(10) 1. A resistor is attached to a voltage $V_0$. As the current flows through the resistor the resistor heats up, doubling its resistance. By what factor does the power dissipated by the resistor change as it heats up?

a. 0.5: b. 0.707: c. 1 (no change): d. 2

Answer: __________

\[
P = \frac{V_0^2}{2R_0} = \frac{1}{2} \frac{V_0^2}{R_0} = \frac{1}{2} P_0 = 0.5 P_0
\]

(10) 2. A 6 Ω resistor, an 8 Ω resistor and a 24 Ω resistor are connected together. What is the minimum resistance that can be produced using all three resistors?

a. 3 Ω: b. 4 Ω: c. 7 Ω: d. (1/24) Ω

Answer: __________

\[
\frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{8} + \frac{1}{24} = \frac{4}{24} + \frac{3}{24} + \frac{1}{24} = \frac{8}{24} = \frac{1}{3}
\]

\[
R_{eq} = 3 \Omega
\]
3. A 2.0 mm (2 x 10⁻³ m) diameter wire of length 20 m has a resistance of 0.25 Ω. What is the resistivity of the wire?

a. 0.25 Ω; b. 5 x 10⁻⁸ Ωm; c. 16 x 10⁻⁷ Ωm; d. 3.9 x 10⁻⁸ Ωm

\[ R = \rho \frac{l}{A} \quad \rho = \frac{A}{l} R = \frac{\pi \left( \frac{2 \times 10^{-3} \text{m}}{2} \right)^2}{20 \text{m}} = 0.25 \Omega \]

\[ = \frac{\pi (10^{-6}) 0.25}{20} \]

\[ = 3.9 \times 10^{-8} \Omega \text{m} \]

4. A parallel plate capacitor has a capacitance of 10 microfarad and is charged with a 20 V power supply. The power supply is then removed and a dielectric of dielectric constant 4 is used to fill the space between the plates. The voltage now across the capacitor is

a. zero; b. 5 V; c. 20 V; d. 80 V

\[ Q = 2 \times 10^{-4} \text{C} \]

\[ C = \kappa C_0 \]

\[ = 4 \left( 10 \times 10^{-6} \text{F} \right) \]

\[ = 40 \times 10^{-6} \text{F} \]

\[ C = \frac{Q}{V} \]

\[ V = \frac{Q}{C} \]

\[ V = \frac{2 \times 10^{-4} \text{C}}{40 \times 10^{-6} \text{F}} \]

\[ V = 5 \text{V} \]
(10) 5. In the circuit, the current in the 4 Ω resistor is 3 A. What is the voltage across the 8 Ω resistor?

a. 12 V; b. 24 V; c. 32 V; d. 44 V

Answer:________

\[ V_4 = V_{12} = (3 A) 4 \Omega = 12 V \]

\[ I_{12} = \frac{12 V}{12 \Omega} = 1 A \]

\[ I_8 = I_4 + I_{12} = 4 A \]

\[ V_8 = I_8 8 \Omega \]

\[ = 4 A 8 \Omega \]

\[ = 32 V \]
(20) a. Find the reading of the ammeter just after the switch is closed.
b. Find the reading of the ammeter after the switch has been closed for a very long time.

(SHOW YOUR WORK NEATLY.)
7. The capacitors in the figure are initially uncharged and are connected, as in the diagram, with switch S open. The applied potential difference is $V_{ab} = 210 \text{ V}$.

a. What is the potential difference $V_{cd}$?

b. What is the potential difference across each capacitor after switch S is closed? (This will require neat step by step work or you will get lost.)

\[ C = \frac{Q}{V} \]

\[ V_{cd} = 170 \text{ V} \]
Part b  switch closed

\[ \frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{2}{9} \]

\[ C_{eq} = 4.5 \times 10^{-6} \, \text{F} \]

\[ Q = (4.5 \times 10^{-6} \, \text{F}) \times 210 \, \text{V} = 9.45 \times 10^{-4} \, \text{C} \]

\[ V' = \frac{Q}{C} \]

\[ V_{ac} = \frac{9.45 \times 10^{-4} \, \text{C}}{9 \times 10^{-6} \, \text{F}} = 105 \, \text{V} \]

\[ V_{db} = 105 \, \text{V} \]

\[ V_{ac} = V_{db} = 105 \, \text{V} \]

105 V across each capacitor