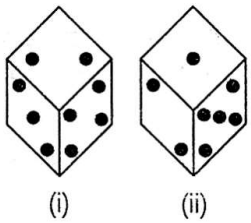
(a) w (b) x (c) y (d) z

26. Choose the alternative which is closely resembles the mirror image of the given combination.



(a) ANS43Q12 (b) S12Q43ANS (c) ANS43Q12 (d) 12Q43ANS

27. A dice is rolled twice and the two positions are shown in the figure below. What is the number of dots at the bottom face when the dice is in position (i)?



(a) 1 (b) 5

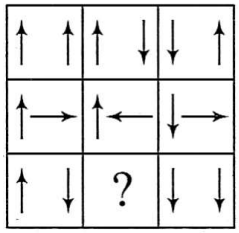
(c) 6 (d) cannot be determined

28. There are 40 boys and girls arranged in a queue in the decreasing order of their height. If Ranvijay is at 17th position and there are 9 boys ahead of him, then total boys behind Ranvijay, if there are 17 girls in total are

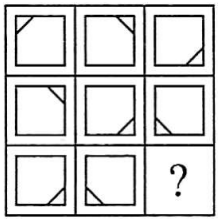
(a) 10 (b) 13 (c) 12 (d) 17

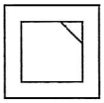
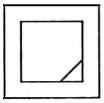
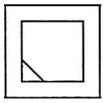
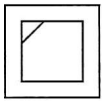
Directions (Q. Nos. 29-30) Which figure will replace the 'question mark' from the options to complete the figure?

29. **Problem Figures**



(a)  (b)  (c)  (d) 

30. 

(a)  (b)  (c)  (d) 

PHYSICS

31. An observer moves in a perpendicular direction to the normal of a stationary plane mirror at a speed of 4 m s^{-1}. The speed of image with respect to mirror is _____ .

(a) 0 m s^{-1} with respect to the mirror (b) 4 m s^{-1} towards the mirror

(c) 4 m s^{-1} away from the mirror (d) 4 m s^{-1} parallel to the mirror

32. _____ is independent of size and shape of a conductor.

(a) Resistance (b) conductance (c) Resistivity (d) it cannot be said

33. A convex mirror is used

(b) by a dentist

(b) for shaving

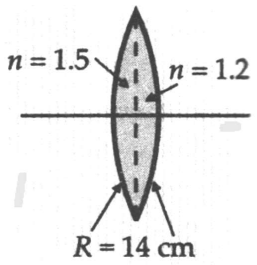
(c) as a rear view mirror in vehicles

(d) as a light reflector for obtaining a parallel beam of light

34. A battery of e.m.f. ξ, and internal resistance 'r', gives a current of 0.5 A with an external resistor of 12 ohm and a current of 0.25 A with an external resistor of 25 ohm. Calculate emf of the cell.

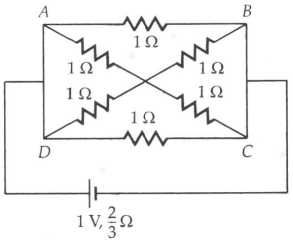
(a) 4 v (b) 6.5 v (c) 8 v (d) 9 v

35. A bi-convex lens is formed with two thin plano-convex lenses as shown in the figure. Refractive index n of the second lens is 1.2. Both the curved surfaces are of the same radius of curvature, R = 14 cm. For this bi-convex lens, for an object distance of 40 cm, the image distance will be



(a) –280.0 cm (b) 40.0 cm (c) 21.5 cm (d) 13.3 cm

36. Find the current drawn from a cell of emf 1 V and internal resistance 2 / 3Ω connected to the network given below.



(a) 1A (b) 0.5 A (c) 0.1 A (d) 2 A

37. Astigmatism can be rectified by a suitable ..... lens.

(a) concave (b) convex (c) cylindrical (d) None of the above

38. Which of the following statements is true?

(a) In tree type distribution of electric power, fuses are present only on the main board

(b) In ring type distribution of electric power, there is an individual fuse for each appliance

