Maxwell's equations: μ

$$\vec{\nabla}\cdot\vec{D}=\rho_f \qquad \nabla\cdot\vec{B}=0$$

$$\vec{\nabla}\times\vec{E}=-\frac{\partial\vec{B}}{\partial t} \qquad \vec{\nabla}\times\vec{H}=J_f+\frac{\partial\vec{D}}{\partial t} \qquad \vec{D}=\varepsilon\vec{E} \qquad \vec{H}=\frac{1}{\mu}\vec{B}$$

Wave equation: $\nabla^2\psi(\vec{r},t)=\frac{1}{v^2}\frac{\partial^2\psi(\vec{r},t)}{\partial t^2}$ Wave velocities: $\boldsymbol{v}_p=\frac{\omega}{k}$, $\boldsymbol{v}_g=\frac{d\omega}{dk}$

Plane wave: $\vec{E}(\vec{r},t)=\tilde{\vec{E}}_0 e^{i(\vec{k}\cdot\vec{r}-\omega t)} \quad \tilde{\vec{E}}_0\cdot\vec{k}=0 \quad \omega\tilde{\vec{B}}_0=\vec{k}\times\tilde{\vec{E}}_0$

Poynting vector: $\vec{S}=\vec{E}\times\vec{H}$

Field energy: $U=\frac{1}{2}\vec{E}\cdot\vec{D}+\frac{1}{2}\vec{B}\cdot\vec{H}$

Stress tensor: $T_{ij}= \ (E_iD_j-\tfrac{1}{2}\delta_{ij}\vec{E}\cdot\vec{D}) + (B_iH_j-\tfrac{1}{2}\delta_{ij}\vec{B}\cdot\vec{H})$

Force density: $\vec{f}=\vec{\nabla}\cdot\vec{T}-\varepsilon\mu\frac{\partial\vec{S}}{\partial t}$

Continuity equation: $\vec{\nabla}\cdot\vec{j}_Q=-\frac{\partial\rho_Q}{\partial t}$ Snell's Law: $\frac{\sin\theta_t}{\sin\theta_i}=\frac{n_i}{n_t}$

Boundary conditions: $\varepsilon_1E_{1\perp}-\varepsilon_2E_{2\perp}=\sigma_f$; $B_{1\perp}=B_{2\perp}$; $E_{1\parallel}=E_{2\parallel}$; $\frac{1}{\mu_1}B_{1\parallel}-\frac{1}{\mu_2}B_{2\parallel}=K_f$

Normal incidence on dielectric:

$$T\equiv\frac{I_t}{I_i}=\frac{\varepsilon_2 v_2}{\varepsilon_1 v_1}\left(\frac{E_t^2}{E_i^2}\right)=\frac{4n_1n_2}{(n_1+n_2)^2}$$

$$R\equiv\frac{I_r}{I_i}=\left(\frac{E_r^2}{E_i^2}\right)=\frac{(n_1-n_2)^2}{(n_1+n_2)^2}$$

Math:

Fourier analysis: $\tilde{f}(z,t)=\int_{-\infty}^{+\infty}\tilde{A}(k)e^{i(kz-\omega t)}dk \qquad \tilde{A}(k)=\frac{1}{2\pi}\int_{-\infty}^{+\infty}\left[f(z,0)+\frac{i}{\omega}\frac{\partial f(z,0)}{\partial t}\right]e^{-ikz}dz$

$$e^{i\theta}=\cos\theta+i\sin\theta \qquad \vec{\nabla}\cdot(\vec{A}\times\vec{B})=\vec{B}\cdot(\vec{\nabla}\times\vec{A})-\vec{A}\cdot(\vec{\nabla}\times\vec{B})$$

$$\vec{\nabla}\times(f\vec{A})=f(\vec{\nabla}\times\vec{A})-\vec{A}\times(\vec{\nabla}f) \qquad \vec{\nabla}\times(\vec{A}\times\vec{B})=(\vec{B}\cdot\vec{\nabla})\vec{A}-(\vec{A}\cdot\vec{\nabla})\vec{B}+\vec{A}(\vec{\nabla}\cdot\vec{B})-\vec{B}(\vec{\nabla}\cdot\vec{A})$$

$$\vec{\nabla}\times(\vec{\nabla}\times\vec{A})=\vec{\nabla}(\vec{\nabla}\cdot\vec{A})-\nabla^2\vec{A}$$

Spherical unit vectors:

$$\hat{r}=\sin\theta\cos\phi\hat{x}+\sin\theta\sin\phi\hat{y}+\cos\theta\hat{z}$$
$$\hat{\theta}=\cos\theta\cos\phi\hat{x}+\cos\theta\sin\phi\hat{y}-\sin\theta\hat{z}$$
$$\hat{\phi}=-\sin\phi\hat{x}+\cos\phi\hat{y}$$

Cylindrical unit vectors:

$$\hat{s}=\cos\phi\hat{x}+\sin\phi\hat{y}$$
$$\hat{\phi}=-\sin\phi\hat{x}+\cos\phi\hat{y}$$

$$\int_{-\infty}^{\infty}e^{-(z+ik)^2}dz=\sqrt{\pi}$$