SCIENCE OLYMPIAD CONTEST

Tier - II Test

Model Question

Time: 90 Minutes Total Mark: 100

S. No.:

Name: ..... College: .....

Registration Number: .....

READ THESE INSTRUCTIONS FIRST

1. Questions are arranged in **two** sections. You should attempt **all** questions of **Section A** (20+5 Physics, 20+5 Chemistry & 25 Mathematics). In **Section B**, you will attempt 25 questions of **either** Biological Sciences **or** Physical Sciences.
2. You need to attempt all together **100** questions. Each multiple-choice question (MCQ) is with 4 answer options (a, b, c & d) and subjective question with a blank space for answer. A blank sheet is also provided for scratch work.
3. Don't forget to write your correct name, college & registration number on this set.
4. Select the correct answer for each MCQ and make a tick mark (√) in only one appropriate option. Do not use any other mark.
5. Submit both this question set as well as scratch work paper at the end of the test.
6. Each correct answer is scored one point.
7. 0.25 point is deducted for every incorrect answer.
8. Marking in more than one options of a question is regarded as incorrect answer.
9. Bringing of mobile, calculator and log tables in the exam hall is strictly prohibited.

Section A

(Attempt **all** the questions in this section)

Physics

1. Which of the following does not possess the same dimensions as pressure?
   (a) Bulk modulus (b) Energy density (c) Stress (d) Energy gradient
2. The percentage errors in the measurement of mass and speed are 1% and 2% respectively. What is the percentage error in the kinetic energy?
   (a) 5% (b) 2.5% (c) 3% (d) 1.5%
3. A car travels 8 km along east, then 15 km along north and then $15\sqrt{2}$ km towards south west. What will be its distance from the starting point?
   (a) 8 km (b) 10 km (c) 24 km (d) None of the above
4. A stone falls from the top of the tower in 8 sec. How much time will it take to cover the first quarter of the distance starting from the top?
   (a) 4 sec (b) 2 sec (c) 1 sec (d) None of the above
5. An electric motor creates a tension of 450 N in a hoisting cable and reels it in at the rate of 2 m/s. What is the power of electric motor?
   (a) 15 kW (b) 9 kW (c) 225 W (d) 81 W
6. In an elevator moving vertically up with an acceleration 'g', the force exerted on the floor by a passenger of mass M is ...
   (a) Mg (b) Mg/2 (c) zero (d) 2Mg
7. In a perfectly inelastic collision, the relative velocity of the bodies ...
   (a) before impact is zero (b) before impact is equal to that after impact
   (c) after impact is zero (d) is characterized by none of the above
8. The rate of variation of 'g' with height (near the surface of the earth, when h<<R) compared to the rate of variation of g with depth is equal to ...
   (a) 1 (b) 2 (c) 3 (d) 4
9. A cable that can support a load W is cut into two equal parts. The maximum load that can be supported by either part is ...
   (a) W/4 (b) W/2 (c) W (d)2W
10. A small object placed on a rotating horizontal turntable just slips when it is placed at a distance of 4 cm from the axis of rotation. If the angular velocity of the turntable is doubled the object slips when its distance from the axis of rotation is ...
    (a) 1 cm (b) 2 cm (c) 4 cm (d) 8 cm
11. Hot syrup flow faster because its ...
    (a) viscosity decreases (b) surface tension decreases
    (c) viscosity increases (d) surface tension increases
12. Air is denser medium than water for ...
    (a) light wave (b) sound wave (c) both a & b (d) neither a nor b
13. A double convex air bubble in water will behaves as ...
    (a) convergent lens (b) divergent lens (c) plane glass plate (d) concave mirror
14. Wavelength of light plays no role in ...
    (a) interference (b) diffraction (c) polarization (d) resolving power
15. A point charge Q is placed at the centre of a closed cube of each side L. Then electric flux through its each face is ...
    (a) $\frac{Q}{6L^2\varepsilon_0}$ (b) $\frac{Q}{6\varepsilon_0}$ (c) $\frac{Q}{\varepsilon_0}$ (d) $\frac{QL^2}{6\varepsilon_0}$
16. A parallel plate air capacitor has capacitance 100 pF. The plates are at distance 'd' apart. If a metallic wire of thickness t<<d is introduced parallel to plates between them, the new capacitance will be ...
    (a) less than 100 pF (b) 100 pF (c) greater than 100 pF (d) zero

