NAME (Please Print)_____

Circle the correct answer, to the nearest number for the quantitative questions.

Part 1. Each Question worth's 1.5 points.

1. An ***RC*** circuit is connected across a **DC** voltage source through an open switch. The switch is closed at $t = 0$ **s.** Which of the following is a correct statement regarding the circuit?

A) The capacitor charges to its maximum value in one time constant.
B) The capacitor charges to its maximum value in two time constants.
C) The resistor and the capacitor share the applied voltage equally as a function of time.
D) The current flows through the circuit even after the capacitor is fully charged.
E) Once the capacitor is fully charged, there is no current in the circuit.

2. An electric device delivers a current of **5.0 A** for **10 seconds**. How many electrons flow through this device?

A) 0.20 B) 50 C) 8.0×10^{-18} D) 3.1×10^{20}
E) 31×10^{20}

3. The resistance of a **100–cm** wire of cross sectional area $\mathbf{2 \times 10^{-6} m^2}$ is **400 Ω**. What is the resistivity of the material of this wire?

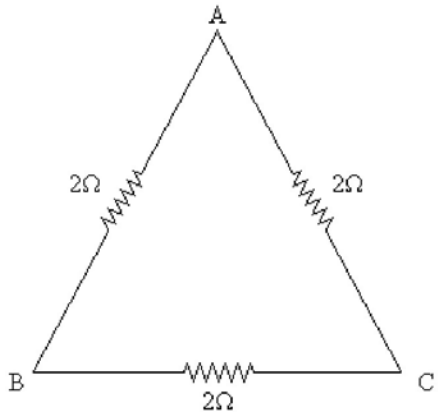
A) 0.8×10^{-4} Ωm B) 8×10^{-4} Ωm C) 0.8×10^{-5} Ωm
D) 0.8×10^{-6} Ωm E) 8×10^{-64} Ωm

4. The power rating of a **400 Ω** resistor is **0.25 W**. What is the maximum voltage?

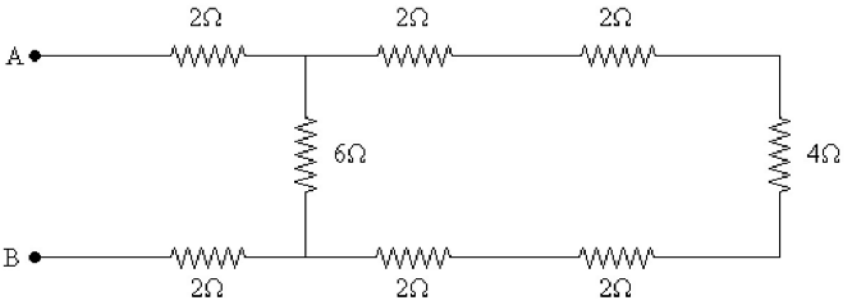
A) 10 V B) 20 V C) 30 V D) 40 V E) 50 V

5. Three **2.0–Ω** resistors are connected across the sides of an equilateral triangle **ABC** as shown. What is the equivalent resistance between any two points, **AB**, **BC**, or **AC**, of this circuit?

A) 2.0 Ω
B) 6.0 Ω
C) 4.3 Ω
D) 3.3 Ω
E) 1.3 Ω

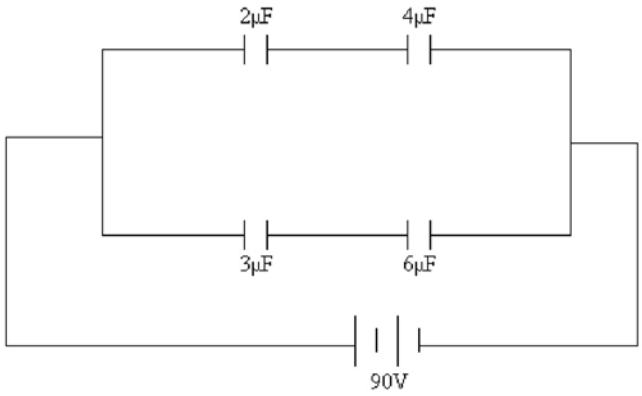


6. A number of resistors are connected across points **A** and **B** as shown below. What is the equivalent resistance between points **A** and **B**?



