

NAME

PHYS-1200 PHYSICS II

QUIZ 3

APRIL 28, 2006

SOLUTIONS

PART A.

- | | |
|------|------|
| 1. C | 5. D |
| 2. B | 6. A |
| 3. C | 7. E |
| 4. D | 8. A |

PART B.

1. a) $N_1 = \frac{L}{\lambda} = \frac{7.50 \times 10^{-6} \text{ m}}{5.00 \times 10^{-7} \text{ m}} \qquad \underline{N_1 = 15}$

b) $N_2 = \frac{L}{\lambda/n} = n \frac{L}{\lambda} = (1.25)(15) \qquad \underline{N_2 = 18.75}$

- c) **THEY ARE NEITHER IN PHASE NOR COMPLETELY OUT OF PHASE.**
 $N_2 - N_1 = 3.75$, which is neither an integer nor an integer plus $\frac{1}{2}$.

2. a) $\underline{E_g = 1.0 \text{ eV}}$

- b) **SEMICONDUCTOR**

NAME

PART C.

1. a) **ULTRAVIOLET**

$$\text{b) } d \sin \theta = m\lambda, \text{ so } d = \frac{m\lambda}{\sin \theta} = \frac{1(1.0 \times 10^{-7} \text{ m})}{\sin 1.0^\circ} \qquad \underline{d = 5.7 \times 10^{-6} \text{ m} = 5.7 \mu\text{m}}$$

$$\text{c) } a \sin \theta = m\lambda, \text{ so } a = \frac{m\lambda}{\sin \theta} = \frac{1(1.0 \times 10^{-7} \text{ m})}{\sin 5.0^\circ} \qquad \underline{a = 1.1 \times 10^{-6} \text{ m} = 1.1 \mu\text{m}}$$

$$\text{d) } \Delta y = D \tan \theta = (0.50 \text{ m}) \tan 1.0^\circ \qquad \underline{\Delta y = 8.7 \times 10^{-3} \text{ m} = 8.7 \text{ mm}}$$

$$2. \text{ a) } p(\lambda) = \frac{h}{\lambda} = \frac{6.63 \times 10^{-34} \text{ J}\cdot\text{s}}{7.00 \times 10^{-11} \text{ m}}$$

$$p(\lambda) = \underline{9.47 \times 10^{-24} \text{ kg}\cdot\text{m/s}}$$

$$\text{b) } E(\lambda) = hf = \frac{hc}{\lambda} = \frac{(6.63 \times 10^{-34} \text{ J}\cdot\text{s})(3.0 \times 10^8 \text{ m/s})}{7.00 \times 10^{-11} \text{ m}}$$

$$E(\lambda) = \underline{2.84 \times 10^{-15} \text{ J} = 1.78 \times 10^4 \text{ eV}}$$

$$\text{c) } E(\lambda') = hf = \frac{hc}{\lambda} = \frac{(6.63 \times 10^{-34} \text{ J}\cdot\text{s})(3.0 \times 10^8 \text{ m/s})}{7.24 \times 10^{-11} \text{ m}}$$

$$E(\lambda') = \underline{2.75 \times 10^{-15} \text{ J} = 1.72 \times 10^4 \text{ eV}}$$

d) From energy conservation, the $K_{\text{electron}} = E(\lambda) - E(\lambda')$

$$K_{\text{electron}} = \underline{9.5 \times 10^{-17} \text{ J} = 600 \text{ eV}}$$