Consider a hollow conductor. Its outer surface is a sphere with radius, R = 0.100 m, while the inner surface is irregular. In the hollow cavity and insulated from the conductor, a total charge, \( Q = 5.00 \text{ nC} \), is spread about. The conductor carries a total charge, \( Q' = -6.00 \text{ nC} \). Take the origin at the center of the sphere (which could be in the body of the conductor) and use \( \frac{1}{4\pi\varepsilon_0} = 8.988 \times 10^9 \text{ N}(m/C)^2 \).

1) What is the charge in nC on the inner surface of the conductor?
   a) 5.00 b) -5.00 c) 1.00 d) -1.00 e) none of these

Draw a gaussian surface that is everywhere in the body of the conductor. Thus everywhere on this surface \( E = 0 \) and the surface can enclose no charge (from the gauss law). If you let the gaussian surface just surround the inner surface of the conductor, in order to enclose zero charge, there must be a charge \( -Q = -5.00 \text{ nC} \) induced on the conductor’s inner surface, (b).

2) What is the charge in nC on the outer surface of the conductor?
   a) 5.00 b) -5.00 c) 1.00 d) -1.00 e) none of these

On the conductor the total charge is \( Q' \), thus, \( Q' = Q_{\text{inner}} + Q_{\text{outer}} \) or \( Q_{\text{outer}} = Q' - Q_{\text{inner}} = -6.00 - (-5.00) = -1.00 \text{ nC} \), (d).

3) The charge on the inner,outer conductor surface is spread uniformly?
   a) true, true b) true, false c) false, true d) false, false e) insufficient information

The inner surface is irregular so the charge on it is **not** spread out uniformly. However,
the outside surface is a sphere, thus there is no special place for charge to accumulate. So on the outside surface charge is spread out uniformly, (c).

4) The electric field magnitude in $10^3$N/C at the outer surface is

a) 5.39 b) 4.49 c) 0.899 d) 0.450 e) none of these

The charge inside the hollow plus the induced charge on the conductor’s inner surface gave $E = 0$ outside the conductor’s inner surface (see about gauss surface in 1 above). The charges on the outer surface are arranged uniformly, so for points outside, they act like a point charge at the center. 

$$E = |Q_{outer}|/(4\pi\epsilon_0R^2) = 8.988 \times 10^9(1.00 \times 10^{-9})/(0.1^2) = 8.988 \times 10^2 = 0.899 \times 10^3 \text{ N/C}, (c).$$

5) This electric field points?

a) towards the origin b) away from the origin c) insufficient information

Since $Q_{outer} < 0$, the $E$ points towards the center, (a).