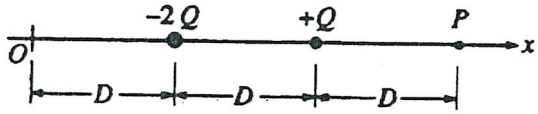
48. A conducting sphere of radius R carries a charge Q. Another conducting sphere has a radius $R/2$, but carries the same charge. The spheres are far apart. The ratio of the electric field near the surface of the smaller sphere to the field near the surface of the larger sphere is most nearly

(A) 1/4
(B) 1/2
(C) 1
(D) 2
(E) 4



49. Two charges, $-2Q$ and $+Q$, are located on the x-axis, as shown above. Point P, at a distance of $3D$ from the origin O, is one of two points on the positive x-axis at which the electric potential is zero. How far from the origin O is the other point?

(A) $\frac{2}{3}D$

(B) D

(C) $\frac{3}{2}D$

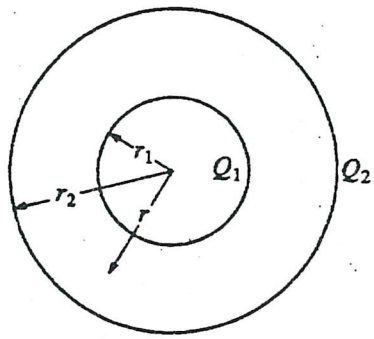
(D) $\frac{5}{3}D$

(E) $2D$

50. What is the radial component of the electric field associated with the potential $V = ar^{-2}$, where a is a constant?

(A) $-2ar^{-3}$
(B) $-2ar^{-1}$
(C) ar^{-1}
(D) $2ar^{-1}$
(E) $2ar^{-3}$

Questions 51-52



Two concentric, spherical conducting shells have radii r_1 and r_2 and charges Q_1 and Q_2, as shown above. Let r be the distance from the center of the spheres and consider the region $r_1 < r < r_2$.

51. In this region the electric field is proportional to

(A) $\frac{Q_1}{r^2}$

(B) $\frac{Q_1 + Q_2}{r^2}$

(C) $\frac{Q_1 + Q_2}{r}$

(D) $\frac{Q_1}{r_1} + \frac{Q_2}{r}$

(E) $\frac{Q_1}{r} + \frac{Q_2}{r_2}$

52. In this region the electric potential relative to infinity is proportional to

(A) $\frac{Q_1}{r^2}$

(B) $\frac{Q_1 + Q_2}{r^2}$

(C) $\frac{Q_1 + Q_2}{r}$

(D) $\frac{Q_1}{r_1} + \frac{Q_2}{r}$

(E) $\frac{Q_1}{r} + \frac{Q_2}{r_2}$