

Physics 114 – Practice Test for Midterm 1

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Conceptual Question 1:

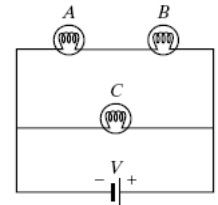
Suppose a positive point charge q is located at the center of a spherical metal shell. What charges appear on

- (a) the outer surface and
- (b) the inner surface of the sphere?
- (c) Suppose you bring an (uncharged) metal object near the sphere. Will your answers to parts (a) or (b) above change? Will the way charge is distributed over the sphere change?

Conceptual Question 2:

The following circuit has three identical light bulbs connected to an ideal battery.

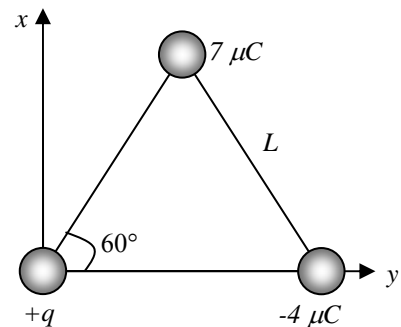
- (a) How do the brightnesses of the three bulbs compare?
- (b) Which draws the most current?
- (c) What happens to the brightness of A and B when C is unscrewed?
- (d) What happens to the brightness of B and C if A is unscrewed?



Problem 1:

Three charged particles are located at the corners of an equilateral triangle as shown in the figure below ($q = 2.00 \mu\text{C}$, $L = 0.50 \text{ m}$).

- (a) Calculate the total electric force on the $7.00 \mu\text{C}$ charge.
- (b) Calculate the electric field at the position of the $2 \mu\text{C}$ charge.
- (c) What is the total electric potential energy associated with this arrangement?



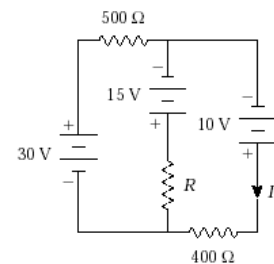
Problem 2:

A parallel-plate capacitor is constructed using a dielectric material whose dielectric constant is 3.00 and whose dielectric strength is $2.00 \times 10^8 \text{ V/m}$. The desired capacitance is $0.25 \mu\text{F}$, and the capacitor must withstand a maximum potential difference of 4000 V. Find the minimum area of the capacitor plates. What is the maximum energy that can be stored in this capacitor?

Problem 3:

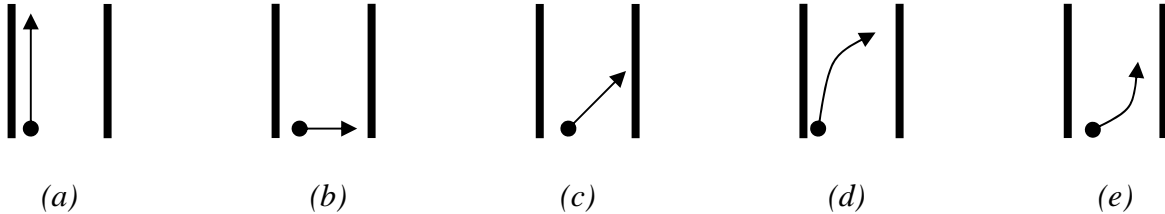
Consider the circuit on the right.

- (a) Write down a complete set of equations to determine the currents in the circuit.
- (b) If $I = 30 \text{ mA}$, determine the magnitude and direction of the current in the $500\text{-}\Omega$ resistor.
- (c) Find the value of R .



Multiple Choice Questions:

1. A positively charged particle is moving in the $+y$ -direction when it enters a region with a uniform electric field pointing in the $+x$ -direction. Which of the diagrams below shows its path while it is in the region where the electric field exists? The region with the field is the region between the plates bounding each figure. The field lines always point to the right. The x -direction is to the right; the y -direction is up.



2. When a positive charge is released and moves along an electric field line, it moves to a position of

- (a) lower potential and lower potential energy.
- (b) lower potential and higher potential energy.
- (c) higher potential and lower potential energy.
- (d) higher potential and higher potential energy.
- (e) greater magnitude of the electric field.

3. The capacitance of a parallel-plate capacitor can be increased by:

- (a) increasing the charge
- (b) decreasing the charge
- (c) increasing the plate separation
- (d) decreasing the plate separation
- (e) decreasing the plate area

4. How much energy is dissipated as heat during a two-minute time interval by a $1.5\text{-k}\Omega$ resistor which has a constant 20 V potential difference across its leads?

- (a) 58 J
- (b) 46 J
- (c) 32 J
- (d) 72 J
- (e) 16 J

5. Most telephone cables are made of copper wire of either 24 or 26 gauge. If the resistance of the 24-gauge wire is $137\ \Omega/\text{mile}$ and the resistance of 26-gauge wire is $220\ \Omega/\text{mile}$, what is the ratio of the diameter of 24-gauge wire to that of 26-gauge wire?

- (a) 1.6
- (b) 1.3
- (c) 0.62
- (d) 0.79
- (e) 0.88