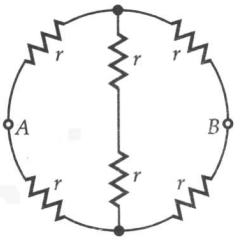
(c) Ring type distribution of electric power is advantageous than the tree type distribution

(d) All the above

39. A spherical surface of radius of curvature R separates air (refractive index 1.0) from glass (refractive index 1.5). The centre of curvature is in the glass. A point object P placed in air is found to have a real image Q in the glass. The line PQ cuts the surface at a point O and PO = OQ. The distance PO is equal to

(a) R (b) 3R (c) 2R (d) 1.5R

40. Find the equivalent resistance of the networks shown in figure between the points A and B.



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

41. If '*l*' is the current through a wire and e is the charge of electron, the number of electrons passing through it in t second will be given by:

(a) $\frac{le}{t}$ (b) *l*ite (c) $\frac{e}{lt}$ (d) $\frac{lt}{e}$

42. Two particles having charges q_1 and q_2 when kept at a certain distance exert force F on each other. If distance is reduced to half, force between them becomes—

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

43. All the following statements are correct except:

(a) A body is said to be positively charged when it has got excess of electrons

(b) When a body is charged positively, some electron escape from it

(c) The presence of moisture in the air reduces the conductivity of charge

(d) None of the above

44. $\frac{4}{25}$ coulomb of charge contain____electrons:

(a) 10^{15} (b) 10^{18} (c) 10^{20} (d) None of these

45. Assuming the charge of electron is 1.6×10^{-19} C, the number of electrons passing through a section of wire per second when the wire carries a current of 1A is :

(a) 6.25×10^{18} (b) 1.6×10^{-19} (c) 1.6×10^{19} (d) 0.625×10^{17}

46. 24 J work is done is moving a charge q between two points having potential difference 12 volt. The value of charge q is:

(a) 2 C (b) 0.5 C (c) 24 C (d) 12 C

47. If current drawn from a cell is increased, then the potential difference across the terminals of the cell will:

(a) increase (b) decrease (c) remains same (d) none of these

48. The efficiency of a cell is 50 Ah. It will give 0.5 amp current upto:

(a) 50 h (b) 100 h (c) 25 h (d) 0.5 h

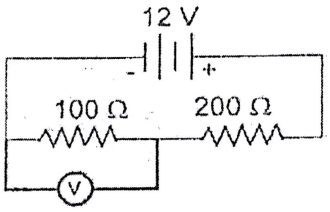
49. A wire of resistance R is cut into n equal parts. These parts are then connected in parallel. The equivalent resistance of combination will be:

(a) nR (b) R/n (c) n/R (d) R/n^2

50. Three resistance each of 8Ω are connected to a triangle. The resistance between any two terminal:

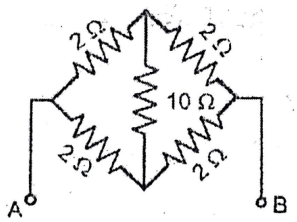
(a) 12Ω (b) 2Ω (c) 6Ω (d) $\frac{16}{3}\Omega$

51. In the circuit shown in fig., the reading of the volmeter V will be:



(a) 4 V (b) 2V (c) 6 V (d) 3 V

52. What is the total resistance across A and B is the circuit shown in Figure?

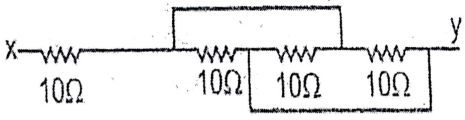


(a) 1 Ω (b) 2 Ω (c) 1.5 Ω (d) none of these

53. A person connects four, $\left(\frac{1}{4}\Omega\right)$ cells in series but one cell has its terminal reversed. The external resistance is 1 Ω. If each cell has an e.m.f. of 1.5 V, the current flowing is :

(a) 1 A (b) 0.5 A (c) 1.5 A (d) 2 A

54. The equivalent resistance between X and y is :



(a) $\frac{10}{3}\Omega$ (b) $\frac{40}{3}\Omega$ (c) $\frac{3}{10}\Omega$ (d) 10 Ω

