

PHYSICS DEPARTMENT

PHY 2054
B. Whiting

Practice Exam #3

November 29, 2001

Name (print): _____ Signature: _____

*On my honor, I have neither given nor received unauthorized aid on this examination.***YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.****DIRECTIONS**

- (1) **Code your test number on your green answer sheet (use 76–80 for the 5-digit number).** Code your name on your answer sheet. **Darken circles completely (errors can occur if too light).** Code your student number on your answer sheet.
- (2) Print your name on this sheet and sign it also.
- (3) Do all scratch work anywhere on this exam that you like. At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout with scratch work most questions demand.
- (4) Work the questions in any order. Incorrect answers are not taken into account in any way; you may guess at answers you don't know if you feel that a correct answer is listed. Guessing on all questions will most likely result in failure.
- (5) If none of the answers is correct, please leave the answer sheet blank. It is not our intention to omit the right answer, but in case of a mistake, please leave the answer sheet blank.
- (6) **Blacken the circle of your intended answer completely, using a number 2 pencil.** Do not make any stray marks or the answer sheet may not read properly.
- (7) As an aid to the examiner (and yourself), in case of poorly marked answer sheets, please circle your selected answer on the examination sheet.
- (6) Good luck!!!

>>>>>>>**WHEN YOU FINISH**<<<<<<<<

Hand in the green answer sheet separately.

Constants

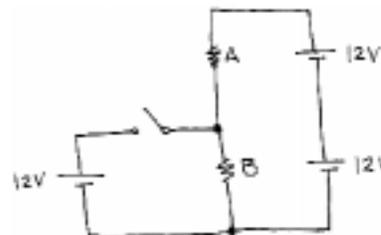
$k = 1/(4\pi\epsilon_0) = 9.0 \times 10^9 \text{ N m}^2/\text{C}^2$	$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/(\text{N m}^2)$	$e = 1.6 \times 10^{-19} \text{ C}$
$1\mu\text{C} = 10^{-6} \text{ C}$	$g = 9.8 \text{ m/s}^2$	electron mass: $m_e = 9.11 \times 10^{-31} \text{ kg}$
Avogadro's number: 6.023×10^{23}	Atomic mass of Al = 27 g	

1. A beam of unpolarized light with intensity 0.15 W/m^2 is incident upon a sequence ($i = 1, 2, 3, 4$) of four circular polarizers. The polarization axes of the four polarizers are oriented as: $\theta_1 = +30$, $\theta_2 = 0$, $\theta_3 = -30$, and $\theta_4 = +30$ degrees. What is the intensity (in W/m^2) of the transmitted light after passing through all four polarizers?

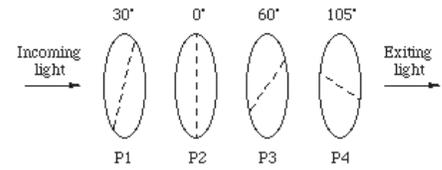
- (1) 0.063 (2) 0.004 (3) 0.032 (4) 0.025 (5) 0.011

2. Two identical light bulbs (drawn as resistors, labeled A and B) are connected to 12V batteries as indicated. Which of the following statements is **true** after the switch is closed?

- (1) Both bulbs remain the same brightness
- (2) The intensity of light bulb B increases
- (3) The intensity of light bulb A decreases
- (4) The intensity of light bulb A increases
- (5) Both bulbs go out

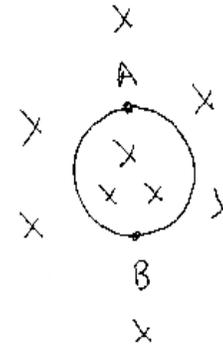


10. Unpolarized light with average energy density 10^{-6} Joules/m³ passes from left to right through a sequence of 4 polarizers as shown. What is the average intensity (in W/m²-sec) of the exiting light after passing through all the polarizers? Select the closest answer (for answers ≤ 1 , select 1; for answers ≥ 30 , select 30).

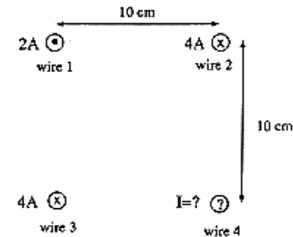


- (1) 2.5 (2) 1 (3) 15 (4) 30 (5) 4
11. What size downward electric field (in N/C) is required to balance the gravitational pull on an electron?
- (1) 5.6×10^{-11} (2) 3.2×10^2 (3) 5.7×10^{-12} (4) 5.9×10^{-5} (5) 9.3×10^{-20}

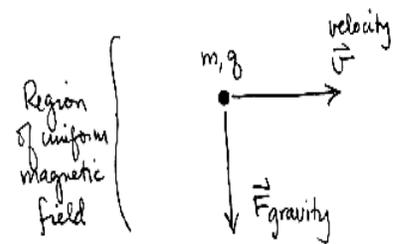
12. The flexible loop in the figure has a radius of 0.2 m and is oriented perpendicular to a magnetic field of strength 0.5 T. The loop is grasped at points A and B and is stretched so that it completely closes (i.e., the area of the loop is reduced to zero) after 0.025 s. What is the average induced emf in the loop while it is being stretched?



