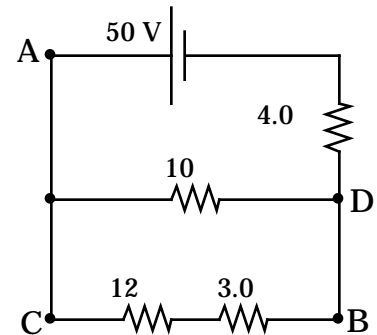


Name _____

Please work the problems on separate sheets of paper and staple these sheets to the front. Read each problem carefully. Show your work and/or give some kind of explanation for every answer; I do give partial credit, but *only* if I can follow your work. Make sure that your answers are given with a reasonable number of sig figs and that you have included appropriate units. Check your answers for physical *reasonableness* whenever possible.

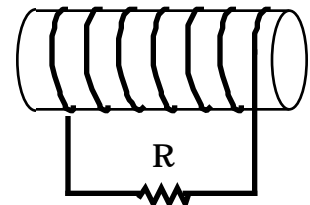
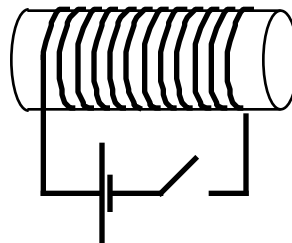
1. [30 pts, 5 pts each] Consider the circuit shown at right.

- a) Find the *equivalent resistance* of the resistor network.
- b) Find the *potential difference* between points A and B.
- c) *Which* resistor has the most current flowing in it?
- d) Find the *voltage drop* across the 3.0 resistor.
- e) How much *power* is the battery delivering?
- f) What would happen to the current through the 4.0 resistor if we reversed the polarity of the battery?



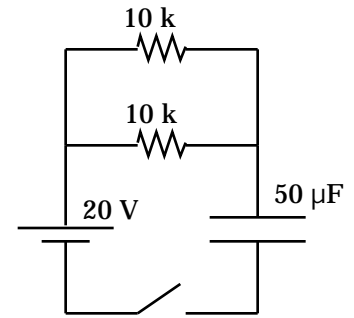
2. [30 pts, 5 pts each] Two solenoids are placed in simple circuits as shown at right.

- a) *Just after* the switch is closed, what direction is the current, if any, through the resistor? Explain your answer.
- b) With the switch closed, we move the left solenoid to the right. What direction is the current, if any, through the resistor? Explain your answer.
- c) With the switch closed, we move the right solenoid to the right. What direction is the current, if any, through the resistor? Explain your answer.
- d) With the switch closed, one of the solenoids is rotated 90° about a vertical axis through its center. What direction is the current, if any, through the resistor? Explain your answer.
- e) Suppose that a potential difference of 2.0 V appears across the resistor when the current in the left solenoid decreases from 30 A to 0 A in 8.0 milliseconds. What is the mutual inductance of the two solenoids?
- f) Name two things you could do to increase the mutual inductance of the two solenoids?



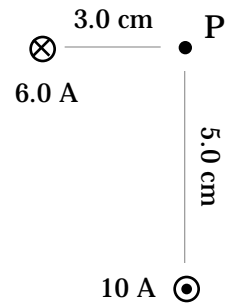
Short Problems

3. [8 pts] When the switch is closed in the circuit shown at right, the capacitor begins to charge at a rate that is characterized by the “time constant” for the circuit. What is the time constant for this circuit?



4. [6 pts] In an electric generator, a coil of wire rotates within a magnetic field. In plain English, what are the factors that determine the peak emf that is generated.

5. [10 pts] Two long straight wires carry currents in or out of the plane of the paper as shown at right. Find the magnetic field (magnitude and direction) at the point P.



6. [6 pts] An electron ($m_e = 9.1 \times 10^{-31}$ kg) and a proton ($m_p = 1.67 \times 10^{-27}$ kg) have the *same kinetic energy* and move perpendicular to the *same uniform magnetic field*. Describe and explain the two important differences between the paths of the particles.

7. [10 pts] Use Kirchhoff's Rules to find I and in the circuit at right.

