Student ID Number: _____

PRELIMINARY EXAMINATION

DEPARTMENT OF PHYSICS
UNIVERSITY OF FLORIDA
Part D, 19 August 2005, 14:00 - 17:00

Instructions

1. You may use a calculator and CRC Math tables or equivalent. No other tables or aids are allowed or required. You may **NOT** use programmable calculators to store formulae.

2. All of the problems will be graded and will be tabulated to generate a final score. Therefore, you should submit work for all of the problems.

3. For convenience in grading please write legibly, use only one side of each sheet of paper, and work different problems on separate sheets of paper. The sheets for each problem will be stapled together but separately from the other two problems.

4. Your assigned student **ID Number**, the **Problem Number**, and the **Page Number** should appear in the upper right hand corner of each sheet. Do **NOT** use your name anywhere on the Exam.

5. All work must be shown to receive full credit. Work must be clear and unambiguous. Be sure that you hand your completed work to the Proctor.

6. Each problem is worth 10 points.

7. Following the UF Honor Code, your work on this examination must reflect your own independent effort, and you must not have given, nor received, any unauthorized help or assistance. If you have any questions, ask the Proctor.

University of Florida Honor Code: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

DO NOT OPEN EXAM UNTIL INSTRUCTED

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D1. (10 points) Consider the interaction of an electron with a photon. Prove that the electron cannot simply absorb the photon.

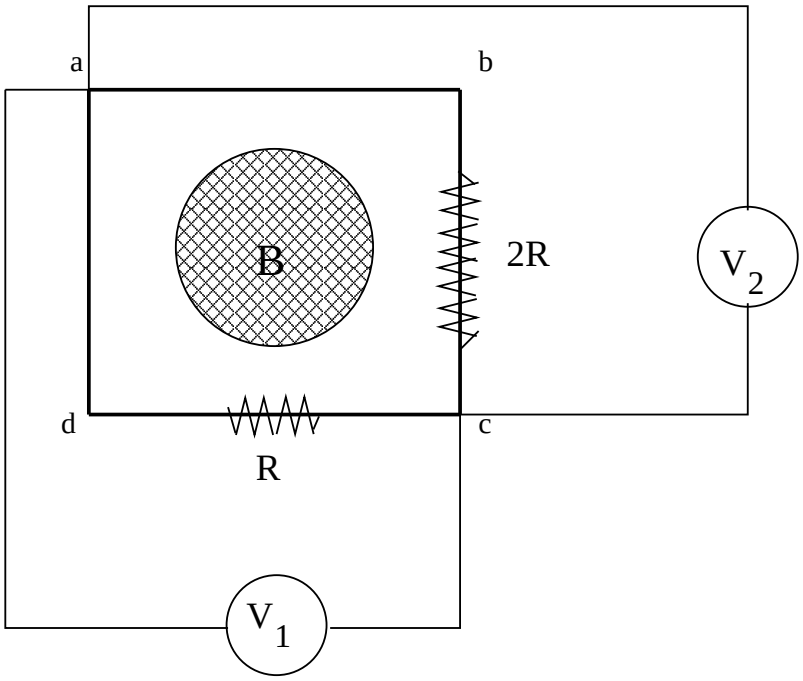
D2. A circuit with two resistors, with resistance R and $2R$, two voltmeters, V_1 and V_2, and a solenoid is constructed as shown in the figure. The solenoid is perpendicular to the circuit and has a cross-sectional area A. The magnetic field B inside the solenoid is uniform, has an RMS (root mean square) magnitude B_0 and oscillates sinusoidally with an angular frequency ω. Give all of your answers in terms of A, B_0, ω and R.

(a) (2 points) What is the RMS value of the induced EMF, from the solenoid, about the loop $abcd$?

(b) (2 points) What is the RMS value of the current flowing through the loop $abcd$?

(c) (3 points) What is the RMS value of the potential measured by V_1?

(d) (3 points) What is the RMS value of the potential measured by V_2?



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D3. Two masses M_1 and M_2 are attached to a massless string and a frictionless pulley as shown $(M_2 > M_1)$. The pivot of the pulley is fixed in position.

(a) (3 points) Assuming that the pulley is massless, find the acceleration of M_2.

(b) (3 points) If M_2 starts from rest, find its velocity as a function of the distance y_2 that it has dropped.

(c) (4 points) Now assume that the pulley has mass M and radius R. The string does not slip on the pulley. Find the acceleration of M_2.