- (1) 2.5 V
 (2) 0.7 V
 (3) 1.2 V
 (4) 3.6 V
 (5) 4.8 V
13. Four wires carry current perpendicular to the page as shown. The wires are located in a square configuration with separations of 10 cm on each side. Wire 1 has a current of 2 A (out of the page) and wires 2 and 3 have a current of 4 A (into the page). What is the current in wire 4 (in A) such that wire 1 feels no net force?

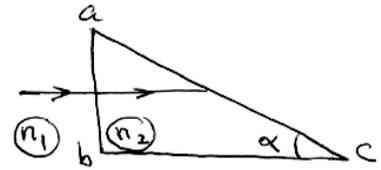


- (1) 6.9, out of page (2) 9.9, out of page (3) 8.0, out of page (4) 5.7, into page (5) 4.0, out of page
14. A massive particle with charge $+1 \times 10^{-12}$ C moves with velocity 5×10^8 m/sec through a region of uniform magnetic field strength 20 tesla (see figure). Gravity also acts on the particle in the indicated direction. What direction must the magnetic field have; and what is the mass (in kg) of the particle if it moves with constant velocity and direction through this region? (Select the closest answer.)



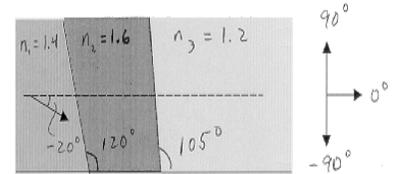
- (1) field directed out of the page; 10^{-1}
 (2) field directed into the page; 10^{-1}
 (3) field directed to top of page; 10^{-3}
 (4) field directed into the page; 10^{-3}
 (5) field directed out of the page; 10^{-3}

15. A ray of light is normally incident on face ab of a plastic prism with an index of refraction $n_2 = 1.2$. Determine the largest value of the angle α so that the ray is totally reflected at the face ac if the prism is immersed in a liquid with refractive index $n_1 = 1.08$.



- (1) 21° (2) 17° (3) 26° (4) 69° (5) 79°

16. The figure shows a light ray traveling through medium 1 ($n = 1.4$) at an angle of -20° with respect to the horizontal. It passes through medium 2 ($n = 1.6$) into medium 3 ($n = 1.2$). At what angle (in degrees) with respect to the horizontal will the ray be traveling in medium 3?

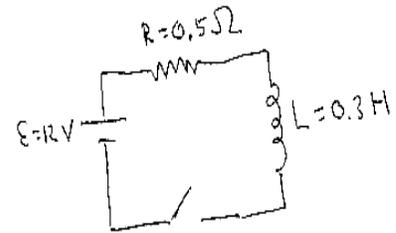


- (1) -10 (2) -36 (3) $+27$ (4) -22 (5) -54

17. A charge $q_1 = -8\mu\text{C}$ is placed at the origin. A second charge of $q_2 = +2\mu\text{C}$ is placed a distance $d = 1\text{ m}$ along the positive x axis. At what position x (in m) must a third charge be placed so that it experiences no force?

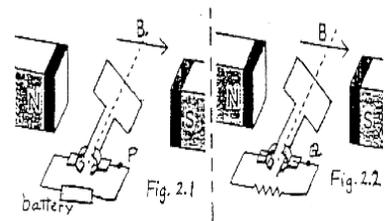
- (1) -2.0 (2) -1.0 (3) 0.67 (4) 2.0 (5) 0.33

18. At time $t = 0$, the switch in the circuit shown is closed. At what time in seconds does the current in the circuit reach 50% of its maximum value?



- (1) 0.21 (2) 0.36 (3) 0.12 (4) 0.29 (5) 0.42

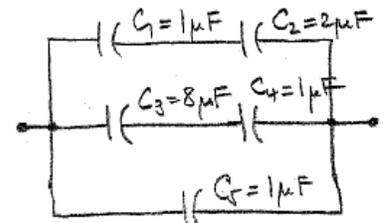
19. The motor shown in Fig. 2.1 is rotating clockwise. The DC generator shown in Fig. 2.2 is also rotating clockwise.



- [i] What is the direction of the current flow at point P?
- [ii] What is the direction of the current flow at point Q?

- (1) none of the above
 (2) [i] to the left and [ii] to the right
 (3) [i] to the right and [ii] to the left
 (4) [i] to the right and [ii] to the right
 (5) [i] to the left and [ii] to the left

20. In the figure, if the energy stored in C_3 is $0.5\ \mu\text{J}$, what is the energy (in μJ) stored in C_5 ? (Choose the closest answer.)



- (1) 500 (2) 0.05 (3) 50 (4) 0.5 (5) 5