Pre-Lab #2: Speed of Sound in Air

Name: _____ **Course:** _____

Date: _____

An organ pipe is 2.0-m long. Assume the pipe is cylindrical with one closed and one open end. (Show your calculations to obtain the answers below.)

1. What is the longest wavelength λ for a standing sound wave possible in the pipe?

Answer: _____

2. **(a)** What is the wavelength of the 1st harmonic? Answer: _____

(b) What is the wavelength of the 2nd harmonic? Answer: _____

3. If the frequency of the 3rd harmonic is 290 Hz, then what is the speed of sound in the pipe?

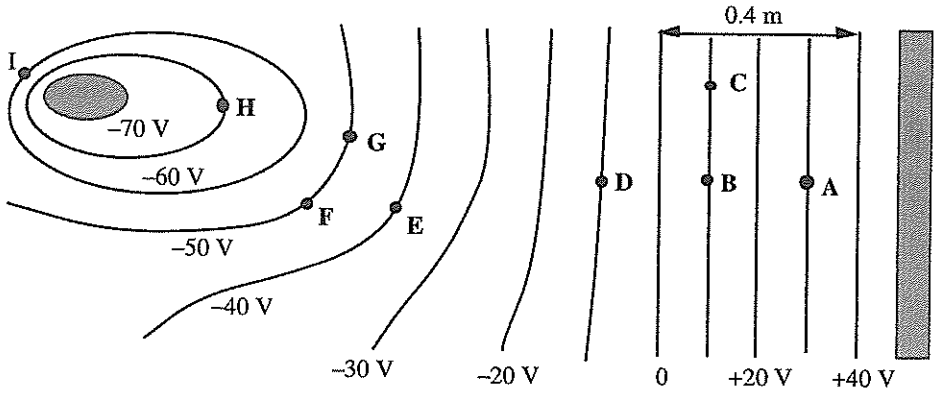
Answer: _____

Pre-Lab #3: Electric Field Mapping

Name: _____ **Course:** _____

Date: _____

1. The sketch shows cross sections of equipotential surfaces between two charged conductors that are shown in solid black.



(a) What is the potential difference between points **B** and **E**? _____

(b) At which of the labeled points will the electric field have the greatest magnitude? _____

(c) What is the electric field at point **A** (magnitude and direction)? _____

2. The sketch on the back of this page shows cross sections of two conducting spherical shells. ($a = 5.0$ cm, $b = 0.50$ m, and $V = 100$ V.)

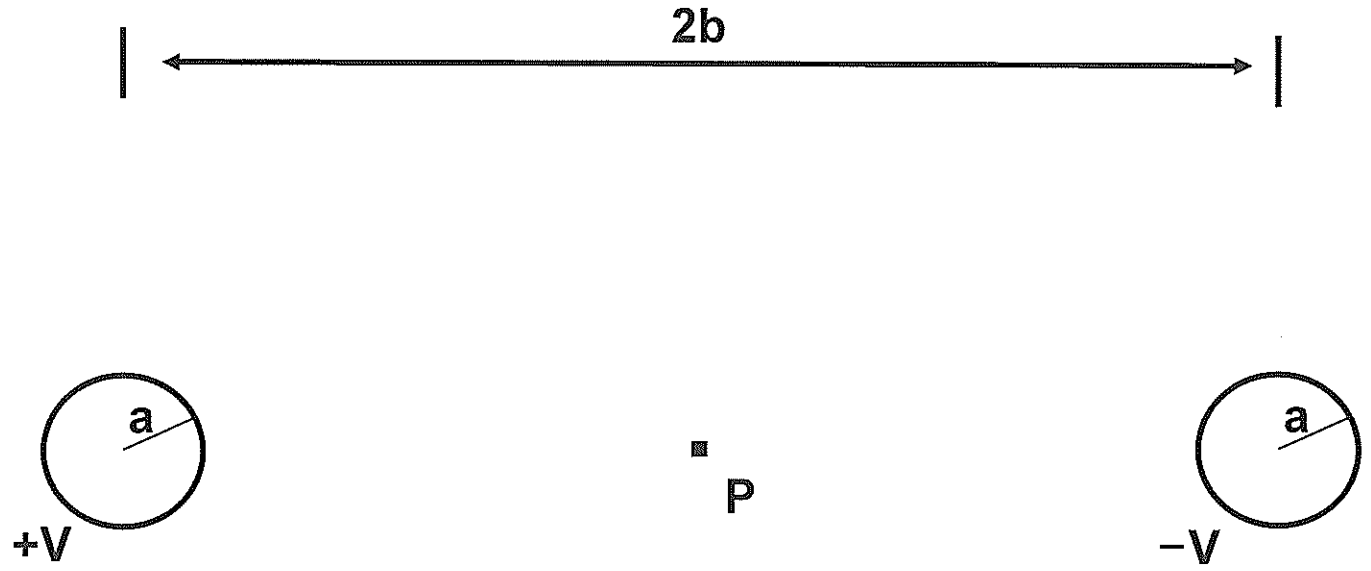
(a) Using dashed curves draw representative equipotentials around and between the spheres.

