IEO

SOF INTERNATIONAL ENGLISH OLYMPIAD

Total Questions : 50   Time : 1 hr.

PATTERN & MARKING SCHEME				
Section	(1) Word and Structure Knowledge	(2) Reading	(3) Spoken and Written Expression	(4) Achievers Section
No. of Questions	30	10	5	5
Marks per Ques.	1	1	1	3

SYLLABUS : As Per Your Prescribed Syllabus.

WORD AND STRUCTURE KNOWLEDGE

1. Choose the best option.

   If you think that doing this maths problem is _____, just try it.
   - (A) a piece of cake
   - (B) ups and downs
   - (C) odds and ends
   - (D) pros and cons

2. Choose the incorrect part of the sentence.
   - (A) Women are now working
   - (B) in every fields
   - (C) like teaching, medicine
   - (D) law, business, etc.

READING

Direction (Q. No. 3 to 6) : Fill the blanks in this paragraph with the right options.

When her friends arrived, Suman ___3___ chips and other snacks and her sister ___4___ drinks. She went round the room ___5___ glasses whenever she noticed that anyone needed a ___6___.
- (A) top-up
- (B) handed round
- (C) poured out
- (D) topping up

SPOKEN AND WRITTEN EXPRESSION

Direction (Q. No. 7 and 8) : Choose the words that best complete the sentences.

7. If you are _____, you have extreme or very strong views.
   - (A) progressive
   - (B) innovative
   - (C) diplomatic
   - (D) radical

8. If you are _____, you are in favour of new ideas.
   - (A) progressive
   - (B) innovative
   - (C) diplomatic
   - (D) radical

ACHIEVERS SECTION

9. Choose the option which is closest in meaning to the underlined bold word.

   Dappled light filtered through the trees on to the ground.
   - (A) Patches of
   - (B) Rays
   - (C) Stirring
   - (D) Slanting

10. Choose the best option.

    The RBI Governor said in a press conference that the nation's economy was _____ yet.
    - (A) out of the forests
    - (B) not out of the trees
    - (C) out of the trees
    - (D) not out of the woods

N S O

**SOF NATIONAL
SCIENCE OLYMPIAD**

Total Questions : 50   Time : 1 hr.

	PATTERN & MARKING SCHEME		
Section	(1) Physics & Chemistry	(2) Achievers Section	(3) Mathematics or Biology
No. of Questions	25	5	20
Marks per Ques.	1	3	1

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for more details

SYLLABUS

Section – 1 : Physics : Electricity and Magnetism, Electromagnetic Induction, Alternating current, Electromagnetic waves, Optics, Modern Physics, Semiconductor Electronics. Chemistry : Solutions, Electrochemistry, Chemical Kinetics, The d- and f-Block Elements, Coordination Compounds, Haloalkanes and Haloarenes, Alcohols, Phenols and Ethers, Aldehydes, Ketones and Carboxylic Acids, Amines, Biomolecules.

Section – 2 : Higher Order Thinking Questions - Syllabus as per Section – 1.

Section – 3 : Relations and Functions, Inverse Trigonometric Functions, Matrices and Determinants, Continuity and Differentiability, Application of Derivatives, Integrals, Application of Integrals, Differential Equations, Vector Algebra, Three Dimensional Geometry, Probability, Linear Programming.

OR

Section – 3 : Reproduction, Genetics and Evolution, Biology in Human Welfare, Biotechnology, Ecology.

PHYSICS AND CHEMISTRY

1. A ray of light passes from vacuum into a medium of refractive index μ. If the angle of incidence is found to be twice the angle of refraction, then the angle of incidence is
   (A) $\cos^{-1}(\mu/2)$
   (B) $2\cos^{-1}(\mu/2)$
   (C) $2\sin^{-1}\mu$
   (D) $2\sin^{-1}(\mu/2)$.

