22-31 GIVEN: Pt CHARGE $q = 2.00\,\mu C$
SPHERE $r = 0.500\,m$ (CONCENTRIC W/CHARGE)

FIND: A_{SPHERE}, $|\vec{E}(r = 0.5m)|$, Φ_{SPHERE}, Φ_{SPHERE} (q NOT AT CENTER)

Φ_{CUBE} 1m x 1m x 1m

$$A_{SPHERE} = 4\pi r^2 = 4\pi(.5m)^2 = 3.14\ m^2$$

$$|\vec{E}| = \frac{kq}{r^2} = \frac{\left(9\times10^9 \frac{N\text{-}m^2}{C^2}\right)(2.0\,\mu C)}{(.5m)^2} = 7.2\times10^4\ N/C$$

$$\Phi_{SPHERE} = |\vec{E}|A = (7.2\times10^4 N/C)(3.14m)^2 = 2.26\times10^5 \frac{N\text{-}m^2}{C}$$

$$\Phi_{SPHERE\ (q\ NOT\ AT\ CENTER)} = \frac{q_{IN}}{\epsilon_0} = \frac{2.0\times10^{-6}\,C}{8.85\times10^{-12}\frac{C^2}{N\text{-}m^2}} = 2.26\times10^5 \frac{N\text{-}m^2}{C}$$

$$\Phi_{CUBE\ 1m\times1m\times1m} = \frac{q_{IN}}{\epsilon_0} = 2.26\times10^5 \frac{N\cdot m^2}{C}$$