55. A wire of resistance R is stretched to four times its initial length. What will be the new resistance :

(a) 16 R (b) 9 R (c) 4 R (d) R

56. The image formed by retina of human eye is

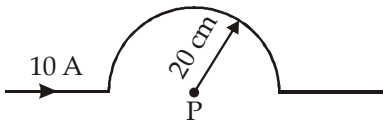
(a) Virtual and erect (b) Real and inverted

(c) Virtual and inverted (d) Real and erect

57. In a circular coil of radius r, the magnetic field at the centre is proportional to

(a) r^2 (b) r (c) 1/r (d) $1/r^2$

58. A current of 10 A is passing through a long wire which has semicircular loop of the radius 20 cm as showm in the figure. Magnetic field produced at the centre of the loop is



(a) $10\ \pi\ \mu T$ (b) $5\ \pi\ \mu T$ (c) $4\ \pi\ \mu T$ (d) $2\ \pi\ \mu T$

59. The persistence of vision for human eye is

(a) 1/10th of a second (b) 1/16th of a second

(c) 1/6th of the second (d) 1/18th of a second

60. A solenoid 1.5 m long and 0.4 cm in diameter possesses 10 turns per cm length. A current of 5 A flows through it. The magnetic field at the axis inside the solenoid is

(a) $2\pi \times 10^{-3}$ T (b) $2\pi \times 10^{-5}$ T (c) $4\pi \times 10^{-2}$ T (d) $4\pi \times 10^{-3}$ T

61. Two long straight wires are set parallel to each other. Each carries a current i in the same direction and separation between them is 2r. Intensity of magnetic field midway between them is

(a) $\frac{\mu_0 i}{r}$ (b) zero (c) $\frac{4\mu_0 i}{r}$ (d) $\frac{\mu_0 i}{4r}$

62. Electron of mass m and charge q is travelling with a speed v along a circular path of radius r at right angles to a uniform magnetic field of intensity B. If the speed of the electron is doubled and the magnetic field is halved, the resulting path would have a radius

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

63. A proton and an α-particle are projected normally into a magnetic field with the same speed. What will be the ratio of radii of the trajectories of the proton and α-particle?

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

64. The amount of light entering the human eye is controlled by

(a) Ciliary muscles (b) Pupil (c) Cornea (d) Eye lens

65. A convex lens of focal length 20 cm is placed coaxially with a convex mirror of radius of curvature 20 cm. The two are kept 15 cm apart. A point object is placed 40 cm in front of the convex lens. Find the position of the image formed by this combination.

(a) –16.67 cm (b) 16.67 cm (c) 40 cm (d) –40 cm

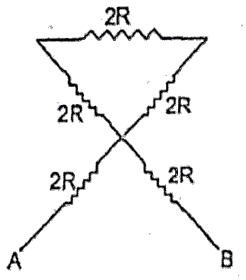
66. A particle is pushed along a horizontal surface in such a way that it starts with a velocity of 12 m/s. and decreases at the rate of 0.5 m/s^2. The time it will take to come to rest is:

(a) 42 s (b) 48 s (c) 24 s (d) 84 s

67. A small bulb is placed at the bottom of a tank containing water to a depth of 80 cm. What is the area of the surface of water through which light from the bulb can emerge out ? Refractive index of water is 1.33. consider the bulb to be a point source.

(a) 2.6 m^2 (b) 2 m^2 (c) 1 m^2 (d) 3.5 m^2

68. In the given circuit, the equivalent resistance between points A and B will be.



(a) $\frac{8}{3}R$ (b) 4R (c) 6R (d) 10R

69. Two identical heater wires are first connected in series and then in parallel with a source of electricity. The ratio of heat produced in the two cases is :

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

70. An electric heater can boil a certain amount of water in 10 minute and another heater can do it in 15 minute, both working at the same voltage. If the two heaters are connected in parallel across the same voltage as before how much time will they take to boil the same amount of water?