(b) Using solid curves and arrows draw the electric field lines.

(c) What is the charge on the left sphere? _____

(d) What is the potential at point **P** midway between the two spheres? _____

(e) What is the magnitude and direction of the electric field at point **P** midway between the two spheres? _____


2b
a
+V
P
a
−V

Pre-Lab #4: Ohm's law and Resistivity

Name: _____ **Course:** _____

Date: _____

The characteristics of five wires are given in the table.

Wire	Material	Length	Gauge
A	iron	2.0 m	#22
B	copper	2.0 m	#22
C	copper	2.0 m	#18
D	copper	1.0 m	#18
E	iron	2.0 m	#18

The gauge is a measure of the diameter of the wire; and #18 corresponds to a diameter of 1.2×10^{-3} m; and #22 corresponds to a diameter of 6.4×10^{-4} m. The resistivity of iron is $9.7 \times 10^{-8}\ \Omega \cdot$ m; and the value for copper is $1.72 \times 10^{-8}\ \Omega \cdot$ m.

1. Of the five wires, which one has the smallest resistance? _____

2. Which one of the wires carries the smallest current when they are connected to identical batteries? _____

3. What is the resistance of wire **B**? (Show work.) _____

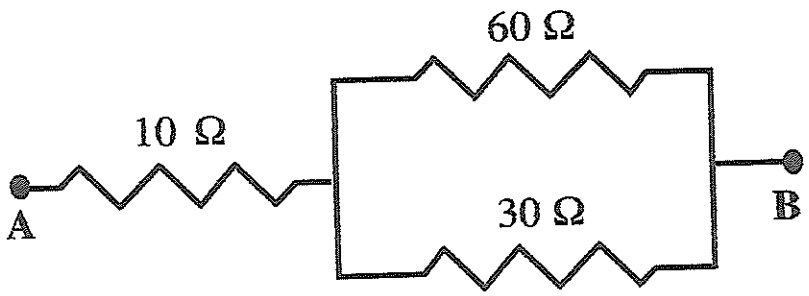
4. Wire **B** is connected to the terminals of a 1.5-V battery. What magnitude current flows through the wire? _____

Pre-Lab #5: Resistors in Series and Parallel

Name: _____ **Course:** _____

Date: _____

Three resistors are placed in a circuit as shown. The potential difference between points **A** and **B** is 30 V.



1. What is the equivalent resistance between points **A** and **B**? _____

2. Complete the following table for the potential difference and current across each of the resistors

R (Ω)	ΔV (V)	I (A)
10		
30		
60		

Pre-Lab #6: RC Circuit

Name: _____ **Course:** _____

Date: _____

1. In a circuit such as the one in Figure 1 (on back) with the capacitor initially uncharged, the switch S is thrown to position A at $t = 0$. The charge on the capacitor is

(a) initially zero and finally $C\varepsilon$.
(b) constant at a value of $C\varepsilon$.
(c) initially $C\varepsilon$ and finally zero.
(d) always less than $C\varepsilon$.

