Student ID Number: _____

PRELIMINARY EXAMINATION

Department of Physics
University of Florida
Part A, January, 2013, 09:00–12:00

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.

   (a) 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.

   (b) 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.

   (c) 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.

   (d) 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.

   (e) Each problem is worth 10 points.

   (f) 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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A1. A current I uniformly distributed over a circular cross section of radius a flows along a long cylindrical wire with conductivity σ.

(a) **[3 points]** What is the magnetic field inside and outside the cylinder?

(b) **[2 points]** What is the electric field inside and outside the cylinder?

(c) **[3 points]** What is the ohmic power dissipated in a length L of the wire?

(d) **[2 points]** What is the integral of the Poynting flux over the length L of the surface of the cylinder?

PRELIMINARY EXAMINATION

DEPARTMENT OF PHYSICS

UNIVERSITY OF FLORIDA

Part A, January, 2013, 09:00–12:00

A2. A particle of mass m is trapped in a hollow sphere of radius R with impenetrable walls.

(a) **[2 points]** Write down the Schrodinger equation for spherical symmetry wave function $\phi(r)$.

(b) **[2 points]** Use a change of variable $\phi(r) = \frac{u(r)}{r}$ to find the simplified equation for $u(r)$

(c) **[4 points]** Find the ground state of the system.

(d) **[2 points]** Obtain an expression for the force exerted on the walls of the sphere by the particle in the ground state.

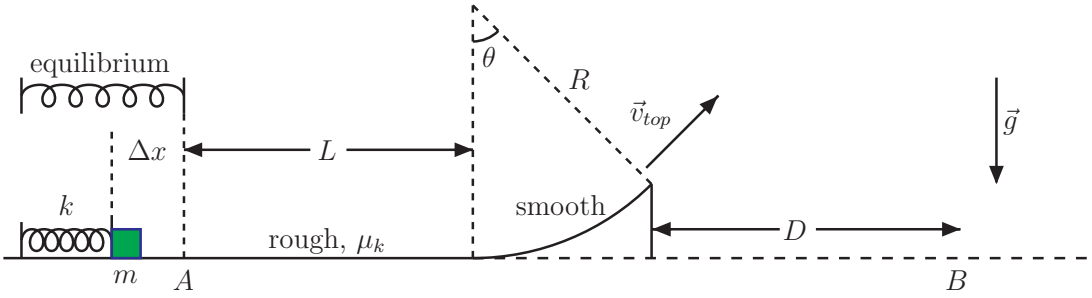
PRELIMINARY EXAMINATION

Department of Physics

University of Florida

Part A, January, 2013, 09:00–12:00

A3. A block of mass m is launched (at point A) using a spring of spring constant k which has been compressed from its equilibrium configuration by a displacement Δx. When the spring is released, the block first slides a known distance L on a rough level surface whose coefficient of kinetic friction is μ_k. Then the block goes up a smooth (frictionless) ramp whose profile is a $\theta = 45°$ circular arc of radius R. After leaving the ramp, the block lands back on the ground (at point B) some distance D away from the bottom of the ramp.



(a) **[2.5 points]** Find the launch speed v_A of the block in the moment when it is released from the spring at point A. (You can ignore friction while the block covers the initial distance Δx during the recoil of the spring.)

(b) **[2.5 points]** Find the speed v_{bot} of the block at the bottom of the ramp.

(c) **[2.5 points]** Find the speed v_{top} of the block at the top of the ramp.

(d) **[2.5 points]** Ignoring air resistance, find the range D in terms of v_{top}, R and g.