A1. Please state the following terminology (20%)
  (i)　conjugate point effects
  (ii)　quasi-equilibrium situation
  (iii)　radiative recombination, dissociative recombination, and attachment
  (iv)　ionospheric storm
  (v)　air glow
  (vi)　plasmaspheric content
  (vii)　SWF and SFD
  (viii) QL approximation
  (ix)　equatorial electrojet
  (x)　the Breit and Tuves's theorem; and the Martyn's theorem

A2. State the formation and morphology of the ionospheric D-, E-, F1, and F2 regions.

(15%)

A3. In a collisionless ionosphere, the geomagnetic filed is 0.5 gauss and the electron density profile can be expressed as

$$N(z) = N_m \{1-(z - z_m)^2/a^2\} \qquad \text{for } |z - z_m| \leq a$$
$$N(z) = 0 \qquad \text{for } |z - z_m| \geq a$$

where $N_m = 10^6$ #/cm$^3$, $z_m = 230$ km, and a = 150 km (i) For a fixed sounding frequency, $f = 6$ MHz, vertical incidence, please derive the reflection heights of O-, X- and Z-wave. (ii) For sweeping frequencies please calculate the critical frequencies of O-, X- and Z-wave.

(15%)

B1. Explain the following expressions:

(a) Butterfly diagrams (5%) (b) Adiabatic Invariant (5%)

B2. Both moon and Venus (金星) have no magnetic fields. The atmospheric density of the moon is very low while the atmospheric density of Venus is very high. What happens when solar wind interacts with moon and Venus, respectively. (10%)

B3. What are the two major physical parameters of a star to determine the behavior of the expansion of ionized gas from the surface of the star and how ? (10%)

B4. A charged particle with velocity $v$ and magnetic moment $\mu$ is moving in a non-uniform magnetic field B. Find the expression for gradient drift (10%)

(Hint: $Vd = \dfrac{c}{q} \cdot \dfrac{\vec{f} \times \vec{B}}{B^2}$ ; f is an external force)

B5. "SPOT" satellite is circling around the earth at the altitude of 830 km. The orbit is fixed with respect to sun-earth line, i e. sun-synchronous.

(a) Find the orbital period in minutes (5%)

(b) Find the equatorial distance between two successive orbits (5%)

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