

Electrodynamics, Physics 322
Spring 2006

Second midterm
Instructor: David Cobden

11.30 am, 22 May 2006

Do not turn this page until the buzzer goes at 11.30. You have up to 55 minutes: hand your exam to me before I leave the room at 12.25.

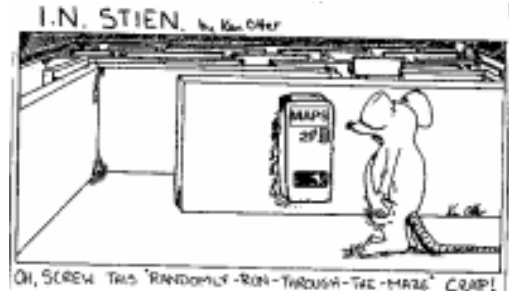
This exam contains 100 points. Be sure to attempt all the questions.

Please write your name on every page and your SID on the first page.

Write all your working on these question sheets. Use this front page for extra working. It is important to show your calculation or derivation. Some of the marks are given for showing clear and accurate working and reasoning.

Watch the blackboard for corrections or clarifications during the exam.

This is a closed book exam. No books, notes or calculators allowed.



4. [20] A small square wire loop of side a and a large circular wire loop of radius $b \gg a$ are coplanar and concentric. Using the properties of mutual inductance, find (approximately) the emf induced in the circular loop when a current $I(t)$ flows around the square loop, assuming the resistance of the circular loop is very large.

5. [5] If you don't assume the resistance of the circular loop is large, is the emf in it smaller or larger, and why?

6. [15] Find approximately the electromagnetic energy stored in a solenoid with length l , cross-section A , and N turns, by any means.

7. [15] A small gold ring of radius a and resistance R is released from rest with its axis horizontal. As it drops it passes between the poles of a magnet. In the center of the magnet the field reaches a maximum value of B_0 . What is the total charge that flows around the ring as it falls past the magnet?

8. [5] The ring is slowed by its interaction with the magnet. Where does the lost kinetic energy go? (at least three named concepts are involved.)

9. [5] What could you do, in principle, to the ring to reduce the amount by which it is slowed down, and why?

10. [extra points] Would a solid disk of gold be slowed more than, less than, or by the same amount as the ring, and why? The answer is not obvious. Specify the relevant factors.