(a) 9 min (b) 12.5 min (c) 7.5 min (d) 6 min

CHEMISTRY

71. $2NaOH + MgSO_4 \longrightarrow ?$

(a) $MgO + Na_2SO_4$ (b) $Mg(OH)_2 + Na_2SO_4$ (c) $Mg(OH)_2 + Na_2O$ (d) $MgO + Na_2O$

72. The equation

$Cu + XHNO_3 \rightarrow Cu(NO_3)_2 + YNO_2 + 2H_2O$, the values of X and Y are

(a) 3 and 1 (b) 8 and 6 (c) 4 and 1 (d) 7 and 1 respectively

73. Zinc can displace copper from copper sulphate solution because zinc is :

(a) more reactive than copper (b) less reactive than copper

(c) more stable than copper (d) less stable than copper

74. The correct acidic strength order is :

(a) $HClO < HClO_2 < HClO_3 < HClO_4$ (b) $HClO_4 < HClO_3 < HClO_2 < HClO$

(c) $HClO < HClO_4 < HClO_3 < HClO_2$ (d) $HClO_4 < HClO_2 < HClO_3 < HClO$

75. Combustion of fuel is:

(a) displacement reaction (b) double displacement reaction

(c) oxidation reaction (d) isomerisation reaction

76. Which of the following is incorrect?

(a) cobalt oxide imparts blue colour to glass

(b) manganese dioxide imparts purple colour to glass

(c) chromium oxide imparts red colour to glass

(d) iron oxide imparts green colour to glass

77. $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl$ is

(a) combination reaction (b) decomposition reaction

(c) displacement reaction (d) double displacement reaction

78. The pH of 0.001 N sodium hydroxide solution at 25°C is :

(a) 3 (b) 4 (c) 11 (d) 12

79. Which of the following acids is present in sour milk?

(a) glycolic acid (b) lactic acid (c) citric acid (d) tartaric acid

80. Which of the following is an example of combination reaction?

(a) $H_2 + Cl_2 \longrightarrow 2HCI$ (b) n-Hexane $\xrightarrow{AlCl_3}$ hexane

(c) $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$ (d) $N_2O_4 \longrightarrow 2NO_2$

81. Non-metals form :

(a) ionic halides (b) covalent halides

(c) coordinate halides (d) none of the above

82. Which among the following statements is false?

(a) Every protonic acid has its conjugate acid.

(b) Pair of Bronsted acid and base that differ by a proton is conjugate acid-base pair.

(c) A substance that accepts an electron pair to form co-ordinate covalent bond is an acid.

(d) Arrhenius theory is confined to aqueous solutions.

83. Identify the favourable conditions for the formation of ionic bond.

(a) low IP value of metal, low EA value of non-metal

(b) low IP value of metal, high EA value of non-metal

(c) high IP value of metal, high EA value of non-metal

(d) high IP value of metal, low IP value of non-metal

84. The main constituents of cement are:

(a) Calcium oxide, Silicon dioxide, Aluminium oxide

(b) Calcium oxide, Iron oxide, Sulphur dioxide

(c) Magnesium oxide, Silicon dioxide, Aluminium oxide

(d) none of these

85. When Zn changes to Zn^{+2} it :

(a) lose 2 electrons (b) lose 1 electron

(c) gains 1 electron (d) gains 2 electrons

86. Ordinary glass is a mixture of :

(a) Sodium silicate, Calcium silicate (b) Sodium silicate, Calcium silicate and Silica

(c) Sodium silicate and Silica (d) none of these

87. When a small piece of dry potassium is put in water, it reacts vigorously to produce :

(a) nitrogen gas (b) hydrogen gas

(c) carbon dioxide gas (d) sulphur dioxide

88. Which of the following is a hardest substance?

(a) Charcoal (b) Coke (c) Graphite (d) Diamond

89. Acids should be stored in containers made of :

(a) plastic (b) glass (c) metals (d) clay

90. Milk of magnesia is an :

(a) acid (b) antacid (c) alkali (d) rock salt

91. Basicity of acetic acid is :

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

92. 'Alum' is an example of :

