

Circle the answer that is most correct.

- (i) In the Chapman theory of ionized layers,
- (a) the reference height is chosen as the point where the optical depth is unity
 - (b) the electron number density is always largest at the reference height in an attachment layer
 - (c) the electron number density at the reference height for a recombination layer increases as the sun sets
 - (d) the rate of ion production per unit volume is minimum at the reference height when the sun is directly overhead
 - (e) none of the above

(ii) Which of the following is true regarding the Q_L and Q_T approximations of the Appleton-Hartree equation?

- (a) the characteristic polarizations under the Q_T approximation are linear
- (b) the characteristic polarizations under the Q_L approximation are circular
- (c) the Q_L approximation is obtained by assuming $Y_L=0$
- (d) under the Q_T approximation, the Appleton-Hartree equation predicts only a single value for the permittivity of ionosphere
- (e) none of the above

(iii) In a lossless, non-magnetized ionosphere,

- (a) the relative permittivity can be much greater than unity
- (b) the phase velocity of waves is much less than the speed of light in free space
- (c) the phase velocity of waves depends on their frequency
- (d) the group velocity of waves is much greater than the speed of light in free space
- (e) none of the above

(iv) A lossless, non-magnetized plasma contains $N_e = 1.5 \times 10^{11}$ free electrons per meter cubed. Find the relative permittivity of this plasma at 5 MHz.

- (a) -18.1 (b) -0.13 (c) 0.52 (d) 0.86 (e) 1.48