

Printed Name: _____

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PHYSICS 222 - SECTION 1

EXAM 3

April 1, 2009

Instructions: When you are told to begin, check that this examination booklet contains all the numbered pages from 2 through 6. Read each problem carefully so that you are certain what it is asking. Do not panic or be discouraged if you cannot do every part of every problem. If a part of a problem depends on a previous answer you have not obtained, define a symbol for it and proceed to maximize your credit. Keep moving to finish as much as you can!

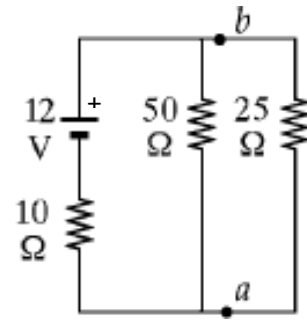
You must show your work. The purpose of this exam is to show how well you understood the material we have covered. You must include an adequate explanation, including correct equations where applicable, for full credit. A number with no explanation will not get credit. **Show your answer's units**, and give an adequate number of significant digits. Completely numerical solutions showing no equations are not eligible for partial credit. Do not use scratch paper. Indicate any work on the backs of the pages that you wish to be considered.

Box your answers.

This examination is administered under the Cadet Honor Code. All suspected violations must be reported appropriately. The seat next to you must be unoccupied. No talking is permitted during the examination, apart from questions to the instructor. You may use a scientific calculator, but may not use "advanced features", including graphing, solving, derivatives, integrals, symbolic manipulation, or equation storage capabilities. Any other electronic devices, including headphones, cell phones, PDAs, and MP3 players, may not be used during the exam in any way. You may use the equation sheet distributed with the exam. No other notes or textbooks may be open during the exam.

1. [20pt] Consider the circuit shown at right.

(a) [5pt] If the 50Ω and 25Ω resistor are considered together as a single resistor between points a and b , what is the resistance of this single resistor?



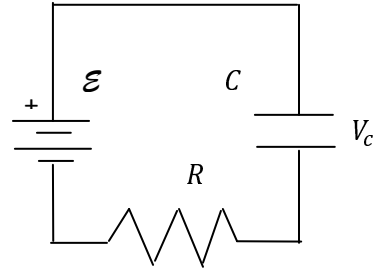
(b) [5pt] What is the electric potential V_{ba} of point b relative to point a ?

(c) [6pt] What is the current flowing through each of the three resistors? Put your answers in the appropriate box below.

Resistor	10 Ω	50 Ω	25 Ω
Current			

(d) [4pt] What is the power \mathcal{P} flowing from the battery?

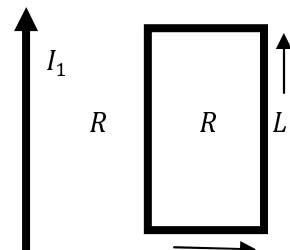
2. [15pt] A capacitor C is charged by a battery with emf $\mathcal{E} = 6.0 \text{ V}$ through a resistance $R = 500 \text{ k}\Omega$ as shown. The current flowing from the battery after 3.0 seconds is half the initial current.



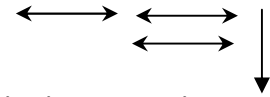
- (a) [5pt] What is the initial current flowing in the circuit at the time the battery is first connected, and the capacitor is uncharged?

- (b) [5pt] What is the voltage V_c across the capacitor 3.0 seconds after it begins charging?

- (c) [5pt] What is the value of the capacitor C being charged?



3. [15pt] In the figure at right, the current in the long, straight wire is $I_1 = 20$ A and the wire lies in the plane of the rectangular loop, which carries the current $I_2 = 12$ A. The dimensions are $R = 0.10$ m and $L = 0.30$ m.



- (a) [2pt] What is the direction of the magnetic field due to the long straight wire at any point to its right? [In all parts of this problem, specify direction as “left”, “right”, “up”, “down”, “into the page”, or “out of the page”.]

- (b) [2pt] What is the direction of the magnetic field due to the rectangular loop at any point inside the loop?

- (c) [4pt] Give the direction of the magnetic force on each segment of the rectangular loop due to the current in the long straight wire. Enter “zero” if there is no force.

Segment	Magnetic Force Direction
Left	
Right	
Top	
Bottom	

- (d) [5pt] Calculate the magnitude of the total magnetic force on the rectangular loop due to the current in the long straight wire.

(e) [2pt] What is the direction of the force in part (d)?