SCIENCE OLYMPIAD FOUNDATION

SAMPLE PAPER

CLASS
11

National Cyber Olympiad

The actual test paper has 50 questions. Time allowed : 60 minutes. There are 3 sections: 15 questions in section I, 15 in section II and 20 in section III.

SYLLABUS

Section – I (Mental Ability) : Sets, Relations and Functions, Mathematical Induction, Logarithms, Complex Numbers & Quadratic Equations, Linear Inequations, Differentiation, Sequences and Series (A.P. & G.P. Misc.), Trigonometry, Cartesian System of Rectangular Coordinates, Straight Lines and Family of Straight Lines, Circles, Conic Section, Trigonometry, Permutations and Combinations, Binomial Theorem, Statistics, Mathematical Logic, Limits, Probability, Introduction to 3-D Geometry.

Section – II (Logical and Analytical Reasoning) : Verbal and Non-verbal Reasoning.

Section – III (Computers and IT) : History, Generation and Types of Computers, Working with OS, Input, Output & Memory Devices, Data Representation, Basics of IT, Internet Services and Protocols, Introduction to XML, Networking, Viruses and Antiviruses, Introduction to C++ till Data Structures.

National Science Olympiad

The actual test paper has 50 questions. Time allowed : 60 minutes. There are 2 sections: 20 questions in section I and 30 in section II.

SYLLABUS

Section – I (Mathematics) : Sets, Relations and Functions, Mathematical Induction, Logarithms, Complex Numbers & Quadratic Equations, Linear Inequations, Differentiation, Sequences and Series (A.P. & G.P. Misc.), Trigonometry, Cartesian System of Rectangular Coordinates, Straight Lines and Family of Straight Lines, Circles, Conic Section, Trigonometry, Permutations and Combinations, Binomial Theorem, Statistics, Mathematical Logic, Limits, Probability, Introduction to 3-D Geometry, Verbal and Non-Verbal Reasoning.

OR

Section – I (Biology) : Diversity in the Living World, Structural Organisation in Plants and Animals, Cell : Structure and Functions, Plant Physiology, Human Physiology.

Section – II (Physics & Chemistry) : *Physics:* Units & Measurements, Mechanics, Properties of Matter, Heat & Thermodynamics, Oscillations, Waves.
Chemistry: Some Basic Concepts of Chemistry, Structure of Atom, Classification of Elements and Periodicity in Properties, Chemical Bonding and Molecular Structure, States of Matter, Thermodynamics, Equilibrium, Redox Reactions, Hydrogen, The *s*-Block Elements, The *p*-Block Elements (Groups 13 and 14), Organic Chemistry - Some Basic Principles and Techniques, Hydrocarbons, Environmental Chemistry.

International Mathematics Olympiad

The actual test paper has 50 questions. Time allowed : 60 minutes. There are 3 sections, 20 questions in section I, 20 in section II and 10 in section III.
Section I : Logical Reasoning, **Section II :** Mathematical Reasoning & **Section III :** Everyday Mathematics

SYLLABUS

Sets, Relations and Functions, Mathematical Induction, Logarithms, Complex Numbers & Quadratic Equations, Linear Inequations, Differentiation, Sequences and Series (A.P. & G.P. Misc.), Trigonometry, Cartesian System of Rectangular Coordinates, Straight Lines and Family of Straight Lines, Circles, Conic Section, Trigonometry, Permutations and Combinations, Binomial Theorem, Statistics, Mathematical Logic, Limits, Probability, Introduction to 3-D Geometry, Problems Based on Figures, Find Odd Numeral Out, Series Completion, Coding-Decoding, Mathematical Reasoning, Analytical Reasoning, Mirror Images, Embedded Figures, Direction Sense Test, Cubes and Dice.

National Cyber Olympiad

MENTAL ABILITY

1. The points z_1, z_2, z_3, on the complex plane are the vertices of an equilateral triangle if and only if :

(A) $\sum(z_1 - z_2)(z_2 - z_3) = 0$ (B) $\sum z_1^2 = 2\sum z_1 z_2$

(C) $\sum z_1^2 = 4\sum z_1 z_2$ (D) $(z_1 + z_2 + z_3)^2 = 3\sum z_1 z_2$

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2. A student is allowed to select atmost n books from a collection of $(2n + 1)$ books. If the total number of ways in which he can select atleast 1 book is 63, find the value of n.

