Consider an electrostatic situation. A point charge \( Q \) is located at the center of a thick spherical conducting shell. The net charge on the shell is \(-\frac{1}{2}Q\). Let \( S \) (dashed circular line) be a concentric spherical surface (Gaussian surface) with a radius \( r \).

What is the charge on the outer surface of the thick spherical conducting shell?

A) \( Q_{\text{outer surface}} = -\frac{1}{2}Q \) 
B) \( Q_{\text{outer surface}} = +\frac{1}{2}Q \) 
C) \( Q_{\text{outer surface}} = -Q \) 
D) \( Q_{\text{outer surface}} = +Q \) 
E) \( Q_{\text{outer surface}} = -\frac{3}{2}Q \)

For an electrostatic case, there must not be charge(s) inside of a conductor (otherwise \( E_{\text{inside}} \neq 0 \)). So the charges can only reside on the inner surface and outer surface of the conducting shell. Since \( \Phi_S = 0 \), the enclosed charge \( Q_{\text{inner surface}} + Q = 0 \), thus \( Q_{\text{inner surface}} = -Q \). 

Since \( Q_{\text{net}} = Q_{\text{inner surface}} + Q_{\text{outer surface}} \), we have

\[
Q_{\text{outer surface}} = Q_{\text{net}} - Q_{\text{inner surface}} \\
= -\frac{1}{2}Q + Q \\
= \frac{1}{2}Q.
\]

Answer B.

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