More E&M

Problem 1:

In which of the following circumstances must the displacement current be zero?

(A) If the magnetic field is zero

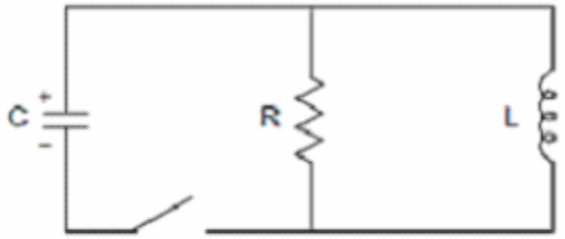
(B) If the electric field is constant in time

(C) When there is an open circuit

(D) In a metal

(E) In an insulator

Problem 2:



The capacitor C in the circuit shown above is initially charged. Neglect the resistance, capacitance, and inductance of the connecting wires. Immediately after the switch S is closed, which of the following is correct?

(A) The voltage across the resistor is zero.

(B) The voltage across the inductor is zero.

(C) The current through the inductor is zero.

(D) The current through the switch is zero.

(E) The current through the inductor is a maximum.

Problem 3:

If $R_1 = 10\ \Omega$, $R_2 = 2000\ \Omega$, and $R_s = 50\ \Omega$, what is R_x if the bridge is balanced?

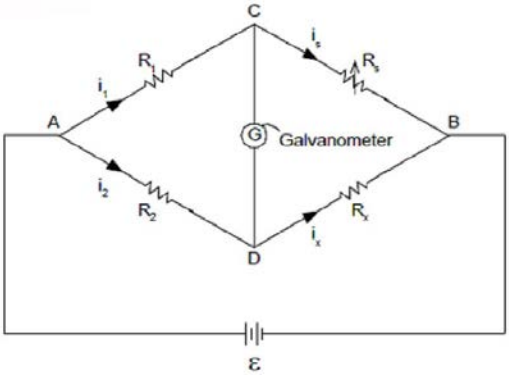
(A) 0.025 Ω

(B) 0.25 Ω

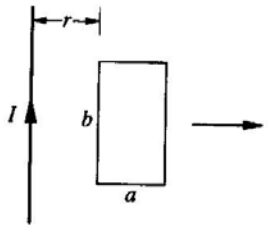
(C) 4 Ω

(D) 400 Ω

(E) 10,000 Ω



Problem 4:



A rectangular loop of wire with dimensions shown above is coplanar with a long wire carrying current I. The distance between the wire and the left side of the loop is r. The loop is pulled to the right as indicated.

What are the directions of the induced current in the loop and the magnetic forces on the left and the right sides of the loop as the loop is pulled?

	Induced Current	Force on Left Side	Force on Right Side
(A)	Counterclockwise	To the left	To the right
(B)	Counterclockwise	To the left	To the left
(C)	Counterclockwise	To the right	To the left
(D)	Clockwise	To the right	To the left
(E)	Clockwise	To the left	To the right

Problem 5:

What is the magnitude of the net force on the loop when the induced current is i?

(A) $\frac{\mu_0 iI}{2\pi} \ln\left(\frac{r+a}{r}\right)$

(B) $\frac{\mu_0 iI}{2\pi} \ln\left(\frac{r}{r+a}\right)$

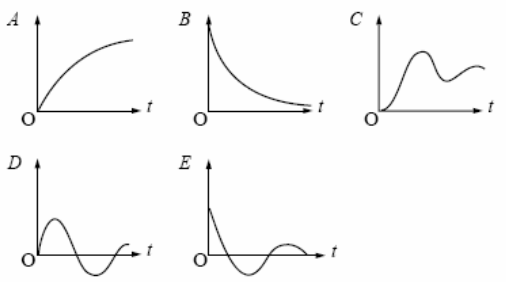
(C) $\frac{\mu_0 iI}{2\pi} \frac{b}{a}$

(D) $\frac{\mu_0 iI}{2\pi} \frac{ab}{r(r+a)}$

(E) $\frac{\mu_0 iI}{2\pi} \frac{r(r+a)}{ab}$

Problem 6:

The graphs below represent variables of an electrical circuit as functions of time t after the circuit switch is closed. In each case the circuit specified contains circuit elements connected in series with each other and with a battery. Any capacitor is uncharged at the beginning. Select the graph that most nearly shows the nature of the time dependence of the indicated variable.



Which graph represents the potential drop across the resistor as a function of time in an inductance-resistance circuit?
(A) (B) (C) (D) (E)

Problem 7:

Which graph represents the charge on the capacitor as a function of time in an underdamped inductance-resistance-capacitance circuit?
(A) (B) (C) (D) (E)

Problem 8:

A charged particle, A, moving at a speed much less than c, decelerates uniformly. A second particle, B, has one-half the mass, twice the charge, three times the velocity, and four times the acceleration of particle A. According to classical electrodynamics, the ratio P_B/P_A of the powers radiated is

(A) 16
(B) 32
(C) 48
(D) 64
(E) 72