A) 4 Ω
B) 6 Ω
C) 8 Ω
D) 10 Ω
E) 12 Ω

7. Four capacitors are connected as shown. What is the charge on a **2.0–μF** capacitor?



A) 68 μC
B) 90 μC
C) 240 μC
D) 120 μC
E) 180 μC

8. A charged particle moving with a certain velocity along the **+*x*–axis** enters a magnetic field pointing toward the **+*z*–axis**. Determine the required direction of an electric field that will allow the charged particle to continue to move along the **+*x*–axis**.

A) along the −*y*−axis B) along the +*y*−axis C) along the −*x*−axis
D) along the +*x*−axis E) along the −*z*−axis

9. A proton moving eastward with a velocity of **5.0×10^3 m/s** enters a magnetic field of **0.20 T** pointing northward. What is the magnitude and direction of the force that acts on the proton?

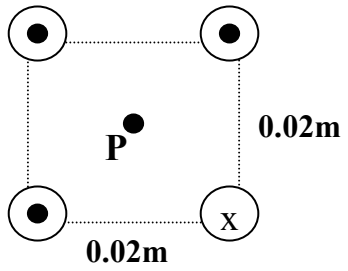
A) 0 N B) 1.6×10^{-16} N upwards C) 1.6×10^{-16} N downwards
D) 1.1×10^{-16} N eastwards E) 4.4×10^{-16} N westwards

10. The magnetic field at a distance of **2.0 cm** from a current carrying wire is **4.0 μT**. What is the magnetic field at a distance of **1.0 cm** from the wire?

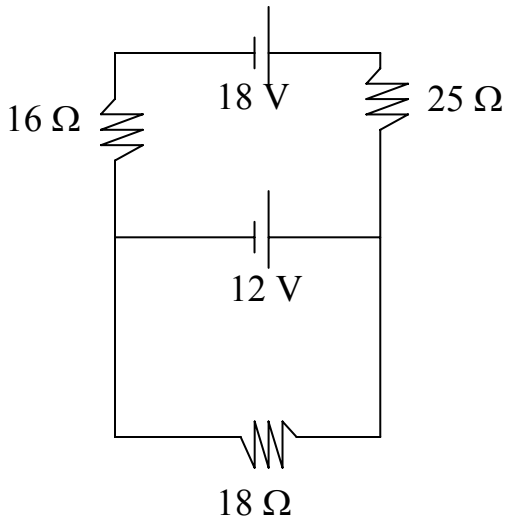
A) 2.0 μT B) 4.0 μT C) 6.0 μT D) 8.0 μT E) 10 μT

Part 2 . Please show your work in the space provided.

11. **Four** long, straight wires are parallel to each other; and their cross-section forms a square. Each side of the square is **0.02 m** as shown in the figure. If **each** wire carries a current of **8.0 A** in the direction shown in the figure, determine the magnitude of the **total magnetic field** at **P**, the center of the square. ***(3 points)***



12. Three resistors and two batteries are connected as shown in the circuit diagram. What is the ***magnitude*** of the ***current*** through the **12-V** battery? ***(2 points)***



Some useful constants: $e^{-} = 1.60 \times 10^{-19}$ C, $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2 /(N.m^2),
$\mu_0 = 4\pi \times 10^{-7}$ T.m/A, $k = (1/4\pi\varepsilon_o) = 8.99 \times 10^{9}$ N.m^2/C^2, $m_e = 9.11 \times 10^{-31}$ kg,
$m_p = 1.67 \times 10^{-27}$ kg..

Good Luck