

FINAL TEST *-Review*
PHN 242

Dr. Weppner
May 2004

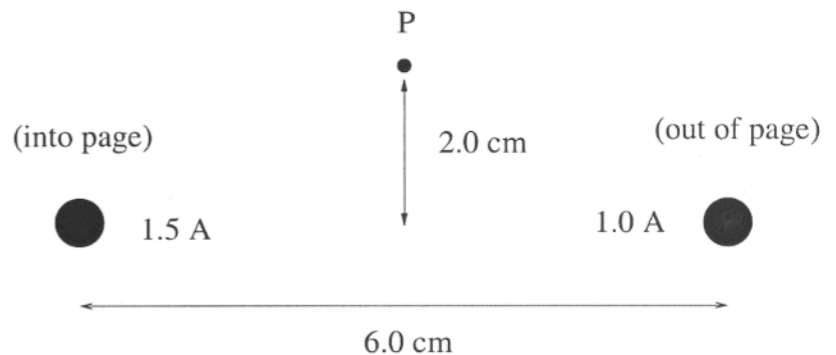
NAME _____

SCORE _____

Remember to get full credit label answers with correct units, show all work, draw diagrams.

Useful constants and formulas: $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$, $\frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9 \text{ Nm}^2/\text{C}^2$, $q_{\text{electron}} = -1.6 \times 10^{-19} \text{ C}$, $mass_{\text{electron}} = 9.11 \times 10^{-31} \text{ kg}$, $q_{\text{proton}} = +1.6 \times 10^{-19} \text{ C}$, $mass_{\text{proton}} = 1.67 \times 10^{-27} \text{ kg}$, $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$, $\mu_0 = 1.26 \times 10^{-6} \text{ Tm/A}$, $B_{\text{wire}} = \frac{\mu_0 i}{2\pi r}$, $A_{\text{circle}} = \pi r^2$, $C_{\text{circle}} = 2\pi r$, $A_{\text{triangle}} = \frac{1}{2}bh$

1. [12 pts] What is the magnitude and direction of the **B** field at point P? The figure represents two wires carrying current into and out of the page. Show all work.

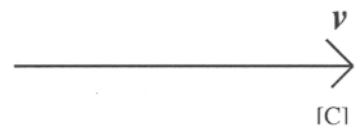
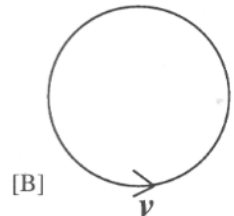
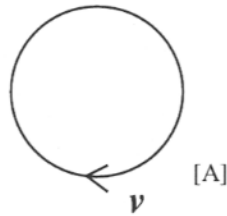


2. [15 pts] Protons are moving in the directions indicated below. If only an external magnetic field is acting on each of the protons draw the force vector and external magnetic field which is causing this force for all three cases. Also calculate the magnitude of the force vector.

(A) $\vec{v} = 2.0 \times 10^8 m/s$, $|\vec{B}| = .025T$

(B) $\vec{v} = 2.0 \times 10^8 m/s$, $|\vec{B}| = .025T$

(C) $\vec{v} = 2.0 \times 10^8 m/s$, $|\vec{B}| = .025T$



3. [12 pts] The figure below shows a double wire circular loop of radius R . Each wire carries 1.5 Amps clockwise from and back to a power supply. Show that the B field at point P is: $B = \frac{1.5A\mu_0}{R}$ downwards.

Hint: Start with the Biot-Savart law:

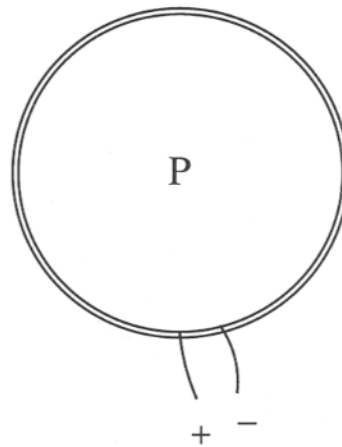
$$B = \int \frac{\mu_0 I dl \sin \theta}{4\pi r^2}$$

and show for this problem it becomes

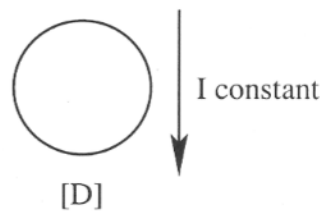
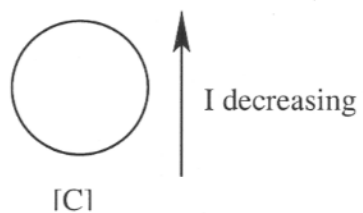
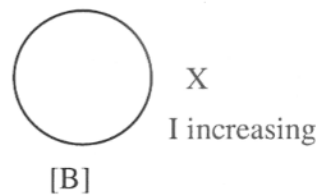
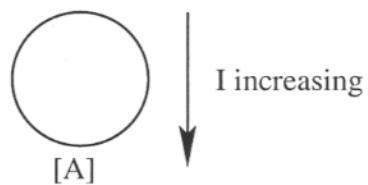
$$B = \frac{\mu_0 (2)(1.5A)}{4\pi R^2} \int_0^{2\pi R} dl,$$

and that $\int_0^{2\pi R} dl = 2\pi R$.

