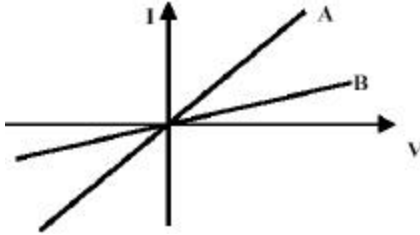


1. A wire contains a steady current of 2 A. The charge that passes a cross section in 2 s is:

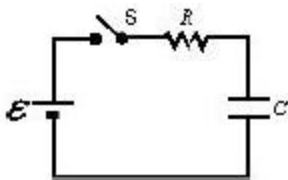
A. 3.2×10^{-19} C
 B. 6.4×10^{-19} C
 C. 1 C
 D. 2 C
 E. 4 C

2. In a Physics 212 lab, Jane measures the current versus voltage characteristics for two nichrome wires and makes the graph shown. The wires are of the **same diameter** but have **different lengths**. Which of the following statements is correct?



- A. Wire A is shorter than wire B.
 B. Wire A has a larger resistance than wire B.
 C. Wire A has a larger resistivity than wire B.
 D. Wire A has a smaller resistivity than wire B.
 E. Neither wire obeys Ohm's Law.
3. The current density across a cylindrical conductor of radius R varies according to the equation $J = J_0(r/R)$, where r is the distance from the central axis. Thus, the current density is zero at the axis ($r = 0$) and increases linearly to J_0 at the surface ($r = R$). Calculate the current in terms of J_0 and R .
- A. $i = (\pi R^2 J_0)/2$
 B. $i = (2\pi R^2 J_0)/3$
 C. $i = (\pi R^2 J_0)/6$
 D. $i = (\pi R^3 J_0)/3$
 E. $i = (\pi R^3 J_0)/6$
4. A wire is 1 m long and 1×10^{-6} m² in cross-sectional area. When connected to a potential difference of 2 V, a current of 4 A exists in the wire. The *resistivity* of the wire material is:
- A. 10^{-7} Ωm
 B. 2×10^{-7} Ωm
 C. 4×10^{-7} Ωm
 D. 5×10^{-7} Ωm
 E. 2×10^{-6} Ωm

5. You wish to double the rate of energy dissipation in a heating device. You could:
- double the potential difference keeping the resistance the same.
 - double the current keeping the resistance the same.
 - double the resistance keeping the potential difference the same.
 - double the resistance keeping the current the same.
 - double both the potential difference and current.
6. Four circuits have the form shown in the diagram. The capacitor is initially uncharged and the switch S is open.



The values of the emf, resistance R , and capacitance C for each for the circuits are

circuit 1: $\text{emf} = 18 \text{ V}$, $R = 3 \Omega$, $C = 1 \mu\text{F}$

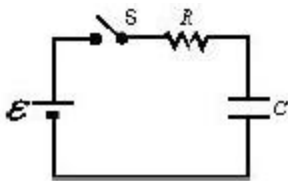
circuit 2: $\text{emf} = 18 \text{ V}$, $R = 6 \Omega$, $C = 9 \mu\text{F}$

circuit 3: $\text{emf} = 12 \text{ V}$, $R = 1 \Omega$, $C = 7 \mu\text{F}$

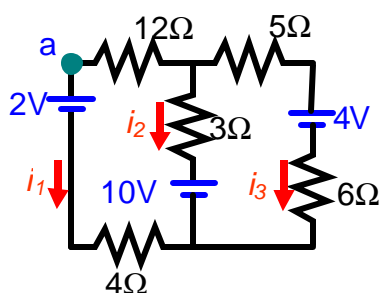
circuit 4: $\text{emf} = 10 \text{ V}$, $R = 5 \Omega$, $C = 7 \mu\text{F}$

Rank the circuits according to the current just after switch S is closed least to greatest.

- 1, 2, 3, 4
 - 4, 3, 2, 1
 - 4, 2, 3, 1
 - 4, 2, 1, 3
 - 3, 1, 2, 4
7. In the circuit with $\text{emf} = 18\text{V}$, $R = 6 \text{ Ohms}$, and $C = 1 \mu\text{F}$, the capacitor has a charge of $10 \mu\text{C}$ and the switch is closed. Just after the switch is closed, what is the current through the resistor? (Hint: write the loop equation)