(a) single salt (b) double salt (c) acids (d) none of these

93. Which of the following is not a base according to any of the theories?

(a) $Mg(OH)_2$ (b) NH_3 (c) $H_2PO^-_4$ (d) BF_3

94. Soft drinks contain :

(a) acetic acid (b) tartaric acid (c) carbonic acid (d) nitric acid

95. Which of the following is formed when an oxide of a non-metal reacts with water?

(a) acid (b) base (c) salt (d) none of these

96. Hydrochloric acid, nitric acid and sulphuric acid are known as mineral acids because they :

(a) attack minerals (b) are obtained from minerals

(c) are obtained from crude oil (d) both (a) and (b)

97. Which of the following solutions has the same concentration of H^+ ions as 0.1 N HCl?

(a) 0.1N H_2SO_4 (b) 0.3 N H_3PO_4 (c) 0.2 N HNO_3 (d) All of these

98. Which of the following acid does not react with metals?

(a) sulphuric acid (b) phosphoric acid (c) carbonic acid (d) nitric acid

99. Which of the following acid is used in fire extinguishers?

(a) hydrochloric acid (b) sulphuric acid

(c) nitric acid (d) oxalic acid

100. Which of the following methods is not used for preparing a salt?

(a) reaction between an acid and a base (b) action of acid on metals

(c) action of acid on metal oxides (d) dissolution of acids in water

101. Which of the following is not a property of acids?

(a) all acids have a sour taste (b) acids turn blue litmus red

(c) acids turn red litmus blue (d) all acids form H+ ions in water

102. P-P-P bond angle in white phosphorus is:

(a) 45º (b) 60º (c) 90º (d) 120º

103. Which of them is not an ore of silver?

(a) Ag_2S (b) $AgNO_3$ (c) AgCl (d) None of them

104. Which of the following is a fast reaction?

(a) reaction between H_2 and O_2 to form H_2O

(b) reaction between acid and base to form salt and water

(c) hydrolysis of ester

(d) hydrolysis of sugar to glucose

105. Which of the following reactions is not correct?

(a) $2AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2Ag$ (b) $Cl_2 + 2KI \rightarrow 2\ KCl + I_2$

(c) $FeSO_4 + Cu \rightarrow CuSO_4 + Fe$ (d) $CuSO_4 + Zn \rightarrow ZnSO_4 + Cu$

106. Which of the following statements is correct?

(a) oxidation involves gain of electron

(b) substance which is reduced is reducing agent

(c) exothermic process involves absorption of heat

(d) oxidation involves loss of electrons

107. Match the entries in Column A with appropriate ones in Column B.

Column A	**Column B**
(1) German silver	(a) for making printing type
(2) Tungsten steel	(b) soldering
(3) Alloy of Sn and Pb	(c) for making high speed tolls
(4) Alloy of Pb, Sn and Sb	(d) for making jewellery

(a) $1 \rightarrow b, 2 \rightarrow c, 3 \rightarrow d, 4 \rightarrow a$ (b) $1 \rightarrow c, 2 \rightarrow d, 3 \rightarrow a, 4 \rightarrow b$

(c) $1 \rightarrow d, 2 \rightarrow c, 3 \rightarrow b, 4 \rightarrow a$ (d) $1 \rightarrow d, 2 \rightarrow a, 3 \rightarrow b, 4 \rightarrow c$

108. The following flow chart represent the extraction of _____.

Froth floatation

↓

Roasting

↓

Smelting

↓

Bessemerisation

↓

Electrolytic refining

(a) copper (b) zinc (c) iron (d) aluminium

109. When Magnesium is burnt in air, a white ash remains as left over. What is this?

(a) MgO_2 (b) MgO (c) Mg (d) Mg_3O

110. In the reaction:

$2FeCl_2 + Cl_2 \rightarrow 2FeCl_3$, Chlorine may be regarded as :

(a) an oxidising agent (b) a reducing agent

(c) a catalyst (d) providing an inert medium

MATHEMATICS

111. Suppose that $w = (0.001)^{1000}$, $x = (0.001)^{0.001}$, $y = (1.001)^{1000}$, and $z = (2^{1000} - 1)^{0.001}$. Put these numbers in order from smallest to largest.

