一、問答題（每題 10 分）

1. Barnard's star is the third closest star to us (which is the closest and which is the second closest?) with a distance of 6 light years.　It has a proper motion of 10.3".　Calculate its space speed projected onto the celestial sphere.

2. Describe the currently accepted theory of the formation of the solar system, i.e., of the Sun, planets, satellites, asteroids, comets, and planetary rings.　Describe lines of observational evidence that provide support to this theory.

3. Describe how the energy is generated at the center of the Sun, and how the energy is transported outwards.

4. The Sun, with a luminosity of 4×10^{26} W and at a distance of 1 AU (1.5×10^8 km) has an apparent magnitude of -26.7 mag.　What is the apparent magnitude of a 100-watt light bulb seen at a distance of 3 m?

5. The absolute magnitude is defined as the apparent magnitude of a star if it were at a distance of 10 pc.　The Sun has an absolute magnitude of +4.8 mag.　What is the absolute magnitude of the 100-watt bulb in the last question?　Polaris is 240 pc away, and has an apparent magnitude of +2.3 mag.　Calculate the absolute magnitude of Polaris.　Is Polaris intrinsically brighter or fainter than the Sun?

6. What is the comet made out of?　Why does the tail of a comet always point away from the Sun?

7. Assuming the human pupil has a maximal diameter of about 7 mm, and an unaided, visual limit of seeing a 6th mag star, estimate how large of a telescope aperture is required to see with an eyepiece a 12th mag star.　If this 12th mag star turns out to be a binary, with the flux ratio of 4:1 between the two component stars, calculate the apparent magnitude of each of the component stars.

二、簡單解釋下列名詞（每小題 2 分）

(1) gravitational lensing; (2) Pangaea; (3) photosphere; (4) coronagraph; (5) limb darkening;
(6) granulation; (7) Great Red Spot; (8) Maunder butterfly diagram; (9) Zeeman effect;
(10) mass deficit; (11) Kirkwood gap; (12) sunspot; (13) Galileo satellites;
(14) Trojan asteroid; (15) Kuiper belt