

Solutions

2.1 B Free Q stays fixed and C triples; both $V=Q/C$ and $U=Q^2/(2C)$ become one third.

Compare the rejected options: 3 and 3; 1 and 3; 1/3 and 3; 1 and 1. Use the stated model and conditions.

2.2 C $\rho_b = -\nabla \cdot \mathbf{P} = 0$ for uniform $\mathbf{P}$, but $\sigma_b = \mathbf{P} \cdot \mathbf{n}$ can be nonzero.

Compare the rejected options: Nonzero bound volume charge everywhere; Zero bound surface charge everywhere; Zero internal electric field as in a metal; Identical numerical $\mathbf{B}$ and $\mathbf{H}$. Use the stated model and conditions.

2.3 100. $M = \chi_m H = 0.2 \cdot 500 = 100$.

2.4 False. With no free surface charge, normal $\mathbf{D}$ is continuous; $\mathbf{E} = \mathbf{D}/\epsilon$ can differ.

3.1 Layers are in series. With no free interface charge, $D = Q/A$ is common. $E_{vac} = Q/(\epsilon_0 A)$ and $E_d = Q/(3\epsilon_0 A)$. $V = (d/2)(E_{vac} + E_d) = 2Qd/(3\epsilon_0 A)$, hence $C = 3\epsilon_0 A/(2d) = 3C_0/2$. Award common D , each field, voltage sum and capacitance. Normal $\mathbf{E}$ is discontinuous; $\mathbf{D}$ is continuous.