(A) 6 (B) 3 (C) 5 (D) 4

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3. c_1 is a fixed circle and c_2 is a variable circle with fixed radius. The common transverse tangents to c_1 and c_2 are perpendicular to each other. The locus of the centre of variable circle is

(A) Circle (B) Ellipse

(C) Hyperbola (D) Parabola

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4. The value of $\log_2[\cos^2(\alpha+\beta) + \cos^2(\alpha-\beta) - \cos 2\alpha \cdot \cos 2\beta]$

(A) Depends on α & β both (B) Depends on α but not on β

(C) Depends on β but not on α (D) Is Independent of both α & β

LOGICAL & ANALYTICAL REASONING

5. 'P + Q' means 'P is brother of Q'; 'P – Q' means 'P is mother of Q' and 'P × Q' means 'P is sister of Q'. Which of the following means 'M is maternal uncle of R'?

(A) M – R + K (B) M + K – R

(C) M + K × Q (D) There is no such symbol

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6. If 1 is coded as Y, 2 is coded as M, 3 as D, 4 as H, 5 as T, 6 as L, 7 as P, 8 as V and 9 as N, which of the following is the coded form of 3972465?

(A) DNPMHLP (B) DNPMHNT (C) DNPMHLT (D) DNPMNLT

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7. Which letter will be the sixth to the left of the nineteenth letter from the right end of the following alphabets?

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

(A) N (B) M (C) Y (D) F

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8. Bablu ranked sixteenth from the top and twenty-ninth from the bottom among those who passed an examination. Six boys did not participate in the competition and five failed in the examination. How many boys were there in that class?

(A) 44 (B) 50 (C) 55 (D) 40

COMPUTERS & INFORMATION TECHNOLOGY

9. Which of the following is not correct

(A) E-commerce includes all business activities involved in the development, facilitation and implementation of business communications and transaction through electronic media

(B) The Intranet is a restricted version of the Internet within a group of users

(C) The Extranet is a closed online network connecting two or more organisations

(D) None of the above.

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10. A debugging tool is a program which

(A) Removes bugs from a user program (B) Removes viruses from the computer

(C) Helps the user find bugs in his/her program (D) Displays errors in a user program

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11. Computers can be protected from virus by using

(A) Software (B) Hardware

(C) Software and hardware (D) Cannot be protected at all

12. Y2K problem mainly arose in computer programmes written in
(A) COBOL (B) BASIC (C) FORTRAN (D) PASCAL

13. In the context of information technology, the term security refers to
(A) Confidentiality only (B) Authentication only
(C) Integrity only (D) All of these

14. Which of the following are super computers developed by Indian Scientists?
1. PARAM 2. ANURAG 3. GIST 4. CDAC
Answer choices
(A) 1 & 2 only (B) 1 only (C) All except 3 (D) 1 and 4

15. Which of the following statements about DOS are true?
1. DOS is an acronym for Disk Operating System
2. Loading of DOS into the main memory is known as booting
3. Storage areas on a disk are known as directories. A directory may contain files and/or subdirectories inside it.
4. Wildcards are special characters carrying special meaning. Two MS-DOS wild cards are ? and *
5. A filter is a command that recieves its input from the standard input device and sends its output to standard output device. FIND, MORE and SORT are MS-DOS filters.