Also remember to verify direction (downwards)



4. [12pts] Calculate the direction of the induced current in each of the loops. Explain fully in English how you came to your conclusions. Answers will not be counted without explanations.



5.[10pts] Light is traveling in glass, and hits a glass/unknown surface. In the glass the light beam is making an angle of 45.0° with the normal to the surface. The glass has an index of refraction of 1.52.

(A) If the refracted light ray leaves the glass at an 55° from the normal, what is the index of refraction for the unknown surface?

(B) Is total internal refraction a possibility for light leaving this glass medium? If so, at what critical angle does this occur at?

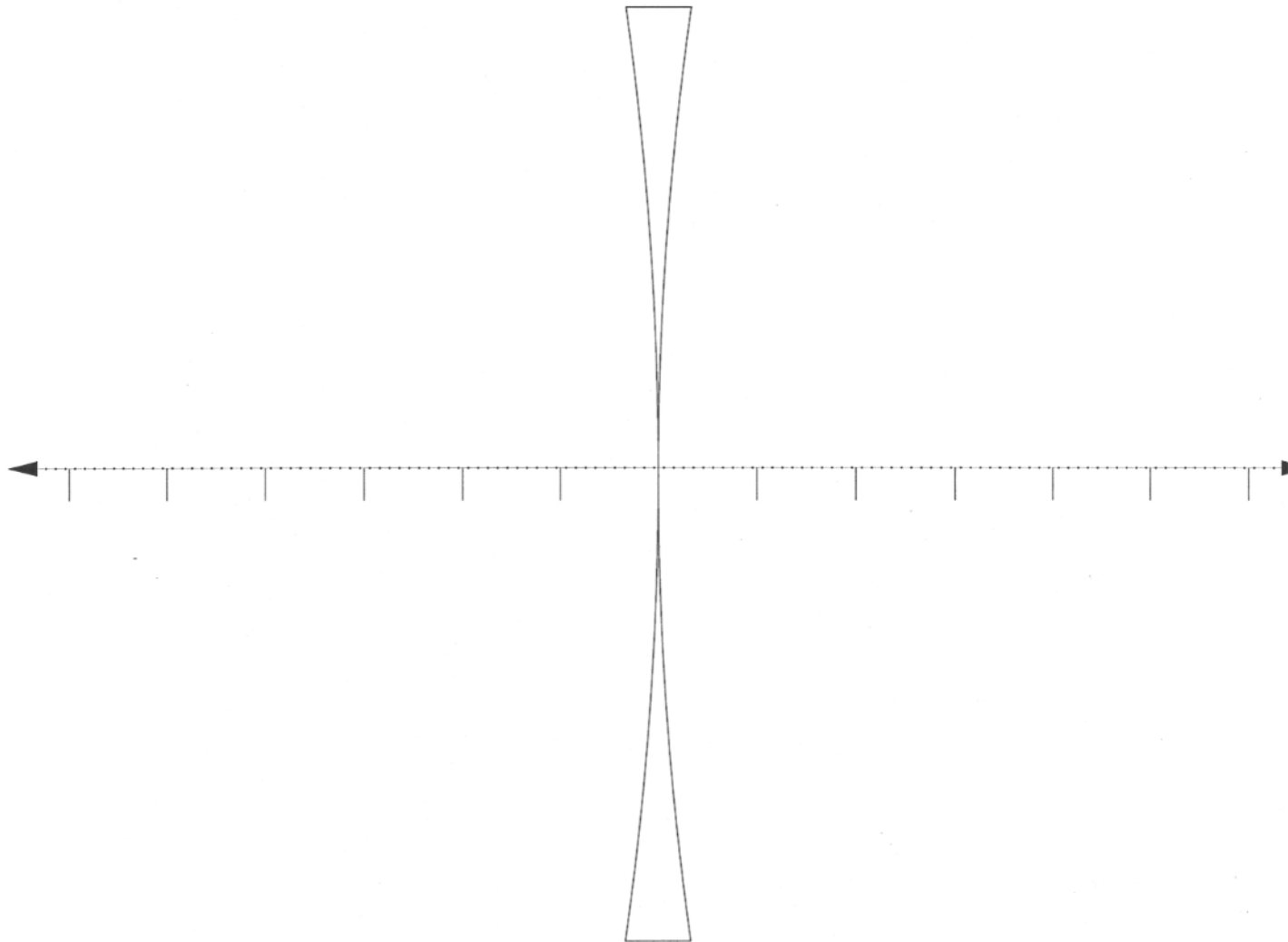
(C) Draw a picture of part (A)

6. [15 pts.] An object is 15.0 cm to the left of a concave lens having a 10.0 cm focal length.

(A) What is the image distance i ?

(B) What is the magnification, is the image upright or inverted, real or virtual, how would you see it?

(C) Verify your results by carefully drawing a ray diagram (give scale).



7. [12 pts.] A proton with a velocity of $2.0 \times 10^5 \text{ m/s}$ comes out of the page into a region of space in which there is a upward-directed magnetic field of magnitude .25 T
- (A) Find a magnitude and direction for an electric field which would cause the proton to continue on its horizontal path.
- (B) Draw a picture of this situation showing the proton, it's velocity, the electric field, the electric force, the magnetic field, and the magnetic force.

8. [12 pts.] Looking at the figure below find the equivalent resistance between
(A) A and B
(B) A and C
(C) B and C

All resistors are 1.0Ω .

