Exam 2

Name:

Formula:

Magnetic forces: $F = qv \times B + qE$, $F = IL \times B$

Biot-Savart Law: $dB = \frac{\mu_0 I}{4\pi} \frac{\vec{dl} \times r}{r^2}$

Faraday's Law: $\varepsilon = -\frac{d\Phi_B}{dt}$

Inductors: $\varepsilon = -L\frac{dI}{dt}$, U = ½ LI^2

Mutual Inductance: $\varepsilon_{12} = -M_{12}\frac{dI_2}{dt}$

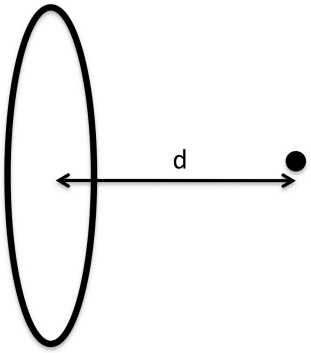
Problem 1

Problem 2

Problem 3

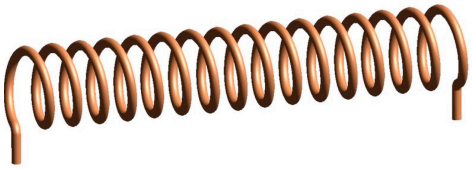
Problem 4

Problem 1



A loop (with radius R), carrying current I, is situated distance d away from our observation point. Calculate the magnitude of magnetic field. No integration tables are necessary to solve this problem.

Problem 2



A solenoid with radius R and length *l* has winding density of n.

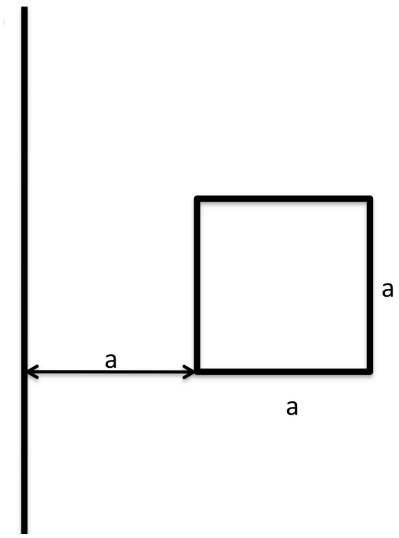
(a) Calculate the magnitude of magnetic field in the middle of the solenoid if current, I, is passed through the solenoid.

(b) Calculate the inductance of the solenoid

(c) Calculate the pressure (force per unit area) on the solenoid. You can assume that the coils are in the magnetic field with the same magnitude as the middle of the solenoid. (i.e. the answer of a)

(d) Will the solenoid explode or implode when an infinite current is passed through?

Problem 3

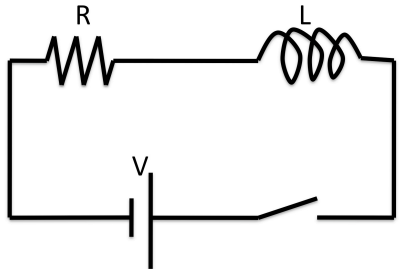


Infinite wire is located next to a loop. Loop is given current, which changes with respect to time. The rate is given by dI/dt.

Calculate the electromotive force induced on the infinite wire by the changing current in the small loop. (Hint: use mutual inductance and ampere's law)

Problem 4

Given a circuit as depicted, the switch is closed at t=0



(a) Give a mathematical relationship between I and dI/dt

(b) What is the current at t=0?

(c) What is the current at t=∞?

(d) At t=∞, the switch is suddenly opened. What is the voltage, which develops over the inductor?