## NUMERICALS

**Note :** Take values of necessary physical constants from the following table :

$$\text{mass of electron} = 9.0 \times 10^{-31}\ \text{kg}$$
$$\text{mass of proton} = 1.7 \times 10^{-27}\ \text{kg}$$
$$\text{charge on electron, } e = -1.6 \times 10^{-19}\ \text{C}$$
$$\text{charge on proton} = +1.6 \times 10^{-19}\ \text{C}$$
$$\text{charge on } \alpha\text{-particle} = +3.2 \times 10^{-19}\ \text{C}$$
$$\varepsilon_0 = 8.85 \times 10^{-12}\ \text{C}^2/\text{N-m}^2$$
$$\frac{1}{4\pi\varepsilon_0} = 9.0 \times 10^{9}\ \text{N-m}^2/\text{C}^2$$
$$1\ \text{Å} = 10^{-10}\ \text{m}$$
$$g = 9.8\ \text{m/s}^2\ (\text{or N/kg})$$

1. A point-charge of 1.8 μC is at the centre of a cubical Gaussian surface of 55 cm side. Find the net electric flux through the surface. **Ans.** $2.0 \times 10^5$ N-m$^2$ C$^{-1}$.
2. The net outward electric flux through the surface of a box is $8.0 \times 10^3$ N m$^2$ C$^{-1}$. What is the net charge inside the box? **Ans.** 70.8 nC (nano-coulomb).
3. A point-charge produces an electric flux of $-750$ N m$^2$ C$^{-1}$ through a spherical Gaussian surface of 10 cm radius with centre at the charge. (i) If the radius of the Gaussian surface be doubled, how much flux would pass through the surface? (ii) What is the magnitude of the point-charge? **Ans.** (i) $-750$ N m$^2$ C$^{-1}$, (ii) $-6.64 \times 10^{-9}$ C.
4. An isolated conductor of any shape has a net charge of +10 μC. Inside the conductor is a cavity within which is a point-charge of +3.0 μC. What is the charge on the cavity wall? On the outer surface of the conductor. **Ans.** $-3.0$ μC, +13 μC.
5. An infinite line charge produces an electric field of $9.0 \times 10^4$ N C$^{-1}$ at a distance of 2.0 cm. What is the linear charge density? ***(ISC 2006)*** **Ans.** 0.1 μC/m.
6. Two large, thin metal plates are placed parallel and close to each other. Their inner faces have equal and opposite charges with a surface charge density of $17.0 \times 10^{-12}$ C m$^{-2}$. What are the magnitudes of electric fields to the left of the plates, to the the plates and in between the plates. **Ans.** Zero, Zero, 2.(
7. Two large metal plates of area 1.0 m$^2$ face eac They are 5.0 cm apart and have equal but o charges on their inner surfaces. If the electr between the plates, ignoring edge effects, is 55 find the charges on the plates. **Ans.** ± 4.9 × 1
8. A uniformly charged conducting sphere of radius has a surface charge density of 80.0 μ What is the charge on the sphere and the total e flux leaving the surface of the sphere? **Ans.** $1.45 \times 10^{-3}$ C, $1.64 \times 10^8$ N-m
9. The electric field due to a charged conducting s of radius 10 cm, at a distance of 20 cm from the c of the sphere is $1.5 \times 10^3$ N C$^{-1}$ and points ra inwards. What is the charge on the sphere? **Ans.** $-6.6$
10. A sphere of metal has a radius of 12 cm and ca a charge of $1.6 \times 10^{-7}$ C distributed uniformly o surface. Calculate the electric field intensity at a p (i) inside the sphere, (ii) just outside the sphere (iii) 18 cm from the centre of the sphere. **Ans.** (i) zero, (ii) $1.0 \times 10^5$ N C
(iii) $4.4 \times 10^4$ N C

## FOR DIFFERENT COMPETITIVE EXAMINATIONS