UNIVERSITY OF SASKATCHEWAN
Department of Physics and Engineering Physics

Physics 111.6
MIDTERM TEST #4

March 7, 2002 Time: 90 minutes

NAME: _____ STUDENT NO.: _____
(Last) **Please Print** (Given)

LECTURE SECTION (please circle):

01	Dr. G.R. Davis (MWF)
02	B. Zulkoskey
03	Dr. G.R. Davis (TTh)
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 rectangular bar of copper of length L has a resistance of R between its ends. The bar is now cut in half lengthwise and the pieces joined to form a new bar of length $2L$. The resistance of the new bar of copper is

(A) ¼ R (B) ½ R (C) R (D) 2 R (E) 4 R

A2. A simple circuit contains a resistance R and an ideal battery. If a second resistor is connected in parallel with R,

(A) the voltage drop across R will decrease.
(B) the current through R will decrease.
(C) the total current drawn from the battery will increase.
(D) the rate of energy dissipation in R will increase.
(E) the equivalent resistance of the circuit will increase.

A3. Which one of the following statements is correct? The kW·h is a unit of

(A) power. (B) voltage. (C) current.
(D) charge. (E) energy.

A4. A charged particle enters a region where there is a magnetic field that is perpendicular to the particle's velocity. The direction of the magnetic force that acts on the charged particle depends on

(A) the sign of the charge. (B) the magnitude of the charge.
(C) the speed of light. (D) the speed of the particle.
(E) the magnitude of the magnetic field.

A5. Consider the electromagnetic waves that comprise the various colours of visible light. When propagating in a vacuum these waves differ in

(A) frequency only. (B) wavelength only.
(C) speed only. (D) frequency and wavelength.
(E) frequency and speed.

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A6. Consider a situation in which parallel light rays strike a surface and remain parallel after reflection. This is called

(A) total internal reflection.
(B) diffuse reflection.
(C) specular reflection.
(D) refraction.
(E) diffraction.

A7. An index of refraction less than one for a medium would imply

(A) that the speed of light in the medium is less than the speed of light in a vacuum.
(B) that the speed of light in the medium is the same as the speed of light in a vacuum.
(C) that the speed of light in the medium is greater than the speed of light in a vacuum.
(D) that refraction is not possible.
(E) that all the light leaving the medium is totally internally reflected regardless of the angle.

A8. Suppose light passes from air into water, with an angle of incidence of 15°. Which of the following could be the angle of refraction?

(A) 10° (B) 20° (C) 30° (D) 45° (E) 60°

A9. When a beam of sunlight is sent through a prism the sunlight is separated into a spectrum of colours. The spreading of light into its colour components is called

(A) rarefaction.
(B) reflection.
(C) magnification.
(D) divergence.
(E) dispersion.

A10. An object is placed between a converging lens and its focal point. Which one of the following correctly describes the image which is formed?

(A) virtual, erect, enlarged
(B) virtual, inverted, reduced
(C) real, erect, enlarged
(D) real, inverted, enlarged
(E) real, inverted, reduced

continued on page 4 ...

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. The emf of a real battery is 9.00 V. A current of 0.850 A is drawn from the battery when a 10.0 Ω resistor is connected to it. Calculate the internal resistance of the battery.

B2. The average power dissipated in a light bulb is 60.0 W when it is operated in a standard 120-V household circuit. Calculate the **peak** current through the light bulb.

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B3. A charge of 2.50×10^{-5} C has a velocity of 4.50×10^{3} m/s due east as it enters a region where the magnetic field is 0.200 T directed 40.0° north of east. Calculate the magnitude of the magnetic force on the charge.

B4. A reflecting mirror on the surface of the Moon is 3.84×10^{8} m from the surface of the Earth. A laser on the surface of the Earth is aimed at the mirror. Calculate the elapsed time from the moment the laser is switched on to the moment the reflected laser light is observed on the Earth. Ignore any effects due to the Earth's atmosphere.

continued on page 6 ...

B5. Consider a light wave which passes from air into another medium. The angle of incidence is 38.0° and the angle of refraction is 23.5°. Calculate the index of refraction of the unknown medium.

ANSWERS FOR PART B

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

THE ANSWERS MUST CONTAIN 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

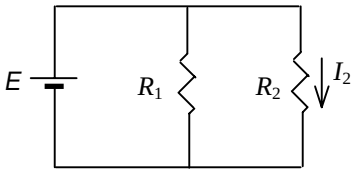
IN EACH OF THE FOLLOWING QUESTIONS, GIVE THE COMPLETE SOLUTION AND ENTER THE FINAL ANSWER IN THE BOX PROVIDED.

THE ANSWERS MUST CONTAIN THREE SIGNIFICANT FIGURES AND THE UNITS MUST BE GIVEN.

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

C1. Two resistors are connected in parallel across an ideal battery, as shown in the diagram. E = 5.00 V, R_1 = 56.2 Ω, I_2 = 0.728 A.

(a) Calculate the total current drawn from the battery.



(b) Calculate the resistance of resistor R_2.

(c) The two resistors are now connected in series across the same battery. Sketch the circuit diagram and calculate the new value of the total current drawn from the battery.

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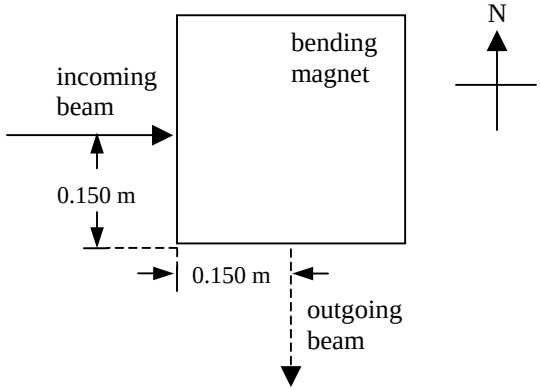
C2. Bending magnets are used to alter the direction of beams of charged particles. Suppose a beam of protons (mass 1.67×10^{-27} kg, charge $+e$) with a velocity of 1.50×10^{6} m/s is to be deflected through 90.0° as shown in the diagram. The magnetic field of the bending magnet is perpendicular to the velocity of the protons. Calculate the magnitude and direction of the required magnetic field.



magnitude: _____

direction: (circle one) N S E W into page out of page

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C3. Two lenses are placed 36.0 cm apart. The left lens is a diverging lens with a focal length of 12.0 cm. The right lens is a converging lens with a focal length of 24.0 cm. An object is placed 17.0 cm to the left of the diverging lens. Calculate the position of the final image (relative to the converging lens) and the overall magnification of the two-lens system.

position of final image:	
magnification:	

END OF EXAMINATION