



## DPP – 7 (Electrostatics)

Video Solution on Website:-

<https://physicsaholics.com/home/courseDetails/93>

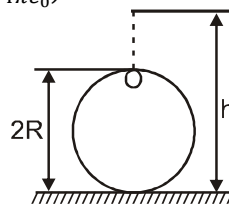
Video Solution on YouTube:-

<https://youtu.be/8CfmVUz6os0>

Written Solution on Website:-

<https://physicsaholics.com/note/notesDetails/39>

- Q 1. A solid sphere of radius  $R$  is charged uniformly. At what distance from its surface is the electrostatic potential half of the potential at the centre?  
 (a)  $R$  (b)  $R/2$  (c)  $R/3$  (d)  $2R$
- Q 2. A hollow metal sphere of radius  $5\text{ cm}$  is charged such that the potential on its surface is  $10\text{ V}$ . The potential at the centre of the sphere is  
 (a) zero  
 (b)  $10\text{ V}$   
 (c) same as at a point  $5\text{ cm}$  away from the surface  
 (d) same as at a point  $25\text{ cm}$  away from the surface
- Q 3. A sphere of radius  $R$  is having charge  $Q$  uniformly distributed over it. The energy density of the electric field in the air, at a distance  $r$  ( $r > R$ ) is given by (in  $\text{J/m}^3$ ):  
 (a)  $\frac{Q^2}{32\pi^2\epsilon_0 R^2 r^2}$  (b)  $\frac{Q^2}{32\pi^2\epsilon_0 r^4}$   
 (c)  $\frac{Q^2}{32\pi^2\epsilon_0 R^4}$  (d)  $\frac{Q^2}{16\pi^2\epsilon_0 r^4}$
- Q 4. An infinite large charge sheet with surface charge density  $\sigma$  is placed in  $x - y$  plane. A uniformly charged spherical shell total charge  $Q$  of radius  $R$  is placed such that center of the shell is at  $(0, 0, 2R)$ . consider points A and B with coordinates  $A(0,0, R/2)$  and  $B(0,0, 7R/2)$   
 (a)  $V_A - V_B = \frac{3\sigma R}{2\epsilon_0}$   
 (b)  $V_A - V_B = \frac{\sigma R}{2\epsilon_0} + \frac{kQ}{2R}$   
 (c) Electric field inside shell is non zero and uniform  
 (d) Net force on hemispherical portion is  $\frac{\sigma Q}{4\epsilon_0}$
- Q 5. A charged liquid drop is released from a height  $(h-2R)$  above the opening of a spherical non-conducting shell of charge  $Q$ . The charge  $Q$  is uniformly distributed on the surface of the shell. Given:  $m$  is the mass of the drop and  $q$  is the charge. The value of  $Q \cdot q$  so that the drop can enter the sphere is:  $\left(k = \frac{1}{4\pi\epsilon_0}\right)$



(a)  $\frac{mgR(h-R)}{k}$

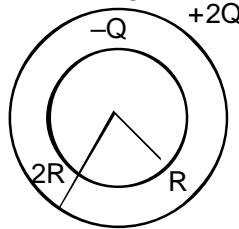
(b)  $\frac{2mgR(h-R)}{k}$

(c)  $\frac{mgR(h-R)}{2k}$

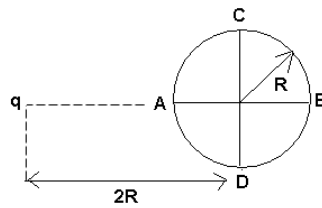
(d)  $\frac{mgh.R}{k}$



- Q 6. Charge  $-Q$  and  $2Q$  are distributed uniformly on surface of two concentric spherical shells of radii ' $R$ ' and ' $2R$ ' respectively as shown in the figure. Select correct alternative(s)



- (a) the total electrostatic energy stored in the system is  $\frac{Q^2}{8\pi\epsilon_0 R}$
- (b) electrostatic energy in the space between two shells is  $\frac{Q^2}{16\pi\epsilon_0 R}$
- (c) electrostatic energy stored outside the system is  $\frac{Q^2}{2\pi\epsilon_0 R}$
- (d) electrostatic energy in space between two shells is zero.
- Q 7. Choose the correct alternative (s) :
- (a) A conducting body with a total negative charge may have negative, zero or positive potential.
- (b) When a total charge is distributed on two isolated conducting spheres such that the total electrical potential energy of system is minimum, no charge will flow when the two spheres are connected by a conducting wire.
- (c) A ring contains non-uniformly distributed positive and negative charges. If sum of total charge is zero then electric field at any point on the axis is either perpendicular to axis of ring or equal to zero.
- (d) A positive charge always moves from higher potential to lower potential
- Q 8. A hollow sphere of radius  $2R$  is charged to  $V$  volts and another smaller sphere of radius  $R$  is charged to  $V/2$  volts. Now the smaller sphere is placed inside the bigger sphere without changing the net charge on each sphere. The potential difference between the two spheres would be:
- (a)  $3V/2$                       (b)  $V/4$                       (c)  $V/2$                       (d)  $V$
- Q 9. 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)  $2V$                       (c)  $4V$                       (d)  $-2V$
- Q 10. A large solid sphere with uniformly distributed positive charge has a smooth narrow tunnel through its centre. A small particle with negative charge, initially at rest far from the sphere, approaches it along the line of the tunnel, reaches its surface with a speed  $v$ , and passes through the tunnel. Its speed at the centre of the sphere will be
- (a)  $0$                       (b)  $v$                       (c)  $\sqrt{2}v$                       (d)  $\sqrt{1.5}v$
- Q 11. A point charge ' $q$ ' is placed in front of a thin conducting spherical shell of radius ' $R$ ', at a distance ' $2R$ ' from the center of sphere. Mark the correct statement [  $V_i$  stands for potential at point ' $i$ ' ]



- (a)  $V_A > V_B$                       (b)  $V_A - V_D = V_C - V_B$   
 (c)  $V_A = \frac{1}{4\pi\epsilon_0} \frac{q}{2R}$                       (d)  $V_B = \frac{1}{4\pi\epsilon_0} \frac{q}{3R}$

Q 12. A point charge  $Q$  is placed at distance  $r$  from centre of neutral conductor solid sphere of radius  $R$  where  $r > R$ . Potential at centre of sphere due to induced charges on sphere is

- (a)  $\frac{kQ}{r}$                       (b)  $\frac{kQ}{R}$                       (c)  $\frac{kQ}{r-R}$                       (d) Zero

Q 13. Mark the correct statement(s)

- (a) At the surface of conductor electric field is perpendicular to surface only if there is no external charge.  
 (b) All points of a conductor have equal potential only if there is no external charge.  
 (c) Induced charges at the surface of neutral conductor do not produce electric field at any point.  
 (d) In a uniform charged solid nonconducting sphere magnitude of potential is maximum at centre.

Q 14. A dipole is placed at distance  $r = 5R/3$  from centre of neutral conductor sphere of radius  $R$  as shown in figure. Potential of point A is

- (a)  $\frac{3kp}{5R^2}$                       (b)  $\frac{9kp}{25R^2}$   
 (c)  $\frac{27kp}{125R^2}$                       (d)  $\frac{36kp}{125R^2}$

## Answer Key

Q.1 c	Q.2 b	Q.3 b	Q.4 a,c	Q.5 a
Q.6 a,b	Q.7 a, b, c, d	Q.8 b	Q.9 a	Q.10 d
Q.11 b,c	Q.12 d	Q.13 d	Q.14 d	