# PH332 - Chapter Thirteen Solutions

P1) The moon has no atmosphere, so there aren't any atoms or molecules to scatter the light coming from the sun.

P3) The air molecules in the atmosphere scatter blue light much more than red light. Since the traveler is looking at light that has traveled through the atmosphere over a longer distance, more of the blue light was scattered leaving mostly red light, so the sun looks red. The sailors are getting most of all of the colors, so the sun looks white.

P6) (c) polarized (in the vertical direction).

P8) (a) Reflected light is polarized. If it bounces off of the ground, then it will be polarized in the horizontal direction. Polarizing sunglasses are constructed in such a way that they absorb light that is polarized horizontally.

(b) If the light bounces off of a vertical surface, then it will be polarized in the vertical direction. Polarizing sunglasses cannot absorb light that is polarized vertically, so they don't reduce this type of glare significantly.

P13) (b), (c) only

PM3) $\frac{I(in)}{I(out)} = \cos^2\theta$ $\quad\quad$ $I(in) = I(out)\cos^2\theta$ $\quad\quad$ (M3)

This is a typo! It should be the other way around!

PM3) (cont.) $\frac{I(out)}{I(in)} = \cos^2\theta$ $I(out) = I(in)\cos^2\theta$

$I(\text{out of filter}) = I(in)\cos^2 45^\circ = I(in)(0.707)^2$

$I(\text{out of filter}) = I(in)\frac{1}{2}$

$I(\text{into analyzer}) = I(\text{out of filter}) = \frac{1}{2} I(in)$

$I(\text{out of analyzer}) = I(\text{into analyzer})\cos^2 45^\circ$

$I(\text{out of analyzer}) = \frac{1}{2} I(in)\left(\frac{1}{2}\right) = \frac{1}{4} I(in)$

PM4) If the analyzer is rotated once per second, then the transmission axis of the polarizer and analyzer will line up twice each time the analyzer goes around. So, two pulses of light will emerge each second.

$$\frac{2\text{ pulses}}{\text{second}} \cdot \frac{60\text{ seconds}}{\text{minute}} = 120\ \frac{\text{pulses}}{\text{minute}}$$