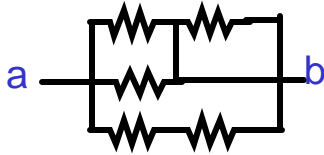


- 3A
- 0A
- 1.1A
- 1.9A
- 1.3A

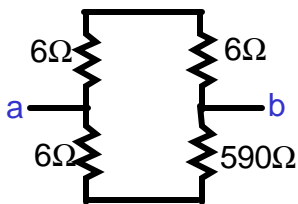


8. The figure above shows a circuit containing ideal batteries and resistors. A student selects the currents I_1 , I_2 and I_3 in the directions indicated in order to do a loop analysis of this circuit. Which of the junction equations is CORRECT?
- $I_1 + I_2 + I_3 = 0$
 - $I_1 - I_2 + I_3 = 0$
 - $I_1 + I_2 - I_3 = 0$
 - $I_1 - I_2 - I_3 = 0$
 - $I_1 = I_2$
9. In the figure above, starting at point a and proceeding counterclockwise, which loop equation is correct?
- $2V - i_1 4\Omega + 10V + i_2 3\Omega - i_1 12\Omega = 0$
 - $-2V - i_1 4\Omega + 10V + i_2 3\Omega - i_1 12\Omega = 0$
 - $2V - i_1 4\Omega - 10V + i_2 3\Omega - i_1 12\Omega = 0$
 - $-2V - i_1 4\Omega + 10V - i_3 3\Omega - i_1 12\Omega = 0$
 - $2V - i_1 4\Omega + 10V - i_2 3\Omega - i_1 12\Omega = 0$
10. A car battery with a 12 V emf has an internal resistance of 0.050Ω . If it supplies a current of 20 A to the car circuitry, what is the potential difference across its terminals?
- 9.1 V
 - 12 V
 - 14.6 V
 - 11 V
 - 10.1 V

11. All resistors shown are 30Ω . What is the resistance between points a and b?

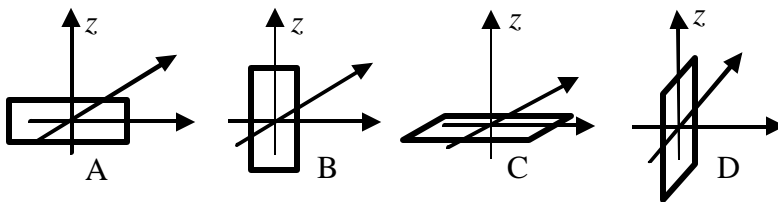


- A. 25.7Ω
 B. 12Ω
 C. 15Ω
 D. 30Ω
 E. This combination cannot be reduced treating resistors in either series or parallel.
12. A charged capacitor is being discharged through a resistor. At the end of one time constant the charge has been reduced by $(1 - 1/e) = 63\%$ of its initial value. At the end of two time constants the charge has been reduced by what percent of its initial value?
- A. 82%
 B. 86%
 C. 100%
 D. between 90% and 100%
 E. need to know more data to answer the question
13. What is the resistance between points a and b?



- A. 6Ω
 B. 12.3Ω
 C. 18Ω
 D. 608Ω
 E. 11.8Ω

14. A particle of charge $Q = +2 \text{ C}$ has an instantaneous velocity $\mathbf{v} = (4\mathbf{i} - 3\mathbf{j}) \text{ m/s}$ and is moving through a magnetic field $\mathbf{B} = (4\mathbf{k}) \text{ T}$. Determine the magnitude of the instantaneous magnetic force on the particle.
- A. 10 N
 B. 20 N
 C. 30 N
 D. 40 N
 E. 60 N
15. A proton (charge = $+e$) travelling at some finite speed enters a region that contains a uniform magnetic field \mathbf{B} and a uniform electric field \mathbf{E} that are perpendicular to each other and also to the initial velocity \mathbf{v} of the particle. Which of the following conditions is necessary for the proton to continue moving without any change in velocity?
- A. This is impossible – the proton's velocity would have to change.
 B. $B = eE$
 C. $E\mathbf{B} = e\mathbf{v}$
 D. $v = E/B$
 E. $e\mathbf{v} = E/B$
16. A rectangular loop is placed in a uniform magnetic field aligned in the positive z -direction. There is a current I circulating in the loop. In which of the following positions will the loop rotate around the z -axis?

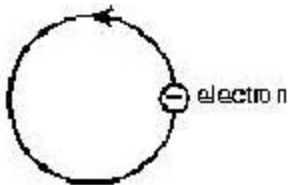


- A. A
 B. B
 C. C
 D. D
 E. none of the above

17. A loop of wire carrying a current of 2.0 A is in the shape of a right triangle with two equal sides, each 15 cm long. A 0.7 T uniform magnetic field is in the plane of the triangle and is perpendicular to the hypotenuse. The total magnetic force on the two equal sides has a magnitude of:

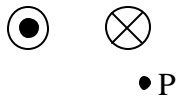
- A. 0
- B. 0.21 N
- C. 0.30 N
- D. 0.41 N
- E. 0.51 N

18. Electrons are going around a circle in a counterclockwise direction as shown. At the center of the circle they produce a magnetic field that is:



- A. into the page.
- B. out of the page.
- C. to the left.
- D. to the right.
- E. zero.

19. *Equal currents* flow through four wires into or out of the page as shown. What is the direction of the magnetic field at the point C?



- A. \rightarrow
- B. \leftarrow
- C. into the page
- D. out of the page
- E. \uparrow

20. Two long straight wires are parallel and carry current in the same direction. The currents are 8.0 A and 12 A and the wires are separated by 0.40 m. The magnetic field in tesla at a point midway between the wires is:
- A. 0
 - B. 4.0×10^{-6}
 - C. 8.0×10^{-6}
 - D. 12×10^{-6}
 - E. 20×10^{-6}