UNIVERSITY OF SASKATCHEWAN
Department of Physics and Engineering Physics

Physics 111.6
MIDTERM TEST #4

March 4, 2004 Time: 90 minutes

NAME: ____ STUDENT NO.: _____________

(Last) **Please Print** (Given)

LECTURE SECTION (please circle):

01	Dr. A. Robinson
02	B. Zulkoskey
03	Dr. K. McWilliams
C15	F. Dean

INSTRUCTIONS:

1. You should have a test paper, a formula sheet, and an OMR sheet. The test paper consists of 9 pages. **It is the responsibility of the student to check that the test paper is complete**.
2. Enter your name and STUDENT NUMBER on the OMR sheet.
3. The test paper, the formula sheet and the OMR sheet must all be submitted.
4. The test paper will be returned. The formula sheet and the OMR sheet will NOT be returned.

PLEASE DO NOT WRITE ANYTHING ON THIS TABLE

QUESTION NO.	MAXIMUM MARKS	MARKS OBTAINED
Part A	10	
Part B	10	
C1	5	
C2	5	
C3	5	
TOTAL	35	

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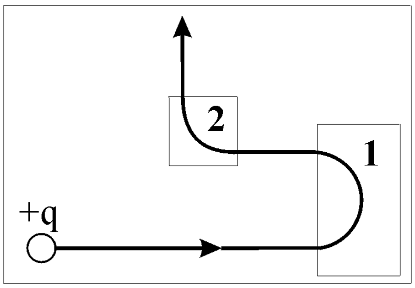
PART A

FOR EACH OF THE FOLLOWING QUESTIONS IN PART A, ENTER THE MOST APPROPRIATE RESPONSE ON THE OMR SHEET.

A1. A positive charge travels through two regions that have magnetic fields directed into (⊗) or out of (⊙) the page. Determine the direction of the magnetic field in each region that would deflect the charge along the path shown in the diagram.



(A) ⊗, ⊗
(B) ⊗, ⊙
(C) ⊙, ⊙
(D) ⊙, ⊗
(E) none of the above

A2. If the current flowing in a resistor which obeys Ohm's Law is reduced by a factor of 3, then the power dissipated by the resistor is reduced by a factor of

(A) $\sqrt{3}$. (B) 3. (C) 9. (D) 27. (E) 81.

A3. Which one of the following statements is true concerning a resistor through which ac current is flowing?

(A) The current flows in one direction only.
(B) The instantaneous power dissipated by the resistor is always greater than zero.
(C) The RMS voltage is zero at certain times.
(D) The instantaneous voltage is zero at certain times.
(E) The current and voltage reach their peak values at different times.

A4. A wire of length L and resistance R ohms is cut into 6 segments of equal length $L/6$, which are then connected in parallel. The equivalent resistance in ohms is

(A) $\frac{R}{36}$. (B) $\frac{R}{6}$. (C) $6R$. (D) $36R$. (E) $6R - 36$.

A5. Two charged particles move in the same direction with respect to a uniform magnetic field. Particle 1 travels three times faster than particle 2, but each experiences the same magnetic force. The ratio q_1/q_2 of the magnitudes of the charges on the particles is

(A) 1/9. (B) 1/6. (C) 1/3. (D) 3/1. (E) 9/1.

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A6. Which one of the following statements is true concerning the magnetic force, **F**, acting on charged particles in a magnetic field, **B**?

(A) **F** is maximum if the particle is stationary.
(B) **F** is zero if the particle moves in a direction perpendicular to **B**.
(C) **F** is maximum if the particle moves in a direction parallel to **B**.
(D) **F** acts in the direction of motion for positively-charged particles.
(E) **F** depends on the component of the particle's velocity that is perpendicular to **B**.

A7. A charged particle of mass *m* and charge *q*, moving with a velocity v which is perpendicular to an applied magnetic field *B*, moves in a circular trajectory of radius *r* such that

(A) $r = \dfrac{qB}{mv}$. (B) $r = \dfrac{vB}{qm}$. (C) $r = \dfrac{mv}{qB}$. (D) $r = \dfrac{B}{mvq}$. (E) $r = \dfrac{mq}{Bv}$.

A8. Which one of the following is ***not*** part of the electromagnetic spectrum?

(A) visible light
(B) thermal radiation
(C) television signals
(D) sound
(E) microwaves

A9. An object is placed a distance d_o from a diverging lens of focal length *f*, such that $d_o < |f|$. Which of the following statements concerning the image is correct?

(A) The image is real, inverted, and larger than the object.
(B) The image is virtual, inverted, and larger than the object.
(C) The image is real, inverted, and smaller than the object.
(D) The image is virtual, inverted, and smaller than the object.
(E) The image is virtual, upright, and smaller than the object.

A10. A beam of light initially in water strikes a water-air interface at an angle of incidence that is greater than the critical angle. Which of the following statements is correct?

(A) All of the light refracts into the air and the angle of refraction is greater than the angle of incidence.
(B) All of the light refracts into the air and the angle of refraction is less than the angle of incidence.
(C) All of the light refracts into the air and the angle of refraction equals the angle of incidence.
(D) The light is partially reflected and partially transmitted at the water-air interface.
(E) The light is totally internally reflected.

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PART B

FOR EACH OF THE FOLLOWING PROBLEMS, WORK OUT THE SOLUTION IN THE SPACE PROVIDED AND ENTER YOUR ANSWERS ON PAGE 6.

ONLY THE ANSWERS WILL BE MARKED. THE SOLUTIONS WILL NOT BE MARKED.

