

Physics 31B Midterm (150 pts Max)
Spring, 2003

1. A voltage signal (Fig. A) consists of a series of parabolic humps given by the expression $v(t) = V_0[1-4(t/T)^2]$. Determine its rms value.

2. A series circuit contains a 240- Ω resistor, a 3.80 μ F capacitor, and a 550-mH inductor. It's placed across the terminals of an ac generator set to 100 Hz. If an ammeter in the circuit reads 250 mA effective, what is the maximum voltage of the generator?

3. A long solenoid of 500 turns carrying a current of 3.8 A produces within itself a uniform magnetic flux of 2.0 mWb. Compute the self-inductance of the coil.

4. The current in a 50- μ H coil (for which R is negligible) goes from 0 to 2.0 A in 0.10 s. Determine the average self-induced emf measured across its terminals.

5. What is the force per unit length experienced by each of two extremely long parallel wires carrying equal 1.0-A currents in opposite directions while separated by a distance of 1 m in vacuum?

6. Determine the power delivered to the circuit by the 12-V source in Fig B.

7. A length of nichrome ribbon with a rectangular cross section of 0.25 mm \times 1.0 mm is to be used as the heating element in a toaster. How long should it be if it's to have a total resistance of 1.5 Ω at room temperature?

8. Determine the capacitance of an isolated metal sphere 50 cm in diameter and immersed in vacuum.

9. Figure C shows three tiny uniformly charged spheres. Determine the net force on the middle sphere due to the other two.