(a) w, x, y, z (b) w, x, z, y (c) x, w, y, z (d) x, w, z, y

112. A triangle with sides of length 13, 14 and 15 inches is to be cut whole from a rectangular sheet of paper. Expressed in square inches, what is the minimum area that this rectangular sheet can have?

(a) 168 (b) 174 (c) 188 (d) 202

113. If $\frac{23}{30} = \frac{1}{a_1} + \frac{1}{a_2} + \ldots + \frac{1}{a_n}$, where $a_1, a_2, \ldots, a_n$ are natural numbers, then the smallest value of n is

(a) 30 (b) 2 (c) 3 (d) 4

114. Suppose a, b and c are real numbers for which $\frac{a}{b} > 1$ and $\frac{a}{c} < -1$. Which of the following must be correct?

(a) a + b – c > 0 (b) a > b (c) (a – c)(b – c) > 0 (d) a – b + c > 0

115. How many pairs of positive integer (a, b) with $a + b \leq 100$ satisfy $\frac{a + b^{-1}}{a^{-1} + b} = 13$?

(a) 3 (b) 4 (c) 5 (d) 7

116. What is the smallest value of the positive integer n for which $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \ldots + \frac{1}{n.(n+1)}$ is at least 1?

(a) 100 (b) 1000

(c) 2002 (d) there is no such value of n

117. If m and n are required to be integers, how many solutions (m, n) are there to the pair of conditions $5n - 3m = 15$ and $n^2 + m^2 \leq 16$?

(a) 0 (b) 1 (c) 2 (d) 3

118. The sides of a triangle are $\sqrt{2}, \sqrt{3}$ and $\sqrt{11}$. Which of the following best describe the triangle?

(a) Isosceles (b) None xistent (c) Acute (d) Equilateral

119. If the LCM of the polynomials $f(x) = (x + 1)^5(x + 2)^a$ and $g(x) = (x + 1)^b(x + 2)^a$ is $(x + 1)^a (x + 2)^b$, then find the minimum value of a + b from the following options.

(a) is 10 (b) is 14 (c) is 15 (d) Cannot say

120. Simplify:

$$\frac{a^2-(b-c)^2}{(a+c)^2-b^2}+\frac{b^2-(a-c)^2}{(a+b)^2-c^2}+\frac{c^2-(a-b)^2}{(b+c)^2-a^2}$$

(a) 0 (b) 1 (c) a + b + c (d) $\frac{1}{a+b+c}$

121. The rational expression $A=\left(\frac{x+1}{x-1}-\frac{x-1}{x+1}-\frac{4x}{x^2+1}\right)$ is multiplied with the additive inverse of $B=\frac{1-x^4}{4x}$ to get C. Then, C = _____

(a) $\frac{32x^2}{x^4-1}$ (b) $\frac{2x}{x^4-1}$ (c) 2 (d) 1

122. A real number is said to be algebraic if it satisfies a polynomial equation with integral coefficients. Which of the following numbers is not algebraic :

(a) $\frac{2}{3}$ (b) $\sqrt{2}$ (c) 0 (d) π

123. The sum of the successors of two numbers is 42 and the difference of their predecessors is 12. Find the numbers.

(a) 26, 16 (b) 14, 16 (c) 26, 14 (d) none of these

124. The total cost of 6 erasers and 9 pens is at least Rs. 102 and the cost of each eraser is at most Rs. 5. Find the minimum possible cost (in Rupees) of a pen. The following are the steps involved in solving the above problem. Arrange them in sequential order.

(A) Let the cost of each eraser be Rs. x and cost of each pen be Rs. y

(B) $6x + 9y \geq 102$ and $x \leq 5$.

