

# NEW STANDARD ACADEMY

Marks: 60

Date : 21-04-25

CLASS : 12<sup>TH</sup>

Time: 3 hours.

## PHYSICS

- Two small charged spheres contain charges  $+q_1$  and  $q_2$  respectively. A charge  $q$  is removed from sphere carrying charge  $q_1$  and is transferred to the other. Find charge on each sphere for maximum electric force between them.
- Two point charges placed at a distance 'r' in air exert a force  $F$  on each other. At what distance will these charges experience the same force  $F$  in medium of dielectric constant  $k$ ?
- Three charges, each equal to  $q$  are placed at three corners of a square of side  $a$ . Find the electric field at fourth corner.
- Calculate the surface charge density of a plane sheet of finite thickness having an electric field of  $500 \text{ N C}^{-1}$  acting downwards near the surface of the sheet.
- Two large thin metal plates are parallel and close to each other. On their inner faces, the plates have surface charge densities of opposite signs and of magnitude  $17.7 \times 10^{-22} \text{ cm}^{-2}$ . What is electric field intensity  $E$  (a) in the outer region of first plate, and (b) between the plates?
- Two large parallel thin metallic plates are placed close to each other. The plates have surface charge densities of opposite signs and magnitude  $20 \times 10^{-12} \text{ cm}^{-2}$ . Calculate the electric field intensity (i) in the outer region of plates (ii) in the interior regions between plates.
- A large plane sheet of charge having surface charge density  $5.0 \times 10^{-16} \text{ C m}^{-2}$  lies in the  $X$ - $Y$  plane. Find the electric flux through a circular area of radius  $0.1 \text{ m}$ , if the normal to the circular area makes an angle of  $60^\circ$  with  $Z$ -axis. Given  $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$ .
- A charge of  $17.7 \times 10^{-4} \text{ C}$  is distributed uniformly over a large sheet of area  $200 \text{ m}^2$ . Calculate the electric field intensity at a distance of  $20 \text{ cm}$  from it.
- A particle of mass  $5 \times 10^{-6} \text{ g}$  is kept over a large horizontal sheet of charge density  $4 \times 10^{-6} \text{ Cm}^{-2}$ . What charge should be given to this particle so that if released it does not fall

down? How many electrons should be removed to give this charge?

- A wire  $AB$  of length  $L$  has linear charge density  $\lambda = kx$  where  $x$  is measured from the end  $A$  of the wire. This wire is enclosed by a Gaussian hollow surface. Find the expression for the electric flux through the surface.

## CHEMISTRY

- An ideal solution containing 1 mole of  $A$  and 3 moles of  $B$  has vapour pressure equal to  $550 \text{ mm}$  at  $300 \text{ K}$ . When one mole of  $B$  is added to the above solution vapour pressure is increased by  $10 \text{ mm}$  at the same temperature. What is the vapour pressure of liquid  $A$  and liquid  $B$ ?
- A solution is prepared by dissolving  $10 \text{ g}$  of non-volatile solute in  $200 \text{ g}$  of water. It has a vapour pressure of  $31.84 \text{ mm Hg}$  at  $308 \text{ K}$ . Calculate the molar mass of the solute. (Vapour pressure of pure water at  $308 \text{ K} = 32 \text{ mm Hg}$ )
- The density of an aqueous solution of ammonia is  $0.9 \text{ g/mL}$  and is  $27\%$  by weight. Calculate the molality and molarity of the solution of ammonia.
- What will be the molality of a solution having  $18 \text{ g}$  of glucose (mol. wt. =  $180$ ) dissolved in  $500 \text{ g}$  of water?
- A solution contains  $92 \text{ gram}$  of ethanol and  $72 \text{ gram}$  of water. What is the mole fraction of ethanol in the solution?
- The mole fraction of benzene in a solution in toluene is  $0.50$ . Calculate the weight per cent of benzene in the solution.
- A solution containing  $3.1 \text{ g}$  of  $\text{BaCl}_2$  in  $250 \text{ g}$  of water boils at  $100.083^\circ \text{C}$ . Calculate the value of van't Hoff factor (i) and molality of  $\text{BaCl}_2$  solution.  $K_b = 0.52 \text{ K kg / mol}$ , molar mass of  $\text{BaCl}_2 = 208.3 \text{ g/mol}$ .

