Three concentric metal shells A, B and C of respectively radii a, b and c ($a < b < c$) have surface charge densities $+\sigma$, $-\sigma$ and $+\sigma$ respectively. The potential of shell B is?

A $\frac{\sigma}{\epsilon_0}\left[\frac{b^2-c^2}{b}+a\right]$

B $\frac{\sigma}{\epsilon_0}\left[\frac{b^2-c^2}{c}+a\right]$

C $\frac{\sigma}{\epsilon_0}\left[\frac{a^2-b^2}{a}+c\right]$

D $\frac{\sigma}{\epsilon_0}\left[\frac{a^2-b^2}{b}+c\right]$

Correct option is D)

$$V_{outer} = \frac{KQ}{r}$$

where r is distance of point from the centre of shell

$$V_{inside} = \frac{KQ}{R}$$

where R is the radius of shell

$$V_B = \frac{Kq_A}{r_b} - \frac{Kq_B}{r_b} + \frac{Kq_C}{r_c}$$

$$V_B = \frac{1}{4\pi\epsilon_o}\left[\frac{\sigma 4\pi a^2}{b} - \frac{\sigma 4\pi b^2}{b} + \frac{\sigma 4\pi c^2}{c}\right]$$

$$V_B = \frac{\sigma}{\epsilon_o}\left[\frac{a^2 - b^2}{b} + c\right]$$