(A) 1 and 2 only (B) 1, 2 and 3 (C) All except 3 (D) All of these

National Science Olympiad

MATHEMATICS

1. A man moving on a parabolic path finds the angle of elevation of a pole, standing on the focus of path, to be 75°. If the directrix of path is at a distance of 7 metres from him then height of pole is
(A) $(14+7\sqrt{3})$ m (B) $\frac{(2+\sqrt{3})}{7}$ m (C) $(14-7\sqrt{3})$ m (D) $\frac{(2-\sqrt{3})}{7}$ m

2. Three ladies have each brought a child for admission to a school. The head of the school wishes to interview the six people one by one, taking care that no child is interviewed before its mother. The number of ways of doing this is
(A) 6 (B) 36 (C) 72 (D) 90

3. A refrigerator is offered for sale at Rs. 250.00 with successive discounts of 20% and 15%. The sale price of the refrigerator is
(A) 35% less than Rs. 250.00 (B) 65% of Rs. 250.00
(C) 77% of Rs. 250.00 (D) 68% of Rs. 250.00

4. The number of revolutions of a wheel, with fixed centre and with an outside diameter of 6 m, required to cause a point on the rim to go one km is
(A) 880 (B) $440/\pi$ (C) $500/3\pi$ (D) $440\ \pi$

OR

BIOLOGY

1. Which of the following statements are true for photosynthetic bacteria (PB) and chemosynthetic bacteria (CB)?
(a) obtain energy from the oxidation of inorganic molecule such as ammonium salt
(b) obtain energy from sunlight (c) contain photosynthetic pigments
(d) are autotrophs.
(A) PB - b, c, d ; CB - a, d (B) PB - a, c ; CB - b, d
(C) PB - b, d ; CB - a, b (D) PB - a, b, c ; CB - b, c, d

2. Anaerobic respiration releases less energy than aerobic respiration because
(A) Energy from oxygen is not made available (B) Ethyl alcohol is a source of energy
(C) Carbon dioxide is released (D) Less energy is required by fermenting organisms

3. Three bean seedlings were grown in three culture solutions. After six weeks, *X* had yellow leaves and short internodes, *Y* has red patches on the stem and *Z* had green leaves and stem. It can be deduced that
(A) *X* lacked magnesium, *Y* lacked calcium and *Z* lacked molybdenum
(B) *X* lacked calcium, *Y* lacked nitrogen and *Z* lacks chlorine
(C) *X* lacked calcium, *Y* lacked nitrogen and *Z* had all nutrients
(D) *X* lacked magnesium, *Y* lacked nitrogen and *Z* had all nutrients

4. In the life cycle of a fern the meiosis occurs during the
(A) Formation of spores (B) Formation of gametes
(C) Germination of a spore (D) Development of a zygote

PHYSICS & CHEMISTRY

5. Hydrogen sulphide (H_2S) contains 94.11% sulphur, water (H_2O) contains 11.11% hydrogen and sulphur dioxide (SO_2) contains 50% oxygen. Find the ratio of all given elements. After your calculations which law has been verified?
(A) Law of multiple proportion (B) Law of reciprocal proportion
(C) Law of constant components (D) Law of combining volumes

6. An astronaut in the space shuttle orbiting the earth performs a trick for a television audience. She inflates a helium filled balloon within the shuttle's controlled atmosphere and lets go of it. To the astonishment of all watching, the balloon
(A) Hovers in place where it was released.
(B) Rises noticeably away from the earth.
(C) Falls noticeably towards the earth.
(D) Drifts backwards opposite to the direction of the shuttle's velocity.

7. A boy throws a table tennis ball of mass 20 g upwards with a velocity of u_0 = 10 m/s at an angle θ_0 with the vertical. The wind imparts a horizontal force of 0.08 N, so that the ball returns to the starting point. Then, the angle θ_0 must be such that, tan θ_0 is
(A) 0.2 (B) 0.4 (C) 2.5 (D) 1.2

8. A weight is attached to the free end of a sonometer wire. It gives resonance at a length 40 cm when it is resonanced with a tuning fork of frequency 51Hz. The weight is then immersed wholly in water, the resonant length is reduced to 30 cm. The relative density in which weight suspended is
(A) 16/9 (B) 16/7 (C) 16/5 (D) 16/3

9. A tank of water has a pinhole leak in the side, 1 m below the water line. If the tank is open to the atmosphere (air pressure = 1.013×10^5 pa), how fast is the water leaving the pinhole ?
(A) $\sqrt{g/4}$ (B) $\sqrt{g/0.1}$ (C) $\sqrt{2g}$ (D) $\sqrt{g}$

