1. The assumption "infinitesimal strain condition" is an important basis for the linear relationship between strain and stress in the constitutive equations. Please explain why this is a well-justified assumption in the case of seismic waves (5%)

2. Describe the seismically observed relationships between the transitional zone thickness (between 410 and 660 discontinuities) and subducting slabs and rising mantle plumes (5%), and explain this phenomena in terms of how phase transitions at the 410 and 660 discontinuities are affected by temperatures. (10%)

3. (1) What is seismic dispersion (5%).
(2) Explain why surface waves are dispersive (5 %)

4. Please explain: (5% /EA)
(1) Elastic anisotropy　(2) Earth's normal modes　(3) Gutenberg-Richter relation

5. Draw the ray path in the Earth's interior for the seismic phase "PKIKP" (5%)

6. Explain what *apparent polar wandering path* (APWP) and *virtual geomagnetic pole* (VGP) are and why the earth's geomagnetic field can be used to track APWP in the earth's history and prove the continental drift. (10%)

7. Plate tectonics considers a lithosphere (plate) as a cool rigid shell in the outermost part of the earth that undergoes little deformation in the geological time scale (hundreds of million years). The lithosphere is usually defined from three aspects: *thermal lithosphere, elastic lithosphere and seismic lithosphere*. Give the physical definitions of these lithospheres and describe how they are determined. (10%)

8. (1) How to describe mathematically the motion of a rigid plate on the surface of a spherical earth? Explain why the relative plate motion along a plate boundary differs from place to place. (6%)
(2) What are the dominant driving and resistant forces for plate motion? What observed evidences support these conclusions? (6%)

9. (1) Explain the geoid anomaly, Free-Air gravity anomaly and Bouguer gravity anomaly.(6%)
(2) Assume an elevated plateau in the continent reaches an Airy-type isostatic equilibrium, what would these three anomalies be inside the plateau? (6%)

10. The thermal diffusivity equation governs the temperature varying with time through heat conduction. It can be used to approximately estimate the cooling history of a subducting slab. Considering the heat conduction only in one-dimensional z direction, the equation can be written as

$$\frac{\partial T}{\partial t} = \kappa \frac{\partial^2 T}{\partial z^2},$$

where κ is the thermal diffusivity. Write down the characteristic time and calculate how long it takes for an oceanic lithosphere which has subducted down to about 700 km depth to be heated by the surrounding mantle (Assume $\kappa = 10^{-6}\ m^2 s^{-1}$). (6%)

試題隨卷繳回