SOF OLYMPIADS

CLASS 12

SAMPLE PAPER 2025-26

NSO 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

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. Match column I with column II and select the correct option.

	Column I (Complex)		**Column II (Hybridisation and magnetic moment)**
(P)	$[Ni(CN)_4]^{2-}$	(I)	sp^3d^2 and 4.89 B.M.
(Q)	$[CoF_6]^{3-}$	(II)	d^2sp^3 and 0 B.M.
(R)	$[NiCl_4]^{2-}$	(III)	dsp^2 and 0 B.M.
(S)	$[Co(NH_3)_6]^{3+}$	(IV)	sp^3 and 2.83 B.M.

(A) (P) - (III), (Q) - (I), (R) - (II), (S) - (IV) (B) (P) - (III), (Q) - (I), (R) - (IV), (S) - (II)

(C) (P) - (IV), (Q) - (I), (R) - (III), (S) - (II) (D) (P) - (IV), (Q) - (II), (R) - (III), (S) - (I)

2. At 298 K, the values of Henry's law constant K_H for the gases (*P*), (*Q*) and (*R*) in water are given as 71.18, 1.67 and 41.85 kbar respectively.
Which of the given statements is/are not correct?

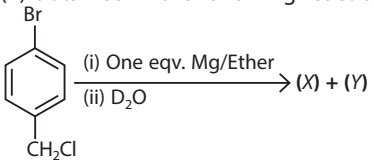
I. (*P*) has the highest solubility in water at a given pressure.

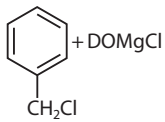
II. The pressure of a 55.5 molal solution of (*Q*) is 1.5×10^{-3} bar.

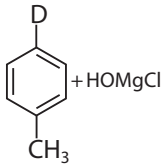
III. The solubility of (*R*) at 293 K is higher than that at 273 K.

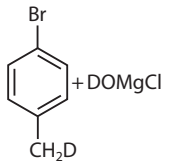
(A) III only (B) II and III only (C) I and II only (D) I, II and III

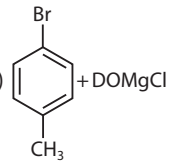
3. The products (*X*) and (*Y*) obtained in the following reaction are



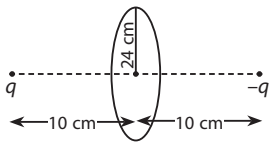
(A) 

(B) 

(C) 

(D) 

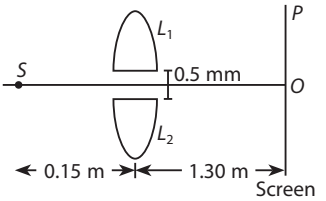
4. The given figure shows two point charges q and $-q$ separated by a distance of 20 cm.



What is the total electric flux passing through the circle?

(A) $\frac{8q}{13\varepsilon_0}$ (B) $\frac{15q}{38\varepsilon_0}$ (C) $\frac{16q}{31\varepsilon_0}$ (D) Zero

5. The given figure shows a monochromatic point source *S* emitting light of wavelength $\lambda = 500$ nm. A thin lens of circular shape and focal length 0.10 m is cut into two identical halves L_1 and L_2 which are placed symmetrically about axis *SO*. Here *P* is the point of third intensity maxima. Which one of the following statements is incorrect?



(A) If the gap between L_1 and L_2 is reduced from its original value of 0.5 mm, the distance *OP* will increase.

(B) The distance of first maximum from the centre is 1.3 mm.

(C) The distance of fifth minimum from the centre is 1.5 mm.

(D) The distance of sixth maximum from the centre is 2 mm.

6. The peak emission from a black body at a certain temperature occurs at a wavelength of 9000 Å. On increasing its temperature, the total radiation emitted is increased 81 times. At the initial temperature, when the peak radiation from the black body is incident on a metal surface, it does not cause any photo emission. After the increase of temperature, the peak radiation from the black body caused photo emission. To bring these photoelectrons to rest, a potential equivalent to the excitation energy between $n = 3$ to $n = 4$, Bohr levels of hydrogen atom is required. What is the work function of the metal?