2. In a circuit such as the one in Figure 1 with the capacitor initially uncharged, the switch S is thrown to position A at $t = 0$. The current in the circuit is

(a) initially zero and finally ε/R.
(b) constant at a value of ε/R..
(c) equal to ε/R..
(d) initially ε/R and finally zero.

3. In a circuit such as the one in Figure 2 the switch S is first closed to charge the capacitor, and then it is opened at $t = 0$. The expression $V = \varepsilon e^{-t/RC}$ gives the value of

(a) the voltage on the capacitor but not the voltmeter.
(b) the voltage on the voltmeter but not the capacitor.
(c) both the voltage on the capacitor and the voltmeter, which are the same.
(d) the charge on the capacitor.

4. If a 5.00 μF capacitor and a 3.50 MΩ resistor form a series RC circuit, what is the RC time constant? (Show work.) _____

5. Assume that a 10.0 μF capacitor, a battery of emf ε = 12.0 V, and a voltmeter of 10.0 MΩ impedence are used in a circuit such as that in Figure 2. The switch S is first closed, and then the switch is opened. What is the reading on the voltmeter 35.0 s after the switch is opened? (Show work.) _____

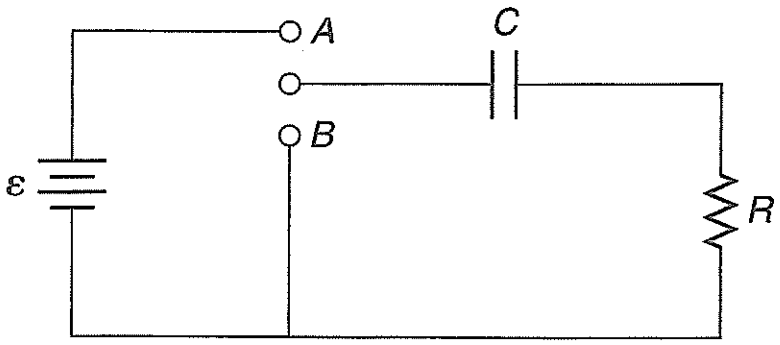


Figure 1

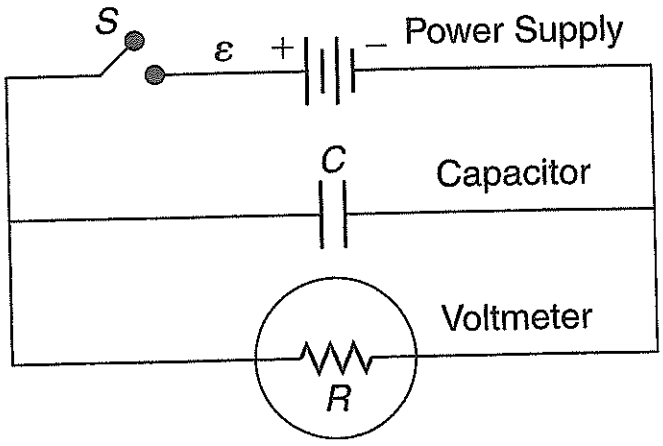


Figure 2

Pre-Lab #7: Magnetic Fields

Name: _____ **Course:** _____

Date: _____

1. Draw a good representation of the magnetic field lines produced by the bar magnet shown on the back of this page.

2. Draw a good representation of the magnetic field lines produced by the solenoid shown on the back of this page.

The magnitude of the magnetic field along the axis of an N-turn coil (Helmholtz coil) is

$$B = \frac{\mu_o NIR^2}{2\left(x^2 + R^2\right)^{3/2}}$$

3. What is the magnitude of the magnetic field at the center of a 100-turn Helmholtz coil of radius 5.0 cm carrying an 0.5-A current? _____

4. What is the magnitude of the magnetic field produced by that Helmholtz coil at a point on the solenoid's axis 3.0 m from its center? _____


S
N