Physics 256 Assignment 5

Due: Wednesday, October 17th, 2012 4:00 pm in the drop box 2nd floor Physics or electronically 62 marks

1) a) 4.40, **8 marks**

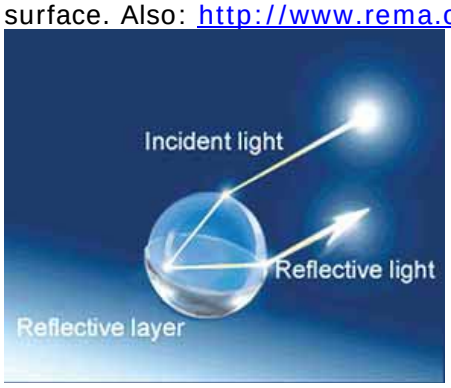
b) 4.45: Field amplitudes and irradiances. **8 marks Final field amplitudes are given by the product of the r's and initial amplitudes.**

c) If a beam of quasimonochromatic light with an irradiance of $400 W/m^2$ is incident in each case, what is the transmitted irradiance in each case? **8 marks**

d) If the beam diameter is 1 cm, what is the transmitted power? **5 marks**

2) Waveguide Question Slide 15: Cone inner segments at the rear of the eye are waveguides and their internal refractive index is 1.353. They are surrounded by a refractive index of 1.339 and the refractive index in front of them is also 1.339. From geometrical theory, what is the critical angle for light leaving the fibre? Calculate the numerical aperture of the fibre and the fibre acceptance angle, θ_{max}. How large a cone of light is accepted? **10 marks**

3) Retroreflector Problem: A transparent sphere can act as a retroreflector. It has an index of refraction of 1.8 and a radius of 1.0 cm. At what distance from the centre line must a ray be sent in parallel to the line to exit the sphere parallel to the incoming beam? Use Snell's Law.
This is the design from Serway Fig 35.8. The ray is initially parallel to the optical axis. The refracted ray must be incident on the vertex of the back surface, reflected at an equal angle and refracted out of the sphere parallel to the original ray. First find the normal to the sphere's surface. Also: http://www.rema.org.uk/pdf/history-retroreflective-materials.pdf **8 marks**



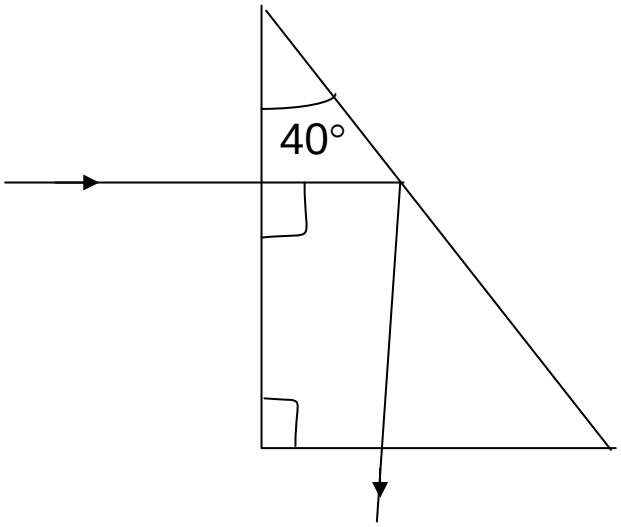
4) Brewster's angle: a) Hecht 8.28. **3 marks**

b) Should the glasses absorb vertical or horizontally polarized light and why? **3 marks**

5) Reflecting prism: Light traverses the following prism.

a) What is the minimum refractive index of the prism in order for the light to reflect? **6 marks**

b) What is the disadvantage with this ray path for a reflecting prism? **3 marks**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