Astr2100 Descriptive Astronomy
Fall 2017 Test 2A - Answers

Definitions

1. What are the terms which go with the following definitions:
   a. The force of gravity acting on you. Weight
   b. The model of the Solar System which puts the Earth at the centre. Geocentric
   c. A gap in the ring system of Saturn Division
   d. The condition when the time it takes any object to rotate on its axis is equal to the time it takes that object to orbit around another one. *Either* tidal locking *or* synchronous rotation.

Concepts/Short Answer

2. Who did the following:
   a. Observed the phases of Venus. Galileo
   b. Found the four large moons of Jupiter. Galileo
   c. Discovered the planet Uranus. William Herschel
   d. Correctly explained the retrograde motion of the planets. Nicholas Copernicus
3. Where would you find
   a. Olympus Mons Mars
   b. Valles Marineris Mars
   c. The Great Red Spot Jupiter
   d. Phobos orbiting around Mars
4. How do you determine the mass of a planet? (Except Mercury and Venus) By timing the orbit of one of its moons, and then using Kepler's 3rd Law
5. Why do we think that there are planets around other stars?
6. Which planet has the lowest orbital speed? Neptune (it's the furthest away)
7. Why did Copernicus still use epicycles in his heliocentric model of the Solar System? He still assumed that the orbits were perfectly circular.
8. 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.
9. On the Earth, Mercury and Venus can only be seen in the western sky during the evening. If you were to stand on Neptune, 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 Neptune then there are no planets further from the Sun.
   c. It therefore follows that no 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 the number of moons, how do the Jovian planets differ from the terrestrial planets?
    The Jovian planets have many moons, the terrestrial planets very few, and only our Moon is sizeable.
12. What is the principal component of the atmospheres of both Jupiter and Saturn? Hydrogen
13. Around which planet does the moon Callisto orbit? Jupiter
14. What is so unusual about the rotation of Uranus? Relative to the ecliptic it rotates on its side.

Numerical

15. Uranus is 19.2 AU from the Sun. Calculate the length of its year. (Don't forget to include units).
    a. $P^2 = a^3 = 19.2^3 = 7165$
    b. $P = \sqrt{7165} = 84.7$ (Earth) years
16. If an object in the Kuiper Belt takes 750 years to make one full orbit around the Sun, what is the radius of its orbit. (Don't forget to include units).
    a. $a^3 = P^2 = 750^2 = 562500$
    b. $a = \sqrt[3]{562500} = 82.5$ AU
17. A planet of mass 1.5×10^{-5} solar masses orbits its star at a distance of 1.5 AU. If it takes 1.2 Earth years to make one orbit, what is the mass of the star? (Don't forget to include units).
    a. $M = a^3/P^2 = 1.5^3/1.2^2$
    b. $M = 2.34$ solar masses
18. Two moons are observed to be orbiting the same planet. Moon A is 0.005AU from the planet, and moon B is 0.008 AU from the planet. If Moon A takes 20 days to make one orbit, how long does moon B take?
    a. $(P_B/P_A)^2 = (a_B/a_A)^3 = (0.008/0.005)^3 = 1.6^3 = 4.096$
    b. $P_B/P_A = \sqrt{4.096}$
    c. $P_B/P_A = \sqrt{4.096} * P_A = \sqrt{4.096} * 20 = 40.5$ days
19. On the Earth your weight is 140 lbs. What would it be on the surface of a planet which has 6 times the mass and three times the radius?
    a. The increase in mass increases the weight by a factor of 6
    b. The increase in radius decreases the weight by a factor of $3^2 = 9$
    c. New weight $= 140 * 6 / 9 = 93.3$ lbs