Exam #1: Practice and Review

1. The binary star, Albireo (β Cyg), has an angular separation of ~35 arcsec and is located 415 light-years away. How far apart are the two stars in AU? The two stars have masses of ~3.8 M_{Sun}. Assuming they are gravitationally bound, what is their orbital period?

2. The Arecibo radio telescope, located in Puerto Rico (latitude = $18^d 20^\circ$) was the largest telescope in the world (D=305 m). It is so large that the primary mirror is fixed and does not move. Tracking of astronomical sources is achieved by moving the secondary mirror over a limited range, $+20^d$ and -19^d from the zenith.

a. Which of the following objects are observable with Arecibo? Explain your reasoning in each case. For example, draw a diagram, do a calculation, and write a quantitative sentence.

b. If the sidereal time is $0^h 0^m$ at midnight which objects are above the horizon at midnight?

Whirlpool Galaxy (M51)	13:29:52.7	+47:11:43
Orion Nebula (M42)	01:35:17.3	-05:23:28
IRC +10216	09:47:57.4	+13:16:44
Ring Nebula (M57)	18:53:35.1	+33:01:45
Triangulum Galaxy	01:33:50.0	+30:39:37

3. A star with an apparent magnitude of $m_v=10$ is observed over the course of a year to have a parallax of 0.01". What is the star's absolute visual magnitude (M_v)?

4. A star is observed that is 64 times more luminous than the Sun with a diameter twice that of the Sun. What is the effective temperature of the star? ($T_{Sun} = 5800 \text{ K}$)

5. Jupiter has approximately 10^{-3} the mass of the Sun and $\sim 10^{-1}$ the diameter of the Sun. What is the ratio of gravitational potential energy of Jupiter compared to the Sun?

6. If the planet Venus had a Moon exactly like ours, would that Moon be within Venus' Hill Sphere?

7. What is the escape speed from the Sun at a distance of 1 AU, moving in a retrograde direction?

8. A "minimoon" (asteroid 2020 DC3) has been discovered orbiting Earth. It has a diameter ~20 feet. How would you expect its temperature to compare to Earth's?

9. What is the spectral-luminosity type of a star with these properties: $\sim 3 L_{Sun}$, $\sim 2 R_{Sun}$, and this spectrum?