17. The fission of a uranium nucleus ...
    (a) always leads to the same pair of fission products like barium and krypton
    (b) does not always produce barium and krypton, but different pairs of fission products
    (c) produce barium and any other fission product
    (d) always produces at least one radioactive fission product
18. The radius of electron's second stationary orbit in Bohr's atom is R. The radius of the third orbit will be
    (a) 3R (b) 2.25R (c) 9R (d) R/3
19. In an electron microscope , if the potential is increased from 20 kV to 80 kV, the resolving power of R of the microscope will become ...
    (a) R (b) 2R (c) 4R (d) R/2
20. Drift velocity of electrons in a conductor bearing potential difference V across its terminals is v. If the length of wire is stretched to three times and same potential difference V is applied, then the drift velocity will become or remain ...
    (a) v (b) v/3 (c) 3v (d) $v/\sqrt{3}$

Subjective questions

21. If you jump off a chair, you accelerate towards the earth; does the earth also accelerate towards you?

22. Does hydrogen balloon posses greater potential energy at higher altitude?

23. Why is ladder more likely to slip when you are high up on it than when you just begin to climb?

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24. A piece of ice is floating in a beaker filled to the brim with a liquid of density 1.5 g/cc. Will there be an overflow of water as the ice melts? Explain your answer

25. Will the temperature of a gas in a container increase when we put the container on a moving train? Explain.

Chemistry

26. The shortest bond length is found in ...
    (a) Benzene (b) Acetylene (c) Ethylene (d) Ethane
27. Marsh gas mainly contains ...
    (a) C_2H_2 (b) CH_4 (c) C_2H_4 (d) C_4H_{10}
28. Anaesthetic chloroform is always stored in yellow bottles filled up to stopper because…
    (a) It is explosive in air and direct sunlight
    (b) It produces carbon tetrachloride in air and sunlight
    (c) It produces ethyl alcohol in air and sunlight
    (d) It produces phosgene in air and sunlight
29. Glycerol, which is also used in cosmetic products, is:
    (a) Monohydric alcohol (b) Dihydric alcohol (c) Trihydric alcohol (d) Polyhydric alcohol
30. Nucleic acid is polymer of ...
    (a) Nucleosides (b) Nucleotides (c) Nucleoproteins (d) Globulins
31. According to Mandeleef, properties of elements are periodic function of their :
    (a) Atomic number (b) Atomic size (c) Atomic weight (d) Atomic energy
32. Froth floatation process is used in the metallurgy of ...
    (a) Oxide ore (b) Sulphide ore (c) Chloride ore (d) Amalgam
33. Sodium and potassium, being reactive with air, are kept under ...
    (a) Alcohol (b) Aqua regia (c) Water (d) Kerosene
34. The number of water of crystallization present in two molecules of washing soda is ...
    (a) 10 (b) 20 (c) 8 (d) 9
35. Calcium oxide is commonly called ...
    (a) Milk of lime (b) Slaked lime (c) Quick lime (d) Marble chips
36. Carbon monoxide is a:
    (a) Acidic oxide (b) Basic oxide (c) Amphoteric oxide (d) Neutral oxide
37. Which of the following allotrope of phosphorus doesn't exist ...
    (a) Red (b) Yellow (c) Black (d) Green

38. The oxide of Nitrogen, which is, also known as laughing gas is ...
(a) NO (b) N_2O (c) N_2O_3 (d) N_2O_5

39. Mixture used in Holmes signal is ...
(a) $CaC_2 + CaCl_2$ (b) $CaCl_2 + Ca_3P_2$ (c) $CaC_2 + Ca_3P_2$ (d) $CaC_2 + Ca_3N_2$

40. Charring of sugar by conc. H_2SO_4 is due to its ...
(a) Oxydizing action (b) Reducing action (c) Dehydrating action (d) Dehydrogenation action

41. H_2O is liquid while H_2S is gas because ...
(a) The molecular weight of H_2S is greater than that of H_2O
(b) of the hydrogen bonding in water molecules
(c) of the electrostatic attraction in H_2S molecules
(d) H – O – H bond angle is greater than H – S – H bond angle

42. Catalyst used in contact process is ...
(a) Finely divided iron (b) Mercury (c) Vanadium pentoxide (d) Silver

43. Most volatile haloacid is ...
(a) HF (b) HCl (c) HBr (d) HI

44. Siderite is ore of ...
(a) Iron (b) Silver (c) Aluminum (d) Copper

45. The no. of 'σ' and 'π' bonds in a CaC_2 molecule is :
(a) $1\sigma\ ,\ 2\pi$ (b) $2\sigma\ ,\ 2\pi$ (c) $3\sigma\ ,\ 2\pi$ (d) $4\sigma\ ,\ 2\pi$