10. One mole of an ideal monatomic gas expands till its temperature doubles under the process V^2T = constant. If the initial temperature is 400 K, the work done by the gas is
(A) 400 *R* (B) 200 *R* (C) – 200 *R* (D) Indeterminate

11. In the reaction,

$$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(l)}$$

when 1 mole of ammonia and 1 mole of O_2 are made to react to completion :
(A) 1.0 mole of H_2O is produced (B) 2.0 mole of NO will be produced
(C) All the oxygen will be consumed (D) All the ammonia will be consumed

International Mathematics Olympiad

LOGICAL REASONING

1. Tony and Sunil are participating in a jog-a-thon to raise money for charity. Tony will raise Rs. 20, plus Rs. 2 for each lap he jogs. Sunil will raise Rs. 30, plus Rs.1.50 for each lap he jogs. The total amount of money each will raise can be calculated using the follwing expressions where n represents the number of laps run :

Tony : $20 + 2n$; Sunil : $30 + 1.50n$

After how many laps will they have raised the same amount of money?

(A) 3 (B) 6.5 (C) 14.5 (D) 20

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2. A formula for computing a value r is $r = \frac{mx + my}{wz}$, where m, x, y, w and z are positive integers. An increase in which variable would result in a corresponding decrease in r ?

(A) m (B) x (C) y (D) z

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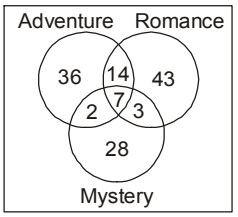
3. The Venn diagram below shows the types of novels the literature club members read during their summer break.

Which of the following is NOT supported by the information in the Venn diagram?

(A) 21 members read both an adventure novel and a romance novel
(B) 64 members read only an adventure novel or a mystery novel
(C) 26 members read all three types of novels
(D) 67 members read a romance novel

Literature Club Summer Reading



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4. A guitar manufacturer uses a computer-controlled machine to make electric guitars. The table shows the total number of guitars made after 2, 4, 8 and 16 hours. If g represents the total number of guitars made after h hours, which equation represents the pattern shown in the table?

(A) $g = 12h - 6$ (B) $g = 12h$

(C) $g = 3h^2 - 6$ (D) $g = 3h^2 + 6$

Hours (h)	Total Number of Guitars Made (g)
2	18
4	42
8	90
16	186

MATHEMATICAL REASONING

5. What is the solution to the system of equations shown below?

$$\begin{cases} 2x - y + 3z = 8 \\ x - 6y - z = 0 \\ -6x + 3y - 9z = 24 \end{cases}$$

(A) (0, 4, 4) (B) $\left(1, 4, \frac{10}{3}\right)$ (C) No solution (D) Infinitely many solutions

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6. What is the nth term in the arithmetic series below?

$3 + 7 + 11 + 15 + 19$ .....

(A) $4n$ (B) $3 + 4n$ (C) $2n + 1$ (D) $4n - 1$

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7. A train is made up of a locomotive, 7 different cars, and a caboose. If the locomotive must be first, and the caboose must be last, how many different ways can the train be ordered?

(A) 5040 (B) 181,440 (C) 362,880 (D) 823,543

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8. If $A + B = \frac{\pi}{4}$ then value of $(1 + \tan A)(1 + \tan B)$ equals

(A) 1 (B) 2 (C) –2 (D) –1

---

9. What are the coordinates of the image of point $P(-3, -7)$ after a reflection about the line $y = 2$?

(A) (– 3, 9) (B) (– 3, 11) (C) (5, – 7) (D) (7, – 7)

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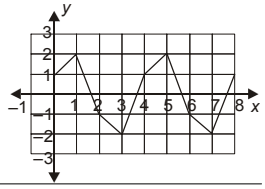
10. Look at this function

As the value of x increases, the y-values form a repeating pattern.

If this pattern continues, what is the y-value when $x = 26$?

