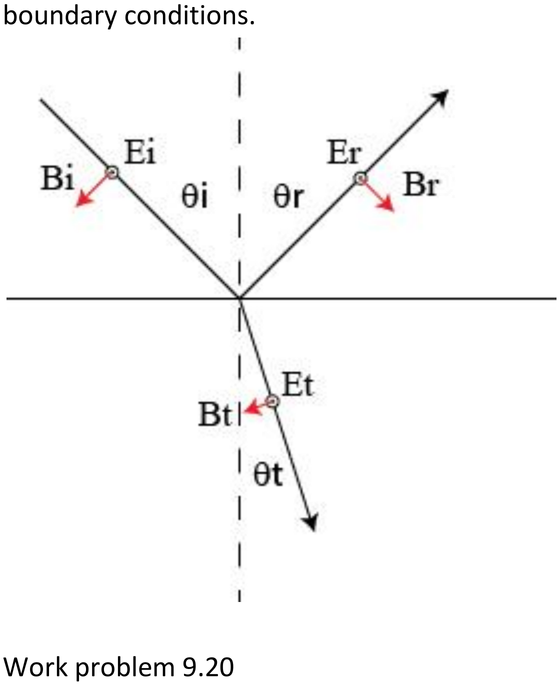
HW9_3

1. Rework the derivation on pages 408-412 of the derivation of the Fresnel equations for oblique incidence, starting from the boundary conditions, i.e. equation 9.101 and the wave-functions of the incident, reflected and transmitted plane waves described by equations 9.89, 9.90, and 9.91. Assume that the incident wave is linearly polarized in the plane of incidence (i.e. E-field is parallel to the plane of incidence).
2. For one of the angles of incidence the amplitude coefficient for reflection becomes zero. This angle is referred to as the Brewster angle. Calculate the angle of refraction for the Brewster angle of the material shown in Fig. 9.16. Calculate the angle between the refracted beam and the reflected beam if a reflected beam would exist. Does your answer make sense?
3. Analyze the case of polarization perpendicular to the plane of incidence (i.e. electric fields in the y-direction in Fig. 9.15) Impose the boundary conditions (Eq 9.101) and obtain the Fresnel equations for $\tilde{\vec{E}}_{oR}$ and $\tilde{\vec{E}}_{oT}$. Sketch $\left|\tilde{\vec{E}}_{oR} / \tilde{\vec{E}}_{oI}\right|$ and $\left|\tilde{\vec{E}}_{oT} / \tilde{\vec{E}}_{oI}\right|$ as a function of the angle of incidence θ_I for the case $b=n_2/n_1=1.5$. We assume that the incident, reflected and transmitted waves all have their electric field in the same direction (see figure below) and that the positive direction of the B-field is flipped for the reflected wav (see figure below). Follow the same approach as you did for problem 1, i.e. assume that the argument of the exponential function of the waves are the same for the incident, reflected and transmitted wave at the interface, so you only have to worry about the complex field amplitudes of the waves when applying the boundary conditions.



4. Work problem 9.20
5. Work problem 9.22