

PHYS-1200 PHYSICS II**QUIZ 3****APRIL 28, 2006**

NAME _____

Put a mark in the box next to the section of the course to which you are assigned. If you are not now in the room to which your section is assigned, ***GO TO IT NOW!***

	SECTION NUMBER	EXAMINATION ROOM	INSTRUCTOR	DAY AND TIME THAT SECTION MEETS
	1	AE 214	SCOTT DWYER	MR 8:00 A.M.
	2	AE 214	SCOTT DWYER	MR 10:00 A.M.
	3	SA 3303	PAUL STOLER	MR 12:00 NOON.
	5	DCC 324	THOMAS SHANNON	TF 10:00 A.M.
	6	DCC 324	THOMAS SHANNON	TF 12:00 NOON
	7	DCC 318	SHAWN-YU LIN	TF 2:00 P.M.
	8	SA 3303	PAUL STOLER	MR 2:00 P.M.
	9	DCC 318	ANGEL GARCIA	MR 12:00 NOON

There are 8 different pages in this quiz, including the cover page. Check now to see that you have all of them.

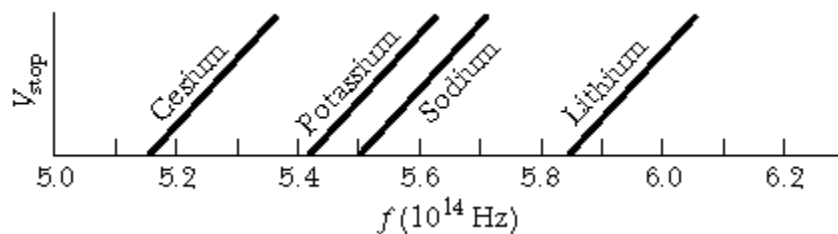
	CREDIT	GRADE
PART A	40%	
PART B	20%	
PART C-1	20%	
PART C-2	20%	
TOTAL	100%	

All work and answers must be given in the spaces provided on these pages.

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PART A. (40%) Each question is worth 5%. In the space provided, to the left of the question number, write the letter corresponding to the best answer to the question.

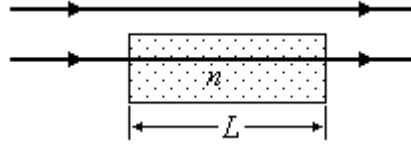
- ___ 1. Light of uniform intensity shines perpendicularly on a totally absorbing surface, fully illuminating the surface. If the area of the surface is decreased and nothing else is changed, the effect on the surface is:
- A. the radiation pressure increases and the radiation force decreases
 - B. the radiation pressure increases and the radiation force increases
 - C. the radiation pressure stays the same and the radiation force decreases
 - D. the radiation pressure stays the same and the radiation force increases
 - E. the radiation pressure decreases and the radiation force decreases
- ___ 2. The index of refraction of a substance is equal to:
- A. the speed of light in the substance
 - B. the speed of light in vacuum divided by the speed of light in the substance
 - C. the speed of light in the substance divided by the speed of light in vacuum
 - D. the wavelength of light in the substance divided by the wavelength of light in vacuum
 - E. the frequency of light in the substance divided by the frequency of light in vacuum
- ___ 3. The reason there are two slits, rather than one, in Young's double slit interference experiment is:
- A. to increase the intensity of the light on the screen.
 - B. the two slits are in parallel and offer less resistance to the light.
 - C. to create a path length difference between two light waves.
 - D. one slit is for frequency and the other is for wavelength.
 - E. one slit is for Electric field, and the other is for Magnetic field.
- ___ 4. The figure shows data collected in a photoelectric effect experiment. It contains graphs of stopping potential as a function of frequency of incident light for four different metals. The four lines are parallel. Which metal has the largest work function?
- A. Cesium
 - B. Potassium
 - C. Sodium
 - D. Lithium
 - E. The work function is the same for all four metals



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PART B. (20%)

1. (12%) The sketch shows two parallel waves of light, initially in phase. One passes through a piece of glass, of index of refraction $n = 1.25$ and length $L = 7.50 \times 10^{-6}$ m, while the other travels the entire path through air. The wavelength of the light in air is $\lambda = 5.00 \times 10^{-7}$ m.



- a) (4%) How many wavelengths are there in the path of length L that goes through air? (The upper path in the diagram.)

$$N_1 = \underline{\hspace{2cm}}$$

- b) (4%) How many wavelengths are there in the path of length L that goes through glass? (The lower path in the diagram.)

$$N_2 = \underline{\hspace{2cm}}$$

- c) (4%) Indicate the phase relationship between the two waves after the lower wave has emerged from the glass by circling one of the following.

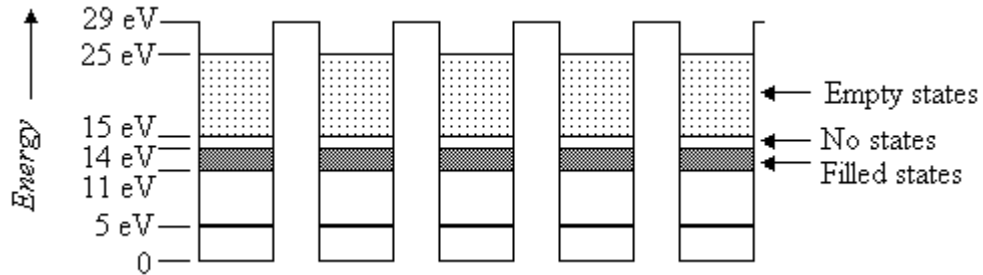
THEY ARE IN PHASE

THEY ARE COMPLETELY OUT OF PHASE

THEY ARE NEITHER IN PHASE NOR COMPLETELY OUT OF PHASE

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2. (8%) The diagram below shows a portion of an array of finite potential energy wells that have been brought close together to form energy bands, and simulate a solid at a temperature of 0 K. The darkly shaded regions indicate filled states, and the lighter shading indicates empty states. Thus, the lowest two bands are completely filled, and the highest band is empty. The important energies, measured from the bottom of the wells, are indicated on the diagram.