(C) $6 \times 5 + 9y \geq 102 \Rightarrow 9y \geq 72 \Rightarrow y \geq 8$.

(D) The minimum possible cost of a pen is Rs. 8.

(a) ABDC (b) ABCD (c) DABC (d) ACBD

125. Sanjana travels 660 km, partly by train and partly by car. If she covers 300 km by train and the rest by car, it takes 13.5 hours. But, if she travels 360 km by train and the rest by car, she

takes 30 minutes longer. Find the time taken by sanjana if she travels 660 km by car. (in hours.)

(a) 13 (b) 14 (c) 12 (d) 11

126. If the ordered pair (sinθ, cosθ) satisfies the system of equations mx + ny + a + b = a – b and nx + my + 2b = 0, then find the value of θ where $0 \le \theta \le 90°$. ($m \ne n$)

(a) 30° (b) 45° (c) 50° (d) 60°

127. If $x = \sqrt{6+\sqrt{6+\sqrt{6+...to\ \infty}}}$, then :

(a) x is an irrational number (b) $2 < x < 3$

(c) $x = 3$ (d) None of these

128. The number of real solutions of the equation $2|x|^2 - 5|x| + 2 = 0$ is :

(a) 0 (b) 4 (c) 2 (d) None of these

129. If $(2+\sqrt{3})^{x^2-2x+1} + (2-\sqrt{3})^{x^2-2x-1} = \frac{2}{2-\sqrt{3}}$, then x is equal to :

(a) 0 (b) 1 (c) 2 (d) Both (a) and (c)

130. If the expression $\left[mx - 1 + \frac{1}{x}\right]$ is non negative for all positive real x, then the minimum value of m must be :

(a) $\frac{-1}{2}$ (b) 0 (c) $\frac{1}{4}$ (d) $\frac{1}{2}$

131. If $x \in R$ and $k = \frac{(x^2-x+1)}{(x^2+x+1)}$, then :

(a) $x \le 0$ (b) $\frac{1}{3} \le k \le 3$ (c) $k \ge 5$ (d) None of these

132. The value of k, so that the equations $2x^2 + kx - 5 = 0$ and $x^2 - 3x - 4 = 0$ have one root in common is :

(a) – 2, – 3 (b) – 3, $-\frac{27}{4}$ (c) – 5, – 6 (d) None of these

133. If $\tan\alpha + \sin\alpha = m$ & $\tan\alpha - \sin\alpha = n$, then $m^2 - n^2 =$_____

(a) $\sqrt{mn}$ (b) $\sqrt{\frac{m}{n}}$ (c) $4\sqrt{mn}$ (d) none

134. If $\sin\theta + \cos\theta = \sqrt{2}.\sin(90-\theta)$, then $\frac{1}{\sqrt{2}+1} =$ _____

(a) $\cot\theta$ (b) $\frac{1}{\sqrt{2}-1}$ (c) $\tan\theta$ (d) none

135. Let $\alpha = \frac{\tan^2 A - \sin^2 A}{\tan^2 A \cdot \sin^2 A}$ & $\beta = \frac{\cot^2 A - \cos^2 A}{\cot^2 A \cdot \cos^2 A}$ (A is acute angle) are the roots of that quadratic equation whose discriminant is 'D', then the most appropriate choice is:

(a) $D > 0$ (b) $D \geq 0$ (c) $D = 0$ (d) $D < 0$

136. Let $T_1 = \frac{\sin 45° - \sin 30° + \cot 90°}{\cos 45° + \cos 60°}$ and $T_2 = \frac{\sec 45° - \tan 45°}{\text{cosec } 45° + \cos 0° + \cot 90°}$ then:

(a) $T_1 + T_2 = 0$ (b) $T_1 - T_2 = 0$ (c) $T_1 = \sqrt{2}T_2$ (d) $T_2 = \sqrt{2}T_1$

137. A ballon is connected to a meteorological ground station by a cable of length 215 m inclined at 60° to the horizontal. Determine the height of the balloon from the ground. Assume that there is no slack in the cable.