(A) 3.48 eV (B) 2.25 eV (C) 6.92 eV (D) 5 eV

ACHIEVERS SECTION

7. Study the following paragraph and fill in the blanks by selecting the correct option.

Compound _(P)_ has general formula $C_4H_{10}O$ and gives immediate turbidity with $ZnCl_2$ and conc. HCl. When _(P)_ is treated with 20% H_3PO_4 at 358 K, it produces _(Q)_ which on further reaction with acidic $KMnO_4$ produces _(R)_. Ozonolysis of _(Q)_ produces (*R*) along with formaldehyde. _(S)_ is a functional isomer of _(R)_.

	(P)	*(Q)*	*(R)*	*(S)*
(A)	2-methyl-propan-2-ol	2-methyl-prop-1-ene	Butanal	Butanone
(B)	2-methyl-propan-1-ol	2-Butene	Butanone	Butanal
(C)	2-methyl-propan-1-ol	1-Butene	Propanal	Propanone
(D)	2-methyl-propan-2-ol	2-methyl-prop-1-ene	Propanone	Propanal

8. A heavy nucleus *P*, at rest, undergoes fission in two lighter nuclei *Q* and *R*. Let $\alpha = M_P - M_Q - M_R$, where M_P, M_Q and M_R are the masses of *P*, *Q* and *R* respectively and E_Q and E_R are the kinetic energies of *Q* and *R* respectively. The speeds of *Q* and *R* are v_Q and v_R respectively. If *c* is the speed of light, which of the following statements are correct?

(i) $E_Q + E_R = c^2\alpha$ (ii) $E_Q = \left(\frac{M_Q}{M_Q + M_R}\right)c^2\alpha$ (iii) $\frac{v_Q}{v_R} = \frac{M_R}{M_Q}$

(iv) The magnitude of momentum for *Q* as well as *R* is $c\sqrt{2\mu\alpha}$, where $\mu = \frac{M_Q M_R}{M_Q + M_R}$

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

MATHEMATICS

9. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & a & 1 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1/2 & -1/2 & 1/2 \\ -4 & 3 & c \\ 5/2 & -3/2 & 1/2 \end{bmatrix}$, then

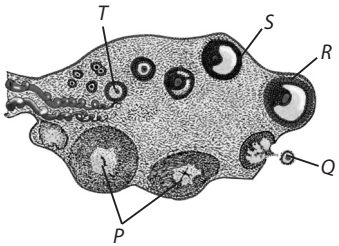
(A) $a = 2, c = 1/2$
(B) $a = 1, c = -1$
(C) $a = -1, c = 1$
(D) $a = 1/2, c = 1/2$

10. If the vectors $\vec{a}, \vec{b}, \vec{c}$ are such that each is inclined at an angle $\frac{\pi}{3}$ with the other and $|\vec{a}|=1, |\vec{b}|=2, |\vec{c}|=3,$ then $|\vec{a} + \vec{b} + \vec{c}| =$

(A) $3\sqrt{2}$ (B) 4
(C) 5 (D) 6

BIOLOGY

9. Refer to the given figure and select the incorrect statement regarding its parts labelled as *P*-*T*.



(A) *P* consists of lutein cells, fibrin and blood clot.
(B) A large number of *T* degenerate during the phase from birth to puberty.
(C) *R* gets transformed into *S* which is characterised by a fluid filled cavity called antrum.
(D) The primary oocyte completes its first meiotic division and is released as haploid *Q*.

10. Given in the box are names of few species.

Lates niloticus, Eichhornia crassipes, Clarias gariepinus, Ectopistes migratorius, Lantana camara, Blatta orientalis, Hydrodamalis gigas, Parthenium hysterophous, Raphrus cucullatus

How many among them are extinct?
(A) 2 (B) 3 (C) 4 (D) 1

ANSWER KEY

Physics and Chemistry	1. (B)	2. (D)	3. (C)	4. (A)	5. (B)	6. (A)	7. (D)	8. (B)
Mathematics	9. (B)	10.(C)						
Biology	9. (C)	10.(B)						