(A) – 2 (B) – 1

(C) 1 (D) 2



11. What is the range of the function $f(x) = x^2 + 3$ if the domain is {– 3, 0, 3}?

(A) {3, 12} (B) {– 6, 3, 12}

(C) All real numbers (D) All real numbers greater than or equal to 3

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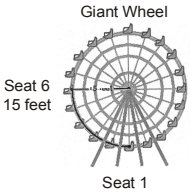
12. The sum of three consecutive odd integers is 21. If x is the least of these odd integers, which equation must be true?

(A) $3x = 21$ (B) $3x + 3 = 21$ (C) $3x + 4 = 21$ (D) $3x + 6 = 21$

EVERYDAY MATHEMATICS

13. Julie works at the amusement park with the maintenance crew. She needs to replace a string of burned-out lights along the arc shown between seat 1 and seat 6. The arc makes up 1/4 of the Giant Wheel.

The 20 seats of the wheel are equally spaced, and the supports from the centre of the wheel to each seat are 15 feet in length. How long, to the nearest foot, does the string of replacement lights need to be?



(A) 24 feet (B) 30 feet (C) 47 feet (D) 90 feet

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14. The typical wingspan of the little blue heron is 4 inches more than half the typical wingspan of the great blue heron. If g represents the typical wingspan of the great blue heron, which expression represents the typical wingspan of the little blue heron?

(A) $4\left(\frac{1}{2}g\right)$ (B) $\frac{1}{2}g + 4$ (C) $2g + 4$ (D) $\frac{1}{2}(g + 4)$

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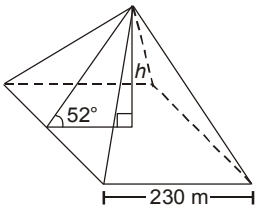
15. This diagram shows the angle of inclination of the triangular faces of the Great Pyramid in Egypt.

When it was built, the length of each side of the square base was 230 meters.

Which equation represents the height, h, of the Great Pyramid when it was built?



(A) $h = 115 \sin 52°$ (B) $h = 115 \tan 52°$

(C) $h = \frac{115}{\sin 52°}$ (D) $h = \frac{115}{\tan 52°}$

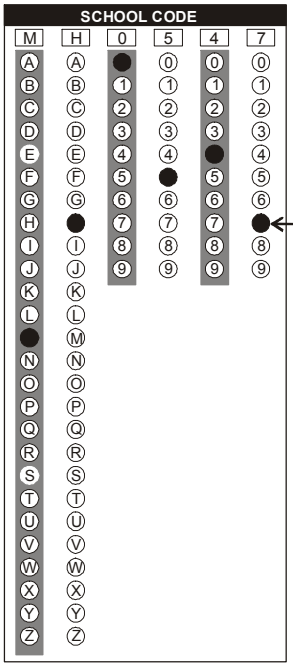
SAMPLE ANSWER SHEET

1. NAME : If your name is SACHIT A IYER, then you should write as follows :

S	A	C	H	I	T		A		I	Y	E	R													

2. FATHER'S NAME : If your father's name is SATISH KUMAR SHARMA, then you should write as follows :

S	A	T	I	S	H		K	U	M	A	R		S	H	A	R	M	A								

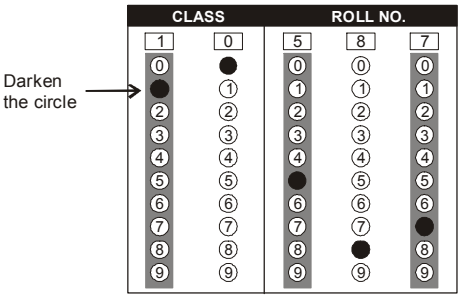


3. SCHOOL CODE
Write your school code i.e. if your school code is MH0547 darken as follows :

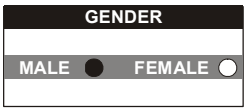
Darken the circle

4. CLASS
If you are in Class 10, then you should darken as follows :

5. ROLL NO.
If your roll no. is 587, then you should write and darken the circles as follows :



6. GENDER
If you are a boy, then darken **Male** circle



7. If your choice for Answer 1 is C, then you should darken the circle as follows : **1.** Ⓐ Ⓑ ● Ⓓ

Darken the circle

MARK YOUR ANSWERS WITH HB PENCIL/BALL POINT PEN (BLUE/BLACK)