2. A capacitor of capacitance C_0 is charged to a potential V_0 and then isolated. A small capacitor of capacitance C is then charged from C_0, discharged and charged again, the process being repeated n times. Due to this, potential of the larger capacitor is decreased to V. The value of C is

   (A) $C_0\left[\dfrac{V_0}{V}\right]^{1/n}$
   (B) $C_0\left[\left(\dfrac{V_0}{V}\right)^{1/n}-1\right]$
   (C) $C_0\left[\left(\dfrac{V_0}{V}\right)-1\right]^{n}$
   (D) $C_0\left[\left(\dfrac{V_0}{V}\right)^{n}-1\right]$.

3. A ray of light in a liquid of refractive index 1.4, approaches the boundary surface between the liquid and air at an angle of incidence whose sine is 0.8. Which of the following statements is correct about the behavior of the light ?
   (A) It is impossible to predict the behavior of the light ray on the basis of the information supplied.
   (B) The sine of the angle of refraction of the emergent ray will be less than 0.8.
   (C) The ray will be internally reflected.
   (D) None of these

4. Five aromatic compounds are given as :
   I.   p-Methoxybenzaldehyde
   II. p-Hydroxyphenylacetaldehyde
   III. p-Hydroxyphenylmethyl ketone
   IV. p-Methylbenzoic acid
   V.   p-Hydroxyphenylvinyl ether

   Now, read the given passage and fill in the blanks by selecting an appropriate option.

   Compound(s) $\underline{(p)}$ form(s) a silver mirror with Tollens' reagent. Compound $\underline{(q)}$ gives positive iodoform test while compound $\underline{(r)}$ on acid hydrolysis gives 1, 4-dihydroxybenzene. Compound $\underline{(s)}$ can be readily extracted in aqueous $NaHCO_3$ solution.

	(p)	(q)	(r)	(s)
(A)	I, II	V	IV	II
(B)	I	IV	III	V
(C)	III, V	IV	V	II
(D)	I, II	III	V	IV

5. 1.00 g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. The freezing point depression constant of benzene is 5.12 K kg mol^{-1}. The molar mass of the solute is
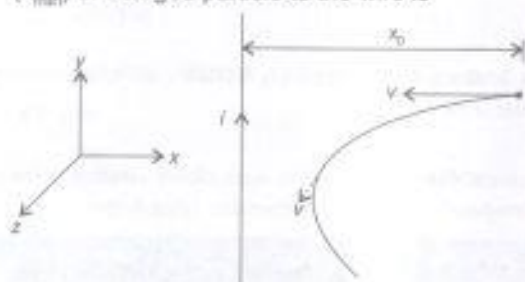   (A) 456 kg/mol
   (B) 352 g/mol
   (C) 256 g/mol
   (D) 240 g/mol.

6. When a compound 'X' is reacted with PCl_5 and then with NH_3, it gives 'Y'. When 'Y' is treated with Br_2 and KOH, it produces 'Z'. 'Z' on treatment with $NaNO_2$ and HCl at 0°C and then on warming with water produces *ortho*-cresol. Compound 'X' is
   (A) *o*-toluic acid
   (B) *o*-chlorotoluene
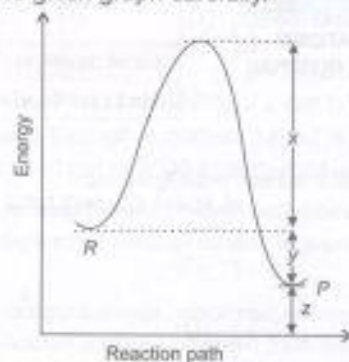   (C) *o*-bromotoluene
   (D) *m*-toluic acid.

7. A long straight wire carries a current i. A particle having a positive charge q and mass m, kept at distance x_0 from the wire is projected towards it with speed v as shown in the figure. The closest distance of approach (x_{min}) of charged particle to the wire is

(A) $x_{min} = x_0 e^{-2\pi mv/\mu_0 qi}$

(B) $x_{min} = x_0 e^{mv/\mu_0 qi}$

(C) $x_{min} = x_0 e^{-\pi mv/\mu_0 qi}$

(D) $x_{min} = x_0 e^{-mv/\mu_0 q2i}$

8. Observe the given graph carefully.

The activation energy of the backward reaction, heat of reaction and threshold energy of the reaction respectively are

(A) $x - y$, y and $x + y - z$

(B) $x + y + z$, $y + z$ and z

(C) $x + y$, y and $x + y + z$

(D) $x + y$, y and $x - y - z$.

