Exercise 1

Consider the system of conductors shown with two cavities. A charge $+Q$ is kept at the center. (i) Determine the charge distributions on the surfaces marked 1,2,3 and 4, (ii) Is the potential of surface 1 lower, higher or same as that of surface 2 ? (iii) Is the potential of surface 4 lower, higher or same as that of surface 1 ? (Answer : (i) $-Q$ for 1 and 3, (ii) $+Q$ for 2 and 4 (ii) equal (iii) lower.)

Exercise 2

Exercise 1 :

Two parallel, infinite plates made of material of perfect conductor, carry charges Q_1 and Q_2. The plates have finite thickness. Show that the charge densities on the two adjecent inside surfaces are equal and opposite while that on the two outside surfaces are equal.

(Hint : Field inside the plates due to four charged surfaces must be zero.)

Exercise 3

Find the potential at a height h above a uniformly charged infinite plane having a charge density σ. What is a good reference point for the zero of the potential ?

[Ans. $-\sigma z/2\epsilon_0$, with $\phi(0) = 0$]

Exercise 4

The potential in a certain region of space is given by the function xy^2z^3 with respect to some reference point. Find the y-component of the electric field at $(1, -3, 2)$.

(Ans. $-48\hat{j}$)

Exercise 5

Find the potential at a distance h from the mid-point of a charged line of length L carrying a total charge Q. Using this determine the electric field at the point.

(Compare your result for the electric field with the field calculated in Example 2.)

$$\left[\text{Ans, } \frac{1}{4\epsilon_0}\frac{Q}{L}\ln\left(\frac{\frac{L}{2}+\sqrt{\frac{L^2}{4}+h^2}}{-\frac{L}{2}+\sqrt{\frac{L^2}{4}+h^2}}\right)\right]$$