Subjective questions

46. Write any two limitation of Bohr's atomic model.

47. Write down a reaction, which proves that nascent hydrogen is more reactive than ordinary hydrogen gas.

48. How can you detect both Nitrogen and Sulphur in an organic compound? (Illustrate through reactions only)

49. Write down an equation that relates normality with molarity.

50. Explain briefly about zwitter ion with an example.

Mathematics

51. The value of $\frac{\sqrt{18}}{\sqrt{72}}$ is ...
(a) a rational number (b) an irrational number (c) an imaginary number (d) none of the above

52. If x is an integer, which of the following is the product of the next two integers greater than 2(x+1)?
(a) $4x^2+14x+12$ (b) $4x^2+12$ (c) $x^2+14x+12$ (d) x^2+x+12

53. The number of integers that satisfy the inequality $|x| < \pi$ is ...
(a) 5 (b) 4 (c) 6 (d) 7

54. If $2< x < 4\ and\ 9 > y > 3$, then the largest integer value of $x - y$ is:
(a) 1 (b) -1 (c) 0 (d) 13

55. If 13, p, q, r, 29 are in an Arithmetic Progression, then the values of p, q, r are ...
(a) 17, 21, 25 (b) 18, 22, 26 (c) 16, 21, 26 (d) 17, 22, 27

56. The sum of $\sum_{n=0}^{\infty} \frac{3}{(-5)^n}$ is ...
(a) $\frac{15}{4}$ (b) $\frac{15}{6}$ (c) $\frac{6}{15}$ (d) $\frac{4}{15}$

57. If a is 80% of b, what percent of a is b?
(a) 125% (b) 120% (c) 80% (d) 75%

58. The area of an equilateral triangle whose altitude 6 cm is ...
(a) $12\sqrt{3}\ cm^2$ (b) $15\sqrt{3}\ cm^2$ (c) $18\sqrt{3}\ cm^2$ (d) $18\ cm^2$

59. The area of the two circles is in the ratio 1:4, the ratio of their radius is ...
(a) 1 : 2 (b) 3 : 4 (c) 5 : 6 (d) 1 : 4

60. The value of $\frac{55^5}{5^{55}}$ when simplified is ...
(a) $\frac{11}{5^{50}}$ (b) $\frac{11}{5^{55}}$ (c) $\frac{11^5}{5^{50}}$ (d) $\frac{11^5}{5^5}$

61. The lines $2x - 5y + k = 0$ and $kx + 10y + 5 = 0$ are parallel. The value of k is ...
(a) – 2 (b) – 4 (c) – 6 (d) – 8

62. The roots of the equations $x^2+(2p-1)x+p^2= 0$ are equal if ...
(a) $p = \frac{1}{4}$ (b) $p \geq \frac{1}{4}$ (c) $p = \frac{1}{6}$ (d) $p \leq \frac{1}{4}$

63. If $0 < x < 1$, which of the following expression is greatest?
(a) $\frac{1}{\sqrt{x}}$ (b) $\sqrt{x}$ (c) $x3$ (d) $\frac{1}{x^3}$

64. The value of $sin\ 15°$ is ...
(a) $\frac{\sqrt{6}-\sqrt{2}}{4}$ (b) $\frac{\sqrt{5}-1}{4}$ (c) $\frac{\sqrt{3}}{2}$ (d) $\frac{\sqrt{6}+\sqrt{2}}{4}$

65. The radian measures of angle 'θ' that satisfy the equations $cos\theta = \frac{1}{\sqrt{2}}$ and $tan\theta = -1$ are ...
(a) $2n\pi + \frac{\pi}{4}$ (b) $2n\pi + \frac{3\pi}{4}$ (c) $2n\pi + \frac{\pi}{6}$ (d) $2n\pi + \frac{7\pi}{4}$ [where n is any integer]

66. What is the domain of the function $cosec^{-1}x$?
(a) (-1 , 1) (b) (-∞ , ∞) (c) $x \geq 1\ or\ x \leq -1$ (d) (-1,1)

67. What is the directrix of the parabola $x^2 = -4py, > 0$?
(a) $x = p$ (b) $x = -p$ (c) $y = p$ (d) $y = -p$

68. The centre of the ellipse $2x^2+3y^2-4x-12y+13=0$ is ...
(a) (1 , 2) (b) (2 , 1) (c) (-1 , 2) (d) (-1 , -2)

69. What is the fundamental period of $4x$?
(a) π (b) $\frac{\pi}{4}$ (c) $-\pi$ (d) 2π

70. Evaluate the limiting value: $\lim_{x\to e} \frac{\log x-1}{x-e}$
(a) e (b) $\frac{1}{e}$ (c) – e (d) $-\frac{1}{e}$

71. The number of points at which the function $f(x)$= $|x-0.5|$ + $|x-1|$ + $tanx$ does not have derivative in the interval (0 , 2) is :
(a) 1 (b) 2 (c) 3 (d) 4

