Exam Duration: One hour and a half
Choose the Correct Answer

Q1- When an insulating material, with a dielectric constant K=3, is inserted between the plates of a capacitor whose capacitance equals $C_o$, what is the new capacitance, $C$?

\[ C = 1/9 C_o \]
\[ 1/3 C_o \]
\[ 3C_o \]
\[ 9C_o \]

Q2- If the stored energy of a capacitor, disconnected from the electric circuit, equals $U_o$, what is its stored energy, $U$, after inserting a dielectric material, whose $K = 5$, between its plates?

\[ 5 U_o \]
\[ 25 U_o \]
\[ 1/5 U_o \]
\[ 1/25 U_o \]

Q3- For a capacitor having $C = 6 \mu F$, $d = 0.07 mm$, and a dielectric material with $E_{\text{max}} = 14 \times 10^6 V/m$, what is the maximum charge that can accumulates on its plate?

\[ 5.9 \times 10^{-3} C \]
\[ 1.2 C \]
\[ 5.9 C \]
\[ 1200 C \]

Q4- A group of electrons ($10^6$ electrons) passes through an area during 20 ns, what is the electric current passing that area?

\[ 8 mA \]
\[ 8 \mu A \]
\[ 8 nA \]
\[ 8 pA \]
Q5- The resistance of a segment of a gold wire \((\alpha = 3.4 \times 10^{-3} \text{ }^\circ\text{C}^{-1})\) is \(80 \Omega\) at room temperature \((25 \text{ }^\circ\text{C})\). When the wire is placed in a liquid bath, the resistance increases to \(90 \Omega\). What is the temperature of the path?

\[
R = 80 \Omega \quad \text{at} \quad T = 25 \text{ }^\circ\text{C}
\]

\[\alpha = 3.4 \times 10^{-3} \text{ }^\circ\text{C}^{-1}\]

\[
\frac{\Delta R}{\Delta T} = \alpha \quad \text{and} \quad \Delta R = 90 \Omega - 80 \Omega = 10 \Omega
\]

\[
\Delta T = \frac{\Delta R}{\alpha} = \frac{10 \Omega}{3.4 \times 10^{-3} \text{ }^\circ\text{C}^{-1}} = 2941^\circ\text{C}
\]

\[
2941^\circ\text{C} - 25^\circ\text{C} = 2896^\circ\text{C}
\]

\[
\frac{2896^\circ\text{C}}{1000} = 2.896^\circ\text{C}
\]

\[
\frac{2.896^\circ\text{C}}{10^3} = 2.896 \times 10^{-3}^\circ\text{C}
\]

\[
\frac{2.896 \times 10^{-3}^\circ\text{C}}{3.4 \times 10^{-3}^\circ\text{C}^{-1}} = 0.8629^\circ\text{C}
\]

\[
T = 25^\circ\text{C} + 0.8629^\circ\text{C} = 25.8629^\circ\text{C}
\]

\[
\text{Closest option is: } a- 4.25 \times 10^{-4}^\circ\text{C}
\]

Q6- An electric current \((I = 3 \text{ }A)\) passes through a resistor creating a voltage difference of \(100 \text{ }V\). What is the energy delivered to the resistor during 5 seconds, using the unit Joule?

\[
\text{Energy} = \frac{V}{R} \cdot I \cdot t
\]

\[
\text{Energy} = \frac{100 \text{ }V}{25 \text{ }\Omega} \cdot 3 \text{ }A \cdot 5 \text{ }s = 36 \text{ }\text{Joule}
\]

\[
b- 36^\circ\text{C}
\]

Q7- What is the equivalent resistance of the resistors, between \(a\) and \(b\), in the figure shown below?

[Diagram of a circuit with resistors and voltage source]

\[
\text{Equivalent Resistance} = \frac{3 \times 5}{3 + 5} = 1.875 \Omega
\]

\[
c- 8.8 \Omega
\]

Q8- Calculate the value of the electric current \(I_2\), in the electric circuit shown below, knowing that the capacitor is at the equilibrium state.

[Diagram of a circuit with a capacitor and resistors]

\[
\text{Current through capacitor} = \frac{6 \text{ }\text{V}}{4 \text{ }\text{Ω}} = 1.5 \text{ }\text{A}
\]

\[
\text{Current through } I_1 = \frac{10 \text{ }\text{V}}{6 \text{ }\text{Ω}} = 1.6666 \text{ }\text{A}
\]

\[
\text{Current through } I_2 = \frac{10 \text{ }\text{V}}{4 \text{ }\text{Ω}} = 2.5 \text{ }\text{A}
\]

\[
\text{Current through } I = \frac{10 \text{ }\text{V}}{10 \text{ }\text{Ω}} = 1 \text{ }\text{A}
\]

\[
\text{Current through } I = I_1 + I_2
\]

\[
1.5 \text{ }\text{A} + 2.5 \text{ }\text{A} = 4 \text{ }\text{A}
\]

\[
\text{Closest option is: } d- 2.5 \text{ }\text{A}
\]
Q9- An electron is moving with a speed of $5 \times 10^5 \text{ m/s}$, making an angle of $30^\circ$ with a magnetic field of $5 \text{ T}$. Calculate the magnitude of the electron acceleration due to the magnetic force?

سـ٩ - يمر الإلكترون بسرعة $5 \times 10^5 \text{ m/s}$ من خلال مجال مغناطيسي مقداره $B = 5 \text{ T}$ ويتوجه زاوية $30^\circ$ مع اتجاه حركة الجسم، من ذلك أوجد مقدار التسارع الناشئ من القوة المغناطيسية؟

\[
a- 2.2 \times 10^{17} \text{ m/s}^2 \quad b- 3.8 \times 10^{-13} \text{ m/s}^2 \quad c- 4.4 \times 10^{17} \text{ m/s}^2 \quad d- 2 \times 10^{-13} \text{ m/s}^2
\]

Q10- What is the value of the magnetic force acting on the wire shown in the figure below, knowing that the magnetic field is uniform?

سـ١٠ - ما مقدار القوة المغناطيسية المؤثرة على السلك، الموضوع بالرسم أدناه، إذا كان المجال المغناطيسي منتظمًا؟

\[
B = 2 \text{ T}
\]

\[
a- 1.6 \text{ N} \quad b- 1.7 \text{ N} \quad c- 2.7 \text{ N} \quad d- 3.2 \text{ N}
\]

مع تمنياتنا لكم بالتوافق