Physicsaholics

DPP – 9 (Electrostatics)

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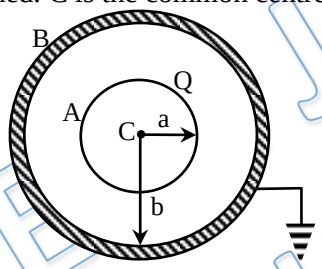
Q 1. A, B & C are three concentric metallic shells. Shell A is the inner most and shell C is the outermost. A is given some charge and shell C is earthed-
(a) The inner surfaces of B & C will have the same charge
(b) The inner surface of B & C will have same charge density
(c) The outer surface of A, B & C will have the same charge
(d) The outer surface of C will have no charge density

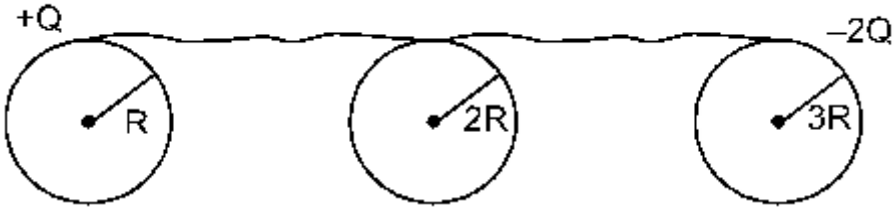
Q 2. A conducting sphere A of radius a, with charge Q, is placed concentrically inside a conducting shell B of radius b. B is earthed. C is the common centre of A and B -



(a) The field at a distance r from C, where a ≤ r ≤ b, is $\frac{KQ}{r^2}$
(b) The potential at a distance r from C, where a ≤ r ≤ b, is $\frac{KQ}{r}$
(c) The potential difference between A and B is $KQ\left(\frac{1}{a}-\frac{1}{b}\right)$
(d) The potential at a distance r from C, where a ≤ r ≤ b, is $KQ\left(\frac{1}{r}-\frac{1}{b}\right)$

Comprehension (Q3 to Q5)

Two conducting spheres of radius R and 3R carry charges Q and –2Q. Between these spheres a neutral conducting sphere of radius 2R is connected. The separation between the sphere is considerably large. Charge flows through conducting wire due to potential difference.



Q 3. The final charge on initially neutral conducting sphere is:
(a) $-\frac{Q}{6}$ (b) $-\frac{Q}{3}$ (c) $\frac{Q}{3}$ (d) $-\frac{Q}{2}$

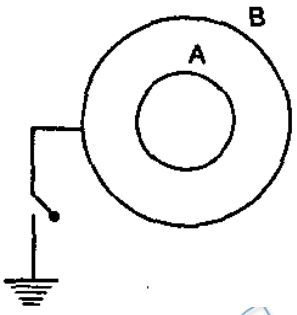
Q 4. The decrease in electric potential energy of sphere of radius R is:
(a) $\frac{kQ^2}{4R}$ (b) $\frac{35kQ^2}{72R}$ (c) $\frac{kQ^2}{72R}$ (d) none

Q 5. The final electric potential of sphere of radius 3R will be:

(a) $-\frac{kQ}{6R}$ (b) $-\frac{kQ}{2R}$ (c) $-\frac{2kQ}{3R}$ (d) $-\frac{3kQ}{R}$

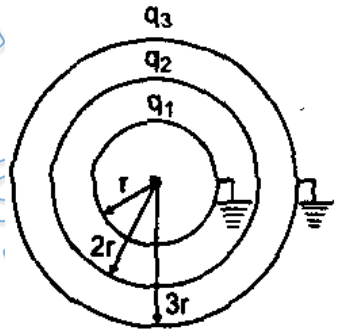
Q 6. A solid conducting sphere of radius 10 cm is enclosed by a thin metallic shell of radius 20 cm. A charge q = 20μC is given to the inner sphere. Find the heat generated in the process, the inner sphere is connected to the shell by a conducting wire
(a) 12 J (b) 9 J (c) 24 J (d) zero

Q 7. Two concentric shells have radii R and 2R charges q_A and q_B and potentials 2V and (3/2)V respectively. Now shell B is earthed and let charges on them become $q'_A$and q'_B. Then:



(a) q_A / q_B = 1/2
(b) q'_A / q'_B = 1
(c) potential of A after earthing becomes (3/2) V
(d) Potential difference between A and B after earthing becomes V/2

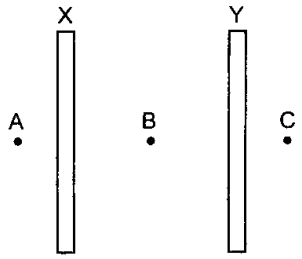
Q 8. Three concentric conducting spherical shells have radii r, 2r and 3r and charges q_1 , q_2 and q_3 respectively. Innermost and outermost shells are earthed as shown in figure. Select the correct alternative(s)



(a) $q_1 + q_3 = -q_2$ (b) $q_1 = -\frac{q_2}{4}$
(c) $\frac{q_3}{q_1} = 3$ (d) $\frac{q_3}{q_2} = -\frac{1}{3}$

Q 9. There are two concentric metal shells of radii r_1 and r_2($>r_1$). If the outer shell has a charge q and the inner shell is grounded, the charge on the inner shell is
(a) zero (b) -(r_1 / r_2)q
(c) $r_1 r_2$q (d) infinity

Q 10. X and Y are large, parallel conducting plates close to each other. Each face has an area A. X is given a charge Q. Y is without any charge. Points A, B and C are as shown in the figure.



(a) The field at B is $\frac{Q}{2\varepsilon_0 A}$
(b) The field at B is $\frac{Q}{\varepsilon_0 A}$
(c) The fields at A, B and C are of the same magnitude.
(d) The fields at A and C are of the same magnitude, but in opposite directions.

Q 11. A conducting sphere of radius R, carrying charge Q, lies inside an uncharged conducting shell of radius 2R. If they are joined by a metal wire,
(a) Q/3 amount of charge will flow from the sphere to the shell
(b) 2Q/3 amount of charge will flow from the sphere to the shell
(c) Q amount of charge will flow from the sphere to the shell
(d) k$\frac{Q^2}{4R}$amount of heat will be produced

Q 12. In Given figure all three conductor plates are parallel and identical. Magnitude of charge which will move through switch after closing switch is

(a) Q
(b) 2Q/3
(c) 4Q/3
(d) Q/3

Answer Key

Q.1 a, d	**Q.2 a, c, d**	**Q.3 b**	**Q.4 b**	**Q.5 a**
Q.6 b	**Q.7 a, d**	**Q.8 a, b, c**	**Q.9 b**	**Q.10 a, c, d**
Q.11 c, d	**Q.12 b**			