Astronomy II (Astr 1020)
Fall 2009
Prof Richard Ignace

HOMEWORK #4

Notes:

You will need a calculator, a pencil, and a standard scantron.

Each question has one correct answer. Choose the best answer for each. Mark your answer on the scantron.

This homework is due at the beginning of class on December 10. Late homeworks will not be accepted.

1. Consider an Earth-like planet orbiting a Sun-like star. The orbit has the properties of a semi-major axis f $a = 1$ AU, an orbital period of $P = 1$ year, and an eccentricity $e = 0.6$. If the habitable zone stretches from 0.9 to 1.3 AU, might you expect to find life on this planet?

   a) No, life does not exist on Earth-sized planets.
   b) No, life does not exist in the habitable zone.
   c) No, the planet's orbit is not always inside the habitable zone.
   d) Yes, the planet's orbital period is just right for life.
   e) Yes, the planet's orbit is always inside the habitable zone.

2. Let's play a silly game called the Cosmic Postman. Suppose that every star has one planet with an intelligent civilization. They have all being launching info "packages" every year for the age of the Milky Way. Doing the math, this works out to a number density of randomly "floating" packages at about $n = 2 \times 10^{-31}$ per cubic kilometer. Statistically, the amount of time before one of these packages randomly strikes the Earth is $t \approx 1/(n\pi R^2 v)$, where $R = 6400$ km for the radius of the Earth, and $v = 6.6 \times 10^9$ km/year for the speed of the Earth around the Milky Way as it is carried along by the Sun. Estimate the number of years before the Earth hits a package.

   a) 2×10^{20} years
   b) 2×10^{16} years
   c) 5,900 billion years
   d) 2×10^5 years
   e) 0.0059 years

3. Which of the following terms of the Drake equation will most likely have a good estimate in the near future?

   a) The fraction of stars that have planets.
   b) The fraction of planets that have life.
   c) The fraction of life-bearing planets with intelligent life.
   d) The fraction of intelligent life that is communicative.
   e) The average lifetime of a technical civilization.

4. Constellations consist of

   a) planets that are mostly unrelated
   b) stars that are mostly unrelated
   c) planets that were formed out of the same interstellar cloud
   d) stars that were formed out of the same interstellar cloud
   e) stars constituting a stellar cluster

5. Newton concluded that some force had to act on the moon because

   a) a force is needed to keep the moon in motion
   b) a force is needed to pull the moon away from straight line motion
   c) a force is needed to pull the moon outward
   d) none of the other answers are correct

6. A beam of light originally emitted at 8000 Å is measured at 8002 Å owing to the Doppler shift. What is the relative motion between the receiver and the emitter?

   a) 750 cm/s
   b) 75 km/s
   c) 0.75 km/s
   d) 7,500 m/s

7. Of the following, which has the largest density? (You will need to hunt through your book or search the web for some of these.)

   a) Iron
   b) Moon
   c) Sun
   d) Earth
   e) Water

8. The _____ is NOT visible during a total eclipse of the Sun.

   a) zenith
   b) corona
   c) umbra
   d) photosphere

9. Main sequence stars

   a) all have the same size.
   b) are stars which have no hydrogen or helium.
   c) are objects which are mostly made of solid material.
   d) have nuclear fusion of hydrogen occuring in their cores.

10. If we ever looked at the spectrum of a planet and saw evidence for the presence of molecular Oxygen, the presence of life there would be almost a certainty. Why?

    a) Only terrestrial planets like the Earth can maintain Oxygen in their atmospheres over long periods.

    b) Only living organisms are capable of producing and maintaining large levels of molecular Oxygen in an atmosphere.

    c) The presence of Oxygen implies that any Carbon Dioxide in the atmosphere has been broken down into Oxygen (for the atmosphere) and Carbon (for living organisms).

    d) Molecular Oxygen requires at least some crude technology to produce in vast quantities, hence life would have to be present.

    e) None of the above.

11. Let's do a little signal-to-noise (S/N) evaluation. Without explanation, suppose that a telescope achieves $S/N = 100 \times \sqrt{t}$, where t is observing time in *hours*. A S/N of 100 means the data quality is good to 1%. To detect an Earth-like planet through eclipse, the amount of stellar light blocked by the planet will only be 0.01%. How long must this telescope observe the star to achieve just barely the needed accuracy to detect the eclipse?

    a) 10,000 hours

    b) 1,000 hours

    c) 100 hours

    d) 10 hours

    e) 1 hour

12. Which is true about a planetary nebula?

    a) Forms just after a supernova explosion.

    b) Forms just before a supernova explosion.

    c) Forms just after the red giant stage.

    d) Forms just before the red giant stage.

13. The "pulsing" effect of pulsars results from a combination of

    a) rotation and beaming.

    b) rotation and starquakes.

    c) pulsation and beaming.

    d) pulsation and magnetism.

14. A cluster of older stars located well away from the Milky Way plane is characteristic of what?

    a) An open cluster.

    b) A globular cluster.

    c) A galaxy merger.

    d) A starburst event.

15. Tycho Brahe is famous for

    a) being the first to look at planets with a telescope.
    b) confirming the heliocentric model.
    c) being the greatest observer before the telescope.
    d) his mathematical models of elliptical orbits.

16. One day the Sun will become

    a) a neutron star.
    b) a white dwarf.
    c) a black hole.
    d) a pulsar.

17. In the H-R Diagram, the largest stars are located where

    a) stars are hot and luminous.
    b) stars are hot and not very luminous.
    c) stars are cool and not very luminous.
    d) stars are cool and highly luminous.

18. Consider two stars in a binary. One of the stars has no stellar wind, but the other has a very strong wind, meaning it has significant mass loss over its lifetime. What will happen to the orbit of the binary over time given that the mass for one of the stars is decreasing with time? (Use what you know about how gravity works.)

    a) The two stars will ultimately collide.
    b) The binary orbit will grow in size.
    c) The binary orbit will shrink in size.
    d) No conclusion can be drawn.