National Cyber Olympiad

1. Ⓐ Ⓑ Ⓒ Ⓓ	5. Ⓐ Ⓑ Ⓒ Ⓓ	9. Ⓐ Ⓑ Ⓒ Ⓓ	13. Ⓐ Ⓑ Ⓒ Ⓓ	17. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ	6. Ⓐ Ⓑ Ⓒ Ⓓ	10. Ⓐ Ⓑ Ⓒ Ⓓ	14. Ⓐ Ⓑ Ⓒ Ⓓ	18. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ	7. Ⓐ Ⓑ Ⓒ Ⓓ	11. Ⓐ Ⓑ Ⓒ Ⓓ	15. Ⓐ Ⓑ Ⓒ Ⓓ	19. Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ	8. Ⓐ Ⓑ Ⓒ Ⓓ	12. Ⓐ Ⓑ Ⓒ Ⓓ	16. Ⓐ Ⓑ Ⓒ Ⓓ	20. Ⓐ Ⓑ Ⓒ Ⓓ

National Science Olympiad

1. Ⓐ Ⓑ Ⓒ Ⓓ	5. Ⓐ Ⓑ Ⓒ Ⓓ	9. Ⓐ Ⓑ Ⓒ Ⓓ	13. Ⓐ Ⓑ Ⓒ Ⓓ	17. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ	6. Ⓐ Ⓑ Ⓒ Ⓓ	10. Ⓐ Ⓑ Ⓒ Ⓓ	14. Ⓐ Ⓑ Ⓒ Ⓓ	18. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ	7. Ⓐ Ⓑ Ⓒ Ⓓ	11. Ⓐ Ⓑ Ⓒ Ⓓ	15. Ⓐ Ⓑ Ⓒ Ⓓ	19. Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ	8. Ⓐ Ⓑ Ⓒ Ⓓ	12. Ⓐ Ⓑ Ⓒ Ⓓ	16. Ⓐ Ⓑ Ⓒ Ⓓ	20. Ⓐ Ⓑ Ⓒ Ⓓ

International Mathematics Olympiad

1. Ⓐ Ⓑ Ⓒ Ⓓ	5. Ⓐ Ⓑ Ⓒ Ⓓ	9. Ⓐ Ⓑ Ⓒ Ⓓ	13. Ⓐ Ⓑ Ⓒ Ⓓ	17. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ	6. Ⓐ Ⓑ Ⓒ Ⓓ	10. Ⓐ Ⓑ Ⓒ Ⓓ	14. Ⓐ Ⓑ Ⓒ Ⓓ	18. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ	7. Ⓐ Ⓑ Ⓒ Ⓓ	11. Ⓐ Ⓑ Ⓒ Ⓓ	15. Ⓐ Ⓑ Ⓒ Ⓓ	19. Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ	8. Ⓐ Ⓑ Ⓒ Ⓓ	12. Ⓐ Ⓑ Ⓒ Ⓓ	16. Ⓐ Ⓑ Ⓒ Ⓓ	20. Ⓐ Ⓑ Ⓒ Ⓓ

ANSWERS

National Cyber Olympiad

1. (D) 2. (B) 3. (A) 4. (D) 5. (B) 6. (C) 7. (A) 8. (C) 9. (D) 10. (C)
11. (C) 12. (A) 13. (D) 14. (A) 15. (D)

National Science Olympiad

MATHEMATICS : 1. (A) 2. (D) 3. (D) 4. (C)

BIOLOGY : 1. (A) 2. (A) 3. (D) 4. (A)

PHYSICS & CHEMISTRY : 5. (B) 6. (B) 7. (B) 8. (B) 9. (C) 10. (C) 11. (C)

International Mathematics Olympiad

1. (D) 2. (D) 3. (C) 4. (A) 5. (C) 6. (D) 7. (A) 8. (B) 9. (B) 10. (B)
11. (A) 12. (D) 13. (A) 14. (B) 15. (B)