ASTRONOMY 1010 **Homework 3** **Due: October 12, 2007**

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (5 points each)

1) Which of the following statements best describes the two principal advantages of telescopes over eyes?
   A) Telescopes have much more magnification and better angular resolution.
   B) Telescopes can collect far more light with far better angular resolution.
   C) Telescopes collect more light and are unaffected by twinkling.
   D) Telescopes can collect far more light with far greater magnification.
   E) Telescopes can see farther without image distortion and can record more accurate colors.

2) What causes stars to twinkle?
   A) It is intrinsic to the stars—their brightness varies as they expand and contract.
   B) variable absorption by interstellar gas along the line of sight to the star
   C) the inability of the human eye to see faint objects
   D) variations in the absorption of the atmosphere
   E) bending of light rays by turbulent layers in the atmosphere

3) Which of the following is *not* a good reason to place observatories on remote mountain tops?
   A) to reduce light pollution
   B) to be able to observe at radio wavelengths
   C) to reduce light absorption
   D) to reduce light distortion
   E) to be able to observe at infrared wavelengths

4) Which of the following is furthest from the Sun?
   A) an asteroid in the asteroid belt
   B) Pluto
   C) a comet in the Oort cloud
   D) Neptune
   E) a comet in the Kuiper belt

5) Which planet has a ring system?
   A) Jupiter
   B) Uranus
   C) Saturn
   D) Neptune
   E) all of the above

6) Which of the following statements is *not* an observed pattern of motion in our solar system?
   A) All planets orbit the Sun in the same direction.
   B) Most planetary orbits lie nearly in the same plane.
   C) Most planets orbit at the same speed.
   D) Almost all moons orbit their planet in the same direction as the planet's rotation.
   E) Most planets rotate in the same direction in which they orbit.

7) Which of the following is *not* a characteristic of the inner (terrestrial) planets?
   A) They all have substantial atmospheres.
   B) They are relatively smaller than the outer planets.
   C) Their orbits are relatively closely spaced.
   D) They all have solid, rocky surfaces.
   E) They have very few, if any, satellites.

8) Why did the solar nebula heat up as it collapsed?
   A) As the cloud shrank, its gravitational potential energy was converted to kinetic energy and then into thermal energy.
   B) Radiation from other nearby stars that had formed earlier heated the nebula.
   C) The shock wave from a nearby supernova heated the gas.
   D) Collisions among planetesimals generated friction and heat.
   E) Nuclear fusion occurring in the core of the protosun produced energy that heated the nebula.

9) What happened during the *accretion* phase of the early solar system?
   A) Atoms and molecules in the gas bonded together and solidified.
   B) Earth gained its oceans from icy planetesimal capture.
   C) Particles grew by colliding and sticking together.
   D) Large planetesimals captured atmospheres from the solar nebula.
   E) The solar nebula differentiated into metals inside of the frost line and ices beyond.

10) Suppose you find a rock that contains some potassium–40 (half–life of 1.3 billion years). You measure the amount and determine that there are 5 grams of potassium–40 in the rock. By measuring the amount of its decay product (argon–40) present in the rock, you realize that there must have been 40 grams of potassium–40 when the rock solidified. How old is the rock?
   A) 5.2 billion years
   B) 1.3 billion years
   C) 2.6 billion years
   D) 3.9 billion years
   E) none of the above

11) Since all stars begin their lives with the same basic composition, what characteristic most determines how they will differ?
   A) mass they are formed with
   B) time they are formed
   C) color they are formed with
   D) luminosity they are formed with
   E) location where they are formed

12) If the distance between us and a star is doubled, with everything else remaining the same, the luminosity
   A) remains the same, but the apparent brightness is decreased by a factor of four.
   B) is decreased by a factor of two, and the apparent brightness is decreased by a factor of two.
   C) is decreased by a factor of four, and the apparent brightness is decreased by a factor of four.
   D) remains the same, but the apparent brightness is decreased by a factor of two.
   E) is decreased by a factor of four, but the apparent brightness remains the same.

13) The spectral sequence sorts stars according to
   A) surface temperature.
   B) core temperature.
   C) mass.
   D) radius.
   E) luminosity.

14) On a Hertzsprung–Russell diagram, where would we find stars that are cool and dim?
   A) upper left B) upper right C) lower left D) lower right

15) On the main sequence, stars obtain their energy
   A) by converting hydrogen to helium.
   B) from gravitational contraction.
   C) from nuclear fission.
   D) by converting helium to carbon, nitrogen, and oxygen.
   E) from chemical reactions.

BONUS QUESTION

16) The H–R diagram is one of the most important plots in astronomy. Study Figure 15.10 of the text. Digest the axes and what the position of a star in this plot means. Pay special attention to the different sections such as the main sequence, giants, supergiants, and white dwarfs. Based on your understanding, what can you say about the following stars?
   (a) The Sun, (b) Beta Centauri, (c) Betelgeuse, (d) Sirius B, (e) Proxima Centauri
   Summarize your results in a table with the following columns:
   Star name, Spectral type, Type of star (main sequence, giant etc.), Luminosity (in solar units), Surface temperature (in K), Radius (in solar units), Wavelength at which radiation peaks (in microns, using Wien's Law), Short description.
   Draw a color picture of how you think the star would look. Show your work or briefly explain how you got your answer.
   (5 points)
   If all these objects were to appear to be the same brightness as our Sun, at what distance would they be from us (in AU)? Hint: Use luminosity and inverse square law. The answer for the Sun is obviously 1 AU.
   (2.5 points)