- An aqueous solution containing 1.248 g of barium chloride (molar mass = 208.34 g mol<sup>-1</sup>) in 100 g of water boils at 100.0832 °C Calculate the degree of dissociation of BaCl<sub>2</sub> (K<sub>b</sub> for water = 0.52 K kg mol<sup>-1</sup>).
- Calculate the boiling point of a solution prepared by adding 15.00 g of NaCl to 250.0 g of water (K<sub>b</sub> for water = 0.512 K kg mol<sup>-1</sup>, Molar mass of NaCl = 58.44 g)
- A 0.01 m aqueous solution of AlCl<sub>3</sub> freezes at - 0.068 °C Calculate the percentage of dissociation. [Given: K<sub>f</sub> for water = 1.86 K kg mol<sup>-1</sup>]

### BIOLOGY

- Give the major reproductive events in human beings.
- What is scrotum give the function?
- What is the function of leydig cell?
- Give the function of sertoli cell.
- Give the name of different part of epididymes also give the function?
- What is the prostate gland give its function?
- What are secondary sex organ?
- What is semen give its chemical composition?
- What is inguinal hernia?
- What is the cryptorchidism?

### MATH

- Evaluate the determinants 
$$\begin{vmatrix} \cos \alpha \cos \beta & \cos \alpha \cos \beta & -\sin \alpha \\ -\sin \beta & \cos \beta & 0 \\ \sin \alpha \cos \beta & \sin \alpha \sin \beta & \cos \alpha \end{vmatrix}$$
- Evaluate 
$$\begin{vmatrix} x & y & x+y \\ y & x+y & x \\ x+y & x & y \end{vmatrix}$$
- If x is a real number ,then show that 
$$\begin{vmatrix} 1 & \sin x & 1 \\ -\sin x & 1 & \sin x \\ -1 & -\sin x & 1 \end{vmatrix}$$
 lies between 2 and 4 (both inclusive).
- Find the cofactors of the elements of the third row of the determinant 
$$\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$$
 and verify that  $a_{11}A_{31} + a_{12}A_{32} + a_{13}A_{33} = 0$ .
- Prove that 
$$\begin{vmatrix} 1 & a & b \\ -a & 1 & c \\ -b & -c & 1 \end{vmatrix} = 1 + a^2 + b^2 + c^2$$
.
- Let  $f(x)$   
=

$$\begin{vmatrix} \cos(x+x^2) & \sin(x+x^2) & -\cos(x+x^2) \\ \sin(x-x^2) & \cos(x-x^2) & \sin(x-x^2) \\ \sin 2x & 0 & \sin(2x^2) \end{vmatrix}$$

the value of  $f'(0)$  is.

- If 
$$\begin{vmatrix} a & b+c & a^2 \\ b & c+a & b^2 \\ c & a+b & c^2 \end{vmatrix} = 0$$
 where a,b,c are distinct real number then prove that the straight line  $ax+by+c=0$  passes through the fixed point. Also find the fixed point.
- By using properties of determinants ,show that 
$$\begin{vmatrix} x & x^2 & yz \\ y & y^2 & zx \\ z & z^2 & xy \end{vmatrix} = (x-y)(y-z)(xy+yz+zx)$$
.
- By using properties of determinants ,show that 
$$\begin{vmatrix} 1+a^2-b^2 & 2ab & -2b \\ 2ab & 1-a^2+b^2 & 2a \\ 2b & -2a & 1-a^2-b^2 \end{vmatrix} = (1+a^2+b^2)^3$$
- Prove 
$$\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ca & cb & a^2+b^2 \end{vmatrix} = 4a^2b^2c^2$$
.