

普通天文學 二〇一〇年春 期中考

2010.04.19 Monday 15:10~16:50

Solar mass: 2×10^{30} kg; AU: 1.5×10^{11} m; Gravitational constant G: 6.7×10^{-11} N m²/kg²;
parsec pc: 3×10^{16} m; Planck constant h: 6.6×10^{-34} J s; speed of light c: 3×10^8 m/s;

一、解釋下列名詞（每小題 4 分）

- (1) brown dwarf (2) giant molecular cloud (3) eclipsing binary (4) dark nebula
(5) mass-luminosity relation (6) type II supernova (7) Cepheid variable
(8) Chandrasekhar limit (9) interstellar reddening (10) Population I star

二、問答題：每題 10 分

- (a) The Sun has an apparent magnitude of -26.7. What is its absolute magnitude? (b) Betelgeuse (Alpha Orionis) is 60,000 times more luminous than the Sun and has a surface temperature of 3500 K. The Sun's radius is about 7×10^8 km, what is the radius of Betelgeuse?
- A star can be classified into one of the stellar spectral types of O, B, A, F, G, K, M, L, or T. (a) How does one tell which spectral type a particular star has? (b) What physical quantity does the spectral type sequence correspond to? (c) What is the spectral type of our Sun? What is the luminosity class of the Sun?
- (a) Draw a Hertzsprung-Russell diagram. Clearly label and explain the physical quantity associated with each axis. (b) Draw the main sequence and mark where the Sun is in the diagram. (c) Explain how does such a diagram help determine the age of a star cluster.
- (a) What is the energy source of the Sun as a main-sequence star? (b) Stars like our Sun, after their main-sequence phase in evolution, will engage in an explosive event in their cores, called "helium flash". Explain what a helium flash is and why it occurs only in low-mass stars, and not in massive stars. (c) Will the Sun eventually become a white dwarf or a neutron star? Why?
- Describe one method to measure or estimate (a) the distance (b) the mass (c) the diameter (d) chemical composition of a star.
- The Schwarzschild radius defines the size of the event horizon of a black hole. (a) Derive the Schwarzschild radius in terms of the mass of an object. (b) What is the Schwarzschild radius (in km) of the Sun if it were to become a black hole? (c) What is the Schwarzschild radius (in AU) of a supermassive black hole of a billion solar masses?