NAME

FINAL EXAMINATION ANSWERS

PHYS-1200 PHYSICS II DECEMBER 15, 2006

PART A.

1. B	4. E	8. A	12. D	17. B
2. D	5. D	9. B	13. C	18. C
3. B	6. B	10. A	14. D	19. B
	7. A	11. C	15. D	20. D
			16. B	

PART B.

1. a) ↑ Apply the right hand rule to each wire, and sum the results.

   b) → Since the currents are parallel, the wire is attracted to the other three.

2. a) **Beam B** Longer wavelengths spread over larger angles.

   b) **Beam A** Faster electrons produce shorter wavelengths, and beam A has shorter wavelengths.

3. a) ↓ Since the current is increasing, the capacitor is discharging. That means that the upper plate in positive.

   b) ↑ The displacement current flows in the same direction as the conventional current.

   c) ↑ The emf will oppose the increase in current, as Lenz's law predicts.

4. a) 8 eV

   b) **INSULATOR**

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PART C.

1. a) $\oint \vec{E}\cdot d\vec{A} = \frac{q_{enclosed}}{\varepsilon_0} = \frac{q}{\varepsilon_0} = \frac{3.0\times10^{-9}\text{ C}}{8.85\times10^{-12}\text{ F/m}}$ $\oint \vec{E}\cdot d\vec{A} = \underline{339\text{ V}\cdot\text{m}}$

   b) Because of the "symmetry" of the surface, 1/2 of the total flux passes through the top. Then the answer is,
   $\int \vec{E}\cdot d\vec{A} = \frac{1}{2}\frac{q}{\varepsilon_0} = \frac{1}{2}\left(\frac{3.0\times10^{-9}\text{ C}}{8.85\times10^{-12}\text{ F/m}}\right)$ $\int \vec{E}\cdot d\vec{A} = \underline{169}$
   $\underline{\text{V}\cdot\text{m}}$

   c) **REMAIN THE SAME**. That is what Gauss's law tells us.

   d) **INCREASE**. Since the charge is up inside the top, the electric field will be stronger there, and more flux will pass through it.

2. a) **CLOCKWISE**. Lenz's law shows the direction.

   b) $\mathcal{E} = BDv$, so $v = \frac{\mathcal{E}}{BD} = \frac{0.15\text{ eV}}{(0.75\text{ T})(0.50\text{ m})}$ $\underline{v = 0.40\text{ m/s}}$

   Alternatively, $|\mathcal{E}| = \frac{d\Phi_B}{dt} = \frac{d(BLD)}{dt} = BD\frac{dL}{dt} = BDv$. Then proceed as above.

   c) $i = \frac{\mathcal{E}}{R} = \frac{0.15\text{ V}}{4.0\times10^{-2}\ \Omega}$ $\underline{i = 3.75\text{ A}}$

   d) $R = \rho\frac{x}{A}$, where x is the length of the entire conducting path. Then,
   $x = \frac{RA}{\rho} = \frac{(4.0\times10^{-2}\ \Omega)(2.0\times10^{-6}\text{ m}^2)}{2.0\times10^{-8}\ \Omega\cdot\text{m}}$, so $x = 4.0$ m. However, the conducting path
   $x = 2L + 2D$, so $L = \frac{x}{2} - D = \frac{4.0\text{ m}}{2} - 0.5\text{ m}$ $\underline{L = 1.5\text{ m}}$

   e) **REMAIN THE SAME**. The emf does not depend on L.

   f) **INCREASE**. Since L decreases, R decreases. $\mathcal{E}$ remains the same, so i increases.

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3. a) $E_{ph} = hf = \frac{hc}{\lambda} = \frac{(6.63\times10^{-34}\text{ J}\cdot\text{s})(3.0\times10^{8}\text{ m/s})}{450\times10^{-9}\text{ m}}$ $\underline{E_{ph} = 4.4\times10^{-19}\text{ J} = 2.8\text{ eV}}$

b) **YES**. Since no photoelectrons come off, the work function has to be at least as large as the energy of the 450 nm photon. Therefore:

$\underline{\Phi_{\text{min}} = 4.4\times10^{-19}\text{ J} = 2.8\text{ eV}}$