Physics 133 Physics IIb—Thermodynamics and Waves
Test 3
November 21, 2014

Name: _____

All problems *must* begin with either a fundamental principle or with an equation from the equation sheet. If any question is unclear, please ask immediately. Be sure to show your work **clearly**. Partial credit may be given for work *if* it can be understood.

Problem 1: (15 pts.) Unpolarized light of intensity 60 W/m^2 is incident on a polarizer with its polarization axis at an angle of 20° away from the vertical. The light then passes through a second polarizer with its polarization axis at an angle of 50° away from the vertical.

a. (10 pts.) What is the intensity of the light after the second polarizer?

b. (5 pts.) Now suppose a third polarizer is added on the end with its polarization axis at an angle of 90° away from the vertical. What would be the intensity after this last polarizer?
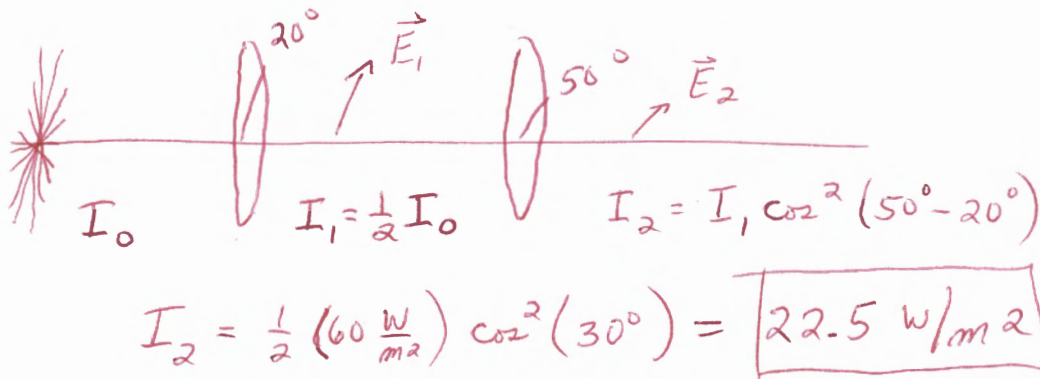
Name: _____SOLUTIONS_____

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Problem 1: (15 pts.) Unpolarized light of intensity 60 W/m^2 is incident on a polarizer with its polarization axis at an angle of 20° away from the vertical. The light then passes through a second polarizer with its polarization axis at an angle of 50° away from the vertical.

a. (10 pts.) What is the intensity of the light after the second polarizer?

$$I_2 = I_1 \cos^2(50° - 20°)$$

$$I_1 = \tfrac{1}{2} I_0$$

$$I_2 = \tfrac{1}{2}\left(60 \tfrac{W}{m^2}\right)\cos^2(30°) = \boxed{22.5 \; W/m^2}$$

b. (5 pts.) Now suppose a third polarizer is added on the end with its polarization axis at an angle of 90° away from the vertical. What would be the intensity after this last polarizer?

$$I_3 = I_2 \cos^2(90° - 50°)$$

$$\boxed{I_3 = 13.2 \; W/m^2}$$