

1. Which mode is relevant to the drought in tropical rainforests in Amazon and South-east Asia: El Niño or La Niña? What is the reason for it? (10 分)
2. The air mass at sea level has an air temperature of 28°C. If this air mass is lifted up along the mountain slope adiabatically, and the clouds start to form at the elevation of the NTU Experimental Forest in Xitou (1200 m asl), answer the following questions. Use the dry adiabatic lapse rate of  $\Gamma_d = 0.01 \text{ K m}^{-1}$  and the wet adiabatic lapse rate of  $\Gamma_w = 0.005 \text{ K m}^{-1}$ . (10 分)
  - (a) What is the dew point temperature of this air mass?
  - (b) What is the temperature of this air mass at the top of a 2000 m mountain?
  - (c) If the air loses all the condensed water by precipitation and descends on the leeward to the 0 m elevation, what is the air temperature?
3. Recently the extent of Arctic sea ice at the end of summer is frequently reported to record its lowest, which suggests the sea ice extent is gradually decreasing with a warming climate. What effect may this have on the Earth's climate? (10 分)
4. Heat transfer occurs in three modes. What are these modes? Which of these modes do not require a medium for heat transfer? (10 分)
5. During a night with calm, clear sky conditions, the surface temperature of a bare soil drops faster than the air temperature above the surface, and the surface temperature is colder than the air temperature. If there is no evaporation or condensation, what is the mechanism of this phenomenon? (10 分)
6. What will be happening on the surface radiation balance of the boreal forest regions during the snow season if the trees are cleared? (10 分)
7. The Earth's black body temperature is roughly 255 K (-18°C), while the mean global surface air temperature is about 288 K (15°C). What made this difference? (10 分)
8. Explain about the "Atmospheric window" for infrared radiation. (10 分)
9. The following figures show the components of the net radiation balance during three cloudless days above a short grass and a forest ( $R_n$ : net radiation,  $S_t$ : downward shortwave radiation,  $\rho S_t$ : upward (reflected) shortwave radiation,  $L_d$ : downward longwave radiation,  $L_u$ : upward longwaveradiation.  $R_n = S_t - \rho S_t + L_d - L_u$ ). Compare the characteristics of the radiation components between these vegetations and describe them. (20 分)