72. $\lim_{x\to 0} \frac{1-cosx}{x^2}$ is equal to ...
(a) 0 (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) 1

73. Evaluate: $\int_0^1 tan^{-1}\ x\ dx$
(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{4} - \frac{1}{2}\ log2$ (c) $\frac{\pi}{4} + \frac{1}{2}\ log2$ (d) $\frac{\pi}{2}$

74. If H is the harmonic mean between P and Q, then the value of $\frac{H}{P} + \frac{H}{Q}$ is :
(a) 2 (b) $\frac{PR}{P+Q}$ (c) $\frac{P+Q}{PQ}$ (d) none of the above

75. If z = 2+$\sqrt{3}\ i$, the value of z$\bar{z}$ is ...
(a) 7 (b) 8 (c) 2 - $\sqrt{3}\ i$ (d) none of the above

Section B

(Attempt **either** Biological Science part **or** Physical Science part)

Biological Sciences

76. Give the position of true coelom.
(a) enclosed by endodermal layer (b) between ectoderm and endoderm
(c) between body wall and gut (d) between ectoderm and mesoderm

77. In which group of animal do we find Ambulacral system?
(a) Arthropods (b) Echinoderms (c) Molluscs (d) Chordates

78. Incomplete digestive tract is only found in ...
(a) Trematodes (b) Cestodes (c) Nematodes (d) None of above

79. Portion of ovaries in *Pheretima*:-
(a) 12th segment (b) 13th segment (c) 14th segment (d) 13/14th segment

80. Where do you find Bidder's Canal?
(a) in the digestive tract (b) in the heart (c) in the respiratory tract (d) in the kidney

81. The dental formula of children (baby) ...
(a) $\frac{2102}{2102}$ (b) $\frac{2012}{2012}$ (c) $\frac{2120}{2120}$ (d) $\frac{2123}{2123}$

82. Number of Cranial nerves in human brain ...
(a) 10 pairs (b) 12 pairs (c) 14 pairs (d) 12 – 14 pairs

83. The causative agent of the disease T.B. ...
(a) *Salmonella* (b) *Leishmania* (c) *Mycobacterium* (d) Ritro-virus

84. Metastaris character is seen in the disease ...
(a) Cancer (b) T.B. (c) Typhoid (d) *Ascariasis*

85. Name the cells, which secrete male hormone ...
(a) Aciner cells (b) Sertoli cells (c) Interstitial cells (d) Brunner's cells

Subjective questions

86. How could you say that Man is very close to Gorilla than Monkey?

87. Give the roles of Surrogate mother in test tube baby:

88. If a couple have blood group A and B, find out the possible blood groups of their offspring.

89. Which are non-seed bearing vascular plants?
(a) Bryophytes (b) Pteridophytes (c) Gymnosperms (d) Angiosperms

90. Pili are essentially present in ...
(a) Gram +ve bacteria (b) Gram –ve bacteria (c) Both of above (d) None of above

91. Red pigment present in root nodules of Legumes is ...
(a) Leghaemoglobin (b) Phyerythin (c) Bacterioviridin (d) Bacteriochlorophyll

92. A virus is made of ...
(a) DNA only (b) RNA only (c) Protein only (d) All of above

93. Common yeast generally reproduces by ...
(a) Akinetes (b) Aplanospores (c) Budding (d) Ascospores

94. Agar – agar is obtained from ...
(a) Bacteria (b) Virus (c) Fungi (d) *Gelidium*

95. Edible part of cauliflower is ...
(a) Inflorescence (b) flower (c) Bud (d) fruit

96. Androecium in pea plant is ...
(a) polyandrous (b) polyadelphous (c) diadelphous (d) monaldephous

97. Tissue only present in dicot is ...
(a) Parenchyma (b) Collenchyma (c) Sclerenchyma (d) Xylem and Phloem

98. The rate of Photosynthesis is maximum in ...
(a) Green light (b) Red light (c) Far-red light (d) Blue light

Subjective questions

99. Write the names of any two cell organelles containing DNA molecule:

100. What do you mean by Achlamydous?

Physical Sciences

101. For a certain gas the ration of specific heat is given to be γ=1.5. Then for this gas ...
(a) C_V=3R/J (b) C_p=3R/J (c) C_V=5R/J (d) C_p=5R/J

102. The kinetic energy of a body is increased by 300%. Its momentum will be increased by
(a) 400% (b) 300% (c) 200% (d) 100%

