PHYSICS 1B QUIZ #3 FALL QUARTER 2009 **Form A**

YOUR NAME ______Answer Key______ (PRINT NEATLY!)

YOUR PID NUMBER________________________ (PRINT NEATLY!)

INSTRUCTIONS: THERE ARE 10 QUESTIONS ON THIS QUIZ. PLEASE FILL IN THE SCANTRON FORM USING A NUMBER 2 PENCIL. ***Note: Any confirmed case of cheating will result in an "F" grade in Physics 1B and referral to the dean for disciplinary action.***

1. A 20- Ω platinum wire at 20°C with a temperature coefficient of resistivity of 3.9×10^{-3} $(°C)^{-1}$ will have what resistance at 100°C?

$$R = R_0[1 + \alpha(T - T_0)]$$
$$R = 20[1 + 3.9 \times 10^{-3}(80)] = 26\Omega$$

   a. 14 Ω
   b. 20 Ω
   c. 26 Ω
   d. 28 Ω

2. A turbine at an electric power plant delivers 4,500 kW of power to an electrical generator which converts 95% of this mechanical energy into electrical energy. What is the current delivered by the generator if it delivers at 3,600 V?

$$W = \frac{95}{100} \times 4500 \times 10^3 = 4.28E6$$
$$W = I \times \Delta V => I = \frac{4.28E6}{3600} = 1.2E3$$

   a. 0.66×10^3 A
   b. 1.0×10^3 A
   c. 1.2×10^3 A
   d. 5.9×10^3 A

3. Number 10 copper wire (radius = 1.3 mm) is commonly used for electrical installations in homes. What is the voltage drop in 40 m of #10 copper wire if it carries a current of 10 A? (The resistivity of copper is 1.7×10^{-8} Ω.m.)

$$R = \rho\frac{l}{A} = 1.7 \times 10^{-8}\frac{40}{\pi(1.3E-3)^2} = 0.13\Omega$$
$$V = IR = 10 \times 0.13 = 1.3\ V$$

   a. 1.3 V
   b. 0.77 V
   c. 0.50 V
   d. 0.13 V

4. A high voltage transmission line of diameter 2 cm and length 200 km carries a steady current of 1 000 A. If the conductor is copper with a free charge density of 8 × 10^{28} electrons/m^3, how long does it take one electron to travel the full length of the cable? (e = 1.6 × 10^{-19} C)

$$I = nqv_dA \Rightarrow v_d = \frac{1000}{8 \times 10^{28} \times 1.6E-19 \times \pi \times 10^4} = 2.49E-4\,\frac{m}{s}$$

$$x = Vt \Rightarrow t = \frac{200 \times 10^3}{2.49E-4} = 8 \times 10^8$$

a. 8 × 10^2 s
b. 8 × 10^4 s
c. 8 × 10^6 s
d. 8 × 10^8 s

5. A resistor is made of a material that has a resistivity that is proportional to the current going through it. If the voltage across the resistor is doubled, what happens to the power dissipated by it?

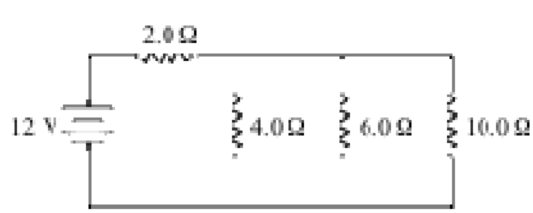
$$\rho \propto I, V' \to 2V, V = IR \Rightarrow I' \to \sqrt{2}\ \&\ R' \to \sqrt{2}$$
$$W = IV \Rightarrow W' = I'V' \Rightarrow 2 \times \sqrt{2}IV = 2^{3/2}$$

a. It doubles.
b. It quadruples.
c. It increases by a factor of $2^{3/2}$.
d. It increases by a factor of $2^{1/2}$.

6. Three resistors connected in parallel have individual values of 4.0, 6.0 and 10.0 Ω, respectively. If this combination is connected in series with a 12-V battery and a 2.0- Ω resistor, what is the current in the 10- Ω resistor?

$$\frac{1}{R} = \frac{1}{6} + \frac{1}{4} + \frac{1}{10} \Rightarrow R = 1.94\Omega$$
$$R_{tot} = 1.94 + 2 = 3.94\Omega$$
$$I_{tot} = \frac{12}{3.94} = 3.05\ A$$
$$V\ of\ 10\Omega\ resistor = 1.94 \times 3.05 = 5.92V$$
$$The\ \ current\ in\ the\ 10\Omega\ is\ I = \frac{5.92}{10} = 0.59A$$

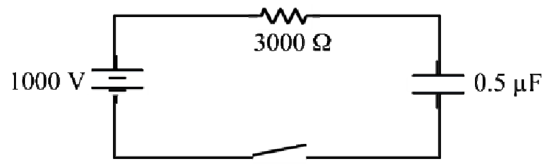
a. 0.59 A
b. 1.0 A
c. 11 A
d. 16 A



7. A 1 000-V battery, a 3 000- Ω resistor and a 0.50-μF capacitor are connected in series with a switch. The time constant for such a circuit, designated by the Greek letter, τ, is defined as the time required to charge the capacitor to 63% of its capacity after the switch is closed. What is the value of τ for this circuit?

$$\tau = RC = 3000 \times 0.5E - 6 = 1.5E - 3\ s$$

a. 6.0×10^{9} s
b. 1.7×10^{-10} s
c. 1.7×10^{-7} s
d. 1.5×10^{-3} S



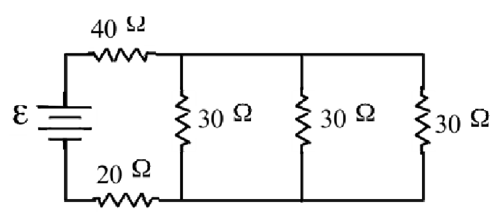
8. If $\mathcal{E}$ = 20 V, at what rate is thermal energy being generated in the 20- Ω resistor?

$$\frac{1}{R} = 3 \times \frac{1}{30} => R = 10\Omega$$

$$R_{tot} = 10 + 20 + 40 = 70\Omega$$

$$I_{tot} = \frac{20}{70} = 0.3A => W = IR^2 = 0.29 \times 20^2 = 1.6W$$

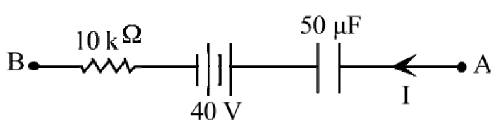
a. 6.5 W
b. 1.6 W
c. 15 W
d. 26 W



9. If $I = 2.0$ mA and the potential difference, $V_A - V_B = +30$ V in the circuit segment shown, determine the charge and polarity of the capacitor.

$$\frac{q}{50E-6} - 40 - 20 + 30 = 0$$
$$q = +1.5mC\ and\ the\ left\ plate\ is\ positive$$

a. 1.5 mC, left plate is positive
b. 1.5 mC, right plate is positive
c. 0.50 mC, left plate is positive
d. 0.50 mC, right plate is positive



10. Consider the circuit shown in the figure. What power is dissipated by the entire circuit?

$$R_1 = 3 + 4 + 3 = 10\Omega$$
$$R_2 = \frac{10\times10}{10+10} = 5\Omega, R_3 = 5 + 2 + 3 = 10\Omega$$
$$R_4 = 5\Omega, R_{tot} = 5 + 5 + 5 = 15\Omega$$
$$W = \frac{28^2}{15} = 52.3W$$

a. 14 W
b. 28 W
c. 52 W
d. 112 W