Make sure your name and student id number are on all pages of your test. Show all work clearly!!! The question is wrong if all work is not clearly shown. It is your responsibility to make sure you understand the question before attempting it. "Cheating" is unfair to those who work for their grade, so if you work for your grade I encourage you to let me know if you see anyone cheating. Be sure to look on the back of the test. Assume ideal conditions unless otherwise stated. Label things clearly. The final answer must include units where appropriate. THINK ABOUT THESE QUESTIONS VERY CAREFULLY. SOME OF THEM CAN BE A BIT SUBTLE! Some useful constants $\varepsilon_0 = 8.85 \times 10^{-12} \text{F/m}$; $\mu_0 = 1.26 \times 10^{-6} \text{H/m}$; $c = 3 \times 10^8 \text{m/s}$.

1) 
   a) Write down Maxwell’s Equations before the prediction and subsequent discovery of the displacement current.

   b) Rewrite the appropriate Maxwell Equation(s) after the discovery of the displacement current.

   c) Assume you have discovered the magnetic mono-pole clearly define all symbols and rewrite the appropriate Maxwell Equation(s).

2) A 12 Volt battery is attached to the primary of a transformer. The transformer has 25 turns in the primary and 75 turns in the secondary.
   a) What is the voltage on the secondary?
   b) What is the current in the secondary?
   c) What is the power output of the secondary?

3) The accompanying circuit represents a capacitor in parallel with a resistor and inductor which are in series. What is the voltage across the capacitor a long time after the switch is closed? $R=300\Omega$ $L=5\text{mH}$ $C=7\mu\text{F}$.
4) The accompanying graph represents the magnetic flux with respect to time in a region of space. What is the emf produced by this flux in each of the regions?
   a) 0 - 4s
   b) 4s - 6s
   c) 6s - 8s

5) The accompanying figure represents the cross section of a co-axial cable. There is no current flowing through the cable, but it does have static charge. The charge per unit length on the inner conductor is +0.3μC/m and -0.5μC/m on the outer conductor. The radius (a) of the inner conductor is 3 millimeters. The inner radius (b) of the outer conductor is 7 millimeters. The outer radius (c) of the outer conductor is 9 millimeters.
   a) What is the electric field 2 millimeters from the center?
   b) What is the electric field 4 millimeters from the center?
   c) What is the electric field 13 millimeters from the center?

6) Use the same figure as in problem 5 but now the co-axial cable does not carry a static current but it does carry a direct current of 3 amps (directed inward) in the inner conductor and 8 amps (directed outward) in the outer conductor.
   a) What is the magnetic field 2 millimeters from the center?
   b) What is the magnetic field 4 millimeters from the center?
   c) What is the magnetic field 13 millimeters from the center?

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