- a) (4%) What is the value of E_g , the energy gap between the top of the valence band and the bottom of the conduction band?

$$E_g = \text{_____} \text{ eV}$$

- b) (4%) The material that results from the band structure shown is a:
(Circle the correct answer.)

INSULATOR

CONDUCTOR

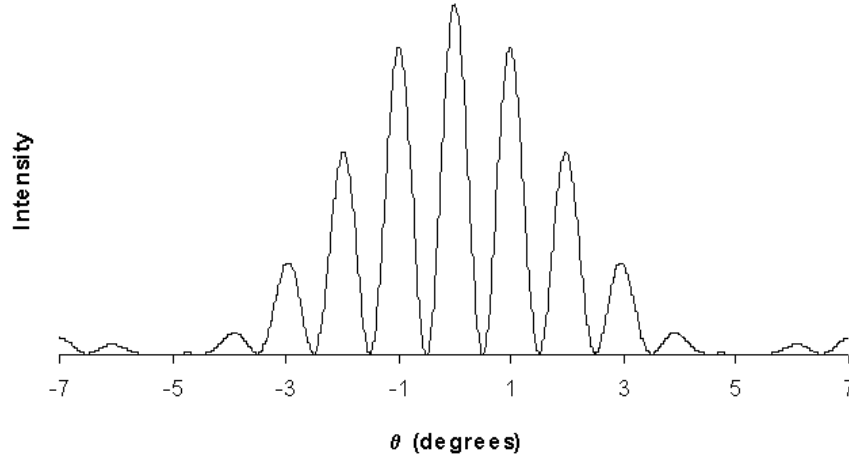
SEMICONDUCTOR

IMPOSSIBLE TO DETERMINE

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PART C. (40%) You must show all your work or state your reasoning in order to receive credit.

1. (20%) The picture below shows the interference pattern that results when electromagnetic waves of wavelength $\lambda = 100 \text{ nm}$ ($1.0 \times 10^{-7} \text{ m}$) are sent through a pair of slits of width a that are separated by a distance d .



- a) (5%) To what region of the electromagnetic spectrum do the electromagnetic waves of wavelength $\lambda = 100 \text{ nm}$ belong? (Circle the correct answer.)

RADIO WAVES	INFRARED	VISIBLE
ULTRAVIOLET	X-RAYS	GAMMA RAYS

- b) (5%) What is the separation between the two slits?

$d =$ _____ units

- c) (5%) What is the width of one of the slits?

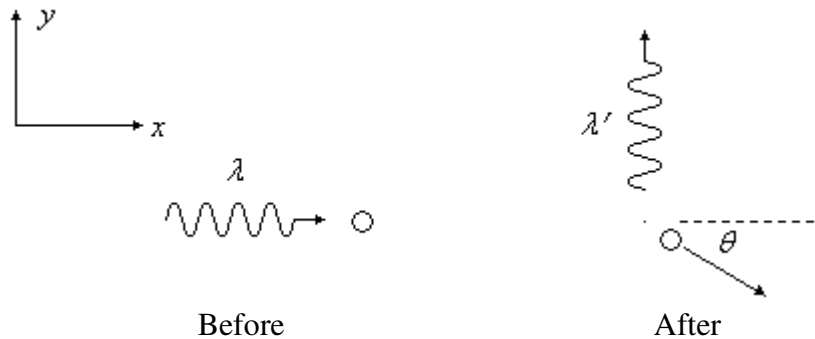
$a =$ _____ units

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- d) (5%) The interference pattern on the previous page was projected on a screen 50 cm (0.50 m) from the slits. What was the distance on the screen between the central maximum (the one at 0°) and the first order maximum (the one at 1.0°)?

$$\Delta y = \underline{\hspace{2cm}} \underline{\hspace{1cm}} \text{units}$$

2. (20%) The picture below shows a Compton collision between a photon and an electron. The set of axes in the picture is just to indicate directions. The picture on the left shows the situation before the collision, when a photon of wavelength λ is moving in the positive x direction toward an electron that is at rest. The picture on the right shows the situation after the collision. A photon of wavelength λ' is moving in the positive y direction, and the electron is moving in a direction that makes an angle θ with the x direction. $\lambda = 70.0 \text{ pm}$ ($7.00 \times 10^{-11} \text{ m}$), and $\lambda' = 72.4 \text{ pm}$ ($7.24 \times 10^{-11} \text{ m}$).



- a) (5%) Find the momentum of the photon of wavelength $\lambda = 70.0 \text{ pm}$ ($7.00 \times 10^{-11} \text{ m}$).

$$p(\lambda) = \underline{\hspace{2cm}} \underline{\hspace{1cm}} \text{units}$$

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b) (5%) Find the energy of the photon of wavelength $\lambda = 70.0 \text{ pm}$ ($7.00 \times 10^{-11} \text{ m}$).

$$E(\lambda) = \underline{\hspace{10em}} \text{ units}$$

c) (5%) Find the energy of the photon of wavelength $\lambda' = 72.4 \text{ pm}$ ($7.24 \times 10^{-11} \text{ m}$).

$$E(\lambda') = \underline{\hspace{10em}} \text{ units}$$

d) (5%) What is the kinetic energy of the electron after the collision?

$$K_{\text{electron}} = \underline{\hspace{10em}} \text{ units}$$