MATHEMATICS

9. If $\sqrt{(1 - x^6)} + \sqrt{(1 - y^6)} = a(x^3 - y^3)$ and $\frac{dy}{dx} = f(x, y)\sqrt{\left(\frac{1 - y^6}{1 - x^6}\right)}$, then

(A) $f(x, y) = \frac{y}{x}$

(B) $f(x, y) = \frac{y^2}{x^2}$

(C) $f(x, y) = \frac{2y^2}{x^2}$

(D) $f(x, y) = \frac{x^2}{y^2}$

10. For non-zero vectors $\vec{a}, \vec{b}, \vec{c}$;
$(\vec{a} \times \vec{b}) \cdot \vec{c} = |\vec{a}| \, |\vec{b}| \, |\vec{c}|$ holds iff

(A) $\vec{a} \cdot \vec{b} = 0, \vec{b} \cdot \vec{c} = 0$

(B) $\vec{b} \cdot \vec{c} = 0, \vec{c} \cdot \vec{a} = 0$

(C) $\vec{c} \cdot \vec{a} = 0, \vec{a} \cdot \vec{b} = 0$

(D) $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{c} = \vec{c} \cdot \vec{a} = 0$

BIOLOGY

9. In which of the following embryonic stages does the implantation take place?
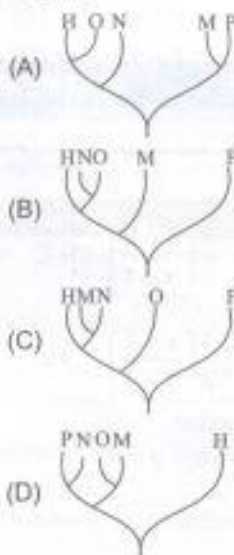
(A)

(B)

(C)

(D)

10. Human blood, when mixed with antibodies present in human blood, give maximum precipitation.
If another animal's blood is mixed with antibodies present in human blood, the percentage of precipitation indicates evolutionary relationship with that animal. The following experimental results were obtained :
Species: Human (H) - 100%; M - 37%; N - 75%; O - 79%; P - 17%

Which phylogenetic tree would best represent these results?

(A)

(B)

(C)

(D)

SYLLABUS

Section – 1 : Verbal and Non-Verbal Reasoning.

Section – 2 : Relations and Functions, Inverse Trigonometric Functions, Matrices and Determinants, Continuity and Differentiability, Application of Derivatives, Integrals, Application of Integrals, Differential Equations, Vector Algebra, Three Dimensional Geometry, Probability, Linear Programming.

OR

Section – 2 : Numbers, Quantification, Numerical Applications, Solutions of Simultaneous Linear Equations, Matrices, Determinants, Application of Derivatives, Integration, Application of Integrations, Differential Equations, Probability, Inferential Statistics, Index numbers, Time-based data, Financial Mathematics, Linear Programming.

Section – 3 : The syllabus of this section will be based on the syllabus of Quantitative Aptitude.

Section – 4 : Matrices, Determinants, Application of Derivatives, Integration, Application of Integrations, Differential Equations, Linear Programming, Probability.

LOGICAL REASONING

1. In the given letter series, some of the letters are missing which are given in that order as one of the options below it. Choose the correct option.

   a_cb_abcb_a_cbc_bcbc

   (A) cccbc (B) cbbac
   (C) bccba (D) abbba

2. Following letters are to be coded as follows:

   Letter: R D A E J M K T B U I P W H F

   Codes: 4 8 5 $ * 1 2 6 % © 7 @ 3 9 #

   While coding the given letters, following conditions are also to be observed.

