Astr2100 Descriptive Astronomy
Fall 2017 Test 2B - Answers

Definitions

1. Define the following:
   a. The alternating light and dark (orange) bands on Jupiter Belts and zones
   b. The force of gravity acting on you. Weight
   c. The model of the Solar System which puts the Sun at the centre. Heliocentric
   d. The periodic backwards motion of the planets in the night sky. Retrograde motion

Concepts/Short Answer

2. What provided the definitive proof that the heliocentric model of the Solar System had to be the correct one? Observation of the phases of Venus, particularly the full and gibbous phases which cannot be explained by the geocentric model.
3. Who did the following:
   a. Take the most accurate data prior to the invention of the telescope. Tycho Brahe
   b. Realized that the orbits of the planets are not circular. Johannes Kepler
   c. Developed a universal theory of gravity. Isaac Newton
   d. First observed one object which clearly did not go around the Earth. Galileo (the moons of Jupiter)
4. Which planet has the lowest surface temperature? Neptune (it's the furthest away from the Sun)
5. Where would you find
   a. Valles Marineris Mars
   b. The Cassini Division in the ring system of Saturn
   c. Olympus Mons Mars
   d. Deimos in orbit around Mars
6. How do you determine the mass of the Sun? By timing the orbit of one of the planets, and then using Kepler's 3rd Law
7. Why do we think that there are planets around other stars?
8. What did Copernicus explain without having to resort to epicycles in his heliocentric model of the Solar System? Retrograde motion, which he explained as the result of an inner planet moving faster in its orbit than an outer one, and so overtaking it when they are both on the same side of the Sun.
9. On the Earth, Mercury and Venus can only be seen in the western sky during the evening. If you were to stand on Mercury, which planets would you be able to see in the eastern sky during the evening? Briefly give your reasoning.
   a. On the Earth Mercury and Venus cannot be see in the eastern sky in the evening because they are both closer to the Sun that the Earth. All the other planets are further from the Sun, and can be seen in the east during the evening.
   b. If you stand on Mercury then there all the other planets are further from the Sun.
   c. It therefore follows that all the other planets can be seen in the east in the evening.
10. What are the two common features in the orbits of ***all*** of the planets?
    a. Their orbits are all in the same direction, counter clockwise when view from above the Earth's north pole.
    b. Their orbits lie in, or at least very close to, the ecliptic.

c. Their orbits are all elliptical
(Any two of the three are sufficient to answer the question)

11. In terms of their composition, how do the Jovian planets differ from the terrestrial planets? The terrestrial planets are all rocky, whereas the Jovian planets are mostly gas and liquid.
12. What is the principal component of the atmospheres of both Mars and Venus? Carbon dioxide
13. Around which planet does the moon Titan orbit? Saturn
14. What is the Great Dark Spot, and where would you find it? A giant storm on Neptune

Numerical

15. Saturn is 9.6 AU from the Sun. Calculate the length of its year. (Don't forget to include units).
    a. $P^2 = a^3 = 9.6^3 = 885$
    b. $P = \sqrt{885} = 29.7$ (Earth) years
16. If an object in the Kuiper Belt takes 1400 years to make one full orbit around the Sun, what is the radius of its orbit. (Don't forget to include units).
    a. $a^3 = P^2 = 1400^2 = 1{,}960{,}000$
    b. $a = \sqrt[3]{1{,}960{,}000} = 125$ AU
17. A planet of mass 3.5×10^{-5} solar masses orbits its star at a distance of 2.2 AU. If it takes 1.75 Earth years to make one orbit, what is the mass of the star? (Don't forget to include units).
    a. $M = a^3/P^2 = 2.2^3/1.75^2$
    b. $M = 3.48$ solar masses
18. Two moons are observed to be orbiting the same planet. Moon A is 0.009AU from the planet, and moon B is 0.003 AU from the planet. If Moon A takes 45 days to make one orbit, how long does moon B take?
    a. $(P_B/P_A)^2 = (a_B/a_A)^3 = (0.003/0.009)^3 = (\frac{1}{3})^3 = 0.037$
    b. $P_B/P_A = \sqrt{0.037}$
    c. $P_B/P_A = \sqrt{0.037} * P_A = \sqrt{0.037} * 45 = 8.7$ days
19. On the Earth your weight is 175 lbs. What would it be on the surface of a planet which has 8 times the mass and four times the radius?
    a. The increase in mass increases the weight by a factor of 8
    b. The increase in radius decreases the weight by a factor of $4^2 = 16$
    c. New weight = 140 * 8 / 16 = 87.5 lbs