ESS415/515 winter 2014
Problem Set #5
Due Monday 2/24/14

Problems from Parks Chapter 5:

1. Parks problem #5.12, p. 210

2. Parks problem #5.15, p. 211

3. Parks problem #5.19, p. 212-213

Problems from Parks Chapter 7

4. Parks problem #7.8, p. 321

5. Parks problem #7.15, p. 323

Other good problems

6. a). Use Poynting's Theorem at the day side magnetopause to **determine** if electromagnetic energy density increases or decreases.

b). **Estimate** the magnitude of $\vec{E} \cdot \vec{J}$

using the Chapman-Ferraro current and a solar wind velocity of 200 km/s. **Justify** any other assumptions you make.

c). Calculate the Poynting Flux on the day side magnetopause and **determine** whether energy enters or exits the magnetosphere at this surface. **Explain** your result.

7. Show that the Magnetic Reynolds number R_M is given, in order of magnitude, by

$$R_M \approx \frac{L^2}{\delta^2}$$

where δ is the skin depth for penetration of electromagnetic waves with frequency $\omega = V/L$ into a medium of conductivity σ. **Comment** on the physical significance of this result.