

NEW STANDARD ACADEMY

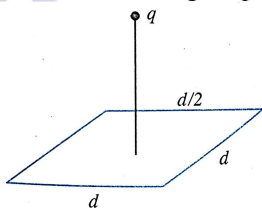
Date : 07-07-25

CLASS : 12TH

Marks: 60
Time: 3 hours.

PHYSICS

- Two charges $4 \times 10^{-9} \text{ C}$ and $-3 \times 10^{-9} \text{ C}$ are located at 0.1 m apart. At what point on the line joining the two charges is the electric potential zero? Take potential at infinity to be zero.
- The electric field in a region is given by $\vec{E} = \frac{A}{x^3} \hat{i}$. Write the S.I unit for A. Write an expression for the potential in the region assuming the potential at infinity to be zero.
- Four point charge $+1 \mu\text{C}$, $+1 \mu\text{C}$, $-1 \mu\text{C}$, $-1 \mu\text{C}$ are placed at corners of ABCD of a square of each side a (i) calculate electric potential at the centre O of the square (ii) If E is middle point of BC, what is work done in carrying an electron from O to E?
- A cube of each side b has a charge q at each of its vertices. Determine the potential and electric field due to this charge at the center of cube.
- Using Gauss's theorem, Derive an expression for electric field due to a uniformly charged spherical shell (i) at a point outside the shell and (ii) at a point inside the shell. (iii) point on the shell.
- (a) Define electric flux. Is it scalar or vector? A point charge q is at a distance of d/2 directly above the centre of a square of side d as shown in Fig. Use Gauss's law to obtain the expression for electric flux through square.



- (b) If the point charge is now moved to a distance from the centre of the square and the side of square and the side of square is doubled explain how the electric flux will be affected?
- Two concentric spherical of radii R and 2R are given charges Q_1 and Q_2 respectively. The surface charge densities on outer surfaces are equal. Determine the ratio $Q_1:Q_2$.
 - An electric dipole consists of two opposite charges of magnitude $\frac{2}{3} \times 10^{-7} \text{ C}$ separated by 2 cm. The dipole is placed in an external field

of $3 \times 10^7 \text{ NC}^{-1}$. What maximum torque does the electric field exert on dipole?

- How does the electric flux due to a point charge enclosed by a spherical Gaussian surface affected when its radius is increased?
- An electric dipole consists of two charges $+20 \mu\text{C}$ and $-20 \mu\text{C}$ separated by a distance of 1 cm. Calculate the electric field intensity at any point on the axial line at a distance of 10 cm from the mid point of dipole.

CHEMISTRY

- A solution of $\text{Ni}(\text{NO}_3)_2$ is electrolysed between platinum electrodes using a current of 5 amperes for 20 minutes. What mass of Ni is deposited at the cathode?
- The conductivity of 0.20 M solution of KCl at 298 K is 0.0248 S cm^{-1} . Calculate its molar conductivity.
- Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration.
- Write the Nernst equation and emf of the following cells at 298K :
(i) $\text{Mg(s)} \mid \text{Mg}^{2+} (0.001\text{M}) \parallel \text{Cu}^{2+} (0.0001 \text{ M}) \mid \text{Cu(s)}$
(ii) $\text{Fe(s)} \mid \text{Fe}^{2+} (0.001\text{M}) \parallel \text{H}^+ (1\text{M}) \mid \text{H}_2(\text{g}) 1 \text{ bar} \mid \text{Pt(s)}$
- The depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid and trifluoroacetic acid increases in the order given below. Explain briefly.
- A 5% solution (by mass) of cane sugar in water has freezing point of 271 K. Calculate the freezing point of 5% glucose in water if freezing point of pure water is 273.15 K.
- An aqueous solution of 2% non-volatile solute exerts a pressure of 1.004 bar at the normal boiling point of the solvent. What is the molar mass of the solute?
- What is meant by positive and negative deviations from Raoult's law and how is the sign of $\Delta_{\text{mix}} H$ related to positive and negative deviations from Raoult's law?
- A solution of glucose in water is labelled as 10% w/w what would be the molality and mole fraction of each component in the solution? If the density of solution is 1.2 g mL^{-1} then what shall be the molarity of the solution?

10. Benzene and toluene form ideal solution over the entire range of composition. The vapour pressure of pure benzene and toluene at 300 K are 50.71 mm Hg and 32.06 mm Hg respectively. Calculate the mole fraction of benzene in vapour phase if 80 g of benzene is mixed with 100 g of toluene.

BIOLOGY

- Mention the role of the codons AUG and UGA during protein synthesis?
- The length of a DNA molecule in a typical mammalian cell is calculated to be approximately 2.2 meters. How is the packaging of this long molecule done to accommodate it within the nucleus of the cell.
- Draw a labeled schematic sketch of replication fork of DNA. Explain the role of the enzymes involved in DNA replication.
- (a) Draw a schematic representation of a transcription unit and show the following in it.
(i) Direction in which the transcription occurs (ii) Polarity of the two strands involved (iii) Template strand (iv) Terminator
(b) Mention the function of promoter in transcription.
- What is vaccine? Give an example of a vaccine produced by recombinant technology
- Name the type of cells the AIDS virus first enters into after getting inside the human body. Explain the sequence of events that the virus undergoes within these cells to increase its progeny.
- Name the host and the site where the following occur in the life cycle of a malarial parasite
(a) Formation of gametocytes.
(b) Fusion of gametes.
- Name the plant source of the drug popularly called "smack." How does it affect the body abuser ?
- If the sequence of one strand of DNA is written as follows:
5'-ATGCATGCATGCATGCATGCATGC-3'
Write down the sequence of complementary strand in 5'-3' direction
- Differentiate between the followings:
(a) Repetitive DNA and Satellite DNA
(b) mRNA and tRNA

- (c) Template strand and Coding strand

MATHS

- Find the domain of $f(x) = \cos^{-1}(1-x^2)$. Also find its range.
- Write the element a_{23} of a 3×3 matrix $A = [a_{ij}]$ whose element a_{ij} are given by $a_{ij} = \frac{|i-j|}{2}$.
- Find x, y, a and b if
$$\begin{bmatrix} 2x-3y & a-b & 3 \\ 1 & x+4y & 3a+4b \end{bmatrix} = \begin{bmatrix} 1 & -2 & 3 \\ 1 & 6 & 29 \end{bmatrix}$$
- If $A = \begin{bmatrix} 9 & 1 \\ 7 & 8 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 5 \\ 7 & 12 \end{bmatrix}$, find matrix C such that $5A+3B+2C$ is a null matrix.
- If A is a square matrix such that $A^2 = I$, then find simplified value of $(A-I)^3 + (A+I)^3 - 7A$.
- If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, verify that $A^2 - 4A - 5I = O$.
- If $A = \begin{bmatrix} 3 & 5 \\ 7 & 9 \end{bmatrix}$ is written as $A = P + Q$, where P is a symmetric matrix and Q is a skew-symmetric matrix then write the matrix P.
- If $A = \begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix}$ find $A(\text{adj}A)$ without computing $\text{adj}A$.
- Using matrix method solve the following system of equations:
 $3x + 2y - 2z = 3$
 $x + 2y + 3z = 6$
 $2x - y + z = 2$.
- If $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix}$ then show that $A^3 - 4A^2 - 3A + 11I = O$. Hence, Find A^{-1}