A solid conducting sphere of radius $a$ is inside of a spherical conducting shell of inner radius $b$ and outer radius $c$. The sphere has a charge $-5Q$ and the shell a net charge of $+7Q$.

(a) What are the charges on the inside and outside of the shell?
- Inside $\rightarrow +5Q$
- Outside $\rightarrow +2Q$

(b) What is the magnitude of the electric field for $r > c$? Draw and label an arrow on the diagram to indicate the direction of the field.
\[
E_{\text{enc}} = +2Q
\]
\[
\varepsilon \cdot \frac{Q}{4\pi r^2} = \frac{2Q}{\varepsilon_0}
\]
\[
E = \frac{1}{2} \frac{Q}{\varepsilon_0 \pi r^2}
\]

(c) What is the potential difference between a point at $r = c$ and a point at $r = a$?
\[
V_a = \left[ \frac{-5Q}{a} + \frac{5Q}{b} + \frac{2Q}{c} \right] \frac{1}{4\pi \varepsilon_0}
\]
\[
V_c = \left[ \frac{-5Q}{c} + \frac{5Q}{c} + \frac{3Q}{c} \right] \frac{1}{4\pi \varepsilon_0} = \frac{3Q}{4\pi \varepsilon_0}
\]
\[
V_c - V_a = \left[ \frac{2Q}{c} + \frac{5Q}{c} - \frac{5Q}{b} - \frac{3Q}{c} \right] \frac{1}{4\pi \varepsilon_0}
\]
\[
= \frac{5Q}{4\pi \varepsilon_0} \left[ \frac{1}{a} - \frac{1}{b} \right]
\]