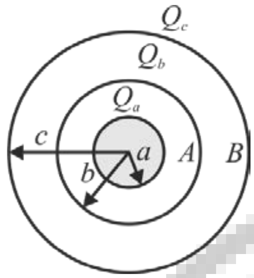
LAKSHYA (JEE)

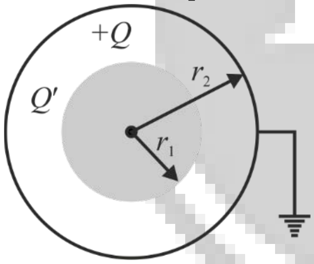
Electrostatic Potential & Capacitance

DPP-05

1. The figure shows three conducting concentric shell or radii a, b and c ($a < b < c$) having charges Q_a, Q_b, and Q_c respectively. Calculate the potential at A, B and C.

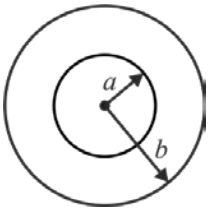


2. The figure shows two concentric spheres having radii r_1 and r_2 respectively $(r_2 > r_1)$. If charge on inner sphere is $+Q$ and outer sphere is earthed then, calculate the charge Q' and the potential at the inner sphere.



3. In the above case if outer sphere is given a charge $+Q$ and inner sphere is earthed then if Q' is the charge induced on inner sphere then, calculate the charge Q' and the potential at the outer sphere.

4. If the electric potential of the inner metal sphere is 10 volt & that of the outer shell is 5 volt, then the potential at the center will be –



5. There are four concentric shells A, B, C and D of radii a, $2a$, $3a$ and $4a$ respectively. Shells B and D are given charges $+q$ and $-q$ respectively. Shell C is now earthed. The potential difference $V_A - V_C$ is

(A) $\frac{Kq}{2a}$ (B) $\frac{Kq}{3a}$

(C) $\frac{Kq}{4a}$ (D) $\frac{Kq}{6a}$

6. The electrostatic potential on the surface of a charged solid conducting sphere is 100 volts. Two statements are made in this regard

Statement - 1: At any point inside the sphere, electrostatic potential is 100 volts.

Statement - 2: At any point inside the sphere, electric field is zero.

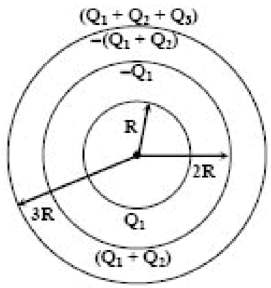
(A) Statement-1 is true, Statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, Statement-2 is true and statement-2 is NOT correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

7. Three concentric metallic spherical shells of radii R, $2R$, $3R$, are given charges Q_1, Q_2, Q_3 respectively. It is found that the surface charge densities on the outer surfaces of the shells are equal. Then the ratio of the charges given to the shells, $Q_1 : Q_2 : Q_3$, is



(A) 1 : 2 : 3 (B) 1 : 3 : 5

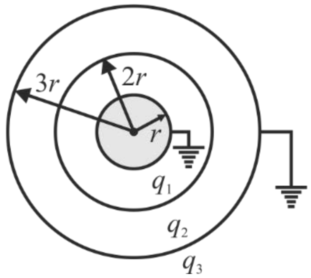
(C) 1 : 4 : 9 (D) 1 : 8 : 18

8. A solid conducting sphere having a charge Q is surrounded by an uncharged concentric conducting hollow spherical shell. Let the potential difference between the surface of the solid sphere and that of the outer surface of the hollow shell be V. If the shell is now given a charge of $-3Q$, the new potential difference between the same two surfaces is

(A) V (B) 2 V
(C) 4 V (D) –2 V

9. A metal sphere A of radius a is charged to potential V. What will be its potential if it is enclosed by a spherical conducting shell B of radius b and the two are connected by a wire?

10. Three concentric conducting spherical shells have radii r, $2r$ and $3r$ and charges q_1, q_2, and q_3, respectively. Innermost and outermost shells are earthed as shown in figure. The charges shown are after earthing. Select the correct alternative.



(A) $q_1 + q_2 = -q_2$ (B) $q_1 = -q_2$

(C) $\frac{q_3}{q_2} = -\frac{1}{3}$ (D) None of these

ANSWER KEY

1. Potential at A; = $\frac{1}{4\pi\in_0}\left[\frac{Q_a}{a}+\frac{Q_b}{b}+\frac{Q_c}{c}\right]$

Potential at B; = $\frac{1}{4\pi\in_0}\left[\frac{Q_a}{b}+\frac{Q_b}{b}+\frac{Q_c}{c}\right]$

Potential at C; = $\frac{1}{4\pi\in_0}\left[\frac{Q_a}{c}+\frac{Q_b}{c}+\frac{Q_c}{c}\right]$

2. $Q' = -Q$; $V_{\text{inner}} = \frac{1}{4\pi\in_0}\left[\frac{1}{r_1}-\frac{1}{r_2}\right]$

3. $Q' = -\frac{r_1}{r_2}Q$; $V_{\text{outer}} = \frac{Q}{4\pi\in_0 r_2}\left[1-\frac{r_1}{r_2}\right]$

4. **(*)**

5. **(D)**

6. **(A)**

7. **(B)**

8. **(A)**

9. $V_A = V_B = \frac{a}{b}(V)$ [V as $a < b$]

10. **(A)**

Note - If you have any query/issue

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