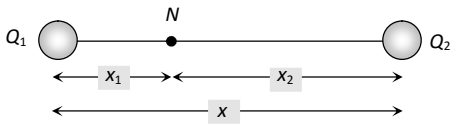
## Neutral Point.

A neutral point is a point where resultant electrical field is zero. It is obtained where two electrical field are equal and opposite. Thus neutral points can be obtained only at those points where the resultant field is subtractive. Thus it can be obtained.

(1) **At an internal point along the line joining two like charges(Due to a system of two like point charge):**Suppose two like charges. $Q_1$ and $Q_2$ are separated by a distance x from each other along a line as shown in following figure.




If N is the neutral point at a distance $x_1$ from $Q_1$ and at a distance $x_2(=x-x_1)$ from $Q_2$ then –

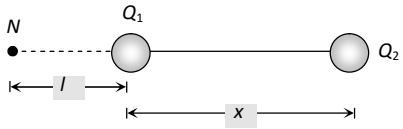
At N $\quad |\ E.F.\ \text{due to}\ Q_1\ | = |\ E.F.\ \text{due to}\ Q_2\ |$

i.e., $\frac{1}{4\pi\varepsilon_0}\cdot\frac{Q_1}{x_1^2}=\frac{1}{4\pi\varepsilon_0}\cdot\frac{Q_2}{x_2^2}\Rightarrow\frac{Q_1}{Q_2}=\left(\frac{x_1}{x_2}\right)^2$

**Short τrick :** $x_1=\frac{x}{1+\sqrt{Q_2/Q_1}}$ and $x_2=\frac{x}{1+\sqrt{Q_1/Q_2}}$

Note: In the above formula if $Q_1=Q_2$, neutral point lies at the center so remember that resultant field at the midpoint of two equal and like charges is zero.

(2) **At an external point along the line joining two like charges (Due to a system of two unlike point charge):**Suppose two unlike charge $Q_1$ and $Q_2$ separated by a distance x from each other.




Here neutral point lies outside the line joining two unlike charges and also it lies nearer to charge which is smaller in magnitude.

If $|Q_1|<|Q_2|$ then neutral point will be obtained on the side of $Q_1$, suppose it is at a distance l from $Q_1$

Hence at neutral point ; $\frac{kQ_1}{l^2}=\frac{kQ_2}{(x+l)^2}\Rightarrow\frac{Q_1}{Q_2}=\left(\frac{l}{x+l}\right)^2$

**Short τrick :** $l=\frac{x}{\left(\sqrt{Q_2/Q_1}-1\right)}$

Note: In the above discussion if $|\ Q_1\ | \neq |\ Q_2\ |$ neutral point will be at infinity.