NAME

PHYS-1200 PHYSICS II QUIZ 1 FEBRUARY 16, 2005

SOLUTIONS

PART A.

1. D
2. B
3. C
4. B
5. D
6. A
7. E
8. C

PART B.

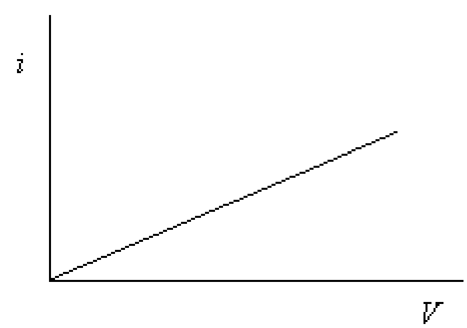
1. a) Since the Gaussian surface is in the conducting metal, the electric field must be equal to zero everywhere on the Gaussian surface. Therefore,

$$(\oint \vec{E}\cdot d\vec{A})_A = 0$$

b) In this case, the integral equals the net charge enclosed by the surface divided by ε_0. Then,

$$(\oint \vec{E}\cdot d\vec{A})_B = q/\varepsilon_0$$

2.



3. Only wires 1, 3, 6, and 7 are enclosed by the path. The sign of the integral is positive for 1, 3, and 7, and negative for 6.
   a) **POSITIVE** There are more currents making a positive contribution than negative.

   b) $\oint \vec{B}\cdot d\vec{s} = \mu_0 i_{enc} = \mu_0(i_1 + i_3 + i_6 + i_7) = \mu_0(i_0 + i_0 - i_0 + i_0)$ $\oint \vec{B}\cdot d\vec{s} = \underline{2\mu_0 i_0}$

NAME

PART C.

1. a) Since the light bulbs all have the same resistance, and they are all in parallel, the 50 A is divided equally among them. Then, $i_1 = \frac{i}{100} = \frac{50\text{ A}}{100}$ i_1 = <u>0.50 A</u>

   b) For any one bulb, $P = i^2R$, so $R = \frac{P}{i^2} = \frac{100\text{ W}}{(0.50\text{ A})^2}$ R = <u>400 Ω</u>

   c) Since all the light bulbs are in parallel, for any one bulb, $P = \mathcal{E}i$, so $\mathcal{E} = \frac{P}{i} = \frac{100\text{ W}}{0.50\text{ A}}$

   $\mathcal{E}$ = <u>200 V</u>

   d) **INTO THE PAGE** According to the right hand rule, the fields from both wires point into the page between the wires.

   e) The magnetic field due to one of the wires is given by, $B_1 = \frac{\mu_0 i}{2\pi r}$. The contributions of the two wires add , so $B = 2B_1 = \frac{\mu_0 i}{\pi r} = \frac{(4\pi\times10^{-7}\text{ H/m})(50\text{ A})}{\pi(0.05\text{ m})}$ <u>$B = 4.0\times10^{-4}$ T</u>

2. a) **THE FIELD IS INCREASING** The current produces a field opposite to the existing field. According to Lenz's law, the induced current must oppose the change, so the field is increasing..

   b) $|\mathcal{E}| = \frac{d\Phi_B}{dt} = \frac{d(BA)}{dt} = A\frac{dB}{dt}$. Since $A = \pi r^2$, this becomes, $|\mathcal{E}| = \pi r^2 \frac{dB}{dt}$. Then,

   $\frac{dB}{dt} = \frac{|\mathcal{E}|}{\pi r^2} = \frac{0.020\text{ V}}{\pi(0.10\text{ m})^2}$

   $\frac{dB}{dt} = 0.64$ T/s