PHYS 222 – Spring 2012 – Quiz # 6

Closed books, notes, etc. No electronic device except a calculator.

NAME: __________________________

(questions with equal weight, i.e. 20 points each)

1. A uniform 4.5-T magnetic field passes through the plane of a wire loop 0.10 m$^2$ in area. What flux passes through the loop when the direction of the 4.5-T field is at a 30° angle to the normal of the loop plane?
   a. 5.0 T·m$^2$
   b. 0.52 T·m$^2$
   c. 0.39 T·m$^2$
   d. 0.225 T·m$^2$

2. According to Lenz’s law the direction of an induced current in a conductor will be that which tends to produce which of the following effects?
   a. enhance the effect which produces it
   b. produce a greater heating effect
   c. produce the greatest voltage
   d. oppose the effect which produces it
3. A square coil, enclosing an area with sides 2.0 cm long, is wrapped with 2500 turns of wire. A uniform magnetic field perpendicular to its plane is turned on and increases to 0.25 T during an interval of 1.0 s. What average voltage is induced in the coil?

\[ E = -N\frac{\Delta \Phi}{\Delta t} = -N\frac{\Delta (BA \cos \theta)}{\Delta t} \]

\[ = -2500 \times (2 \times 10^{-2} m)^2 \times \frac{0.25 T}{1 s} = -0.25 V \]

4. What is the stored energy in a 0.50-mH coil carrying a current of 4.0 A?

\[ P_E = \frac{1}{2} L I^2 = \frac{1}{2} \times 0.5 \times 10^{-3} H \times (4 A)^2 \]

\[ = 4 \times 10^{-3} J \]

5. The current in a coil with a self-inductance of 1.5 mH increases from 0 to 1.0 A in a tenth of a second. What is the induced emf in the coil?

\[ E = -L \frac{\Delta I}{\Delta t} = -1.5 \times 10^{-3} H \times \frac{1 \text{ A}}{0.1 \text{ s}} \]

\[ = -15 \times 10^{-3} \text{ V} = -15 \text{ mV} \]