(a) $107.5\sqrt{3}$m (b) $100\sqrt{3}$m (c) $215\sqrt{3}$m (d) $215/\sqrt{3}$m

138. If $\sin^2 A = 2\sin A \cos A$ and $\sin 20° = K$, then the value of $\cos 20° \cos 40° \cos 80° \cos 160°$ = _____

(a) K (b) $-\sqrt{1-K^2}$ (c) $\sqrt{\frac{1-K^2}{8}}$ (d) $-\frac{\sqrt{1-K^2}}{8}$

139. The length of the side (in cm) of an equivalent triangle inscribed in a circle of radius 8 cm is _____

(a) $16\sqrt{3}$ (b) $12\sqrt{3}$ (c) $8\sqrt{3}$ (d) $10\sqrt{3}$

140. A wheel makes 20 revolutions per hour. The radians it turns through 25 minutes is _____

(a) $\frac{50\pi^c}{7}$ (b) $\frac{250\pi^c}{3}$ (c) $\frac{150\pi^c}{7}$ (d) $\frac{50\pi^c}{3}$

141. The mode of the data 6, 4, 3, 6, 4, 3, 4, 6, 5 and x can be:

(a) Only 5 (b) Both 4 and 6 (c) Both 3 and 6 (d) 3, 4 or 6

142. Observation of some data are $\frac{x}{5}, x, \frac{x}{3}, \frac{2x}{3}, \frac{x}{4}, \frac{2x}{5}$ and $\frac{3x}{4}$ where $x > 0$. If the median of the data is 4, then find the value of 'x'?

(a) 5 (b) 7 (c) 8 (d) 10

143. If a coin is tossed two times, then what is the probability of getting a head at least once?

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

144. One ticket is drawn from a bag containing 70 tickets numbered 1 to 70. Find the probability that is a multiple of 5 or 7.

(a) $\frac{1}{10}$ (b) $\frac{1}{70}$ (c) $\frac{6}{70}$ (d) $\frac{11}{35}$

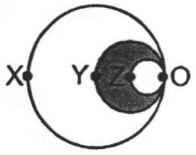
145. If one number is selected from the first 70 natural numbers, the probability that the number is a solution of $x^2 + 2x > 4$ is _____.

(a) $\frac{69}{70}$ (b) $\frac{1}{70}$ (c) 1 (d) 0

146. A 4-digit number is formed by using the digits 1, 2, 4, 8 and 9 without repetition. If one number is selected from those numbers, then what is the probability that it will be an odd number?

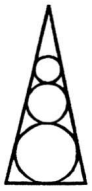
(a) $\frac{1}{5}$ (b) $\frac{2}{5}$ (c) $\frac{3}{5}$ (d) $\frac{4}{5}$

147. In the figure shown, three circles X, Y and Z are tangent to each other at point O. The center of Y is on Z and the center of X is on Y. If the radius of Z is r, what is the area of the unshaded region?



(a) $2\pi r^2$ (a) $3\pi r^2$ (a) $4\pi r^2$ (a) $13\pi r^2$

148. In the figure shown, three circles are inscribed in a cone as shown. The radius of the circles are 8, 12 and r. Find the area of largest circle with radius r.



(a) 324π (b) 225π (c) 196π (d) 289π

149. A cone, a hemisphere and a cylinder stand on equal bases of radius R and have equal heights H. Their whole surfaces area in the ratio:

(a) $(\sqrt{3} + 1) : 3 : 4$ (b) $(\sqrt{2} + 1) : 7 : 8$ (c) $(\sqrt{2} + 1) : 3 : 4$ (d) None of these

150. If a cube of maximum possible volume is cut off from a solid sphere of diameter d, then the volume of the remaining (waste) material of the sphere would be equal to :

(a) $\frac{d^3}{3}\left(\pi - \frac{d}{2}\right)$ (b) $\frac{d^3}{3}\left(\frac{\pi}{2} - \frac{1}{\sqrt{3}}\right)$ (c) $\frac{d^2}{4}\left(\sqrt{2} - \pi\right)$ (d) None of these