1) A capacitor consists of two parallel plates of area \( A = 0.20 \text{ cm}^2 \) separated by a distance \( 0.25 \text{ mm} \). How much charge accumulates on the capacitor when it is connected to a 3.6 V battery?

- a) \( 9.67 \times 10^{-13} \text{ C} \)
- b) \( 1.85 \times 10^{-12} \text{ C} \)
- c) \( 2.55 \times 10^{-12} \text{ C} \)
- d) \( 2.90 \times 10^{-12} \text{ C} \)
- e) \( 3.12 \times 10^{-12} \text{ C} \)

\[
Q = CV = \frac{\varepsilon_0 A}{d} V = 2.25 \times 10^{-12} \text{ C}
\]

2) Capacitors \( A \) and \( B \) are identical, except that capacitor \( B \) is filled with a material that has a dielectric constant of 3.6. If the battery has a voltage of 12 V, what is the ratio of the energies stored in capacitors \( B \) and \( A \), \( U_B/U_A \)?

- a) 0.3
- b) 1.8
- c) 3.6
- d) 7.2
- e) 9.0

\[
\frac{U_B}{U_A} = \frac{C_B}{C_A} = \frac{k\varepsilon_0 A}{d} = 3.6
\]

3) When 93.0 V is applied across a graphite cylinder that is 12 m long and has a 0.43 mm radius, the magnitude of the current density is \( 1.5 \times 10^4 \text{ A/m}^2 \). What is the resistivity of graphite?

- a) \( 8.7 \times 10^{-5} \Omega \cdot \text{m} \)
- b) \( 9.9 \times 10^{-5} \Omega \cdot \text{m} \)
- c) \( 1.0 \times 10^{-4} \Omega \cdot \text{m} \)
- d) \( 3.5 \times 10^{-4} \Omega \cdot \text{m} \)
- e) \( 5.2 \times 10^{-4} \Omega \cdot \text{m} \)

\[
L = 12 \text{ m}, \quad r = 0.43 \times 10^{-3} \text{ m}, \quad A = \pi r^2 = 5.81 \times 10^{-7} \text{ m}^2
\]

\[
R = \rho \frac{L}{A} \quad \rho = R \frac{A}{L}
\]

\[
V = iR, \quad \text{so} \quad R = \frac{V}{i} = \frac{\text{Dolen}}{\text{MAMA}} = \frac{V}{JA}, \quad \text{so}
\]

\[
\rho = R \frac{A}{L} = \frac{V}{JA} \frac{A}{L} = \frac{V}{JL} = 5.2 \times 10^{-4} \Omega \cdot \text{m}
\]