103. The dimensions of $B^2/(2\mu_0)$ where μ_0 = permeability of free space, B= magnetic field ...
(a) $[MLT^{-1}]$ (b) $[ML^2T^{-2}]$ (c) $[ML^{-1}T^{-2}]$ (d) $[ML^2T^{-1}]$

104. The time (t) and displacement(x) are related as $t = ax^2 + bx$. What is the acceleration of the particle at the origin of the coordinate axes?
(a) $-2ab^3$ (b) $-2ab$ (c) $-2a/b^3$ (d) $-2(a/b)$

105. The length of an elastic spring is 'a' meter when the tension is 4N and 'b' meter when the tension in 5N. The length in meter when the tension is 9N , is ...
(a) 4a-5b (b) 5b-4a (c) 5b+4a (d) 9(b-a)

106. The value of g at a place decreases by 2%. The barometric height of mercury ...
(a) increases by 2% (b) decreases by 2%
(c) remains unchanged (d) sometimes increases and sometimes decreases

107. The resistance of resistance thermometer has values 6.74 Ω and 7.74 Ω at 0^0C and 100^0C. What is the resistance at 50^0C?
(a) 7.56 Ω (b) 7.24 Ω (c) 7.64 Ω (d) 7.52 Ω

108. All gas at same temperature have same ...
(a) Kinetic energy (b) density (c) RMS speed (d) none of the above

109. If tension in sonometer wire decreases by 19%, then percentage change in frequency is ...
(a) 10% (b) -10% (c) 15% (d) -15%

110. The emf of the battery in a thermocouple is doubled. The rate of heat generated at one of the two junctions will ...
(a) remains unchanged (c) becomes half (c) be doubled (d) be four times

Subjective questions

111. A piece of floating cork is floating in water contained in a beaker. What is the apparent weight of the cork piece?

112. Define one lux.

113. The probability that a leap year selected at random contain 53 Sundays is ...
(a) $\frac{7}{366}$ (b) $\frac{26}{183}$ (c) $\frac{1}{7}$ (d) $\frac{2}{7}$

114. A polygon has 9 diagonals, then the number of its sides are ...
(a) 5 (b) 6 (c) 7 (d) 8

115. Everybody in a room shakes hands with everybody else. The total number of handshakes is 66. The total number of persons in the room is ...
(a) 11 (b) 12 (c) 13 (d) 14

116. The number of arrangements which can be made by using all the letters of the word 'LAUGH' if the vowels are adjacent is ...
(a) 10 (b) 24 (c) 48 (d) 120

117. The probability that an event A happens in a trail is 0.4, three independent trials are made. The probability that A happens at least once is ...
(a) 0.936 (b) 0.216 (c) 0.784 (d) 0.064

118. A person is known to speak the truth 4 times out 5 times. He throws a dice and reports that it is a six. The probability that it is actually a six is:
(a) $\frac{1}{2}$ (b) $\frac{2}{9}$ (c) $\frac{4}{9}$ (d) $\frac{5}{9}$

119. If ω is an imaginary cube root of unity, then $(1 + \omega - \omega^2)^7$ equals to ...
(a) $128\,\omega$ (b) $-128\,\omega$ (c) $128\,\omega^2$ (d) $-128\,\omega^2$

120. The average wage of 500 workers was found to be 200. Later on, it was discovered that the wages of two workers were misread as 180 and 20 instead of 80 and 220. The correct average wage is ...
(a) Rs. 200 (b) Rs. 200.20 (c) Rs. 220 (d) Rs. 200.50

121. The average of x and y is 40. If $z = 19$. What is the average of x, y and z?
(a) 33 (b) 40 (c) 30 (d) 35

122. The tangent to the curve $y = e^{2x}$ at the point (0 , 1) meets the x-axis at:
(a) (0 , 0) (b) (2 , 0) (c) (- $\frac{1}{2}$, 0) (d) (2 , -$\frac{1}{2}$)

123. $\int \frac{dx}{x^2-3x+2}$ is equal to:
(a) $\log_e(x-2) + C$ (b) $\log_e\left(\frac{x-2}{x-1}\right) + C$ (c) $\log_e\left(\frac{x-1}{x-2}\right) + C$ (d) 1

124. The differential equation of the family of lines passing through the origin is ...
(a) $\frac{dy}{dx}$ – y = 0 (b) x + $\frac{dy}{dx}$ = o (c) x$\frac{dy}{dx}$ – y = 0 (d) $\frac{dy}{dx}$ – y = 0

125. The degree of the differential equations $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3$ + 6y = 0 is ...
(a) 1 (b) 2 (c) 3 (d) 4

END