Physics 2220
Spring 2005
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FOURTH MIDTERM

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Name: Key

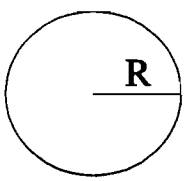
Discussion Instructor (circle): Gillman Rodriguez Shepherd Webb

Student ID #:_____

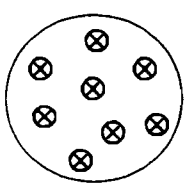
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

(a) Take the earth's magnetic field as 1.27×10^{-4} T at 80° from the horizontal in Salt Lake City. Calculate the magnetic flux through 6.25 m^2 of the physics parking lot. $\Phi_B = \int \vec{B} \cdot d\vec{A} = \Phi_B = \vec{B} A \cos\theta = \Phi_B = (1.27 \times 10^{-4}\,T)(6.25 m^2)(\cos 90 - 80) =$
$\Phi_B = 7.82 \times 10^{-4}\ T \cdot m^2$
7.82×10^{-4} Wb

(b) Given a circular loop of wire of R = 2.25 cm. There is a magnetic field perpendicular to the paper which can be described by B(t) = (945 + 1.75 × 10^{-4} t) Tesla. Calculate the magnitude of the emf that appears in the loop. $|\mathcal{E}| = \frac{d\Phi_B}{dt} = \pi r^2 (1.75 \times 10^{-4})T = 2.78 \times 10^{-7}$ V



(c) Given a circular loop of wire. There is a magnetic field into the paper and its magnitude is decreasing. What is the direction of the current in the loop–clockwise or counterclockwise?



Clockwise

(d) Calculate the cyclotron frequency, in Hz, for an electron in a magnetic field of 0.333 T.
$m_e = 9.1094 \times 10^{-31}$ kg $\quad q_e = 1.6022 \times 10^{-19}$ C
$f = \frac{qB}{2\pi m} = \frac{(1.6022 \times 10^{-19})(.333)}{2(\pi)(9.1094 \times 10^{-31})} = \frac{5.3356 \times 10^{-20}}{5.7236 \times 10^{-30}} = 9.32 \times 10^{9}$ Hz

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(e) Calculate the magnetic field at the surface of a large wire (diameter = 6.25 cm) carrying a current of 4750 A.
$I = 4750$ A $\quad R = d/2 = \frac{6.25\ cm}{2} = \frac{.0625 m}{2} = .03125$ m
$B = \frac{\mu_0 I}{2\pi R} = \frac{(4\pi \times 10^{-7})(4750)}{2\pi(.03125)} = .0304$

$B = 3.04 \times 10^{-2}$ T
