

Class - 12th

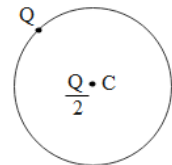
Electric Charges and Fields

DPP – 10

Topics:

- **Miscellaneous problems on Gauss law and Electric flux**

1. A thin metallic spherical shell of radius R carries a charge Q on its surface. A point charge $\frac{Q}{2}$ is placed at its centre C and another charge $+2Q$ is placed outside the shell at a distance x from the centre as shown in fig.



A
• 2Q

[CBSE D 15]

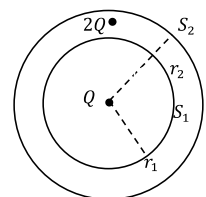
Find

- (i) The force on the charge at the centre of shell and at the point A ,
 - (ii) The electric flux through the shell.
2. Two thin concentric and coplanar spherical shells, of radii a and b ($b > a$) carry charges, q and Q , respectively. Find the magnitude of the electric field, at a point distant x , from their common centre for
- (a) $0 < x < a$ (b) $a \leq x < b$ (c) $b \leq x < \infty$ **[CBSE F 15, D 16C]**
3. A spherical conducting shell of inner radius r_1 and the outer radius r_2 has a charge ' Q '. A charge q is placed at the centre of the shell. **[CBSE OD 10]**
- (a) What is the surface charge density on the (i) inner surface, (ii) outer surface of the shell?
 - (b) Write the expression for the electric field at a point $x > r_2$ from the centre of the shell.
4. An early model of an atom considered it to have a positively charged point nucleus of charge Ze , surrounded by a uniform density of negative charge up to a radius R . The atom as a whole is neutral. For this model, what is the electric field at a distance r from the nucleus?

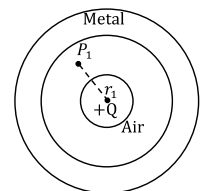
[NCERT; AIIMS 18]

5. Two concentric metallic spherical shells of radii R and $2R$ are given charge Q_1 and Q_2 respectively. The surface charge densities on the outer surfaces of the shells are equal. Determine the ratio $Q_1 : Q_2$. **[Foreign 2013]**

6. A sphere S_1 of radius r_1 encloses a net charge Q . If there is another concentric sphere S_2 of radius r_2 ($r_2 > r_1$) enclosing charge $2Q$, find the ratio of the electric flux through S_1 and S_2 . How will the electric flux through sphere S_1 change if a medium of dielectric constant K is introduced in the space inside S_2 in place of air? **All India 2014**



7. A small metal sphere carrying a charge $+Q$ is located at the centre of a spherical cavity in a large uncharged metallic spherical shell. Write the charges on the inner and outer surfaces of the shell. Write the expression for the electric field at the point P_1 . **Delhi 2014C**



8. A point charge $+Q$ is placed at the centre O of an uncharged hollow spherical conductor of inner radius ' a ' and outer radius ' b '. Find the following: **[CBSE SP 18]**

- (a) The magnitude and sign of the charge induced on the inner and outer surfaces of the conducting shell.

- (b) The magnitude of electric field vector at a distance

- (i) $r = \frac{a}{2}$ and (ii) $r = 2b$, from the centre of the shell.

