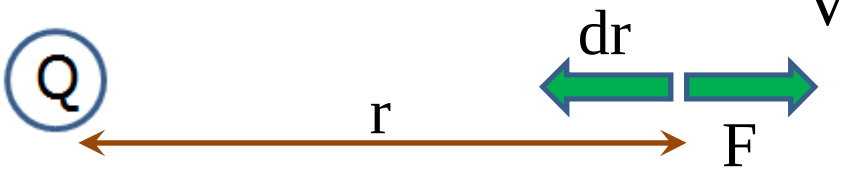
ELECTROSTATIC POTENTIAL

It is defined at a point ONLY like ELECTRIC FIELD

Work done in bringing a unit positive charge from infinity to that POINT against ELECTRIC force without ACCELERATION



$$V = \int_{\infty}^{r} \vec{F}.d\vec{r} = \int_{\infty}^{r} F.dr.\cos 180° = -\int_{\infty}^{r} F.dr$$

$$F = k\frac{1\times Q}{r^2} = k\frac{Q}{r^2}$$

$$V = -\int_{\infty}^{r} k\frac{Q}{r^2}.dr = -kQ\int_{\infty}^{r}\frac{1}{r^2}.dr$$

$$\int r^n.dr = \frac{r^{n+1}}{n+1}$$

$$V = -kQ\int_{\infty}^{r} r^{-2}.dr = -kQ.\left.\frac{r^{-2+1}}{-2+1}\right|_{\infty}^{r}$$

$$V = -kQ.\left.\frac{r^{-2+1}}{-2+1}\right|_{\infty}^{r} = kQ\left[\frac{1}{r} - \frac{1}{\infty}\right] = \frac{kQ}{r}$$

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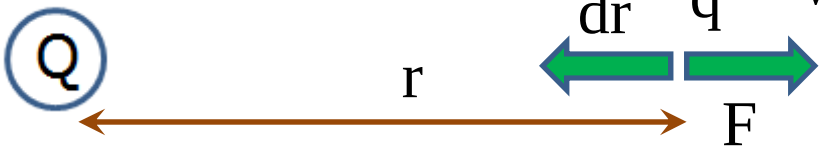

$$W = \int_{\infty}^{r} \vec{F}.d\vec{r} = \int_{\infty}^{r} F.dr.\cos 180^\circ = -\int_{\infty}^{r} F.dr$$

$$F = k\frac{qQ}{r^2} = k\frac{qQ}{r^2}$$

$$W = -\int_{\infty}^{r} k\frac{qQ}{r^2}.dr = -kqQ\int_{\infty}^{r}\frac{1}{r^2}.dr$$

$$\int r^n.dr = \frac{r^{n+1}}{n+1}$$

$$W = -kqQ\int_{\infty}^{r} r^{-2}.dr = -kqQ.\left.\frac{r^{-2+1}}{-2+1}\right|_{\infty}^{r}$$

$$W = -kqQ.\left.\frac{r^{-2+1}}{-2+1}\right|_{\infty}^{r} = kqQ\left[\frac{1}{r} - \frac{1}{\infty}\right] = \frac{kqQ}{r}$$

$$V = \frac{W}{q} = \frac{kQ}{r}$$