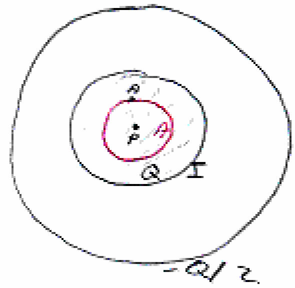
430-1 A) Let point P be the center of the charge distribution. Surface A (the Gaussian surface chosen for this part of the problem) is a spherical shell of radius R centered on P.

Charged enclosed by A is:

$Q_{IN\,A} = \frac{V_A}{V_I} Q$ where I represents the given inner sphere



$$Q_{IN\,A} = \frac{\frac{4}{3}\pi R^3}{\frac{4}{3}\pi (2R)^3} Q = \frac{1}{8} Q$$

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{IN\,A}}{\epsilon_0}$$

$\vec{E}$ constant and everywhere ∥ Area vector so:

$$\oint E\,dA = \frac{Q_{IN\,A}}{\epsilon_0}$$

$$\underbrace{E \oint dA}_{} = \frac{Q_{IN\,A}}{\epsilon_0}$$

Area of the Gaussian surface (which is the sphere labeled A having radius R)

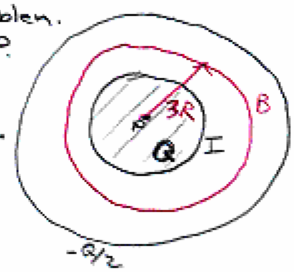
$$E\, 4\pi R^2 = \frac{\frac{1}{8}Q}{\epsilon_0}$$

$\boxed{\vec{E} = \frac{Q}{32\pi\epsilon_0 R^2}}$ radially outward from center of distribution, toward top of page.

(continued on next page)

430-1 continued

B) Spherical shell B is the Gaussian surface chosen for this part of the problem. It is a spherical shell centered on point P. It has radius 3R. It encloses all of the charge on the inner sphere (I).



Hence $Q_{IN\,B} = Q$

$$\oint_B \vec{E}\cdot d\vec{A} = \frac{Q_{IN\,B}}{\epsilon_0}$$

$\vec{E}$ is constant on B and always parallel to $d\vec{A}$ on B, so

$$\oint E\,dA = \frac{Q_{IN\,B}}{\epsilon_0}$$

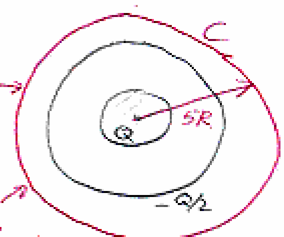
$$E\oint dA = \frac{Q_{IN\,B}}{\epsilon_0}$$

$$E\,4\pi(3R)^2 = \frac{Q}{\epsilon_0}$$

$$\boxed{\vec{E} = \frac{Q}{36\pi\epsilon_0 R^2} \text{ straight outward from center of charge distrib toward top of page in given diagram}}$$

c) $$\oint_C \vec{E}\cdot d\vec{A} = \frac{Q_{IN\,C}}{\epsilon_0}$$

The gaussian surface (C) chosen for this part of the problem is a spherical shell centered on the center of the given charge distribution.



$$\oint_C E\,dA = \frac{Q + \left(-\frac{Q}{2}\right)}{\epsilon_0}$$

$$E\oint dA = +\frac{Q}{2\epsilon_0}$$

$$E\,4\pi(5R)^2 = +\frac{Q}{2\epsilon_0}$$

$$\boxed{\vec{E} = \frac{Q}{200\pi\epsilon_0 R^2} \text{ straight outward from center of charge distribution, toward top of page in given diagram.}}$$