ST. LAWRENCE HIGH SCHOOL

A JESUIT CHRISTIAN MINORITY INSTITUTION

SOLUTION TO WORK SHEET 7

Subject : PHYSICS

Date : 11.5.20

CLASS : XII

Chapter : Electrostatics

Topic : Equipotential surface, potential of a charged spherical conductor, *V VS r* graph, potential of charged concentric spherical shells.

Multiple Choice Question : **1 x 15 = 15**

1. The electrostatic potential of a uniformly charged thin spherical shell of charge Q and radius R at a distance r from the centre is

   (a) $\frac{Q}{4\pi\varepsilon_0 r}$ for points outside and $\frac{Q}{4\pi\varepsilon_0 R}$ for points inside the shell

   (b) $\frac{Q}{4\pi\varepsilon_0 r}$ for both points inside and outside the shell

   (c) zero for points outside and $\frac{Q}{4\pi\varepsilon_0 r}$ for points inside the shell

   (d) zero for both points inside and outside the shell

   Ans : (a) $\frac{Q}{4\pi\varepsilon_0 r}$ for points outside and $\frac{Q}{4\pi\varepsilon_0 R}$ for points inside the shell

2. A solid conducting sphere having a charge Q is surrouned by an uncharged concentric hollow spherical shell. Let the potential difference between the surface of the solid sphere and that of the outer surface of hollow shell be *V.* What will be the new potential difference between the same two surfaces if the shell is given a charge $-3Q$? :

   (a) V (b) $-3V$ (c) $2V$ (d) $4V$

   Ans. : (a) V

3. If a charged spherical conductor of radius 10 cm has potential V at a point distant 5 cm from its centre, then the potential at a point distant 15 cm from the centre will be :

   (a) $\frac{1}{3}V$ (b) $\frac{2}{3}V$ (c) $\frac{3}{2}V$ (d) V

   Ans. : (b) $\frac{2}{3}V$

4. Equipotential surfaces between two equal and opposite charges passing through the middle point is

   (a) a plane (b) curved surface (c) both (a) and (b) (d) none of these

   Ans. : (a) a plane

5. Work done to carry a charge q once along the circular path of radius r with charge q' at its centre, will be :

   (a) zero (b) $\frac{qq'}{4\pi\epsilon_0}\left(\frac{1}{\pi r}\right)$ (c) $\frac{qq'}{4\pi\epsilon_0}\left(\frac{1}{2\pi r}\right)$ (d) $\frac{qq'}{4\pi\epsilon_0 r}$

   Ans. : (a) zero

6. Equipotential surfaces associated with an electric field which is increasing in magnitude along x-direction are :

   (a) Planes parallel to *YZ* plane. (b) Planes parallelto *XY* plane.

   (c) Planes parallel to *XZ* plane (d) Coaxial cylinders of increasing radii around x-axis.

   Ans. : (a) Planes parallel to *YZ* plane.

7. Which of the following is not the property of equipotential surfaces?

(a) They do not cross each other.

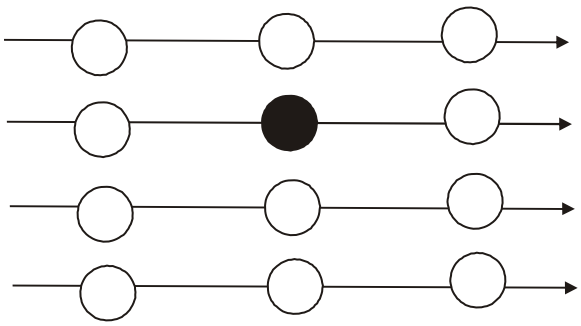
(b) They are concentric spheres for non-uniform electric field.

(c) Rate of change of potential with the distance on them is zero.

(d) They can be imaginary spheres.

Ans. : (c) Rate of change of potential with the distance on them is zero.

8. There is a uniform electric field of intensity E as shown in the figure. How many labelled points do have the same potential as the fully shaded point?



(a) 2 (b) 3 (c) 8 (d) 11

Ans. : (b) 3

9. Two conducting spheres of radii r_1 and r_2 are at the same potential. The ratio of their charges is

(a) $\left(\frac{r_1^2}{r_2^2}\right)$ (b) $\left(\frac{r_2^2}{r_1^2}\right)$ (c) $\frac{r_1}{r_2}$ (d) $\frac{r_2}{r_1}$

Ans. : (c) $\frac{r_1}{r_2}$

10. A hollow metal sphere of radius 10 cm is charged such that the potential on its surface is 80 V. The potential at the centre of the sphere is :

(a) zero (b) 80 V (c) 800 V (d) 8 V

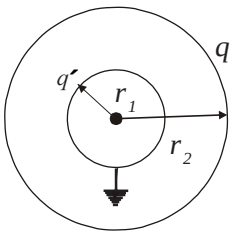
Ans. : (b) 80 V

11. The example of an equipotential surface is the surface of a —

(a) charged conductor (b) insulator (c) non-conductor (d) uncharged body

Ans. : (a) charged conductor

12. Two concentric spheres are of radii r_1 and r_2. The outer sphere is given a charge q. The charge q' on the inner sphere will be (inner sphere is grounded) —



(a) q (b) $-q$ (c) $-q\frac{r_1}{r_2}$ (d) zero

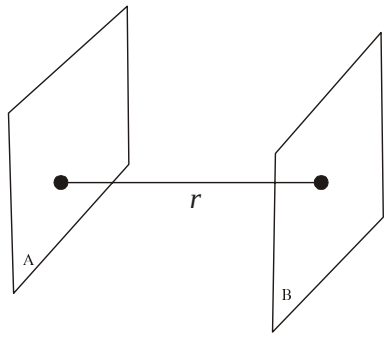
Ans. : (c) $-q\frac{r_1}{r_2}$

13. Conducting shells A and B have charges Q and $2Q$ distributed uniformly over A and B Value of $V_A - V_B$ is

(a) $\frac{Q}{4\pi\varepsilon_0 R}$ (b) $\frac{Q}{8\pi\varepsilon_0 R}$ (c) $\frac{3Q}{4\pi\varepsilon_0 R}$ (d) $\frac{3Q}{8\pi\varepsilon_0 R}$

Ans. : (b) $\frac{Q}{8\pi\varepsilon_0 R}$

14. The figure shows two parallel equipotential surfaces A and B kept a small distance r apart from each other. A point charge of q coulomb is taken from the surface A to B. The amount of net work done will be :



(a) $-\frac{1}{4\pi\in_0}\ \frac{q}{r}$ (b) $\frac{1}{4\pi\in_0}\cdot\frac{q}{r^2}$ (c) $-\frac{1}{4\pi\in_0}\ \frac{q}{r^2}$ (d) zero

Ans. : (d) zero.

15. A thin spherical conducting shell of radius R has a charge q. Another charge Q is placed at the centre of the shell. The electrostatic potential at a poing P at a distance $R/2$ from the centre of the shell is

(a) $\frac{2Q}{4\pi\varepsilon_0 R}$ (b) $\frac{2Q}{4\pi\varepsilon_0 R}-\frac{2q}{4\pi\varepsilon_0 R}$ (c) $\frac{2Q}{4\pi\varepsilon_0 R}+\frac{q}{4\pi\varepsilon_0 R}$ (d) $\frac{(q+Q)2}{4\pi\varepsilon_0 R}$

Ans. : (c) $\frac{2Q}{4\pi\varepsilon_0 R}+\frac{q}{4\pi\varepsilon_0 R}$

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