   Conditions:
   (i) If the first letter is a consonant and the last letter is a vowel, then both are to be coded as d.
   (ii) If both the first and the last letters are consonants, then both are to be coded as the code for the last letter.
   (iii) If the first letter is a vowel and the last letter is a consonant, then their codes are to be interchanged.

   What will be the code for METUFB?

   (A) %$6©#1 (B) 1$6©#1
   (C) %$6©#% (D) 1$6©#%

3. There is a definite relationship between figures P and Q. Establish a similar relationship between figures R and S by selecting a figure from the options that would replace the (?) in figure R.
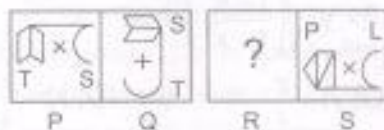
   (A)   (B)
   (C)   (D)

MATHEMATICAL REASONING

4. $\displaystyle\int \frac{dx}{[(x-1)^3(x+2)^5]^{1/4}} =$

   (A) $\dfrac{4}{3}\left(\dfrac{x-1}{x+2}\right)^{1/4}+C$ (B) $\dfrac{4}{3}\left(\dfrac{x+2}{x-1}\right)^{1/4}+C$

   (C) $\dfrac{1}{3}\left(\dfrac{x-1}{x+2}\right)^{1/4}+C$ (D) $\dfrac{1}{3}\left(\dfrac{x+2}{x-1}\right)^{1/4}+C$

5. Degree of the differential equation

   $\left[1+2\left(\dfrac{dy}{dx}\right)^2\right]^{3/2} = 5\dfrac{d^2y}{dx^2}$ is

   (A) 1 (B) 2
   (C) 3 (D) 4

6. The value of x for which the matrix product

   $\begin{bmatrix} 2 & 0 & 7 \\ 0 & 1 & 0 \\ 1 & -2 & 1 \end{bmatrix}\begin{bmatrix} -x & 14x & 7x \\ 0 & 1 & 0 \\ x & -4x & -2x \end{bmatrix}$

   is equal to identity matrix is

   (A) $\dfrac{1}{2}$ (B) $\dfrac{1}{3}$

   (C) $\dfrac{1}{4}$ (D) $\dfrac{1}{5}$

APPLIED MATHEMATICS

4. If A and B are square matrices of the same order and A is non-singular, then for a positive integer n, $(A^{-1}BA)^n$ is equal to

(A) $A^nB^nA^n$

(B) $A^nB^nA^{-n}$

(C) $A^{-1}B^nA$

(D) $n(A^{-1}BA)$

5. The area bounded by $y = x^2 + 2$, x-axis, $x = 1$ and $x = 2$ is

(A) $\dfrac{16}{3}$ sq. units

(B) $\dfrac{17}{3}$ sq. units

(C) $\dfrac{13}{3}$ sq. units

(D) $\dfrac{20}{3}$ sq. units

6. Records show that probability of a car breaking down while driving through a certain tunnel is 0.0004. The probability that out of 2000 cars that drive through this tunnel at least one will break is

(A) $e^{\frac{-4}{5}}$

(B) $1 - e^{\frac{4}{5}}$

(C) $1 - e^{\frac{-4}{5}}$

(D) $1 + e^{\frac{-4}{5}}$

EVERYDAY MATHEMATICS

7. A can lay railway track between two given stations in 16 days and B can do the same job in 12 days. With the help of C, they did the job in 4 days only. Then C alone can do the job in

(A) $9\dfrac{1}{5}$ days

(B) $9\dfrac{2}{5}$ days

(C) $9\dfrac{3}{5}$ days

(D) 9 days

8. In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there?

(A) 159

(B) 194

(C) 205

(D) 209

ACHIEVERS SECTION

9. Consider the following statements.

Statement 1 : A tangent parallel to x-axis can be drawn for $f(x) = (x - 1)(x - 2)(x - 3)$ in the interval $[1, 3]$.