B1. A television set uses 75.0 W of power and is switched on for 6.00 hours a day. If the cost of energy is $0.115 per kilowatt·hour, calculate the cost to watch TV each day.

B2. The equivalent resistance for two resistors when connected in parallel is 10.0 Ω. The resistance of one of the resistors is 21.5 Ω. Calculate the resistance of the other resistor.

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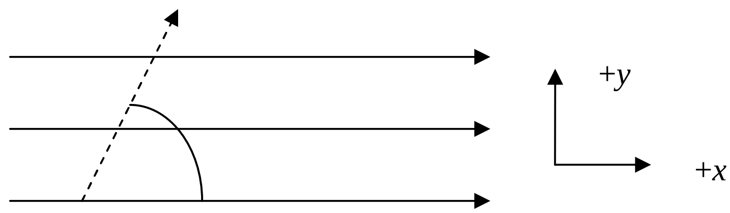
B3. A charged particle is moving in a magnetic field of magnitude 2.50 T directed along the positive x axis. The velocity of the particle is 2.98×10^6 m/s directed 60.0° counter-clockwise from the positive x axis. The magnitude of the charge on the particle is 1.61×10^{-19} C. Calculate the magnitude of the magnetic force on the particle.



B4. An object is placed 23.5 cm from a converging lens whose focal length is 45.0 cm. Calculate the lateral magnification, including the proper sign.

continued on page 6 ...

B5. A ray of sunlight hits a frozen lake at an angle of incidence of 45.0°. Calculate the angle (measured from the normal) at which the ray enters the water beneath the ice. (n_{ice} = 1.31, n_{water} = 1.33)

ANSWERS FOR PART B

ENTER THE ANSWERS FOR THE PART B PROBLEMS IN THE BOXES BELOW.

THE ANSWERS MUST BE EXPRESSED TO THREE SIGNIFICANT FIGURES AND THE UNITS MUST BE GIVEN.

ONLY THE ANSWERS WILL BE MARKED. THE SOLUTIONS WILL NOT BE MARKED.

B1

B2

B3

B4

B5

continued on page 7 ...

PART C

IN EACH OF THE FOLLOWING QUESTIONS, GIVE THE COMPLETE SOLUTION AND ENTER THE FINAL ANSWER IN THE BOX PROVIDED.

THE ANSWERS MUST BE EXPRESSED TO THREE SIGNIFICANT FIGURES AND THE UNITS MUST BE GIVEN.

SHOW YOUR WORK - NO CREDIT WILL BE GIVEN FOR ANSWERS ONLY. EQUATIONS NOT PROVIDED ON THE FORMULA SHEET MUST BE DERIVED.

C1. A battery delivers a current of 1.45 A to a light bulb that has a resistance of 8.32 Ω. The power being dissipated by the internal resistance of the battery is 2.71 W.

(a) Calculate the internal resistance of the battery.

(b) Calculate the EMF of the battery.

(c) Calculate the power dissipated in the light bulb.

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C2. A charged particle of mass 7.20×10^{-8} kg is traveling due East at 185 m/s when it enters a region with a uniform magnetic field of 0.310 T directed vertically down. The charge completes ¼ of a circle of radius 23.7 m before leaving the region of magnetic field and traveling due South. The particle's motion is always perpendicular to the magnetic field.

(a) Calculate the magnitude of the force on the particle while it is in the region of magnetic field.

(b) Calculate the magnitude and sign of the charge on the particle.

magnitude:	
sign (circle one):	+ –

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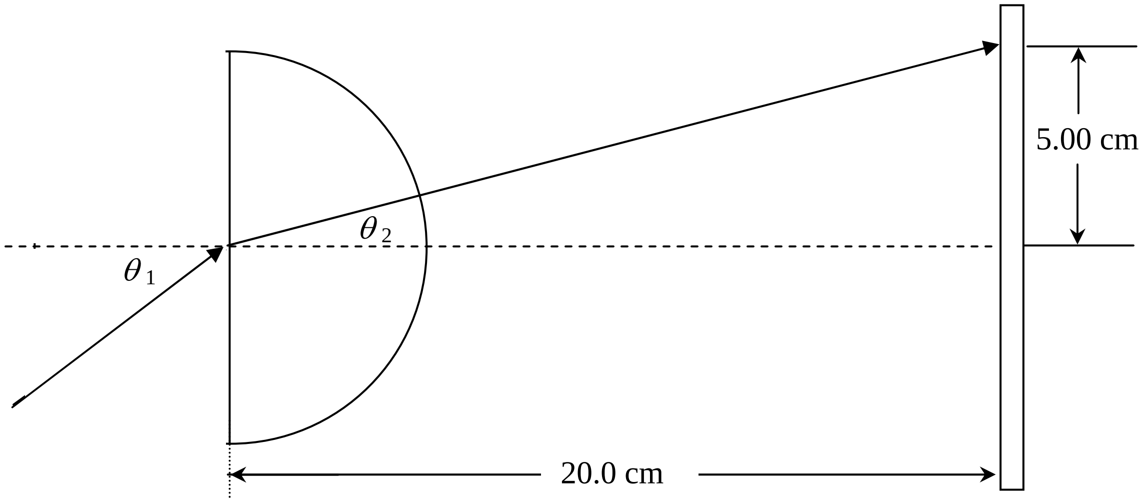
C3. Consider a semicircular disk of radius 4.00 cm made of glass with an index of refraction of 1.52. A beam of light strikes the disk as shown in the diagram.



(a) Calculate the time required for the beam of light to travel through the glass.

(b) Calculate the angle of incidence, θ_1, for which the beam of light will hit the indicated point on the screen.

END OF EXAMINATION