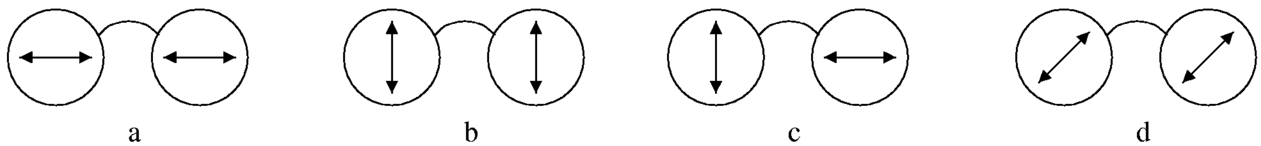
(a) Why? In what direction is it polarized?

Now hold one of your linear polarizers in front of one eye (close the other) and rotate it in its own plane. You will see the glare come and go.

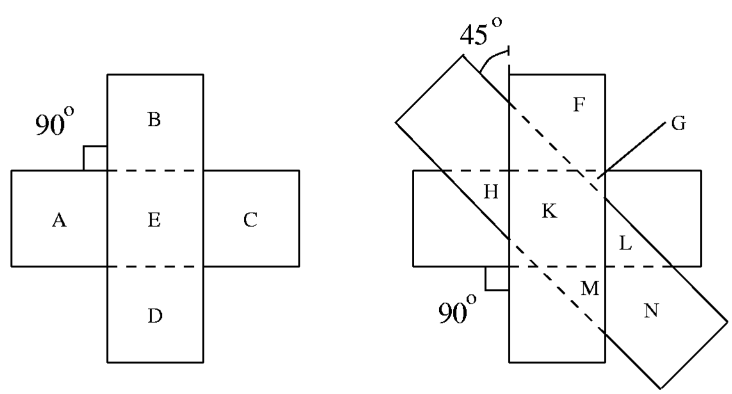
(b) Determine from this experiment the direction of polarization for each of your three linear polarizers.

(c) If you had to design a pair of polarized sunglasses would you choose the direction of polarization as indicated in figure a, b, c or d or would you choose another way and why?



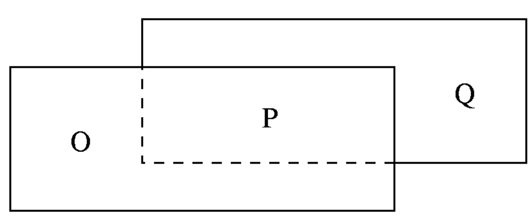
If you happen to have a pair of polarized sunglasses, you can now (using your polarizers) measure the direction of polarization of your glasses. Of course, even without your polarizers you could have determined the direction of polarization of your glasses with the above method.

Hold in front of one eye (close the other) two "crossed" polarizers (see left figure below).



Now stick a third linear polarizer *in between* the two plates; you have now turned darkness (area E) back into light (area K)!

(d) Calculate the light *intensity* per unit area (in terms of I_o, which is the intensity of the unpolarized light as it strikes the polarizer) that you will see from the areas A, B, C, D, E, F, G, H, K, L, M, and N when the situation is as shown in the figure above right. Notice the 45^o angle. Assume that your polarizers are "ideal" (HN-50) so that light intensities per unit area from the areas O, P and Q in the figure below would all be the same ($\frac{1}{2}\, I_o$). You can check, by experiment, that this is not so (your polarizers are HN-38).



(e) Now recalculate for your HN-38 polarizers the light intensities from the areas marked F, G, H, K, L, M, N, O, P, and Q and check whether there is reasonable agreement between your calculations and your observations.

Try to get hold of some cellophane (from a friend's pack of cigarettes — *I hope YOU don't smoke* — or book wrapping or a wrapping from a box with chocolates or ?). Put a piece between two crossed polarizers and rotate the cellophane in its own plane. Look through the polarizers into a bright light (one eye closed). Repeat this with a piece of cellophane which is wrinkled and folded so that at some places you have two layers and at others one, or three, or more. *You will now see very nice color patterns.* At night you can project them on your walls! Rotate the cellophane (without rotating the polarizers) and notice a change in colors. Also change the 90^o angle between your polarizers to different angles. I am not asking you to explain this phenomenon (called birefringence), but I wanted you to enjoy this. We will not cover it in lectures. If you can't find cellophane, try it with pre-stretched plastic kitchen wrap (cellophane is much prettier though).

Problem 10.2
Brewster Angle I.
Giancoli 36-49.
This is the reason why rainbows are so highly polarized! Recall the geometry as discussed in my lecture on rainbows.

Problem 10.3
Brewster Angle II.
Giancoli 36-66.

Problem 10.4
Circularly Polarized Light.
Circularly polarized light is incident on an "ideal" (HN-50) polarizer. Which fraction of the light intensity gets through. Is the light that makes it through linearly polarized?