Statement 2 : A horizontal tangent can be drawn in Rolle's theorem.

Which of the following options is correct?

(A) Both Statement 1 and Statement 2 are true.

(B) Both Statement 1 and Statement 2 are false.

(C) Statement 1 is true but Statement 2 is false.

(D) Statement 1 is false but Statement 2 is true.

10. The diagram shows a quadratic curve and a straight line $y = mx + c$. They meet at the points P and Q on the x-axis and y-axis respectively.
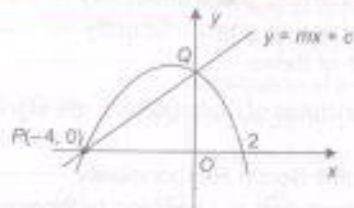
(a) Find the equation of the quadratic curve.

(b) Find the values of m and c respectively.

	(a)	(b)
(A)	$-x^2 - 2x + 8$	2, 8
(B)	$x^2 + 2x + 8$	6, 4
(C)	$x^2 - 2x - 8$	4, 6
(D)	$-x^2 - 2x + 8$	8, 2

ECONOMICS

1. In 1991, the share of foreign equity participation was increased and in many activities 100 per cent Foreign Direct Investment (FDI) was permitted. Identify the reform.
   - (A) Liberalisation
   - (B) Privatisation
   - (C) Globalisation
   - (D) Both (A) and (C)

2. Why externalities are a limitation of taking GDP as an index of welfare?
   - (A) It helps GDP to rise.
   - (B) GDP fails to value the cost of such factors.
   - (C) It results in a decrease in GDP.
   - (D) It will have no effect on GDP.

3. From the following data about government, find revenue deficit, fiscal deficit and primary deficit :
   Plan capital expenditure = ₹ 120
   Revenue expenditure = ₹ 100
   Non plan capital expenditure = ₹ 80
   Revenue receipts = ₹ 70
   Recovery of loans and advances = ₹ 140
   Interest payments = ₹ 30
   - (A) Revenue deficit = ₹ 40, Fiscal deficit = ₹ 90, Primary deficit = ₹ 60
   - (B) Revenue deficit = ₹ 30, Fiscal deficit = ₹ 90, Primary deficit = ₹ 60
   - (C) Revenue deficit = ₹ 40, Fiscal deficit = ₹ 60, Primary deficit = ₹ 30
   - (D) Revenue deficit = ₹ 30, Fiscal deficit = ₹ 60, Primary deficit = ₹ 30

4. Which policy was associated in increasing the interest of the cultivators to earn more incentive?
   - (A) Tillers to the land
   - (B) Incentives of the land
   - (C) Land to the tiller
   - (D) Incentives to the cultivators

BUSINESS STUDIES

5. Management is a process of
   - (A) Getting things done
   - (B) Achieving goals effectively
   - (C) Achieving goals efficiently
   - (D) All of these.

6. The principles of management are significant because of
   - (A) Fulfill Social Responsibility
   - (B) Adaptation to changing technology
   - (C) Optimum utilisation of resources
   - (D) All of these.

7. Planning may not guarantee success because
   - (A) Top level plans and middle level management implements
   - (B) Dynamics of business environment
   - (C) Planning is futuristic
   - (D) All of these.

8. Which of the following cannot be achieved by control function of a management?
   - (A) Controlling function can suitably modifies the external factors of business environment.
   - (B) The controlling function is used to ensure that the organisation meets its business goals.
   - (C) Controlling function helps the organisations in their efforts to improve quality by verifying whether the standards set are accurate and objective.
   - (D) Controlling helps to reduce wastage of resources thereby increasing efficiency and effectiveness.

