

Name: _____ Date: _____
Astro 129, Fall 2014, Homework on Chapter 13

1. Most of the evidence for the existence of planetary systems in the process of formation around other stars comes from
 - A) periodic wobbling of the physical positions and spectral line positions of several nearby stars.
 - B) direct photography of actual planets near other stars.
 - C) spectroscopic evidence of large quantities of molecules such as ammonia and methane, which can only exist in planetary atmospheres.
 - D) detection of very regular pulses of radio energy from some stars.

2. Astrometry is the branch of astronomy dealing with the measurement of the
 - A) ages of stars and galaxies.
 - B) accurate motions of stars with respect to the Sun.
 - C) precise positions of stars and galaxies.
 - D) precise surface temperatures of stars.

3. What is the astrometric method used in searches for planets orbiting stars other than the Sun?
 - A) a search for excess infrared radiation from the star, caused by the presence of planets that are cool and thus emit primarily in the infrared
 - B) a search for tiny wobbles in the position of the star due to the gravitational pull of a planet orbiting around it
 - C) a search for tiny wobbles in the positions of absorption lines in the star's spectrum, caused by radial velocity variations of the star due to a planet orbiting around it
 - D) a search for tiny "bumps" on images of the star, due to the light from a planet located close to the star

4. We measure the mass of an extrasolar planet by
 - A) using spectra to measure the planet's temperature and photometry to measure its brightness.
 - B) We cannot make a useful estimate of the mass of an extrasolar planet with present technology.
 - C) measuring the planet's angular diameter and its size, using spectra to find its composition and hence density.
 - D) using Newton's law of gravity, using the measured distance from the star and its gravitational pull on the star.

5. What is surprising about the extrasolar planets that have been discovered?
- A) More than half of them have strong lines of molecular oxygen in their spectra, a possible indication of life on these planets.
 - B) The majority of them rotate much faster than the planets in our solar system.
 - C) Many of them are giant planets like Jupiter, orbiting at distances characteristic of terrestrial planets.
 - D) Many of them are terrestrial planets like Earth but orbiting at distances characteristic of giant planets.
6. Of the extrasolar planets that have been found, many have masses comparable to that of Jupiter but orbits smaller than Earth. What is believed to be the most likely explanation for this surprising combination?
- A) The protoplanetary disk was much denser than that of the Sun, and larger planets formed. Collisions between these planets then sent some of them into much smaller orbits.
 - B) Friction with the protoplanetary disk caused planets formed farther from the Sun to lose energy and migrate inward.
 - C) "Planets," are in fact low-mass objects that formed separately in the same manner as stars, and were later captured into the orbits in which we now see them.
 - D) The protoplanetary disk was much denser than that of the Sun, allowing large planets to form very close to the star.
7. Some extrasolar planets appear to have very surprising characteristics (Jupiter-like masses but very small orbital radii). What observational uncertainty may render this observation meaningless?
- A) The radial velocity method can only give a lower limit for a planet's mass, so they could be massive brown dwarf or low-mass stars.
 - B) The astrometric method can only give an upper limit for a planet's mass, so they could be terrestrial planets.
 - C) The astrometric method can only give a lower limit to the orbital radius, so they could be orbiting at the proper distance expected for a Jovian planet.
 - D) The radial velocity method cannot distinguish between orbital variations due to a planet and stellar pulsations where the radial velocity variations are caused by motion of the star's surface. Thus, there may be no planets at all.

8. Observers in a distant solar system are watching our Sun and using the radial velocity method to try to determine whether the Sun has planets. Because of the gravitational pull of Jupiter, these observers will see the Sun's spectrum slowly redshift and then blueshift by a tiny amount. How long must they observe in order to see a full cycle?
- A) 25 days
 - B) one year
 - C) almost 12 years
 - D) It depends on how far away the observers are.
9. Interaction between newly formed planets and gas and dust left over in the stellar nebula may account for our observation of
- A) large planets in orbits near their stars, but not the large eccentricities of their orbits.
 - B) the large eccentricities of the orbits, but not the existence of large planets so close to their stars.
 - C) both the existence of large planets in near orbits and the large eccentricities of the orbits.
 - D) neither the existence of large planets in near orbits nor the large eccentricities of the orbits.