Questions 1

Due problem 6.6 in the Piel textbook:

**6.6** The plasma of the ionospheric F-layer has a density \( n_e \approx 2 \times 10^{12} \text{ m}^{-3} \). The typical magnetic field at mid-latitude is \( B = 50 \mu \text{T} \). Calculate the electron plasma frequency \( f_{pe} \), electron cyclotron frequency \( f_{ce} \) and the upper hybrid frequency \( f_{uh} \).

Question 2

![Image of Sir Edward Appleton](image)

**Fig. I.**

Figure 1: Sir Edward Appleton (1892-1965) who was awarded the 19478 Nobel Prize in physics. (Right) Fig. 1 from his Nobel Lecture illustrating the paths of direct and reflected radio waves.

Sir Edward Victor Appleton was awarded the Nobel Prize in physics in 1947 for his investigation of radio wave propagation in the ionosphere. In his Nobel Lecture, he described the variations in the reception of radio waves when the direct waves (near ground) interfered with waves reflected from the ionosphere.

Consider radio waves reflected from the so-called “E layer”. The E-layer has a plasma density of \( 10^5 \text{ cm}^{-3} \) and is located at an altitude of about 100 km.

**Part A**

What frequency radio waves can reflect from the E-layer?

**Part B**

Describe (very approximately) how the received radio signals vary as the distance between the transmitting antenna and the receiving antenna changes.