ACCOUNTANCY

9. X, Y and Z are partners sharing profits in the ratio of 5 : 3 : 2. They decided to share future profits in the ratio of 2 : 3 : 5 with effect from 1st April, 2023. They also decided to record the effect of following revaluations without affecting the book values of assets and liabilities, by passing single adjusting entry :

	Book Figure (in ₹)	Revised Figure (in ₹)
Land and Building	3,00,000	4,50,000
Plant and Machinery	4,50,000	4,20,000
Trade Creditors	1,50,000	1,35,000
Outstanding Rent	1,35,000	1,80,000

   The necessary single adjusting entry will be :
   - (A) Dr. Z and Cr. X by ₹ 27,000
   - (B) Dr. X and Cr. Z by ₹ 27,000
   - (C) Dr. Y and Cr. X by ₹ 27,000
   - (D) Dr. X and Cr. Y by ₹ 27,000.

10. M Ltd. issued 10,000 shares of ₹ 50 each. The amount of share was payable as follows :
   ₹ 15 on application, ₹ 10 on allotment and balance of first and final call. Applications for 15,000 shares were received and allotment was made to all the applicants on pro-rata basis. Directors decided to adjust excess application money towards allotment. Calculate the amount transferred to Share Allotment.

(A) ₹ 60,000
(B) ₹ 70,000
(C) ₹ 85,000
(D) None of these

11. Depreciation is charged on
    (A) Current Assets
    (B) Fixed Assets
    (C) Both Current and Fixed Assets
    (D) None of these.

12. For a manufacturing concern, interest received by other financial enterprises is shown as _____ activity, however interest paid to other financial enterprises is shown as _____ in cash flow statement.
    (A) Operating, financing
    (B) Investing, financing
    (C) Financing, investing
    (D) Operating, investing

ACHIEVERS SECTION

13. From the following information, calculate return on investment (or return on capital employed).

| Particulars	₹
Share Capital	5,00,000
Reserves and Surplus	2,50,000
Net Fixed Assets	22,50,000
Non-current Trade Investments	2,50,000
Current Assets	11,00,000
10% Long-term Borrowings	20,00,000
Current Liabilities	8,50,000
Long-term Provisions	NiL

Net Profit before Tax is ₹ 6,00,000.
(A) 29.09%   (B) 39.09%
(C) 49.09%   (D) 9.09%

14. Read the following statements and select the correct option.

    Statement 1 : Great Leap Forward (GLF) campaign initiated in 1968, aimed at industrialising the country on a massive scale.

    Statement 2 : Under great Proletarian Cultural Revolution, introduced by Mao in 1965, students and professionals were sent to work and learn from the countryside.

(A) Both statements 1 and 2 are true.
(B) Both statements 1 and 2 are false.
(C) Statement 1 is true but statement 2 is false.
(D) Statement 1 is false but statement 2 is true.

15. Match the columns and select the correct option.

	Column I		Column II
(a)	Authority	(i)	Being answerable for the final outcome
(b)	Responsibility	(ii)	Right of an individual to command his subordinates and to take action within the scope of his position
(c)	Accountability	(iii)	Difficulty of coordination for a multi-product company
(d)	Functional structure	(iv)	Obligation of a subordinate to properly perform the assigned duty.

	(a)	(b)	(c)	(d)
(A)	(i)	(ii)	(iv)	(iii)
(B)	(iv)	(i)	(iii)	(ii)
(C)	(ii)	(iv)	(i)	(iii)
(D)	(iii)	(iv)	(ii)	(i)
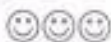
☺☺☺

IEO – 1. (A) 2. (B) 3. (B) 4. (C) 5. (D) 6. (A) 7. (D) 8. (A) 9. (A) 10. (D)

NSO – (PHYSICS AND CHEMISTRY) 1. (B) 2. (B) 3. (C) 4. (D) 5. (C) 6. (A) 7. (A) 8. (C)

(MATHEMATICS) 9. (D) 10. (D)

(BIOLOGY) 9. (A) 10. (A)

IMO – 1. (C) 2. (C) 3. (D)

(MATHEMATICAL REASONING) 4. (A) 5. (B) 6. (D)

(APPLIED MATHEMATICS) 4. (C) 5. (C) 6. (C)

7. (C) 8. (D) 9. (A) 10. (A)

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